NORTH LONDON WASTE AUTHORITY

# NORTH LONDON HEAT AND POWER PROJECT

# TRANSPORT ASSESSMENT: FIGURES AND APPENDICES

The Planning Act 2008 The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5 (2) (q)

AD05.11

Arup

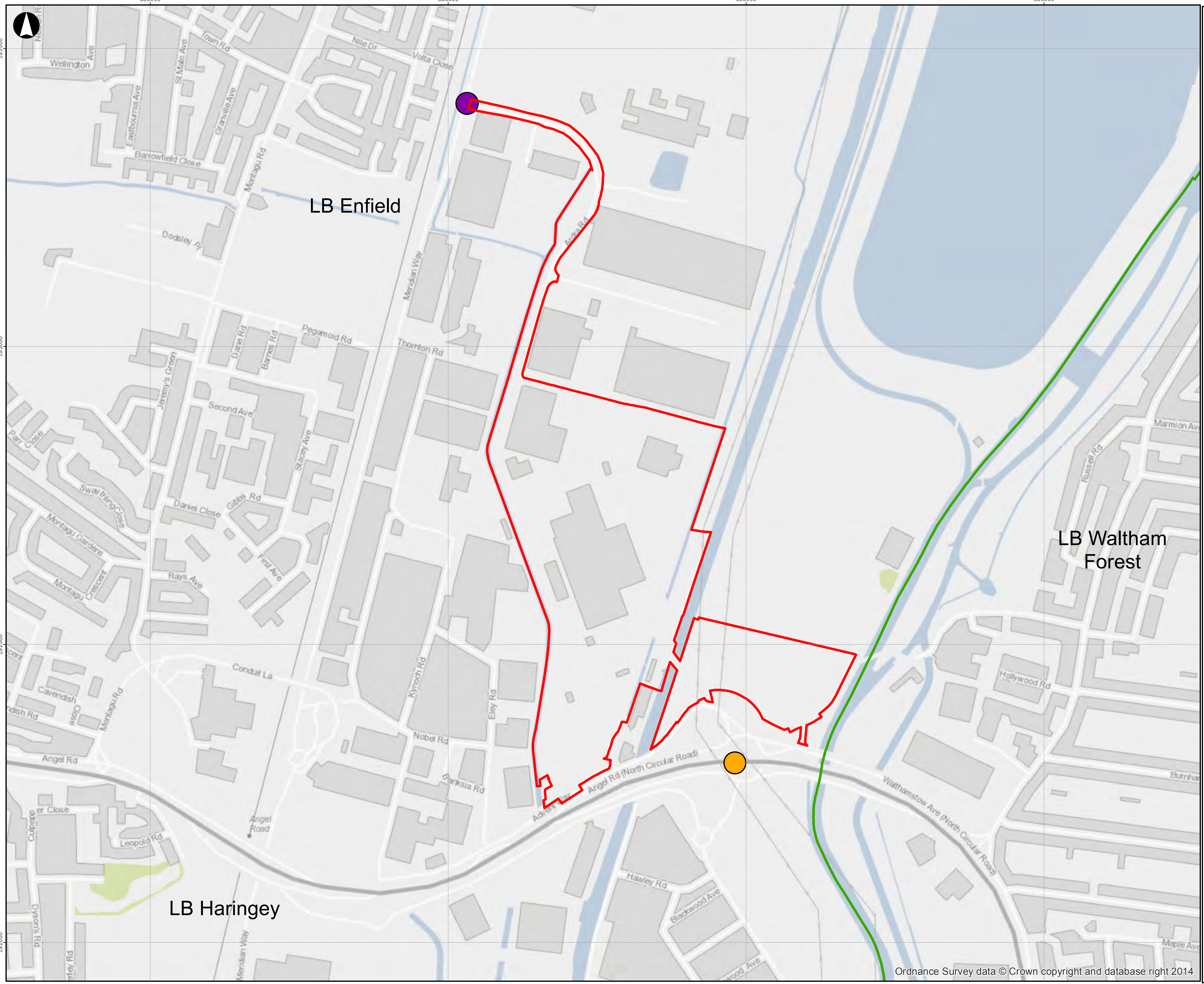
Revision 0 | October 2015

nlwa
north london waste authority

# TRANSPORT ASSESSMENT: FIGURES

## Figures

A3




MXD Location

## Legend

- Application Site boundary
- London Borough Boundary
- A1055 Meridian Way - Ardra Road
- Cooks Ferry Roundabout



| Revision | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 26-08-15 | AC | DM | SJ |

Metres
0 50 100 200

ARUP

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www.arup.com

Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

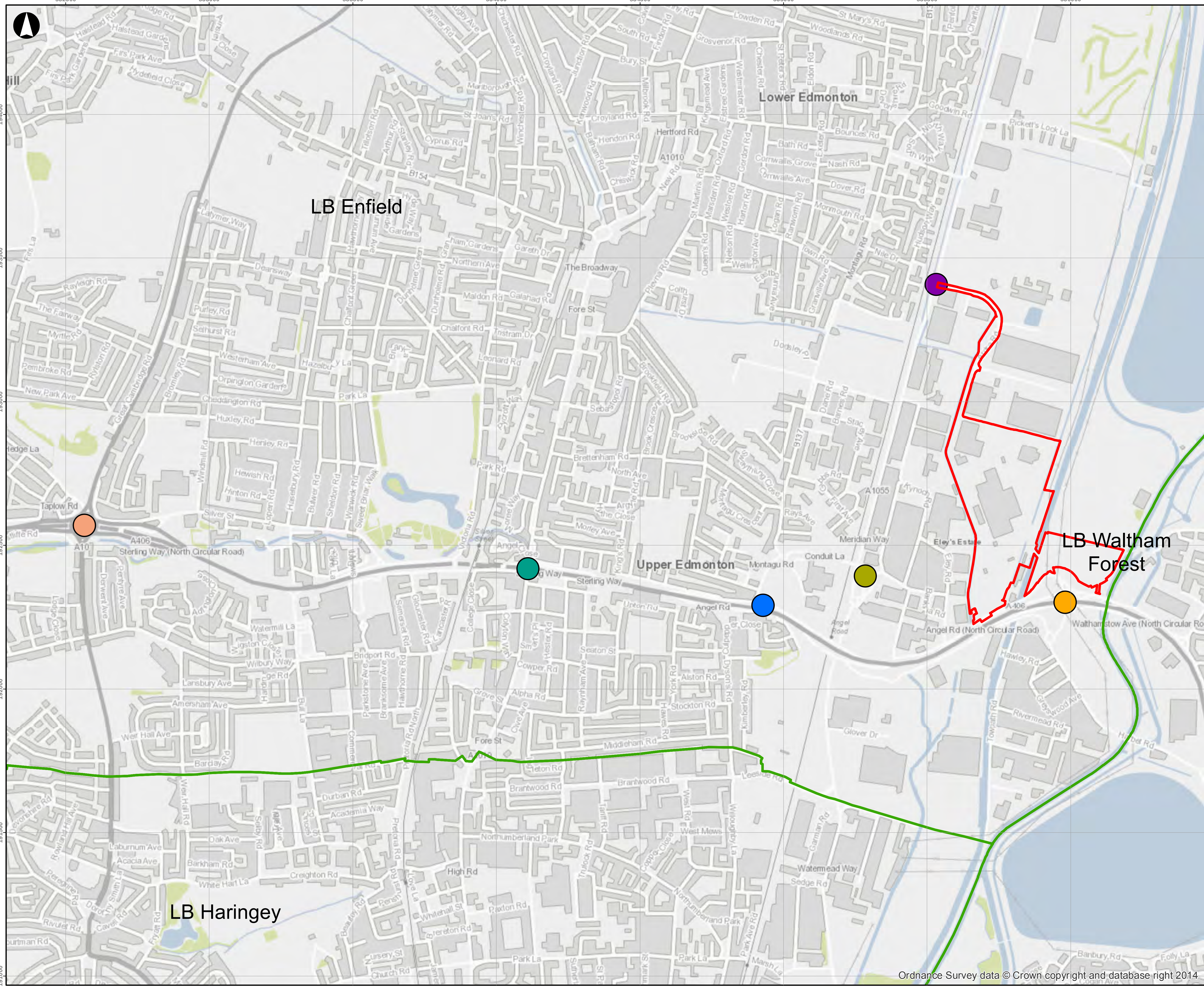
Figure Title
**Local highway network**

Scale at A3
**1:6,000**

| Job No | Drawing Status |
|---|---|
| 235271-30 | Issue |

| Figure No | Revision |
|---|---|
| 3.1 | P1 |

A3




MXD Location

**Legend**

- Application Site boundary
- London Borough Boundary
- Cooks Ferry Roundabout
- A1055 Meridian Way - Conduit Lane
- A406 North Circular Road - Montagu Road
- A406 North Circular Road - A1010 Fore Street
- A406 North Circular Road - A10 Great Cambridge Road
- A1055 Meridian Way - Ardra Road



| Revision | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 26-08-15 | AC | DM | SJ |

Metres
0 100 200 400

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Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

Figure Title
**Local highway network wider context**

Scale at A3
**1:12,500**

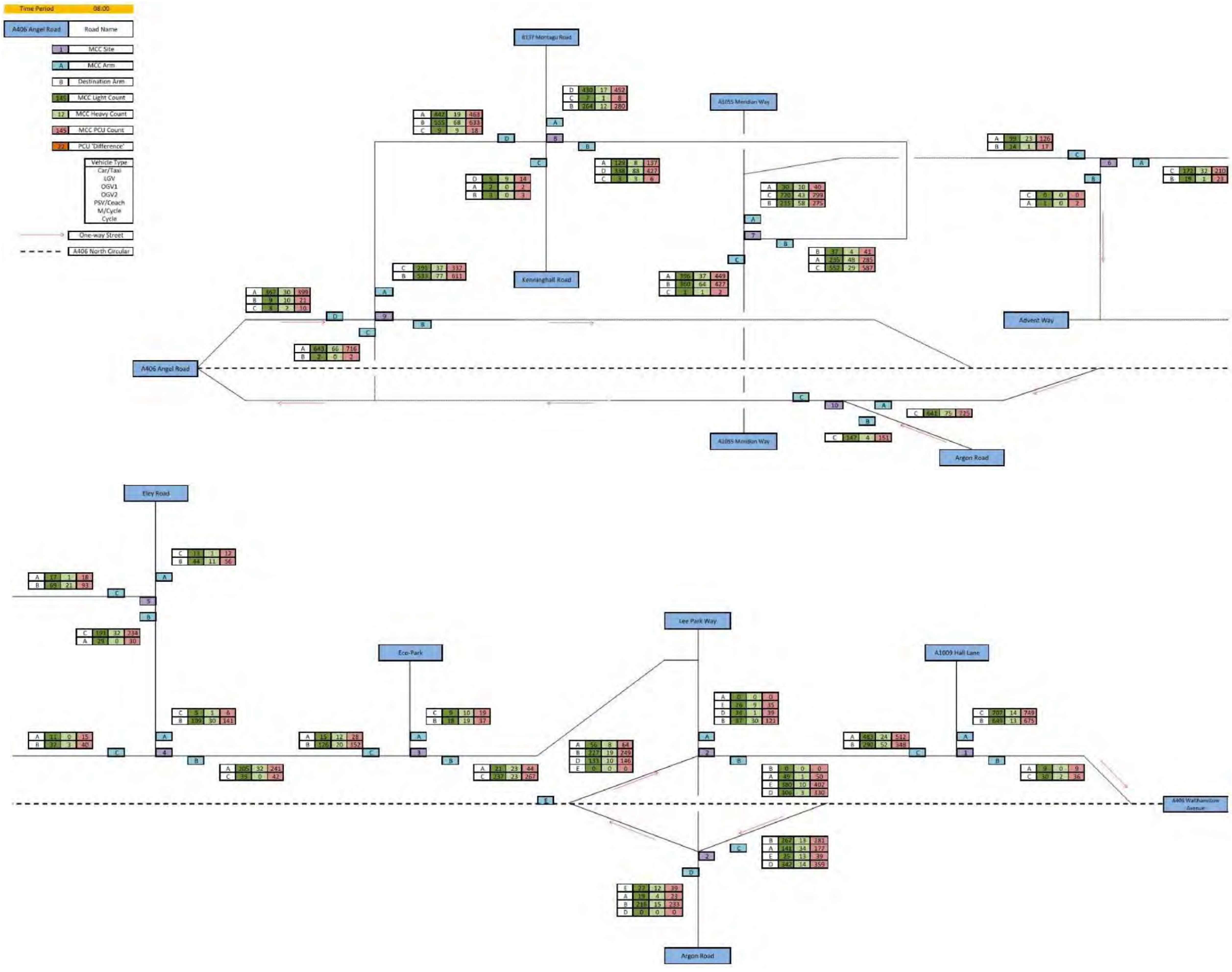
Job No
**235271-30**

Drawing Status
**Issue**

Figure No
**3.2**

Revision
**P1**

A3

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|---|---|---|---|---|
| Revision | Date | By | Chkd | Appd |

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Client

**North London Waste Authority**

Job Title

**North London Heat and Power Project**

Drawing Title

**Baseline traffic flows - AM peak hour**

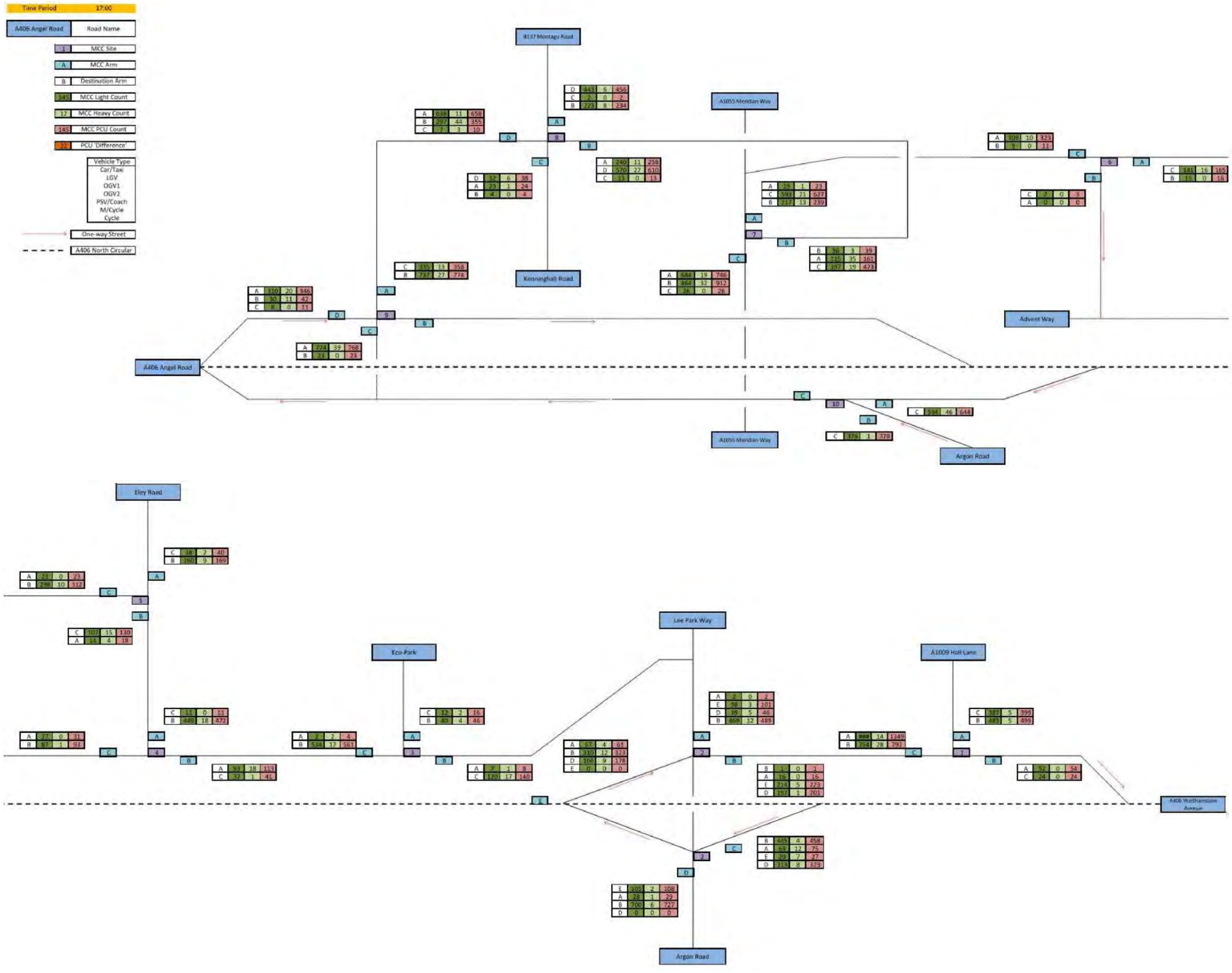
Scale at A3

| Job No | Drawing Status |
|---|---|
| **235271-00** | **Issue** |

| Figure No | Revision |
|---|---|
| **3.3** | **P1** |

MXD Location

A3






| Revision | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 20-08-15 | DM | DM | GW |

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Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

Drawing Title
**Baseline traffic flows - PM peak hour**

Scale at A3

Job No
**235271-00**

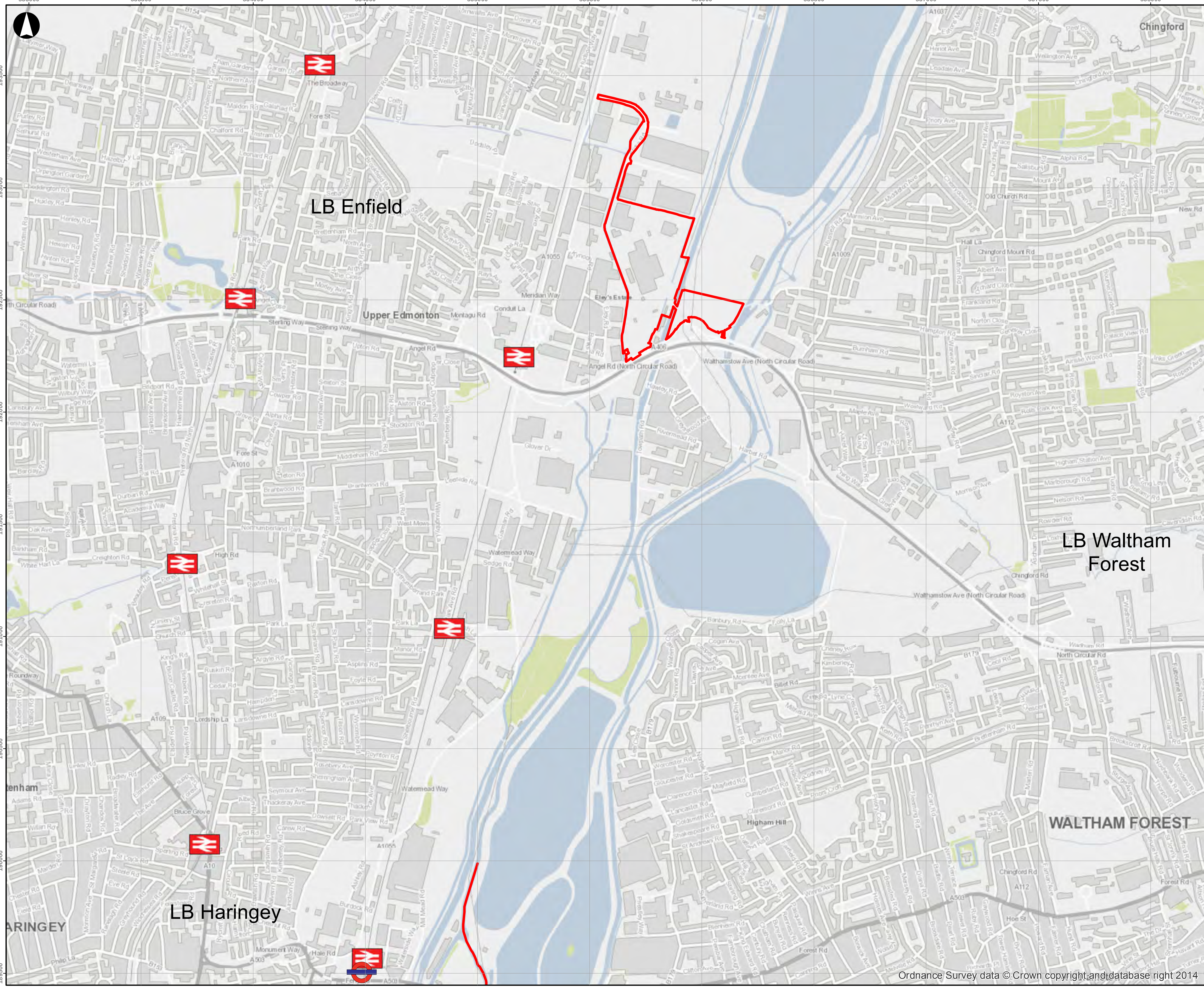
Drawing Status
**Issue**

Figure No
**3.4**

Revision
**P1**

MXD Location

A3




MXD Location

**Legend**

- Application Site boundary
- London Underground
- National Rail Stations



| Revision | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 26-08-15 | AC | DM | SJ |

Metres: 0, 200, 400, 800

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Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

Figure Title
**Local transport stations**

Scale at A3
**1:16,000**

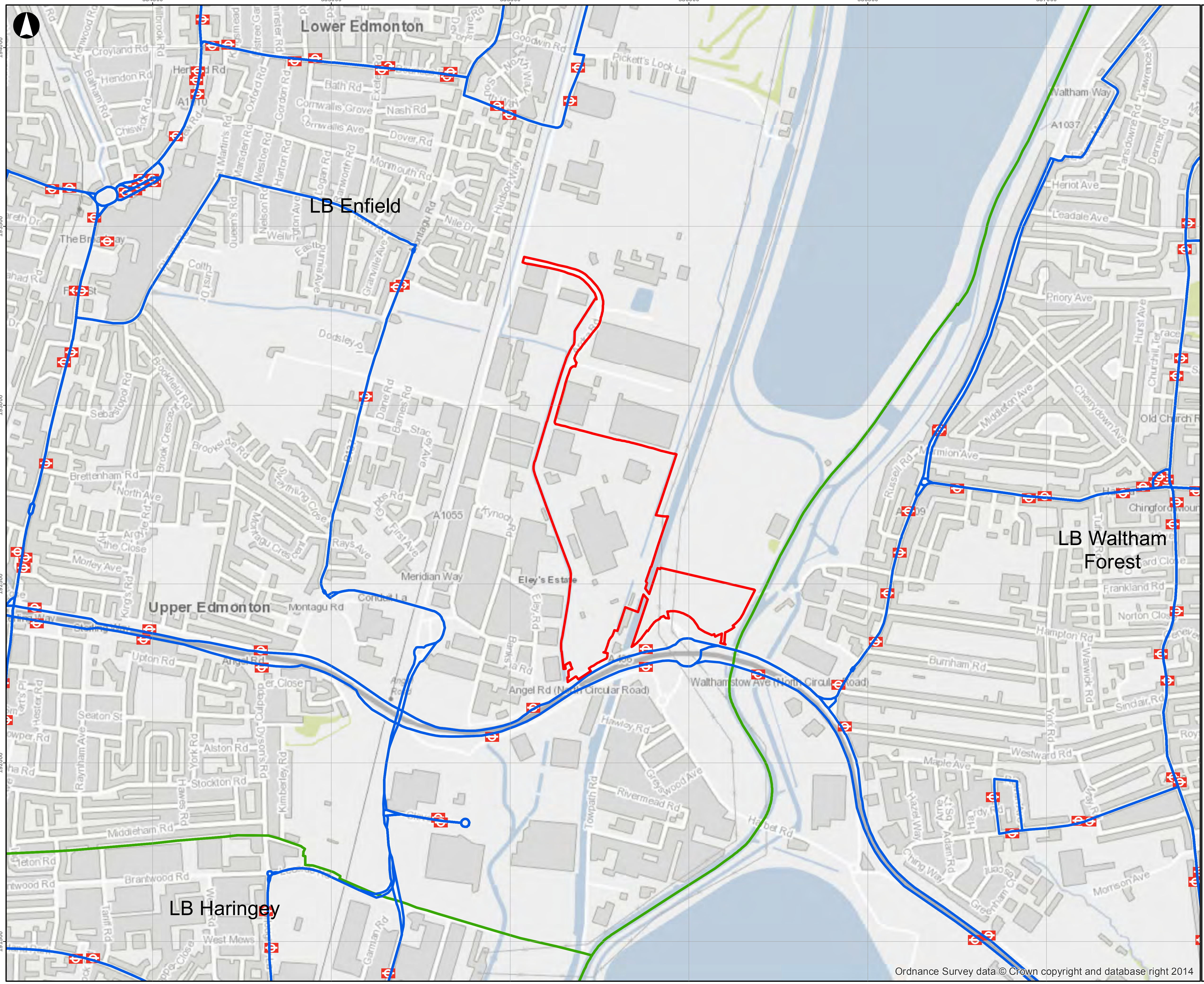
Job No
**235271-30**

Drawing Status
**Issue**

Figure No
**3.5**

Revision
**P1**

A3




## Legend

- Application Site boundary
- Roads Used by Buses
- London Bus Stop
- London Borough Boundary



| Revision | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 26-08-15 | AC | DM | SJ |

Metres
0 100 200 400

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Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

Figure Title
**Local bus stops and roads used by buses**

Scale at A3
**1:10,000**

Job No
**235271-30**

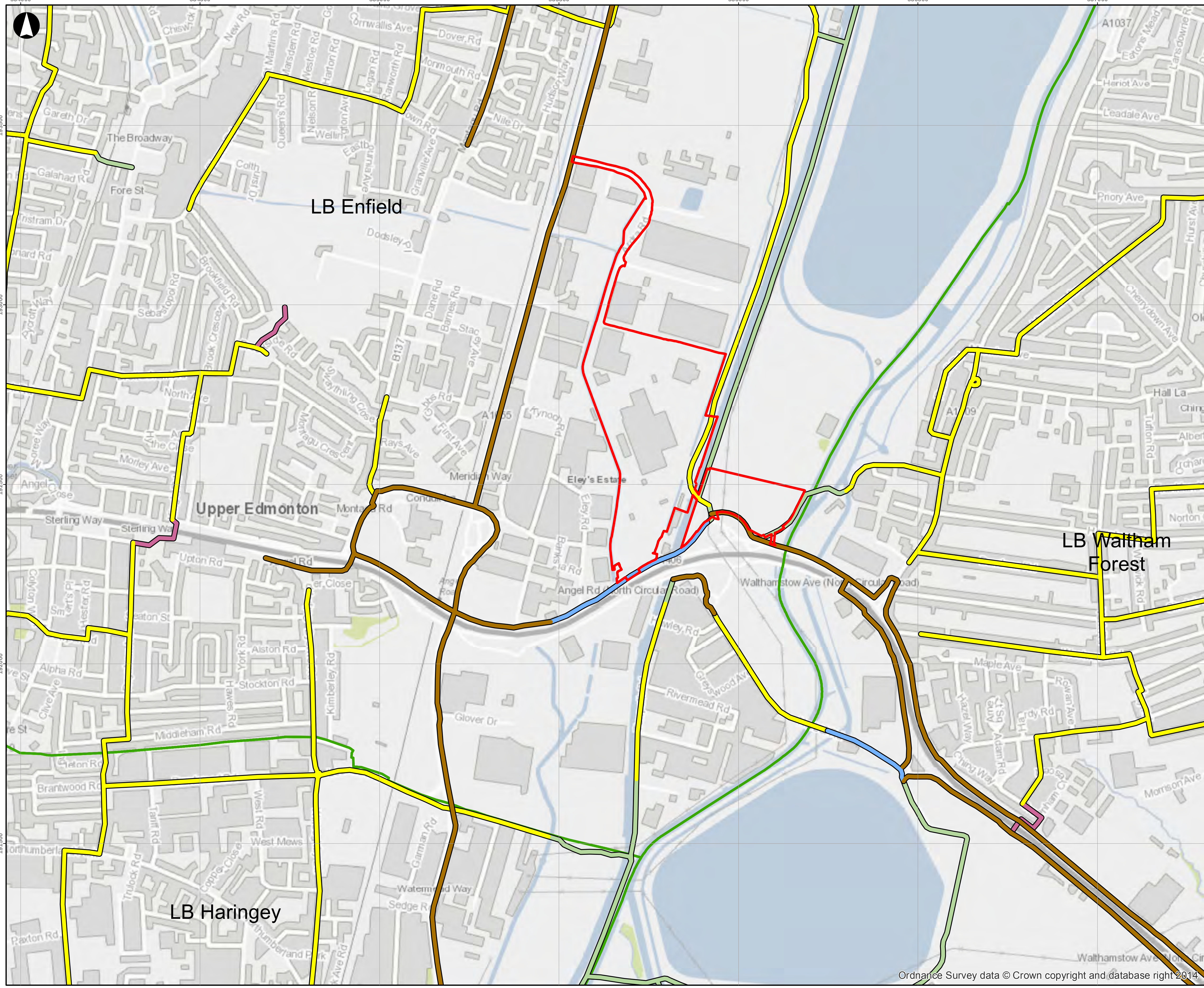
Drawing Status
**Issue**

Figure No
**4.5**

Revision
**P1**

MXD Location

A3




**Legend**

Application Site boundary

**London Cycle Guide**

**FACILITY**

| | |
|---|---|
| Off Carriage | *Provision for cyclists alongside busy roads* |
| Signed Route | *Routes signed for cyclists that may be on busier roads* |
| Advisory | *Routes on quieter roads recommended by cyclists* |
| Park or Canal Route | *Routes through parks for walking & cycling* |
| Pedestrian Link | *Pedestrian only route* |
| London Borough Boundary | |



| Revision | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 26-08-15 | AC | DM | SJ |

Metres
0 100 200 400

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Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

Drawing Title
**Local cycle routes**

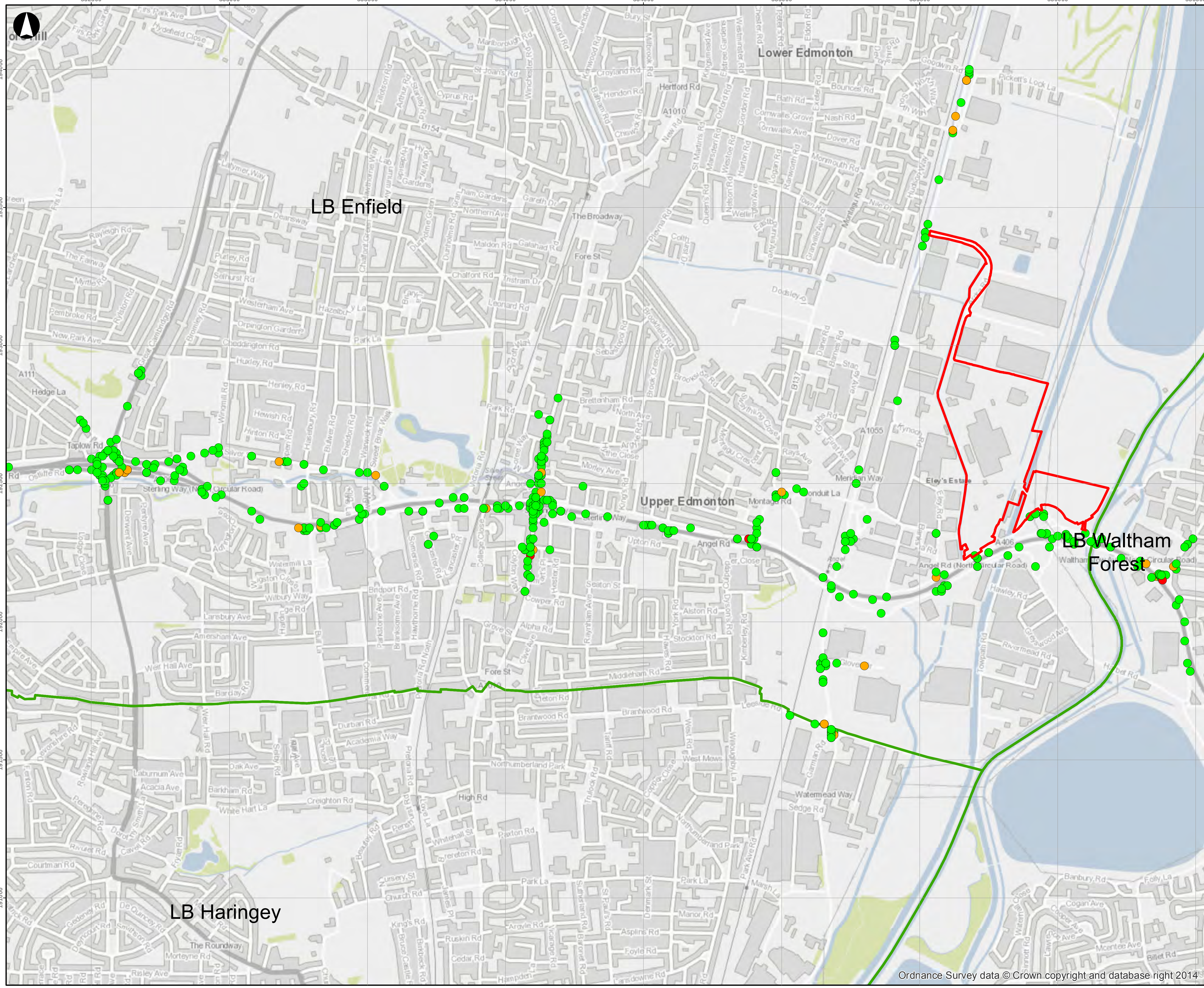
Scale at A3
**1:10,000**

Job No **235271-30**
Drawing Status **Issue**

Figure No **3.7**
Revision **P1**

MXD Location

A3




**Legend**

Application Site boundary

**Accident locations**

**Severity**

- 3 Slight
- 2 Serious
- 1 Fatal

London Borough Boundary



| P1 | 26-08-15 | AC | DM | SJ |
|---|---|---|---|---|
| Revision | Date | By | Chkd | Appd |

Metres

0 100 200 400

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Client

**North London Waste Authority**

Job Title

**North London Heat and Power Project**

Drawing Title

**Accident Locations**

Scale at A3

**1:13,000**

Job No **235271-30**

Drawing Status **Issue**

Figure No **3.8**

Revision **P1**

MXD Location

# TRANSPORT ASSESSMENT: APPENDICES

## Appendices

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Appendix B – Stakeholder Meeting Minutes & TfL Pre-application advice letter

Appendix C – Modelling Output

Appendix D – Road Safety Audits

Appendix F – Operation Trip Generation Supporting Information

Appendix G – Construction Trip Generation Supporting Information

Appendix H – Cumulative Scheme Information

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Appendix J – Framework Construction Travel Plan

Appendix K – Framework Operation Travel Plan

# **Appendix A** – TA Scoping Report

North London Waste Authority

# North London Heat and Power Project

Transport Assessment Scoping Report

PS3

Issue Revision A

30 September 2014 | 235271-30

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north london waste authority

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# Contents



## Figures

# Glossary

| | |
|---|---|
| CPZ | Controlled Parking Zone |
| ATC | Automatic Traffic Count |
| BWRF | Bulky Waste Recycling Facility |
| DCLG | Department for Communities and Local Government |
| DCO | Development Consent Order |
| DEN | Decentralised Energy Network |
| DfT | Department for Transport |
| EfW | Energy from Waste |
| ERF | Energy Recovery Facility |
| FPP | Fuel Preparation Plant |
| GLA | Greater London Authority |
| HWRC | Household Waste Recycling Centre |
| LBE | London Borough of Enfield |
| LBH | London Borough of Haringey |
| LCN+ | London Cycle Network Plus |
| LVHN | Lea Valley Heat Network |
| LWL | LondonWaste Limited |
| MCC | Manual Classified Count |
| MW | Mega Watts |
| NLHPP | North London Heat and Power Project |
| NLWA | North London Waste Authority |
| NPPF | National Planning Policy Framework |
| PTAL | Public Transport Accessibility Level |
| SRN | Strategic Road Network |
| TA | Transport Assessment |
| TfL | Transport for London |
| TLRN | Transport for London Road Network |
| WCA | Waste Collection Authority |

# 1 Introduction

## 1.1 Scoping study

1.1.1 Arup has been appointed by the North London Waste Authority ('the Authority') to undertake a Transport Assessment (TA) to support a Development Consent Order (DCO) submission for the North London Heat and Power Project (hereon referred to as the NLHPP). It is currently intended that the DCO application will be submitted to the Planning Inspectorate in late summer 2015.

1.1.2 The TA will set out the transport issues relating to the NLHPP and identify what measures will be taken to deal with the anticipated transport impacts of the scheme.

1.1.3 The TA will be prepared in accordance with the Department for Transport's (DfT) *Guidance on Transport Assessment* (2007) and Transport for London's (TfL) best practice guidance (http://www.tfl.gov.uk/info-for/urban-planning-and-construction/transport-assessment-guidance, 2014).

1.1.4 The purpose of this TA Scoping Report is to provide the local planning and highways authorities with a description of the work proposed to be undertaken in the TA. The methodology for the assessment work is to be informed by discussions with the London Borough of Enfield (LBE), TfL and other relevant stakeholders. The report will ensure that the scope and methodology of the TA is acceptable.

## 1.2 The North London Waste Authority

1.2.1 The North London Waste Authority is a statutory authority, which was established in 1986 after the abolition of the Greater London Council. The Authority's principal statutory responsibility is for the disposal of waste collected by the seven north London boroughs of Barnet, Camden, Enfield, Hackney, Haringey, Islington and Waltham Forest (the Constituent Boroughs). The Constituent Boroughs are also waste collection authorities (WCAs) in their respective areas.

1.2.2 The Authority is the UK's second largest waste disposal authority handling approximately 2.5% of the total national municipal waste stream. Since 1994 the Authority has managed its waste arisings predominantly through its waste management contract with LondonWaste Limited (LWL) and the use of the energy-from-waste (EfW) facility at the EcoPark in Edmonton.

1.2.3 The Authority is now seeking to gain a Development Consent Order for the development of a new state-of-the-art Energy Recovery Facility (ERF) to replace the current ageing facility which was opened in 1970 and has a projected remaining operational life to circa 2025.

## 1.3 Site location and description

1.3.1 The NLHPP is located at the Edmonton EcoPark (the EcoPark), which is a waste management complex of around 16 hectares which is located within the London Borough of Enfield. It is accessed from Advent Way, which leads onto the A406 North Circular, and the nearest residential properties are located approximately 500m to the east and 600m to the west of the site.

1.3.2 The EcoPark which is within the Lea Valley corridor which follows the River Lee from Ware, Hertfordshire, in the north to the River Thames at the East India Dock Basin in the south. The site is close to boundaries with the London Boroughs of Haringey and Waltham Forest.

1.3.3 To the north of the EcoPark are a number of industrial and commercial premises (including a materials recovery facility operated by a commercial waste management company) beyond which lies the Deephams Sewage Treatment Works (STW). The Lee Valley Regional Park (LVRP) which is managed by the Lee Valley Regional Park Authority is located to the east of the EcoPark. The LVRP is designated as Green Belt and a Site of Metropolitan Importance for Nature Conservation. The A406 North Circular is located to the south beyond which are retail and trading estates contained within the wider Meridian Water area. To the west is the Salmons Brook watercourse beyond which is Eley Industrial and Retail Park and Angel Road station. The location of the NLHPP can be seen in Figure 1-1.

1.3.4 The development would comprise an electricity generating facility using residual waste as a fuel and capable of an electrical output of up to 70 MW. The main plant would comprise:

- two process lines, with each line having a moving grate, furnace, boiler and a flue gas treatment plant and stack;
- a steam turbine and generator set;
- “heat off-take” equipment within the ERF with an initial heat supply through a connection to a separate heat network centre located on the site. The system will be designed to be capable of providing heat in the region of 35 MW which will provide benefit to north and east London;
- a waste bunker with sufficient capacity to hold a minimum equivalent of 5-7 days of processing capacity;
- two overhead cranes in the bunker hall;
- air or water cooled condenser(s);
- a plant control and monitoring system;
- an emergency diesel generator; and
- a tipping hall and one way access ramp.

1.3.5 Ancillary elements would include:

- a weigh bridge;
- Fuel Preparation Plant (FPP);
- Bulky Waste Recycling Facility (BWRF); and
- Household Waste Recycling Centre (HWRC).

- hard and soft landscaping directly related to the main building works.

1.3.6 The project is expected to include the following associated development:

- upgrade of the electricity connection to the National Grid;
- new site access from the Lee Park Way;
- new internal roads and parking areas;
- administrative buildings and visitor centre;
- the decommissioning of the existing Edmonton EfW facility and making the site good (timed to take place following commissioning of the new ERF and with a transition period of up to a year).
- relocation of the LondonWaste Limited (LWL) vehicle depot and servicing.

1.3.7 Areas of the site not utilised for the NLHPP will be retained for other potential waste management activity in the future.

## 1.4 Construction programme

1.4.1 It is expected that the earliest construction would commence is 2018/2019, although this may be later.

1.4.2 It is estimated that construction will take three years, including a six month commissioning period. Once construction is complete and the operating licence is in place, it is expected that the phased movement from the existing EfW to the new ERF will occur over one year. The existing EfW will then be decommissioned and demolished after 2024/2025.

# 2 Policy context

2.1.1 The TA will outline the national, regional and local polices relevant to the NLHPP. These currently include:

- National Planning Policy Framework (NPPF) (Department for Communities and Local Government (DCLG), 2012);
- The London Plan (GLA, 2011) including the Revised Minor Alterations to the London Plan (2013) and the Draft Further Alterations to the London Plan (2014);
- The Mayor’s Transport Strategy (GLA, 2010);
- Adopted Enfield Core Strategy (LBE, 2010);
- Unitary Development Plan Saved Policies (LBE, 1994); and
- Edmonton EcoPark Planning Brief (LBE, 2013).

2.1.2 A commentary on how the NLHPP will comply with all national, regional and local policy will be provided.

2.1.3 Other relevant guidance will be consulted as appropriate, including but not limited to:

- Manual for Streets (DfT, 2007); and

- Inclusive Mobility (DfT, 2002).

# 3 Existing site

3.1.1 The TA will provide details of the current operations on the Edmonton EcoPark site, including:

- the existing capacity and operation of the site in terms of waste throughput;
- the waste streams treated on the site and the typical daily number of vehicles associated with each waste stream;
- the existing site access for all modes of transport;
- the provision of parking (car, motorcycle and cycle) on the site;
- other activities on the site including the LBE vehicle depot and the Sea Cadets facility; and
- activities and land uses in the vicinity of the site.

# 4 Baseline conditions

4.1.1 Existing transport conditions in the vicinity of the NLHPP will be established to provide baseline data against which the potential impacts arising from the NLHPP can effectively be assessed. Baseline observations have been informed by a series of site visits.

4.1.2 The following sections describe the baseline data to be provided within the TA report.

## 4.2 Local highway network and traffic flows

4.2.1 The key route in the vicinity of the NLHPP is the A406 North Circular Road. This forms part of the Transport for London Route Network (TLRN) and provides the main east to west connection across north London. While there is no direct access to the Strategic Road Network (SRN) in the vicinity of the proposed site, it can be accessed to the west of the site on the A1010 Fore Street and to the east of the site on the A112 Chingford Mount Road. Both of these routes travel in a north to south direction.

4.2.2 In the direct vicinity of the site, the key highway links are:

- A1005 Meridian Way;
- Advent Way;
- Argon Road;
- Walthamstow Avenue;
- Hall Lane;
- Montagu Road;
- Eley Road; and
- Nobel Road.

4.2.3 Traffic flow data collected in May 2013 will be used to inform the assessment of the effect of the NLHPP on the local highway network. The traffic surveys included manual classified counts (MCC) and queue length measurements at a number of locations in the vicinity of the site including:

- The site access on Advent Way;
- A number of junctions within the Eley Estate;
- The junction of the A406 North Circular Road with Advent Way; and
- The junctions of Meridian Way and Montagu Road with the A406 North Circular Road.

4.2.4 Saturation flow measurements undertaken in November 2012 will also be used to inform the assessment. Where appropriate, traffic survey data which forms part of on-going monitoring by TfL and the DfT on the A406 North Circular Road and other roads will be obtained to compare with the traffic surveys and to highlight any traffic flow trends on the local highway network in recent years.

## 4.3 Public transport

4.3.1 The TA will outline existing public transport services operating in the surrounding. Information will be provided on the frequency of services, location of bus stops, mainline rail and London Underground stations. The site currently has a Public Transport Accessibility Level (PTAL) of 1b (source: TfL Planning Information Database). This is rated as ‘very poor’ (with 1a being the lowest accessibility and 6b being the highest accessibility).

4.3.2 The closest London Underground station to the EcoPark site is Tottenham Hale which is over 3km (straight line distance) to the south of the EcoPark. Victoria line London Underground trains are accessible at this station and operate to Walthamstow Central in the northbound direction and to Brixton in the southbound direction.

4.3.3 National Rail services are available at Angel Road station, located approximately 600m (walking distance) to the west of the EcoPark. National Rail services from Angel Road operate to Stratford in the southbound direction. Trains services to and from Angel Road are operated by National Express East Anglia.

4.3.4 There are no direct trains to Liverpool Street station. However, services operating to and from Liverpool Street can be accessed by interchanging at Tottenham Hale station.

4.3.5 There are two London Bus routes operating in close proximity to the Eco-park. Routes 34 and 444 are served by bus stop on the eastbound off-slip and westbound on-slip at the junction of the A406 North Circular Road and Advent Way. These bus stops are almost 500m walking distance from the Eco-park. One additional route, Route 192, is accessible on Meridian Way to the north and south of the A406.

## 4.4 Pedestrian and cycle Networks

4.4.1 Footways are provided along the main routes leading to and from the site and public transport nodes. In particular, there is a continuous footway on the north side of Advent Way although on the approach to the roundabout where the A406 on/off slips meet Advent Way, the footway widths are narrow and are overgrowing with vegetation in places. There are no crossing facilities at this junction.

4.4.2 The pedestrian environment is generally poor and the quality of the environment is reduced by noise associated with high traffic flows on the A406. The A406 also acts as a barrier to pedestrian movements in the vicinity of the site. A footbridge is, however, provided over the dual carriageway some 600m to the west of the site.

4.4.3 There are a number of cycle routes within the vicinity of the EcoPark. The following routes are available:

- a north to south route along the River Lee Navigation;
- an off-carriageway route adjacent to the A406 to the east of the EcoPark and along Advent Way to the west; and
- an off-carriageway route in a north to south direction along Meridian Way both to the north and south of the A406.

4.4.4 The London Cycle Network Plus (LCN+) is also accessible from the NLHPP. LCN+ Link 202 runs in a north to south direction on the A112 Chingford Hall Road north and south of the A606.

## 4.5 Parking

4.5.1 The existing EcoPark provides parking for 211 cars / vans / operational vehicles. These parking spaces are all provided at grade. Details on the existing parking provision for cycles and motorcycles will also be provided in the TA.

## 4.6 Road safety

4.6.1 Details of road traffic accidents in the vicinity of the NLHPP will be obtained from TfL and will be reviewed to determine whether there are any particular problems or trends on the local highway network. Data for the latest available three year period for the local area will be analysed including a review of the severity, casualty type and location of recorded accidents. Any accident hotspots or trends in causality will be identified.

# 5 Proposed development

5.1.1 The TA will outline the development proposals in detail. This will comprise a description of both construction and operational activities, including:

- the proposed capacity of the site in terms of waste throughput;
- the volume of waste to be treated in each waste stream and the types of vehicles to be used in transporting the waste to the site;

- the origin and destination of waste input and waste output;
- the proposed site access for all modes of transport and the internal vehicular circulation on the site;
- any office facilities to be provided on site;
- the provision of parking (car, operational vehicle, motorcycle and cycle) on the site;
- the construction phasing for the NLHPP including decommissioning and demolition of the existing EfW; and
- any ancillary activities on the site such as a visitor centre.

5.1.2 Work to determine the optimal site access is underway. It is likely that the existing access location at the south of the site, accessed via the A406 and Advent Way, will continue to be the main access point. Additionally, the Authority is investigating a separate route and entry for the general public to access the HWRC via the Lea Park Way. A potential alternative construction access from the north is also being investigated via Meridian Way, Deephams Farm Road and Ardra Road.

# 6 Trip generation

6.1.1 The TA will outline the trip generation for the NLHPP. The trip generation model used to inform the Edmonton EcoPark Planning Brief (LBE, 2013) will be used as the basis for this exercise and will be updated as appropriate. It is envisaged that three trip generation scenarios will be developed. These are:

1. Construction phase with the existing EfW facility in operation;
2. Transition period in which the ERF is completed and existing EfW is decommissioned and demolished; and
3. Completed ERF with the HWRC also operational on the site.

6.1.2 For each scenario, the number of vehicle trips generated by the NLHPP will be calculated with an appropriate directional split applied to distribute the trips to the local highway network.

6.1.3 The number of trips and the directional distribution will be derived based on the borough/location from which waste is arriving, the volume of municipal waste arriving at the site from each borough/location, the location of any waste transfer stations from which waste is arriving and the destination of any waste outputs. The number of construction traffic trips and directional distribution will be derived in a similar manner, based on the anticipated origins and destinations of construction materials and construction waste.

6.1.4 For employee trips, a mode share will be calculated to determine the number of trips undertaken to the NLHPP by each mode of transport. These trips will also be distributed to the local transport networks. Existing employee mode share data will be obtained, if available, to inform this element of the assessment.

6.1.5 All source information and assumptions used in developing the trip generation for the NLHPP will be clearly set out within the TA.

## 7 Effect of the proposed development

7.1.1 The TA will assess the effect of the NLHPP on the local transport networks. The main focus of this assessment will be on the local highway network.

7.1.2 The analysis of the future operation of the local highway network will focus on the construction and operational phases. It is assumed that five scenarios would be assessed, namely:

- the existing baseline (2014/15);
- the future baseline (including traffic associated with the committed and planned schemes);
- the development case for a nominated year in the construction period;
- the development case for the opening year of operation of the new ERF while the existing EfW is decommissioned and demolished; and
- the development case for a completed site including the HWRC when the EfW is decommissioned.

7.1.3 The geographical scope of the assessment of the local highway network has not yet been determined and will depend on the location of the site access. This scope of the assessment will be agreed with TfL and LBE. At the very least, the proposed site access will be assessed.

7.1.4 While the focus of the assessment will be on the local highway network, an assessment will also be undertaken of the effects of the NLHPP on the public transport walking and cycling networks. Opportunities to transport materials by water during construction and operation will also be discussed in the TA.

7.1.5 The TA will also identify any measures that may be necessary to mitigate the effects of additional vehicular and person trips arising from the NLHPP.

## 8 Servicing and waste

8.1.1 Details of the servicing of any office and ancillary facilities provided as part of the NLHPP will be set out in the TA. This will include:

- calculation of the number of deliveries / collections for design use and inclusion in the TA;
- details of the type of deliveries and anticipated delivery times;
- details of the number of loading bays and service area layout, including vehicle swept path analysis; and
- calculation of waste generation. This will be provided in waste streams (paper, plastics, etc), so that the waste recycling can be considered. Any existing site policy regarding waste will be reviewed an updated as necessary.

# 9 Travel Plan

9.1.1 The TA will include a Framework Travel Plan for employees at the NLHPP during both construction and operation. The Travel Plan will identify a series of measures aimed at encouraging sustainable travel choices and reducing the number of car based trips generated as a result of the development. The Framework Travel Plan will outline what should be contained within the Final Travel Plan, to include targets and a robust monitoring strategy.

9.1.2 The Framework Travel Plan will be completed in accordance with TfL's guidance (November 2013) on travel planning. In order to influence all modes of travel, the Framework Travel Plan will include both physical and awareness-raising measures. The Framework Travel Plan will include the following:

- objectives;
- potential measures to encourage public transport use;
- potential measures to promote walking;
- potential measures to promote cycling;
- car-sharing;
- mode share targets;
- travel information and marketing;
- the need for a Travel Plan Co-ordinator;
- monitoring and review mechanisms;
- an action plan; and
- details on securing the travel plan and how it will be funded.

# 10 Reporting

10.1.1 All of the above will be reported in detail in the TA and associated appendices accompanying the DCO submission for the NLHPP, which is expected to be submitted in late summer 2015.

10.1.2 Arup proposes to maintain a continuing dialogue with LBE and TfL through a series of meetings to discuss and agree various elements of the TA prior to its submission.

# Figures

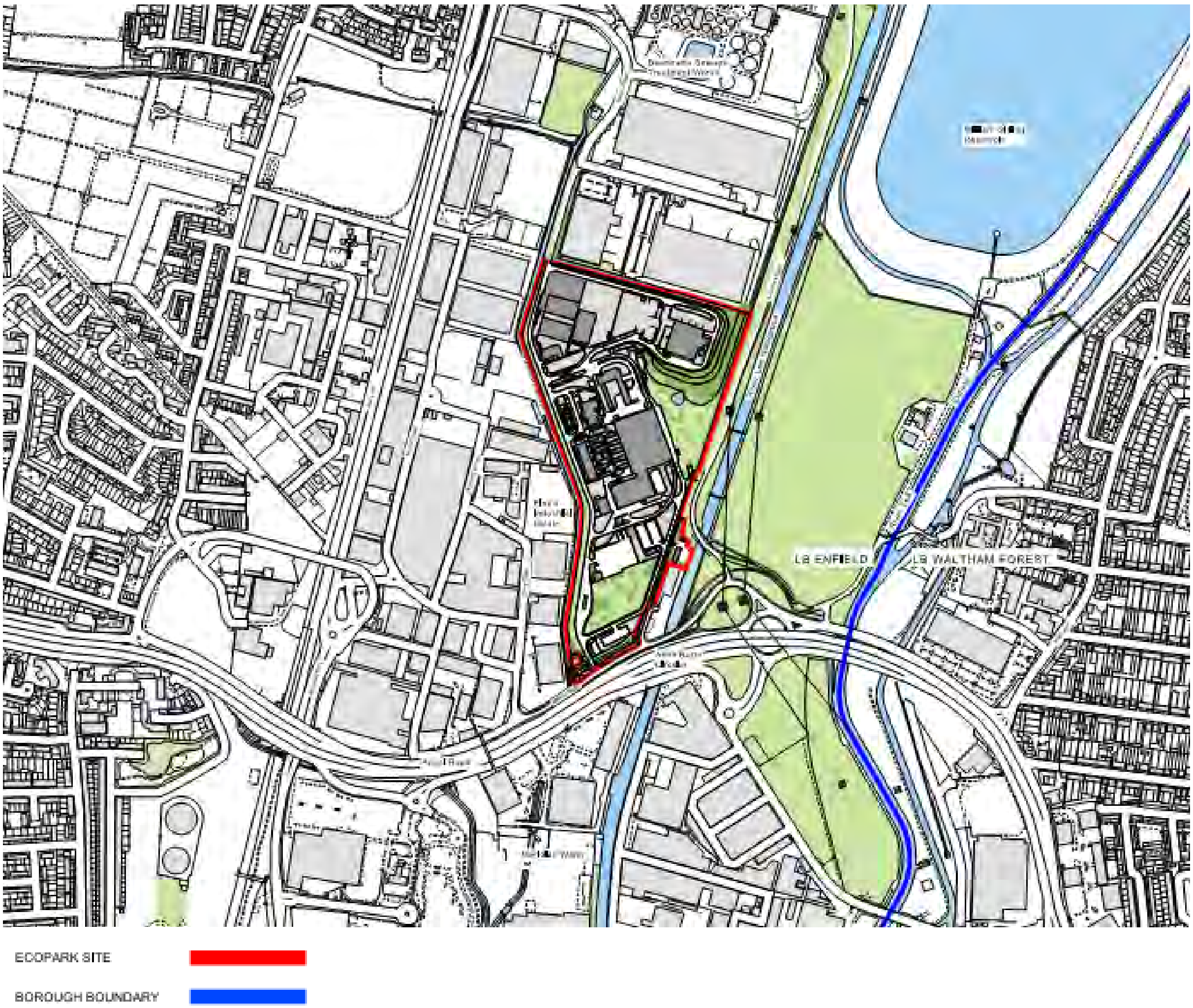


Figure 1-1: Site location

# **Appendix B** – Stakeholder Meeting Minutes & TfL Pre-application advice letter

# Minutes

ARUP

| | | | |
|---|---|---|---|
| Project title | North London Heat and Power Project | Job number<br>235716-30 | |
| Meeting name and number | TfL Pre-Application Meeting | File reference<br>02 | |
| Location | 55 Broadway | Time and date<br>10:00 26 August 2014 | |
| Purpose of meeting | Formal Pre-application for the NLHPP | | |
| Present | Melvyn Dresner (MD) - TfL<br>Martin Rose (MR) - TfL<br>Nathaniel Chin (NC) - TfL<br>Euston Ling (EL) - NLWA<br>Stuart Jenkins (SJ) - Arup | Ashok Banerjee (AB) - TfL<br>Lukman Agboola (LA) - TfL<br>Mike Hoyland (MH) - LBE<br>Nick Finney (NF) - Arup<br>David McCann (DM) - Arup | |
| Apologies | Gavin Wicks - Arup | | |
| Circulation | Those present<br>Anne Crane - TfL<br>Katie Kerr - Arup | <br>Gavin Wicks - Arup<br>Nicola White - Arup | |

Action

**1. Introductions**

**2. TfL pre-application advice service**

MD outlined that the meeting was undertaken as part of the TfL formal pre-application service. MD advised that a letter would be prepared and issued within 10 working days of the meeting and that this would provide a summary of the meeting and TfL's advice. — MD

**3. Overview of the proposals and the DCO Process**

EL described the role of the Authority as a statutory body which manages the waste arising from seven north London boroughs (Camden, Islington, Barnet, Enfield, Haringey, Waltham Forest and Hackney). The Authority is responsible for waste arising from 1.7 million homes and for between 800,000 and 900,000 tonnes per annum (tpa). Residual waste is taken to the existing Edmonton EcoPark energy from waste (EfW) facility which has a capacity to process 530,000 tpa. Some waste is consigned to landfill via a rail transfer station at Hendon.

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|---|---|
| Prepared by | David McCann |
| Date of circulation | 2 September 2014 |
| Date of next meeting | TBC |

Action

EL described that the proposals will see the construction of a new Energy Recovery Facility (ERF) on the site which is planned to treat all of the non-recoverable waste arising from the seven north London boroughs. The facility would replace the existing EfW facility and would generate in excess of 50 megawatts of energy. This level of energy generation triggers the need for an application to be made to the Secretary of State for Energy through the Development Consent Order (DCO) process, rather than a typical planning application that is determined by the Local Planning Authority.

EL described that the ERF will have a capacity to process between 600,000 and 700,000 tpa. While a recycling rate of 33% is currently being achieved, the Authority's target is to increase this to around 50% by 2020/21. This will offset any increase in non-recoverable waste due to population growth.

EL also described that the ERF is expected to be linked to the Lee Valley Heat Network (LVHN), providing heat to homes in Enfield and Haringey.

**4. Planning and construction programme**

EL outlined that it is intended that the application be submitted to the Planning Inspectorate (PINS) in September 2015. It is anticipated that a decision to grant or refuse permission by December 2016. In the lead up to submission, there will be two stages of consultation which must be undertaken as part of the statutory process. The first will commence at the very end of the November for eight weeks while the second will commence in May 2015, again for eight weeks. It is intended that any issues are resolved during consultation so that the final TA represents an agreed position, so far as is practically possible.

EL outlined that the earliest construction could commence is 2018/19, but that it may commence slightly later. It is estimated that the scheme would take approximately three years to complete, including a six month commissioning period. The existing EfW has a life capacity up to 2025.

EL stated that the new ERF would have a design life of 25 to 30 years but that is likely to be extended through ongoing maintenance.

LA requested that an overview of the construction programme be included in an update of the TA Scoping Report and in the TA. — **Action:** Arup

**5. Transport context and TA methodology**

DM stated that the TA would include a number of trip generation / assessment scenarios. As set out in the TA Scoping Report, these would include:

- Construction of the ERF and associated facilities while the existing EfW is still in operation;
- Operation of the new ERF while the existing EfW is

| | | Action |
|---|---|---|
| | decommissioned and/or demolished; and<br>• Operation of the new ERF when the demolition of the existing EfW completed. | |
| | DM stated that all of the above scenarios will be considered against an appropriate future baseline scenario, which LA had also requested. MH queried whether this would coincide with the Deephams development to the north of the EcoPark. EL confirmed that it would not. | |
| | LA indicated the need to identify an area of interest for the assessment and that this would include critical junctions. LA also noted that the assessment should take account of other committed developments and infrastructure schemes within this area. SJ stated that this would be discussed in greater detail with TfL when the trip generation scenarios have been fully developed and a list of committed schemes has been compiled. | All |
| | EL discussed that there may be other development on the site post-decommissioning of the existing EfW but that any such developments would be subject to their own separate planning application(s). | |
| **6.** | **Vehicle access / construction access** | |
| | DM described the existing access which is at the south of the site. Vehicles typically access the site via Advent Way from the A406. DM stated that there are three options being considered for access. These are:<br>• The existing access;<br>• An access to the north of the site; and<br>• An access to the east of the site from Lee Park Way. | |
| | EL indicated that discussions are being undertaken with Thames Water regarding the use of the road at the north-west of the site (via Ardra Road). This access may be used during the construction phase to keep construction and operational traffic separate. LA stated that this would need to be considered against the operation and performance of the network. | |
| | EL also stated that an access from Lee Park Way could be used by small vehicles only and that the HGV/RCV traffic would use the access on Advent Way. Discussions have also been held with the Lee Valley Regional Park Authority regarding the possible use of Lee Park Way. | |
| | MD stated that car use and the use of car sharing should be looked at to ensure the number of vehicle trips by staff is kept to a minimum. DM stated that this will be addressed through the Travel Plan. | Arup |

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| **7.** | **Walking, cycling and public transport access – permanent scheme and construction** | |
| | DM stated that the TA will provide a review of the existing walking, cycling and public transport facilities in the vicinity of the EcoPark. For walking and cycling, opportunities to enhance the facilities and encourage increased travel to the site by these modes would be discussed in the TA. Any opportunities to improve access to public transport facilities would be explored but it was acknowledged that such opportunities might be limited given the location of the site with reference to nearby public transport nodes. | |
| | NC stated that the frequency of rail services at Angel Road station is currently very low but improvements are planned to support the Meridian Water development. The completion of the first 5,000 homes of the Meridian Water development would trigger the station upgrade. The station will be moved to the south (of the A406) and will be served by four trains an hour. NC indicated that that the level of development on the NLHPP site would not trigger an improvement for buses. | |
| | NC indicated that the bus routes in the area are being reviewed in respect of the number of buses serving the proposed Meridian Water development. TfL is looking to build up origin-destination data for trips to and from the area and from the data that is available, it appears that most people are travelling to and from the east. It is unlikely that this study will be completed by September 2015 but NC will provide updates as and when more information is available. | NC |
| **8.** | **Freight including access by water** | |
| | EL indicated that Peter Brett Associates has been commissioned to undertake a study looking at the options for transport by water. The study is in its formative stage but would be shared with TfL at an appropriate stage. The study will be provided as an appendix to the TA. | Arup/NLWA |
| | The movement of waste by water can be considered for two movements:<br>• The movement of waste into the site; and<br>• The movement of ash away from the site. | |
| | LA suggested that a number of other issues should be considered including cost and environmental conditions and that when all of the options are considered, it may be better to manage the movement of waste on the highway network. LA indicated that the need for vehicle access to the wharf should be considered. AB stated that if appropriate, the TA should show that some waste can be transported by water to show less traffic on the local highway network. | |
| | LA asked whether water transport will be used during the construction phase. EL indicated that this will need to be explored. | |

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| | AB suggested that the transport of waste could be addressed through a sensitivity analysis. SJ stated that this could be included using 'with water' and 'without water' scenarios. | Arup/NLWA |
| | EL stated that the movement of waste by water will need to be considered along with supply and off-take points. The movement of waste by water would only be feasible if appropriate facilities can be provided at these points. | |
| | NC suggested that there may be some constraints in moving freight by water, indicating that this may have been explored unsuccessfully for the Meridian Water site. | |
| **9.** | **Transport impacts / mitigation** | |
| | MR questioned whether other boroughs (outside of the seven north London boroughs) would be allowed to bring waste to the ERF. EL indicated that this was very unlikely but that some commercial and industrial waste may be brought to the ERF should there be any spare capacity. This would only be allowed until such time that the ERF would operate at capacity from household waste arising from the seven boroughs. | |
| | MR also asked whether the capacity takes account of projected population growth. EL stated that it does and that the Authority is looking to achieve a 50% recycling rate to off-set this. LA suggested that the London Plan waste projections are consulted. | Arup/NLWA |
| | EL indicated that the Authority has a waste transfer station at Hornsey Street, Islington. In the longer term, the Authority is also looking to provide a road based bulking facility that would reduce the number of vehicle trips to Edmonton (i.e. larger vehicles would be used). | |
| | EL also indicated that some boroughs are looking at implementing night time collections which would spread the delivery of waste to the ERF over a longer period. There are currently typically two peaks for the delivery of waste to the existing EfW, one in the morning and one in the afternoon. | |
| | DM indicated that the TA would be supported by a Travel Plan for employees during construction and operation. LA asked whether this would include cycle safety training for HGV drivers and said that this would need to be pushed further. EL confirmed that all vehicles under control of the Authority would be equipped with the correct safety equipment and training provided for drivers. However, the Authority can only encourage the boroughs to provide training for their vehicle drivers as they are not in the control of the Authority. SJ suggested that issues such as this might be covered in the Code of Construction Practice as well as under an operational Travel Plan. | Arup |

| | | Action |
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| | MR indicated that there may be issues with night-time travel given the likely shift-work nature of the site and this will need to be addressed in the TA. | |
| | NC asked if it was known where people do / will travel to and from as this will affect the bus routes. DM indicated that it was hoped that travel data for the existing employees can be obtained to assist in identifying this. | |
| | NC indicated that it might be more economical for the Authority to run a shuttle to a nearby station (Tottenham Hale or Walthamstow Central) rather than to contribute towards the extension of an existing bus route. | |
| | LA stated that there may be some issues with signals in the local area but that this would need to be looked at in greater detail when the trip generation exercise is completed. | Arup/NLWA |
| | It was requested that a section be included in the TA to set out potential Section 106 Heads of Terms and conditions relating to transport. | |
| **10.** | **Construction impact summary** | |
| | EL indicated that it is possible that there may be up to 500 construction staff on site at the peak of the construction period. EL indicated that an off-site construction compound could be used where employees could park and then be shuttled to the site. | |
| | MR and LA suggested that consolidation of materials be considered so to minimise the number of trips on the local highway network. This could involve the use of an off-site construction compound. MR also suggested that innovative techniques (e.g. off-site pre-fabrication) be considered to minimise the impact on the highway networks. | |
| | MR also discussed the hours of operation. The typical hours of operation are between 08:00 and 18:00 but given the location of the EcoPark (in a predominantly industrial area), different hours of operation could be considered. LA indicated that this could be an option but would need to be considered against the other environmental constraints (e.g. noise). AB indicated that any abnormal or special loads will need to be identified in the TA, both in terms of size and frequency. | Arup |
| **11.** | **Next Steps** | |
| | • MD agreed that TfL will review the draft scoping report and will provide a pre-application advice letter within ten working days of the meeting | MD |
| | • The letter will set out TfL's view of issues, matters to be addressed in the TA and next steps up to the provision of a draft TA. | |
| | • When the letter is received, Arup will produce an updated TA Scoping Report, based on comments received and including an outline programme, and issue to TfL for information. | Arup |

| | | Action |
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| | • The TA will be drafted on this basis if no further comments are received | Arup |
| | • A draft TA will be issued to TfL for comment at the appropriate stage. | Arup/NLWA |
| | It was also agreed that additional meetings would be held, if required. | |
| **12.** | **A.O.B.** | |
| | SJ indicated that other boroughs (Waltham Forest and Haringey) will need to be consulted and questioned when this should occur. MD indicated that Enfield will be kept informed on progress and Waltham Forest and Haringey can be involved if appropriate. EL stated that Waltham Forest and Haringey are statutory consultees and will be consulted during both phases of consultation. Additional discussions can be undertaken with both boroughs if requested / required. | TfL/Arup/NLWA |
| | MH stated that Enfield would be undertaking its own pre-application process. | |
| | LA indicated that there may be some issues related to the highway works approval process (post-consent) and questioned whether a co-operation protocol, similar to the Thames Tideway Tunnel project, would be required. SJ stated that it is too early to suggest what works, if any, would be required but that such works would likely be addressed through a S278 or S106 Agreement. EL added that any such agreements could be made through consultation or other additional meetings, as necessary. | |
| | LA requested that a site visit be organised. TfL to make contact with EL so that a site visit can be arranged. | TfL |
| | MH stated that the Eley Estate roads are currently unadopted but Enfield is currently looking at potentially adopting these roads. MH also highlighted that there are issues with vehicles accessing the EcoPark travelling through the Eley Estate and that this should be addressed for both the construction and operational stages. | |

Our ref: 14/2529

Transport for London
Group Planning

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Stuart Jenkins
Associate Director Transport Planning
Arup
13 Fitzroy Street
London W1T 4BQ

9 September 2014

Dear Stuart

**North London Heat and Power Project, Edmonton EcoPark– London Borough of Enfield – TfL's pre-application advice letter**

*Please note that these comments represent the views of Transport for London officers and are made entirely on a "without prejudice" basis. They should not be taken to represent an indication of any subsequent Mayoral decision in relation to a planning application based on the proposed scheme. These comments also do not necessarily represent the views of the Greater London Authority.*

Thank you for requesting a Transport for London pre-application meeting. The attendees were as follows:

| Name | Organisation |
|---|---|
| Euston Ling | **North London Waste Authority** |
| Mike Hoyland | **London Borough of Enfield – Highways and Transport** |
| Nick Finney | **Arup** |
| Stuart Jenkins | **Arup** |
| David McCann | **Arup** |
| Lukman Agboola | **TfL Forward Planning** |
| Ashok Banerjee | **TfL Road Space Management** |
| Nathaniel Chin | **TfL Buses** |
| Melvyn Dresner | **TfL Borough Planning** |
| Martin Rose | **TfL Delivery Planning – Water Freight** |

## 1. General

The Transport Assessment (TA) report to be produced by the applicant as part of the submission should be in line with TfL's 'Transport Assessment Best Practice Guidance' document (2010):
http://www.tfl.gov.uk/assets/downloads/businessandpartners/transport-assessment-best-practice-guidance.pdf

Should this application be granted planning permission, the developer and its representatives are reminded that this does not discharge the requirements under the Traffic Management Act 2004. Formal notifications and approval may be needed for both the permanent highway scheme and any temporary highway works required during the construction phase of the development.

## 2. Site and Surroundings

The Edmonton Eco Park is within the Upper Lee Valley Opportunity Area and is bounded by industrial uses to the north, the Lea Navigation and the Lee Valley Regional Park to the east, Advent Way to the south and Salmons Brook and Ely Industrial Estate to the west. The site is accessed from Advent Way, which leads to the A406 North Circular Road, part of the Transport for London Road Network (TLRN). The site lies some 1.5km from the nearest section of the Strategic Road Network (SRN) at the A1010 Fore Street.

Whilst Angel Road National Rail station lies approximately 500m to the south west, the walking environment between this station and the site is very poor. Currently frequency of service throughout the day is also poor (2tph).

Infrastructure upgrades to deliver 4 trains per hour service are, however, funded and will be delivered by 2019. Local bus routes include the 34, 341 and 444 run within 450m of the site, although the quality of the pedestrian routes between the site and bus stops served by these routes is again very poor. The site has a Public Transport Accessibility Level of 1b within the range of 6 (highest) and 1 (lowest).

The site currently operates as a waste processing facility and contains a central ‘Energy from Waste’ (EfW) incinerator, a composting facility, bulky waste and recycling facilities and Enfield Council’s refuse vehicle depot.

## 3. The North London West Authority

The North London Waste Authority is a statutory authority, which was established in 1986 after the abolition of the Greater London Council. The Authority’s principal statutory responsibility is for the disposal of waste collected by the seven north London boroughs of Barnet, Camden, Enfield, Hackney, Haringey, Islington and Waltham Forest (the Constituent Boroughs). The Constituent Boroughs are also waste collection authorities (WCAs). The Authority is responsible for waste arising from 1.7 million homes and for between 800,000 and 900,000 tonnes per annum (tonnes per annum). Residual waste is taken to the existing Edmonton EcoPark energy from waste (EfW) facility which has a capacity to process 530,000 tonnes per annum. Some waste is consigned to landfill via a rail transfer station at Hendon.

## 4. Development Consent Order

The Authority is seeking to gain a Development Consent Order for the development of a new state-of-the-art Energy Recovery Facility (ERF) to replace the current ageing facility which was opened in 1970 and has a projected remaining operational life to circa 2025. The Authority is the UK’s second largest waste disposal authority handling approximately 2.5% of the total national municipal waste stream.

The facility would replace the existing EfW facility and would generate in excess of 50 megawatts of energy. This level of energy generation triggers the need for an application to be made to the Secretary of State for Energy through the Development Consent Order (DCO) process, rather than a typical planning application that is determined by the Local Planning Authority.

The ERF will have a capacity to process between 600,000 and 700,000 tonnes per annum, which with current recycling rates means that the new facility would be capable of handling all waste generated in the Constituent Boroughs.

While a recycling rate of 33% is currently being achieved, the Authority's target is to increase this to around 50% by 2020/21. This will offset any increase in non-recoverable waste due to growth. The ERF is expected to be linked to the Lee Valley Heat Network (LVHN), providing heat to homes in Enfield and Haringey.

## 5. Development Overview

The development would comprise an electricity generating facility using waste as a fuel and capable of an electrical output of around 70 Megawatts. The main plant would comprise:

1) two process lines, with each line having a moving grate, furnace, boiler and a flue gas treatment plant and stack;
2) a steam turbine and generator set;
3) "heat off-take" equipment within the ERF with an initial heat supply through a connection to a separate heat network centre located on the site. The system will be designed to be capable of providing heat in the region of 40 MW which will provide benefit to north and east London;
4) a waste bunker with sufficient capacity to hold a minimum equivalent of 5-7 days of processing capacity;
5) two overhead cranes in the bunker hall;
6) air or water cooled condenser(s);
7) a plant control and monitoring system;
8) an emergency diesel generator;
9) a tipping hall and one way access ramp;
10) Fuel Preparation Plant (FPP);
11) Bulky Waste Recycling Facility (BWRF); and
12) Household Waste Recycling Centre (HWRC).

Ancillary elements would include a weigh bridge; and hard and soft landscaping directly related to the main building works. The project is expected to include the following associated development:

1) upgrade of the electricity connection to the National Grid;
2) new site access from the Lee Park Way;

3) new internal roads and parking areas;
4) administrative buildings and visitor centre;
5) the decommissioning of the existing Edmonton EfW facility and making the site good (timed to take place following commissioning of the new ERF and with a transition period of up to a year).
6) re-location of the LondonWaste Limited (LWL) vehicle depot and servicing.

Areas of the site not utilised for the NLWA will be retained for other potential waste management activity in the future; though likely part of a further application post approval of this proposal.

## 6. Planning and construction programme

The application will be submitted to the Planning Inspectorate (PINS) in September 2015. It is anticipated that a decision to grant or refuse permission will be made by December 2016.

In the lead up to submission, there will be two stages of consultation which must be undertaken as part of the statutory process. The first will commence at the very end of November (2014) for eight weeks while the second will commence in May 2015, again for eight weeks. It is intended that any issues are resolved during consultation so that the final TA represents an agreed position, so far as is practically possible.

The earliest construction could commence is 2018/19, but it may commence slightly later. It is estimated that the scheme would take approximately three years to complete, including a six month commissioning period.

The existing EfW has a life capacity up to 2025. The new ERF would have a design life of 25 to 30 years but that is likely to be extended through ongoing maintenance.

TfL agrees that an overview of the construction programme be included in an update of the TA Scoping Report and in the TA.

## 7. Vehicle access / construction access

The existing access which is at the south of the site will be retained. Vehicles typically access the site via Advent Way from the A406. There are three options being considered for access. These are:

- The existing access;
- An access to the north of the site; and
- An access to the east of the site from Lee Park Way.

Discussions are being undertaken with Thames Water regarding the use of the road at the north-west of the site (via Ardra Road). This access may be used during the construction phase to keep construction and operational traffic separate. The TA should consider these against the operation and performance of the network.

The access from Lee Park Way could be used by small vehicles only and HGV/RCV traffic would use the access on Advent Way. Discussions have also been held with the Lee Valley Regional Park Authority regarding the possible use of Lee Park Way for HGV/RCV traffic

The applicant should demonstrate that the existing site access and proposed site access can safely accommodate the full range of traffic from HGV/RCVs to cyclists, in line with London Plan policy 6.9.

**8. Transport context and TA methodology**

The TA Scoping Report includes the following scenario:

- Construction of the ERF and associated facilities while the existing EfW is still in operation;
- Operation of the new ERF while the existing EfW is decommissioned and/or demolished; and
- Operation of the new ERF when the demolition of the existing EfW is completed.
-

It was proposed that all of the above scenarios will be considered against an appropriate and agreed future baseline scenario. The TA will need to identify an area of interest for the assessment and take account of other committed developments and infrastructure schemes within this area.

For construction impact, it is worth noting that there may be a build up of activity and peak period. For TfL it would useful to understand this profile and its likely duration of the busiest peak over the build programme and over a construction day. TfL recommend that measures are considered to reduce the peak impact wherever possible both management measures, travel demand and alternative modes for goods and workers.

**9. Car and Cycle Parking**

TfL agrees that operational parking will be necessary to allow staff to access the site at all times of the day. Nevertheless, the theme of London Plan policy 6.13 is to ensure that a balance is struck between providing car parking and promoting sustainable travel, and all proposed car parking provision will be assessed on this basis.

Cycle parking together with changing facilities, lockers and showers should also be provided for staff wishing to cycle to work, and which should allow for overlapping shift workers. It is likely that during construction additional temporary provision maybe needed on and/or off site.

Provision should also be made for Electric Vehicle Charging points, parking for disabled car users and other provision that maybe needed related to visitor centre.

## 10. Walking, cycling and public transport access – permanent scheme and construction

The TA should provide a review of the existing walking, cycling and public transport facilities in the vicinity of the EcoPark. Opportunities to enhance the walking and cycling facilities and encourage increased travel to the site by these modes should be discussed in the TA.

There was a commitment to explore any opportunities to improve access to public transport facilities. However, it was acknowledged that such opportunities might be limited given the location of the site with reference to nearby public transport nodes.

## 11. Freight including access by water and Delivery and Servicing Planning

TfL would expect the TA to include a draft Delivery and Servicing Plan. The TA should provide detail about delivery and servicing arrangements by phase and overall and how this accords with best practice published by TfL and others, please see this link: http://www.tfl.gov.uk/info-for/freight/ and here: http://www.fors-online.org.uk/

The NLWA has commissioned Peter Brett Associates to undertake a study looking at the options for transport by water. The study is in its formative stage and should be shared with TfL before the conclusions are settled. TfL would welcome further engagement on this issue. The study should be provided as an appendix to the TA.

The use of water is being considered for two movements:

- The movement of waste into the site; and
- The movement of ash away from the site.

It would be useful for the TA to provide context on this issue i.e. setting out the various flows of all materials into and out of site – estimated volume and if not by water – how many lorry movements. TfL understands that to a large extent many loads are already on the road network – therefore, moving onto water may not be beneficial. Therefore, we are considering this as an opportunity to maximise water use during construction and operation. TfL understand there are dis-benefits and constraints to using water; however there is an opportunity here and external benefits as well as potential benefits to NLWA. Therefore, TfL would expect to take a balance approach.

At the meeting, we suggested that the transport of waste could be addressed through a sensitivity analysis. This could be included using 'with water' and 'without water' scenarios. It was stated that the movement of waste by water will need to be considered along with supply and off-take points. The movement of waste by water would only be feasible if appropriate facilities can be provided at these points. TfL favours a 'with water' scenario in accord with London Plan policy. It may be an unnecessary complication (depending on numbers) to undertaken sensitivity tests – however, we can discuss this further through the scoping and drafting of the Transport Assessment.

**12. Transport impacts / mitigation**

As stated earlier, the NLWA is not a collection authority so has limited control over vehicles that access the site. The NLWA is also looking to provide a road based bulking facility at Hornsey Street, Islington that would reduce the number of vehicle trips to Edmonton (i.e. larger vehicles would be used).
It was also indicated at the meeting that some boroughs are looking at implementing night time collections which would spread the delivery of waste to the ERF over a longer period. There are currently typically two peaks for the delivery of waste to the existing EfW, one in the morning and one in the afternoon.

TfL would expect that the TA will include measures to reduce impact of traffic on the wider network. However, given the nature of land use and the location this needs to be balanced against to the need to meet operational requirements.

**13. Construction impact summary**

The TA should include a summary of construction impacts. At the meeting it was suggested that there may be up to 500 construction staff on site at the peak of the construction period. It was indicated that an off-site compound could be used where employees could park and then be shuttled to the site. TfL suggested that consolidation of materials be considered so to minimise the number of trips on the local highway network. This could involve the use of an off-site construction compound. TfL suggests that innovative techniques (e.g. off-site pre-fabrication) be considered to minimise the impact on the highway networks.

TfL suggests considering the hours of construction and related work. The typical hours of operation are between 08:00 and 18:00 but given the location of the EcoPark (in a predominantly industrial area); different hours of operation could be considered. TfL understands there may other environmental constraints (e.g. noise). TfL would like to understand about any abnormal or special loads and these will need to be identified in the TA, both in terms of size and frequency.

A Construction Logistics Plan (CLP) will be required, and while this should be secured by condition or S106, the TA should still contain some information on how construction impacts are intended to be dealt with, in order to minimise the potential impact on the surrounding highway network. A CLP should include the cumulative impacts of construction traffic, likely construction trips generated, and mitigation proposed such as use of water especially to move bulky and abnormal loads. Details should include; site access arrangements, booking systems, construction phasing, vehicular routes and scope for load consolidation or modal shift to water use in order to reduce the total number of road trips generated.

Specific TfL advice can be found here:
http://www.tfl.gov.uk/microsites/freight/construction_logistics_plans.aspx

**14. Public Transport**

The frequency of rail services at Angel Road station is currently very low but improvements are planned to support the Meridian Water development. The station will be moved to the south (of the A406) and will be served by four trains an hour.

The level of development on the NLWA site would be unlikely to trigger a need for bus service enhancement. TfL indicated that the bus routes in the area are being reviewed in respect of the number of buses serving the proposed Meridian Water development. TfL is looking to build up origin-destination data for trips to and from the area and from the data that is available, it appears that most people are travelling to and from the east. It is unlikely that this study will be completed by September 2015 but NC will provide updates as and when more information is available.

Therefore, during construction and operation, TfL expects the TA to consider approaches to reduce car dependency and these would relate to soft measures, provision of staff travel buses, car sharing as well as promoting existing public transport, cycling and walking.

**15. Travel Plan**

The TA would be supported by a Travel Plan for employees during construction and operation. This should include cycle safety training for HGV drivers where it can be promoted. It should be confirmed that all vehicles under control of the NLWA would be equipped with the correct safety equipment and training provided for drivers and others should be encourage to follow best practice on this matters. It is acknowledge that the NLWA can only encourage the Boroughs to provide training for their vehicle drivers.

TfL indicated that there may be issues with night-time travel given the likely shift-work nature of the site and this will need to be addressed in the TA.
The TA should include travel data for the existing employees to help define future travel demand. It was suggested that the NLWA may wish to run a shuttle bus service NC indicated that it might be more economical for the Authority to run to a nearby station (Tottenham Hale or Walthamstow Central) rather than to contribute towards the extension of an existing bus route. In this circumstance agreement would need to be reached with TfL and the local highway authority as to suitable pick up and drop off points.

TfL would expect a Travel Plan for the Construction stage and permanent scheme. We understand there will be limited scope to improve existing public transport services – however, we expect over this time period improvements will be made by TfL and others. TfL expects opportunities to promote sustainable transport including public transport use, walking, cycling and shared travel will form part of the Travel Plan. The TP should set out targets and measures to achieve the above. There should be baseline mode of travel assessment as well as targets for one year, three years and five years. There need to be measures to discourage car use as well as positive measures to encourage public transport use, walking and cycling.

TfL guidance on Travel Plans can be found here:
*http://www.lscp.org.uk/newwaytoplan/travelplan_guidance.html*

**16. S106 Contributions and Community Infrastructure Levy (CIL)**
TfL expects that the applicants intended Section 106 Heads of Terms and conditions relating to transport should be included in the Transport Assessment.

In accordance with Policy 8.3 of the London Plan, the Mayor of London has introduced a London-wide Community Infrastructure Levy (CIL) that is paid by most new development in Greater London. More details are available via the GLA website www.london.gov.uk.

**17. Summary and Next Steps**
This letter constitutes TfL pre-application advice on this proposal. TfL areas of concern are as follows:

a. TfL Transport Assessment best practice advice should be followed.
b. An updated TA scope to be submitted to TfL for review.
c. TfL supports the principal of the development as helping to meet London needs and future growth.
d. TfL supports the proposed access strategy for the site; TfL would need to know that access can work safely in the future and take account of non-motorised modes.
e. Scenario testing proposed is acceptable to TfL – this may need further work in a revised scope, sensitivity testing only if necessary.
f. Car and cycle parking needs to be related to London Plan standards, operational needs and overall management including during construction.
g. Impact on TfL and Borough's areas of responsibility should be assessed. Mitigation agreed with each authority.
h. TfL would seek to review information and identify gaps. TfL aim to seek appropriate mitigation so we can support the granting of the DCO.
i. TfL needs to understand how the proposals translate into transport impacts – we will verify where we can and rely on the expertise of the NLWA.
j. Walking, cycling and public transport access may change in relation to other proposals in this area. TfL would seek options to improve access to site and encourage mode shift where practicable.
k. We expect DSP to be prepared for this site though we understand that the NLWA can influence logistics from collection authorities and only directly control a proportion of movements to site. .
l. Water freight study is welcome and this may require a workshop with TfL, Canal and Rivers Trust, NLWA and relevant consultants before the recommendations are finalised.

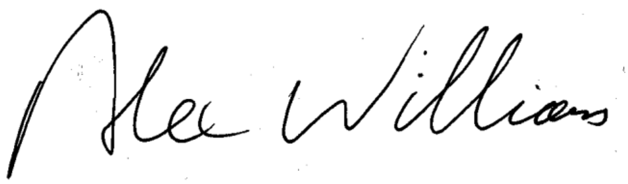
m. The opportunity to reduce this site's operational impact is shared with the seven collection authorities as well as through Travel Plan and DSP.

n. TfL is most concerned about construction impact. This should be assessed in the TA and mitigation proposed including CLP and other measures.

o. Programme information is useful for TfL, particularly where there is likely need for approval from TfL during the planning process and post-planning.

If you have any queries, further questions or seek clarification please contact the case officer Melvyn Dresner can be contacted (020 3054 7034 melvyn.dresner@tfl.gov.uk ) or I.

Yours sincerely



Alex Williams
**Director of Borough Planning**
Email: Alexwilliams@tfl.gov.uk
Direct line: 020 3054 7023

CC Euston Ling - NLWA
Nick Finney - Arup
Stuart Jenkins - Arup
David McCann – Arup
Ashok Banerjee - TfL

# Minutes

ARUP

| | | | |
|---|---|---|---|
| Project title | North London Heat and Power Project | Job number<br>235271-30 | |
| Meeting name and number | TfL Meeting 2/15 | File reference<br>235271-30 | |
| Location | TfL, Windsor House | Time and date<br>10:00am | 9 March 2015 |
| Purpose of meeting | Discussion of trip generation, travel plan and water transport | | |
| Present | Melvyn Dresner (TfL), Mike Hoyland (LB Enfield), Euston Ling (NLWA), Nick Finney (Arup), Gavin Wicks (Arup), David McCann (Arup) | | |
| Apologies | | | |
| Circulation | Those present | | |

Action

## 2.1 Project update

EL updated on consultation to date:

- Outlined the three access points (from Advent Way, Ardra Road and from Lee Park Way). Lee Park Way to be used by staff, visitors and public trips to the resource recovery centre (RRC).
- Construction activity could start 2018 at the earliest with the demolition of the existing facility (the final activity of the construction phase) complete by 2026 at the latest.
- ERF would likely be built-out by 2025.
- Construction layover area to be provided on the on the land directly to the east of the EcoPark / River Lee Navigation. Majority of construction trips (including employees) would be undertaken here and only large vehicles would travel to the site via the existing highway network. Staff and light vehicles would use Lee Park Way.

## 2.2 Transport / trip generation

DM described the estimated trip generation during operation and construction. MD indicated that the initial numbers seemed sensible but that this would need to be discussed with TfL colleagues, particularly in relation to the maximum construction scenario).

The following items were agreed to be included in the TA:

| | |
|---|---|
| Prepared by | Gavin Wicks |
| Date of circulation | 16 March 2015 |
| Date of next meeting | TBC |

Action

- Split out by vehicle trips;
- Show vehicle routing;
- Appendix to show background info and calculations;
- Set out the principles of keeping the operational and construction activities separate;
- Identify the phase with the largest increase in trips; and
- Arup to issue draft note setting out the trip generation information.

**Post meeting note:** This will be provided by the end of March. Comments would be welcomed on this but it is acknowledged that detailed comments are likely to be provided following the Phase 2 Consultation. Arup

MH raised option of 24hrs working for construction. EL this would likely only be for specific construction elements (such as abnormal load deliveries). DM stated that this would be agreed through the Code of Construction Practice.

MD raised issue of parking numbers and management of workers parking. DM stated that this will be dealt with in CoCP and through the Travel Plan.

**2.3 Cumulative scheme**

DM outlined that the current strategy was to include all relevant cumulative schemes, including Meridian Water. However, no trip generation information is available for the Meridian Water masterplan and a trip generation exercise has been undertaken using TRICS. MH will see if there is any data behind this masterplan and pass on. MH

MH indicated that there is some uncertainty around Meridian Water delivery timescales given the current planning appeal that is underway on the Stonehill site. It was therefore agreed that the cumulative assessment would include background growth factors (derived using TEMPRO) and the cumulative schemes excluding Meridian Water, with a sensitivity test undertaken using the estimated Meridian Water trips.

MD asked if Angel Road would be included in committed developments, NF stated that this was not a confirmed scheme as yet.

MD / EL discussed if there were options to expand the bus network to include the site. Information on the expected number of bus trips will be provided to TfL. Following this, further discussions will be undertaken with TfL if required.

**2.4 Travel plan**

DM stated that two Framework Travel Plans will be prepared to support the DCO submission, one for construction and one for operation. For the Construction Travel Plan, the measures will focus on the promotion of

| | | Action |
|---|---|---|
| | public transport through the provision of shuttle services between a local station(s) and the construction site and the promotion of car sharing. A shuttle at a local station would utilise existing infrastructure in the vicinity of the particular station rather than providing a new facility. MD/MH accepted this strategy. | |
| | For the Operational Travel Plan, DM explained that similar measures would be provided although the need for a shuttle bus to a local station would need to be assessed against demand given that the number of employees will be much less than during construction and the nature of the shift working patterns means that public transport will not be accessible to all employees. | |
| **2.5** | **Water transport** | |
| | EL ran through the summary note of the water transport report. | |
| | MD to discuss with TfL freight team. He is particularly keen on understanding the embodied carbon and generated carbon figures in relation to not only transporting the construction material but the material in operation, etc. | |
| | While the water transport study will be included in the TA, it was agreed that information would be shared with TfL in advance of this to facilitate further discussions. | Arup/NLWA |
| | **Post meeting note:** This information will be provided as soon as possible. | |
| **2.6** | **A.O.B** | |
| | None. | |
| **2.7** | **Next meeting** | |
| | Will be arranged as required and will focus on a specific topic, such as Water transport | All |

# **Appendix C** – Modelling Output

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** AM Peak Hour-Base.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:06:22

« (Default Analysis Set) - AM peak base, AM
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak base | | | |
| Arm A | 0.16 | 2.90 | 0.11 | A |
| Arm B | 0.49 | 1.85 | 0.32 | A |
| Arm C | 1.10 | 3.49 | 0.49 | A |
| Arm D | 0.27 | 2.50 | 0.19 | A |
| Arm E | 0.61 | 3.60 | 0.35 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak base, AM " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:06:21*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak base, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak base, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak base, AM | AM peak base | AM | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.88 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 239.00 | 112.293 |
| B | ONE HOUR | ✓ | 774.00 | 112.293 |
| C | ONE HOUR | ✓ | 925.00 | 112.293 |
| D | ONE HOUR | ✓ | 314.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 493.00 | 112.293 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 156.000 | 0.000 | 39.000 | 44.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 215.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 72.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.65 | 0.00 | 0.16 | 0.18 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.15 | 0.54 | 0.00 | 0.31 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.11 | 2.90 | 0.16 | A | 246.27 | 248.85 | 10.06 | 2.43 | 0.11 | 10.06 | 2.43 |
| B | 0.32 | 1.85 | 0.49 | A | 797.55 | 1196.32 | 33.61 | 1.69 | 0.37 | 33.61 | 1.69 |
| C | 0.49 | 3.49 | 1.10 | A | 953.14 | 1429.71 | 59.26 | 2.49 | 0.66 | 59.27 | 2.49 |
| D | 0.19 | 2.50 | 0.27 | A | 323.55 | 485.33 | 16.13 | 1.99 | 0.18 | 16.13 | 1.99 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.35 | 3.60 | 0.61 | A | 508.00 | 762.00 | 36.53 | 2.88 | 0.41 | 36.54 | 2.88 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 202.05 | 136.11 | 34.03 | 65.94 | 0.00 | 135.81 | 308.83 | 804.87 | 0.00 | 2502.72 | 477.02 | 0.054 | 0.00 | 0.07 | 1.961 | |
| B | 654.34 | 654.34 | 163.59 | 0.00 | 65.94 | 653.24 | 741.63 | 199.05 | 0.00 | 3108.40 | 2417.67 | 0.211 | 0.00 | 0.28 | 1.520 | |
| C | 782.00 | 782.00 | 195.50 | 0.00 | 0.00 | 780.60 | 0.00 | 852.28 | 0.00 | 3362.37 | 0.00 | 0.233 | 0.00 | 0.35 | 1.603 | |
| D | 265.46 | 265.46 | 66.36 | 0.00 | 0.00 | 265.01 | 743.40 | 889.49 | 0.00 | 3077.42 | 1317.69 | 0.086 | 0.00 | 0.11 | 1.508 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 456.57 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 416.78 | 416.78 | 104.20 | 0.00 | 0.00 | 415.77 | 0.00 | 697.93 | 0.00 | 2300.16 | 654.36 | 0.181 | 0.00 | 0.25 | 2.191 | |

### Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 241.27 | 162.53 | 40.63 | 78.74 | 0.00 | 162.42 | 369.20 | 962.30 | 0.00 | 2207.09 | 477.02 | 0.074 | 0.07 | 0.10 | 2.269 | |
| B | 781.35 | 781.35 | 195.34 | 0.00 | 78.74 | 781.03 | 886.67 | 238.05 | 0.00 | 3052.87 | 2417.67 | 0.256 | 0.28 | 0.36 | 1.642 | |
| C | 933.78 | 933.78 | 233.44 | 0.00 | 0.00 | 933.02 | 0.00 | 1019.07 | 0.00 | 2927.80 | 0.00 | 0.319 | 0.35 | 0.54 | 2.075 | |
| D | 316.98 | 316.98 | 79.25 | 0.00 | 0.00 | 316.79 | 888.77 | 1063.33 | 0.00 | 2660.78 | 1317.69 | 0.119 | 0.11 | 0.16 | 1.810 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 545.87 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 497.68 | 497.68 | 124.42 | 0.00 | 0.00 | 497.25 | 0.00 | 834.25 | 0.00 | 2071.70 | 654.36 | 0.240 | 0.25 | 0.36 | 2.624 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 295.49 | 199.06 | 49.76 | 96.44 | 0.00 | 198.83 | 451.77 | 1177.62 | 0.00 | 1802.74 | 477.02 | 0.110 | 0.10 | 0.16 | 2.893 | |
| B | 956.95 | 956.95 | 239.24 | 0.00 | 96.44 | 956.41 | 1085.08 | 291.36 | 0.00 | 2976.94 | 2417.67 | 0.321 | 0.36 | 0.49 | 1.846 | |
| C | 1143.64 | 1143.64 | 285.91 | 0.00 | 0.00 | 1141.39 | 0.00 | 1247.78 | 0.00 | 2331.93 | 0.00 | 0.490 | 0.54 | 1.10 | 3.472 | |
| D | 388.22 | 388.22 | 97.05 | 0.00 | 0.00 | 387.78 | 1087.77 | 1301.40 | 0.00 | 2090.20 | 1317.69 | 0.186 | 0.16 | 0.27 | 2.493 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 668.35 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 609.53 | 609.53 | 152.38 | 0.00 | 0.00 | 608.56 | 0.00 | 1020.84 | 0.00 | 1759.01 | 654.36 | 0.347 | 0.36 | 0.61 | 3.588 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 295.49 | 199.06 | 49.76 | 96.44 | 0.00 | 199.05 | 452.50 | 1179.48 | 0.00 | 1799.26 | 477.02 | 0.111 | 0.16 | 0.16 | 2.900 | |
| B | 956.95 | 956.95 | 239.24 | 0.00 | 96.44 | 956.95 | 1086.75 | 291.78 | 0.00 | 2976.35 | 2417.67 | 0.322 | 0.49 | 0.49 | 1.847 | |
| C | 1143.64 | 1143.64 | 285.91 | 0.00 | 0.00 | 1143.62 | 0.00 | 1248.72 | 0.00 | 2329.46 | 0.00 | 0.491 | 1.10 | 1.10 | 3.490 | |
| D | 388.22 | 388.22 | 97.05 | 0.00 | 0.00 | 388.22 | 1089.23 | 1303.12 | 0.00 | 2086.09 | 1317.69 | 0.186 | 0.27 | 0.27 | 2.499 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 668.87 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 609.53 | 609.53 | 152.38 | 0.00 | 0.00 | 609.52 | 0.00 | 1022.46 | 0.00 | 1756.29 | 654.36 | 0.347 | 0.61 | 0.61 | 3.602 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 241.27 | 162.53 | 40.63 | 78.74 | 0.00 | 162.76 | 370.21 | 964.93 | 0.00 | 2202.15 | 477.02 | 0.074 | 0.16 | 0.10 | 2.277 | |
| B | 781.35 | 781.35 | 195.34 | 0.00 | 78.74 | 781.88 | 889.03 | 238.66 | 0.00 | 3052.00 | 2417.67 | 0.256 | 0.49 | 0.36 | 1.643 | |
| C | 933.78 | 933.78 | 233.44 | 0.00 | 0.00 | 936.03 | 0.00 | 1020.54 | 0.00 | 2923.99 | 0.00 | 0.319 | 1.10 | 0.54 | 2.086 | |
| D | 316.98 | 316.98 | 79.25 | 0.00 | 0.00 | 317.42 | 890.83 | 1065.73 | 0.00 | 2655.02 | 1317.69 | 0.119 | 0.27 | 0.16 | 1.818 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 546.66 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 497.68 | 497.68 | 124.42 | 0.00 | 0.00 | 498.65 | 0.00 | 836.49 | 0.00 | 2067.95 | 654.36 | 0.241 | 0.61 | 0.37 | 2.636 | |

## Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 202.05 | 136.11 | 34.03 | 65.94 | 0.00 | 136.22 | 309.70 | 807.28 | 0.00 | 2498.19 | 477.02 | 0.054 | 0.10 | 0.07 | 1.964 | |
| B | 654.34 | 654.34 | 163.59 | 0.00 | 65.94 | 654.66 | 743.79 | 199.71 | 0.00 | 3107.46 | 2417.67 | 0.211 | 0.36 | 0.28 | 1.523 | |
| C | 782.00 | 782.00 | 195.50 | 0.00 | 0.00 | 782.76 | 0.00 | 854.37 | 0.00 | 3356.93 | 0.00 | 0.233 | 0.54 | 0.35 | 1.607 | |
| D | 265.46 | 265.46 | 66.36 | 0.00 | 0.00 | 265.65 | 745.40 | 891.73 | 0.00 | 3072.04 | 1317.69 | 0.086 | 0.16 | 0.11 | 1.512 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 457.63 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 416.78 | 416.78 | 104.20 | 0.00 | 0.00 | 417.22 | 0.00 | 699.75 | 0.00 | 2297.10 | 654.36 | 0.181 | 0.37 | 0.26 | 2.200 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.10 | 0.07 | 1.961 | A | A |
| B | 4.09 | 0.27 | 1.520 | A | A |
| C | 5.16 | 0.34 | 1.603 | A | A |
| D | 1.65 | 0.11 | 1.508 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.75 | 0.25 | 2.191 | A | A |

## Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.52 | 0.10 | 2.269 | A | A |
| B | 5.29 | 0.35 | 1.642 | A | A |
| C | 7.95 | 0.53 | 2.075 | A | A |
| D | 2.37 | 0.16 | 1.810 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.35 | 0.36 | 2.624 | A | A |

## Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.36 | 0.16 | 2.893 | A | A |
| B | 7.27 | 0.48 | 1.846 | A | A |
| C | 16.08 | 1.07 | 3.472 | A | A |
| D | 3.97 | 0.26 | 2.493 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.90 | 0.59 | 3.588 | A | A |

## Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.40 | 0.16 | 2.900 | A | A |
| B | 7.35 | 0.49 | 1.847 | A | A |
| C | 16.53 | 1.10 | 3.490 | A | A |
| D | 4.03 | 0.27 | 2.499 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.10 | 0.61 | 3.602 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.56 | 0.10 | 2.277 | A | A |
| B | 5.42 | 0.36 | 1.643 | A | A |
| C | 8.25 | 0.55 | 2.086 | A | A |
| D | 2.43 | 0.16 | 1.818 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.56 | 0.37 | 2.636 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.13 | 0.08 | 1.964 | A | A |
| B | 4.19 | 0.28 | 1.523 | A | A |
| C | 5.30 | 0.35 | 1.607 | A | A |
| D | 1.69 | 0.11 | 1.512 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.87 | 0.26 | 2.200 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** AM Peak Hour-Base - FB-1d.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:07:45



## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak hour, 1d FB | | | |
| Arm A | 0.12 | 2.49 | 0.09 | A |
| Arm B | 0.41 | 1.72 | 0.28 | A |
| Arm C | 0.70 | 2.48 | 0.38 | A |
| Arm D | 0.20 | 2.04 | 0.14 | A |
| Arm E | 0.44 | 2.95 | 0.28 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak hour, 1d FB, AM " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:07:44*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak hour, 1d FB, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak hour, 1d FB, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak hour, 1d FB, AM | AM peak hour, 1d FB | AM | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.30 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 239.00 | 100.000 |
| B | ONE HOUR | ✓ | 774.00 | 100.000 |
| C | ONE HOUR | ✓ | 925.00 | 100.000 |
| D | ONE HOUR | ✓ | 314.00 | 100.000 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 493.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 156.000 | 0.000 | 39.000 | 44.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 215.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 72.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.65 | 0.00 | 0.16 | 0.18 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.15 | 0.54 | 0.00 | 0.31 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.09 | 2.49 | 0.12 | A | 219.31 | 221.60 | 7.97 | 2.16 | 0.09 | 7.97 | 2.16 |
| B | 0.28 | 1.72 | 0.41 | A | 710.24 | 1065.35 | 28.25 | 1.59 | 0.31 | 28.25 | 1.59 |
| C | 0.38 | 2.48 | 0.70 | A | 848.80 | 1273.19 | 41.11 | 1.94 | 0.46 | 41.11 | 1.94 |
| D | 0.14 | 2.04 | 0.20 | A | 288.13 | 432.20 | 12.31 | 1.71 | 0.14 | 12.31 | 1.71 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.28 | 2.95 | 0.44 | A | 452.39 | 678.58 | 27.97 | 2.47 | 0.31 | 27.97 | 2.47 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 179.93 | 121.21 | 30.30 | 58.72 | 0.00 | 120.96 | 275.07 | 716.89 | 0.00 | 2667.93 | 477.02 | 0.045 | 0.00 | 0.06 | 1.821 | |
| B | 582.71 | 582.71 | 145.68 | 0.00 | 58.72 | 581.76 | 660.56 | 177.29 | 0.00 | 3139.39 | 2417.67 | 0.186 | 0.00 | 0.24 | 1.459 | |
| C | 696.39 | 696.39 | 174.10 | 0.00 | 0.00 | 695.29 | 0.00 | 759.05 | 0.00 | 3605.27 | 0.00 | 0.193 | 0.00 | 0.27 | 1.422 | |
| D | 236.40 | 236.40 | 59.10 | 0.00 | 0.00 | 236.03 | 662.12 | 792.23 | 0.00 | 3310.52 | 1317.69 | 0.071 | 0.00 | 0.09 | 1.380 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 406.63 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 371.16 | 371.16 | 92.79 | 0.00 | 0.00 | 370.33 | 0.00 | 621.63 | 0.00 | 2428.02 | 654.36 | 0.153 | 0.00 | 0.21 | 2.007 | |

## Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 214.86 | 144.74 | 36.18 | 70.12 | 0.00 | 144.65 | 328.84 | 857.10 | 0.00 | 2404.64 | 477.02 | 0.060 | 0.06 | 0.08 | 2.053 | |
| B | 695.81 | 695.81 | 173.95 | 0.00 | 70.12 | 695.55 | 789.73 | 212.02 | 0.00 | 3089.93 | 2417.67 | 0.225 | 0.24 | 0.30 | 1.558 | |
| C | 831.56 | 831.56 | 207.89 | 0.00 | 0.00 | 831.06 | 0.00 | 907.57 | 0.00 | 3218.32 | 0.00 | 0.258 | 0.27 | 0.40 | 1.733 | |
| D | 282.28 | 282.28 | 70.57 | 0.00 | 0.00 | 282.14 | 791.58 | 947.05 | 0.00 | 2939.46 | 1317.69 | 0.096 | 0.09 | 0.13 | 1.596 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 486.14 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 443.20 | 443.20 | 110.80 | 0.00 | 0.00 | 442.88 | 0.00 | 743.05 | 0.00 | 2224.55 | 654.36 | 0.199 | 0.21 | 0.28 | 2.319 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 263.14 | 177.26 | 44.32 | 85.88 | 0.00 | 177.11 | 402.55 | 1049.24 | 0.00 | 2043.82 | 477.02 | 0.087 | 0.08 | 0.12 | 2.486 | |
| B | 852.19 | 852.19 | 213.05 | 0.00 | 85.88 | 851.77 | 966.78 | 259.56 | 0.00 | 3022.23 | 2417.67 | 0.282 | 0.30 | 0.41 | 1.718 | |
| C | 1018.44 | 1018.44 | 254.61 | 0.00 | 0.00 | 1017.25 | 0.00 | 1111.33 | 0.00 | 2687.43 | 0.00 | 0.379 | 0.40 | 0.70 | 2.477 | |
| D | 345.72 | 345.72 | 86.43 | 0.00 | 0.00 | 345.44 | 969.11 | 1159.47 | 0.00 | 2430.37 | 1317.69 | 0.142 | 0.13 | 0.20 | 2.035 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 595.28 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 542.80 | 542.80 | 135.70 | 0.00 | 0.00 | 542.17 | 0.00 | 909.62 | 0.00 | 1945.39 | 654.36 | 0.279 | 0.28 | 0.44 | 2.943 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 263.14 | 177.26 | 44.32 | 85.88 | 0.00 | 177.26 | 402.97 | 1050.36 | 0.00 | 2041.71 | 477.02 | 0.087 | 0.12 | 0.12 | 2.489 | |
| B | 852.19 | 852.19 | 213.05 | 0.00 | 85.88 | 852.19 | 967.79 | 259.84 | 0.00 | 3021.83 | 2417.67 | 0.282 | 0.41 | 0.41 | 1.719 | |
| C | 1018.44 | 1018.44 | 254.61 | 0.00 | 0.00 | 1018.44 | 0.00 | 1112.03 | 0.00 | 2685.62 | 0.00 | 0.379 | 0.70 | 0.70 | 2.482 | |
| D | 345.72 | 345.72 | 86.43 | 0.00 | 0.00 | 345.72 | 969.99 | 1160.47 | 0.00 | 2427.97 | 1317.69 | 0.142 | 0.20 | 0.20 | 2.038 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 595.65 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 542.80 | 542.80 | 135.70 | 0.00 | 0.00 | 542.80 | 0.00 | 910.54 | 0.00 | 1943.86 | 654.36 | 0.279 | 0.44 | 0.44 | 2.948 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 214.86 | 144.74 | 36.18 | 70.12 | 0.00 | 144.89 | 329.45 | 858.75 | 0.00 | 2401.53 | 477.02 | 0.060 | 0.12 | 0.08 | 2.056 | |
| B | 695.81 | 695.81 | 173.95 | 0.00 | 70.12 | 696.23 | 791.21 | 212.44 | 0.00 | 3089.34 | 2417.67 | 0.225 | 0.41 | 0.30 | 1.561 | |
| C | 831.56 | 831.56 | 207.89 | 0.00 | 0.00 | 832.75 | 0.00 | 908.66 | 0.00 | 3215.47 | 0.00 | 0.259 | 0.70 | 0.40 | 1.737 | |
| D | 282.28 | 282.28 | 70.57 | 0.00 | 0.00 | 282.56 | 792.88 | 948.53 | 0.00 | 2935.91 | 1317.69 | 0.096 | 0.20 | 0.13 | 1.599 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 486.71 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 443.20 | 443.20 | 110.80 | 0.00 | 0.00 | 443.82 | 0.00 | 744.38 | 0.00 | 2222.32 | 654.36 | 0.199 | 0.44 | 0.29 | 2.323 | |

### Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 179.93 | 121.21 | 30.30 | 58.72 | 0.00 | 121.29 | 275.74 | 718.76 | 0.00 | 2664.43 | 477.02 | 0.045 | 0.08 | 0.06 | 1.827 | |
| B | 582.71 | 582.71 | 145.68 | 0.00 | 58.72 | 582.97 | 662.24 | 177.82 | 0.00 | 3138.64 | 2417.67 | 0.186 | 0.30 | 0.24 | 1.462 | |
| C | 696.39 | 696.39 | 174.10 | 0.00 | 0.00 | 696.89 | 0.00 | 760.78 | 0.00 | 3600.77 | 0.00 | 0.193 | 0.40 | 0.28 | 1.427 | |
| D | 236.40 | 236.40 | 59.10 | 0.00 | 0.00 | 236.53 | 663.69 | 793.99 | 0.00 | 3306.30 | 1317.69 | 0.072 | 0.13 | 0.09 | 1.384 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 407.50 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 371.16 | 371.16 | 92.79 | 0.00 | 0.00 | 371.47 | 0.00 | 623.02 | 0.00 | 2425.69 | 654.36 | 0.153 | 0.29 | 0.21 | 2.011 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 0.91 | 0.06 | 1.821 | A | A |
| B | 3.50 | 0.23 | 1.459 | A | A |
| C | 4.08 | 0.27 | 1.422 | A | A |
| D | 1.35 | 0.09 | 1.380 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.06 | 0.20 | 2.007 | A | A |

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.22 | 0.08 | 2.053 | A | A |
| B | 4.47 | 0.30 | 1.558 | A | A |
| C | 5.93 | 0.40 | 1.733 | A | A |
| D | 1.86 | 0.12 | 1.596 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.22 | 0.28 | 2.319 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.81 | 0.12 | 2.486 | A | A |
| B | 6.03 | 0.40 | 1.718 | A | A |
| C | 10.31 | 0.69 | 2.477 | A | A |
| D | 2.90 | 0.19 | 2.035 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.53 | 0.44 | 2.943 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.83 | 0.12 | 2.489 | A | A |
| B | 6.10 | 0.41 | 1.719 | A | A |
| C | 10.50 | 0.70 | 2.482 | A | A |
| D | 2.93 | 0.20 | 2.038 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.65 | 0.44 | 2.948 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.26 | 0.08 | 2.056 | A | A |
| B | 4.57 | 0.30 | 1.561 | A | A |
| C | 6.10 | 0.41 | 1.737 | A | A |
| D | 1.90 | 0.13 | 1.599 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.36 | 0.29 | 2.323 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 0.93 | 0.06 | 1.827 | A | A |
| B | 3.58 | 0.24 | 1.462 | A | A |
| C | 4.18 | 0.28 | 1.427 | A | A |
| D | 1.37 | 0.09 | 1.384 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.15 | 0.21 | 2.011 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
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**Filename:** AM Peak Hour-Base - FB-2.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:09:50



## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak hour, 2 FB | | | |
| Arm A | 0.15 | 2.82 | 0.11 | A |
| Arm B | 0.47 | 1.82 | 0.31 | A |
| Arm C | 1.01 | 3.26 | 0.47 | A |
| Arm D | 0.25 | 2.40 | 0.18 | A |
| Arm E | 0.57 | 3.47 | 0.33 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak hour, 2 FB, AM " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:09:50*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak hour, 2 FB, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak hour, 2 FB, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak hour, 2 FB, AM | AM peak hour, 2 FB | AM | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.76 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 239.00 | 110.150 |
| B | ONE HOUR | ✓ | 774.00 | 110.150 |
| C | ONE HOUR | ✓ | 925.00 | 110.150 |
| D | ONE HOUR | ✓ | 314.00 | 110.150 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 493.00 | 110.150 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 156.000 | 0.000 | 39.000 | 44.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 215.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 72.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.65 | 0.00 | 0.16 | 0.18 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.15 | 0.54 | 0.00 | 0.31 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

## Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.11 | 2.82 | 0.15 | A | 241.57 | 244.10 | 9.66 | 2.37 | 0.11 | 9.66 | 2.37 |
| B | 0.31 | 1.82 | 0.47 | A | 782.32 | 1173.49 | 32.63 | 1.67 | 0.36 | 32.63 | 1.67 |
| C | 0.47 | 3.26 | 1.01 | A | 934.95 | 1402.42 | 55.32 | 2.37 | 0.61 | 55.32 | 2.37 |
| D | 0.18 | 2.40 | 0.25 | A | 317.38 | 476.07 | 15.37 | 1.94 | 0.17 | 15.37 | 1.94 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.33 | 3.47 | 0.57 | A | 498.30 | 747.45 | 34.84 | 2.80 | 0.39 | 34.84 | 2.80 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 198.19 | 133.51 | 33.38 | 64.68 | 0.00 | 133.23 | 302.95 | 789.53 | 0.00 | 2531.51 | 477.02 | 0.053 | 0.00 | 0.07 | 1.935 | |
| B | 641.85 | 641.85 | 160.46 | 0.00 | 64.68 | 640.78 | 727.50 | 195.26 | 0.00 | 3113.80 | 2417.67 | 0.206 | 0.00 | 0.27 | 1.509 | |
| C | 767.07 | 767.07 | 191.77 | 0.00 | 0.00 | 765.74 | 0.00 | 836.03 | 0.00 | 3404.71 | 0.00 | 0.225 | 0.00 | 0.33 | 1.568 | |
| D | 260.39 | 260.39 | 65.10 | 0.00 | 0.00 | 259.96 | 729.23 | 872.54 | 0.00 | 3118.04 | 1317.69 | 0.084 | 0.00 | 0.11 | 1.484 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 447.86 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 408.83 | 408.83 | 102.21 | 0.00 | 0.00 | 407.85 | 0.00 | 684.63 | 0.00 | 2322.44 | 654.36 | 0.176 | 0.00 | 0.24 | 2.157 | |

## Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 236.66 | 159.43 | 39.86 | 77.24 | 0.00 | 159.32 | 362.16 | 943.97 | 0.00 | 2241.51 | 477.02 | 0.071 | 0.07 | 0.10 | 2.228 | |
| B | 766.43 | 766.43 | 191.61 | 0.00 | 77.24 | 766.13 | 869.77 | 233.51 | 0.00 | 3059.33 | 2417.67 | 0.251 | 0.27 | 0.35 | 1.626 | |
| C | 915.96 | 915.96 | 228.99 | 0.00 | 0.00 | 915.26 | 0.00 | 999.64 | 0.00 | 2978.44 | 0.00 | 0.308 | 0.33 | 0.51 | 2.006 | |
| D | 310.93 | 310.93 | 77.73 | 0.00 | 0.00 | 310.75 | 871.83 | 1043.07 | 0.00 | 2709.34 | 1317.69 | 0.115 | 0.11 | 0.15 | 1.769 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 535.46 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 488.18 | 488.18 | 122.05 | 0.00 | 0.00 | 487.77 | 0.00 | 818.36 | 0.00 | 2098.34 | 654.36 | 0.233 | 0.24 | 0.35 | 2.565 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 289.85 | 195.26 | 48.81 | 94.60 | 0.00 | 195.04 | 443.21 | 1155.28 | 0.00 | 1844.70 | 477.02 | 0.106 | 0.10 | 0.15 | 2.813 | |
| B | 938.69 | 938.69 | 234.67 | 0.00 | 94.60 | 938.17 | 1064.50 | 285.82 | 0.00 | 2984.83 | 2417.67 | 0.314 | 0.35 | 0.47 | 1.823 | |
| C | 1121.82 | 1121.82 | 280.45 | 0.00 | 0.00 | 1119.82 | 0.00 | 1224.00 | 0.00 | 2393.88 | 0.00 | 0.469 | 0.51 | 1.01 | 3.249 | |
| D | 380.81 | 380.81 | 95.20 | 0.00 | 0.00 | 380.41 | 1067.12 | 1276.70 | 0.00 | 2149.39 | 1317.69 | 0.177 | 0.15 | 0.25 | 2.399 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 655.62 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 597.90 | 597.90 | 149.47 | 0.00 | 0.00 | 597.00 | 0.00 | 1001.49 | 0.00 | 1791.43 | 654.36 | 0.334 | 0.35 | 0.57 | 3.458 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 289.85 | 195.26 | 48.81 | 94.60 | 0.00 | 195.25 | 443.87 | 1156.97 | 0.00 | 1841.52 | 477.02 | 0.106 | 0.15 | 0.15 | 2.818 | |
| B | 938.69 | 938.69 | 234.67 | 0.00 | 94.60 | 938.68 | 1066.01 | 286.21 | 0.00 | 2984.28 | 2417.67 | 0.315 | 0.47 | 0.47 | 1.823 | |
| C | 1121.82 | 1121.82 | 280.45 | 0.00 | 0.00 | 1121.80 | 0.00 | 1224.89 | 0.00 | 2391.55 | 0.00 | 0.469 | 1.01 | 1.01 | 3.259 | |
| D | 380.81 | 380.81 | 95.20 | 0.00 | 0.00 | 380.81 | 1068.44 | 1278.25 | 0.00 | 2145.69 | 1317.69 | 0.177 | 0.25 | 0.25 | 2.404 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 656.11 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 597.90 | 597.90 | 149.47 | 0.00 | 0.00 | 597.89 | 0.00 | 1002.95 | 0.00 | 1788.98 | 654.36 | 0.334 | 0.57 | 0.57 | 3.468 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 236.66 | 159.43 | 39.86 | 77.24 | 0.00 | 159.64 | 363.09 | 946.38 | 0.00 | 2236.98 | 477.02 | 0.071 | 0.15 | 0.10 | 2.236 | |
| B | 766.43 | 766.43 | 191.61 | 0.00 | 77.24 | 766.94 | 871.94 | 234.08 | 0.00 | 3058.51 | 2417.67 | 0.251 | 0.47 | 0.35 | 1.628 | |
| C | 915.96 | 915.96 | 228.99 | 0.00 | 0.00 | 917.95 | 0.00 | 1001.03 | 0.00 | 2974.82 | 0.00 | 0.308 | 1.01 | 0.51 | 2.015 | |
| D | 310.93 | 310.93 | 77.73 | 0.00 | 0.00 | 311.33 | 873.72 | 1045.26 | 0.00 | 2704.09 | 1317.69 | 0.115 | 0.25 | 0.15 | 1.773 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 536.20 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 488.18 | 488.18 | 122.05 | 0.00 | 0.00 | 489.08 | 0.00 | 820.39 | 0.00 | 2094.93 | 654.36 | 0.233 | 0.57 | 0.35 | 2.574 | |

### Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 198.19 | 133.51 | 33.38 | 64.68 | 0.00 | 133.62 | 303.77 | 791.84 | 0.00 | 2527.19 | 477.02 | 0.053 | 0.10 | 0.07 | 1.939 | |
| B | 641.85 | 641.85 | 160.46 | 0.00 | 64.68 | 642.16 | 729.57 | 195.89 | 0.00 | 3112.90 | 2417.67 | 0.206 | 0.35 | 0.27 | 1.510 | |
| C | 767.07 | 767.07 | 191.77 | 0.00 | 0.00 | 767.78 | 0.00 | 838.05 | 0.00 | 3399.44 | 0.00 | 0.226 | 0.51 | 0.34 | 1.572 | |
| D | 260.39 | 260.39 | 65.10 | 0.00 | 0.00 | 260.57 | 731.15 | 874.69 | 0.00 | 3112.89 | 1317.69 | 0.084 | 0.15 | 0.11 | 1.489 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 448.89 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 408.83 | 408.83 | 102.21 | 0.00 | 0.00 | 409.24 | 0.00 | 686.37 | 0.00 | 2319.53 | 654.36 | 0.176 | 0.35 | 0.25 | 2.163 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.06 | 0.07 | 1.935 | A | A |
| B | 3.99 | 0.27 | 1.509 | A | A |
| C | 4.95 | 0.33 | 1.568 | A | A |
| D | 1.59 | 0.11 | 1.484 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.62 | 0.24 | 2.157 | A | A |

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.46 | 0.10 | 2.228 | A | A |
| B | 5.14 | 0.34 | 1.626 | A | A |
| C | 7.55 | 0.50 | 2.006 | A | A |
| D | 2.27 | 0.15 | 1.769 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.14 | 0.34 | 2.565 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.25 | 0.15 | 2.813 | A | A |
| B | 7.04 | 0.47 | 1.823 | A | A |
| C | 14.77 | 0.98 | 3.249 | A | A |
| D | 3.75 | 0.25 | 2.399 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.42 | 0.56 | 3.458 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.29 | 0.15 | 2.818 | A | A |
| B | 7.12 | 0.47 | 1.823 | A | A |
| C | 15.16 | 1.01 | 3.259 | A | A |
| D | 3.80 | 0.25 | 2.404 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.60 | 0.57 | 3.468 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.51 | 0.10 | 2.236 | A | A |
| B | 5.26 | 0.35 | 1.628 | A | A |
| C | 7.81 | 0.52 | 2.015 | A | A |
| D | 2.33 | 0.16 | 1.773 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.33 | 0.36 | 2.574 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.09 | 0.07 | 1.939 | A | A |
| B | 4.08 | 0.27 | 1.510 | A | A |
| C | 5.09 | 0.34 | 1.572 | A | A |
| D | 1.63 | 0.11 | 1.489 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.74 | 0.25 | 2.163 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** AM Peak Hour-Base - FB-3.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:11:30



## Summary of junction performance

| | AM peak hour 3 FB | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Scenario 1 | | | |
| Arm A | 0.12 | 2.49 | 0.09 | A |
| Arm B | 0.41 | 1.72 | 0.28 | A |
| Arm C | 0.70 | 2.48 | 0.38 | A |
| Arm D | 0.20 | 2.04 | 0.14 | A |
| Arm E | 0.44 | 2.95 | 0.28 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Scenario 1, AM peak hour 3 FB " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:11:29*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Scenario 1, AM peak hour 3 FB

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 1, AM peak hour 3 FB | Scenario 1 | AM peak hour 3 FB | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.30 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 239.00 | 100.000 |
| B | ONE HOUR | ✓ | 774.00 | 100.000 |
| C | ONE HOUR | ✓ | 925.00 | 100.000 |
| D | ONE HOUR | ✓ | 314.00 | 100.000 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 493.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 156.000 | 0.000 | 39.000 | 44.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 215.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 72.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.65 | 0.00 | 0.16 | 0.18 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.15 | 0.54 | 0.00 | 0.31 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.09 | 2.49 | 0.12 | A | 219.31 | 221.60 | 7.97 | 2.16 | 0.09 | 7.97 | 2.16 |
| B | 0.28 | 1.72 | 0.41 | A | 710.24 | 1065.35 | 28.25 | 1.59 | 0.31 | 28.25 | 1.59 |
| C | 0.38 | 2.48 | 0.70 | A | 848.80 | 1273.19 | 41.11 | 1.94 | 0.46 | 41.11 | 1.94 |
| D | 0.14 | 2.04 | 0.20 | A | 288.13 | 432.20 | 12.31 | 1.71 | 0.14 | 12.31 | 1.71 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.28 | 2.95 | 0.44 | A | 452.39 | 678.58 | 27.97 | 2.47 | 0.31 | 27.97 | 2.47 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 179.93 | 121.21 | 30.30 | 58.72 | 0.00 | 120.96 | 275.07 | 716.89 | 0.00 | 2667.93 | 477.02 | 0.045 | 0.00 | 0.06 | 1.821 | |
| B | 582.71 | 582.71 | 145.68 | 0.00 | 58.72 | 581.76 | 660.56 | 177.29 | 0.00 | 3139.39 | 2417.67 | 0.186 | 0.00 | 0.24 | 1.459 | |
| C | 696.39 | 696.39 | 174.10 | 0.00 | 0.00 | 695.29 | 0.00 | 759.05 | 0.00 | 3605.27 | 0.00 | 0.193 | 0.00 | 0.27 | 1.422 | |
| D | 236.40 | 236.40 | 59.10 | 0.00 | 0.00 | 236.03 | 662.12 | 792.23 | 0.00 | 3310.52 | 1317.69 | 0.071 | 0.00 | 0.09 | 1.380 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 406.63 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 371.16 | 371.16 | 92.79 | 0.00 | 0.00 | 370.33 | 0.00 | 621.63 | 0.00 | 2428.02 | 654.36 | 0.153 | 0.00 | 0.21 | 2.007 | |

## Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 214.86 | 144.74 | 36.18 | 70.12 | 0.00 | 144.65 | 328.84 | 857.10 | 0.00 | 2404.64 | 477.02 | 0.060 | 0.06 | 0.08 | 2.053 | |
| B | 695.81 | 695.81 | 173.95 | 0.00 | 70.12 | 695.55 | 789.73 | 212.02 | 0.00 | 3089.93 | 2417.67 | 0.225 | 0.24 | 0.30 | 1.558 | |
| C | 831.56 | 831.56 | 207.89 | 0.00 | 0.00 | 831.06 | 0.00 | 907.57 | 0.00 | 3218.32 | 0.00 | 0.258 | 0.27 | 0.40 | 1.733 | |
| D | 282.28 | 282.28 | 70.57 | 0.00 | 0.00 | 282.14 | 791.58 | 947.05 | 0.00 | 2939.46 | 1317.69 | 0.096 | 0.09 | 0.13 | 1.596 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 486.14 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 443.20 | 443.20 | 110.80 | 0.00 | 0.00 | 442.88 | 0.00 | 743.05 | 0.00 | 2224.55 | 654.36 | 0.199 | 0.21 | 0.28 | 2.319 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 263.14 | 177.26 | 44.32 | 85.88 | 0.00 | 177.11 | 402.55 | 1049.24 | 0.00 | 2043.82 | 477.02 | 0.087 | 0.08 | 0.12 | 2.486 | |
| B | 852.19 | 852.19 | 213.05 | 0.00 | 85.88 | 851.77 | 966.78 | 259.56 | 0.00 | 3022.23 | 2417.67 | 0.282 | 0.30 | 0.41 | 1.718 | |
| C | 1018.44 | 1018.44 | 254.61 | 0.00 | 0.00 | 1017.25 | 0.00 | 1111.33 | 0.00 | 2687.43 | 0.00 | 0.379 | 0.40 | 0.70 | 2.477 | |
| D | 345.72 | 345.72 | 86.43 | 0.00 | 0.00 | 345.44 | 969.11 | 1159.47 | 0.00 | 2430.37 | 1317.69 | 0.142 | 0.13 | 0.20 | 2.035 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 595.28 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 542.80 | 542.80 | 135.70 | 0.00 | 0.00 | 542.17 | 0.00 | 909.62 | 0.00 | 1945.39 | 654.36 | 0.279 | 0.28 | 0.44 | 2.943 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 263.14 | 177.26 | 44.32 | 85.88 | 0.00 | 177.26 | 402.97 | 1050.36 | 0.00 | 2041.71 | 477.02 | 0.087 | 0.12 | 0.12 | 2.489 | |
| B | 852.19 | 852.19 | 213.05 | 0.00 | 85.88 | 852.19 | 967.79 | 259.84 | 0.00 | 3021.83 | 2417.67 | 0.282 | 0.41 | 0.41 | 1.719 | |
| C | 1018.44 | 1018.44 | 254.61 | 0.00 | 0.00 | 1018.44 | 0.00 | 1112.03 | 0.00 | 2685.62 | 0.00 | 0.379 | 0.70 | 0.70 | 2.482 | |
| D | 345.72 | 345.72 | 86.43 | 0.00 | 0.00 | 345.72 | 969.99 | 1160.47 | 0.00 | 2427.97 | 1317.69 | 0.142 | 0.20 | 0.20 | 2.038 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 595.65 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 542.80 | 542.80 | 135.70 | 0.00 | 0.00 | 542.80 | 0.00 | 910.54 | 0.00 | 1943.86 | 654.36 | 0.279 | 0.44 | 0.44 | 2.948 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 214.86 | 144.74 | 36.18 | 70.12 | 0.00 | 144.89 | 329.45 | 858.75 | 0.00 | 2401.53 | 477.02 | 0.060 | 0.12 | 0.08 | 2.056 | |
| B | 695.81 | 695.81 | 173.95 | 0.00 | 70.12 | 696.23 | 791.21 | 212.44 | 0.00 | 3089.34 | 2417.67 | 0.225 | 0.41 | 0.30 | 1.561 | |
| C | 831.56 | 831.56 | 207.89 | 0.00 | 0.00 | 832.75 | 0.00 | 908.66 | 0.00 | 3215.47 | 0.00 | 0.259 | 0.70 | 0.40 | 1.737 | |
| D | 282.28 | 282.28 | 70.57 | 0.00 | 0.00 | 282.56 | 792.88 | 948.53 | 0.00 | 2935.91 | 1317.69 | 0.096 | 0.20 | 0.13 | 1.599 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 486.71 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 443.20 | 443.20 | 110.80 | 0.00 | 0.00 | 443.82 | 0.00 | 744.38 | 0.00 | 2222.32 | 654.36 | 0.199 | 0.44 | 0.29 | 2.323 | |

## Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 179.93 | 121.21 | 30.30 | 58.72 | 0.00 | 121.29 | 275.74 | 718.76 | 0.00 | 2664.43 | 477.02 | 0.045 | 0.08 | 0.06 | 1.827 | |
| B | 582.71 | 582.71 | 145.68 | 0.00 | 58.72 | 582.97 | 662.24 | 177.82 | 0.00 | 3138.64 | 2417.67 | 0.186 | 0.30 | 0.24 | 1.462 | |
| C | 696.39 | 696.39 | 174.10 | 0.00 | 0.00 | 696.89 | 0.00 | 760.78 | 0.00 | 3600.77 | 0.00 | 0.193 | 0.40 | 0.28 | 1.427 | |
| D | 236.40 | 236.40 | 59.10 | 0.00 | 0.00 | 236.53 | 663.69 | 793.99 | 0.00 | 3306.30 | 1317.69 | 0.072 | 0.13 | 0.09 | 1.384 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 407.50 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 371.16 | 371.16 | 92.79 | 0.00 | 0.00 | 371.47 | 0.00 | 623.02 | 0.00 | 2425.69 | 654.36 | 0.153 | 0.29 | 0.21 | 2.011 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 0.91 | 0.06 | 1.821 | A | A |
| B | 3.50 | 0.23 | 1.459 | A | A |
| C | 4.08 | 0.27 | 1.422 | A | A |
| D | 1.35 | 0.09 | 1.380 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.06 | 0.20 | 2.007 | A | A |

## Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.22 | 0.08 | 2.053 | A | A |
| B | 4.47 | 0.30 | 1.558 | A | A |
| C | 5.93 | 0.40 | 1.733 | A | A |
| D | 1.86 | 0.12 | 1.596 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.22 | 0.28 | 2.319 | A | A |

## Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.81 | 0.12 | 2.486 | A | A |
| B | 6.03 | 0.40 | 1.718 | A | A |
| C | 10.31 | 0.69 | 2.477 | A | A |
| D | 2.90 | 0.19 | 2.035 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.53 | 0.44 | 2.943 | A | A |

## Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.83 | 0.12 | 2.489 | A | A |
| B | 6.10 | 0.41 | 1.719 | A | A |
| C | 10.50 | 0.70 | 2.482 | A | A |
| D | 2.93 | 0.20 | 2.038 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.65 | 0.44 | 2.948 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.26 | 0.08 | 2.056 | A | A |
| B | 4.57 | 0.30 | 1.561 | A | A |
| C | 6.10 | 0.41 | 1.737 | A | A |
| D | 1.90 | 0.13 | 1.599 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.36 | 0.29 | 2.323 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 0.93 | 0.06 | 1.827 | A | A |
| B | 3.58 | 0.24 | 1.462 | A | A |
| C | 4.18 | 0.28 | 1.427 | A | A |
| D | 1.37 | 0.09 | 1.384 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.15 | 0.21 | 2.011 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** AM Peak Hour-Base - FB-4.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:12:51



## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak hour, 3 FB | | | |
| Arm A | 0.16 | 2.90 | 0.11 | A |
| Arm B | 0.49 | 1.85 | 0.32 | A |
| Arm C | 1.10 | 3.49 | 0.49 | A |
| Arm D | 0.27 | 2.50 | 0.19 | A |
| Arm E | 0.61 | 3.60 | 0.35 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak hour, 3 FB, AM " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:12:50*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak hour, 3 FB, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak hour, 3 FB, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak hour, 3 FB, AM | AM peak hour, 3 FB | AM | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.88 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 239.00 | 112.293 |
| B | ONE HOUR | ✓ | 774.00 | 112.293 |
| C | ONE HOUR | ✓ | 925.00 | 112.293 |
| D | ONE HOUR | ✓ | 314.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 493.00 | 112.293 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 156.000 | 0.000 | 39.000 | 44.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 215.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 72.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.65 | 0.00 | 0.16 | 0.18 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.15 | 0.54 | 0.00 | 0.31 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.11 | 2.90 | 0.16 | A | 246.27 | 248.85 | 10.06 | 2.43 | 0.11 | 10.06 | 2.43 |
| B | 0.32 | 1.85 | 0.49 | A | 797.55 | 1196.32 | 33.61 | 1.69 | 0.37 | 33.61 | 1.69 |
| C | 0.49 | 3.49 | 1.10 | A | 953.14 | 1429.71 | 59.26 | 2.49 | 0.66 | 59.27 | 2.49 |
| D | 0.19 | 2.50 | 0.27 | A | 323.55 | 485.33 | 16.13 | 1.99 | 0.18 | 16.13 | 1.99 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.35 | 3.60 | 0.61 | A | 508.00 | 762.00 | 36.53 | 2.88 | 0.41 | 36.54 | 2.88 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 202.05 | 136.11 | 34.03 | 65.94 | 0.00 | 135.81 | 308.83 | 804.87 | 0.00 | 2502.72 | 477.02 | 0.054 | 0.00 | 0.07 | 1.961 | |
| B | 654.34 | 654.34 | 163.59 | 0.00 | 65.94 | 653.24 | 741.63 | 199.05 | 0.00 | 3108.40 | 2417.67 | 0.211 | 0.00 | 0.28 | 1.520 | |
| C | 782.00 | 782.00 | 195.50 | 0.00 | 0.00 | 780.60 | 0.00 | 852.28 | 0.00 | 3362.37 | 0.00 | 0.233 | 0.00 | 0.35 | 1.603 | |
| D | 265.46 | 265.46 | 66.36 | 0.00 | 0.00 | 265.01 | 743.40 | 889.49 | 0.00 | 3077.42 | 1317.69 | 0.086 | 0.00 | 0.11 | 1.508 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 456.57 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 416.78 | 416.78 | 104.20 | 0.00 | 0.00 | 415.77 | 0.00 | 697.93 | 0.00 | 2300.16 | 654.36 | 0.181 | 0.00 | 0.25 | 2.191 | |

## Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 241.27 | 162.53 | 40.63 | 78.74 | 0.00 | 162.42 | 369.20 | 962.30 | 0.00 | 2207.09 | 477.02 | 0.074 | 0.07 | 0.10 | 2.269 | |
| B | 781.35 | 781.35 | 195.34 | 0.00 | 78.74 | 781.03 | 886.67 | 238.05 | 0.00 | 3052.87 | 2417.67 | 0.256 | 0.28 | 0.36 | 1.642 | |
| C | 933.78 | 933.78 | 233.44 | 0.00 | 0.00 | 933.02 | 0.00 | 1019.07 | 0.00 | 2927.80 | 0.00 | 0.319 | 0.35 | 0.54 | 2.075 | |
| D | 316.98 | 316.98 | 79.25 | 0.00 | 0.00 | 316.79 | 888.77 | 1063.33 | 0.00 | 2660.78 | 1317.69 | 0.119 | 0.11 | 0.16 | 1.810 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 545.87 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 497.68 | 497.68 | 124.42 | 0.00 | 0.00 | 497.25 | 0.00 | 834.25 | 0.00 | 2071.70 | 654.36 | 0.240 | 0.25 | 0.36 | 2.624 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 295.49 | 199.06 | 49.76 | 96.44 | 0.00 | 198.83 | 451.77 | 1177.62 | 0.00 | 1802.74 | 477.02 | 0.110 | 0.10 | 0.16 | 2.893 | |
| B | 956.95 | 956.95 | 239.24 | 0.00 | 96.44 | 956.41 | 1085.08 | 291.36 | 0.00 | 2976.94 | 2417.67 | 0.321 | 0.36 | 0.49 | 1.846 | |
| C | 1143.64 | 1143.64 | 285.91 | 0.00 | 0.00 | 1141.39 | 0.00 | 1247.78 | 0.00 | 2331.93 | 0.00 | 0.490 | 0.54 | 1.10 | 3.472 | |
| D | 388.22 | 388.22 | 97.05 | 0.00 | 0.00 | 387.78 | 1087.77 | 1301.40 | 0.00 | 2090.20 | 1317.69 | 0.186 | 0.16 | 0.27 | 2.493 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 668.35 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 609.53 | 609.53 | 152.38 | 0.00 | 0.00 | 608.56 | 0.00 | 1020.84 | 0.00 | 1759.01 | 654.36 | 0.347 | 0.36 | 0.61 | 3.588 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 295.49 | 199.06 | 49.76 | 96.44 | 0.00 | 199.05 | 452.50 | 1179.48 | 0.00 | 1799.26 | 477.02 | 0.111 | 0.16 | 0.16 | 2.900 | |
| B | 956.95 | 956.95 | 239.24 | 0.00 | 96.44 | 956.95 | 1086.75 | 291.78 | 0.00 | 2976.35 | 2417.67 | 0.322 | 0.49 | 0.49 | 1.847 | |
| C | 1143.64 | 1143.64 | 285.91 | 0.00 | 0.00 | 1143.62 | 0.00 | 1248.72 | 0.00 | 2329.46 | 0.00 | 0.491 | 1.10 | 1.10 | 3.490 | |
| D | 388.22 | 388.22 | 97.05 | 0.00 | 0.00 | 388.22 | 1089.23 | 1303.12 | 0.00 | 2086.09 | 1317.69 | 0.186 | 0.27 | 0.27 | 2.499 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 668.87 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 609.53 | 609.53 | 152.38 | 0.00 | 0.00 | 609.52 | 0.00 | 1022.46 | 0.00 | 1756.29 | 654.36 | 0.347 | 0.61 | 0.61 | 3.602 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 241.27 | 162.53 | 40.63 | 78.74 | 0.00 | 162.76 | 370.21 | 964.93 | 0.00 | 2202.15 | 477.02 | 0.074 | 0.16 | 0.10 | 2.277 | |
| B | 781.35 | 781.35 | 195.34 | 0.00 | 78.74 | 781.88 | 889.03 | 238.66 | 0.00 | 3052.00 | 2417.67 | 0.256 | 0.49 | 0.36 | 1.643 | |
| C | 933.78 | 933.78 | 233.44 | 0.00 | 0.00 | 936.03 | 0.00 | 1020.54 | 0.00 | 2923.99 | 0.00 | 0.319 | 1.10 | 0.54 | 2.086 | |
| D | 316.98 | 316.98 | 79.25 | 0.00 | 0.00 | 317.42 | 890.83 | 1065.73 | 0.00 | 2655.02 | 1317.69 | 0.119 | 0.27 | 0.16 | 1.818 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 546.66 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 497.68 | 497.68 | 124.42 | 0.00 | 0.00 | 498.65 | 0.00 | 836.49 | 0.00 | 2067.95 | 654.36 | 0.241 | 0.61 | 0.37 | 2.636 | |

### Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 202.05 | 136.11 | 34.03 | 65.94 | 0.00 | 136.22 | 309.70 | 807.28 | 0.00 | 2498.19 | 477.02 | 0.054 | 0.10 | 0.07 | 1.964 | |
| B | 654.34 | 654.34 | 163.59 | 0.00 | 65.94 | 654.66 | 743.79 | 199.71 | 0.00 | 3107.46 | 2417.67 | 0.211 | 0.36 | 0.28 | 1.523 | |
| C | 782.00 | 782.00 | 195.50 | 0.00 | 0.00 | 782.76 | 0.00 | 854.37 | 0.00 | 3356.93 | 0.00 | 0.233 | 0.54 | 0.35 | 1.607 | |
| D | 265.46 | 265.46 | 66.36 | 0.00 | 0.00 | 265.65 | 745.40 | 891.73 | 0.00 | 3072.04 | 1317.69 | 0.086 | 0.16 | 0.11 | 1.512 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 457.63 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 416.78 | 416.78 | 104.20 | 0.00 | 0.00 | 417.22 | 0.00 | 699.75 | 0.00 | 2297.10 | 654.36 | 0.181 | 0.37 | 0.26 | 2.200 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.10 | 0.07 | 1.961 | A | A |
| B | 4.09 | 0.27 | 1.520 | A | A |
| C | 5.16 | 0.34 | 1.603 | A | A |
| D | 1.65 | 0.11 | 1.508 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.75 | 0.25 | 2.191 | A | A |

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.52 | 0.10 | 2.269 | A | A |
| B | 5.29 | 0.35 | 1.642 | A | A |
| C | 7.95 | 0.53 | 2.075 | A | A |
| D | 2.37 | 0.16 | 1.810 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.35 | 0.36 | 2.624 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.36 | 0.16 | 2.893 | A | A |
| B | 7.27 | 0.48 | 1.846 | A | A |
| C | 16.08 | 1.07 | 3.472 | A | A |
| D | 3.97 | 0.26 | 2.493 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.90 | 0.59 | 3.588 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.40 | 0.16 | 2.900 | A | A |
| B | 7.35 | 0.49 | 1.847 | A | A |
| C | 16.53 | 1.10 | 3.490 | A | A |
| D | 4.03 | 0.27 | 2.499 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.10 | 0.61 | 3.602 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.56 | 0.10 | 2.277 | A | A |
| B | 5.42 | 0.36 | 1.643 | A | A |
| C | 8.25 | 0.55 | 2.086 | A | A |
| D | 2.43 | 0.16 | 1.818 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.56 | 0.37 | 2.636 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.13 | 0.08 | 1.964 | A | A |
| B | 4.19 | 0.28 | 1.523 | A | A |
| C | 5.30 | 0.35 | 1.607 | A | A |
| D | 1.69 | 0.11 | 1.512 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.87 | 0.26 | 2.200 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]




**Filename:** AM Peak Hour-Base - Tot-1d.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:17:01

« (Default Analysis Set) - AM peak hour, 1d Tot, AM
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak hour, 1d Tot | | | |
| Arm A | 0.19 | 2.78 | 0.13 | A |
| Arm B | 0.50 | 1.89 | 0.33 | A |
| Arm C | 1.12 | 3.63 | 0.49 | A |
| Arm D | 0.26 | 2.44 | 0.18 | A |
| Arm E | 0.64 | 3.67 | 0.36 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak hour, 1d Tot, AM " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:17:00*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak hour, 1d Tot, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak hour, 1d Tot, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak hour, 1d Tot, AM | AM peak hour, 1d Tot | AM | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.93 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 291.00 | 109.303 |
| B | ONE HOUR | ✓ | 793.00 | 109.303 |
| C | ONE HOUR | ✓ | 925.00 | 109.303 |
| D | ONE HOUR | ✓ | 314.00 | 109.303 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 526.00 | 109.303 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 175.000 | 0.000 | 72.000 | 44.000 | 0.000 |
| | B | 70.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 215.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 105.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.60 | 0.00 | 0.25 | 0.15 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.40 | 0.51 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.20 | 0.51 | 0.00 | 0.29 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.13 | 2.78 | 0.19 | A | 291.87 | 306.16 | 11.90 | 2.33 | 0.13 | 11.90 | 2.33 |
| B | 0.33 | 1.89 | 0.50 | A | 795.37 | 1193.05 | 34.10 | 1.71 | 0.38 | 34.10 | 1.72 |
| C | 0.49 | 3.63 | 1.12 | A | 927.76 | 1391.64 | 59.37 | 2.56 | 0.66 | 59.37 | 2.56 |
| D | 0.18 | 2.44 | 0.26 | A | 314.94 | 472.41 | 15.44 | 1.96 | 0.17 | 15.44 | 1.96 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.36 | 3.67 | 0.64 | A | 527.57 | 791.35 | 38.49 | 2.92 | 0.43 | 38.49 | 2.92 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 239.46 | 167.46 | 41.86 | 72.00 | 0.00 | 167.11 | 343.30 | 783.43 | 0.00 | 2542.99 | 632.02 | 0.066 | 0.00 | 0.09 | 1.888 | |
| B | 652.55 | 652.55 | 163.14 | 0.00 | 72.00 | 651.44 | 729.68 | 220.85 | 0.00 | 3077.36 | 2351.37 | 0.212 | 0.00 | 0.28 | 1.538 | |
| C | 761.17 | 761.17 | 190.29 | 0.00 | 0.00 | 759.80 | 0.00 | 872.29 | 0.00 | 3310.25 | 0.00 | 0.230 | 0.00 | 0.34 | 1.623 | |
| D | 258.39 | 258.39 | 64.60 | 0.00 | 0.00 | 257.96 | 750.69 | 881.40 | 0.00 | 3096.81 | 1373.89 | 0.083 | 0.00 | 0.11 | 1.494 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 444.41 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 432.84 | 432.84 | 108.21 | 0.00 | 0.00 | 431.78 | 0.00 | 694.95 | 0.00 | 2305.15 | 612.53 | 0.188 | 0.00 | 0.27 | 2.213 | |

## Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 285.94 | 199.96 | 49.99 | 85.98 | 0.00 | 199.83 | 410.42 | 936.66 | 0.00 | 2255.22 | 632.04 | 0.089 | 0.09 | 0.12 | 2.184 | |
| B | 779.21 | 779.21 | 194.80 | 0.00 | 85.98 | 778.88 | 872.38 | 264.11 | 0.00 | 3015.75 | 2351.35 | 0.258 | 0.28 | 0.36 | 1.668 | |
| C | 908.92 | 908.92 | 227.23 | 0.00 | 0.00 | 908.16 | 0.00 | 1043.00 | 0.00 | 2865.47 | 0.00 | 0.317 | 0.34 | 0.53 | 2.115 | |
| D | 308.54 | 308.54 | 77.14 | 0.00 | 0.00 | 308.36 | 897.49 | 1053.66 | 0.00 | 2683.95 | 1373.89 | 0.115 | 0.11 | 0.15 | 1.786 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 531.33 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 516.85 | 516.85 | 129.21 | 0.00 | 0.00 | 516.40 | 0.00 | 830.69 | 0.00 | 2077.67 | 612.52 | 0.249 | 0.27 | 0.38 | 2.656 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 350.20 | 244.90 | 61.23 | 105.30 | 0.00 | 244.63 | 502.21 | 1146.21 | 0.00 | 1861.72 | 632.05 | 0.132 | 0.12 | 0.19 | 2.776 | |
| B | 954.33 | 954.33 | 238.58 | 0.00 | 105.30 | 953.78 | 1067.57 | 323.27 | 0.00 | 2931.50 | 2351.33 | 0.326 | 0.36 | 0.50 | 1.886 | |
| C | 1113.19 | 1113.19 | 278.30 | 0.00 | 0.00 | 1110.87 | 0.00 | 1277.05 | 0.00 | 2255.65 | 0.00 | 0.494 | 0.53 | 1.11 | 3.608 | |
| D | 377.88 | 377.88 | 94.47 | 0.00 | 0.00 | 377.47 | 1098.41 | 1289.52 | 0.00 | 2118.68 | 1373.91 | 0.178 | 0.15 | 0.26 | 2.438 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 650.54 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 633.01 | 633.01 | 158.25 | 0.00 | 0.00 | 631.98 | 0.00 | 1016.45 | 0.00 | 1766.37 | 612.52 | 0.358 | 0.38 | 0.64 | 3.652 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 350.20 | 244.90 | 61.23 | 105.30 | 0.00 | 244.90 | 503.03 | 1148.07 | 0.00 | 1858.24 | 632.05 | 0.132 | 0.19 | 0.19 | 2.782 | |
| B | 954.33 | 954.33 | 238.58 | 0.00 | 105.30 | 954.33 | 1069.25 | 323.72 | 0.00 | 2930.86 | 2351.33 | 0.326 | 0.50 | 0.50 | 1.887 | |
| C | 1113.19 | 1113.19 | 278.30 | 0.00 | 0.00 | 1113.16 | 0.00 | 1278.05 | 0.00 | 2253.04 | 0.00 | 0.494 | 1.11 | 1.12 | 3.630 | |
| D | 377.88 | 377.88 | 94.47 | 0.00 | 0.00 | 377.88 | 1099.94 | 1291.28 | 0.00 | 2114.45 | 1373.91 | 0.179 | 0.26 | 0.26 | 2.443 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 651.06 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 633.01 | 633.01 | 158.25 | 0.00 | 0.00 | 633.00 | 0.00 | 1018.10 | 0.00 | 1763.60 | 612.52 | 0.359 | 0.64 | 0.64 | 3.667 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 285.94 | 199.96 | 49.99 | 85.98 | 0.00 | 200.23 | 411.56 | 939.29 | 0.00 | 2250.30 | 632.04 | 0.089 | 0.19 | 0.12 | 2.189 | |
| B | 779.21 | 779.21 | 194.80 | 0.00 | 85.98 | 779.76 | 874.74 | 264.78 | 0.00 | 3014.80 | 2351.35 | 0.258 | 0.50 | 0.36 | 1.672 | |
| C | 908.92 | 908.92 | 227.23 | 0.00 | 0.00 | 911.24 | 0.00 | 1044.54 | 0.00 | 2861.46 | 0.00 | 0.318 | 1.12 | 0.54 | 2.126 | |
| D | 308.54 | 308.54 | 77.14 | 0.00 | 0.00 | 308.95 | 899.65 | 1056.13 | 0.00 | 2678.04 | 1373.89 | 0.115 | 0.26 | 0.15 | 1.791 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 532.11 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 516.85 | 516.85 | 129.21 | 0.00 | 0.00 | 517.89 | 0.00 | 832.96 | 0.00 | 2073.86 | 612.52 | 0.249 | 0.64 | 0.38 | 2.668 | |

### Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 239.46 | 167.46 | 41.86 | 72.00 | 0.00 | 167.59 | 344.29 | 785.79 | 0.00 | 2538.54 | 632.02 | 0.066 | 0.12 | 0.09 | 1.895 | |
| B | 652.55 | 652.55 | 163.14 | 0.00 | 72.00 | 652.88 | 731.82 | 221.57 | 0.00 | 3076.33 | 2351.37 | 0.212 | 0.36 | 0.28 | 1.542 | |
| C | 761.17 | 761.17 | 190.29 | 0.00 | 0.00 | 761.94 | 0.00 | 874.45 | 0.00 | 3304.61 | 0.00 | 0.230 | 0.54 | 0.34 | 1.627 | |
| D | 258.39 | 258.39 | 64.60 | 0.00 | 0.00 | 258.57 | 752.74 | 883.65 | 0.00 | 3091.41 | 1373.89 | 0.084 | 0.15 | 0.11 | 1.497 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 445.45 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 432.84 | 432.84 | 108.21 | 0.00 | 0.00 | 433.31 | 0.00 | 696.77 | 0.00 | 2302.09 | 612.53 | 0.188 | 0.38 | 0.27 | 2.219 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.30 | 0.09 | 1.888 | A | A |
| B | 4.13 | 0.28 | 1.538 | A | A |
| C | 5.08 | 0.34 | 1.623 | A | A |
| D | 1.59 | 0.11 | 1.494 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.93 | 0.26 | 2.213 | A | A |

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.80 | 0.12 | 2.184 | A | A |
| B | 5.36 | 0.36 | 1.668 | A | A |
| C | 7.89 | 0.53 | 2.115 | A | A |
| D | 2.27 | 0.15 | 1.786 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.62 | 0.37 | 2.656 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.79 | 0.19 | 2.776 | A | A |
| B | 7.40 | 0.49 | 1.886 | A | A |
| C | 16.25 | 1.08 | 3.608 | A | A |
| D | 3.78 | 0.25 | 2.438 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.40 | 0.63 | 3.652 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.83 | 0.19 | 2.782 | A | A |
| B | 7.49 | 0.50 | 1.887 | A | A |
| C | 16.74 | 1.12 | 3.630 | A | A |
| D | 3.84 | 0.26 | 2.443 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.62 | 0.64 | 3.667 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.85 | 0.12 | 2.189 | A | A |
| B | 5.49 | 0.37 | 1.672 | A | A |
| C | 8.19 | 0.55 | 2.126 | A | A |
| D | 2.33 | 0.16 | 1.791 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.85 | 0.39 | 2.668 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.34 | 0.09 | 1.895 | A | A |
| B | 4.23 | 0.28 | 1.542 | A | A |
| C | 5.23 | 0.35 | 1.627 | A | A |
| D | 1.63 | 0.11 | 1.497 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.06 | 0.27 | 2.219 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
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**Filename:** AM Peak Hour-Base - Tot-3.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:26:29

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## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak hour, 3 Tota | | | |
| Arm A | 0.17 | 2.82 | 0.12 | A |
| Arm B | 0.49 | 1.86 | 0.32 | A |
| Arm C | 1.12 | 3.55 | 0.49 | A |
| Arm D | 0.24 | 2.48 | 0.17 | A |
| Arm E | 0.60 | 3.45 | 0.34 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak hour, 3 Tota, AM " model duration: 08:00 - 09:30*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:26:29*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak hour, 3 Tota, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak hour, 3 Tota, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak hour, 3 Tota, AM | AM peak hour, 3 Tota | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.88 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 254.00 | 111.645 |
| B | ONE HOUR | ✓ | 774.00 | 111.645 |
| C | ONE HOUR | ✓ | 926.00 | 111.645 |
| D | ONE HOUR | ✓ | 314.00 | 100.000 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 507.00 | 111.645 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 157.000 | 0.000 | 39.000 | 58.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 216.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 86.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.62 | 0.00 | 0.15 | 0.23 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.17 | 0.53 | 0.00 | 0.30 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.12 | 2.82 | 0.17 | A | 260.22 | 269.69 | 10.71 | 2.38 | 0.12 | 10.71 | 2.38 |
| B | 0.32 | 1.86 | 0.49 | A | 792.94 | 1189.41 | 33.64 | 1.70 | 0.37 | 33.64 | 1.70 |
| C | 0.49 | 3.55 | 1.12 | A | 948.66 | 1422.99 | 59.75 | 2.52 | 0.66 | 59.75 | 2.52 |
| D | 0.17 | 2.48 | 0.24 | A | 288.13 | 432.20 | 14.27 | 1.98 | 0.16 | 14.27 | 1.98 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.34 | 3.45 | 0.60 | A | 519.41 | 779.11 | 36.19 | 2.79 | 0.40 | 36.19 | 2.79 |

## Main Results for each time segment

### Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 213.49 | 147.51 | 36.88 | 65.98 | 0.00 | 147.19 | 317.18 | 779.14 | 0.00 | 2551.03 | 498.34 | 0.058 | 0.00 | 0.08 | 1.944 | |
| B | 650.56 | 650.56 | 162.64 | 0.00 | 65.98 | 649.46 | 716.69 | 209.65 | 0.00 | 3093.31 | 2367.59 | 0.210 | 0.00 | 0.28 | 1.527 | |
| C | 778.32 | 778.32 | 194.58 | 0.00 | 0.00 | 776.93 | 0.00 | 859.11 | 0.00 | 3344.58 | 0.00 | 0.233 | 0.00 | 0.35 | 1.612 | |
| D | 236.40 | 236.40 | 59.10 | 0.00 | 0.00 | 236.00 | 739.11 | 896.93 | 0.00 | 3059.58 | 1298.71 | 0.077 | 0.00 | 0.10 | 1.502 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 461.74 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 426.14 | 426.14 | 106.54 | 0.00 | 0.00 | 425.13 | 0.00 | 671.20 | 0.00 | 2344.96 | 662.84 | 0.182 | 0.00 | 0.25 | 2.155 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 254.93 | 176.14 | 44.04 | 78.79 | 0.00 | 176.02 | 379.18 | 931.54 | 0.00 | 2264.84 | 498.34 | 0.078 | 0.08 | 0.11 | 2.237 | |
| B | 776.84 | 776.84 | 194.21 | 0.00 | 78.79 | 776.52 | 856.85 | 250.72 | 0.00 | 3034.82 | 2367.59 | 0.256 | 0.28 | 0.36 | 1.652 | |
| C | 929.39 | 929.39 | 232.35 | 0.00 | 0.00 | 928.63 | 0.00 | 1027.24 | 0.00 | 2906.53 | 0.00 | 0.320 | 0.35 | 0.54 | 2.093 | |
| D | 282.28 | 282.28 | 70.57 | 0.00 | 0.00 | 282.11 | 883.64 | 1072.23 | 0.00 | 2639.44 | 1298.71 | 0.107 | 0.10 | 0.14 | 1.799 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 552.05 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 508.86 | 508.86 | 127.21 | 0.00 | 0.00 | 508.43 | 0.00 | 802.29 | 0.00 | 2125.26 | 662.84 | 0.239 | 0.25 | 0.36 | 2.560 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 312.23 | 215.73 | 53.93 | 96.49 | 0.00 | 215.49 | 463.99 | 1140.00 | 0.00 | 1873.39 | 498.34 | 0.115 | 0.11 | 0.17 | 2.819 | |
| B | 951.43 | 951.43 | 237.86 | 0.00 | 96.49 | 950.89 | 1048.60 | 306.90 | 0.00 | 2954.82 | 2367.59 | 0.322 | 0.36 | 0.49 | 1.861 | |
| C | 1138.27 | 1138.27 | 284.57 | 0.00 | 0.00 | 1135.98 | 0.00 | 1257.78 | 0.00 | 2305.85 | 0.00 | 0.494 | 0.54 | 1.11 | 3.531 | |
| D | 345.72 | 345.72 | 86.43 | 0.00 | 0.00 | 345.34 | 1081.49 | 1312.27 | 0.00 | 2064.14 | 1298.71 | 0.167 | 0.14 | 0.24 | 2.469 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 675.92 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 623.22 | 623.22 | 155.81 | 0.00 | 0.00 | 622.29 | 0.00 | 981.69 | 0.00 | 1824.61 | 662.84 | 0.342 | 0.36 | 0.59 | 3.442 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 312.23 | 215.73 | 53.93 | 96.49 | 0.00 | 215.73 | 464.74 | 1141.77 | 0.00 | 1870.06 | 498.34 | 0.115 | 0.17 | 0.17 | 2.824 | |
| B | 951.43 | 951.43 | 237.86 | 0.00 | 96.49 | 951.42 | 1050.19 | 307.30 | 0.00 | 2954.24 | 2367.59 | 0.322 | 0.49 | 0.49 | 1.862 | |
| C | 1138.27 | 1138.27 | 284.57 | 0.00 | 0.00 | 1138.25 | 0.00 | 1258.73 | 0.00 | 2303.39 | 0.00 | 0.494 | 1.11 | 1.12 | 3.552 | |
| D | 345.72 | 345.72 | 86.43 | 0.00 | 0.00 | 345.72 | 1082.94 | 1314.03 | 0.00 | 2059.92 | 1298.71 | 0.168 | 0.24 | 0.24 | 2.475 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 676.45 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 623.22 | 623.22 | 155.81 | 0.00 | 0.00 | 623.21 | 0.00 | 983.30 | 0.00 | 1821.92 | 662.84 | 0.342 | 0.59 | 0.60 | 3.452 | |

## Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 254.93 | 176.14 | 44.04 | 78.79 | 0.00 | 176.38 | 380.23 | 934.06 | 0.00 | 2260.12 | 498.34 | 0.078 | 0.17 | 0.11 | 2.243 | |
| B | 776.84 | 776.84 | 194.21 | 0.00 | 78.79 | 777.37 | 859.11 | 251.33 | 0.00 | 3033.96 | 2367.59 | 0.256 | 0.49 | 0.36 | 1.656 | |
| C | 929.39 | 929.39 | 232.35 | 0.00 | 0.00 | 931.70 | 0.00 | 1028.70 | 0.00 | 2902.72 | 0.00 | 0.320 | 1.12 | 0.54 | 2.102 | |
| D | 282.28 | 282.28 | 70.57 | 0.00 | 0.00 | 282.66 | 885.70 | 1074.70 | 0.00 | 2633.53 | 1298.71 | 0.107 | 0.24 | 0.14 | 1.805 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 552.86 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 508.86 | 508.86 | 127.21 | 0.00 | 0.00 | 509.78 | 0.00 | 804.50 | 0.00 | 2121.56 | 662.84 | 0.240 | 0.60 | 0.36 | 2.570 | |

### Main results: (09:15-09:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 213.49 | 147.51 | 36.88 | 65.98 | 0.00 | 147.63 | 318.07 | 781.46 | 0.00 | 2546.67 | 498.34 | 0.058 | 0.11 | 0.08 | 1.949 | |
| B | 650.56 | 650.56 | 162.64 | 0.00 | 65.98 | 650.89 | 718.77 | 210.33 | 0.00 | 3092.34 | 2367.59 | 0.210 | 0.36 | 0.28 | 1.528 | |
| C | 778.32 | 778.32 | 194.58 | 0.00 | 0.00 | 779.10 | 0.00 | 861.21 | 0.00 | 3339.10 | 0.00 | 0.233 | 0.54 | 0.35 | 1.619 | |
| D | 236.40 | 236.40 | 59.10 | 0.00 | 0.00 | 236.57 | 741.10 | 899.21 | 0.00 | 3054.11 | 1298.71 | 0.077 | 0.14 | 0.10 | 1.506 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 462.82 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 426.14 | 426.14 | 106.54 | 0.00 | 0.00 | 426.58 | 0.00 | 672.96 | 0.00 | 2342.00 | 662.84 | 0.182 | 0.36 | 0.26 | 2.161 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.18 | 0.08 | 1.944 | A | A |
| B | 4.09 | 0.27 | 1.527 | A | A |
| C | 5.16 | 0.34 | 1.612 | A | A |
| D | 1.46 | 0.10 | 1.502 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.77 | 0.25 | 2.155 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.62 | 0.11 | 2.237 | A | A |
| B | 5.29 | 0.35 | 1.652 | A | A |
| C | 7.98 | 0.53 | 2.093 | A | A |
| D | 2.09 | 0.14 | 1.799 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.34 | 0.36 | 2.560 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.49 | 0.17 | 2.819 | A | A |
| B | 7.28 | 0.49 | 1.861 | A | A |
| C | 16.27 | 1.08 | 3.531 | A | A |
| D | 3.50 | 0.23 | 2.469 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.73 | 0.58 | 3.442 | A | A |

### Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.53 | 0.17 | 2.824 | A | A |
| B | 7.37 | 0.49 | 1.862 | A | A |
| C | 16.75 | 1.12 | 3.552 | A | A |
| D | 3.56 | 0.24 | 2.475 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.92 | 0.59 | 3.452 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.67 | 0.11 | 2.243 | A | A |
| B | 5.42 | 0.36 | 1.656 | A | A |
| C | 8.28 | 0.55 | 2.102 | A | A |
| D | 2.15 | 0.14 | 1.805 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.55 | 0.37 | 2.570 | A | A |

## Queueing Delay results: (09:15-09:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.21 | 0.08 | 1.949 | A | A |
| B | 4.19 | 0.28 | 1.528 | A | A |
| C | 5.31 | 0.35 | 1.619 | A | A |
| D | 1.50 | 0.10 | 1.506 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.89 | 0.26 | 2.161 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** AM Peak Hour-Base - Tot-4.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:28:04

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## Summary of junction performance

| | AM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - AM peak hour, 4 Tot | | | |
| **Arm A** | 0.17 | 2.92 | 0.12 | A |
| **Arm B** | 0.49 | 1.86 | 0.32 | A |
| **Arm C** | 1.12 | 3.55 | 0.49 | A |
| **Arm D** | 0.27 | 2.52 | 0.19 | A |
| **Arm E** | 0.62 | 3.62 | 0.35 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - AM peak hour, 4 Tot, AM " model duration: 07:45 - 09:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:28:04*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - AM peak hour, 4 Tot, AM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - AM peak hour, 4 Tot, AM | Demand Set 1: Scenario Name includes Time Period Name ('AM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM peak hour, 4 Tot, AM | AM peak hour, 4 Tot | AM | | ONE HOUR | 07:45 | 09:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 2.92 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 244.00 | 112.293 |
| B | ONE HOUR | ✓ | 774.00 | 112.293 |
| C | ONE HOUR | ✓ | 922.00 | 112.293 |
| D | ONE HOUR | ✓ | 314.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 501.00 | 112.293 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 153.000 | 0.000 | 39.000 | 52.000 | 0.000 |
| | B | 51.000 | 0.000 | 0.000 | 321.000 | 402.000 | 0.000 |
| | C | 212.000 | 292.000 | 0.000 | 368.000 | 50.000 | 0.000 |
| | D | 28.000 | 241.000 | 0.000 | 0.000 | 45.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 80.000 | 268.000 | 0.000 | 153.000 | 0.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.63 | 0.00 | 0.16 | 0.21 | 0.00 |
| | B | 0.07 | 0.00 | 0.00 | 0.41 | 0.52 | 0.00 |
| | C | 0.23 | 0.32 | 0.00 | 0.40 | 0.05 | 0.00 |
| | D | 0.09 | 0.77 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.16 | 0.53 | 0.00 | 0.31 | 0.00 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.380 | 1.000 | 1.050 | 1.410 | 1.000 |
| | B | 1.040 | 1.000 | 1.000 | 1.020 | 1.050 | 1.000 |
| | C | 1.320 | 1.090 | 1.000 | 1.080 | 1.520 | 1.000 |
| | D | 1.290 | 1.120 | 1.000 | 1.000 | 1.530 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.220 | 1.140 | 1.000 | 1.130 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 38.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | B | 4.0 | 0.0 | 0.0 | 2.0 | 5.0 | 0.0 |
| | C | 32.0 | 9.0 | 0.0 | 8.0 | 52.0 | 0.0 |
| | D | 29.0 | 12.0 | 0.0 | 0.0 | 53.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 22.0 | 14.0 | 0.0 | 13.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.12 | 2.92 | 0.17 | A | 251.42 | 258.89 | 10.55 | 2.44 | 0.12 | 10.55 | 2.44 |
| B | 0.32 | 1.86 | 0.49 | A | 797.55 | 1196.32 | 33.80 | 1.70 | 0.38 | 33.80 | 1.70 |
| C | 0.49 | 3.55 | 1.12 | A | 950.05 | 1425.07 | 59.86 | 2.52 | 0.67 | 59.86 | 2.52 |
| D | 0.19 | 2.52 | 0.27 | A | 323.55 | 485.33 | 16.24 | 2.01 | 0.18 | 16.24 | 2.01 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.35 | 3.62 | 0.62 | A | 516.24 | 774.36 | 37.25 | 2.89 | 0.41 | 37.25 | 2.89 |

## Main Results for each time segment

### Main results: (07:45-08:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 206.28 | 141.60 | 35.40 | 64.67 | 0.00 | 141.29 | 313.05 | 804.86 | 0.00 | 2502.73 | 488.97 | 0.057 | 0.00 | 0.08 | 1.972 | |
| B | 654.34 | 654.34 | 163.59 | 0.00 | 64.67 | 653.23 | 740.36 | 205.79 | 0.00 | 3098.80 | 2385.44 | 0.211 | 0.00 | 0.28 | 1.526 | |
| C | 779.46 | 779.46 | 194.86 | 0.00 | 0.00 | 778.07 | 0.00 | 859.03 | 0.00 | 3344.80 | 0.00 | 0.233 | 0.00 | 0.35 | 1.612 | |
| D | 265.46 | 265.46 | 66.36 | 0.00 | 0.00 | 265.01 | 743.40 | 893.70 | 0.00 | 3067.33 | 1307.74 | 0.087 | 0.00 | 0.11 | 1.514 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 463.31 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 423.55 | 423.55 | 105.89 | 0.00 | 0.00 | 422.51 | 0.00 | 695.39 | 0.00 | 2304.41 | 658.98 | 0.184 | 0.00 | 0.26 | 2.196 | |

## Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 246.32 | 169.09 | 42.27 | 77.23 | 0.00 | 168.97 | 374.24 | 962.29 | 0.00 | 2207.10 | 488.97 | 0.077 | 0.08 | 0.11 | 2.285 | |
| B | 781.35 | 781.35 | 195.34 | 0.00 | 77.23 | 781.02 | 885.15 | 246.12 | 0.00 | 3041.38 | 2385.44 | 0.257 | 0.28 | 0.36 | 1.650 | |
| C | 930.75 | 930.75 | 232.69 | 0.00 | 0.00 | 929.99 | 0.00 | 1027.14 | 0.00 | 2906.79 | 0.00 | 0.320 | 0.35 | 0.54 | 2.093 | |
| D | 316.98 | 316.98 | 79.25 | 0.00 | 0.00 | 316.79 | 888.76 | 1068.37 | 0.00 | 2648.71 | 1307.74 | 0.120 | 0.11 | 0.16 | 1.819 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 553.94 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 505.76 | 505.76 | 126.44 | 0.00 | 0.00 | 505.31 | 0.00 | 831.22 | 0.00 | 2076.79 | 658.98 | 0.244 | 0.26 | 0.37 | 2.632 | |

## Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 301.67 | 207.09 | 51.77 | 94.58 | 0.00 | 206.85 | 457.93 | 1177.59 | 0.00 | 1802.80 | 488.97 | 0.115 | 0.11 | 0.17 | 2.918 | |
| B | 956.95 | 956.95 | 239.24 | 0.00 | 94.58 | 956.41 | 1083.20 | 301.24 | 0.00 | 2962.88 | 2385.44 | 0.323 | 0.36 | 0.49 | 1.859 | |
| C | 1139.93 | 1139.93 | 284.98 | 0.00 | 0.00 | 1137.63 | 0.00 | 1257.65 | 0.00 | 2306.21 | 0.00 | 0.494 | 0.54 | 1.11 | 3.533 | |
| D | 388.22 | 388.22 | 97.05 | 0.00 | 0.00 | 387.78 | 1087.74 | 1307.54 | 0.00 | 2075.49 | 1307.74 | 0.187 | 0.16 | 0.27 | 2.515 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 678.22 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 619.42 | 619.42 | 154.86 | 0.00 | 0.00 | 618.43 | 0.00 | 1017.10 | 0.00 | 1765.28 | 658.98 | 0.351 | 0.37 | 0.62 | 3.603 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 301.67 | 207.09 | 51.77 | 94.58 | 0.00 | 207.09 | 458.68 | 1179.47 | 0.00 | 1799.26 | 488.97 | 0.115 | 0.17 | 0.17 | 2.924 | |
| B | 956.95 | 956.95 | 239.24 | 0.00 | 94.58 | 956.95 | 1084.90 | 301.67 | 0.00 | 2962.27 | 2385.44 | 0.323 | 0.49 | 0.49 | 1.860 | |
| C | 1139.93 | 1139.93 | 284.98 | 0.00 | 0.00 | 1139.91 | 0.00 | 1258.62 | 0.00 | 2303.69 | 0.00 | 0.495 | 1.11 | 1.12 | 3.554 | |
| D | 388.22 | 388.22 | 97.05 | 0.00 | 0.00 | 388.22 | 1089.23 | 1309.30 | 0.00 | 2071.28 | 1307.74 | 0.187 | 0.27 | 0.27 | 2.521 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 678.76 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 619.42 | 619.42 | 154.86 | 0.00 | 0.00 | 619.41 | 0.00 | 1018.75 | 0.00 | 1762.51 | 658.98 | 0.351 | 0.62 | 0.62 | 3.617 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 246.32 | 169.09 | 42.27 | 77.23 | 0.00 | 169.33 | 375.28 | 964.96 | 0.00 | 2202.09 | 488.97 | 0.077 | 0.17 | 0.11 | 2.293 | |
| B | 781.35 | 781.35 | 195.34 | 0.00 | 77.23 | 781.88 | 887.54 | 246.75 | 0.00 | 3040.47 | 2385.44 | 0.257 | 0.49 | 0.36 | 1.654 | |
| C | 930.75 | 930.75 | 232.69 | 0.00 | 0.00 | 933.06 | 0.00 | 1028.63 | 0.00 | 2902.90 | 0.00 | 0.321 | 1.12 | 0.54 | 2.102 | |
| D | 316.98 | 316.98 | 79.25 | 0.00 | 0.00 | 317.42 | 890.86 | 1070.83 | 0.00 | 2642.81 | 1307.74 | 0.120 | 0.27 | 0.16 | 1.824 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 554.75 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 505.76 | 505.76 | 126.44 | 0.00 | 0.00 | 506.75 | 0.00 | 833.50 | 0.00 | 2072.97 | 658.98 | 0.244 | 0.62 | 0.37 | 2.641 | |

### Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 206.28 | 141.60 | 35.40 | 64.67 | 0.00 | 141.72 | 313.93 | 807.28 | 0.00 | 2498.18 | 488.97 | 0.057 | 0.11 | 0.08 | 1.978 | |
| B | 654.34 | 654.34 | 163.59 | 0.00 | 64.67 | 654.66 | 742.53 | 206.48 | 0.00 | 3097.82 | 2385.44 | 0.211 | 0.36 | 0.28 | 1.527 | |
| C | 779.46 | 779.46 | 194.86 | 0.00 | 0.00 | 780.23 | 0.00 | 861.14 | 0.00 | 3339.28 | 0.00 | 0.233 | 0.54 | 0.35 | 1.616 | |
| D | 265.46 | 265.46 | 66.36 | 0.00 | 0.00 | 265.65 | 745.41 | 895.97 | 0.00 | 3061.88 | 1307.74 | 0.087 | 0.16 | 0.11 | 1.519 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 464.40 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 423.55 | 423.55 | 105.89 | 0.00 | 0.00 | 423.99 | 0.00 | 697.22 | 0.00 | 2301.34 | 658.98 | 0.184 | 0.37 | 0.26 | 2.205 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (07:45-08:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.15 | 0.08 | 1.972 | A | A |
| B | 4.11 | 0.27 | 1.526 | A | A |
| C | 5.17 | 0.34 | 1.612 | A | A |
| D | 1.66 | 0.11 | 1.514 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.81 | 0.25 | 2.196 | A | A |

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.59 | 0.11 | 2.285 | A | A |
| B | 5.32 | 0.35 | 1.650 | A | A |
| C | 7.99 | 0.53 | 2.093 | A | A |
| D | 2.38 | 0.16 | 1.819 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.45 | 0.36 | 2.632 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.48 | 0.17 | 2.918 | A | A |
| B | 7.32 | 0.49 | 1.859 | A | A |
| C | 16.31 | 1.09 | 3.533 | A | A |
| D | 4.00 | 0.27 | 2.515 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.08 | 0.61 | 3.603 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.52 | 0.17 | 2.924 | A | A |
| B | 7.40 | 0.49 | 1.860 | A | A |
| C | 16.78 | 1.12 | 3.554 | A | A |
| D | 4.07 | 0.27 | 2.521 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.29 | 0.62 | 3.617 | A | A |

## Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.64 | 0.11 | 2.293 | A | A |
| B | 5.44 | 0.36 | 1.654 | A | A |
| C | 8.29 | 0.55 | 2.102 | A | A |
| D | 2.44 | 0.16 | 1.824 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.67 | 0.38 | 2.641 | A | A |

## Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.18 | 0.08 | 1.978 | A | A |
| B | 4.21 | 0.28 | 1.527 | A | A |
| C | 5.32 | 0.35 | 1.616 | A | A |
| D | 1.70 | 0.11 | 1.519 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 3.95 | 0.26 | 2.205 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** Inter-peak Hour-Base - FB-1d.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:33:38

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## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, 1d FB | | | |
| Arm A | 0.74 | 8.69 | 0.35 | A |
| Arm B | 0.29 | 1.82 | 0.22 | A |
| Arm C | 0.69 | 2.35 | 0.38 | A |
| Arm D | 0.54 | 2.22 | 0.33 | A |
| Arm E | 1.63 | 9.35 | 0.58 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, 1d FB, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:33:38*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, 1d FB, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, 1d FB, IP | Interpeak hour, 1d FB | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 4.26 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 371.00 | 109.303 |
| B | ONE HOUR | ✓ | 482.00 | 109.303 |
| C | ONE HOUR | ✓ | 879.00 | 109.303 |
| D | ONE HOUR | ✓ | 724.00 | 109.303 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 527.00 | 109.303 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 228.000 | 0.000 | 44.000 | 99.000 | 0.000 |
| | B | 43.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 166.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 61.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.61 | 0.00 | 0.12 | 0.27 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.51 | 0.40 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.12 | 0.38 | 0.00 | 0.49 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.35 | 8.69 | 0.74 | A | 372.11 | 386.65 | 35.33 | 5.48 | 0.39 | 35.33 | 5.48 |
| B | 0.22 | 1.82 | 0.29 | A | 483.44 | 725.16 | 20.21 | 1.67 | 0.22 | 20.21 | 1.67 |
| C | 0.38 | 2.35 | 0.69 | A | 881.62 | 1322.43 | 40.80 | 1.85 | 0.45 | 40.80 | 1.85 |
| D | 0.33 | 2.22 | 0.54 | A | 726.16 | 1089.24 | 32.62 | 1.80 | 0.36 | 32.62 | 1.80 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.58 | 9.35 | 1.63 | A | 528.57 | 792.86 | 76.14 | 5.76 | 0.85 | 76.15 | 5.76 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 305.29 | 211.48 | 52.87 | 93.81 | 0.00 | 210.79 | 261.18 | 1141.37 | 0.00 | 1870.81 | 539.46 | 0.113 | 0.00 | 0.17 | 2.948 | |
| B | 396.63 | 396.63 | 99.16 | 0.00 | 93.81 | 395.96 | 1017.54 | 334.63 | 0.00 | 2915.33 | 2544.03 | 0.136 | 0.00 | 0.17 | 1.523 | |
| C | 723.32 | 723.32 | 180.83 | 0.00 | 0.00 | 722.21 | 0.00 | 730.59 | 0.00 | 3679.43 | 0.00 | 0.197 | 0.00 | 0.28 | 1.379 | |
| D | 595.77 | 595.77 | 148.94 | 0.00 | 0.00 | 594.86 | 729.95 | 722.86 | 0.00 | 3476.78 | 1696.57 | 0.171 | 0.00 | 0.23 | 1.386 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 347.38 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 433.66 | 433.66 | 108.42 | 0.00 | 0.00 | 432.22 | 0.00 | 970.34 | 0.00 | 1843.64 | 478.30 | 0.235 | 0.00 | 0.36 | 3.006 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 364.55 | 252.53 | 63.13 | 112.02 | 0.00 | 252.08 | 312.22 | 1364.48 | 0.00 | 1451.85 | 539.45 | 0.174 | 0.17 | 0.28 | 4.082 | |
| B | 473.62 | 473.62 | 118.40 | 0.00 | 112.02 | 473.43 | 1216.39 | 400.17 | 0.00 | 2822.00 | 2544.03 | 0.168 | 0.17 | 0.21 | 1.634 | |
| C | 863.72 | 863.72 | 215.93 | 0.00 | 0.00 | 863.22 | 0.00 | 873.60 | 0.00 | 3306.82 | 0.00 | 0.261 | 0.28 | 0.40 | 1.668 | |
| D | 711.41 | 711.41 | 177.85 | 0.00 | 0.00 | 711.03 | 872.71 | 864.12 | 0.00 | 3138.21 | 1696.57 | 0.227 | 0.23 | 0.32 | 1.646 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 415.32 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 517.84 | 517.84 | 129.46 | 0.00 | 0.00 | 516.87 | 0.00 | 1159.83 | 0.00 | 1526.08 | 478.30 | 0.339 | 0.36 | 0.60 | 4.205 | |

## Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 446.48 | 309.29 | 77.32 | 137.19 | 0.00 | 307.53 | 381.94 | 1668.14 | 0.00 | 881.62 | 539.45 | 0.351 | 0.28 | 0.72 | 8.505 | |
| B | 580.06 | 580.06 | 145.02 | 0.00 | 137.19 | 579.75 | 1487.65 | 488.02 | 0.00 | 2696.90 | 2544.03 | 0.215 | 0.21 | 0.29 | 1.812 | |
| C | 1057.83 | 1057.83 | 264.46 | 0.00 | 0.00 | 1056.69 | 0.00 | 1067.77 | 0.00 | 2800.92 | 0.00 | 0.378 | 0.40 | 0.68 | 2.337 | |
| D | 871.30 | 871.30 | 217.82 | 0.00 | 0.00 | 870.46 | 1067.00 | 1057.47 | 0.00 | 2674.83 | 1696.57 | 0.326 | 0.32 | 0.53 | 2.214 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 508.07 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 634.22 | 634.22 | 158.55 | 0.00 | 0.00 | 630.22 | 0.00 | 1419.86 | 0.00 | 1090.31 | 478.30 | 0.582 | 0.60 | 1.60 | 9.153 | |

## Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 446.48 | 309.29 | 77.32 | 137.19 | 0.00 | 309.23 | 382.68 | 1672.69 | 0.00 | 873.07 | 539.45 | 0.354 | 0.72 | 0.74 | 8.685 | |
| B | 580.06 | 580.06 | 145.02 | 0.00 | 137.19 | 580.06 | 1491.00 | 490.92 | 0.00 | 2692.76 | 2544.03 | 0.215 | 0.29 | 0.29 | 1.816 | |
| C | 1057.83 | 1057.83 | 264.46 | 0.00 | 0.00 | 1057.81 | 0.00 | 1070.98 | 0.00 | 2792.55 | 0.00 | 0.379 | 0.68 | 0.69 | 2.350 | |
| D | 871.30 | 871.30 | 217.82 | 0.00 | 0.00 | 871.29 | 1069.80 | 1059.00 | 0.00 | 2671.16 | 1696.57 | 0.326 | 0.53 | 0.54 | 2.220 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 509.03 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 634.22 | 634.22 | 158.55 | 0.00 | 0.00 | 634.12 | 0.00 | 1421.26 | 0.00 | 1087.96 | 478.30 | 0.583 | 1.60 | 1.63 | 9.352 | |

## Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 364.55 | 252.53 | 63.13 | 112.02 | 0.00 | 254.32 | 313.24 | 1370.54 | 0.00 | 1440.47 | 539.45 | 0.175 | 0.74 | 0.29 | 4.136 | |
| B | 473.62 | 473.62 | 118.40 | 0.00 | 112.02 | 473.92 | 1220.92 | 403.94 | 0.00 | 2816.62 | 2544.03 | 0.168 | 0.29 | 0.22 | 1.640 | |
| C | 863.72 | 863.72 | 215.93 | 0.00 | 0.00 | 864.86 | 0.00 | 877.87 | 0.00 | 3295.71 | 0.00 | 0.262 | 0.69 | 0.40 | 1.680 | |
| D | 711.41 | 711.41 | 177.85 | 0.00 | 0.00 | 712.25 | 876.45 | 866.28 | 0.00 | 3133.04 | 1696.57 | 0.227 | 0.54 | 0.33 | 1.653 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 416.65 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 517.84 | 517.84 | 129.46 | 0.00 | 0.00 | 521.89 | 0.00 | 1161.88 | 0.00 | 1522.64 | 478.30 | 0.340 | 1.63 | 0.61 | 4.262 | |

## Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 305.29 | 211.48 | 52.87 | 93.81 | 0.00 | 211.95 | 261.93 | 1145.20 | 0.00 | 1863.63 | 539.46 | 0.113 | 0.29 | 0.17 | 2.965 | |
| B | 396.63 | 396.63 | 99.16 | 0.00 | 93.81 | 396.82 | 1020.65 | 336.49 | 0.00 | 2912.67 | 2544.03 | 0.136 | 0.22 | 0.17 | 1.525 | |
| C | 723.32 | 723.32 | 180.83 | 0.00 | 0.00 | 723.82 | 0.00 | 733.32 | 0.00 | 3672.33 | 0.00 | 0.197 | 0.40 | 0.28 | 1.385 | |
| D | 595.77 | 595.77 | 148.94 | 0.00 | 0.00 | 596.16 | 732.41 | 724.73 | 0.00 | 3472.28 | 1696.57 | 0.172 | 0.33 | 0.23 | 1.391 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 348.42 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 433.66 | 433.66 | 108.42 | 0.00 | 0.00 | 434.65 | 0.00 | 972.48 | 0.00 | 1840.06 | 478.30 | 0.236 | 0.61 | 0.37 | 3.023 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.55 | 0.17 | 2.948 | A | A |
| B | 2.49 | 0.17 | 1.523 | A | A |
| C | 4.11 | 0.27 | 1.379 | A | A |
| D | 3.40 | 0.23 | 1.386 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.32 | 0.35 | 3.006 | A | A |

## Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.20 | 0.28 | 4.082 | A | A |
| B | 3.19 | 0.21 | 1.634 | A | A |
| C | 5.94 | 0.40 | 1.668 | A | A |
| D | 4.83 | 0.32 | 1.646 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.83 | 0.59 | 4.205 | A | A |

## Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 10.43 | 0.70 | 8.505 | A | A |
| B | 4.33 | 0.29 | 1.812 | A | A |
| C | 10.12 | 0.67 | 2.337 | A | A |
| D | 7.91 | 0.53 | 2.214 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 22.68 | 1.51 | 9.153 | A | A |

## Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 11.02 | 0.73 | 8.685 | A | A |
| B | 4.38 | 0.29 | 1.816 | A | A |
| C | 10.31 | 0.69 | 2.350 | A | A |
| D | 8.04 | 0.54 | 2.220 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 24.26 | 1.62 | 9.352 | A | A |

## Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.48 | 0.30 | 4.136 | A | A |
| B | 3.27 | 0.22 | 1.640 | A | A |
| C | 6.12 | 0.41 | 1.680 | A | A |
| D | 4.96 | 0.33 | 1.653 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.48 | 0.63 | 4.262 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.66 | 0.18 | 2.965 | A | A |
| B | 2.55 | 0.17 | 1.525 | A | A |
| C | 4.21 | 0.28 | 1.385 | A | A |
| D | 3.48 | 0.23 | 1.391 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.58 | 0.37 | 3.023 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



**Filename:** Inter-peak Hour-Base - FB-2.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:36:20

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« (Default Analysis Set) - Interpeak hour, 2 FB, IP
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, 2 FB | | | |
| Arm A | 0.78 | 9.12 | 0.37 | A |
| Arm B | 0.30 | 1.82 | 0.22 | A |
| Arm C | 0.71 | 2.39 | 0.38 | A |
| Arm D | 0.55 | 2.25 | 0.33 | A |
| Arm E | 1.73 | 9.86 | 0.60 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, 2 FB, IP " model duration: 08:00 - 09:30*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:36:19*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, 2 FB, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, 2 FB, IP | Interpeak hour, 2 FB | P | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 4.42 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 371.00 | 110.150 |
| B | ONE HOUR | ✓ | 482.00 | 110.150 |
| C | ONE HOUR | ✓ | 879.00 | 110.150 |
| D | ONE HOUR | ✓ | 724.00 | 110.150 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 527.00 | 110.150 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 228.000 | 0.000 | 44.000 | 99.000 | 0.000 |
| | B | 43.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 166.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 61.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.61 | 0.00 | 0.12 | 0.27 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.51 | 0.40 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.12 | 0.38 | 0.00 | 0.49 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.37 | 9.12 | 0.78 | A | 374.99 | 389.65 | 36.83 | 5.67 | 0.41 | 36.83 | 5.67 |
| B | 0.22 | 1.82 | 0.30 | A | 487.18 | 730.78 | 20.45 | 1.68 | 0.23 | 20.45 | 1.68 |
| C | 0.38 | 2.39 | 0.71 | A | 888.45 | 1332.68 | 41.65 | 1.88 | 0.46 | 41.65 | 1.88 |
| D | 0.33 | 2.25 | 0.55 | A | 731.79 | 1097.68 | 33.24 | 1.82 | 0.37 | 33.24 | 1.82 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.60 | 9.86 | 1.73 | A | 532.67 | 799.00 | 79.60 | 5.98 | 0.88 | 79.61 | 5.98 |

## Main Results for each time segment

### Main results: (08:00-08:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 307.66 | 213.12 | 53.28 | 94.54 | 0.00 | 212.42 | 263.20 | 1150.19 | 0.00 | 1854.25 | 539.46 | 0.115 | 0.00 | 0.18 | 2.981 | |
| B | 399.71 | 399.71 | 99.93 | 0.00 | 94.54 | 399.03 | 1025.40 | 337.21 | 0.00 | 2911.66 | 2544.03 | 0.137 | 0.00 | 0.17 | 1.527 | |
| C | 728.93 | 728.93 | 182.23 | 0.00 | 0.00 | 727.80 | 0.00 | 736.24 | 0.00 | 3664.72 | 0.00 | 0.199 | 0.00 | 0.28 | 1.388 | |
| D | 600.39 | 600.39 | 150.10 | 0.00 | 0.00 | 599.46 | 735.59 | 728.45 | 0.00 | 3463.37 | 1696.57 | 0.173 | 0.00 | 0.23 | 1.395 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 350.06 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 437.02 | 437.02 | 109.26 | 0.00 | 0.00 | 435.55 | 0.00 | 977.85 | 0.00 | 1831.06 | 478.30 | 0.239 | 0.00 | 0.37 | 3.041 | |

### Main results: (08:15-08:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 367.37 | 254.49 | 63.62 | 112.89 | 0.00 | 254.02 | 314.64 | 1375.02 | 0.00 | 1432.05 | 539.45 | 0.178 | 0.18 | 0.29 | 4.154 | |
| B | 477.29 | 477.29 | 119.32 | 0.00 | 112.89 | 477.10 | 1225.79 | 403.25 | 0.00 | 2817.61 | 2544.03 | 0.169 | 0.17 | 0.22 | 1.639 | |
| C | 870.41 | 870.41 | 217.60 | 0.00 | 0.00 | 869.91 | 0.00 | 880.35 | 0.00 | 3289.24 | 0.00 | 0.265 | 0.28 | 0.41 | 1.685 | |
| D | 716.92 | 716.92 | 179.23 | 0.00 | 0.00 | 716.53 | 879.45 | 870.81 | 0.00 | 3122.19 | 1696.57 | 0.230 | 0.23 | 0.33 | 1.661 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 418.53 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 521.85 | 521.85 | 130.46 | 0.00 | 0.00 | 520.85 | 0.00 | 1168.81 | 0.00 | 1511.03 | 478.30 | 0.345 | 0.37 | 0.62 | 4.284 | |

## Main results: (08:30-08:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 449.94 | 311.68 | 77.92 | 138.26 | 0.00 | 309.79 | 384.85 | 1680.78 | 0.00 | 857.88 | 539.45 | 0.363 | 0.29 | 0.76 | 8.907 | |
| B | 584.56 | 584.56 | 146.14 | 0.00 | 138.26 | 584.24 | 1498.99 | 491.59 | 0.00 | 2691.81 | 2544.04 | 0.217 | 0.22 | 0.30 | 1.821 | |
| C | 1066.03 | 1066.03 | 266.51 | 0.00 | 0.00 | 1064.85 | 0.00 | 1075.83 | 0.00 | 2779.91 | 0.00 | 0.383 | 0.41 | 0.70 | 2.377 | |
| D | 878.05 | 878.05 | 219.51 | 0.00 | 0.00 | 877.18 | 1075.09 | 1065.59 | 0.00 | 2655.35 | 1696.57 | 0.331 | 0.33 | 0.55 | 2.247 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 511.95 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 639.13 | 639.13 | 159.78 | 0.00 | 0.00 | 634.81 | 0.00 | 1430.82 | 0.00 | 1071.93 | 478.30 | 0.596 | 0.62 | 1.70 | 9.622 | |

## Main results: (08:45-09:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 449.94 | 311.68 | 77.92 | 138.26 | 0.00 | 311.62 | 385.64 | 1685.64 | 0.00 | 848.75 | 539.45 | 0.367 | 0.76 | 0.78 | 9.117 | |
| B | 584.56 | 584.56 | 146.14 | 0.00 | 138.26 | 584.55 | 1502.54 | 494.72 | 0.00 | 2687.36 | 2544.04 | 0.218 | 0.30 | 0.30 | 1.824 | |
| C | 1066.03 | 1066.03 | 266.51 | 0.00 | 0.00 | 1066.01 | 0.00 | 1079.27 | 0.00 | 2770.96 | 0.00 | 0.385 | 0.70 | 0.71 | 2.391 | |
| D | 878.05 | 878.05 | 219.51 | 0.00 | 0.00 | 878.04 | 1078.08 | 1067.20 | 0.00 | 2651.50 | 1696.57 | 0.331 | 0.55 | 0.55 | 2.253 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 512.97 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 639.13 | 639.13 | 159.78 | 0.00 | 0.00 | 639.02 | 0.00 | 1432.27 | 0.00 | 1069.51 | 478.30 | 0.598 | 1.70 | 1.73 | 9.859 | |

## Main results: (09:00-09:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 367.37 | 254.49 | 63.62 | 112.89 | 0.00 | 256.42 | 315.71 | 1381.45 | 0.00 | 1419.98 | 539.45 | 0.179 | 0.78 | 0.30 | 4.217 | |
| B | 477.29 | 477.29 | 119.32 | 0.00 | 112.89 | 477.60 | 1230.58 | 407.29 | 0.00 | 2811.86 | 2544.03 | 0.170 | 0.30 | 0.22 | 1.646 | |
| C | 870.41 | 870.41 | 217.60 | 0.00 | 0.00 | 871.59 | 0.00 | 884.89 | 0.00 | 3277.41 | 0.00 | 0.266 | 0.71 | 0.41 | 1.697 | |
| D | 716.92 | 716.92 | 179.23 | 0.00 | 0.00 | 717.79 | 883.42 | 873.06 | 0.00 | 3116.78 | 1696.57 | 0.230 | 0.55 | 0.33 | 1.668 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 419.93 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 521.85 | 521.85 | 130.46 | 0.00 | 0.00 | 526.24 | 0.00 | 1170.92 | 0.00 | 1507.49 | 478.30 | 0.346 | 1.73 | 0.63 | 4.348 | |

## Main results: (09:15-09:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 307.66 | 213.12 | 53.28 | 94.54 | 0.00 | 213.60 | 263.97 | 1154.11 | 0.00 | 1846.90 | 539.46 | 0.115 | 0.30 | 0.18 | 2.999 | |
| B | 399.71 | 399.71 | 99.93 | 0.00 | 94.54 | 399.90 | 1028.58 | 339.13 | 0.00 | 2908.93 | 2544.03 | 0.137 | 0.22 | 0.17 | 1.532 | |
| C | 728.93 | 728.93 | 182.23 | 0.00 | 0.00 | 729.44 | 0.00 | 739.03 | 0.00 | 3657.46 | 0.00 | 0.199 | 0.41 | 0.28 | 1.392 | |
| D | 600.39 | 600.39 | 150.10 | 0.00 | 0.00 | 600.78 | 738.10 | 730.36 | 0.00 | 3458.79 | 1696.57 | 0.174 | 0.33 | 0.23 | 1.400 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 351.12 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 437.02 | 437.02 | 109.26 | 0.00 | 0.00 | 438.05 | 0.00 | 980.02 | 0.00 | 1827.41 | 478.30 | 0.239 | 0.63 | 0.37 | 3.060 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.60 | 0.17 | 2.981 | A | A |
| B | 2.51 | 0.17 | 1.527 | A | A |
| C | 4.17 | 0.28 | 1.388 | A | A |
| D | 3.45 | 0.23 | 1.395 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.42 | 0.36 | 3.041 | A | A |

### Queueing Delay results: (08:15-08:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.30 | 0.29 | 4.154 | A | A |
| B | 3.23 | 0.22 | 1.639 | A | A |
| C | 6.04 | 0.40 | 1.685 | A | A |
| D | 4.91 | 0.33 | 1.661 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.06 | 0.60 | 4.284 | A | A |

### Queueing Delay results: (08:30-08:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 10.98 | 0.73 | 8.907 | A | A |
| B | 4.38 | 0.29 | 1.821 | A | A |
| C | 10.36 | 0.69 | 2.377 | A | A |
| D | 8.09 | 0.54 | 2.247 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 23.94 | 1.60 | 9.622 | A | A |

### Queueing Delay results: (08:45-09:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 11.64 | 0.78 | 9.117 | A | A |
| B | 4.44 | 0.30 | 1.824 | A | A |
| C | 10.57 | 0.70 | 2.391 | A | A |
| D | 8.22 | 0.55 | 2.253 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 25.73 | 1.72 | 9.859 | A | A |

### Queueing Delay results: (09:00-09:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.60 | 0.31 | 4.217 | A | A |
| B | 3.31 | 0.22 | 1.646 | A | A |
| C | 6.23 | 0.42 | 1.697 | A | A |
| D | 5.04 | 0.34 | 1.668 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.76 | 0.65 | 4.348 | A | A |

## Queueing Delay results: (09:15-09:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.71 | 0.18 | 2.999 | A | A |
| B | 2.57 | 0.17 | 1.532 | A | A |
| C | 4.27 | 0.28 | 1.392 | A | A |
| D | 3.53 | 0.24 | 1.400 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.69 | 0.38 | 3.060 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



**Filename:** Inter-peak Hour-Base - FB-3.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:39:21

« (Default Analysis Set) - Interpeak hour, 3 FB, IP
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, 3 FB | | | |
| Arm A | 30.42 | 428.50 | 1.66 | F |
| Arm B | 0.24 | 1.62 | 0.19 | A |
| Arm C | 0.56 | 1.81 | 0.35 | A |
| Arm D | 1.09 | 3.74 | 0.52 | A |
| Arm E | 10.43 | 55.94 | 0.94 | F |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, 3 FB, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:39:21*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, 3 FB, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, 3 FB, IP | Interpeak hour, 3 FB | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 91.64 | F |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 100 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 647.00 | 111.645 |
| B | ONE HOUR | ✓ | 444.00 | 111.645 |
| C | ONE HOUR | ✓ | 908.00 | 111.645 |
| D | ONE HOUR | ✓ | 860.00 | 111.645 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 583.00 | 111.645 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 495.000 | 0.000 | 48.000 | 104.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 65.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.07 | 0.16 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.11 | 0.57 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1.66 | 428.50 | 30.42 | F | 662.83 | 233.58 | 475.81 | 122.22 | 5.29 | 475.81 | 122.22 |
| B | 0.19 | 1.62 | 0.24 | A | 454.87 | 682.30 | 17.27 | 1.52 | 0.19 | 17.27 | 1.52 |
| C | 0.35 | 1.81 | 0.56 | A | 930.22 | 1395.33 | 36.20 | 1.56 | 0.40 | 36.20 | 1.56 |
| D | 0.52 | 3.74 | 1.09 | A | 881.05 | 1321.57 | 59.20 | 2.69 | 0.66 | 59.20 | 2.69 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.94 | 55.94 | 10.43 | F | 597.27 | 895.90 | 282.12 | 18.89 | 3.13 | 282.13 | 18.89 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 543.82 | 127.76 | 31.94 | 416.06 | 0.00 | 127.30 | 167.73 | 1422.30 | 0.00 | 1343.28 | 151.03 | 0.095 | 0.00 | 0.12 | 3.266 | |
| B | 373.19 | 373.19 | 93.30 | 0.00 | 416.06 | 372.61 | 1269.05 | 280.54 | 0.00 | 2992.35 | 2309.65 | 0.125 | 0.00 | 0.15 | 1.407 | |
| C | 763.19 | 763.19 | 190.80 | 0.00 | 0.00 | 762.16 | 0.00 | 653.15 | 0.00 | 3881.19 | 0.00 | 0.197 | 0.00 | 0.26 | 1.226 | |
| D | 722.85 | 722.85 | 180.71 | 0.00 | 0.00 | 721.54 | 484.20 | 931.11 | 0.00 | 2977.66 | 1041.80 | 0.243 | 0.00 | 0.33 | 1.634 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 550.84 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 490.02 | 490.02 | 122.51 | 0.00 | 0.00 | 488.21 | 0.00 | 1101.82 | 0.00 | 1623.30 | 780.18 | 0.302 | 0.00 | 0.45 | 3.330 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 649.37 | 152.56 | 38.14 | 496.81 | 0.00 | 152.02 | 200.46 | 1699.76 | 0.00 | 822.24 | 151.03 | 0.186 | 0.12 | 0.25 | 5.920 | |
| B | 445.63 | 445.63 | 111.41 | 0.00 | 496.81 | 445.47 | 1516.65 | 335.13 | 0.00 | 2914.61 | 2309.65 | 0.153 | 0.15 | 0.18 | 1.493 | |
| C | 911.33 | 911.33 | 227.83 | 0.00 | 0.00 | 910.90 | 0.00 | 780.61 | 0.00 | 3549.12 | 0.00 | 0.257 | 0.26 | 0.37 | 1.449 | |
| D | 863.15 | 863.15 | 215.79 | 0.00 | 0.00 | 862.36 | 578.72 | 1112.79 | 0.00 | 2542.25 | 1041.80 | 0.340 | 0.33 | 0.52 | 2.193 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 658.29 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 585.14 | 585.14 | 146.28 | 0.00 | 0.00 | 583.35 | 0.00 | 1316.86 | 0.00 | 1262.91 | 780.18 | 0.463 | 0.45 | 0.90 | 5.559 | |

## Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 795.31 | 186.84 | 46.71 | 608.47 | 0.00 | 141.02 | 242.34 | 2055.85 | 0.00 | 153.54 | 151.03 | 1.217 | 0.25 | 11.70 | 203.846 |
| B | 545.78 | 545.78 | 136.45 | 0.00 | 608.47 | 545.56 | 1840.31 | 356.56 | 0.00 | 2884.09 | 2309.65 | 0.189 | 0.18 | 0.24 | 1.576 |
| C | 1116.14 | 1116.14 | 279.04 | 0.00 | 0.00 | 1115.38 | 0.00 | 902.13 | 0.00 | 3232.50 | 0.00 | 0.345 | 0.37 | 0.56 | 1.806 |
| D | 1057.14 | 1057.14 | 264.29 | 0.00 | 0.00 | 1054.86 | 694.42 | 1323.08 | 0.00 | 2038.24 | 1041.80 | 0.519 | 0.52 | 1.09 | 3.742 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 766.42 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 716.64 | 716.64 | 179.16 | 0.00 | 0.00 | 686.67 | 0.00 | 1611.52 | 0.00 | 769.10 | 780.18 | 0.932 | 0.90 | 8.39 | 37.513 |

## Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 795.31 | 186.84 | 46.71 | 608.47 | 0.00 | 111.96 | 244.94 | 2077.61 | 0.00 | 112.69 | 151.03 | 1.658 | 11.70 | 30.42 | 428.502 |
| B | 545.78 | 545.78 | 136.45 | 0.00 | 608.47 | 545.79 | 1855.22 | 334.35 | 0.00 | 2915.72 | 2309.65 | 0.187 | 0.24 | 0.24 | 1.555 |
| C | 1116.14 | 1116.14 | 279.04 | 0.00 | 0.00 | 1116.19 | 0.00 | 880.14 | 0.00 | 3289.78 | 0.00 | 0.339 | 0.56 | 0.55 | 1.758 |
| D | 1057.14 | 1057.14 | 264.29 | 0.00 | 0.00 | 1057.21 | 685.64 | 1310.69 | 0.00 | 2067.94 | 1041.80 | 0.511 | 1.09 | 1.08 | 3.650 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 753.83 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 716.64 | 716.64 | 179.16 | 0.00 | 0.00 | 708.48 | 0.00 | 1614.07 | 0.00 | 764.83 | 780.18 | 0.937 | 8.39 | 10.43 | 55.936 |

## Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 649.37 | 152.56 | 38.14 | 496.81 | 0.00 | 273.12 | 205.09 | 1737.80 | 0.00 | 750.80 | 151.03 | 0.203 | 30.42 | 0.28 | 10.905 |
| B | 445.63 | 445.63 | 111.41 | 0.00 | 496.81 | 445.77 | 1542.20 | 468.72 | 0.00 | 2724.38 | 2309.65 | 0.164 | 0.24 | 0.20 | 1.620 |
| C | 911.33 | 911.33 | 227.83 | 0.00 | 0.00 | 911.82 | 0.00 | 914.49 | 0.00 | 3200.29 | 0.00 | 0.285 | 0.55 | 0.42 | 1.670 |
| D | 863.15 | 863.15 | 215.79 | 0.00 | 0.00 | 865.01 | 617.43 | 1208.88 | 0.00 | 2311.94 | 1041.80 | 0.373 | 1.08 | 0.61 | 2.550 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 754.16 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 585.14 | 585.14 | 146.28 | 0.00 | 0.00 | 623.16 | 0.00 | 1319.74 | 0.00 | 1258.10 | 780.18 | 0.465 | 10.43 | 0.93 | 6.327 |

## Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 543.82 | 127.76 | 31.94 | 416.06 | 0.00 | 128.43 | 168.42 | 1428.46 | 0.00 | 1331.70 | 151.03 | 0.096 | 0.28 | 0.12 | 3.304 | |
| B | 373.19 | 373.19 | 93.30 | 0.00 | 416.06 | 373.41 | 1274.06 | 282.83 | 0.00 | 2989.10 | 2309.65 | 0.125 | 0.20 | 0.15 | 1.409 | |
| C | 763.19 | 763.19 | 190.80 | 0.00 | 0.00 | 763.85 | 0.00 | 656.24 | 0.00 | 3873.16 | 0.00 | 0.197 | 0.42 | 0.26 | 1.229 | |
| D | 722.85 | 722.85 | 180.71 | 0.00 | 0.00 | 723.98 | 485.53 | 934.56 | 0.00 | 2969.40 | 1041.80 | 0.243 | 0.61 | 0.33 | 1.644 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 553.54 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 490.02 | 490.02 | 122.51 | 0.00 | 0.00 | 491.89 | 0.00 | 1104.99 | 0.00 | 1617.98 | 780.18 | 0.303 | 0.93 | 0.46 | 3.370 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.70 | 0.11 | 3.266 | A | A |
| B | 2.17 | 0.14 | 1.407 | A | A |
| C | 3.86 | 0.26 | 1.226 | A | A |
| D | 4.86 | 0.32 | 1.634 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.64 | 0.44 | 3.330 | A | A |

## Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.64 | 0.24 | 5.920 | A | A |
| B | 2.75 | 0.18 | 1.493 | A | A |
| C | 5.45 | 0.36 | 1.449 | A | A |
| D | 7.76 | 0.52 | 2.193 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 13.04 | 0.87 | 5.559 | A | A |

## Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 100.29 | 6.69 | 203.846 | F | F |
| B | 3.55 | 0.24 | 1.576 | A | A |
| C | 8.28 | 0.55 | 1.806 | A | A |
| D | 15.97 | 1.06 | 3.742 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 93.06 | 6.20 | 37.513 | E | D |

## Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 316.34 | 21.09 | 428.502 | F | F |
| B | 3.55 | 0.24 | 1.555 | A | A |
| C | 8.24 | 0.55 | 1.758 | A | A |
| D | 16.24 | 1.08 | 3.650 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 143.13 | 9.54 | 55.936 | F | E |

## Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 52.04 | 3.47 | 10.905 | B | B |
| B | 3.03 | 0.20 | 1.620 | A | A |
| C | 6.42 | 0.43 | 1.670 | A | A |
| D | 9.36 | 0.62 | 2.550 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 19.22 | 1.28 | 6.327 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.80 | 0.12 | 3.304 | A | A |
| B | 2.21 | 0.15 | 1.409 | A | A |
| C | 3.95 | 0.26 | 1.229 | A | A |
| D | 5.01 | 0.33 | 1.644 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 7.04 | 0.47 | 3.370 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** Inter-peak Hour-Base - FB-4.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:41:49

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« (Default Analysis Set) - Interpeak hour, 4 FB, IP
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, 4 FB | | | |
| Arm A | 0.73 | 8.33 | 0.35 | A |
| Arm B | 0.30 | 1.80 | 0.22 | A |
| Arm C | 0.71 | 2.37 | 0.39 | A |
| Arm D | 0.58 | 2.34 | 0.34 | A |
| Arm E | 1.53 | 9.59 | 0.57 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, 4 FB, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:41:49*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, 4 FB, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, 4 FB, IP | Interpeak hour, 4 FB | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 4.18 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 371.00 | 112.293 |
| B | ONE HOUR | ✓ | 482.00 | 112.293 |
| C | ONE HOUR | ✓ | 879.00 | 112.293 |
| D | ONE HOUR | ✓ | 724.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 527.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 228.000 | 0.000 | 44.000 | 99.000 | 0.000 |
| | B | 43.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 166.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 61.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.61 | 0.00 | 0.12 | 0.27 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.51 | 0.40 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.12 | 0.38 | 0.00 | 0.49 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.35 | 8.33 | 0.73 | A | 382.29 | 397.23 | 35.23 | 5.32 | 0.39 | 35.23 | 5.32 |
| B | 0.22 | 1.80 | 0.30 | A | 496.66 | 744.99 | 20.64 | 1.66 | 0.23 | 20.64 | 1.66 |
| C | 0.39 | 2.37 | 0.71 | A | 905.74 | 1358.61 | 42.13 | 1.86 | 0.47 | 42.14 | 1.86 |
| D | 0.34 | 2.34 | 0.58 | A | 746.02 | 1119.04 | 34.85 | 1.87 | 0.39 | 34.85 | 1.87 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.57 | 9.59 | 1.53 | A | 483.58 | 725.38 | 70.96 | 5.87 | 0.79 | 70.96 | 5.87 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 313.64 | 217.27 | 54.32 | 96.38 | 0.00 | 216.56 | 262.70 | 1129.59 | 0.00 | 1892.94 | 539.45 | 0.115 | 0.00 | 0.18 | 2.920 | |
| B | 407.48 | 407.48 | 101.87 | 0.00 | 96.38 | 406.80 | 1026.81 | 319.34 | 0.00 | 2937.11 | 2544.03 | 0.139 | 0.00 | 0.17 | 1.517 | |
| C | 743.11 | 743.11 | 185.78 | 0.00 | 0.00 | 741.97 | 0.00 | 726.14 | 0.00 | 3691.04 | 0.00 | 0.201 | 0.00 | 0.29 | 1.382 | |
| D | 612.07 | 612.07 | 153.02 | 0.00 | 0.00 | 611.11 | 725.93 | 742.17 | 0.00 | 3430.49 | 1696.57 | 0.178 | 0.00 | 0.24 | 1.417 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 356.42 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 396.75 | 396.75 | 99.19 | 0.00 | 0.00 | 395.42 | 0.00 | 996.86 | 0.00 | 1799.19 | 478.30 | 0.221 | 0.00 | 0.33 | 3.022 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 374.52 | 259.44 | 64.86 | 115.08 | 0.00 | 258.99 | 314.03 | 1350.37 | 0.00 | 1478.34 | 539.45 | 0.175 | 0.18 | 0.29 | 4.016 | |
| B | 486.57 | 486.57 | 121.64 | 0.00 | 115.08 | 486.38 | 1227.48 | 381.89 | 0.00 | 2848.03 | 2544.03 | 0.171 | 0.17 | 0.22 | 1.625 | |
| C | 887.34 | 887.34 | 221.84 | 0.00 | 0.00 | 886.83 | 0.00 | 868.27 | 0.00 | 3320.71 | 0.00 | 0.267 | 0.29 | 0.41 | 1.675 | |
| D | 730.87 | 730.87 | 182.72 | 0.00 | 0.00 | 730.46 | 867.89 | 887.21 | 0.00 | 3082.87 | 1696.57 | 0.237 | 0.24 | 0.34 | 1.698 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 426.13 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 473.76 | 473.76 | 118.44 | 0.00 | 0.00 | 472.87 | 0.00 | 1191.54 | 0.00 | 1472.94 | 478.30 | 0.322 | 0.33 | 0.56 | 4.243 | |

## Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 458.69 | 317.75 | 79.44 | 140.95 | 0.00 | 316.04 | 384.16 | 1650.92 | 0.00 | 913.96 | 539.45 | 0.348 | 0.29 | 0.72 | 8.168 | |
| B | 595.93 | 595.93 | 148.98 | 0.00 | 140.95 | 595.62 | 1501.24 | 465.72 | 0.00 | 2728.66 | 2544.04 | 0.218 | 0.22 | 0.30 | 1.799 | |
| C | 1086.77 | 1086.77 | 271.69 | 0.00 | 0.00 | 1085.58 | 0.00 | 1061.33 | 0.00 | 2817.69 | 0.00 | 0.386 | 0.41 | 0.71 | 2.353 | |
| D | 895.13 | 895.13 | 223.78 | 0.00 | 0.00 | 894.19 | 1061.17 | 1085.75 | 0.00 | 2607.04 | 1696.57 | 0.343 | 0.34 | 0.58 | 2.332 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 521.32 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 580.24 | 580.24 | 145.06 | 0.00 | 0.00 | 576.45 | 0.00 | 1458.62 | 0.00 | 1025.34 | 478.30 | 0.566 | 0.56 | 1.50 | 9.384 | |

## Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 458.69 | 317.75 | 79.44 | 140.95 | 0.00 | 317.69 | 384.89 | 1655.38 | 0.00 | 905.57 | 539.45 | 0.351 | 0.72 | 0.73 | 8.330 | |
| B | 595.93 | 595.93 | 148.98 | 0.00 | 140.95 | 595.93 | 1504.58 | 468.49 | 0.00 | 2724.70 | 2544.04 | 0.219 | 0.30 | 0.30 | 1.802 | |
| C | 1086.77 | 1086.77 | 271.69 | 0.00 | 0.00 | 1086.75 | 0.00 | 1064.42 | 0.00 | 2809.66 | 0.00 | 0.387 | 0.71 | 0.71 | 2.366 | |
| D | 895.13 | 895.13 | 223.78 | 0.00 | 0.00 | 895.12 | 1063.88 | 1087.29 | 0.00 | 2603.34 | 1696.57 | 0.344 | 0.58 | 0.58 | 2.339 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 522.28 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 580.24 | 580.24 | 145.06 | 0.00 | 0.00 | 580.14 | 0.00 | 1460.13 | 0.00 | 1022.81 | 478.30 | 0.567 | 1.50 | 1.53 | 9.590 | |

## Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 374.52 | 259.44 | 64.86 | 115.08 | 0.00 | 261.18 | 315.04 | 1356.31 | 0.00 | 1467.20 | 539.45 | 0.177 | 0.73 | 0.29 | 4.066 | |
| B | 486.57 | 486.57 | 121.64 | 0.00 | 115.08 | 486.88 | 1232.00 | 385.49 | 0.00 | 2842.91 | 2544.03 | 0.171 | 0.30 | 0.22 | 1.631 | |
| C | 887.34 | 887.34 | 221.84 | 0.00 | 0.00 | 888.53 | 0.00 | 872.37 | 0.00 | 3310.03 | 0.00 | 0.268 | 0.71 | 0.42 | 1.686 | |
| D | 730.87 | 730.87 | 182.72 | 0.00 | 0.00 | 731.81 | 871.51 | 889.39 | 0.00 | 3077.66 | 1696.57 | 0.237 | 0.58 | 0.35 | 1.703 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 427.46 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 473.76 | 473.76 | 118.44 | 0.00 | 0.00 | 477.61 | 0.00 | 1193.74 | 0.00 | 1469.26 | 478.30 | 0.322 | 1.53 | 0.57 | 4.300 | |

## Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 313.64 | 217.27 | 54.32 | 96.38 | 0.00 | 217.73 | 263.44 | 1133.33 | 0.00 | 1885.92 | 539.45 | 0.115 | 0.29 | 0.18 | 2.938 | |
| B | 407.48 | 407.48 | 101.87 | 0.00 | 96.38 | 407.68 | 1029.94 | 321.12 | 0.00 | 2934.57 | 2544.03 | 0.139 | 0.22 | 0.17 | 1.518 | |
| C | 743.11 | 743.11 | 185.78 | 0.00 | 0.00 | 743.62 | 0.00 | 728.79 | 0.00 | 3684.11 | 0.00 | 0.202 | 0.42 | 0.29 | 1.388 | |
| D | 612.07 | 612.07 | 153.02 | 0.00 | 0.00 | 612.49 | 728.33 | 744.09 | 0.00 | 3425.89 | 1696.57 | 0.179 | 0.35 | 0.24 | 1.420 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 357.48 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 396.75 | 396.75 | 99.19 | 0.00 | 0.00 | 397.67 | 0.00 | 999.10 | 0.00 | 1795.44 | 478.30 | 0.221 | 0.57 | 0.34 | 3.039 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.59 | 0.17 | 2.920 | A | A |
| B | 2.55 | 0.17 | 1.517 | A | A |
| C | 4.23 | 0.28 | 1.382 | A | A |
| D | 3.57 | 0.24 | 1.417 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.89 | 0.33 | 3.022 | A | A |

### Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.24 | 0.28 | 4.016 | A | A |
| B | 3.26 | 0.22 | 1.625 | A | A |
| C | 6.12 | 0.41 | 1.675 | A | A |
| D | 5.11 | 0.34 | 1.698 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.15 | 0.54 | 4.243 | A | A |

### Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 10.31 | 0.69 | 8.168 | A | A |
| B | 4.42 | 0.29 | 1.799 | A | A |
| C | 10.46 | 0.70 | 2.353 | A | A |
| D | 8.55 | 0.57 | 2.332 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 21.27 | 1.42 | 9.384 | A | A |

### Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 10.86 | 0.72 | 8.330 | A | A |
| B | 4.47 | 0.30 | 1.802 | A | A |
| C | 10.67 | 0.71 | 2.366 | A | A |
| D | 8.70 | 0.58 | 2.339 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 22.76 | 1.52 | 9.590 | A | A |

### Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.52 | 0.30 | 4.066 | A | A |
| B | 3.34 | 0.22 | 1.631 | A | A |
| C | 6.31 | 0.42 | 1.686 | A | A |
| D | 5.26 | 0.35 | 1.703 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.76 | 0.58 | 4.300 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.71 | 0.18 | 2.938 | A | A |
| B | 2.60 | 0.17 | 1.518 | A | A |
| C | 4.34 | 0.29 | 1.388 | A | A |
| D | 3.66 | 0.24 | 1.420 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.13 | 0.34 | 3.039 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** Inter-peak Hour-Base - Tot-1d.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:43:36

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## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour 1d Tot | | | |
| Arm A | 0.95 | 9.62 | 0.41 | A |
| Arm B | 0.31 | 1.89 | 0.23 | A |
| Arm C | 0.75 | 2.56 | 0.40 | A |
| Arm D | 0.58 | 2.40 | 0.34 | A |
| Arm E | 2.04 | 11.04 | 0.63 | B |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour 1d Tot, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:43:36*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour 1d Tot, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour 1d Tot, IP | Interpeak hour 1d Tot | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 4.92 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 417.00 | 109.303 |
| B | ONE HOUR | ✓ | 493.00 | 109.303 |
| C | ONE HOUR | ✓ | 879.00 | 109.303 |
| D | ONE HOUR | ✓ | 724.00 | 109.303 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 562.00 | 109.303 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 239.000 | 0.000 | 44.000 | 134.000 | 0.000 |
| | B | 54.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 166.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 96.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.57 | 0.00 | 0.11 | 0.32 | 0.00 |
| | B | 0.11 | 0.00 | 0.00 | 0.50 | 0.39 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.17 | 0.36 | 0.00 | 0.46 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.41 | 9.62 | 0.95 | A | 418.24 | 447.58 | 44.03 | 5.90 | 0.49 | 44.03 | 5.90 |
| B | 0.23 | 1.89 | 0.31 | A | 494.47 | 741.71 | 21.40 | 1.73 | 0.24 | 21.40 | 1.73 |
| C | 0.40 | 2.56 | 0.75 | A | 881.62 | 1322.43 | 43.51 | 1.97 | 0.48 | 43.51 | 1.97 |
| D | 0.34 | 2.40 | 0.58 | A | 726.16 | 1089.24 | 34.55 | 1.90 | 0.38 | 34.55 | 1.90 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.63 | 11.04 | 2.04 | B | 563.68 | 845.52 | 91.37 | 6.48 | 1.02 | 91.37 | 6.48 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 343.15 | 244.81 | 61.20 | 98.34 | 0.00 | 243.98 | 298.90 | 1141.28 | 0.00 | 1870.99 | 646.21 | 0.131 | 0.00 | 0.21 | 3.045 | |
| B | 405.68 | 405.68 | 101.42 | 0.00 | 98.34 | 404.98 | 1021.97 | 363.29 | 0.00 | 2874.52 | 2389.80 | 0.141 | 0.00 | 0.18 | 1.564 | |
| C | 723.32 | 723.32 | 180.83 | 0.00 | 0.00 | 722.18 | 0.00 | 768.27 | 0.00 | 3581.27 | 0.00 | 0.202 | 0.00 | 0.29 | 1.426 | |
| D | 595.77 | 595.77 | 148.94 | 0.00 | 0.00 | 594.83 | 729.89 | 760.55 | 0.00 | 3386.43 | 1590.74 | 0.176 | 0.00 | 0.24 | 1.431 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 376.06 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 462.46 | 462.46 | 115.62 | 0.00 | 0.00 | 460.85 | 0.00 | 979.32 | 0.00 | 1828.58 | 502.91 | 0.253 | 0.00 | 0.40 | 3.145 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 409.75 | 292.33 | 73.08 | 117.42 | 0.00 | 291.77 | 357.33 | 1364.35 | 0.00 | 1452.09 | 646.16 | 0.201 | 0.21 | 0.35 | 4.271 | |
| B | 484.43 | 484.43 | 121.11 | 0.00 | 117.42 | 484.22 | 1221.69 | 434.43 | 0.00 | 2773.21 | 2389.85 | 0.175 | 0.18 | 0.23 | 1.687 | |
| C | 863.72 | 863.72 | 215.93 | 0.00 | 0.00 | 863.18 | 0.00 | 918.66 | 0.00 | 3189.43 | 0.00 | 0.271 | 0.29 | 0.42 | 1.752 | |
| D | 711.41 | 711.41 | 177.85 | 0.00 | 0.00 | 711.00 | 872.63 | 909.21 | 0.00 | 3030.15 | 1590.73 | 0.235 | 0.24 | 0.34 | 1.723 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 449.62 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 552.23 | 552.23 | 138.06 | 0.00 | 0.00 | 551.10 | 0.00 | 1170.58 | 0.00 | 1508.06 | 502.91 | 0.366 | 0.40 | 0.69 | 4.492 | |

## Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 501.84 | 358.03 | 89.51 | 143.81 | 0.00 | 355.72 | 436.81 | 1667.17 | 0.00 | 883.43 | 646.15 | 0.405 | 0.35 | 0.92 | 9.355 |
| B | 593.30 | 593.30 | 148.33 | 0.00 | 143.81 | 592.96 | 1493.62 | 529.27 | 0.00 | 2638.16 | 2389.85 | 0.225 | 0.23 | 0.31 | 1.888 |
| C | 1057.83 | 1057.83 | 264.46 | 0.00 | 0.00 | 1056.53 | 0.00 | 1122.24 | 0.00 | 2659.02 | 0.00 | 0.398 | 0.42 | 0.74 | 2.542 |
| D | 871.30 | 871.30 | 217.82 | 0.00 | 0.00 | 870.35 | 1066.43 | 1112.34 | 0.00 | 2543.32 | 1590.72 | 0.343 | 0.34 | 0.58 | 2.388 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 549.79 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 676.34 | 676.34 | 169.08 | 0.00 | 0.00 | 671.09 | 0.00 | 1432.90 | 0.00 | 1068.45 | 502.91 | 0.633 | 0.69 | 2.00 | 10.695 |

## Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 501.84 | 358.03 | 89.51 | 143.81 | 0.00 | 357.93 | 438.02 | 1672.64 | 0.00 | 873.17 | 646.15 | 0.410 | 0.92 | 0.95 | 9.620 |
| B | 593.30 | 593.30 | 148.33 | 0.00 | 143.81 | 593.30 | 1497.58 | 532.99 | 0.00 | 2632.85 | 2389.85 | 0.225 | 0.31 | 0.31 | 1.893 |
| C | 1057.83 | 1057.83 | 264.46 | 0.00 | 0.00 | 1057.81 | 0.00 | 1126.29 | 0.00 | 2648.46 | 0.00 | 0.399 | 0.74 | 0.75 | 2.563 |
| D | 871.30 | 871.30 | 217.82 | 0.00 | 0.00 | 871.29 | 1069.76 | 1114.33 | 0.00 | 2538.54 | 1590.72 | 0.343 | 0.58 | 0.58 | 2.397 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 551.13 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 676.34 | 676.34 | 169.08 | 0.00 | 0.00 | 676.17 | 0.00 | 1434.49 | 0.00 | 1065.79 | 502.91 | 0.635 | 2.00 | 2.04 | 11.036 |

## Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 409.75 | 292.33 | 73.08 | 117.42 | 0.00 | 294.70 | 358.93 | 1371.54 | 0.00 | 1438.58 | 646.16 | 0.203 | 0.95 | 0.35 | 4.343 | |
| B | 484.43 | 484.43 | 121.11 | 0.00 | 117.42 | 484.76 | 1227.00 | 439.24 | 0.00 | 2766.36 | 2389.85 | 0.175 | 0.31 | 0.23 | 1.692 | |
| C | 863.72 | 863.72 | 215.93 | 0.00 | 0.00 | 865.02 | 0.00 | 924.00 | 0.00 | 3175.51 | 0.00 | 0.272 | 0.75 | 0.42 | 1.768 | |
| D | 711.41 | 711.41 | 177.85 | 0.00 | 0.00 | 712.36 | 877.04 | 911.98 | 0.00 | 3023.50 | 1590.73 | 0.235 | 0.58 | 0.34 | 1.729 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 451.45 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 552.23 | 552.23 | 138.06 | 0.00 | 0.00 | 557.59 | 0.00 | 1172.89 | 0.00 | 1504.19 | 502.91 | 0.367 | 2.04 | 0.70 | 4.573 | |

## Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 343.15 | 244.81 | 61.20 | 98.34 | 0.00 | 245.39 | 299.88 | 1145.33 | 0.00 | 1863.38 | 646.21 | 0.131 | 0.35 | 0.21 | 3.067 | |
| B | 405.68 | 405.68 | 101.42 | 0.00 | 98.34 | 405.89 | 1025.28 | 365.43 | 0.00 | 2871.46 | 2389.80 | 0.141 | 0.23 | 0.18 | 1.566 | |
| C | 723.32 | 723.32 | 180.83 | 0.00 | 0.00 | 723.87 | 0.00 | 771.33 | 0.00 | 3573.30 | 0.00 | 0.202 | 0.42 | 0.29 | 1.430 | |
| D | 595.77 | 595.77 | 148.94 | 0.00 | 0.00 | 596.19 | 732.49 | 762.71 | 0.00 | 3381.27 | 1590.74 | 0.176 | 0.34 | 0.24 | 1.434 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 377.31 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 462.46 | 462.46 | 115.62 | 0.00 | 0.00 | 463.63 | 0.00 | 981.59 | 0.00 | 1824.79 | 502.91 | 0.253 | 0.70 | 0.41 | 3.166 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.04 | 0.20 | 3.045 | A | A |
| B | 2.61 | 0.17 | 1.564 | A | A |
| C | 4.25 | 0.28 | 1.426 | A | A |
| D | 3.51 | 0.23 | 1.431 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.92 | 0.39 | 3.145 | A | A |

## Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 5.08 | 0.34 | 4.271 | A | A |
| B | 3.37 | 0.22 | 1.687 | A | A |
| C | 6.23 | 0.42 | 1.752 | A | A |
| D | 5.05 | 0.34 | 1.723 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 10.04 | 0.67 | 4.492 | A | A |

## Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 13.20 | 0.88 | 9.355 | A | A |
| B | 4.61 | 0.31 | 1.888 | A | A |
| C | 10.99 | 0.73 | 2.542 | A | A |
| D | 8.52 | 0.57 | 2.388 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 27.93 | 1.86 | 10.695 | B | B |

## Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 14.07 | 0.94 | 9.620 | A | A |
| B | 4.67 | 0.31 | 1.893 | A | A |
| C | 11.24 | 0.75 | 2.563 | A | A |
| D | 8.67 | 0.58 | 2.397 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 30.36 | 2.02 | 11.036 | B | B |

## Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 5.45 | 0.36 | 4.343 | A | A |
| B | 3.46 | 0.23 | 1.692 | A | A |
| C | 6.44 | 0.43 | 1.768 | A | A |
| D | 5.20 | 0.35 | 1.729 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 10.89 | 0.73 | 4.573 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.19 | 0.21 | 3.067 | A | A |
| B | 2.68 | 0.18 | 1.566 | A | A |
| C | 4.36 | 0.29 | 1.430 | A | A |
| D | 3.60 | 0.24 | 1.434 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.23 | 0.42 | 3.166 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** Inter-peak Hour-Base - Tot-2.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:44:45

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## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, 2 Tot | | | |
| Arm A | 0.93 | 9.79 | 0.41 | A |
| Arm B | 0.30 | 1.86 | 0.22 | A |
| Arm C | 0.75 | 2.52 | 0.40 | A |
| Arm D | 0.58 | 2.37 | 0.34 | A |
| Arm E | 2.00 | 10.93 | 0.63 | B |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, 2 Tot, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:44:45*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, 2 Tot, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, 2 Tot, IP | Interpeak hour, 2 Tot | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 4.86 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 400.00 | 110.150 |
| B | ONE HOUR | ✓ | 482.00 | 110.150 |
| C | ONE HOUR | ✓ | 883.00 | 110.150 |
| D | ONE HOUR | ✓ | 724.00 | 110.150 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 552.00 | 110.150 |

# Turning Proportions

## Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 232.000 | 0.000 | 44.000 | 124.000 | 0.000 |
| | B | 43.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 170.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 86.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

## Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.58 | 0.00 | 0.11 | 0.31 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.51 | 0.40 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.16 | 0.36 | 0.00 | 0.47 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

## Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

## Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.41 | 9.79 | 0.93 | A | 404.30 | 430.58 | 42.87 | 5.97 | 0.48 | 42.87 | 5.97 |
| B | 0.22 | 1.86 | 0.30 | A | 487.18 | 730.78 | 20.79 | 1.71 | 0.23 | 20.79 | 1.71 |
| C | 0.40 | 2.52 | 0.75 | A | 892.50 | 1338.75 | 43.46 | 1.95 | 0.48 | 43.46 | 1.95 |
| D | 0.34 | 2.37 | 0.58 | A | 731.79 | 1097.68 | 34.47 | 1.88 | 0.38 | 34.47 | 1.88 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.63 | 10.93 | 2.00 | B | 557.94 | 836.91 | 89.74 | 6.43 | 1.00 | 89.74 | 6.43 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 331.71 | 235.51 | 58.88 | 96.19 | 0.00 | 234.72 | 287.16 | 1150.13 | 0.00 | 1854.36 | 563.68 | 0.127 | 0.00 | 0.20 | 3.049 | |
| B | 399.71 | 399.71 | 99.93 | 0.00 | 96.19 | 399.02 | 1027.01 | 357.84 | 0.00 | 2882.28 | 2482.07 | 0.139 | 0.00 | 0.17 | 1.545 | |
| C | 732.24 | 732.24 | 183.06 | 0.00 | 0.00 | 731.09 | 0.00 | 756.86 | 0.00 | 3610.99 | 0.00 | 0.203 | 0.00 | 0.29 | 1.417 | |
| D | 600.39 | 600.39 | 150.10 | 0.00 | 0.00 | 599.44 | 735.56 | 752.40 | 0.00 | 3405.98 | 1665.54 | 0.176 | 0.00 | 0.24 | 1.424 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 370.71 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 457.76 | 457.76 | 114.44 | 0.00 | 0.00 | 456.17 | 0.00 | 981.13 | 0.00 | 1825.56 | 492.34 | 0.251 | 0.00 | 0.40 | 3.129 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 396.09 | 281.22 | 70.31 | 114.87 | 0.00 | 280.69 | 343.29 | 1374.94 | 0.00 | 1432.20 | 563.68 | 0.196 | 0.20 | 0.33 | 4.290 | |
| B | 477.29 | 477.29 | 119.32 | 0.00 | 114.87 | 477.09 | 1227.71 | 427.92 | 0.00 | 2782.49 | 2482.07 | 0.172 | 0.17 | 0.22 | 1.664 | |
| C | 874.37 | 874.37 | 218.59 | 0.00 | 0.00 | 873.84 | 0.00 | 905.01 | 0.00 | 3224.99 | 0.00 | 0.271 | 0.29 | 0.42 | 1.735 | |
| D | 716.92 | 716.92 | 179.23 | 0.00 | 0.00 | 716.51 | 879.40 | 899.45 | 0.00 | 3053.55 | 1665.54 | 0.235 | 0.24 | 0.34 | 1.709 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 443.22 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 546.60 | 546.60 | 136.65 | 0.00 | 0.00 | 545.49 | 0.00 | 1172.73 | 0.00 | 1504.45 | 492.34 | 0.363 | 0.40 | 0.67 | 4.468 | |

## Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 485.11 | 344.43 | 86.11 | 140.68 | 0.00 | 342.15 | 419.69 | 1680.17 | 0.00 | 859.02 | 563.68 | 0.401 | 0.33 | 0.90 | 9.520 |
| B | 584.56 | 584.56 | 146.14 | 0.00 | 140.68 | 584.23 | 1501.00 | 521.32 | 0.00 | 2649.48 | 2482.07 | 0.221 | 0.22 | 0.30 | 1.858 |
| C | 1070.88 | 1070.88 | 267.72 | 0.00 | 0.00 | 1069.60 | 0.00 | 1105.55 | 0.00 | 2702.49 | 0.00 | 0.396 | 0.42 | 0.74 | 2.495 |
| D | 878.05 | 878.05 | 219.51 | 0.00 | 0.00 | 877.11 | 1074.73 | 1100.42 | 0.00 | 2571.88 | 1665.54 | 0.341 | 0.34 | 0.57 | 2.357 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 541.98 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 669.45 | 669.45 | 167.36 | 0.00 | 0.00 | 664.31 | 0.00 | 1435.55 | 0.00 | 1064.00 | 492.34 | 0.629 | 0.67 | 1.96 | 10.596 |

## Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 485.11 | 344.43 | 86.11 | 140.68 | 0.00 | 344.34 | 420.80 | 1685.60 | 0.00 | 848.82 | 563.68 | 0.406 | 0.90 | 0.93 | 9.793 |
| B | 584.56 | 584.56 | 146.14 | 0.00 | 140.68 | 584.55 | 1504.94 | 525.00 | 0.00 | 2644.24 | 2482.07 | 0.221 | 0.30 | 0.30 | 1.863 |
| C | 1070.88 | 1070.88 | 267.72 | 0.00 | 0.00 | 1070.86 | 0.00 | 1109.55 | 0.00 | 2692.06 | 0.00 | 0.398 | 0.74 | 0.75 | 2.516 |
| D | 878.05 | 878.05 | 219.51 | 0.00 | 0.00 | 878.04 | 1078.06 | 1102.35 | 0.00 | 2567.25 | 1665.54 | 0.342 | 0.57 | 0.58 | 2.366 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 543.28 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 669.45 | 669.45 | 167.36 | 0.00 | 0.00 | 669.29 | 0.00 | 1437.12 | 0.00 | 1061.39 | 492.34 | 0.631 | 1.96 | 2.00 | 10.926 |

## Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 396.09 | 281.22 | 70.31 | 114.87 | 0.00 | 283.56 | 344.76 | 1382.09 | 0.00 | 1418.78 | 563.68 | 0.198 | 0.93 | 0.34 | 4.363 | |
| B | 477.29 | 477.29 | 119.32 | 0.00 | 114.87 | 477.61 | 1232.98 | 432.67 | 0.00 | 2775.72 | 2482.07 | 0.172 | 0.30 | 0.22 | 1.670 | |
| C | 874.37 | 874.37 | 218.59 | 0.00 | 0.00 | 875.65 | 0.00 | 910.28 | 0.00 | 3211.26 | 0.00 | 0.272 | 0.75 | 0.43 | 1.750 | |
| D | 716.92 | 716.92 | 179.23 | 0.00 | 0.00 | 717.86 | 883.80 | 902.13 | 0.00 | 3047.11 | 1665.54 | 0.235 | 0.58 | 0.34 | 1.718 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 444.99 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 546.60 | 546.60 | 136.65 | 0.00 | 0.00 | 551.85 | 0.00 | 1175.00 | 0.00 | 1500.65 | 492.34 | 0.364 | 2.00 | 0.69 | 4.544 | |

## Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 331.71 | 235.51 | 58.88 | 96.19 | 0.00 | 236.07 | 288.08 | 1154.19 | 0.00 | 1846.74 | 563.68 | 0.128 | 0.34 | 0.20 | 3.068 | |
| B | 399.71 | 399.71 | 99.93 | 0.00 | 96.19 | 399.91 | 1030.31 | 359.95 | 0.00 | 2879.27 | 2482.07 | 0.139 | 0.22 | 0.17 | 1.550 | |
| C | 732.24 | 732.24 | 183.06 | 0.00 | 0.00 | 732.79 | 0.00 | 759.86 | 0.00 | 3603.18 | 0.00 | 0.203 | 0.43 | 0.29 | 1.423 | |
| D | 600.39 | 600.39 | 150.10 | 0.00 | 0.00 | 600.81 | 738.15 | 754.49 | 0.00 | 3400.96 | 1665.54 | 0.177 | 0.34 | 0.24 | 1.427 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 371.92 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 457.76 | 457.76 | 114.44 | 0.00 | 0.00 | 458.90 | 0.00 | 983.38 | 0.00 | 1821.79 | 492.34 | 0.251 | 0.69 | 0.40 | 3.150 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.93 | 0.20 | 3.049 | A | A |
| B | 2.54 | 0.17 | 1.545 | A | A |
| C | 4.27 | 0.28 | 1.417 | A | A |
| D | 3.52 | 0.23 | 1.424 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.83 | 0.39 | 3.129 | A | A |

## Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.91 | 0.33 | 4.290 | A | A |
| B | 3.28 | 0.22 | 1.664 | A | A |
| C | 6.25 | 0.42 | 1.735 | A | A |
| D | 5.05 | 0.34 | 1.709 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 9.88 | 0.66 | 4.468 | A | A |

## Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 12.92 | 0.86 | 9.520 | A | A |
| B | 4.47 | 0.30 | 1.858 | A | A |
| C | 10.93 | 0.73 | 2.495 | A | A |
| D | 8.48 | 0.57 | 2.357 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 27.42 | 1.83 | 10.596 | B | B |

## Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 13.78 | 0.92 | 9.793 | A | A |
| B | 4.53 | 0.30 | 1.863 | A | A |
| C | 11.17 | 0.74 | 2.516 | A | A |
| D | 8.62 | 0.57 | 2.366 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 29.76 | 1.98 | 10.926 | B | B |

## Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 5.27 | 0.35 | 4.363 | A | A |
| B | 3.36 | 0.22 | 1.670 | A | A |
| C | 6.46 | 0.43 | 1.750 | A | A |
| D | 5.20 | 0.35 | 1.718 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 10.71 | 0.71 | 4.544 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.07 | 0.20 | 3.068 | A | A |
| B | 2.60 | 0.17 | 1.550 | A | A |
| C | 4.38 | 0.29 | 1.423 | A | A |
| D | 3.61 | 0.24 | 1.427 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.14 | 0.41 | 3.150 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** Inter-peak Hour-Base - Tot-3.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:45:44

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## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, Phase 3 Tot | | | |
| Arm A | 1.00 | 10.64 | 0.42 | B |
| Arm B | 0.31 | 1.87 | 0.22 | A |
| Arm C | 0.77 | 2.57 | 0.41 | A |
| Arm D | 0.59 | 2.41 | 0.35 | A |
| Arm E | 2.19 | 11.92 | 0.65 | B |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, Phase 3 Tot, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:45:43*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, Phase 3 Tot, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, Phase 3 Tot, IP | Interpeak hour, Phase 3 Tot | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 5.16 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 394.00 | 111.645 |
| B | ONE HOUR | ✓ | 482.00 | 111.645 |
| C | ONE HOUR | ✓ | 882.00 | 111.645 |
| D | ONE HOUR | ✓ | 724.00 | 111.645 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 547.00 | 111.645 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 231.000 | 0.000 | 44.000 | 119.000 | 0.000 |
| | B | 43.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 169.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 81.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.59 | 0.00 | 0.11 | 0.30 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.51 | 0.40 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.15 | 0.37 | 0.00 | 0.48 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.42 | 10.64 | 1.00 | B | 403.64 | 427.97 | 45.11 | 6.32 | 0.50 | 45.11 | 6.32 |
| B | 0.22 | 1.87 | 0.31 | A | 493.80 | 740.69 | 21.15 | 1.71 | 0.23 | 21.15 | 1.71 |
| C | 0.41 | 2.57 | 0.77 | A | 903.59 | 1355.38 | 44.73 | 1.98 | 0.50 | 44.73 | 1.98 |
| D | 0.35 | 2.41 | 0.59 | A | 741.72 | 1112.58 | 35.41 | 1.91 | 0.39 | 35.41 | 1.91 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.65 | 11.92 | 2.19 | B | 560.39 | 840.58 | 95.68 | 6.83 | 1.06 | 95.68 | 6.83 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 331.17 | 234.09 | 58.52 | 97.08 | 0.00 | 233.28 | 286.03 | 1165.71 | 0.00 | 1825.10 | 558.76 | 0.128 | 0.00 | 0.20 | 3.097 | |
| B | 405.13 | 405.13 | 101.28 | 0.00 | 97.08 | 404.44 | 1040.51 | 358.49 | 0.00 | 2881.35 | 2493.95 | 0.141 | 0.00 | 0.17 | 1.549 | |
| C | 741.34 | 741.34 | 185.34 | 0.00 | 0.00 | 740.17 | 0.00 | 762.92 | 0.00 | 3595.19 | 0.00 | 0.206 | 0.00 | 0.29 | 1.429 | |
| D | 608.54 | 608.54 | 152.13 | 0.00 | 0.00 | 607.57 | 745.52 | 757.57 | 0.00 | 3393.58 | 1671.54 | 0.179 | 0.00 | 0.24 | 1.434 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 371.55 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 459.77 | 459.77 | 114.94 | 0.00 | 0.00 | 458.15 | 0.00 | 993.59 | 0.00 | 1804.67 | 489.63 | 0.255 | 0.00 | 0.40 | 3.174 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 395.44 | 279.52 | 69.88 | 115.92 | 0.00 | 278.96 | 341.93 | 1393.55 | 0.00 | 1397.26 | 558.88 | 0.200 | 0.20 | 0.34 | 4.410 | |
| B | 483.77 | 483.77 | 120.94 | 0.00 | 115.92 | 483.57 | 1243.83 | 428.68 | 0.00 | 2781.40 | 2493.85 | 0.174 | 0.17 | 0.22 | 1.670 | |
| C | 885.23 | 885.23 | 221.31 | 0.00 | 0.00 | 884.68 | 0.00 | 912.24 | 0.00 | 3206.14 | 0.00 | 0.276 | 0.29 | 0.43 | 1.757 | |
| D | 726.65 | 726.65 | 181.66 | 0.00 | 0.00 | 726.23 | 891.30 | 905.62 | 0.00 | 3038.74 | 1671.55 | 0.239 | 0.24 | 0.35 | 1.728 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 444.22 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 549.01 | 549.01 | 137.25 | 0.00 | 0.00 | 547.84 | 0.00 | 1187.64 | 0.00 | 1479.48 | 489.63 | 0.371 | 0.40 | 0.70 | 4.589 | |

## Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 484.32 | 342.34 | 85.59 | 141.98 | 0.00 | 339.83 | 417.97 | 1702.43 | 0.00 | 817.23 | 558.88 | 0.419 | 0.34 | 0.97 | 10.281 |
| B | 592.49 | 592.49 | 148.12 | 0.00 | 141.98 | 592.16 | 1520.40 | 521.85 | 0.00 | 2648.72 | 2493.85 | 0.224 | 0.22 | 0.31 | 1.866 |
| C | 1084.18 | 1084.18 | 271.05 | 0.00 | 0.00 | 1082.84 | 0.00 | 1114.01 | 0.00 | 2680.45 | 0.00 | 0.404 | 0.43 | 0.77 | 2.551 |
| D | 889.97 | 889.97 | 222.49 | 0.00 | 0.00 | 888.99 | 1088.97 | 1107.88 | 0.00 | 2554.00 | 1671.55 | 0.348 | 0.35 | 0.59 | 2.399 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 543.12 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 672.39 | 672.39 | 168.10 | 0.00 | 0.00 | 666.63 | 0.00 | 1453.76 | 0.00 | 1033.49 | 489.63 | 0.651 | 0.70 | 2.14 | 11.494 |

## Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 484.32 | 342.34 | 85.59 | 141.98 | 0.00 | 342.23 | 419.13 | 1708.45 | 0.00 | 805.93 | 558.88 | 0.425 | 0.97 | 1.00 | 10.635 |
| B | 592.49 | 592.49 | 148.12 | 0.00 | 141.98 | 592.49 | 1524.72 | 525.95 | 0.00 | 2642.89 | 2493.85 | 0.224 | 0.31 | 0.31 | 1.871 |
| C | 1084.18 | 1084.18 | 271.05 | 0.00 | 0.00 | 1084.16 | 0.00 | 1118.43 | 0.00 | 2668.92 | 0.00 | 0.406 | 0.77 | 0.77 | 2.574 |
| D | 889.97 | 889.97 | 222.49 | 0.00 | 0.00 | 889.96 | 1092.66 | 1109.93 | 0.00 | 2549.10 | 1671.55 | 0.349 | 0.59 | 0.59 | 2.408 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 544.50 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 672.39 | 672.39 | 168.10 | 0.00 | 0.00 | 672.19 | 0.00 | 1455.39 | 0.00 | 1030.76 | 489.63 | 0.652 | 2.14 | 2.19 | 11.920 |

## Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 395.44 | 279.52 | 69.88 | 115.92 | 0.00 | 282.12 | 343.48 | 1401.43 | 0.00 | 1382.46 | 558.88 | 0.202 | 1.00 | 0.35 | 4.495 | |
| B | 483.77 | 483.77 | 120.94 | 0.00 | 115.92 | 484.09 | 1249.60 | 433.95 | 0.00 | 2773.90 | 2493.85 | 0.174 | 0.31 | 0.23 | 1.678 | |
| C | 885.23 | 885.23 | 221.31 | 0.00 | 0.00 | 886.58 | 0.00 | 918.04 | 0.00 | 3191.04 | 0.00 | 0.277 | 0.77 | 0.44 | 1.773 | |
| D | 726.65 | 726.65 | 181.66 | 0.00 | 0.00 | 727.63 | 896.16 | 908.46 | 0.00 | 3031.94 | 1671.55 | 0.240 | 0.59 | 0.35 | 1.734 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 446.09 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 549.01 | 549.01 | 137.25 | 0.00 | 0.00 | 554.91 | 0.00 | 1190.00 | 0.00 | 1475.52 | 489.63 | 0.372 | 2.19 | 0.71 | 4.680 | |

## Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 331.17 | 234.09 | 58.52 | 97.08 | 0.00 | 234.67 | 286.95 | 1169.91 | 0.00 | 1817.22 | 558.76 | 0.129 | 0.35 | 0.20 | 3.118 | |
| B | 405.13 | 405.13 | 101.28 | 0.00 | 97.08 | 405.33 | 1043.92 | 360.67 | 0.00 | 2878.25 | 2493.95 | 0.141 | 0.23 | 0.18 | 1.554 | |
| C | 741.34 | 741.34 | 185.34 | 0.00 | 0.00 | 741.90 | 0.00 | 766.00 | 0.00 | 3587.17 | 0.00 | 0.207 | 0.44 | 0.30 | 1.436 | |
| D | 608.54 | 608.54 | 152.13 | 0.00 | 0.00 | 608.97 | 748.21 | 759.70 | 0.00 | 3388.48 | 1671.54 | 0.180 | 0.35 | 0.24 | 1.437 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 372.77 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 459.77 | 459.77 | 114.94 | 0.00 | 0.00 | 460.97 | 0.00 | 995.90 | 0.00 | 1800.81 | 489.63 | 0.255 | 0.71 | 0.41 | 3.199 | |

# Queueing Delay Results for each time segment

## Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.96 | 0.20 | 3.097 | A | A |
| B | 2.59 | 0.17 | 1.549 | A | A |
| C | 4.36 | 0.29 | 1.429 | A | A |
| D | 3.60 | 0.24 | 1.434 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.95 | 0.40 | 3.174 | A | A |

## Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 5.01 | 0.33 | 4.410 | A | A |
| B | 3.33 | 0.22 | 1.670 | A | A |
| C | 6.40 | 0.43 | 1.757 | A | A |
| D | 5.17 | 0.34 | 1.728 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 10.19 | 0.68 | 4.589 | A | A |

## Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 13.81 | 0.92 | 10.281 | B | B |
| B | 4.55 | 0.30 | 1.866 | A | A |
| C | 11.30 | 0.75 | 2.551 | A | A |
| D | 8.74 | 0.58 | 2.399 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 29.68 | 1.98 | 11.494 | B | B |

## Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 14.83 | 0.99 | 10.635 | B | B |
| B | 4.61 | 0.31 | 1.871 | A | A |
| C | 11.56 | 0.77 | 2.574 | A | A |
| D | 8.90 | 0.59 | 2.408 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 32.51 | 2.17 | 11.920 | B | B |

## Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 5.40 | 0.36 | 4.495 | A | A |
| B | 3.42 | 0.23 | 1.678 | A | A |
| C | 6.63 | 0.44 | 1.773 | A | A |
| D | 5.32 | 0.35 | 1.734 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 11.09 | 0.74 | 4.680 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.10 | 0.21 | 3.118 | A | A |
| B | 2.65 | 0.18 | 1.554 | A | A |
| C | 4.48 | 0.30 | 1.436 | A | A |
| D | 3.68 | 0.25 | 1.437 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.26 | 0.42 | 3.199 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
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**Filename:** Inter-peak Hour-Base - Tot-4.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 10:48:23



## Summary of junction performance

| | IP | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - Interpeak hour, 4 Tot | | | |
| Arm A | 1.01 | 10.93 | 0.43 | B |
| Arm B | 0.31 | 1.87 | 0.23 | A |
| Arm C | 0.78 | 2.58 | 0.41 | A |
| Arm D | 0.60 | 2.40 | 0.35 | A |
| Arm E | 2.21 | 12.06 | 0.66 | B |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - Interpeak hour, 4 Tot, IP " model duration: 10:45 - 12:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 10:48:23*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - Interpeak hour, 4 Tot, IP

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interpeak hour, 4 Tot, IP | Interpeak hour, 4 Tot | P | | ONE HOUR | 10:45 | 12:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 5.20 | A |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 386.00 | 112.293 |
| B | ONE HOUR | ✓ | 482.00 | 112.293 |
| C | ONE HOUR | ✓ | 878.00 | 112.293 |
| D | ONE HOUR | ✓ | 724.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 543.00 | 112.293 |

# Turning Proportions

## Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 227.000 | 0.000 | 44.000 | 115.000 | 0.000 |
| | B | 43.000 | 0.000 | 0.000 | 248.000 | 191.000 | 0.000 |
| | C | 165.000 | 346.000 | 0.000 | 337.000 | 30.000 | 0.000 |
| | D | 48.000 | 578.000 | 0.000 | 0.000 | 98.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 77.000 | 201.000 | 0.000 | 260.000 | 5.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

## Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.59 | 0.00 | 0.11 | 0.30 | 0.00 |
| | B | 0.09 | 0.00 | 0.00 | 0.51 | 0.40 | 0.00 |
| | C | 0.19 | 0.39 | 0.00 | 0.38 | 0.03 | 0.00 |
| | D | 0.07 | 0.80 | 0.00 | 0.00 | 0.14 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.14 | 0.37 | 0.00 | 0.48 | 0.01 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

## Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.400 | 1.000 | 1.050 | 1.510 | 1.000 |
| | B | 1.470 | 1.000 | 1.000 | 1.030 | 1.050 | 1.000 |
| | C | 1.340 | 1.080 | 1.000 | 1.080 | 1.530 | 1.000 |
| | D | 1.210 | 1.080 | 1.000 | 1.000 | 1.270 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.500 | 1.190 | 1.000 | 1.120 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

## Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 40.0 | 0.0 | 5.0 | 51.0 | 0.0 |
| | B | 47.0 | 0.0 | 0.0 | 3.0 | 5.0 | 0.0 |
| | C | 34.0 | 8.0 | 0.0 | 8.0 | 53.0 | 0.0 |
| | D | 21.0 | 8.0 | 0.0 | 0.0 | 27.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 50.0 | 19.0 | 0.0 | 12.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.43 | 10.93 | 1.01 | B | 397.74 | 421.18 | 45.23 | 6.44 | 0.50 | 45.23 | 6.44 |
| B | 0.23 | 1.87 | 0.31 | A | 496.66 | 744.99 | 21.27 | 1.71 | 0.24 | 21.27 | 1.71 |
| C | 0.41 | 2.58 | 0.78 | A | 904.71 | 1357.06 | 44.87 | 1.98 | 0.50 | 44.87 | 1.98 |
| D | 0.35 | 2.40 | 0.60 | A | 746.02 | 1119.04 | 35.57 | 1.91 | 0.40 | 35.57 | 1.91 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.66 | 12.06 | 2.21 | B | 559.52 | 839.28 | 96.28 | 6.88 | 1.07 | 96.28 | 6.88 |

## Main Results for each time segment

### Main results: (10:45-11:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 326.32 | 230.37 | 57.59 | 95.95 | 0.00 | 229.58 | 280.94 | 1172.48 | 0.00 | 1812.40 | 554.48 | 0.127 | 0.00 | 0.20 | 3.110 | |
| B | 407.48 | 407.48 | 101.87 | 0.00 | 95.95 | 406.78 | 1044.86 | 357.20 | 0.00 | 2883.19 | 2500.99 | 0.141 | 0.00 | 0.18 | 1.550 | |
| C | 742.26 | 742.26 | 185.57 | 0.00 | 0.00 | 741.08 | 0.00 | 763.98 | 0.00 | 3592.44 | 0.00 | 0.207 | 0.00 | 0.29 | 1.430 | |
| D | 612.07 | 612.07 | 153.02 | 0.00 | 0.00 | 611.10 | 749.85 | 755.22 | 0.00 | 3399.22 | 1676.44 | 0.180 | 0.00 | 0.24 | 1.433 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 370.33 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 459.05 | 459.05 | 114.76 | 0.00 | 0.00 | 457.44 | 0.00 | 995.98 | 0.00 | 1800.66 | 487.52 | 0.255 | 0.00 | 0.40 | 3.177 | |

### Main results: (11:00-11:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 389.66 | 275.09 | 68.77 | 114.58 | 0.00 | 274.53 | 335.84 | 1401.63 | 0.00 | 1382.08 | 554.48 | 0.199 | 0.20 | 0.34 | 4.446 | |
| B | 486.57 | 486.57 | 121.64 | 0.00 | 114.58 | 486.37 | 1249.03 | 427.13 | 0.00 | 2783.61 | 2500.99 | 0.175 | 0.18 | 0.23 | 1.670 | |
| C | 886.33 | 886.33 | 221.58 | 0.00 | 0.00 | 885.78 | 0.00 | 913.50 | 0.00 | 3202.87 | 0.00 | 0.277 | 0.29 | 0.43 | 1.759 | |
| D | 730.87 | 730.87 | 182.72 | 0.00 | 0.00 | 730.45 | 896.47 | 902.81 | 0.00 | 3045.49 | 1676.44 | 0.240 | 0.24 | 0.35 | 1.726 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 442.76 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 548.15 | 548.15 | 137.04 | 0.00 | 0.00 | 546.98 | 0.00 | 1190.49 | 0.00 | 1474.69 | 487.52 | 0.372 | 0.40 | 0.70 | 4.601 | |

### Main results: (11:15-11:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 477.24 | 336.91 | 84.23 | 140.33 | 0.00 | 334.35 | 410.54 | 1712.23 | 0.00 | 798.82 | 554.48 | 0.422 | 0.34 | 0.98 | 10.549 |
| B | 595.93 | 595.93 | 148.98 | 0.00 | 140.33 | 595.60 | 1526.70 | 519.88 | 0.00 | 2651.53 | 2500.99 | 0.225 | 0.23 | 0.31 | 1.866 |
| C | 1085.53 | 1085.53 | 271.38 | 0.00 | 0.00 | 1084.18 | 0.00 | 1115.47 | 0.00 | 2676.64 | 0.00 | 0.406 | 0.43 | 0.77 | 2.558 |
| D | 895.13 | 895.13 | 223.78 | 0.00 | 0.00 | 894.15 | 1095.23 | 1104.42 | 0.00 | 2562.29 | 1676.44 | 0.349 | 0.35 | 0.59 | 2.395 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 541.32 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 671.35 | 671.35 | 167.84 | 0.00 | 0.00 | 665.51 | 0.00 | 1457.26 | 0.00 | 1027.63 | 487.52 | 0.653 | 0.70 | 2.16 | 11.622 |

### Main results: (11:30-11:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 477.24 | 336.91 | 84.23 | 140.33 | 0.00 | 336.79 | 411.68 | 1718.36 | 0.00 | 787.31 | 554.48 | 0.428 | 0.98 | 1.01 | 10.933 |
| B | 595.93 | 595.93 | 148.98 | 0.00 | 140.33 | 595.93 | 1531.10 | 524.05 | 0.00 | 2645.59 | 2500.99 | 0.225 | 0.31 | 0.31 | 1.872 |
| C | 1085.53 | 1085.53 | 271.38 | 0.00 | 0.00 | 1085.51 | 0.00 | 1119.97 | 0.00 | 2664.91 | 0.00 | 0.407 | 0.77 | 0.78 | 2.581 |
| D | 895.13 | 895.13 | 223.78 | 0.00 | 0.00 | 895.12 | 1099.00 | 1106.48 | 0.00 | 2557.37 | 1676.44 | 0.350 | 0.59 | 0.60 | 2.404 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 542.71 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 671.35 | 671.35 | 167.84 | 0.00 | 0.00 | 671.14 | 0.00 | 1458.89 | 0.00 | 1024.89 | 487.52 | 0.655 | 2.16 | 2.21 | 12.064 |

### Main results: (11:45-12:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 389.66 | 275.09 | 68.77 | 114.58 | 0.00 | 277.73 | 337.36 | 1409.64 | 0.00 | 1367.04 | 554.48 | 0.201 | 1.01 | 0.35 | 4.534 | |
| B | 486.57 | 486.57 | 121.64 | 0.00 | 114.58 | 486.90 | 1254.89 | 432.49 | 0.00 | 2775.97 | 2500.99 | 0.175 | 0.31 | 0.23 | 1.679 | |
| C | 886.33 | 886.33 | 221.58 | 0.00 | 0.00 | 887.69 | 0.00 | 919.40 | 0.00 | 3187.51 | 0.00 | 0.278 | 0.78 | 0.44 | 1.775 | |
| D | 730.87 | 730.87 | 182.72 | 0.00 | 0.00 | 731.85 | 901.42 | 905.66 | 0.00 | 3038.66 | 1676.44 | 0.241 | 0.60 | 0.35 | 1.732 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 444.65 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 548.15 | 548.15 | 137.04 | 0.00 | 0.00 | 554.14 | 0.00 | 1192.86 | 0.00 | 1470.72 | 487.52 | 0.373 | 2.21 | 0.71 | 4.692 | |

### Main results: (12:00-12:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 326.32 | 230.37 | 57.59 | 95.95 | 0.00 | 230.95 | 281.84 | 1176.71 | 0.00 | 1804.45 | 554.48 | 0.128 | 0.35 | 0.20 | 3.133 | |
| B | 407.48 | 407.48 | 101.87 | 0.00 | 95.95 | 407.69 | 1048.29 | 359.38 | 0.00 | 2880.09 | 2500.99 | 0.141 | 0.23 | 0.18 | 1.554 | |
| C | 742.26 | 742.26 | 185.57 | 0.00 | 0.00 | 742.83 | 0.00 | 767.07 | 0.00 | 3584.40 | 0.00 | 0.207 | 0.44 | 0.30 | 1.434 | |
| D | 612.07 | 612.07 | 153.02 | 0.00 | 0.00 | 612.50 | 752.56 | 757.34 | 0.00 | 3394.14 | 1676.44 | 0.180 | 0.35 | 0.24 | 1.438 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 371.55 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 459.05 | 459.05 | 114.76 | 0.00 | 0.00 | 460.26 | 0.00 | 998.29 | 0.00 | 1796.79 | 487.52 | 0.255 | 0.71 | 0.41 | 3.202 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (10:45-11:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.92 | 0.19 | 3.110 | A | A |
| B | 2.60 | 0.17 | 1.550 | A | A |
| C | 4.37 | 0.29 | 1.430 | A | A |
| D | 3.61 | 0.24 | 1.433 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.94 | 0.40 | 3.177 | A | A |

### Queueing Delay results: (11:00-11:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.97 | 0.33 | 4.446 | A | A |
| B | 3.35 | 0.22 | 1.670 | A | A |
| C | 6.42 | 0.43 | 1.759 | A | A |
| D | 5.20 | 0.35 | 1.726 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 10.20 | 0.68 | 4.601 | A | A |

### Queueing Delay results: (11:15-11:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 13.92 | 0.93 | 10.549 | B | B |
| B | 4.58 | 0.31 | 1.866 | A | A |
| C | 11.34 | 0.76 | 2.558 | A | A |
| D | 8.77 | 0.58 | 2.395 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 29.94 | 2.00 | 11.622 | B | B |

### Queueing Delay results: (11:30-11:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 14.99 | 1.00 | 10.933 | B | B |
| B | 4.64 | 0.31 | 1.872 | A | A |
| C | 11.61 | 0.77 | 2.581 | A | A |
| D | 8.93 | 0.60 | 2.404 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 32.83 | 2.19 | 12.064 | B | B |

### Queueing Delay results: (11:45-12:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 5.36 | 0.36 | 4.534 | A | A |
| B | 3.44 | 0.23 | 1.679 | A | A |
| C | 6.64 | 0.44 | 1.775 | A | A |
| D | 5.35 | 0.36 | 1.732 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 11.11 | 0.74 | 4.692 | A | A |

## Queueing Delay results: (12:00-12:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.07 | 0.20 | 3.133 | A | A |
| B | 2.66 | 0.18 | 1.554 | A | A |
| C | 4.49 | 0.30 | 1.434 | A | A |
| D | 3.70 | 0.25 | 1.438 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.26 | 0.42 | 3.202 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** PM Peak Hour-Base.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:13:01

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## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, Base | | | |
| Arm A | 5.63 | 49.53 | 0.87 | E |
| Arm B | 0.21 | 1.55 | 0.17 | A |
| Arm C | 0.45 | 1.62 | 0.30 | A |
| Arm D | 0.72 | 2.76 | 0.41 | A |
| Arm E | 1.64 | 9.34 | 0.61 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, Base, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:13:00*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, Base, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, Base, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, Base, PM | PM peak hour, Base | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 12.21 | B |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 647.00 | 100.000 |
| B | ONE HOUR | ✓ | 444.00 | 100.000 |
| C | ONE HOUR | ✓ | 908.00 | 100.000 |
| D | ONE HOUR | ✓ | 860.00 | 100.000 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 583.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 495.000 | 0.000 | 48.000 | 104.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 65.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.07 | 0.16 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.11 | 0.57 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.87 | 49.53 | 5.63 | E | 593.70 | 549.88 | 157.64 | 17.20 | 1.75 | 157.64 | 17.20 |
| B | 0.17 | 1.55 | 0.21 | A | 407.42 | 611.13 | 14.87 | 1.46 | 0.17 | 14.87 | 1.46 |
| C | 0.30 | 1.62 | 0.45 | A | 833.20 | 1249.80 | 28.73 | 1.38 | 0.32 | 28.73 | 1.38 |
| D | 0.41 | 2.76 | 0.72 | A | 789.15 | 1183.73 | 40.80 | 2.07 | 0.45 | 40.80 | 2.07 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.61 | 9.34 | 1.64 | A | 534.97 | 802.46 | 74.55 | 5.57 | 0.83 | 74.55 | 5.57 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 487.10 | 300.76 | 75.19 | 186.33 | 0.00 | 299.79 | 150.28 | 1274.35 | 0.00 | 1621.10 | 158.49 | 0.186 | 0.00 | 0.24 | 2.913 | |
| B | 334.27 | 334.27 | 83.57 | 0.00 | 186.33 | 333.76 | 1322.73 | 251.42 | 0.00 | 3033.83 | 2430.27 | 0.110 | 0.00 | 0.13 | 1.365 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 682.73 | 0.00 | 585.18 | 0.00 | 4058.30 | 0.00 | 0.168 | 0.00 | 0.21 | 1.133 | |
| D | 647.45 | 647.45 | 161.86 | 0.00 | 0.00 | 646.42 | 433.74 | 834.17 | 0.00 | 3210.00 | 1024.65 | 0.202 | 0.00 | 0.26 | 1.438 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 493.53 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 438.91 | 438.91 | 109.73 | 0.00 | 0.00 | 437.58 | 0.00 | 987.06 | 0.00 | 1815.62 | 784.67 | 0.242 | 0.00 | 0.33 | 2.746 | |

### Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 581.64 | 359.14 | 89.79 | 222.50 | 0.00 | 358.19 | 179.64 | 1523.26 | 0.00 | 1153.68 | 158.49 | 0.311 | 0.24 | 0.48 | 4.834 | |
| B | 399.15 | 399.15 | 99.79 | 0.00 | 222.50 | 399.02 | 1580.95 | 300.51 | 0.00 | 2963.92 | 2430.28 | 0.135 | 0.13 | 0.16 | 1.437 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 815.96 | 0.00 | 699.52 | 0.00 | 3760.38 | 0.00 | 0.217 | 0.21 | 0.29 | 1.298 | |
| D | 773.12 | 773.12 | 193.28 | 0.00 | 0.00 | 772.61 | 518.42 | 997.06 | 0.00 | 2819.61 | 1024.64 | 0.274 | 0.26 | 0.39 | 1.800 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 589.95 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 524.11 | 524.11 | 131.03 | 0.00 | 0.00 | 523.18 | 0.00 | 1179.72 | 0.00 | 1492.75 | 784.67 | 0.351 | 0.33 | 0.57 | 3.903 | |

### Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 712.36 | 439.86 | 109.96 | 272.50 | 0.00 | 423.01 | 219.62 | 1862.19 | 0.00 | 517.22 | 158.49 | 0.850 | 0.48 | 4.69 | 36.151 |
| B | 488.85 | 488.85 | 122.21 | 0.00 | 272.50 | 488.65 | 1924.08 | 361.11 | 0.00 | 2877.62 | 2430.28 | 0.170 | 0.16 | 0.21 | 1.543 |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.11 | 0.00 | 849.77 | 0.00 | 3368.93 | 0.00 | 0.297 | 0.29 | 0.45 | 1.613 |
| D | 946.88 | 946.88 | 236.72 | 0.00 | 0.00 | 945.56 | 632.95 | 1215.93 | 0.00 | 2295.05 | 1024.64 | 0.413 | 0.39 | 0.72 | 2.729 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 717.37 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 641.89 | 641.89 | 160.47 | 0.00 | 0.00 | 637.70 | 0.00 | 1444.11 | 0.00 | 1049.66 | 784.67 | 0.612 | 0.57 | 1.61 | 9.103 |

### Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 712.36 | 439.86 | 109.96 | 272.50 | 0.00 | 436.12 | 220.19 | 1867.20 | 0.00 | 507.81 | 158.49 | 0.866 | 4.69 | 5.63 | 49.528 |
| B | 488.85 | 488.85 | 122.21 | 0.00 | 272.50 | 488.85 | 1935.93 | 367.38 | 0.00 | 2868.69 | 2430.28 | 0.170 | 0.21 | 0.21 | 1.549 |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.71 | 0.00 | 856.23 | 0.00 | 3352.08 | 0.00 | 0.298 | 0.45 | 0.45 | 1.625 |
| D | 946.88 | 946.88 | 236.72 | 0.00 | 0.00 | 946.85 | 634.83 | 1221.11 | 0.00 | 2282.63 | 1024.64 | 0.415 | 0.72 | 0.72 | 2.759 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 722.35 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 641.89 | 641.89 | 160.47 | 0.00 | 0.00 | 641.78 | 0.00 | 1445.61 | 0.00 | 1047.16 | 784.67 | 0.613 | 1.61 | 1.64 | 9.338 |

### Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 581.64 | 359.14 | 89.79 | 222.50 | 0.00 | 379.68 | 180.39 | 1529.88 | 0.00 | 1141.25 | 158.49 | 0.315 | 5.63 | 0.50 | 5.193 | |
| B | 399.15 | 399.15 | 99.79 | 0.00 | 222.50 | 399.35 | 1599.25 | 310.31 | 0.00 | 2949.96 | 2430.28 | 0.135 | 0.21 | 0.16 | 1.445 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 816.88 | 0.00 | 709.66 | 0.00 | 3733.98 | 0.00 | 0.219 | 0.45 | 0.30 | 1.310 | |
| D | 773.12 | 773.12 | 193.28 | 0.00 | 0.00 | 774.45 | 521.49 | 1005.05 | 0.00 | 2800.45 | 1024.64 | 0.276 | 0.72 | 0.39 | 1.820 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 597.61 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 524.11 | 524.11 | 131.03 | 0.00 | 0.00 | 528.37 | 0.00 | 1181.89 | 0.00 | 1489.10 | 784.67 | 0.352 | 1.64 | 0.58 | 3.959 | |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 487.10 | 300.76 | 75.19 | 186.33 | 0.00 | 301.76 | 150.73 | 1278.29 | 0.00 | 1613.70 | 158.49 | 0.186 | 0.50 | 0.25 | 2.938 | |
| B | 334.27 | 334.27 | 83.57 | 0.00 | 186.33 | 334.40 | 1327.17 | 252.88 | 0.00 | 3031.74 | 2430.27 | 0.110 | 0.16 | 0.13 | 1.369 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 683.92 | 0.00 | 587.28 | 0.00 | 4052.82 | 0.00 | 0.169 | 0.30 | 0.22 | 1.135 | |
| D | 647.45 | 647.45 | 161.86 | 0.00 | 0.00 | 647.98 | 434.69 | 836.51 | 0.00 | 3204.40 | 1024.65 | 0.202 | 0.39 | 0.26 | 1.444 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 495.33 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 438.91 | 438.91 | 109.73 | 0.00 | 0.00 | 439.86 | 0.00 | 989.16 | 0.00 | 1812.10 | 784.67 | 0.242 | 0.58 | 0.34 | 2.763 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.58 | 0.24 | 2.913 | A | A |
| B | 1.88 | 0.13 | 1.365 | A | A |
| C | 3.20 | 0.21 | 1.133 | A | A |
| D | 3.83 | 0.26 | 1.438 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.92 | 0.33 | 2.746 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 7.02 | 0.47 | 4.834 | A | A |
| B | 2.37 | 0.16 | 1.437 | A | A |
| C | 4.38 | 0.29 | 1.298 | A | A |
| D | 5.73 | 0.38 | 1.800 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.30 | 0.55 | 3.903 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 55.60 | 3.71 | 36.151 | E | D |
| B | 3.11 | 0.21 | 1.543 | A | A |
| C | 6.64 | 0.44 | 1.613 | A | A |
| D | 10.54 | 0.70 | 2.729 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 22.78 | 1.52 | 9.103 | A | A |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 78.74 | 5.25 | 49.528 | E | D |
| B | 3.15 | 0.21 | 1.549 | A | A |
| C | 6.75 | 0.45 | 1.625 | A | A |
| D | 10.82 | 0.72 | 2.759 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 24.48 | 1.63 | 9.338 | A | A |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 8.95 | 0.60 | 5.193 | A | A |
| B | 2.43 | 0.16 | 1.445 | A | A |
| C | 4.51 | 0.30 | 1.310 | A | A |
| D | 5.95 | 0.40 | 1.820 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.91 | 0.59 | 3.959 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.76 | 0.25 | 2.938 | A | A |
| B | 1.92 | 0.13 | 1.369 | A | A |
| C | 3.26 | 0.22 | 1.135 | A | A |
| D | 3.93 | 0.26 | 1.444 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.15 | 0.34 | 2.763 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



**Filename:** PM Peak Hour-Base - FB-1d.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:19:06



## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 1d FB | | | |
| Arm A | 5.63 | 49.53 | 0.87 | E |
| Arm B | 0.21 | 1.55 | 0.17 | A |
| Arm C | 0.45 | 1.62 | 0.30 | A |
| Arm D | 0.72 | 2.76 | 0.41 | A |
| Arm E | 1.64 | 9.34 | 0.61 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 1d FB, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:19:06*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 1d FB, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 1d FB, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 1d FB, PM | PM peak hour, 1d FB | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 12.21 | B |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 647.00 | 100.000 |
| B | ONE HOUR | ✓ | 444.00 | 100.000 |
| C | ONE HOUR | ✓ | 908.00 | 100.000 |
| D | ONE HOUR | ✓ | 860.00 | 100.000 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 583.00 | 100.000 |

# Turning Proportions

## Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 495.000 | 0.000 | 48.000 | 104.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 65.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

## Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.07 | 0.16 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.11 | 0.57 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

## Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.87 | 49.53 | 5.63 | E | 593.70 | 549.88 | 157.64 | 17.20 | 1.75 | 157.64 | 17.20 |
| B | 0.17 | 1.55 | 0.21 | A | 407.42 | 611.13 | 14.87 | 1.46 | 0.17 | 14.87 | 1.46 |
| C | 0.30 | 1.62 | 0.45 | A | 833.20 | 1249.80 | 28.73 | 1.38 | 0.32 | 28.73 | 1.38 |
| D | 0.41 | 2.76 | 0.72 | A | 789.15 | 1183.73 | 40.80 | 2.07 | 0.45 | 40.80 | 2.07 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.61 | 9.34 | 1.64 | A | 534.97 | 802.46 | 74.55 | 5.57 | 0.83 | 74.55 | 5.57 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 487.10 | 300.76 | 75.19 | 186.33 | 0.00 | 299.79 | 150.28 | 1274.35 | 0.00 | 1621.10 | 158.49 | 0.186 | 0.00 | 0.24 | 2.913 | |
| B | 334.27 | 334.27 | 83.57 | 0.00 | 186.33 | 333.76 | 1322.73 | 251.42 | 0.00 | 3033.83 | 2430.27 | 0.110 | 0.00 | 0.13 | 1.365 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 682.73 | 0.00 | 585.18 | 0.00 | 4058.30 | 0.00 | 0.168 | 0.00 | 0.21 | 1.133 | |
| D | 647.45 | 647.45 | 161.86 | 0.00 | 0.00 | 646.42 | 433.74 | 834.17 | 0.00 | 3210.00 | 1024.65 | 0.202 | 0.00 | 0.26 | 1.438 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 493.53 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 438.91 | 438.91 | 109.73 | 0.00 | 0.00 | 437.58 | 0.00 | 987.06 | 0.00 | 1815.62 | 784.67 | 0.242 | 0.00 | 0.33 | 2.746 | |

## Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 581.64 | 359.14 | 89.79 | 222.50 | 0.00 | 358.19 | 179.64 | 1523.26 | 0.00 | 1153.68 | 158.49 | 0.311 | 0.24 | 0.48 | 4.834 | |
| B | 399.15 | 399.15 | 99.79 | 0.00 | 222.50 | 399.02 | 1580.95 | 300.51 | 0.00 | 2963.92 | 2430.28 | 0.135 | 0.13 | 0.16 | 1.437 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 815.96 | 0.00 | 699.52 | 0.00 | 3760.38 | 0.00 | 0.217 | 0.21 | 0.29 | 1.298 | |
| D | 773.12 | 773.12 | 193.28 | 0.00 | 0.00 | 772.61 | 518.42 | 997.06 | 0.00 | 2819.61 | 1024.64 | 0.274 | 0.26 | 0.39 | 1.800 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 589.95 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 524.11 | 524.11 | 131.03 | 0.00 | 0.00 | 523.18 | 0.00 | 1179.72 | 0.00 | 1492.75 | 784.67 | 0.351 | 0.33 | 0.57 | 3.903 | |

## Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 712.36 | 439.86 | 109.96 | 272.50 | 0.00 | 423.01 | 219.62 | 1862.19 | 0.00 | 517.22 | 158.49 | 0.850 | 0.48 | 4.69 | 36.151 | |
| B | 488.85 | 488.85 | 122.21 | 0.00 | 272.50 | 488.65 | 1924.08 | 361.11 | 0.00 | 2877.62 | 2430.28 | 0.170 | 0.16 | 0.21 | 1.543 | |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.11 | 0.00 | 849.77 | 0.00 | 3368.93 | 0.00 | 0.297 | 0.29 | 0.45 | 1.613 | |
| D | 946.88 | 946.88 | 236.72 | 0.00 | 0.00 | 945.56 | 632.95 | 1215.93 | 0.00 | 2295.05 | 1024.64 | 0.413 | 0.39 | 0.72 | 2.729 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 717.37 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | |
| E | 641.89 | 641.89 | 160.47 | 0.00 | 0.00 | 637.70 | 0.00 | 1444.11 | 0.00 | 1049.66 | 784.67 | 0.612 | 0.57 | 1.61 | 9.103 | |

## Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 712.36 | 439.86 | 109.96 | 272.50 | 0.00 | 436.12 | 220.19 | 1867.20 | 0.00 | 507.81 | 158.49 | 0.866 | 4.69 | 5.63 | 49.528 | |
| B | 488.85 | 488.85 | 122.21 | 0.00 | 272.50 | 488.85 | 1935.93 | 367.38 | 0.00 | 2868.69 | 2430.28 | 0.170 | 0.21 | 0.21 | 1.549 | |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.71 | 0.00 | 856.23 | 0.00 | 3352.08 | 0.00 | 0.298 | 0.45 | 0.45 | 1.625 | |
| D | 946.88 | 946.88 | 236.72 | 0.00 | 0.00 | 946.85 | 634.83 | 1221.11 | 0.00 | 2282.63 | 1024.64 | 0.415 | 0.72 | 0.72 | 2.759 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 722.35 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | |
| E | 641.89 | 641.89 | 160.47 | 0.00 | 0.00 | 641.78 | 0.00 | 1445.61 | 0.00 | 1047.16 | 784.67 | 0.613 | 1.61 | 1.64 | 9.338 | |

## Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 581.64 | 359.14 | 89.79 | 222.50 | 0.00 | 379.68 | 180.39 | 1529.88 | 0.00 | 1141.25 | 158.49 | 0.315 | 5.63 | 0.50 | 5.193 | |
| B | 399.15 | 399.15 | 99.79 | 0.00 | 222.50 | 399.35 | 1599.25 | 310.31 | 0.00 | 2949.96 | 2430.28 | 0.135 | 0.21 | 0.16 | 1.445 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 816.88 | 0.00 | 709.66 | 0.00 | 3733.98 | 0.00 | 0.219 | 0.45 | 0.30 | 1.310 | |
| D | 773.12 | 773.12 | 193.28 | 0.00 | 0.00 | 774.45 | 521.49 | 1005.05 | 0.00 | 2800.45 | 1024.64 | 0.276 | 0.72 | 0.39 | 1.820 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 597.61 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 524.11 | 524.11 | 131.03 | 0.00 | 0.00 | 528.37 | 0.00 | 1181.89 | 0.00 | 1489.10 | 784.67 | 0.352 | 1.64 | 0.58 | 3.959 | |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 487.10 | 300.76 | 75.19 | 186.33 | 0.00 | 301.76 | 150.73 | 1278.29 | 0.00 | 1613.70 | 158.49 | 0.186 | 0.50 | 0.25 | 2.938 | |
| B | 334.27 | 334.27 | 83.57 | 0.00 | 186.33 | 334.40 | 1327.17 | 252.88 | 0.00 | 3031.74 | 2430.27 | 0.110 | 0.16 | 0.13 | 1.369 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 683.92 | 0.00 | 587.28 | 0.00 | 4052.82 | 0.00 | 0.169 | 0.30 | 0.22 | 1.135 | |
| D | 647.45 | 647.45 | 161.86 | 0.00 | 0.00 | 647.98 | 434.69 | 836.51 | 0.00 | 3204.40 | 1024.65 | 0.202 | 0.39 | 0.26 | 1.444 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 495.33 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 438.91 | 438.91 | 109.73 | 0.00 | 0.00 | 439.86 | 0.00 | 989.16 | 0.00 | 1812.10 | 784.67 | 0.242 | 0.58 | 0.34 | 2.763 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.58 | 0.24 | 2.913 | A | A |
| B | 1.88 | 0.13 | 1.365 | A | A |
| C | 3.20 | 0.21 | 1.133 | A | A |
| D | 3.83 | 0.26 | 1.438 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.92 | 0.33 | 2.746 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 7.02 | 0.47 | 4.834 | A | A |
| B | 2.37 | 0.16 | 1.437 | A | A |
| C | 4.38 | 0.29 | 1.298 | A | A |
| D | 5.73 | 0.38 | 1.800 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.30 | 0.55 | 3.903 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 55.60 | 3.71 | 36.151 | E | D |
| B | 3.11 | 0.21 | 1.543 | A | A |
| C | 6.64 | 0.44 | 1.613 | A | A |
| D | 10.54 | 0.70 | 2.729 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 22.78 | 1.52 | 9.103 | A | A |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 78.74 | 5.25 | 49.528 | E | D |
| B | 3.15 | 0.21 | 1.549 | A | A |
| C | 6.75 | 0.45 | 1.625 | A | A |
| D | 10.82 | 0.72 | 2.759 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 24.48 | 1.63 | 9.338 | A | A |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 8.95 | 0.60 | 5.193 | A | A |
| B | 2.43 | 0.16 | 1.445 | A | A |
| C | 4.51 | 0.30 | 1.310 | A | A |
| D | 5.95 | 0.40 | 1.820 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.91 | 0.59 | 3.959 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.76 | 0.25 | 2.938 | A | A |
| B | 1.92 | 0.13 | 1.369 | A | A |
| C | 3.26 | 0.22 | 1.135 | A | A |
| D | 3.93 | 0.26 | 1.444 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.15 | 0.34 | 2.763 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** PM Peak Hour-Base - FB-2.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:21:07

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« (Default Analysis Set) - PM peak hour, 2 FB, PM
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 2 FB | | | |
| Arm A | 5.63 | 49.53 | 0.87 | E |
| Arm B | 0.21 | 1.55 | 0.17 | A |
| Arm C | 0.45 | 1.62 | 0.30 | A |
| Arm D | 0.72 | 2.76 | 0.41 | A |
| Arm E | 1.64 | 9.34 | 0.61 | A |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 2 FB, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:21:06*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 2 FB, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 2 FB, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 2 FB, PM | PM peak hour, 2 FB | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 12.21 | B |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 50 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 647.00 | 100.000 |
| B | ONE HOUR | ✓ | 444.00 | 100.000 |
| C | ONE HOUR | ✓ | 908.00 | 100.000 |
| D | ONE HOUR | ✓ | 860.00 | 100.000 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 583.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 495.000 | 0.000 | 48.000 | 104.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 65.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.07 | 0.16 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.11 | 0.57 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.87 | 49.53 | 5.63 | E | 593.70 | 549.88 | 157.64 | 17.20 | 1.75 | 157.64 | 17.20 |
| B | 0.17 | 1.55 | 0.21 | A | 407.42 | 611.13 | 14.87 | 1.46 | 0.17 | 14.87 | 1.46 |
| C | 0.30 | 1.62 | 0.45 | A | 833.20 | 1249.80 | 28.73 | 1.38 | 0.32 | 28.73 | 1.38 |
| D | 0.41 | 2.76 | 0.72 | A | 789.15 | 1183.73 | 40.80 | 2.07 | 0.45 | 40.80 | 2.07 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.61 | 9.34 | 1.64 | A | 534.97 | 802.46 | 74.55 | 5.57 | 0.83 | 74.55 | 5.57 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 487.10 | 300.76 | 75.19 | 186.33 | 0.00 | 299.79 | 150.28 | 1274.35 | 0.00 | 1621.10 | 158.49 | 0.186 | 0.00 | 0.24 | 2.913 | |
| B | 334.27 | 334.27 | 83.57 | 0.00 | 186.33 | 333.76 | 1322.73 | 251.42 | 0.00 | 3033.83 | 2430.27 | 0.110 | 0.00 | 0.13 | 1.365 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 682.73 | 0.00 | 585.18 | 0.00 | 4058.30 | 0.00 | 0.168 | 0.00 | 0.21 | 1.133 | |
| D | 647.45 | 647.45 | 161.86 | 0.00 | 0.00 | 646.42 | 433.74 | 834.17 | 0.00 | 3210.00 | 1024.65 | 0.202 | 0.00 | 0.26 | 1.438 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 493.53 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 438.91 | 438.91 | 109.73 | 0.00 | 0.00 | 437.58 | 0.00 | 987.06 | 0.00 | 1815.62 | 784.67 | 0.242 | 0.00 | 0.33 | 2.746 | |

## Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 581.64 | 359.14 | 89.79 | 222.50 | 0.00 | 358.19 | 179.64 | 1523.26 | 0.00 | 1153.68 | 158.49 | 0.311 | 0.24 | 0.48 | 4.834 | |
| B | 399.15 | 399.15 | 99.79 | 0.00 | 222.50 | 399.02 | 1580.95 | 300.51 | 0.00 | 2963.92 | 2430.28 | 0.135 | 0.13 | 0.16 | 1.437 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 815.96 | 0.00 | 699.52 | 0.00 | 3760.38 | 0.00 | 0.217 | 0.21 | 0.29 | 1.298 | |
| D | 773.12 | 773.12 | 193.28 | 0.00 | 0.00 | 772.61 | 518.42 | 997.06 | 0.00 | 2819.61 | 1024.64 | 0.274 | 0.26 | 0.39 | 1.800 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 589.95 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 524.11 | 524.11 | 131.03 | 0.00 | 0.00 | 523.18 | 0.00 | 1179.72 | 0.00 | 1492.75 | 784.67 | 0.351 | 0.33 | 0.57 | 3.903 | |

## Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 712.36 | 439.86 | 109.96 | 272.50 | 0.00 | 423.01 | 219.62 | 1862.19 | 0.00 | 517.22 | 158.49 | 0.850 | 0.48 | 4.69 | 36.151 |
| B | 488.85 | 488.85 | 122.21 | 0.00 | 272.50 | 488.65 | 1924.08 | 361.11 | 0.00 | 2877.62 | 2430.28 | 0.170 | 0.16 | 0.21 | 1.543 |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.11 | 0.00 | 849.77 | 0.00 | 3368.93 | 0.00 | 0.297 | 0.29 | 0.45 | 1.613 |
| D | 946.88 | 946.88 | 236.72 | 0.00 | 0.00 | 945.56 | 632.95 | 1215.93 | 0.00 | 2295.05 | 1024.64 | 0.413 | 0.39 | 0.72 | 2.729 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 717.37 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 641.89 | 641.89 | 160.47 | 0.00 | 0.00 | 637.70 | 0.00 | 1444.11 | 0.00 | 1049.66 | 784.67 | 0.612 | 0.57 | 1.61 | 9.103 |

## Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 712.36 | 439.86 | 109.96 | 272.50 | 0.00 | 436.12 | 220.19 | 1867.20 | 0.00 | 507.81 | 158.49 | 0.866 | 4.69 | 5.63 | 49.528 |
| B | 488.85 | 488.85 | 122.21 | 0.00 | 272.50 | 488.85 | 1935.93 | 367.38 | 0.00 | 2868.69 | 2430.28 | 0.170 | 0.21 | 0.21 | 1.549 |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.71 | 0.00 | 856.23 | 0.00 | 3352.08 | 0.00 | 0.298 | 0.45 | 0.45 | 1.625 |
| D | 946.88 | 946.88 | 236.72 | 0.00 | 0.00 | 946.85 | 634.83 | 1221.11 | 0.00 | 2282.63 | 1024.64 | 0.415 | 0.72 | 0.72 | 2.759 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 722.35 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 641.89 | 641.89 | 160.47 | 0.00 | 0.00 | 641.78 | 0.00 | 1445.61 | 0.00 | 1047.16 | 784.67 | 0.613 | 1.61 | 1.64 | 9.338 |

## Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 581.64 | 359.14 | 89.79 | 222.50 | 0.00 | 379.68 | 180.39 | 1529.88 | 0.00 | 1141.25 | 158.49 | 0.315 | 5.63 | 0.50 | 5.193 | |
| B | 399.15 | 399.15 | 99.79 | 0.00 | 222.50 | 399.35 | 1599.25 | 310.31 | 0.00 | 2949.96 | 2430.28 | 0.135 | 0.21 | 0.16 | 1.445 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 816.88 | 0.00 | 709.66 | 0.00 | 3733.98 | 0.00 | 0.219 | 0.45 | 0.30 | 1.310 | |
| D | 773.12 | 773.12 | 193.28 | 0.00 | 0.00 | 774.45 | 521.49 | 1005.05 | 0.00 | 2800.45 | 1024.64 | 0.276 | 0.72 | 0.39 | 1.820 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 597.61 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 524.11 | 524.11 | 131.03 | 0.00 | 0.00 | 528.37 | 0.00 | 1181.89 | 0.00 | 1489.10 | 784.67 | 0.352 | 1.64 | 0.58 | 3.959 | |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 487.10 | 300.76 | 75.19 | 186.33 | 0.00 | 301.76 | 150.73 | 1278.29 | 0.00 | 1613.70 | 158.49 | 0.186 | 0.50 | 0.25 | 2.938 | |
| B | 334.27 | 334.27 | 83.57 | 0.00 | 186.33 | 334.40 | 1327.17 | 252.88 | 0.00 | 3031.74 | 2430.27 | 0.110 | 0.16 | 0.13 | 1.369 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 683.92 | 0.00 | 587.28 | 0.00 | 4052.82 | 0.00 | 0.169 | 0.30 | 0.22 | 1.135 | |
| D | 647.45 | 647.45 | 161.86 | 0.00 | 0.00 | 647.98 | 434.69 | 836.51 | 0.00 | 3204.40 | 1024.65 | 0.202 | 0.39 | 0.26 | 1.444 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 495.33 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 438.91 | 438.91 | 109.73 | 0.00 | 0.00 | 439.86 | 0.00 | 989.16 | 0.00 | 1812.10 | 784.67 | 0.242 | 0.58 | 0.34 | 2.763 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.58 | 0.24 | 2.913 | A | A |
| B | 1.88 | 0.13 | 1.365 | A | A |
| C | 3.20 | 0.21 | 1.133 | A | A |
| D | 3.83 | 0.26 | 1.438 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 4.92 | 0.33 | 2.746 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 7.02 | 0.47 | 4.834 | A | A |
| B | 2.37 | 0.16 | 1.437 | A | A |
| C | 4.38 | 0.29 | 1.298 | A | A |
| D | 5.73 | 0.38 | 1.800 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.30 | 0.55 | 3.903 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 55.60 | 3.71 | 36.151 | E | D |
| B | 3.11 | 0.21 | 1.543 | A | A |
| C | 6.64 | 0.44 | 1.613 | A | A |
| D | 10.54 | 0.70 | 2.729 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 22.78 | 1.52 | 9.103 | A | A |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 78.74 | 5.25 | 49.528 | E | D |
| B | 3.15 | 0.21 | 1.549 | A | A |
| C | 6.75 | 0.45 | 1.625 | A | A |
| D | 10.82 | 0.72 | 2.759 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 24.48 | 1.63 | 9.338 | A | A |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 8.95 | 0.60 | 5.193 | A | A |
| B | 2.43 | 0.16 | 1.445 | A | A |
| C | 4.51 | 0.30 | 1.310 | A | A |
| D | 5.95 | 0.40 | 1.820 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 8.91 | 0.59 | 3.959 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.76 | 0.25 | 2.938 | A | A |
| B | 1.92 | 0.13 | 1.369 | A | A |
| C | 3.26 | 0.22 | 1.135 | A | A |
| D | 3.93 | 0.26 | 1.444 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 5.15 | 0.34 | 2.763 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** PM Peak Hour-Base - FB-3.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:22:41

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## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 3 FB | | | |
| Arm A | 30.42 | 428.50 | 1.66 | F |
| Arm B | 0.24 | 1.62 | 0.19 | A |
| Arm C | 0.56 | 1.81 | 0.35 | A |
| Arm D | 1.09 | 3.74 | 0.52 | A |
| Arm E | 10.43 | 55.94 | 0.94 | F |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 3 FB, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:22:40*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 3 FB, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 3 FB, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 3 FB, PM | PM peak hour, 3 FB | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 91.64 | F |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 100 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 647.00 | 111.645 |
| B | ONE HOUR | ✓ | 444.00 | 111.645 |
| C | ONE HOUR | ✓ | 908.00 | 111.645 |
| D | ONE HOUR | ✓ | 860.00 | 111.645 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 583.00 | 111.645 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 495.000 | 0.000 | 48.000 | 104.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 65.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.07 | 0.16 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.11 | 0.57 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1.66 | 428.50 | 30.42 | F | 662.83 | 233.58 | 475.81 | 122.22 | 5.29 | 475.81 | 122.22 |
| B | 0.19 | 1.62 | 0.24 | A | 454.87 | 682.30 | 17.27 | 1.52 | 0.19 | 17.27 | 1.52 |
| C | 0.35 | 1.81 | 0.56 | A | 930.22 | 1395.33 | 36.20 | 1.56 | 0.40 | 36.20 | 1.56 |
| D | 0.52 | 3.74 | 1.09 | A | 881.05 | 1321.57 | 59.20 | 2.69 | 0.66 | 59.20 | 2.69 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.94 | 55.94 | 10.43 | F | 597.27 | 895.90 | 282.12 | 18.89 | 3.13 | 282.13 | 18.89 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 543.82 | 127.76 | 31.94 | 416.06 | 0.00 | 127.30 | 167.73 | 1422.30 | 0.00 | 1343.28 | 151.03 | 0.095 | 0.00 | 0.12 | 3.266 | |
| B | 373.19 | 373.19 | 93.30 | 0.00 | 416.06 | 372.61 | 1269.05 | 280.54 | 0.00 | 2992.35 | 2309.65 | 0.125 | 0.00 | 0.15 | 1.407 | |
| C | 763.19 | 763.19 | 190.80 | 0.00 | 0.00 | 762.16 | 0.00 | 653.15 | 0.00 | 3881.19 | 0.00 | 0.197 | 0.00 | 0.26 | 1.226 | |
| D | 722.85 | 722.85 | 180.71 | 0.00 | 0.00 | 721.54 | 484.20 | 931.11 | 0.00 | 2977.66 | 1041.80 | 0.243 | 0.00 | 0.33 | 1.634 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 550.84 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 490.02 | 490.02 | 122.51 | 0.00 | 0.00 | 488.21 | 0.00 | 1101.82 | 0.00 | 1623.30 | 780.18 | 0.302 | 0.00 | 0.45 | 3.330 | |

## Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 649.37 | 152.56 | 38.14 | 496.81 | 0.00 | 152.02 | 200.46 | 1699.76 | 0.00 | 822.24 | 151.03 | 0.186 | 0.12 | 0.25 | 5.920 | |
| B | 445.63 | 445.63 | 111.41 | 0.00 | 496.81 | 445.47 | 1516.65 | 335.13 | 0.00 | 2914.61 | 2309.65 | 0.153 | 0.15 | 0.18 | 1.493 | |
| C | 911.33 | 911.33 | 227.83 | 0.00 | 0.00 | 910.90 | 0.00 | 780.61 | 0.00 | 3549.12 | 0.00 | 0.257 | 0.26 | 0.37 | 1.449 | |
| D | 863.15 | 863.15 | 215.79 | 0.00 | 0.00 | 862.36 | 578.72 | 1112.79 | 0.00 | 2542.25 | 1041.80 | 0.340 | 0.33 | 0.52 | 2.193 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 658.29 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 585.14 | 585.14 | 146.28 | 0.00 | 0.00 | 583.35 | 0.00 | 1316.86 | 0.00 | 1262.91 | 780.18 | 0.463 | 0.45 | 0.90 | 5.559 | |

## Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 795.31 | 186.84 | 46.71 | 608.47 | 0.00 | 141.02 | 242.34 | 2055.85 | 0.00 | 153.54 | 151.03 | 1.217 | 0.25 | 11.70 | 203.846 |
| B | 545.78 | 545.78 | 136.45 | 0.00 | 608.47 | 545.56 | 1840.31 | 356.56 | 0.00 | 2884.09 | 2309.65 | 0.189 | 0.18 | 0.24 | 1.576 |
| C | 1116.14 | 1116.14 | 279.04 | 0.00 | 0.00 | 1115.38 | 0.00 | 902.13 | 0.00 | 3232.50 | 0.00 | 0.345 | 0.37 | 0.56 | 1.806 |
| D | 1057.14 | 1057.14 | 264.29 | 0.00 | 0.00 | 1054.86 | 694.42 | 1323.08 | 0.00 | 2038.24 | 1041.80 | 0.519 | 0.52 | 1.09 | 3.742 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 766.42 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 716.64 | 716.64 | 179.16 | 0.00 | 0.00 | 686.67 | 0.00 | 1611.52 | 0.00 | 769.10 | 780.18 | 0.932 | 0.90 | 8.39 | 37.513 |

## Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 795.31 | 186.84 | 46.71 | 608.47 | 0.00 | 111.96 | 244.94 | 2077.61 | 0.00 | 112.69 | 151.03 | 1.658 | 11.70 | 30.42 | 428.502 |
| B | 545.78 | 545.78 | 136.45 | 0.00 | 608.47 | 545.79 | 1855.22 | 334.35 | 0.00 | 2915.72 | 2309.65 | 0.187 | 0.24 | 0.24 | 1.555 |
| C | 1116.14 | 1116.14 | 279.04 | 0.00 | 0.00 | 1116.19 | 0.00 | 880.14 | 0.00 | 3289.78 | 0.00 | 0.339 | 0.56 | 0.55 | 1.758 |
| D | 1057.14 | 1057.14 | 264.29 | 0.00 | 0.00 | 1057.21 | 685.64 | 1310.69 | 0.00 | 2067.94 | 1041.80 | 0.511 | 1.09 | 1.08 | 3.650 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 753.83 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 716.64 | 716.64 | 179.16 | 0.00 | 0.00 | 708.48 | 0.00 | 1614.07 | 0.00 | 764.83 | 780.18 | 0.937 | 8.39 | 10.43 | 55.936 |

## Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 649.37 | 152.56 | 38.14 | 496.81 | 0.00 | 273.12 | 205.09 | 1737.80 | 0.00 | 750.80 | 151.03 | 0.203 | 30.42 | 0.28 | 10.905 |
| B | 445.63 | 445.63 | 111.41 | 0.00 | 496.81 | 445.77 | 1542.20 | 468.72 | 0.00 | 2724.38 | 2309.65 | 0.164 | 0.24 | 0.20 | 1.620 |
| C | 911.33 | 911.33 | 227.83 | 0.00 | 0.00 | 911.82 | 0.00 | 914.49 | 0.00 | 3200.29 | 0.00 | 0.285 | 0.55 | 0.42 | 1.670 |
| D | 863.15 | 863.15 | 215.79 | 0.00 | 0.00 | 865.01 | 617.43 | 1208.88 | 0.00 | 2311.94 | 1041.80 | 0.373 | 1.08 | 0.61 | 2.550 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 754.16 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 585.14 | 585.14 | 146.28 | 0.00 | 0.00 | 623.16 | 0.00 | 1319.74 | 0.00 | 1258.10 | 780.18 | 0.465 | 10.43 | 0.93 | 6.327 |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 543.82 | 127.76 | 31.94 | 416.06 | 0.00 | 128.43 | 168.42 | 1428.46 | 0.00 | 1331.70 | 151.03 | 0.096 | 0.28 | 0.12 | 3.304 | |
| B | 373.19 | 373.19 | 93.30 | 0.00 | 416.06 | 373.41 | 1274.06 | 282.83 | 0.00 | 2989.10 | 2309.65 | 0.125 | 0.20 | 0.15 | 1.409 | |
| C | 763.19 | 763.19 | 190.80 | 0.00 | 0.00 | 763.85 | 0.00 | 656.24 | 0.00 | 3873.16 | 0.00 | 0.197 | 0.42 | 0.26 | 1.229 | |
| D | 722.85 | 722.85 | 180.71 | 0.00 | 0.00 | 723.98 | 485.53 | 934.56 | 0.00 | 2969.40 | 1041.80 | 0.243 | 0.61 | 0.33 | 1.644 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 553.54 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 490.02 | 490.02 | 122.51 | 0.00 | 0.00 | 491.89 | 0.00 | 1104.99 | 0.00 | 1617.98 | 780.18 | 0.303 | 0.93 | 0.46 | 3.370 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.70 | 0.11 | 3.266 | A | A |
| B | 2.17 | 0.14 | 1.407 | A | A |
| C | 3.86 | 0.26 | 1.226 | A | A |
| D | 4.86 | 0.32 | 1.634 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.64 | 0.44 | 3.330 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.64 | 0.24 | 5.920 | A | A |
| B | 2.75 | 0.18 | 1.493 | A | A |
| C | 5.45 | 0.36 | 1.449 | A | A |
| D | 7.76 | 0.52 | 2.193 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 13.04 | 0.87 | 5.559 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 100.29 | 6.69 | 203.846 | F | F |
| B | 3.55 | 0.24 | 1.576 | A | A |
| C | 8.28 | 0.55 | 1.806 | A | A |
| D | 15.97 | 1.06 | 3.742 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 93.06 | 6.20 | 37.513 | E | D |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 316.34 | 21.09 | 428.502 | F | F |
| B | 3.55 | 0.24 | 1.555 | A | A |
| C | 8.24 | 0.55 | 1.758 | A | A |
| D | 16.24 | 1.08 | 3.650 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 143.13 | 9.54 | 55.936 | F | E |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 52.04 | 3.47 | 10.905 | B | B |
| B | 3.03 | 0.20 | 1.620 | A | A |
| C | 6.42 | 0.43 | 1.670 | A | A |
| D | 9.36 | 0.62 | 2.550 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 19.22 | 1.28 | 6.327 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.80 | 0.12 | 3.304 | A | A |
| B | 2.21 | 0.15 | 1.409 | A | A |
| C | 3.95 | 0.26 | 1.229 | A | A |
| D | 5.01 | 0.33 | 1.644 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 7.04 | 0.47 | 3.370 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]




**Filename:** PM Peak Hour-Base - FB-4.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:27:08

« (Default Analysis Set) - PM peak hour, 4 FB, PM
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 4 FB | | | |
| Arm A | 37.05 | 502.42 | 1.93 | F |
| Arm B | 0.24 | 1.65 | 0.19 | A |
| Arm C | 0.56 | 1.80 | 0.35 | A |
| Arm D | 1.10 | 3.75 | 0.52 | A |
| Arm E | 13.12 | 67.87 | 0.96 | F |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 4 FB, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:27:08*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 4 FB, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 4 FB, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 4 FB, PM | PM peak hour, 4 FB | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 107.56 | F |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **A** | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| **B** | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| **C** | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| **D** | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| **F** | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| **E** | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 100 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 647.00 | 112.293 |
| B | ONE HOUR | ✓ | 444.00 | 112.293 |
| C | ONE HOUR | ✓ | 908.00 | 112.293 |
| D | ONE HOUR | ✓ | 860.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 583.00 | 112.293 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 495.000 | 0.000 | 48.000 | 104.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 65.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.07 | 0.16 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.11 | 0.57 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1.93 | 502.42 | 37.05 | F | 666.68 | 234.94 | 591.15 | 150.97 | 6.57 | 591.15 | 150.97 |
| B | 0.19 | 1.65 | 0.24 | A | 457.51 | 686.26 | 17.40 | 1.52 | 0.19 | 17.40 | 1.52 |
| C | 0.35 | 1.80 | 0.56 | A | 935.62 | 1403.43 | 36.63 | 1.57 | 0.41 | 36.63 | 1.57 |
| D | 0.52 | 3.75 | 1.10 | A | 886.16 | 1329.24 | 60.22 | 2.72 | 0.67 | 60.22 | 2.72 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.96 | 67.87 | 13.12 | F | 600.73 | 901.10 | 331.48 | 22.07 | 3.68 | 331.48 | 22.07 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 546.97 | 128.50 | 32.13 | 418.47 | 0.00 | 128.03 | 168.70 | 1430.52 | 0.00 | 1327.83 | 151.03 | 0.097 | 0.00 | 0.12 | 3.308 | |
| B | 375.36 | 375.36 | 93.84 | 0.00 | 418.47 | 374.77 | 1276.39 | 282.16 | 0.00 | 2990.05 | 2309.65 | 0.126 | 0.00 | 0.15 | 1.410 | |
| C | 767.62 | 767.62 | 191.91 | 0.00 | 0.00 | 766.57 | 0.00 | 656.93 | 0.00 | 3871.35 | 0.00 | 0.198 | 0.00 | 0.26 | 1.231 | |
| D | 727.04 | 727.04 | 181.76 | 0.00 | 0.00 | 725.72 | 487.00 | 936.50 | 0.00 | 2964.74 | 1041.80 | 0.245 | 0.00 | 0.33 | 1.646 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 554.02 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 492.87 | 492.87 | 123.22 | 0.00 | 0.00 | 491.03 | 0.00 | 1108.20 | 0.00 | 1612.60 | 780.18 | 0.306 | 0.00 | 0.46 | 3.371 | |

### Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 653.14 | 153.44 | 38.36 | 499.70 | 0.00 | 152.88 | 201.61 | 1709.55 | 0.00 | 803.85 | 151.03 | 0.191 | 0.12 | 0.26 | 6.095 | |
| B | 448.21 | 448.21 | 112.05 | 0.00 | 499.70 | 448.06 | 1525.40 | 337.03 | 0.00 | 2911.90 | 2309.65 | 0.154 | 0.15 | 0.19 | 1.496 | |
| C | 916.62 | 916.62 | 229.15 | 0.00 | 0.00 | 916.18 | 0.00 | 785.09 | 0.00 | 3537.43 | 0.00 | 0.259 | 0.26 | 0.37 | 1.458 | |
| D | 868.16 | 868.16 | 217.04 | 0.00 | 0.00 | 867.35 | 582.07 | 1119.20 | 0.00 | 2526.86 | 1041.80 | 0.344 | 0.33 | 0.53 | 2.220 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 662.07 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 588.53 | 588.53 | 147.13 | 0.00 | 0.00 | 586.68 | 0.00 | 1324.49 | 0.00 | 1250.13 | 780.18 | 0.471 | 0.46 | 0.92 | 5.693 | |

### Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 799.93 | 187.93 | 46.98 | 612.00 | 0.00 | 131.65 | 243.09 | 2062.50 | 0.00 | 141.07 | 151.03 | 1.332 | 0.26 | 14.33 | 264.129 |
| B | 548.95 | 548.95 | 137.24 | 0.00 | 612.00 | 548.74 | 1847.58 | 346.57 | 0.00 | 2898.33 | 2309.65 | 0.189 | 0.19 | 0.24 | 1.569 |
| C | 1122.62 | 1122.62 | 280.66 | 0.00 | 0.00 | 1121.87 | 0.00 | 895.31 | 0.00 | 3250.28 | 0.00 | 0.345 | 0.37 | 0.56 | 1.796 |
| D | 1063.28 | 1063.28 | 265.82 | 0.00 | 0.00 | 1061.00 | 695.25 | 1321.93 | 0.00 | 2041.00 | 1041.80 | 0.521 | 0.53 | 1.10 | 3.755 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 762.03 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 720.80 | 720.80 | 180.20 | 0.00 | 0.00 | 684.68 | 0.00 | 1620.90 | 0.00 | 753.39 | 780.18 | 0.957 | 0.92 | 9.96 | 42.818 |

### Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 799.93 | 187.93 | 46.98 | 612.00 | 0.00 | 97.02 | 245.87 | 2085.75 | 0.00 | 97.40 | 151.03 | 1.929 | 14.33 | 37.05 | 502.415 |
| B | 548.95 | 548.95 | 137.24 | 0.00 | 612.00 | 548.96 | 1863.47 | 319.31 | 0.00 | 2937.15 | 2309.65 | 0.187 | 0.24 | 0.24 | 1.546 |
| C | 1122.62 | 1122.62 | 280.66 | 0.00 | 0.00 | 1122.68 | 0.00 | 868.27 | 0.00 | 3320.73 | 0.00 | 0.338 | 0.56 | 0.54 | 1.742 |
| D | 1063.28 | 1063.28 | 265.82 | 0.00 | 0.00 | 1063.38 | 684.70 | 1306.24 | 0.00 | 2078.60 | 1041.80 | 0.512 | 1.10 | 1.08 | 3.631 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 746.14 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 720.80 | 720.80 | 180.20 | 0.00 | 0.00 | 708.15 | 0.00 | 1623.47 | 0.00 | 749.07 | 780.18 | 0.962 | 9.96 | 13.12 | 67.866 |

### Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 653.14 | 153.44 | 38.36 | 499.70 | 0.00 | 300.43 | 207.43 | 1756.97 | 0.00 | 714.80 | 151.03 | 0.215 | 37.05 | 0.31 | 14.247 |
| B | 448.21 | 448.21 | 112.05 | 0.00 | 499.70 | 448.33 | 1556.96 | 500.44 | 0.00 | 2679.21 | 2309.65 | 0.167 | 0.24 | 0.21 | 1.655 |
| C | 916.62 | 916.62 | 229.15 | 0.00 | 0.00 | 917.01 | 0.00 | 948.78 | 0.00 | 3110.96 | 0.00 | 0.295 | 0.54 | 0.45 | 1.745 |
| D | 868.16 | 868.16 | 217.04 | 0.00 | 0.00 | 869.89 | 629.09 | 1236.70 | 0.00 | 2245.27 | 1041.80 | 0.387 | 1.08 | 0.65 | 2.685 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 779.38 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 588.53 | 588.53 | 147.13 | 0.00 | 0.00 | 637.19 | 0.00 | 1327.21 | 0.00 | 1245.57 | 780.18 | 0.473 | 13.12 | 0.95 | 6.734 |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 546.97 | 128.50 | 32.13 | 418.47 | 0.00 | 129.24 | 169.42 | 1436.95 | 0.00 | 1315.77 | 151.03 | 0.098 | 0.31 | 0.12 | 3.351 | |
| B | 375.36 | 375.36 | 93.84 | 0.00 | 418.47 | 375.59 | 1281.63 | 284.56 | 0.00 | 2986.63 | 2309.65 | 0.126 | 0.21 | 0.15 | 1.414 | |
| C | 767.62 | 767.62 | 191.91 | 0.00 | 0.00 | 768.35 | 0.00 | 660.16 | 0.00 | 3862.95 | 0.00 | 0.199 | 0.45 | 0.26 | 1.235 | |
| D | 727.04 | 727.04 | 181.76 | 0.00 | 0.00 | 728.30 | 488.40 | 940.11 | 0.00 | 2956.11 | 1041.80 | 0.246 | 0.65 | 0.33 | 1.657 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 556.85 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 492.87 | 492.87 | 123.22 | 0.00 | 0.00 | 494.82 | 0.00 | 1111.55 | 0.00 | 1606.99 | 780.18 | 0.307 | 0.95 | 0.47 | 3.413 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.73 | 0.12 | 3.308 | A | A |
| B | 2.18 | 0.15 | 1.410 | A | A |
| C | 3.90 | 0.26 | 1.231 | A | A |
| D | 4.92 | 0.33 | 1.646 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.76 | 0.45 | 3.371 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.77 | 0.25 | 6.095 | A | A |
| B | 2.77 | 0.18 | 1.496 | A | A |
| C | 5.51 | 0.37 | 1.458 | A | A |
| D | 7.90 | 0.53 | 2.220 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 13.41 | 0.89 | 5.693 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 118.61 | 7.91 | 264.129 | F | F |
| B | 3.56 | 0.24 | 1.569 | A | A |
| C | 8.29 | 0.55 | 1.796 | A | A |
| D | 16.12 | 1.07 | 3.755 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 106.03 | 7.07 | 42.818 | E | D |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 385.55 | 25.70 | 502.415 | F | F |
| B | 3.55 | 0.24 | 1.546 | A | A |
| C | 8.20 | 0.55 | 1.742 | A | A |
| D | 16.29 | 1.09 | 3.631 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 175.43 | 11.70 | 67.866 | F | E |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 79.65 | 5.31 | 14.247 | B | B |
| B | 3.12 | 0.21 | 1.655 | A | A |
| C | 6.74 | 0.45 | 1.745 | A | A |
| D | 9.91 | 0.66 | 2.685 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 22.67 | 1.51 | 6.734 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.84 | 0.12 | 3.351 | A | A |
| B | 2.23 | 0.15 | 1.414 | A | A |
| C | 3.99 | 0.27 | 1.235 | A | A |
| D | 5.08 | 0.34 | 1.657 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 7.18 | 0.48 | 3.413 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** PM Peak Hour-Base - Tot-1d.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:28:33

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« (Default Analysis Set) - PM peak hour, 1d Tot, PM
» Junction Network
» Arms
» Traffic Flows
» Entry Flows
» Turning Proportions
» Vehicle Mix
» Results

## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 1d Tot | | | |
| Arm A | 6.09 | 95.34 | 0.91 | F |
| Arm B | 0.25 | 1.63 | 0.20 | A |
| Arm C | 0.51 | 1.83 | 0.32 | A |
| Arm D | 0.99 | 3.48 | 0.49 | A |
| Arm E | 4.01 | 21.03 | 0.80 | C |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 1d Tot, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:28:32*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 1d Tot, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 1d Tot, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 1d Tot, PM | PM peak hour, 1d Tot | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 23.94 | C |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 92 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 670.00 | 109.303 |
| B | ONE HOUR | ✓ | 455.00 | 109.303 |
| C | ONE HOUR | ✓ | 908.00 | 100.000 |
| D | ONE HOUR | ✓ | 860.00 | 109.303 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 595.00 | 109.303 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 506.000 | 0.000 | 48.000 | 116.000 | 0.000 |
| | B | 27.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 89.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 77.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.76 | 0.00 | 0.07 | 0.17 | 0.00 |
| | B | 0.06 | 0.00 | 0.00 | 0.44 | 0.50 | 0.00 |
| | C | 0.10 | 0.50 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.13 | 0.56 | 0.00 | 0.00 | 0.31 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.91 | 95.34 | 6.09 | F | 672.00 | 307.64 | 138.94 | 27.10 | 1.54 | 138.94 | 27.10 |
| B | 0.20 | 1.63 | 0.25 | A | 456.36 | 684.54 | 17.40 | 1.53 | 0.19 | 17.40 | 1.53 |
| C | 0.32 | 1.83 | 0.51 | A | 833.20 | 1249.80 | 31.59 | 1.52 | 0.35 | 31.59 | 1.52 |
| D | 0.49 | 3.48 | 0.99 | A | 862.57 | 1293.85 | 52.81 | 2.45 | 0.59 | 52.81 | 2.45 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.80 | 21.03 | 4.01 | C | 596.78 | 895.16 | 144.81 | 9.71 | 1.61 | 144.81 | 9.71 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 551.34 | 168.26 | 42.07 | 383.07 | 0.00 | 167.70 | 176.89 | 1360.74 | 0.00 | 1458.87 | 265.85 | 0.115 | 0.00 | 0.14 | 3.036 | |
| B | 374.42 | 374.42 | 93.60 | 0.00 | 383.07 | 373.83 | 1243.86 | 284.57 | 0.00 | 2986.61 | 2229.77 | 0.125 | 0.00 | 0.15 | 1.410 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 682.68 | 0.00 | 658.40 | 0.00 | 3867.52 | 0.00 | 0.177 | 0.00 | 0.23 | 1.200 | |
| D | 707.69 | 707.69 | 176.92 | 0.00 | 0.00 | 706.46 | 451.04 | 890.04 | 0.00 | 3076.11 | 988.22 | 0.230 | 0.00 | 0.31 | 1.556 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 546.81 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 489.62 | 489.62 | 122.40 | 0.00 | 0.00 | 487.94 | 0.00 | 1049.69 | 0.00 | 1710.66 | 779.31 | 0.286 | 0.00 | 0.42 | 3.097 | |

## Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 658.35 | 200.92 | 50.23 | 457.43 | 0.00 | 200.35 | 211.42 | 1626.37 | 0.00 | 960.06 | 265.84 | 0.209 | 0.14 | 0.29 | 5.160 | |
| B | 447.09 | 447.09 | 111.77 | 0.00 | 457.43 | 446.93 | 1486.65 | 340.06 | 0.00 | 2907.60 | 2229.77 | 0.154 | 0.15 | 0.19 | 1.497 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 815.91 | 0.00 | 786.99 | 0.00 | 3532.49 | 0.00 | 0.231 | 0.23 | 0.32 | 1.407 | |
| D | 845.05 | 845.05 | 211.26 | 0.00 | 0.00 | 844.37 | 539.12 | 1063.79 | 0.00 | 2659.69 | 988.23 | 0.318 | 0.31 | 0.48 | 2.031 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 653.57 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 584.65 | 584.65 | 146.16 | 0.00 | 0.00 | 583.22 | 0.00 | 1254.58 | 0.00 | 1367.30 | 779.31 | 0.428 | 0.42 | 0.78 | 4.827 | |

## Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 806.31 | 246.08 | 61.52 | 560.23 | 0.00 | 231.15 | 257.55 | 1981.87 | 0.00 | 292.48 | 265.84 | 0.841 | 0.29 | 4.02 | 55.096 |
| B | 547.57 | 547.57 | 136.89 | 0.00 | 560.23 | 547.33 | 1811.08 | 401.94 | 0.00 | 2819.48 | 2229.77 | 0.194 | 0.19 | 0.25 | 1.622 |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 998.99 | 0.00 | 949.26 | 0.00 | 3109.69 | 0.00 | 0.321 | 0.32 | 0.50 | 1.811 |
| D | 1034.97 | 1034.97 | 258.74 | 0.00 | 0.00 | 1032.97 | 656.81 | 1291.44 | 0.00 | 2114.07 | 988.23 | 0.490 | 0.48 | 0.98 | 3.405 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 789.07 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 716.05 | 716.05 | 179.01 | 0.00 | 0.00 | 704.07 | 0.00 | 1535.34 | 0.00 | 896.77 | 779.31 | 0.798 | 0.78 | 3.77 | 18.659 |

## Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 806.31 | 246.08 | 61.52 | 560.23 | 0.00 | 237.78 | 259.13 | 1993.45 | 0.00 | 270.74 | 265.84 | 0.909 | 4.02 | 6.09 | 95.344 |
| B | 547.57 | 547.57 | 136.89 | 0.00 | 560.23 | 547.56 | 1820.58 | 410.65 | 0.00 | 2807.08 | 2229.77 | 0.195 | 0.25 | 0.25 | 1.630 |
| C | 999.73 | 999.73 | 249.93 | 0.00 | 0.00 | 999.70 | 0.00 | 958.21 | 0.00 | 3086.38 | 0.00 | 0.324 | 0.50 | 0.51 | 1.832 |
| D | 1034.97 | 1034.97 | 258.74 | 0.00 | 0.00 | 1034.89 | 658.73 | 1299.18 | 0.00 | 2095.52 | 988.23 | 0.494 | 0.98 | 0.99 | 3.475 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 796.61 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 716.05 | 716.05 | 179.01 | 0.00 | 0.00 | 715.11 | 0.00 | 1537.46 | 0.00 | 893.22 | 779.31 | 0.802 | 3.77 | 4.01 | 21.034 |

## Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 658.35 | 200.92 | 50.23 | 457.43 | 0.00 | 224.10 | 213.50 | 1641.60 | 0.00 | 931.45 | 265.84 | 0.216 | 6.09 | 0.30 | 5.726 | |
| B | 447.09 | 447.09 | 111.77 | 0.00 | 457.43 | 447.32 | 1502.20 | 363.50 | 0.00 | 2874.22 | 2229.77 | 0.156 | 0.25 | 0.19 | 1.518 | |
| C | 816.27 | 816.27 | 204.07 | 0.00 | 0.00 | 816.99 | 0.00 | 810.82 | 0.00 | 3470.39 | 0.00 | 0.235 | 0.51 | 0.33 | 1.443 | |
| D | 845.05 | 845.05 | 211.26 | 0.00 | 0.00 | 847.06 | 545.26 | 1082.56 | 0.00 | 2614.68 | 988.23 | 0.323 | 0.99 | 0.49 | 2.087 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 672.02 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 584.65 | 584.65 | 146.16 | 0.00 | 0.00 | 597.50 | 0.00 | 1257.60 | 0.00 | 1362.22 | 779.31 | 0.429 | 4.01 | 0.80 | 5.042 | |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 551.34 | 168.26 | 42.07 | 383.07 | 0.00 | 168.90 | 177.54 | 1365.80 | 0.00 | 1449.37 | 265.85 | 0.116 | 0.30 | 0.14 | 3.064 | |
| B | 374.42 | 374.42 | 93.60 | 0.00 | 383.07 | 374.58 | 1248.19 | 286.51 | 0.00 | 2983.85 | 2229.77 | 0.125 | 0.19 | 0.15 | 1.414 | |
| C | 683.59 | 683.59 | 170.90 | 0.00 | 0.00 | 683.98 | 0.00 | 661.09 | 0.00 | 3860.51 | 0.00 | 0.177 | 0.33 | 0.23 | 1.203 | |
| D | 707.69 | 707.69 | 176.92 | 0.00 | 0.00 | 708.42 | 452.13 | 892.95 | 0.00 | 3069.13 | 988.22 | 0.231 | 0.49 | 0.31 | 1.561 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 549.14 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 489.62 | 489.62 | 122.40 | 0.00 | 0.00 | 491.11 | 0.00 | 1052.22 | 0.00 | 1706.41 | 779.31 | 0.287 | 0.80 | 0.43 | 3.123 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.09 | 0.14 | 3.036 | A | A |
| B | 2.18 | 0.15 | 1.410 | A | A |
| C | 3.39 | 0.23 | 1.200 | A | A |
| D | 4.53 | 0.30 | 1.556 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.18 | 0.41 | 3.097 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 4.19 | 0.28 | 5.160 | A | A |
| B | 2.77 | 0.18 | 1.497 | A | A |
| C | 4.74 | 0.32 | 1.407 | A | A |
| D | 7.04 | 0.47 | 2.031 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 11.37 | 0.76 | 4.827 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 45.76 | 3.05 | 55.096 | F | E |
| B | 3.66 | 0.24 | 1.622 | A | A |
| C | 7.44 | 0.50 | 1.811 | A | A |
| D | 14.27 | 0.95 | 3.405 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 49.00 | 3.27 | 18.659 | C | B |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 78.35 | 5.22 | 95.344 | F | F |
| B | 3.71 | 0.25 | 1.630 | A | A |
| C | 7.60 | 0.51 | 1.832 | A | A |
| D | 14.83 | 0.99 | 3.475 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 58.77 | 3.92 | 21.034 | C | C |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 6.36 | 0.42 | 5.726 | A | A |
| B | 2.86 | 0.19 | 1.518 | A | A |
| C | 4.96 | 0.33 | 1.443 | A | A |
| D | 7.48 | 0.50 | 2.087 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 12.97 | 0.86 | 5.042 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 2.19 | 0.15 | 3.064 | A | A |
| B | 2.22 | 0.15 | 1.414 | A | A |
| C | 3.46 | 0.23 | 1.203 | A | A |
| D | 4.66 | 0.31 | 1.561 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.52 | 0.43 | 3.123 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]



For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** PM Peak Hour-Base - Tot-2.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:30:05

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## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 2 Tot | | | |
| Arm A | 12.62 | 217.93 | 1.14 | F |
| Arm B | 0.24 | 1.59 | 0.19 | A |
| Arm C | 0.55 | 1.80 | 0.34 | A |
| Arm D | 1.04 | 3.61 | 0.51 | A |
| Arm E | 5.68 | 31.11 | 0.86 | D |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 2 Tot, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:30:05*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 2 Tot, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 2 Tot, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 2 Tot, PM | PM peak hour, 2 Tot | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 47.28 | E |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 100 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 634.00 | 110.150 |
| B | ONE HOUR | ✓ | 444.00 | 110.150 |
| C | ONE HOUR | ✓ | 902.00 | 110.150 |
| D | ONE HOUR | ✓ | 860.00 | 110.150 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 576.00 | 110.150 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 488.000 | 0.000 | 48.000 | 98.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 83.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 58.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.08 | 0.15 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.09 | 0.51 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.10 | 0.58 | 0.00 | 0.00 | 0.32 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1.14 | 217.93 | 12.62 | F | 640.82 | 221.36 | 213.12 | 57.77 | 2.37 | 213.12 | 57.77 |
| B | 0.19 | 1.59 | 0.24 | A | 448.78 | 673.16 | 16.89 | 1.51 | 0.19 | 16.89 | 1.51 |
| C | 0.34 | 1.80 | 0.55 | A | 911.70 | 1367.55 | 34.68 | 1.52 | 0.39 | 34.69 | 1.52 |
| D | 0.51 | 3.61 | 1.04 | A | 869.25 | 1303.87 | 55.56 | 2.56 | 0.62 | 55.56 | 2.56 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.86 | 31.11 | 5.68 | D | 582.20 | 873.29 | 183.73 | 12.62 | 2.04 | 183.73 | 12.62 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 525.76 | 121.07 | 30.27 | 404.68 | 0.00 | 120.65 | 154.75 | 1403.35 | 0.00 | 1378.85 | 136.30 | 0.088 | 0.00 | 0.11 | 3.162 | |
| B | 368.19 | 368.19 | 92.05 | 0.00 | 404.68 | 367.62 | 1252.13 | 271.87 | 0.00 | 3004.71 | 2326.40 | 0.123 | 0.00 | 0.14 | 1.398 | |
| C | 748.00 | 748.00 | 187.00 | 0.00 | 0.00 | 747.00 | 0.00 | 639.49 | 0.00 | 3916.79 | 0.00 | 0.191 | 0.00 | 0.25 | 1.205 | |
| D | 713.17 | 713.17 | 178.29 | 0.00 | 0.00 | 711.91 | 477.73 | 908.76 | 0.00 | 3031.22 | 1041.02 | 0.235 | 0.00 | 0.31 | 1.589 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 538.54 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 477.66 | 477.66 | 119.41 | 0.00 | 0.00 | 475.96 | 0.00 | 1082.13 | 0.00 | 1656.28 | 780.20 | 0.288 | 0.00 | 0.42 | 3.202 | |

## Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 627.80 | 144.57 | 36.14 | 483.23 | 0.00 | 144.12 | 184.95 | 1677.22 | 0.00 | 864.57 | 136.30 | 0.167 | 0.11 | 0.22 | 5.518 | |
| B | 439.66 | 439.66 | 109.92 | 0.00 | 483.23 | 439.51 | 1496.50 | 324.84 | 0.00 | 2929.28 | 2326.37 | 0.150 | 0.14 | 0.18 | 1.481 | |
| C | 893.18 | 893.18 | 223.30 | 0.00 | 0.00 | 892.78 | 0.00 | 764.34 | 0.00 | 3591.49 | 0.00 | 0.249 | 0.25 | 0.35 | 1.415 | |
| D | 851.59 | 851.59 | 212.90 | 0.00 | 0.00 | 850.87 | 571.00 | 1086.13 | 0.00 | 2606.13 | 1041.03 | 0.327 | 0.31 | 0.50 | 2.099 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 643.65 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 570.37 | 570.37 | 142.59 | 0.00 | 0.00 | 568.82 | 0.00 | 1293.35 | 0.00 | 1302.32 | 780.19 | 0.438 | 0.42 | 0.81 | 5.150 | |

## Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 768.90 | 177.07 | 44.27 | 591.83 | 0.00 | 155.38 | 224.90 | 2039.14 | 0.00 | 184.94 | 136.30 | 0.957 | 0.22 | 5.64 | 101.767 |
| B | 538.47 | 538.47 | 134.62 | 0.00 | 591.83 | 538.25 | 1822.68 | 371.84 | 0.00 | 2862.34 | 2326.37 | 0.188 | 0.18 | 0.24 | 1.586 |
| C | 1093.92 | 1093.92 | 273.48 | 0.00 | 0.00 | 1093.14 | 0.00 | 910.09 | 0.00 | 3211.77 | 0.00 | 0.341 | 0.35 | 0.55 | 1.803 |
| D | 1042.99 | 1042.99 | 260.75 | 0.00 | 0.00 | 1040.83 | 692.26 | 1310.97 | 0.00 | 2067.27 | 1041.03 | 0.505 | 0.50 | 1.03 | 3.584 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 769.06 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 698.56 | 698.56 | 174.64 | 0.00 | 0.00 | 681.30 | 0.00 | 1582.74 | 0.00 | 817.35 | 780.19 | 0.855 | 0.81 | 5.13 | 25.268 |

## Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 768.90 | 177.07 | 44.27 | 591.83 | 0.00 | 149.13 | 226.56 | 2054.85 | 0.00 | 155.44 | 136.30 | 1.139 | 5.64 | 12.62 | 217.927 |
| B | 538.47 | 538.47 | 134.62 | 0.00 | 591.83 | 538.47 | 1833.61 | 370.36 | 0.00 | 2864.45 | 2326.37 | 0.188 | 0.24 | 0.24 | 1.585 |
| C | 1093.92 | 1093.92 | 273.48 | 0.00 | 0.00 | 1093.92 | 0.00 | 908.83 | 0.00 | 3215.03 | 0.00 | 0.340 | 0.55 | 0.55 | 1.800 |
| D | 1042.99 | 1042.99 | 260.75 | 0.00 | 0.00 | 1042.96 | 690.59 | 1312.17 | 0.00 | 2064.39 | 1041.03 | 0.505 | 1.03 | 1.04 | 3.608 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 770.06 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 698.56 | 698.56 | 174.64 | 0.00 | 0.00 | 696.34 | 0.00 | 1585.07 | 0.00 | 813.43 | 780.19 | 0.859 | 5.13 | 5.68 | 31.106 |

## Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 627.80 | 144.57 | 36.14 | 483.23 | 0.00 | 194.12 | 187.27 | 1698.93 | 0.00 | 823.79 | 136.30 | 0.176 | 12.62 | 0.24 | 6.835 | |
| B | 439.66 | 439.66 | 109.92 | 0.00 | 483.23 | 439.86 | 1511.56 | 381.49 | 0.00 | 2848.60 | 2326.37 | 0.154 | 0.24 | 0.19 | 1.533 | |
| C | 893.18 | 893.18 | 223.30 | 0.00 | 0.00 | 893.88 | 0.00 | 821.35 | 0.00 | 3442.96 | 0.00 | 0.259 | 0.55 | 0.37 | 1.501 | |
| D | 851.59 | 851.59 | 212.90 | 0.00 | 0.00 | 853.64 | 587.99 | 1127.24 | 0.00 | 2507.61 | 1041.03 | 0.340 | 1.04 | 0.53 | 2.233 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 684.44 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 570.37 | 570.37 | 142.59 | 0.00 | 0.00 | 589.76 | 0.00 | 1296.44 | 0.00 | 1297.14 | 780.19 | 0.440 | 5.68 | 0.83 | 5.496 | |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 525.76 | 121.07 | 30.27 | 404.68 | 0.00 | 121.59 | 155.32 | 1408.85 | 0.00 | 1368.54 | 136.30 | 0.088 | 0.24 | 0.11 | 3.190 | |
| B | 368.19 | 368.19 | 92.05 | 0.00 | 404.68 | 368.37 | 1256.58 | 273.86 | 0.00 | 3001.87 | 2326.40 | 0.123 | 0.19 | 0.14 | 1.402 | |
| C | 748.00 | 748.00 | 187.00 | 0.00 | 0.00 | 748.48 | 0.00 | 642.23 | 0.00 | 3909.65 | 0.00 | 0.191 | 0.37 | 0.25 | 1.210 | |
| D | 713.17 | 713.17 | 178.29 | 0.00 | 0.00 | 714.02 | 478.91 | 911.80 | 0.00 | 3023.94 | 1041.02 | 0.236 | 0.53 | 0.32 | 1.598 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 540.93 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 477.66 | 477.66 | 119.41 | 0.00 | 0.00 | 479.27 | 0.00 | 1084.89 | 0.00 | 1651.67 | 780.20 | 0.289 | 0.83 | 0.43 | 3.231 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.56 | 0.10 | 3.162 | A | A |
| B | 2.12 | 0.14 | 1.398 | A | A |
| C | 3.72 | 0.25 | 1.205 | A | A |
| D | 4.66 | 0.31 | 1.589 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.23 | 0.42 | 3.202 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.22 | 0.21 | 5.518 | A | A |
| B | 2.69 | 0.18 | 1.481 | A | A |
| C | 5.22 | 0.35 | 1.415 | A | A |
| D | 7.34 | 0.49 | 2.099 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 11.81 | 0.79 | 5.150 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 56.57 | 3.77 | 101.767 | F | F |
| B | 3.53 | 0.24 | 1.586 | A | A |
| C | 8.10 | 0.54 | 1.803 | A | A |
| D | 15.12 | 1.01 | 3.584 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 63.01 | 4.20 | 25.268 | D | C |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 138.95 | 9.26 | 217.927 | F | F |
| B | 3.55 | 0.24 | 1.585 | A | A |
| C | 8.20 | 0.55 | 1.800 | A | A |
| D | 15.58 | 1.04 | 3.608 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 81.86 | 5.46 | 31.106 | D | C |

### Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 11.17 | 0.74 | 6.835 | A | A |
| B | 2.83 | 0.19 | 1.533 | A | A |
| C | 5.64 | 0.38 | 1.501 | A | A |
| D | 8.06 | 0.54 | 2.233 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 14.24 | 0.95 | 5.496 | A | A |

### Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.64 | 0.11 | 3.190 | A | A |
| B | 2.17 | 0.14 | 1.402 | A | A |
| C | 3.80 | 0.25 | 1.210 | A | A |
| D | 4.80 | 0.32 | 1.598 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.58 | 0.44 | 3.231 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.4.487 [15039,24/03/2014]


For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk



**Filename:** PM Peak Hour-Base - Tot-3.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:32:09

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## Summary of junction performance

| | Pm | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 3 Tot | | | |
| **Arm A** | 31.04 | 443.06 | 1.69 | F |
| **Arm B** | 0.24 | 1.61 | 0.19 | A |
| **Arm C** | 0.55 | 1.78 | 0.34 | A |
| **Arm D** | 1.06 | 3.62 | 0.51 | A |
| **Arm E** | 8.47 | 46.12 | 0.91 | E |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 3 Tot, Pm " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:32:09*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 3 Tot, Pm

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 3 Tot, Pm | PM peak hour, 3 Tot | Pm | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 91.69 | F |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 100 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 635.00 | 111.645 |
| B | ONE HOUR | ✓ | 444.00 | 111.645 |
| C | ONE HOUR | ✓ | 902.00 | 111.645 |
| D | ONE HOUR | ✓ | 860.00 | 111.645 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 577.00 | 111.645 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 489.000 | 0.000 | 48.000 | 98.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 83.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 59.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.77 | 0.00 | 0.08 | 0.15 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.09 | 0.51 | 0.00 | 0.36 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.10 | 0.58 | 0.00 | 0.00 | 0.32 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1.69 | 443.06 | 31.04 | F | 650.54 | 228.12 | 488.77 | 128.56 | 5.43 | 488.77 | 128.56 |
| B | 0.19 | 1.61 | 0.24 | A | 454.87 | 682.30 | 17.20 | 1.51 | 0.19 | 17.20 | 1.51 |
| C | 0.34 | 1.78 | 0.55 | A | 924.08 | 1386.11 | 35.58 | 1.54 | 0.40 | 35.58 | 1.54 |
| D | 0.51 | 3.62 | 1.06 | A | 881.05 | 1321.57 | 57.75 | 2.62 | 0.64 | 57.75 | 2.62 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.91 | 46.12 | 8.47 | E | 591.12 | 886.68 | 243.64 | 16.49 | 2.71 | 243.65 | 16.49 |

## Main Results for each time segment

### Main results: (16:45-17:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 533.73 | 124.77 | 31.19 | 408.96 | 0.00 | 124.32 | 157.68 | 1422.33 | 0.00 | 1343.21 | 138.63 | 0.093 | 0.00 | 0.11 | 3.261 | |
| B | 373.19 | 373.19 | 93.30 | 0.00 | 408.96 | 372.61 | 1271.12 | 275.53 | 0.00 | 2999.49 | 2327.05 | 0.124 | 0.00 | 0.15 | 1.404 | |
| C | 758.15 | 758.15 | 189.54 | 0.00 | 0.00 | 757.13 | 0.00 | 648.14 | 0.00 | 3894.26 | 0.00 | 0.195 | 0.00 | 0.26 | 1.217 | |
| D | 722.85 | 722.85 | 180.71 | 0.00 | 0.00 | 721.55 | 484.20 | 921.06 | 0.00 | 3001.74 | 1041.20 | 0.241 | 0.00 | 0.32 | 1.617 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 545.82 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 484.98 | 484.98 | 121.25 | 0.00 | 0.00 | 483.21 | 0.00 | 1096.80 | 0.00 | 1631.71 | 780.12 | 0.297 | 0.00 | 0.44 | 3.292 | |

## Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 637.33 | 148.99 | 37.25 | 488.34 | 0.00 | 148.47 | 188.44 | 1699.83 | 0.00 | 822.10 | 138.63 | 0.181 | 0.11 | 0.24 | 5.897 | |
| B | 445.63 | 445.63 | 111.41 | 0.00 | 488.34 | 445.47 | 1519.15 | 329.16 | 0.00 | 2923.13 | 2327.05 | 0.152 | 0.15 | 0.18 | 1.488 | |
| C | 905.31 | 905.31 | 226.33 | 0.00 | 0.00 | 904.89 | 0.00 | 774.63 | 0.00 | 3564.70 | 0.00 | 0.254 | 0.26 | 0.36 | 1.436 | |
| D | 863.15 | 863.15 | 215.79 | 0.00 | 0.00 | 862.39 | 578.73 | 1100.79 | 0.00 | 2570.99 | 1041.20 | 0.336 | 0.32 | 0.52 | 2.156 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 652.31 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 579.12 | 579.12 | 144.78 | 0.00 | 0.00 | 577.41 | 0.00 | 1310.87 | 0.00 | 1272.96 | 780.12 | 0.455 | 0.44 | 0.87 | 5.429 | |

## Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 780.56 | 182.47 | 45.62 | 598.09 | 0.00 | 134.30 | 228.38 | 2060.06 | 0.00 | 145.64 | 138.63 | 1.253 | 0.24 | 12.29 | 221.816 |
| B | 545.78 | 545.78 | 136.45 | 0.00 | 598.09 | 545.57 | 1845.28 | 349.08 | 0.00 | 2894.75 | 2327.05 | 0.189 | 0.18 | 0.24 | 1.569 |
| C | 1108.77 | 1108.77 | 277.19 | 0.00 | 0.00 | 1108.02 | 0.00 | 894.65 | 0.00 | 3251.99 | 0.00 | 0.341 | 0.36 | 0.55 | 1.781 |
| D | 1057.14 | 1057.14 | 264.29 | 0.00 | 0.00 | 1054.97 | 693.32 | 1309.35 | 0.00 | 2071.16 | 1041.20 | 0.510 | 0.52 | 1.06 | 3.620 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 760.06 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 709.27 | 709.27 | 177.32 | 0.00 | 0.00 | 684.18 | 0.00 | 1604.26 | 0.00 | 781.28 | 780.12 | 0.908 | 0.87 | 7.14 | 33.148 |

## Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 780.56 | 182.47 | 45.62 | 598.09 | 0.00 | 107.45 | 230.56 | 2080.06 | 0.00 | 108.09 | 138.63 | 1.688 | 12.29 | 31.04 | 443.064 |
| B | 545.78 | 545.78 | 136.45 | 0.00 | 598.09 | 545.79 | 1858.57 | 328.94 | 0.00 | 2923.44 | 2327.05 | 0.187 | 0.24 | 0.24 | 1.550 |
| C | 1108.77 | 1108.77 | 277.19 | 0.00 | 0.00 | 1108.81 | 0.00 | 874.72 | 0.00 | 3303.90 | 0.00 | 0.336 | 0.55 | 0.54 | 1.742 |
| D | 1057.14 | 1057.14 | 264.29 | 0.00 | 0.00 | 1057.19 | 685.03 | 1298.51 | 0.00 | 2097.14 | 1041.20 | 0.504 | 1.06 | 1.05 | 3.547 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 749.02 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 709.27 | 709.27 | 177.32 | 0.00 | 0.00 | 703.94 | 0.00 | 1606.68 | 0.00 | 777.22 | 780.12 | 0.913 | 7.14 | 8.47 | 46.115 |

## Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 637.33 | 148.99 | 37.25 | 488.34 | 0.00 | 272.08 | 191.90 | 1731.18 | 0.00 | 763.23 | 138.63 | 0.195 | 31.04 | 0.27 | 10.599 |
| B | 445.63 | 445.63 | 111.41 | 0.00 | 488.34 | 445.77 | 1542.38 | 460.88 | 0.00 | 2735.55 | 2327.05 | 0.163 | 0.24 | 0.20 | 1.612 |
| C | 905.31 | 905.31 | 226.33 | 0.00 | 0.00 | 905.79 | 0.00 | 906.65 | 0.00 | 3220.72 | 0.00 | 0.281 | 0.54 | 0.42 | 1.652 |
| D | 863.15 | 863.15 | 215.79 | 0.00 | 0.00 | 864.95 | 619.16 | 1193.28 | 0.00 | 2349.32 | 1041.20 | 0.367 | 1.05 | 0.60 | 2.488 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 744.58 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 579.12 | 579.12 | 144.78 | 0.00 | 0.00 | 609.43 | 0.00 | 1313.66 | 0.00 | 1268.29 | 780.12 | 0.457 | 8.47 | 0.89 | 6.010 |

### Main results: (18:00-18:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 533.73 | 124.77 | 31.19 | 408.96 | 0.00 | 125.40 | 158.30 | 1428.35 | 0.00 | 1331.91 | 138.63 | 0.094 | 0.27 | 0.11 | 3.297 | |
| B | 373.19 | 373.19 | 93.30 | 0.00 | 408.96 | 373.41 | 1276.04 | 277.71 | 0.00 | 2996.38 | 2327.05 | 0.125 | 0.20 | 0.15 | 1.408 | |
| C | 758.15 | 758.15 | 189.54 | 0.00 | 0.00 | 758.78 | 0.00 | 651.12 | 0.00 | 3886.50 | 0.00 | 0.195 | 0.42 | 0.26 | 1.221 | |
| D | 722.85 | 722.85 | 180.71 | 0.00 | 0.00 | 723.93 | 485.51 | 924.39 | 0.00 | 2993.77 | 1041.20 | 0.241 | 0.60 | 0.33 | 1.626 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 548.43 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 484.98 | 484.98 | 121.25 | 0.00 | 0.00 | 486.76 | 0.00 | 1099.89 | 0.00 | 1626.52 | 780.12 | 0.298 | 0.89 | 0.45 | 3.328 | |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:45-17:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.66 | 0.11 | 3.261 | A | A |
| B | 2.16 | 0.14 | 1.404 | A | A |
| C | 3.81 | 0.25 | 1.217 | A | A |
| D | 4.80 | 0.32 | 1.617 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.49 | 0.43 | 3.292 | A | A |

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.54 | 0.24 | 5.897 | A | A |
| B | 2.74 | 0.18 | 1.488 | A | A |
| C | 5.36 | 0.36 | 1.436 | A | A |
| D | 7.63 | 0.51 | 2.156 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 12.61 | 0.84 | 5.429 | A | A |

### Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 104.05 | 6.94 | 221.816 | F | F |
| B | 3.54 | 0.24 | 1.569 | A | A |
| C | 8.12 | 0.54 | 1.781 | A | A |
| D | 15.48 | 1.03 | 3.620 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 82.07 | 5.47 | 33.148 | D | C |

### Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 325.28 | 21.69 | 443.064 | F | F |
| B | 3.54 | 0.24 | 1.550 | A | A |
| C | 8.09 | 0.54 | 1.742 | A | A |
| D | 15.76 | 1.05 | 3.547 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 118.61 | 7.91 | 46.115 | E | D |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 52.49 | 3.50 | 10.599 | B | B |
| B | 3.02 | 0.20 | 1.612 | A | A |
| C | 6.30 | 0.42 | 1.652 | A | A |
| D | 9.12 | 0.61 | 2.488 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 16.99 | 1.13 | 6.010 | A | A |

## Queueing Delay results: (18:00-18:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 1.75 | 0.12 | 3.297 | A | A |
| B | 2.21 | 0.15 | 1.408 | A | A |
| C | 3.90 | 0.26 | 1.221 | A | A |
| D | 4.96 | 0.33 | 1.626 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 6.88 | 0.46 | 3.328 | A | A |

# Junctions 8

## ARCADY 8 - Roundabout Module



**Filename:** PM Peak Hour-Base - Tot-4.arc8
**Path:** \\global\london\PTG\ICL-JOBS\235000\235271 - NLWA 2014\4 Edmonton Eco Park\1-30 Transport\4 Internal Project Data\4-04 Arup Calculations\Modelling\Cooks Ferry RA
**Report generation date:** 17/04/2015 11:33:22

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## Summary of junction performance

| | PM | | | |
|---|---|---|---|---|
| | Queue (PCU) | Delay (s) | RFC | LOS |
| | A1 - PM peak hour, 4 Tot | | | |
| **Arm A** | 31.38 | 482.81 | 1.88 | F |
| **Arm B** | 0.24 | 1.61 | 0.19 | A |
| **Arm C** | 0.54 | 1.75 | 0.34 | A |
| **Arm D** | 1.04 | 3.53 | 0.51 | A |
| **Arm E** | 9.02 | 49.11 | 0.92 | E |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.*

*"D1 - PM peak hour, 4 Tot, PM " model duration: 16:45 - 18:15*

*Run using Junctions 8.0.4.487 at 17/04/2015 11:33:22*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 14/04/2015 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Enumerator** | David.McCann |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | RFC Threshold | Average Delay Threshold (s) | Queue Threshold (PCU) |
|---|---|---|---|---|---|---|
| 5.75 | | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCU | PCU | perHour | s | -Min | perMin |

# (Default Analysis Set) - PM peak hour, 4 Tot, PM

## Data Errors and Warnings

| Severity | Area | Item | Description |
|---|---|---|---|
| Warning | Geometry | Arm A - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm C - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm D - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | Geometry | Arm E - Roundabout Geometry | Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution. |
| Warning | DemandSets | D1 - PM peak hour, 4 Tot, PM | Demand Set 1: Scenario Name includes Time Period Name ('PM'). Are you sure this is correct? |
| Warning | DemandSets | D1 - PM peak hour, 4 Tot, PM | Time results are shown for central hour only. (Model is run for a 90 minute period.) |

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM peak hour, 4 Tot, PM | PM peak hour, 4 Tot | PM | | ONE HOUR | 16:45 | 18:15 | 90 | 15 | ✓ | | | ✓ | | |

# Junction Network

## Junctions

| Junction | Name | Junction Type | Arm Order | Grade Separated | Large Roundabout | Do Geometric Delay | Junction Delay (s) | Junction LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | A,B,C,D,F,E | ✓ | ✓ | | 97.69 | F |

## Junction Network Options

| Driving Side | Lighting |
|---|---|
| Left | Normal/unknown |

# Arms

## Arms

| Arm | Arm | Name | Description |
|---|---|---|---|
| **A** | A | Advent Way | |
| **B** | B | Walthamstow Avenue | |
| **C** | C | A406 WB Off Slip | |
| **D** | D | Argon Road | |
| **F** | F | A406 WB On Slip | |
| **E** | E | A406 EB Off Slip | |

## Capacity Options

| Arm | Minimum Capacity (PCU/hr) | Maximum Capacity (PCU/hr) | Assume Flat Start Profile | Initial Queue (PCU) |
|---|---|---|---|---|
| **A** | 0.00 | 99999.00 | | 0.00 |
| **B** | 0.00 | 99999.00 | | 0.00 |
| **C** | 0.00 | 99999.00 | | 0.00 |
| **D** | 0.00 | 99999.00 | | 0.00 |
| **F** | 0.00 | 99999.00 | | 0.00 |
| **E** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Arm | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| A | 5.36 | 13.30 | 32.84 | 175.00 | 52.79 | 27.00 | |
| B | 5.25 | 13.98 | 23.93 | 98.40 | 61.00 | 71.00 | |
| C | 12.00 | 16.00 | 136.35 | 61.63 | 44.07 | 42.00 | |
| D | 12.00 | 15.99 | 31.02 | 8.96 | 46.74 | 23.00 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | ✓ |
| E | 5.36 | 9.78 | 41.10 | 37.49 | 48.72 | 39.00 | |

## Large Roundabout Data

| Arm | Circulating flow (PCU/hr) | Entry-to-exit separation (m) |
|---|---|---|
| A | 0.00 | 0.00 |
| B | 0.00 | 0.00 |
| C | 0.00 | 0.00 |
| D | 0.00 | 0.00 |
| F | 0.00 | 0.00 |
| E | 0.00 | 0.00 |

## Bypass

| Arm | Arm Has Bypass | Bypass Utilisation (%) |
|---|---|---|
| A | ✓ | 100 |
| B | | |
| C | | |
| D | | |
| F | | |
| E | | |

## Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Arm | Enter slope and intercept directly | Entered slope | Entered intercept (PCU/hr) | Final Slope | Final Intercept (PCU/hr) |
|---|---|---|---|---|---|
| A | | (calculated) | (calculated) | 1.878 | 4014.150 |
| B | | (calculated) | (calculated) | 1.424 | 3391.853 |
| C | | (calculated) | (calculated) | 2.605 | 5582.959 |
| D | | (calculated) | (calculated) | 2.397 | 5209.217 |
| F | | (calculated) | (calculated) | Exit-only | Exit-only |
| E | | (calculated) | (calculated) | 1.676 | 3469.790 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCU Factor for a HV (PCU) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | HV Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Arm | Profile Type | Use Turning Counts | Average Demand Flow (PCU/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| A | ONE HOUR | ✓ | 617.00 | 112.293 |
| B | ONE HOUR | ✓ | 444.00 | 112.293 |
| C | ONE HOUR | ✓ | 898.00 | 112.293 |
| D | ONE HOUR | ✓ | 860.00 | 112.293 |
| F | Exit-only | ✓ | Exit-only | Exit-only |
| E | ONE HOUR | ✓ | 573.00 | 112.293 |

# Turning Proportions

### Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.000 | 485.000 | 0.000 | 48.000 | 84.000 | 0.000 |
| | B | 16.000 | 1.000 | 0.000 | 200.000 | 227.000 | 0.000 |
| | C | 79.000 | 456.000 | 0.000 | 329.000 | 34.000 | 0.000 |
| | D | 30.000 | 721.000 | 0.000 | 0.000 | 109.000 | 0.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 55.000 | 335.000 | 0.000 | 0.000 | 183.000 | 0.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Turning Proportions (PCU) - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.00 | 0.79 | 0.00 | 0.08 | 0.14 | 0.00 |
| | B | 0.04 | 0.00 | 0.00 | 0.45 | 0.51 | 0.00 |
| | C | 0.09 | 0.51 | 0.00 | 0.37 | 0.04 | 0.00 |
| | D | 0.03 | 0.84 | 0.00 | 0.00 | 0.13 | 0.00 |
| | F | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| | E | 0.10 | 0.58 | 0.00 | 0.00 | 0.32 | 0.00 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Vehicle Mix

### Average PCU Per Vehicle - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 1.000 | 1.050 | 1.000 | 1.210 | 1.060 | 1.000 |
| | B | 1.000 | 1.000 | 1.000 | 1.010 | 1.040 | 1.000 |
| | C | 1.270 | 1.020 | 1.000 | 1.050 | 1.410 | 1.000 |
| | D | 1.070 | 1.020 | 1.000 | 1.000 | 1.040 | 1.000 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 1.120 | 1.070 | 1.000 | 1.100 | 1.000 | 1.000 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

### Heavy Vehicle Percentages - Junction 1 (for whole period)

| | | To | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | F | E |
| From | A | 0.0 | 5.0 | 0.0 | 21.0 | 6.0 | 0.0 |
| | B | 0.0 | 0.0 | 0.0 | 1.0 | 4.0 | 0.0 |
| | C | 27.0 | 2.0 | 0.0 | 5.0 | 41.0 | 0.0 |
| | D | 7.0 | 2.0 | 0.0 | 0.0 | 4.0 | 0.0 |
| | F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| | E | 12.0 | 7.0 | 0.0 | 10.0 | 0.0 | 0.0 |

*Arm F is exit only and so the above grid should be ignored for this Arm.*

# Results

## Results Summary for whole modelled period

| Arm | Max RFC | Max Delay (s) | Max Queue (PCU) | Max LOS | Average Demand (PCU/hr) | Total Junction Arrivals (PCU) | Total Queueing Delay (PCU-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCU-min/min) | Inclusive Total Queueing Delay (PCU-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 1.88 | 482.81 | 31.38 | F | 692.85 | 148.23 | 485.15 | 196.38 | 5.39 | 488.22 | 143.58 |
| B | 0.19 | 1.61 | 0.24 | A | 498.58 | 498.58 | 12.82 | 1.54 | 0.14 | 17.19 | 1.50 |
| C | 0.34 | 1.75 | 0.54 | A | 1008.39 | 1008.39 | 27.56 | 1.64 | 0.31 | 35.22 | 1.52 |
| D | 0.51 | 3.53 | 1.04 | A | 965.72 | 965.72 | 47.22 | 2.93 | 0.52 | 56.96 | 2.57 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 0.92 | 49.11 | 9.02 | E | 643.44 | 643.44 | 240.97 | 22.47 | 2.68 | 254.38 | 17.23 |

## Main Results for each time segment

### Main results: (17:00-17:15)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 622.86 | 133.25 | 33.31 | 489.60 | 0.00 | 132.78 | 181.48 | 1709.70 | 0.00 | 803.57 | 130.42 | 0.166 | 0.10 | 0.22 | 5.953 | |
| B | 448.21 | 448.21 | 112.05 | 0.00 | 489.60 | 448.06 | 1525.51 | 316.97 | 0.00 | 2940.48 | 2337.80 | 0.152 | 0.15 | 0.18 | 1.479 | |
| C | 906.52 | 906.52 | 226.63 | 0.00 | 0.00 | 906.11 | 0.00 | 765.03 | 0.00 | 3589.70 | 0.00 | 0.253 | 0.25 | 0.36 | 1.422 | |
| D | 868.16 | 868.16 | 217.04 | 0.00 | 0.00 | 867.41 | 582.09 | 1089.06 | 0.00 | 2599.12 | 1047.29 | 0.334 | 0.32 | 0.51 | 2.128 | |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 642.01 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | E o |
| E | 578.44 | 578.44 | 144.61 | 0.00 | 0.00 | 576.72 | 0.00 | 1314.46 | 0.00 | 1266.94 | 777.63 | 0.457 | 0.44 | 0.87 | 5.469 | |

### Main results: (17:15-17:30)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 762.84 | 163.20 | 40.80 | 599.64 | 0.00 | 115.57 | 219.86 | 2070.78 | 0.00 | 125.52 | 130.42 | 1.300 | 0.22 | 12.13 | 259.189 |
| B | 548.95 | 548.95 | 137.24 | 0.00 | 599.64 | 548.74 | 1852.99 | 333.36 | 0.00 | 2917.14 | 2337.80 | 0.188 | 0.18 | 0.24 | 1.557 |
| C | 1110.26 | 1110.26 | 277.56 | 0.00 | 0.00 | 1109.53 | 0.00 | 882.10 | 0.00 | 3284.69 | 0.00 | 0.338 | 0.36 | 0.54 | 1.755 |
| D | 1063.28 | 1063.28 | 265.82 | 0.00 | 0.00 | 1061.17 | 695.70 | 1295.92 | 0.00 | 2103.33 | 1047.29 | 0.506 | 0.51 | 1.04 | 3.530 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 748.39 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 708.44 | 708.44 | 177.11 | 0.00 | 0.00 | 681.93 | 0.00 | 1608.71 | 0.00 | 773.82 | 777.63 | 0.916 | 0.87 | 7.50 | 34.572 |

### Main results: (17:30-17:45)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 762.84 | 163.20 | 40.80 | 599.64 | 0.00 | 86.19 | 221.97 | 2091.47 | 0.00 | 86.66 | 130.42 | 1.883 | 12.13 | 31.38 | 482.805 |
| B | 548.95 | 548.95 | 137.24 | 0.00 | 599.64 | 548.96 | 1867.15 | 310.51 | 0.00 | 2949.67 | 2337.80 | 0.186 | 0.24 | 0.23 | 1.535 |
| C | 1110.26 | 1110.26 | 277.56 | 0.00 | 0.00 | 1110.30 | 0.00 | 859.47 | 0.00 | 3343.65 | 0.00 | 0.332 | 0.54 | 0.53 | 1.711 |
| D | 1063.28 | 1063.28 | 265.82 | 0.00 | 0.00 | 1063.33 | 685.40 | 1284.37 | 0.00 | 2131.02 | 1047.29 | 0.499 | 1.04 | 1.03 | 3.455 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 736.64 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 708.44 | 708.44 | 177.11 | 0.00 | 0.00 | 702.38 | 0.00 | 1611.06 | 0.00 | 769.87 | 777.63 | 0.920 | 7.50 | 9.02 | 49.113 |

### Main results: (17:45-18:00)

| Arm | Total Demand (PCU/hr) | Junction Demand (PCU/hr) | Junction Arrivals (PCU) | Bypass Demand (PCU/hr) | Bypass Exit Flow (PCU/hr) | Entry Flow (PCU/hr) | Exit Flow (PCU/hr) | Circulating Flow (PCU/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCU/hr) | Saturation Capacity (PCU/hr) | RFC | Start Queue (PCU) | End Queue (PCU) | Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 622.86 | 133.25 | 33.31 | 489.60 | 0.00 | 257.78 | 184.93 | 1743.14 | 0.00 | 740.78 | 130.42 | 0.180 | 31.38 | 0.25 | 10.929 |
| B | 448.21 | 448.21 | 112.05 | 0.00 | 489.60 | 448.35 | 1548.03 | 452.89 | 0.00 | 2746.93 | 2337.80 | 0.163 | 0.23 | 0.20 | 1.606 |
| C | 906.52 | 906.52 | 226.63 | 0.00 | 0.00 | 906.98 | 0.00 | 901.24 | 0.00 | 3234.82 | 0.00 | 0.280 | 0.53 | 0.41 | 1.639 |
| D | 868.16 | 868.16 | 217.04 | 0.00 | 0.00 | 869.90 | 627.99 | 1180.23 | 0.00 | 2380.61 | 1047.29 | 0.365 | 1.03 | 0.59 | 2.444 |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | 732.97 | Exit-only | 0.00 | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 578.44 | 578.44 | 144.61 | 0.00 | 0.00 | 610.91 | 0.00 | 1317.16 | 0.00 | 1262.41 | 777.63 | 0.458 | 9.02 | 0.90 | 6.099 |

## Queueing Delay Results for each time segment

### Queueing Delay results: (17:00-17:15)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 3.20 | 0.21 | 5.953 | A | A |
| B | 2.74 | 0.18 | 1.479 | A | A |
| C | 5.32 | 0.35 | 1.422 | A | A |
| D | 7.58 | 0.51 | 2.128 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 12.69 | 0.85 | 5.469 | A | A |

## Queueing Delay results: (17:15-17:30)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 101.69 | 6.78 | 259.189 | F | F |
| B | 3.53 | 0.24 | 1.557 | A | A |
| C | 8.01 | 0.53 | 1.755 | A | A |
| D | 15.19 | 1.01 | 3.530 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 85.25 | 5.68 | 34.572 | D | C |

## Queueing Delay results: (17:30-17:45)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 326.52 | 21.77 | 482.805 | F | F |
| B | 3.53 | 0.24 | 1.535 | A | A |
| C | 7.96 | 0.53 | 1.711 | A | A |
| D | 15.44 | 1.03 | 3.455 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 125.53 | 8.37 | 49.113 | E | D |

## Queueing Delay results: (17:45-18:00)

| Arm | Queueing Total Delay (PCU-min) | Queueing Rate Of Delay (PCU-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| A | 53.74 | 3.58 | 10.929 | B | B |
| B | 3.03 | 0.20 | 1.606 | A | A |
| C | 6.27 | 0.42 | 1.639 | A | A |
| D | 9.01 | 0.60 | 2.444 | A | A |
| F | Exit-only | Exit-only | Exit-only | Exit-only | Exit-only |
| E | 17.52 | 1.17 | 6.099 | A | A |

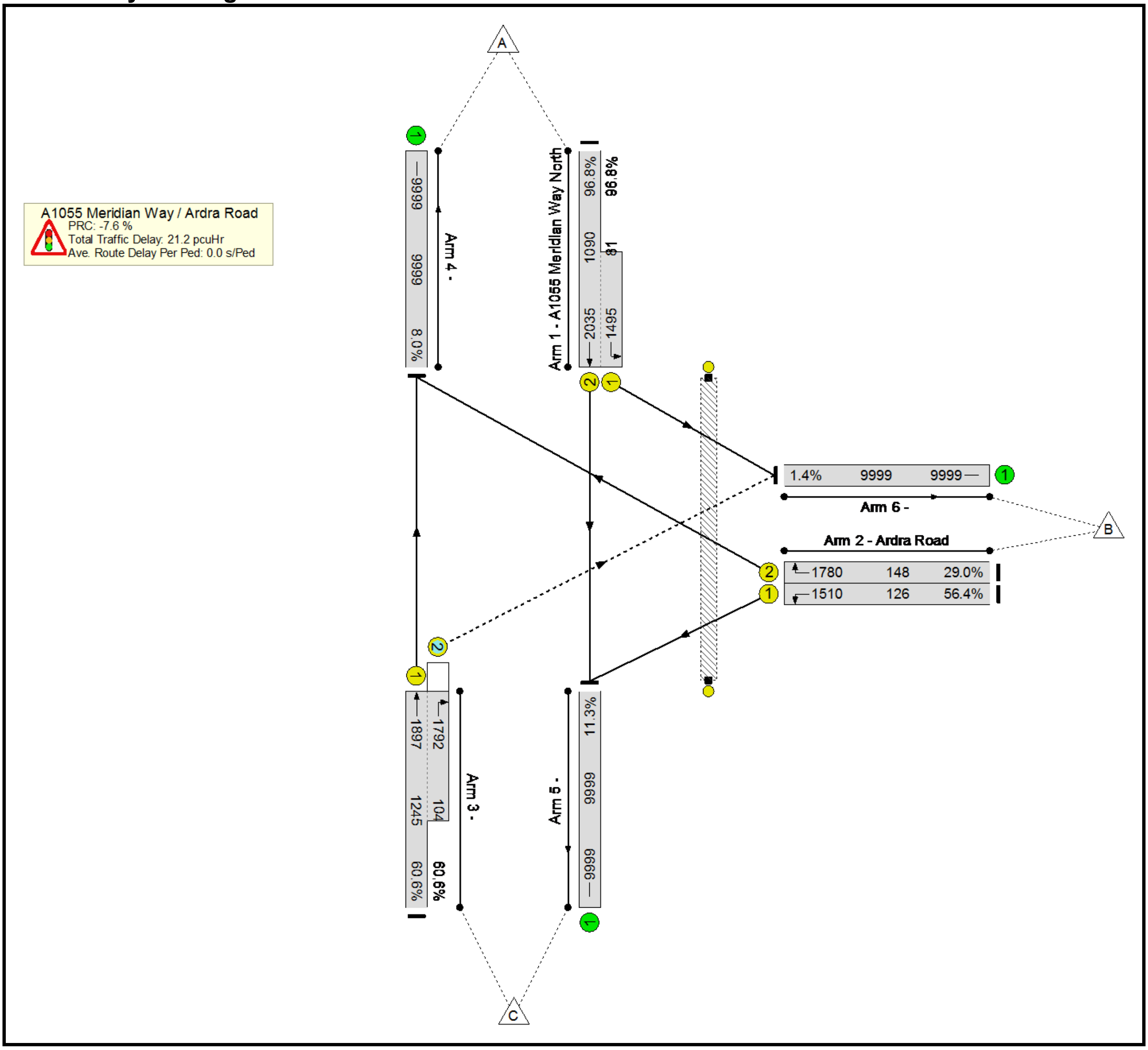
# Basic Results Summary

## User and Project Details

| | |
|---|---|
| **Project:** | **NLHPP** |
| **Title:** | **Meridian Way / Ardra Road** |
| **Location:** | |
| **File name:** | Meridian Way-Ardra Road - Base.lsg3x |
| **Author:** | David McCann |
| **Company:** | Arup |
| **Address:** | London |
| **Notes:** | |

**Scenario 1: 'AM peak hour'** (FG1: 'AM peak hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



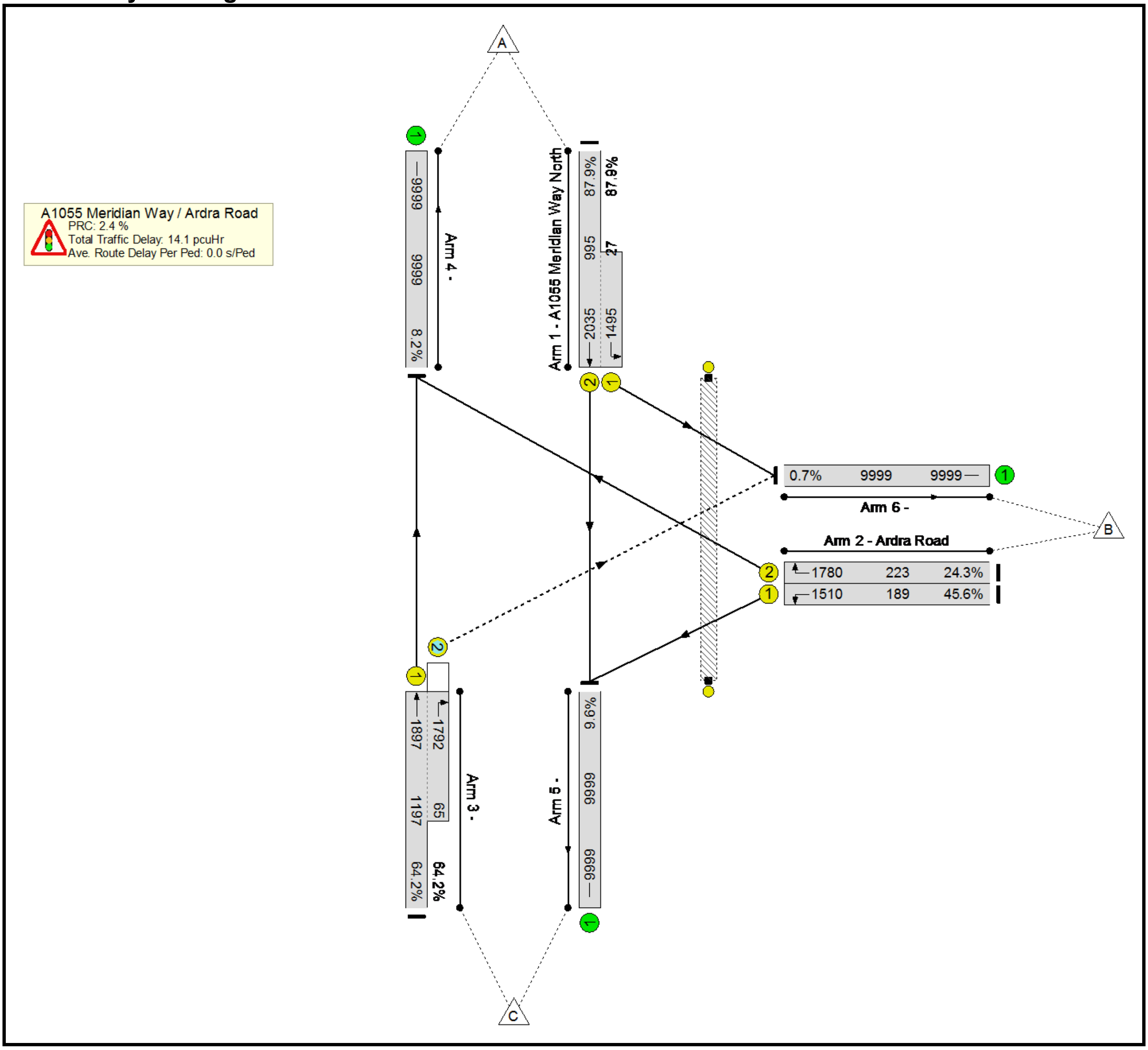
Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **96.8%** | **6** | **56** | **1** | **21.2** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **96.8%** | **6** | **56** | **1** | **21.2** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1133 | 2035:1495 | 1090+81 | 96.8 : 96.8% | - | - | - | 15.9 | 50.6 | 38.0 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 71 | 1510 | 126 | 56.4% | - | - | - | 1.5 | 74.4 | 2.4 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 43 | 1780 | 148 | 29.0% | - | - | - | 0.7 | 58.4 | 1.3 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 818 | 1897:1792 | 1245+104 | 60.6 : 60.6% | 6 | 56 | 1 | 3.0 | 13.0 | 11.1 |
| 4/1 | | U | - | | - | - | - | 798 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1126 | 9999 | 9999 | 11.3% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 141 | 9999 | 9999 | 1.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -7.6 Total Delay for Signalled Lanes (pcuHr): 21.04 Cycle Time (s): 96
PRC Over All Lanes (%): -7.6 Total Delay Over All Lanes(pcuHr): 21.15

Basic Results Summary
**Scenario 2: 'PM peak hour'** (FG2: 'PM peak hour', Plan 1: 'Network Control Plan 1')
## Network Layout Diagram



Basic Results Summary

## Network Results

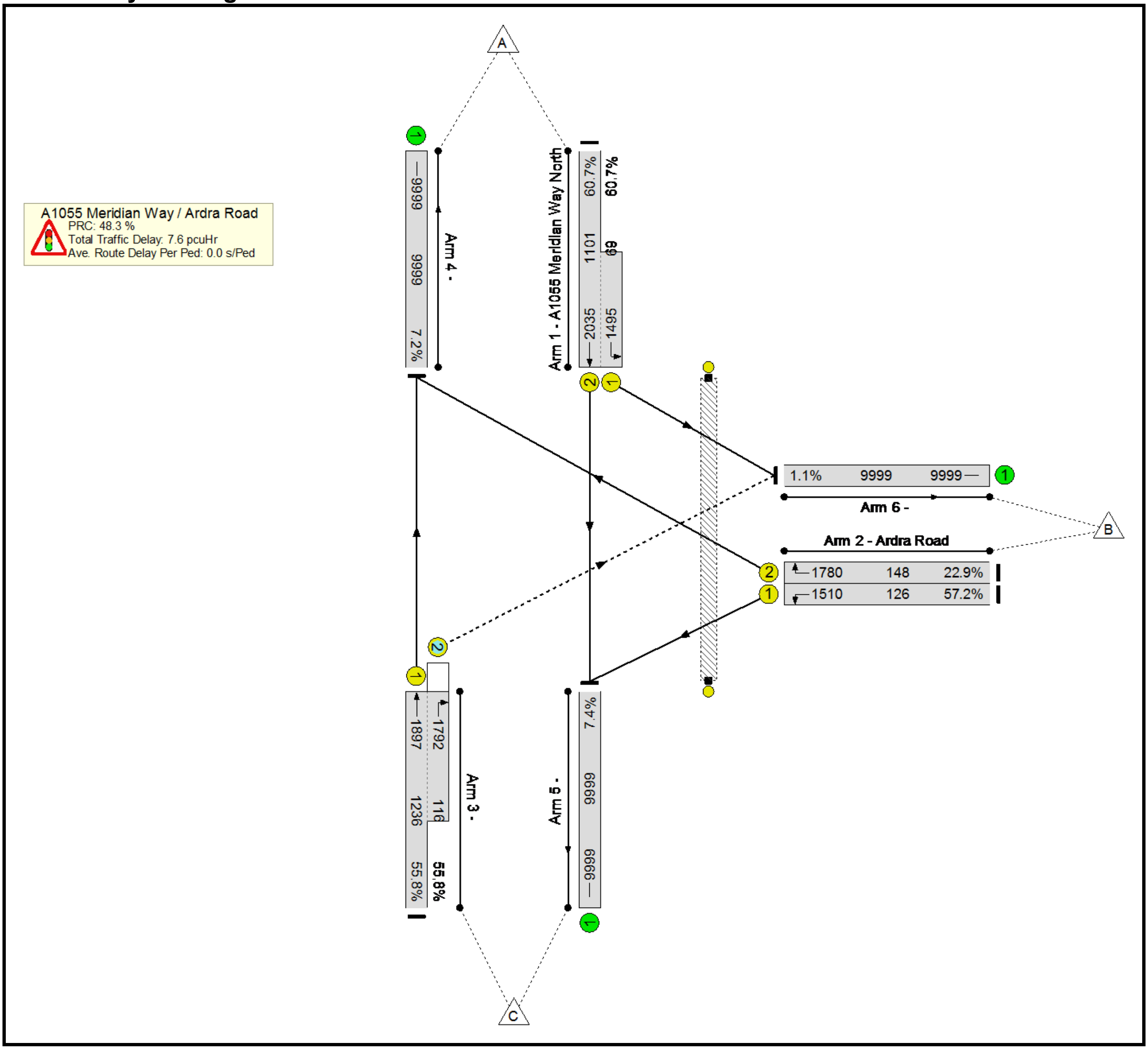
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **87.9%** | **35** | **6** | **1** | **14.1** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **87.9%** | **35** | **6** | **1** | **14.1** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 47 | - | 898 | 2035:1495 | 995+27 | 87.9 : 87.9% | - | - | - | 8.7 | 34.9 | 24.4 |
| 2/1 | Ardra Road Left | U | B | | 1 | 11 | - | 86 | 1510 | 189 | 45.6% | - | - | - | 1.3 | 56.4 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 11 | - | 54 | 1780 | 223 | 24.3% | - | - | - | 0.7 | 48.6 | 1.4 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 62 | - | 810 | 1897:1792 | 1197+65 | 64.2 : 64.2% | 35 | 6 | 1 | 3.3 | 14.5 | 12.8 |
| 4/1 | | U | - | | - | - | - | 822 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 960 | 9999 | 9999 | 9.6% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 66 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 2.4 Total Delay for Signalled Lanes (pcuHr): 14.05 Cycle Time (s): 96
PRC Over All Lanes (%): 2.4 Total Delay Over All Lanes(pcuHr): 14.15

Basic Results Summary

**Scenario 3: 'Inter-peak hour'** (FG3: 'Interpeak Hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **60.7%** | **57** | **7** | **1** | **7.6** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **60.7%** | **57** | **7** | **1** | **7.6** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 710 | 2035:1495 | 1101+69 | 60.7 : 60.7% | - | - | - | 3.3 | 16.8 | 12.3 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 72 | 1510 | 126 | 57.2% | - | - | - | 1.5 | 75.0 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 34 | 1780 | 148 | 22.9% | - | - | - | 0.5 | 56.9 | 1.0 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 755 | 1897:1792 | 1236+116 | 55.8 : 55.8% | 57 | 7 | 1 | 2.2 | 10.6 | 9.3 |
| 4/1 | | U | - | | - | - | - | 724 | 9999 | 9999 | 7.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 740 | 9999 | 9999 | 7.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 107 | 9999 | 9999 | 1.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

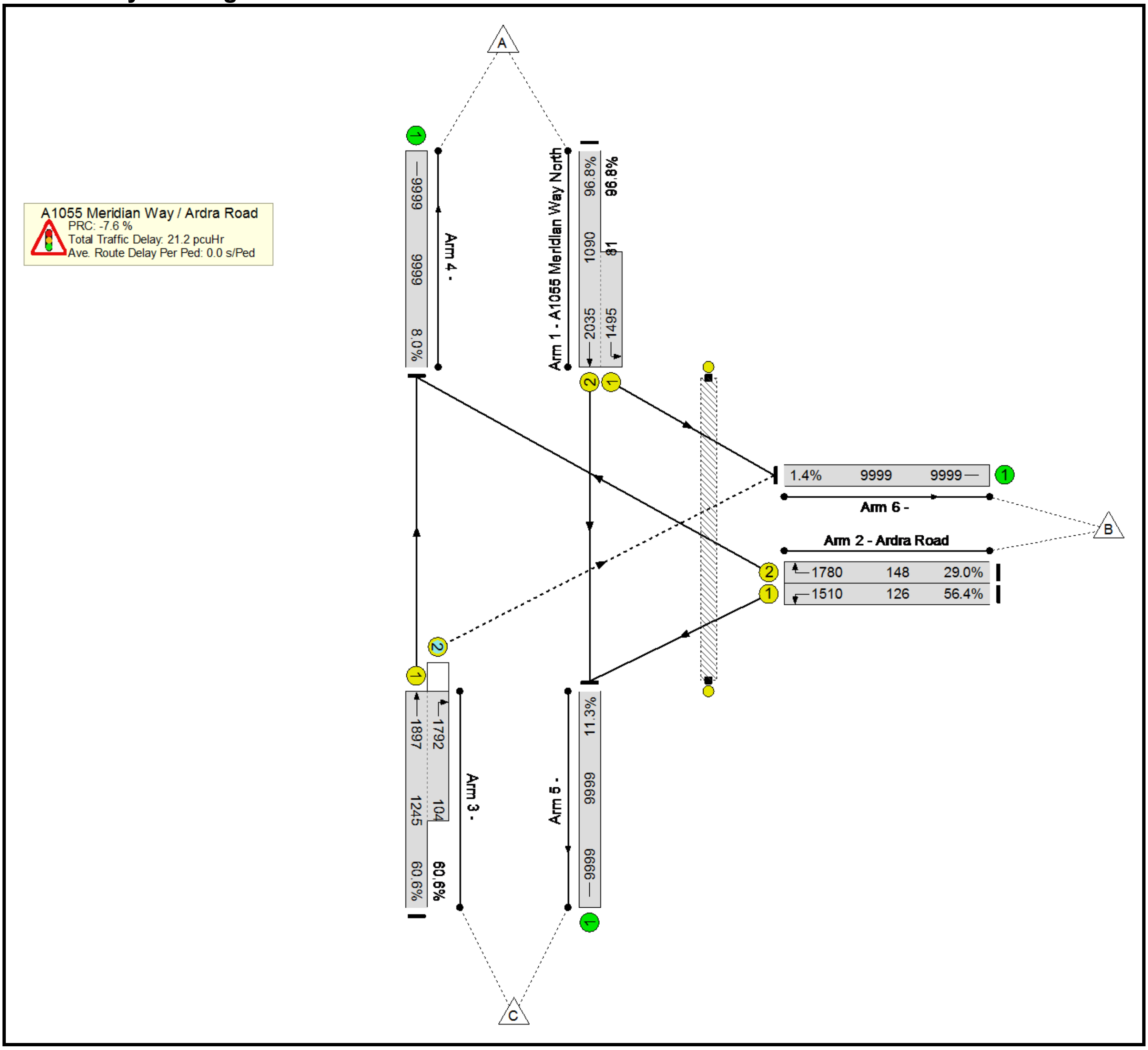
C1 PRC for Signalled Lanes (%): 48.3 Total Delay for Signalled Lanes (pcuHr): 7.56 Cycle Time (s): 96
PRC Over All Lanes (%): 48.3 Total Delay Over All Lanes(pcuHr): 7.65

Basic Results Summary
# Basic Results Summary

## User and Project Details

| | |
|---|---|
| **Project:** | **NLHPP** |
| **Title:** | **Meridian Way / Ardra Road** |
| **Location:** | |
| **File name:** | Meridian Way-Ardra Road - FB.lsg3x |
| **Author:** | David McCann |
| **Company:** | Arup |
| **Address:** | London |
| **Notes:** | |

**Scenario 1: 'AM peak hour'** (FG1: 'AM peak hour', Plan 1: 'Network Control Plan 1')
## Network Layout Diagram



Basic Results Summary

## Network Results

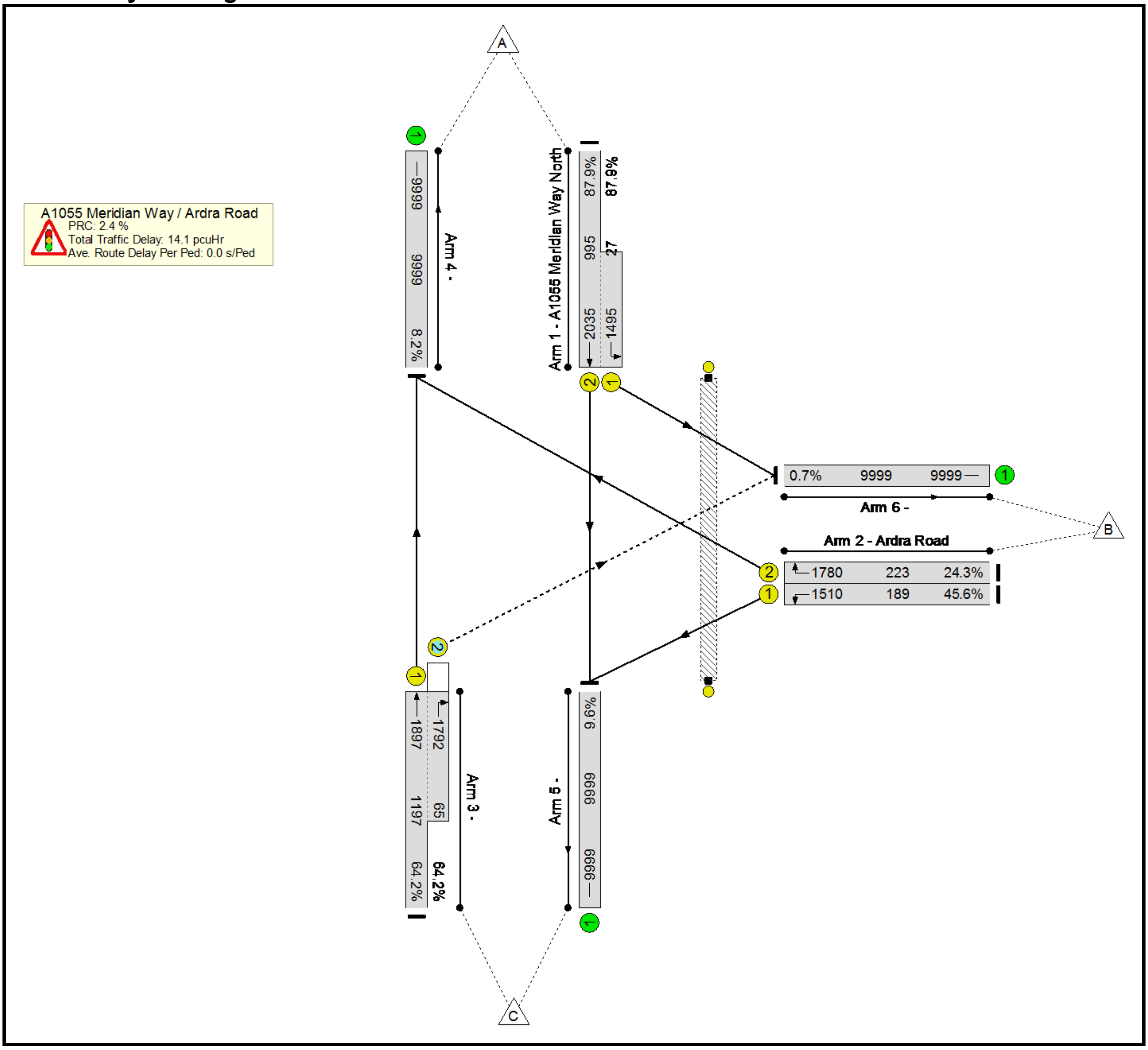
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **96.8%** | **6** | **56** | **1** | **21.2** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **96.8%** | **6** | **56** | **1** | **21.2** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1133 | 2035:1495 | 1090+81 | 96.8 : 96.8% | - | - | - | 15.9 | 50.6 | 38.0 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 71 | 1510 | 126 | 56.4% | - | - | - | 1.5 | 74.4 | 2.4 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 43 | 1780 | 148 | 29.0% | - | - | - | 0.7 | 58.4 | 1.3 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 818 | 1897:1792 | 1245+104 | 60.6 : 60.6% | 6 | 56 | 1 | 3.0 | 13.0 | 11.1 |
| 4/1 | | U | - | | - | - | - | 798 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1126 | 9999 | 9999 | 11.3% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 141 | 9999 | 9999 | 1.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -7.6 Total Delay for Signalled Lanes (pcuHr): 21.04 Cycle Time (s): 96
PRC Over All Lanes (%): -7.6 Total Delay Over All Lanes(pcuHr): 21.15

Basic Results Summary

**Scenario 2: 'PM peak hour'** (FG2: 'PM peak hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

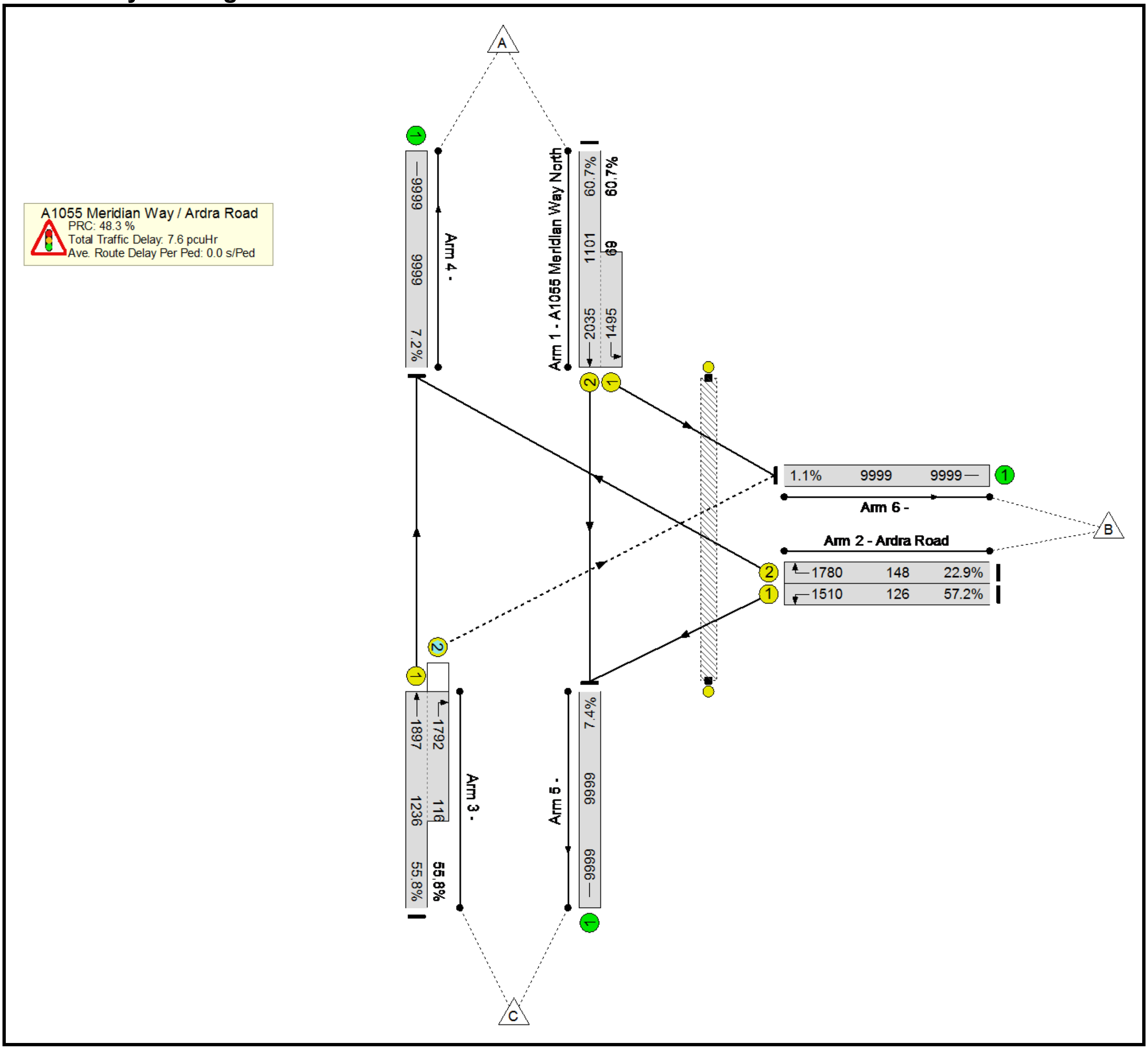
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **87.9%** | **35** | **6** | **1** | **14.1** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **87.9%** | **35** | **6** | **1** | **14.1** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 47 | - | 898 | 2035:1495 | 995+27 | 87.9 : 87.9% | - | - | - | 8.7 | 34.9 | 24.4 |
| 2/1 | Ardra Road Left | U | B | | 1 | 11 | - | 86 | 1510 | 189 | 45.6% | - | - | - | 1.3 | 56.4 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 11 | - | 54 | 1780 | 223 | 24.3% | - | - | - | 0.7 | 48.6 | 1.4 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 62 | - | 810 | 1897:1792 | 1197+65 | 64.2 : 64.2% | 35 | 6 | 1 | 3.3 | 14.5 | 12.8 |
| 4/1 | | U | - | | - | - | - | 822 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 960 | 9999 | 9999 | 9.6% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 66 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 2.4 Total Delay for Signalled Lanes (pcuHr): 14.05 Cycle Time (s): 96
PRC Over All Lanes (%): 2.4 Total Delay Over All Lanes(pcuHr): 14.15

Basic Results Summary

**Scenario 3: 'Inter-peak hour'** (FG3: 'Interpeak Hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

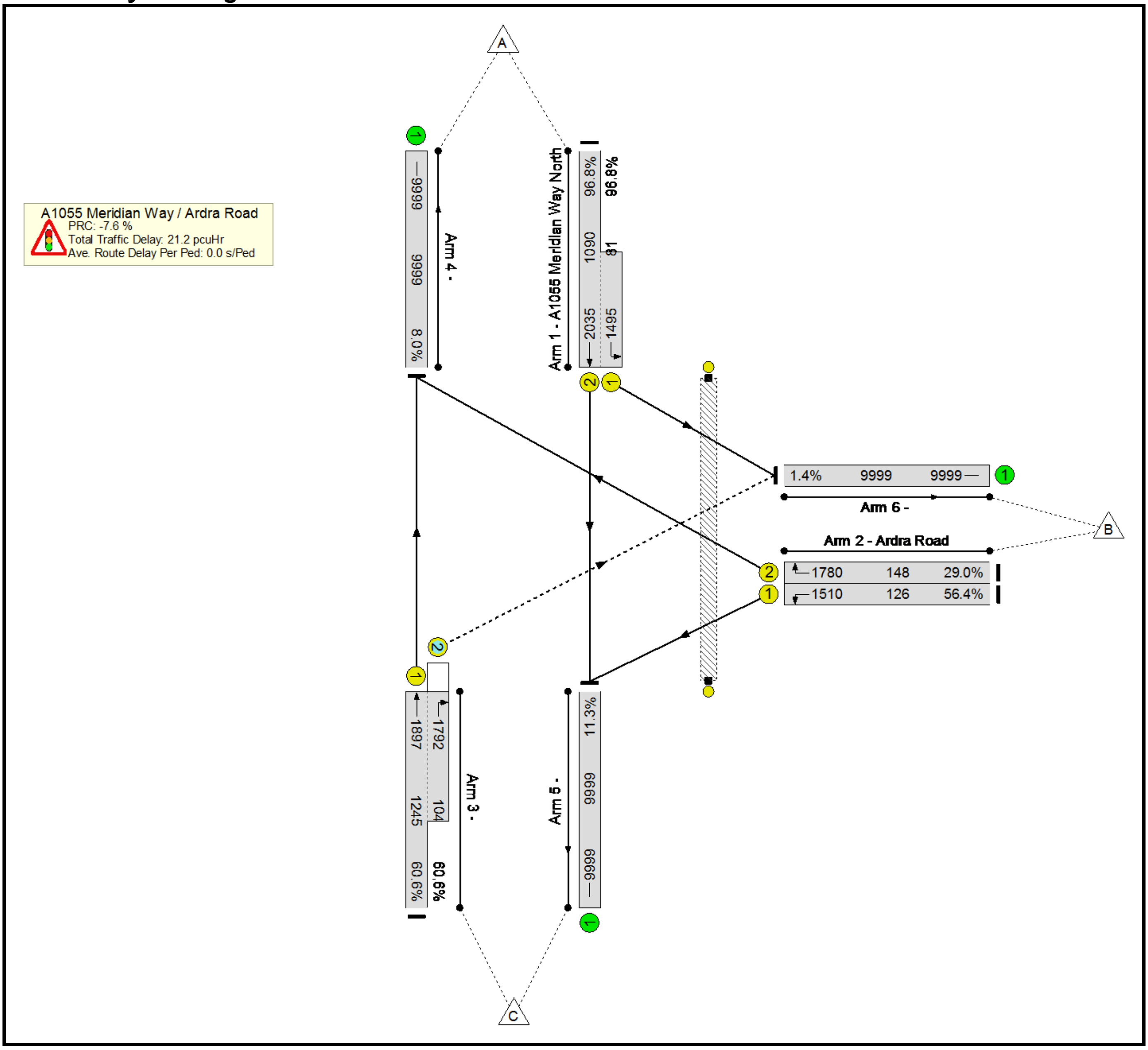
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **60.7%** | **57** | **7** | **1** | **7.6** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **60.7%** | **57** | **7** | **1** | **7.6** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 710 | 2035:1495 | 1101+69 | 60.7 : 60.7% | - | - | - | 3.3 | 16.8 | 12.3 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 72 | 1510 | 126 | 57.2% | - | - | - | 1.5 | 75.0 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 34 | 1780 | 148 | 22.9% | - | - | - | 0.5 | 56.9 | 1.0 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 755 | 1897:1792 | 1236+116 | 55.8 : 55.8% | 57 | 7 | 1 | 2.2 | 10.6 | 9.3 |
| 4/1 | | U | - | | - | - | - | 724 | 9999 | 9999 | 7.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 740 | 9999 | 9999 | 7.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 107 | 9999 | 9999 | 1.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 48.3 Total Delay for Signalled Lanes (pcuHr): 7.56 Cycle Time (s): 96
PRC Over All Lanes (%): 48.3 Total Delay Over All Lanes(pcuHr): 7.65

Basic Results Summary

**Scenario 4: 'AM peak hour 2024'** (FG4: 'AM peak hour 2024', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

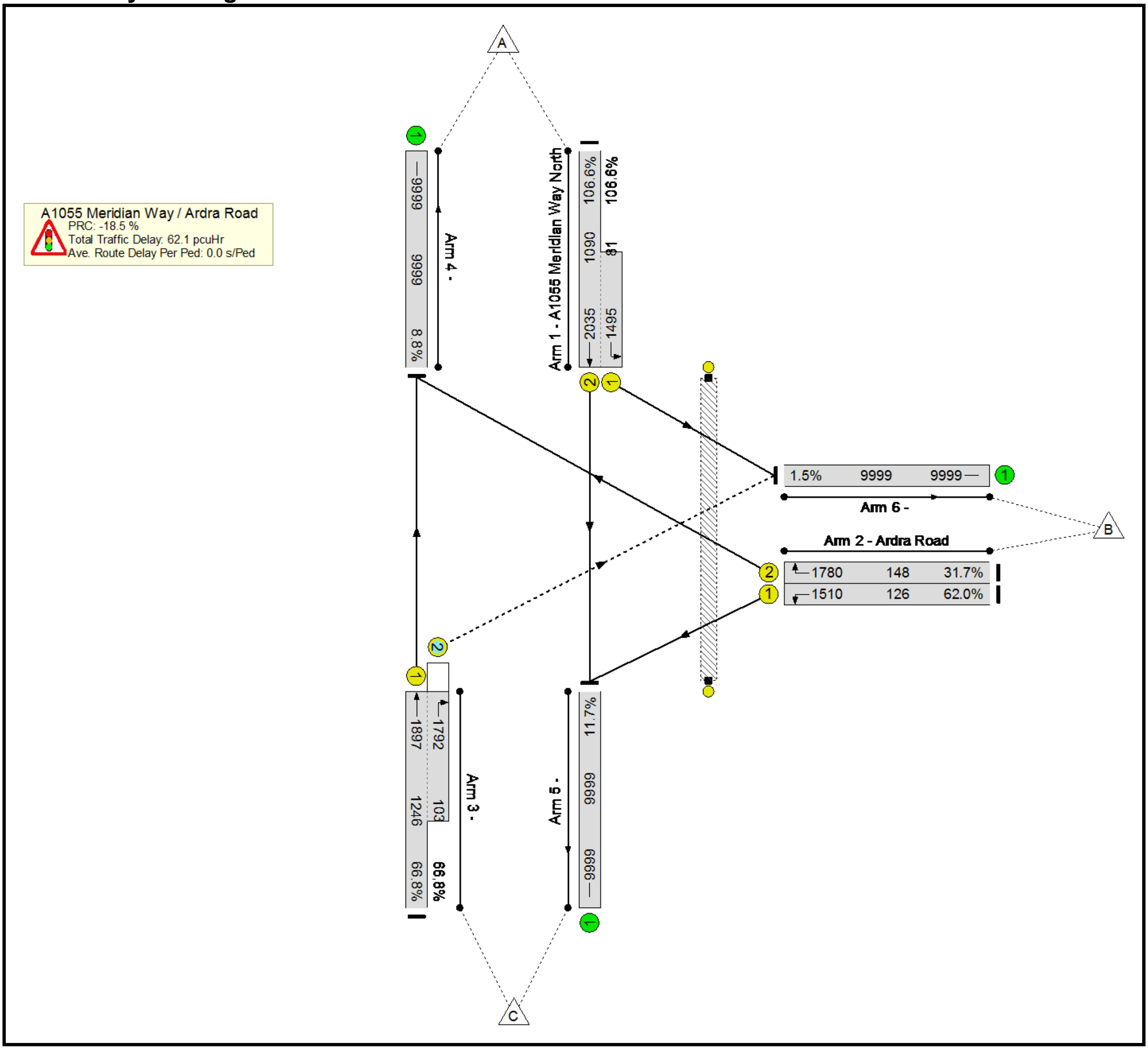
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **96.8%** | **6** | **56** | **1** | **21.2** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **96.8%** | **6** | **56** | **1** | **21.2** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1133 | 2035:1495 | 1090+81 | 96.8 : 96.8% | - | - | - | 15.9 | 50.6 | 38.0 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 71 | 1510 | 126 | 56.4% | - | - | - | 1.5 | 74.4 | 2.4 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 43 | 1780 | 148 | 29.0% | - | - | - | 0.7 | 58.4 | 1.3 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 818 | 1897:1792 | 1245+104 | 60.6 : 60.6% | 6 | 56 | 1 | 3.0 | 13.0 | 11.1 |
| 4/1 | | U | - | | - | - | - | 798 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1126 | 9999 | 9999 | 11.3% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 141 | 9999 | 9999 | 1.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -7.6 Total Delay for Signalled Lanes (pcuHr): 21.04 Cycle Time (s): 96
PRC Over All Lanes (%): -7.6 Total Delay Over All Lanes(pcuHr): 21.15

Basic Results Summary

**Scenario 5: 'AM peak hour 2025'** (FG5: 'AM peak hour 2025', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

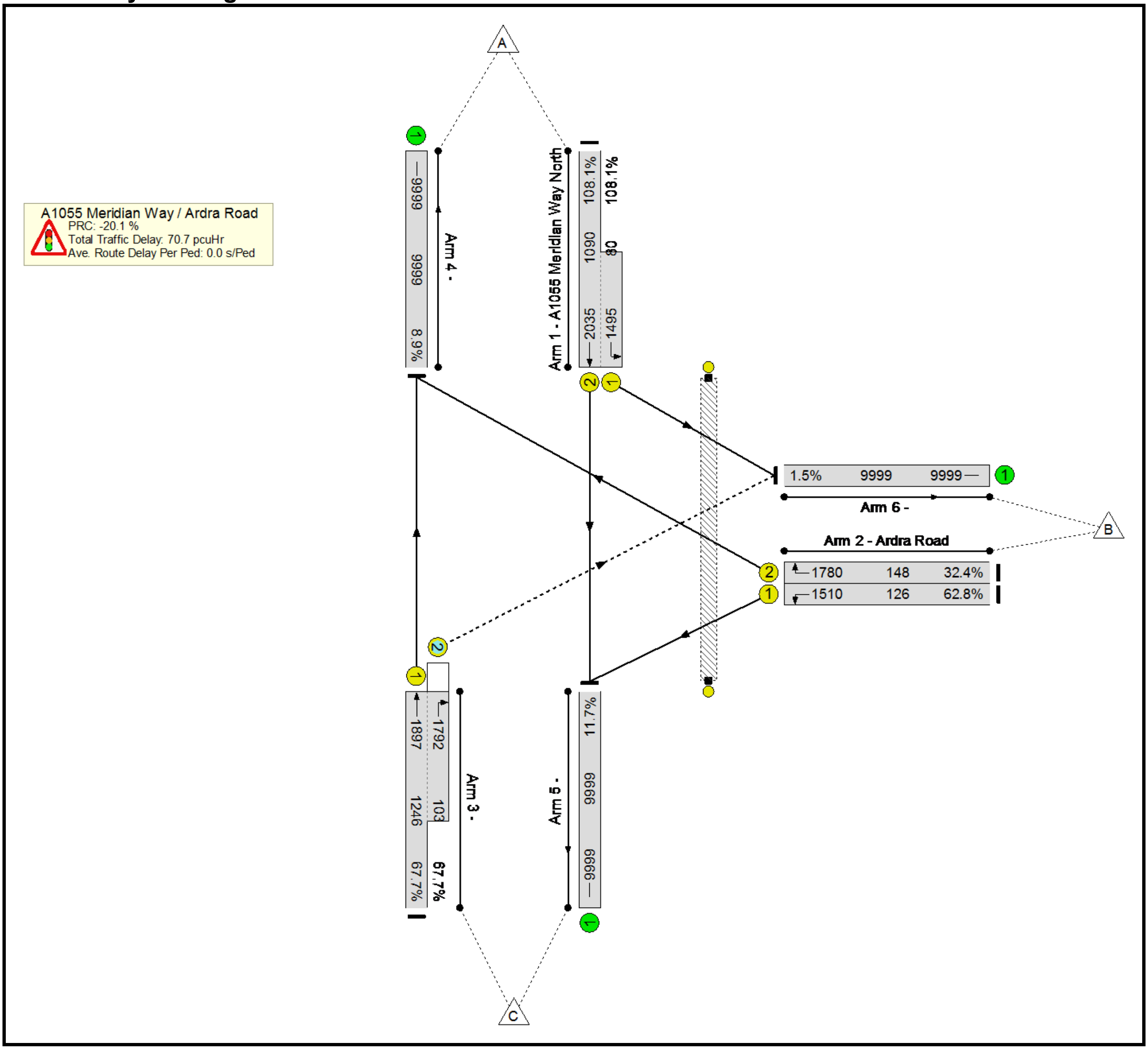
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **106.6%** | **0** | **68** | **1** | **62.1** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **106.6%** | **0** | **68** | **1** | **62.1** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1248 | 2035:1495 | 1090+81 | 106.6 : 106.6% | - | - | - | 56.0 | 161.5 | 82.6 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 78 | 1510 | 126 | 62.0% | - | - | - | 1.7 | 79.0 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 47 | 1780 | 148 | 31.7% | - | - | - | 0.8 | 59.2 | 1.4 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 901 | 1897:1792 | 1246+103 | 66.8 : 66.8% | 0 | 68 | 1 | 3.5 | 14.2 | 13.5 |
| 4/1 | | U | - | | - | - | - | 879 | 9999 | 9999 | 8.8% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1240 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 155 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -18.5 Total Delay for Signalled Lanes (pcuHr): 62.03 Cycle Time (s): 96
PRC Over All Lanes (%): -18.5 Total Delay Over All Lanes(pcuHr): 62.15

Basic Results Summary

**Scenario 6: 'AM peak hour 2027'** (FG6: 'AM peak hour 2027', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

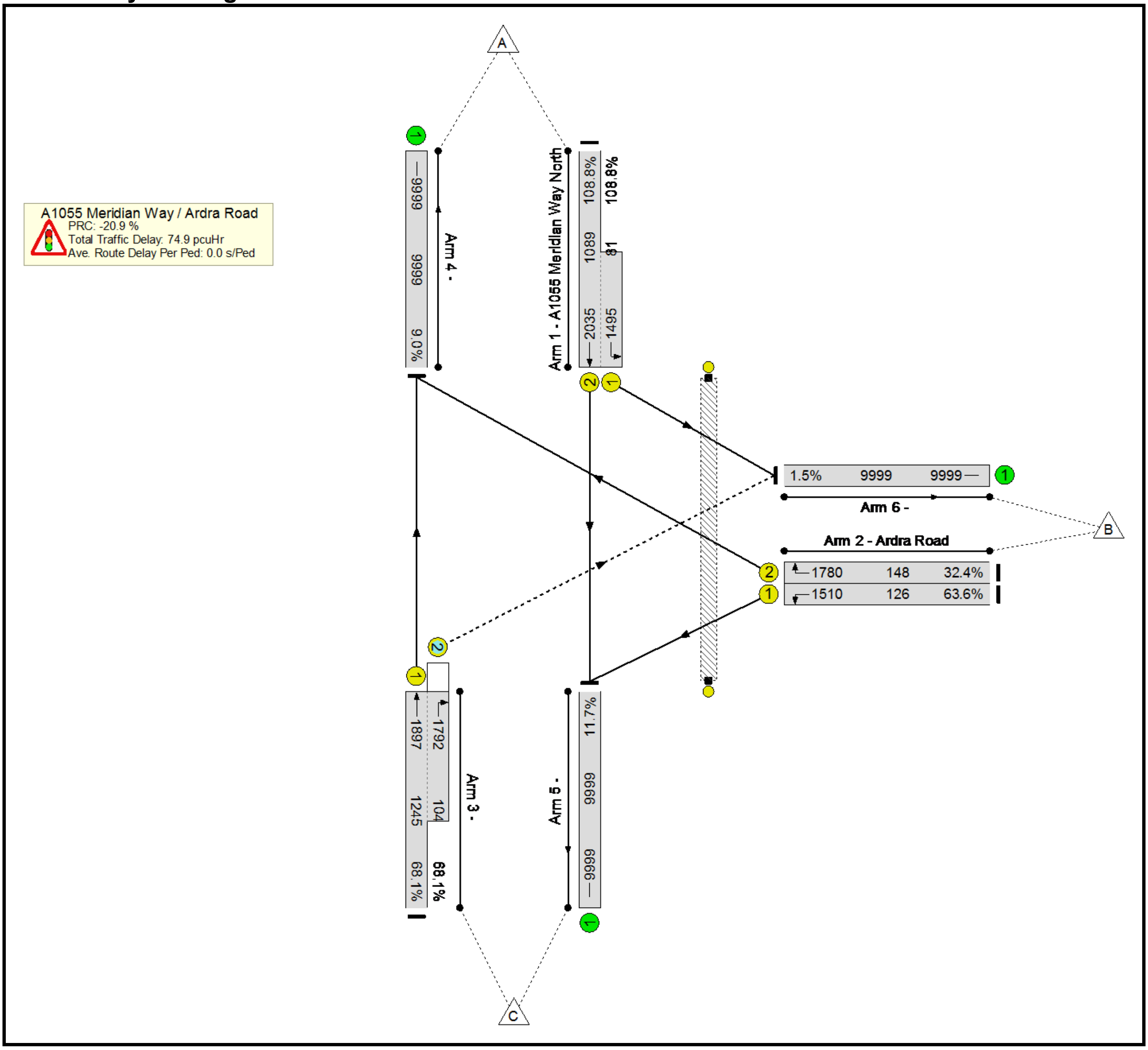
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **108.1%** | **0** | **69** | **1** | **70.7** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **108.1%** | **0** | **69** | **1** | **70.7** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1265 | 2035:1495 | 1090+80 | 108.1 : 108.1% | - | - | - | 64.4 | 183.4 | 91.1 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 79 | 1510 | 126 | 62.8% | - | - | - | 1.7 | 79.7 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 48 | 1780 | 148 | 32.4% | - | - | - | 0.8 | 59.4 | 1.4 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 913 | 1897:1792 | 1246+103 | 67.7 : 67.7% | 0 | 69 | 1 | 3.6 | 14.3 | 13.8 |
| 4/1 | | U | - | | - | - | - | 891 | 9999 | 9999 | 8.9% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1257 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 157 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -20.1 Total Delay for Signalled Lanes (pcuHr): 70.62 Cycle Time (s): 96
PRC Over All Lanes (%): -20.1 Total Delay Over All Lanes(pcuHr): 70.74

Basic Results Summary

**Scenario 7: 'AM peak hour 2028'** (FG7: 'AM peak hour 2028', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

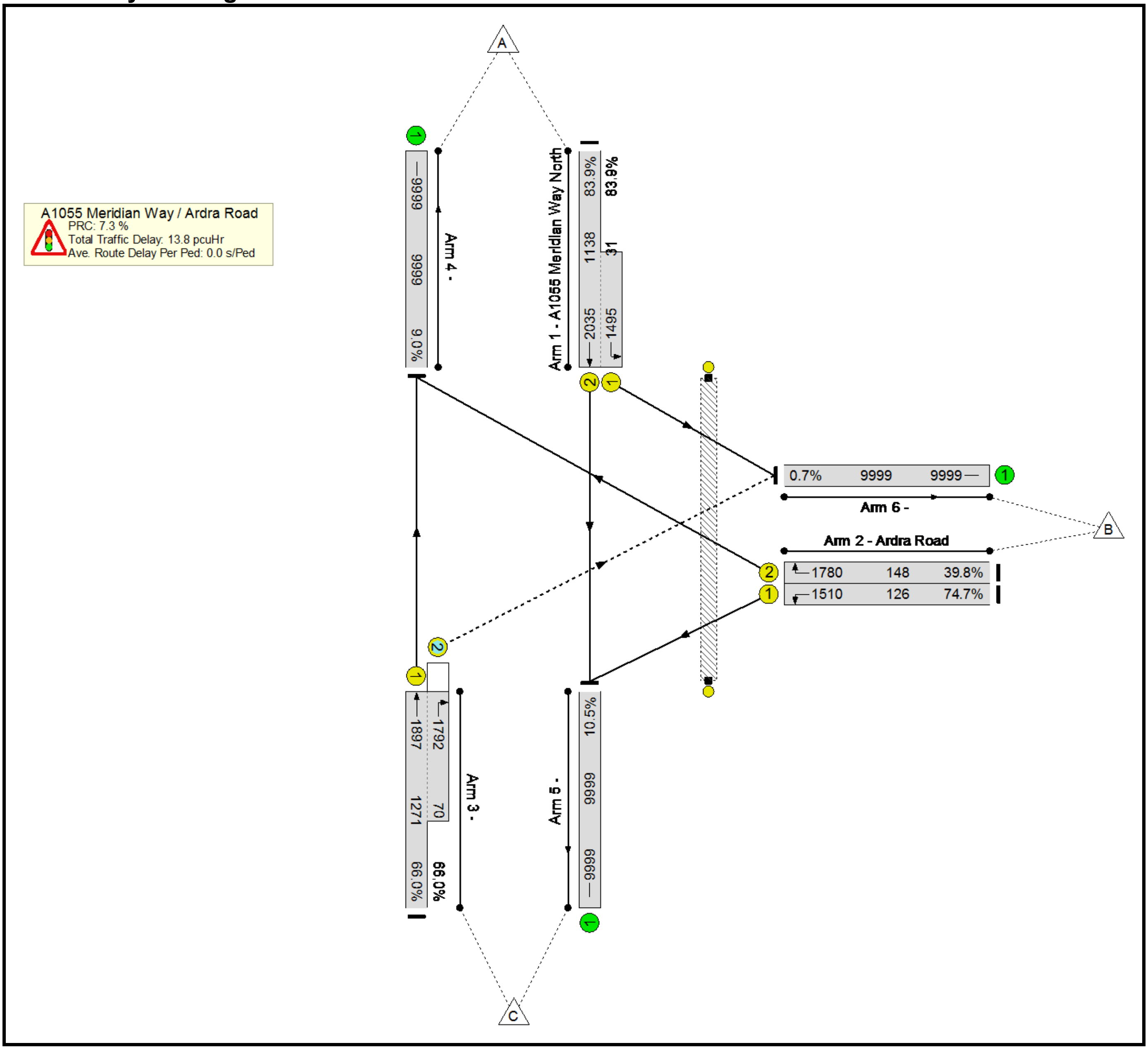
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **108.8%** | **0** | **70** | **1** | **74.9** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **108.8%** | **0** | **70** | **1** | **74.9** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1273 | 2035:1495 | 1089+81 | 108.8 : 108.8% | - | - | - | 68.5 | 193.6 | 95.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 80 | 1510 | 126 | 63.6% | - | - | - | 1.8 | 80.5 | 2.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 48 | 1780 | 148 | 32.4% | - | - | - | 0.8 | 59.4 | 1.4 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 919 | 1897:1792 | 1245+104 | 68.1 : 68.1% | 0 | 70 | 1 | 3.7 | 14.5 | 13.9 |
| 4/1 | | U | - | | - | - | - | 896 | 9999 | 9999 | 9.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1265 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 159 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -20.9 Total Delay for Signalled Lanes (pcuHr): 74.74 Cycle Time (s): 96
PRC Over All Lanes (%): -20.9 Total Delay Over All Lanes(pcuHr): 74.87

Basic Results Summary

**Scenario 8: 'PM peak hour 2024'** (FG8: 'PM peak hour 2024', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

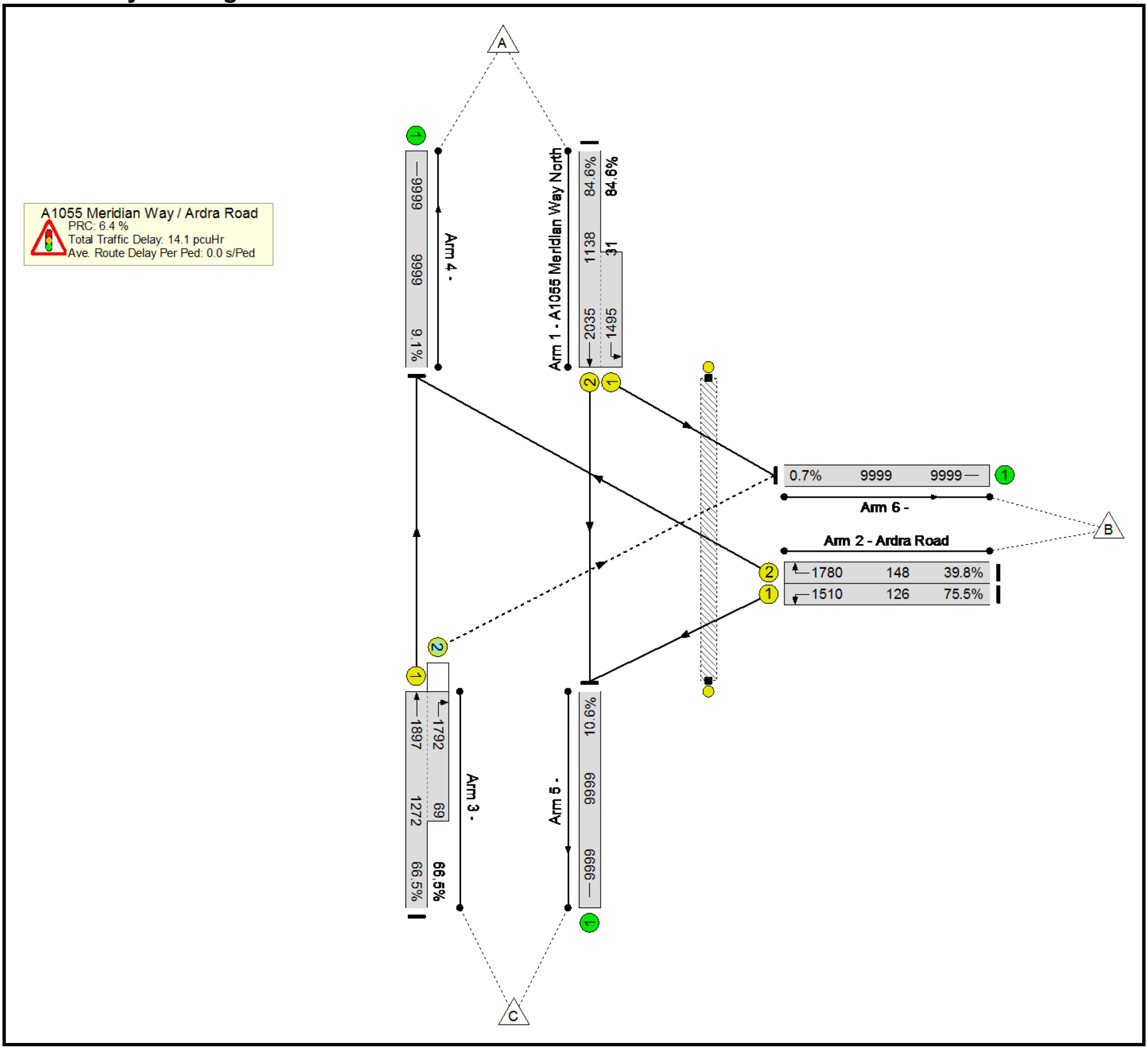
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **83.9%** | **40** | **5** | **1** | **13.8** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **83.9%** | **40** | **5** | **1** | **13.8** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 981 | 2035:1495 | 1138+31 | 83.9 : 83.9% | - | - | - | 7.1 | 25.9 | 23.6 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 94 | 1510 | 126 | 74.7% | - | - | - | 2.5 | 95.1 | 3.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 59 | 1780 | 148 | 39.8% | - | - | - | 1.0 | 61.7 | 1.8 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 885 | 1897:1792 | 1271+70 | 66.0 : 66.0% | 40 | 5 | 1 | 3.1 | 12.8 | 13.4 |
| 4/1 | | U | - | | - | - | - | 898 | 9999 | 9999 | 9.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1049 | 9999 | 9999 | 10.5% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 72 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 7.3 Total Delay for Signalled Lanes (pcuHr): 13.70 Cycle Time (s): 96
PRC Over All Lanes (%): 7.3 Total Delay Over All Lanes(pcuHr): 13.81

Basic Results Summary

**Scenario 9: 'PM peak hour 2025'** (FG9: 'PM peak hour 2025', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

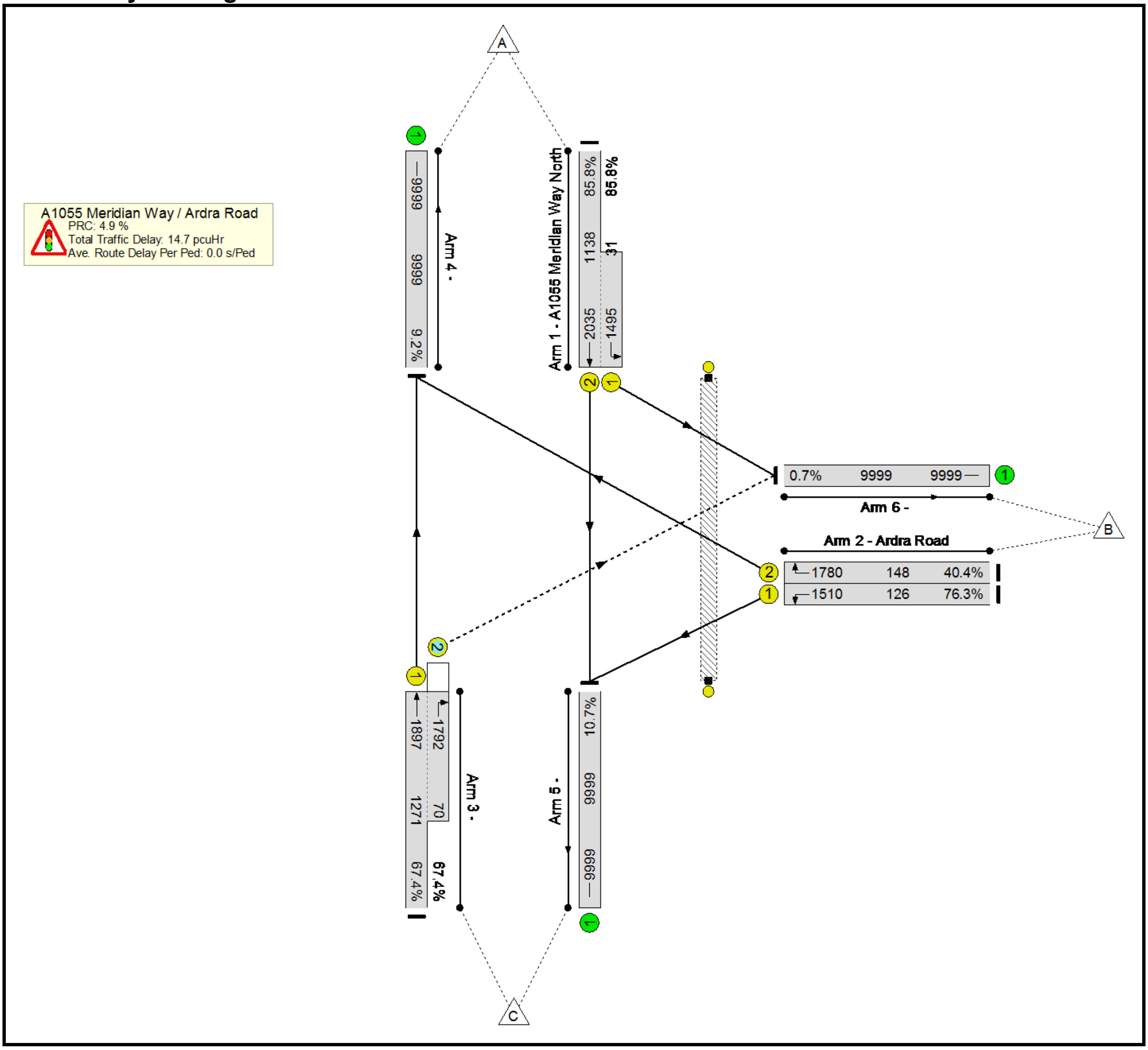
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **84.6%** | **40** | **5** | **1** | **14.1** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **84.6%** | **40** | **5** | **1** | **14.1** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 989 | 2035:1495 | 1138+31 | 84.6 : 84.6% | - | - | - | 7.3 | 26.4 | 24.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 95 | 1510 | 126 | 75.5% | - | - | - | 2.5 | 96.5 | 3.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 59 | 1780 | 148 | 39.8% | - | - | - | 1.0 | 61.7 | 1.8 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 892 | 1897:1792 | 1272+69 | 66.5 : 66.5% | 40 | 5 | 1 | 3.2 | 12.9 | 13.5 |
| 4/1 | | U | - | | - | - | - | 905 | 9999 | 9999 | 9.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1058 | 9999 | 9999 | 10.6% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 72 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 6.4 Total Delay for Signalled Lanes (pcuHr): 14.02 Cycle Time (s): 96
PRC Over All Lanes (%): 6.4 Total Delay Over All Lanes(pcuHr): 14.14

Basic Results Summary

**Scenario 10: 'PM peak hour 2027'** (FG10: 'PM peak hour 2027', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

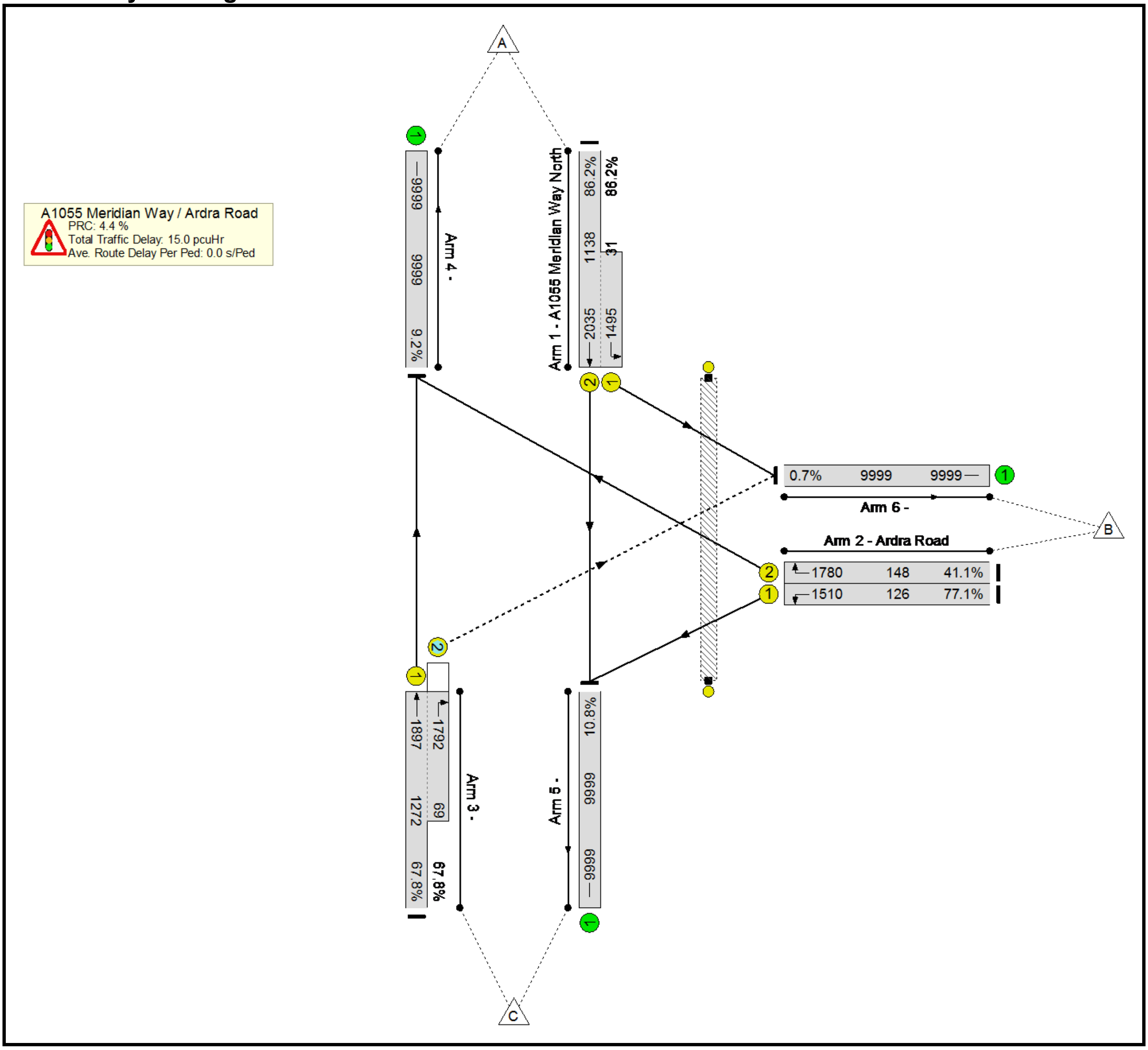
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **85.8%** | **41** | **5** | **1** | **14.7** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **85.8%** | **41** | **5** | **1** | **14.7** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1003 | 2035:1495 | 1138+31 | 85.8 : 85.8% | - | - | - | 7.6 | 27.4 | 25.0 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 96 | 1510 | 126 | 76.3% | - | - | - | 2.6 | 98.0 | 3.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 60 | 1780 | 148 | 40.4% | - | - | - | 1.0 | 62.0 | 1.9 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 904 | 1897:1792 | 1271+70 | 67.4 : 67.4% | 41 | 5 | 1 | 3.3 | 13.2 | 14.0 |
| 4/1 | | U | - | | - | - | - | 917 | 9999 | 9999 | 9.2% | - | - | - | 0.1 | 0.2 | 0.1 |
| 5/1 | | U | - | | - | - | - | 1072 | 9999 | 9999 | 10.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 74 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 4.9 Total Delay for Signalled Lanes (pcuHr): 14.60 Cycle Time (s): 96
PRC Over All Lanes (%): 4.9 Total Delay Over All Lanes(pcuHr): 14.71

Basic Results Summary

**Scenario 11: ' PM peak hour 2028'** (FG11: 'PM peak hour 2028', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

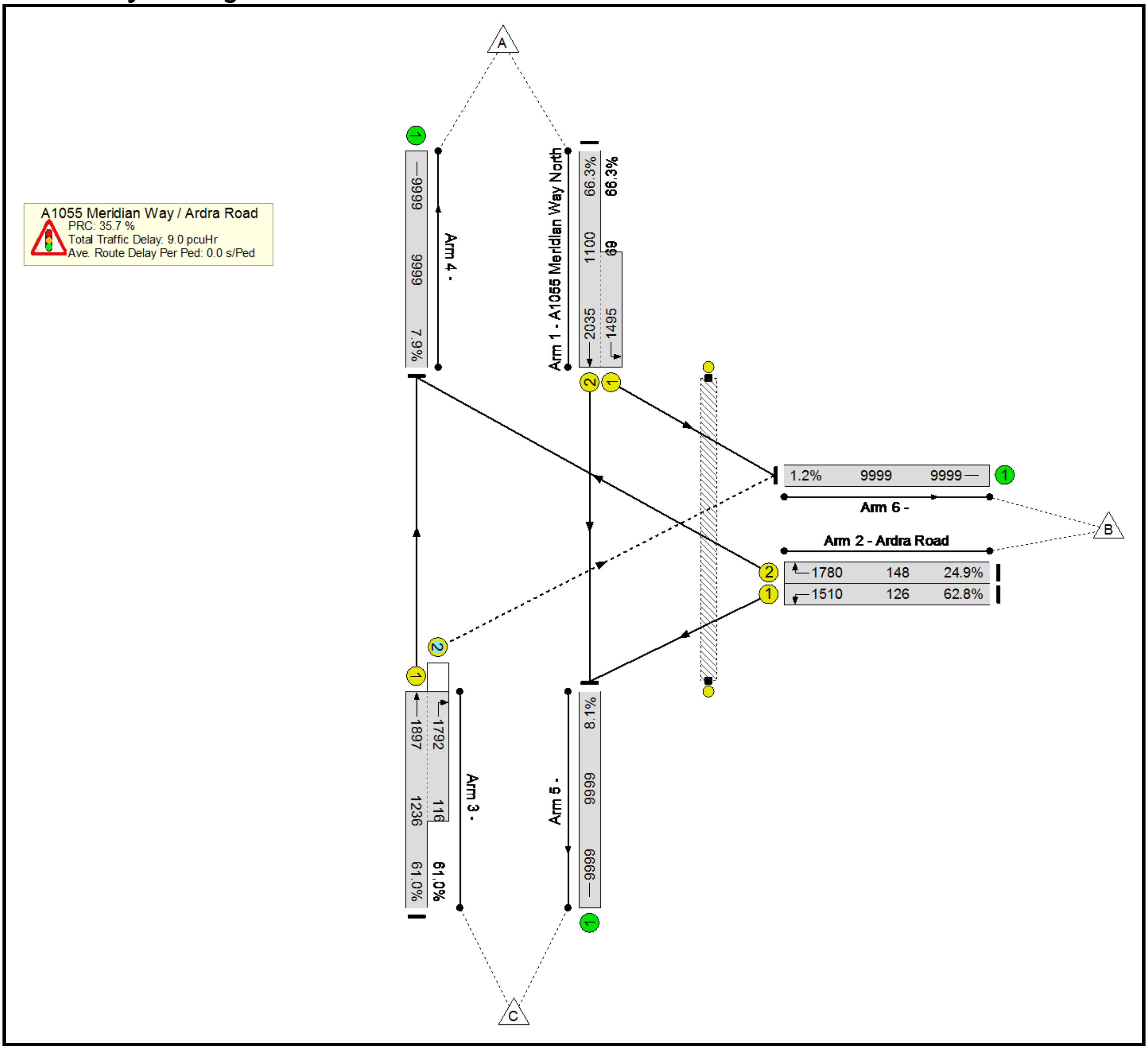
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **86.2%** | **41** | **5** | **1** | **15.0** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **86.2%** | **41** | **5** | **1** | **15.0** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1008 | 2035:1495 | 1138+31 | 86.2 : 86.2% | - | - | - | 7.8 | 27.8 | 25.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 97 | 1510 | 126 | 77.1% | - | - | - | 2.7 | 99.6 | 4.1 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 61 | 1780 | 148 | 41.1% | - | - | - | 1.1 | 62.2 | 1.9 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 909 | 1897:1792 | 1272+69 | 67.8 : 67.8% | 41 | 5 | 1 | 3.4 | 13.3 | 14.1 |
| 4/1 | | U | - | | - | - | - | 923 | 9999 | 9999 | 9.2% | - | - | - | 0.1 | 0.2 | 0.1 |
| 5/1 | | U | - | | - | - | - | 1078 | 9999 | 9999 | 10.8% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 74 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 4.4 Total Delay for Signalled Lanes (pcuHr): 14.88 Cycle Time (s): 96
PRC Over All Lanes (%): 4.4 Total Delay Over All Lanes(pcuHr): 14.99

Basic Results Summary

**Scenario 12: 'Inter peak hour 2024'** (FG12: 'Interpeak hour 2024', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

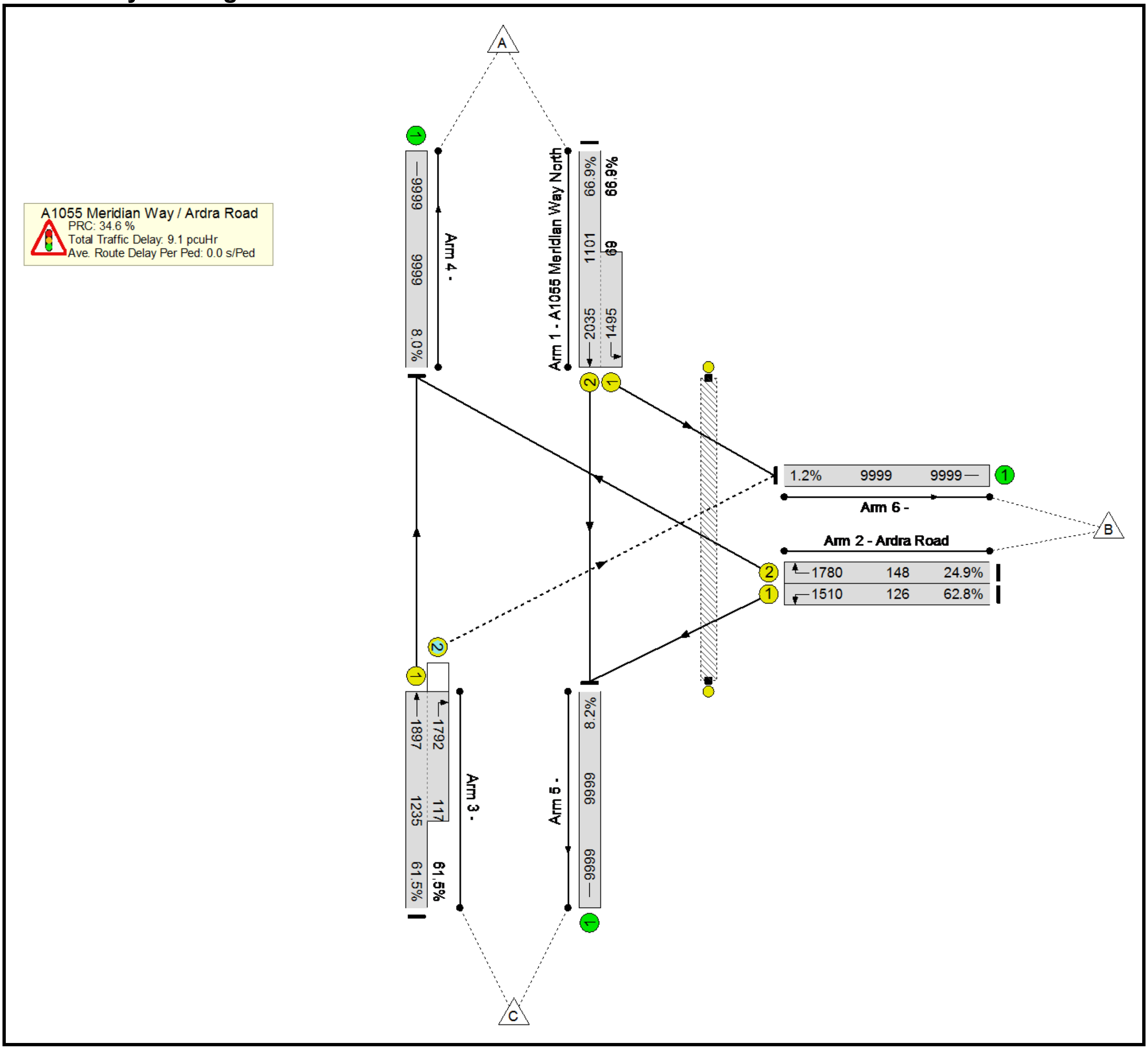
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **66.3%** | **62** | **7** | **1** | **9.0** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **66.3%** | **62** | **7** | **1** | **9.0** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 776 | 2035:1495 | 1100+69 | 66.3 : 66.3% | - | - | - | 3.9 | 18.1 | 14.3 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 79 | 1510 | 126 | 62.8% | - | - | - | 1.7 | 79.7 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 37 | 1780 | 148 | 24.9% | - | - | - | 0.6 | 57.3 | 1.1 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 825 | 1897:1792 | 1236+116 | 61.0 : 61.0% | 62 | 7 | 1 | 2.6 | 11.5 | 11.2 |
| 4/1 | | U | - | | - | - | - | 791 | 9999 | 9999 | 7.9% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 809 | 9999 | 9999 | 8.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 117 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 35.7 Total Delay for Signalled Lanes (pcuHr): 8.88 Cycle Time (s): 96
PRC Over All Lanes (%): 35.7 Total Delay Over All Lanes(pcuHr): 8.97

Basic Results Summary

**Scenario 13: 'Inter peak hour 2025'** (FG13: 'Interpeak hour 2025', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

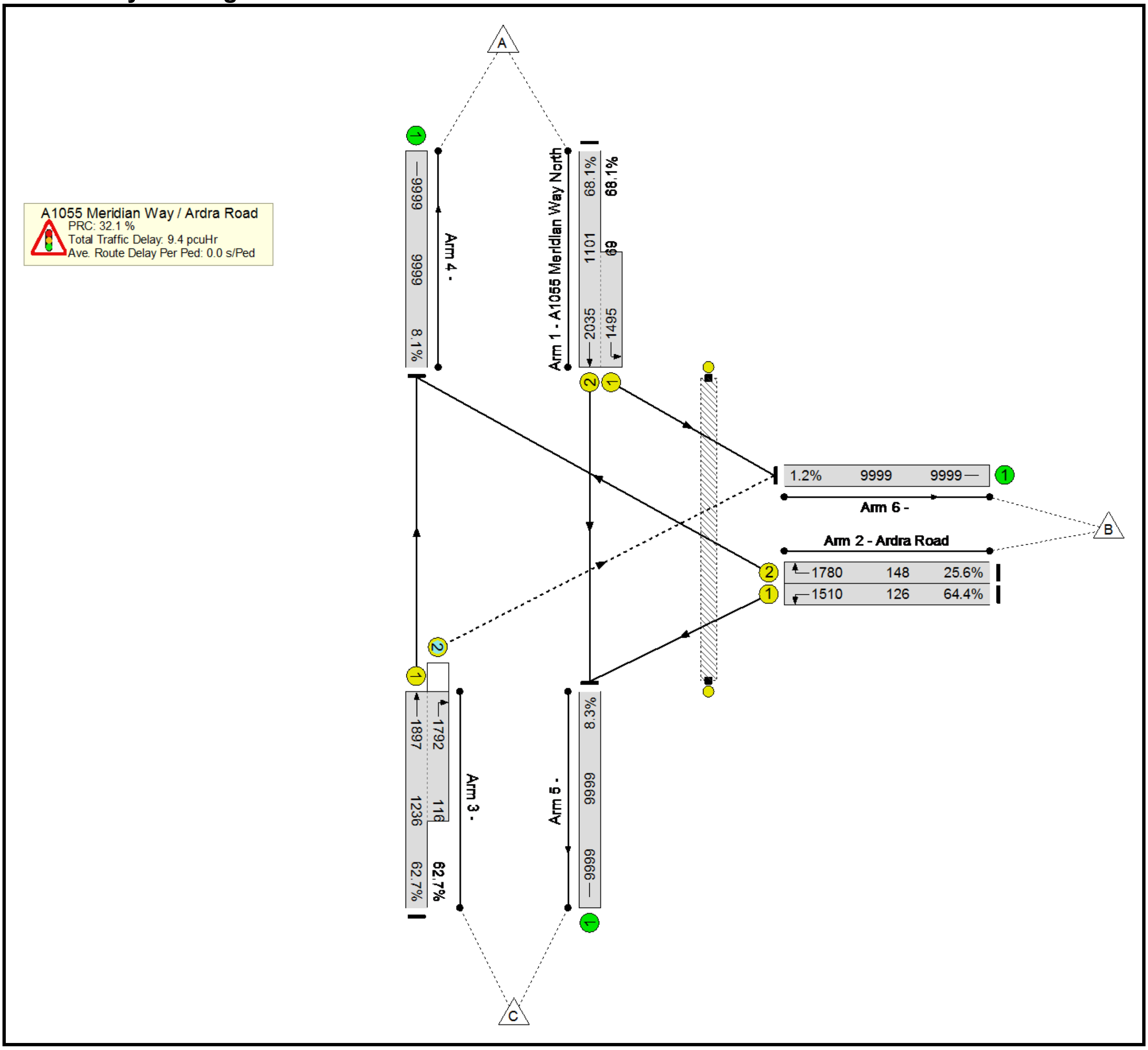
## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **66.9%** | **63** | **8** | **2** | **9.1** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **66.9%** | **63** | **8** | **2** | **9.1** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 782 | 2035:1495 | 1101+69 | 66.9 : 66.9% | - | - | - | 4.0 | 18.3 | 14.6 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 79 | 1510 | 126 | 62.8% | - | - | - | 1.7 | 79.7 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 37 | 1780 | 148 | 24.9% | - | - | - | 0.6 | 57.3 | 1.1 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 832 | 1897:1792 | 1235+117 | 61.5 : 61.5% | 63 | 8 | 2 | 2.7 | 11.6 | 11.2 |
| 4/1 | | U | - | | - | - | - | 797 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 815 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 118 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 34.6 Total Delay for Signalled Lanes (pcuHr): 8.99 Cycle Time (s): 96

PRC Over All Lanes (%): 34.6 Total Delay Over All Lanes(pcuHr): 9.08

Basic Results Summary
**Scenario 14: 'Inter peak hour 2027'** (FG14: 'Interpeak hour 2027', Plan 1: 'Network Control Plan 1')
## Network Layout Diagram



Basic Results Summary

## Network Results

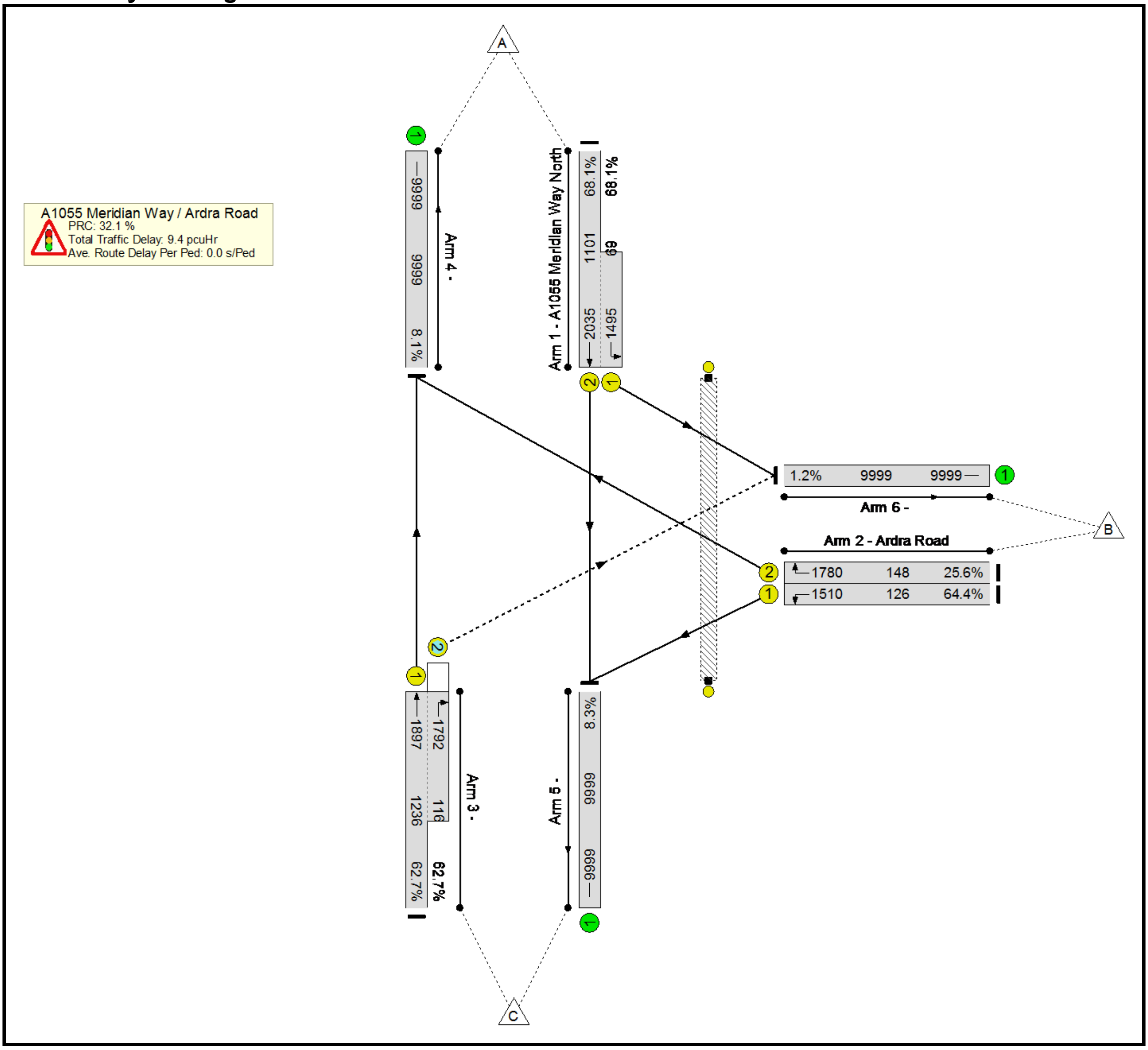
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **68.1%** | **64** | **8** | **2** | **9.4** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **68.1%** | **64** | **8** | **2** | **9.4** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 797 | 2035:1495 | 1101+69 | 68.1 : 68.1% | - | - | - | 4.1 | 18.6 | 15.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 81 | 1510 | 126 | 64.4% | - | - | - | 1.8 | 81.3 | 2.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 38 | 1780 | 148 | 25.6% | - | - | - | 0.6 | 57.5 | 1.1 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 848 | 1897:1792 | 1236+116 | 62.7 : 62.7% | 64 | 8 | 2 | 2.8 | 11.9 | 11.7 |
| 4/1 | | U | - | | - | - | - | 813 | 9999 | 9999 | 8.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 831 | 9999 | 9999 | 8.3% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 120 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 32.1 Total Delay for Signalled Lanes (pcuHr): 9.35 Cycle Time (s): 96
PRC Over All Lanes (%): 32.1 Total Delay Over All Lanes(pcuHr): 9.44

Basic Results Summary

**Scenario 15: 'Inter peak hour 2028'** (FG15: 'Interpeak hour 2028', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **68.1%** | **64** | **8** | **2** | **9.4** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **68.1%** | **64** | **8** | **2** | **9.4** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 797 | 2035:1495 | 1101+69 | 68.1 : 68.1% | - | - | - | 4.1 | 18.6 | 15.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 81 | 1510 | 126 | 64.4% | - | - | - | 1.8 | 81.3 | 2.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 38 | 1780 | 148 | 25.6% | - | - | - | 0.6 | 57.5 | 1.1 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 848 | 1897:1792 | 1236+116 | 62.7 : 62.7% | 64 | 8 | 2 | 2.8 | 11.9 | 11.7 |
| 4/1 | | U | - | | - | - | - | 813 | 9999 | 9999 | 8.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 831 | 9999 | 9999 | 8.3% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 120 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 32.1 Total Delay for Signalled Lanes (pcuHr): 9.35 Cycle Time (s): 96
PRC Over All Lanes (%): 32.1 Total Delay Over All Lanes(pcuHr): 9.44

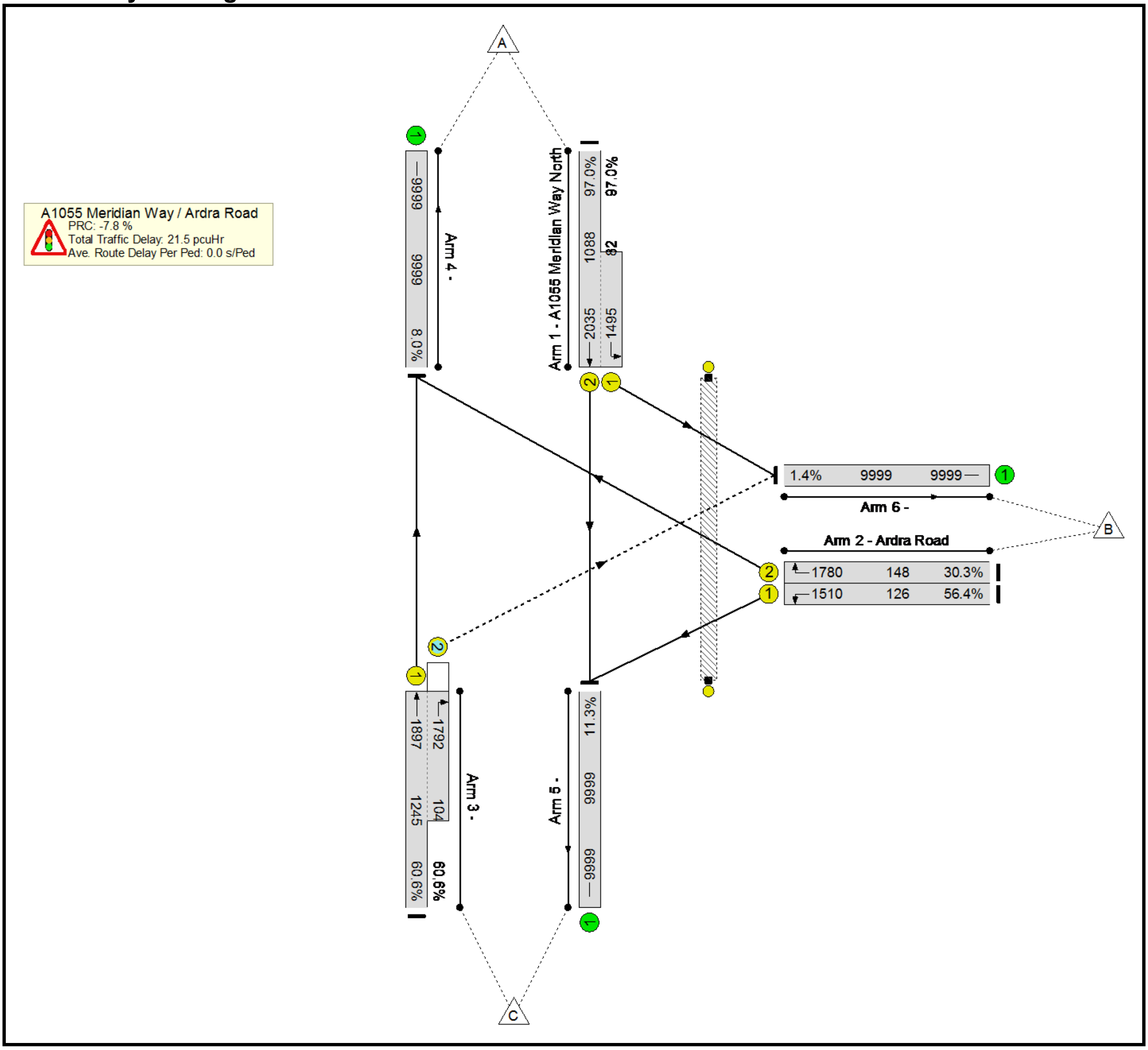
Basic Results Summary
# Basic Results Summary

## User and Project Details

| | |
|---|---|
| **Project:** | **NLHPP** |
| **Title:** | **Meridian Way / Ardra Road** |
| **Location:** | |
| **File name:** | Meridian Way-Ardra Road - Total (1D).lsg3x |
| **Author:** | David McCann |
| **Company:** | Arup |
| **Address:** | London |
| **Notes:** | |

**Scenario 1: 'AM peak hour'** (FG1: 'AM peak hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

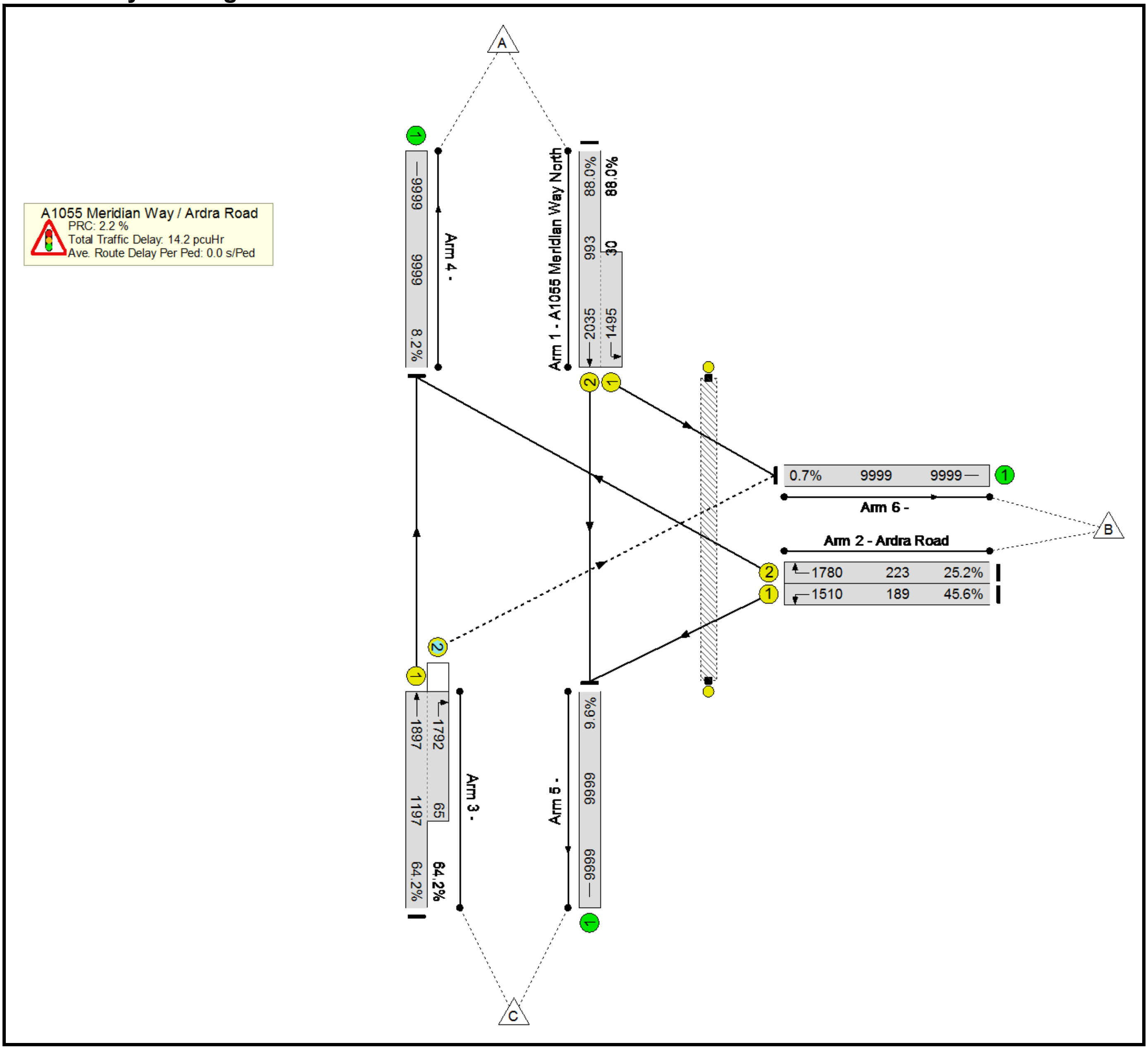
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **97.0%** | **6** | **56** | **1** | **21.5** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **97.0%** | **6** | **56** | **1** | **21.5** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1135 | 2035:1495 | 1088+82 | 97.0 : 97.0% | - | - | - | 16.2 | 51.4 | 38.6 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 71 | 1510 | 126 | 56.4% | - | - | - | 1.5 | 74.4 | 2.4 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 45 | 1780 | 148 | 30.3% | - | - | - | 0.7 | 58.8 | 1.3 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 818 | 1897:1792 | 1245+104 | 60.6 : 60.6% | 6 | 56 | 1 | 3.0 | 13.0 | 11.1 |
| 4/1 | | U | - | | - | - | - | 800 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1126 | 9999 | 9999 | 11.3% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 143 | 9999 | 9999 | 1.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -7.8 Total Delay for Signalled Lanes (pcuHr): 21.36 Cycle Time (s): 96
PRC Over All Lanes (%): -7.8 Total Delay Over All Lanes(pcuHr): 21.48

Basic Results Summary

**Scenario 2: 'PM peak hour'** (FG2: 'PM peak hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

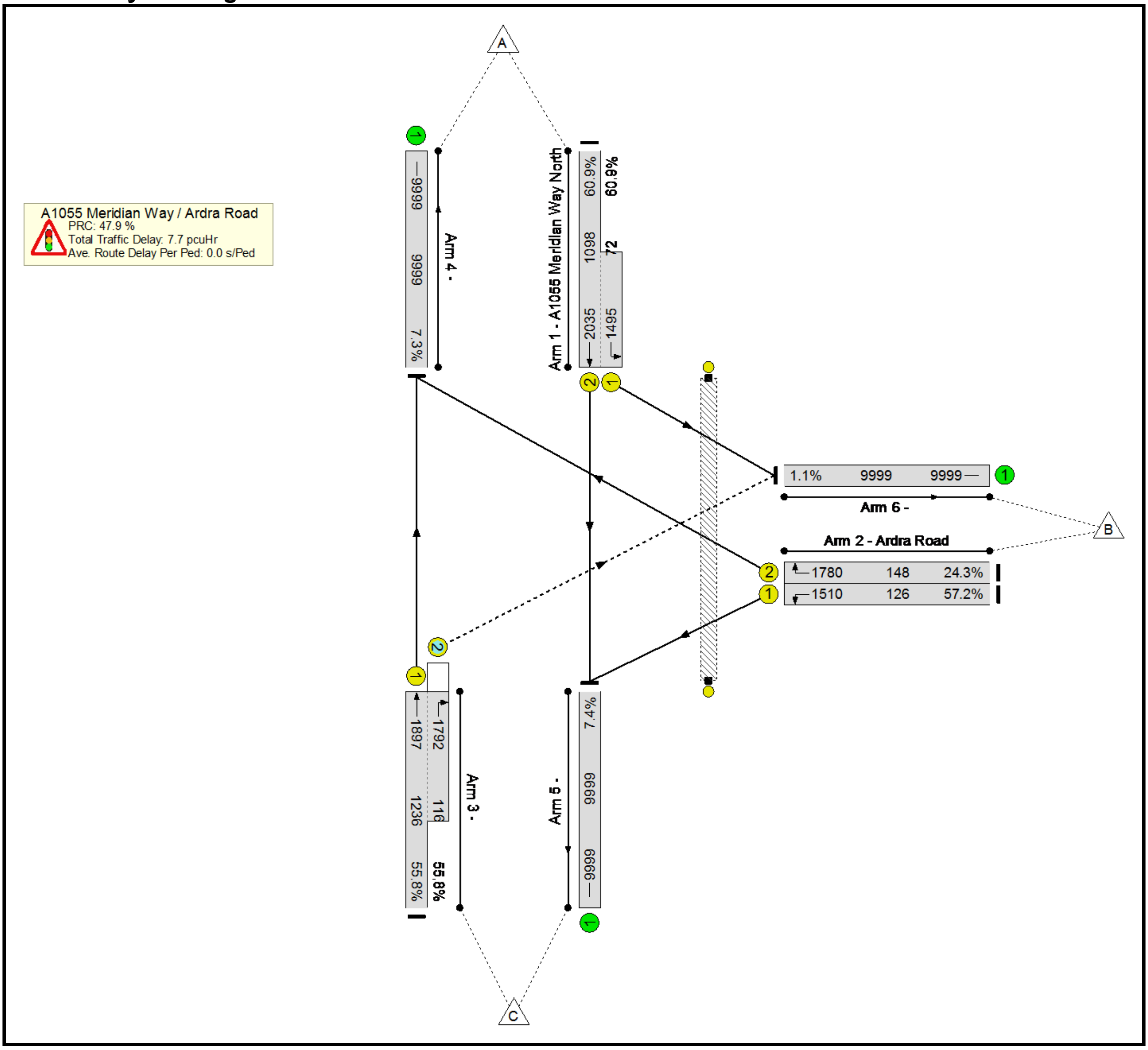
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **88.0%** | **35** | **6** | **1** | **14.2** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **88.0%** | **35** | **6** | **1** | **14.2** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 47 | - | 900 | 2035:1495 | 993+30 | 88.0 : 88.0% | - | - | - | 8.8 | 35.1 | 24.5 |
| 2/1 | Ardra Road Left | U | B | | 1 | 11 | - | 86 | 1510 | 189 | 45.6% | - | - | - | 1.3 | 56.4 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 11 | - | 56 | 1780 | 223 | 25.2% | - | - | - | 0.8 | 48.8 | 1.5 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 62 | - | 810 | 1897:1792 | 1197+65 | 64.2 : 64.2% | 35 | 6 | 1 | 3.3 | 14.5 | 12.8 |
| 4/1 | | U | - | | - | - | - | 824 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 960 | 9999 | 9999 | 9.6% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 68 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 2.2 Total Delay for Signalled Lanes (pcuHr): 14.15 Cycle Time (s): 96
PRC Over All Lanes (%): 2.2 Total Delay Over All Lanes(pcuHr): 14.25

Basic Results Summary

**Scenario 3: 'Inter-peak hour'** (FG3: 'Interpeak Hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



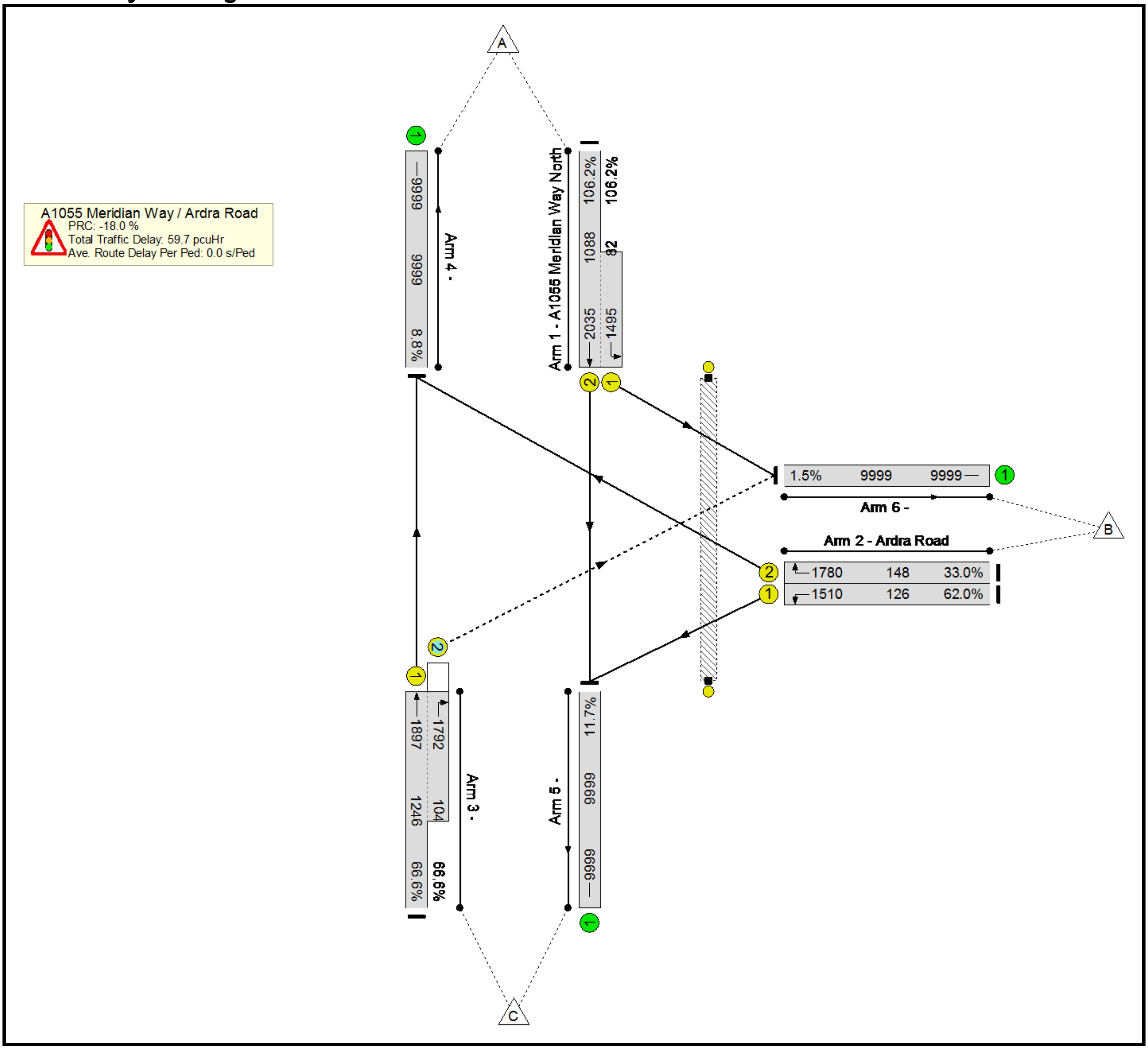
Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **60.9%** | **57** | **7** | **1** | **7.7** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **60.9%** | **57** | **7** | **1** | **7.7** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 712 | 2035:1495 | 1098+72 | 60.9 : 60.9% | - | - | - | 3.3 | 16.8 | 12.3 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 72 | 1510 | 126 | 57.2% | - | - | - | 1.5 | 75.0 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 36 | 1780 | 148 | 24.3% | - | - | - | 0.6 | 57.2 | 1.0 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 755 | 1897:1792 | 1236+116 | 55.8 : 55.8% | 57 | 7 | 1 | 2.2 | 10.6 | 9.3 |
| 4/1 | | U | - | | - | - | - | 726 | 9999 | 9999 | 7.3% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 740 | 9999 | 9999 | 7.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 109 | 9999 | 9999 | 1.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 47.9 Total Delay for Signalled Lanes (pcuHr): 7.61 Cycle Time (s): 96
PRC Over All Lanes (%): 47.9 Total Delay Over All Lanes(pcuHr): 7.70

Basic Results Summary
**Scenario 4: 'AM peak hour 2024'** (FG4: 'AM peak hour 2024', Plan 1: 'Network Control Plan 1')
## Network Layout Diagram



Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **106.2%** | **0** | **68** | **1** | **59.7** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **106.2%** | **0** | **68** | **1** | **59.7** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1243 | 2035:1495 | 1088+82 | 106.2 : 106.2% | - | - | - | 53.5 | 155.1 | 80.1 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 78 | 1510 | 126 | 62.0% | - | - | - | 1.7 | 79.0 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 49 | 1780 | 148 | 33.0% | - | - | - | 0.8 | 59.6 | 1.5 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 898 | 1897:1792 | 1246+104 | 66.6 : 66.6% | 0 | 68 | 1 | 3.5 | 14.1 | 13.2 |
| 4/1 | | U | - | | - | - | - | 878 | 9999 | 9999 | 8.8% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1234 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 156 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

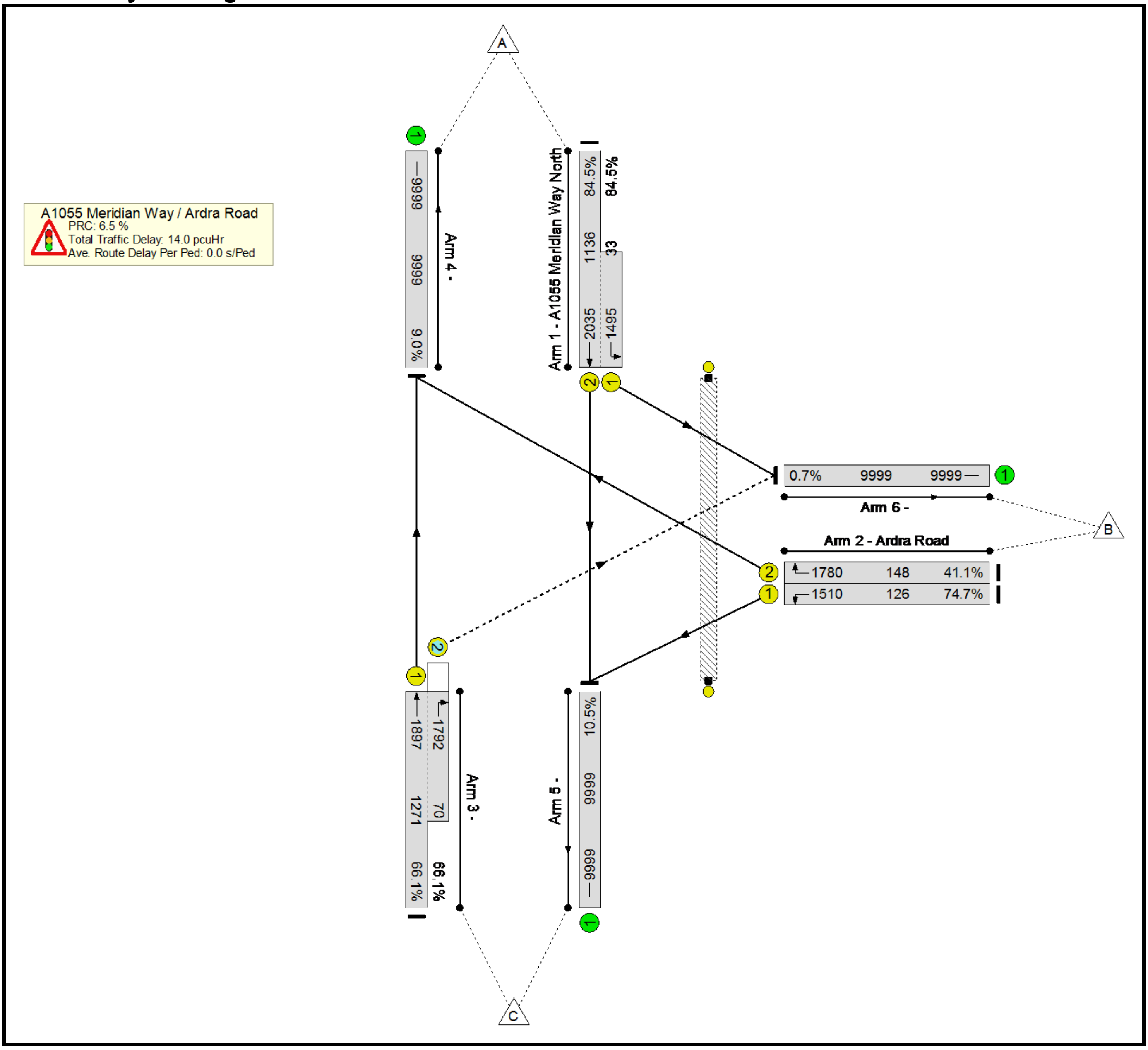
C1 PRC for Signalled Lanes (%): -18.0 Total Delay for Signalled Lanes (pcuHr): 59.59 Cycle Time (s): 96

PRC Over All Lanes (%): -18.0 Total Delay Over All Lanes(pcuHr): 59.71

Basic Results Summary

**Scenario 5: 'PM peak hour 2024'** (FG5: 'PM peak hour 2024', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



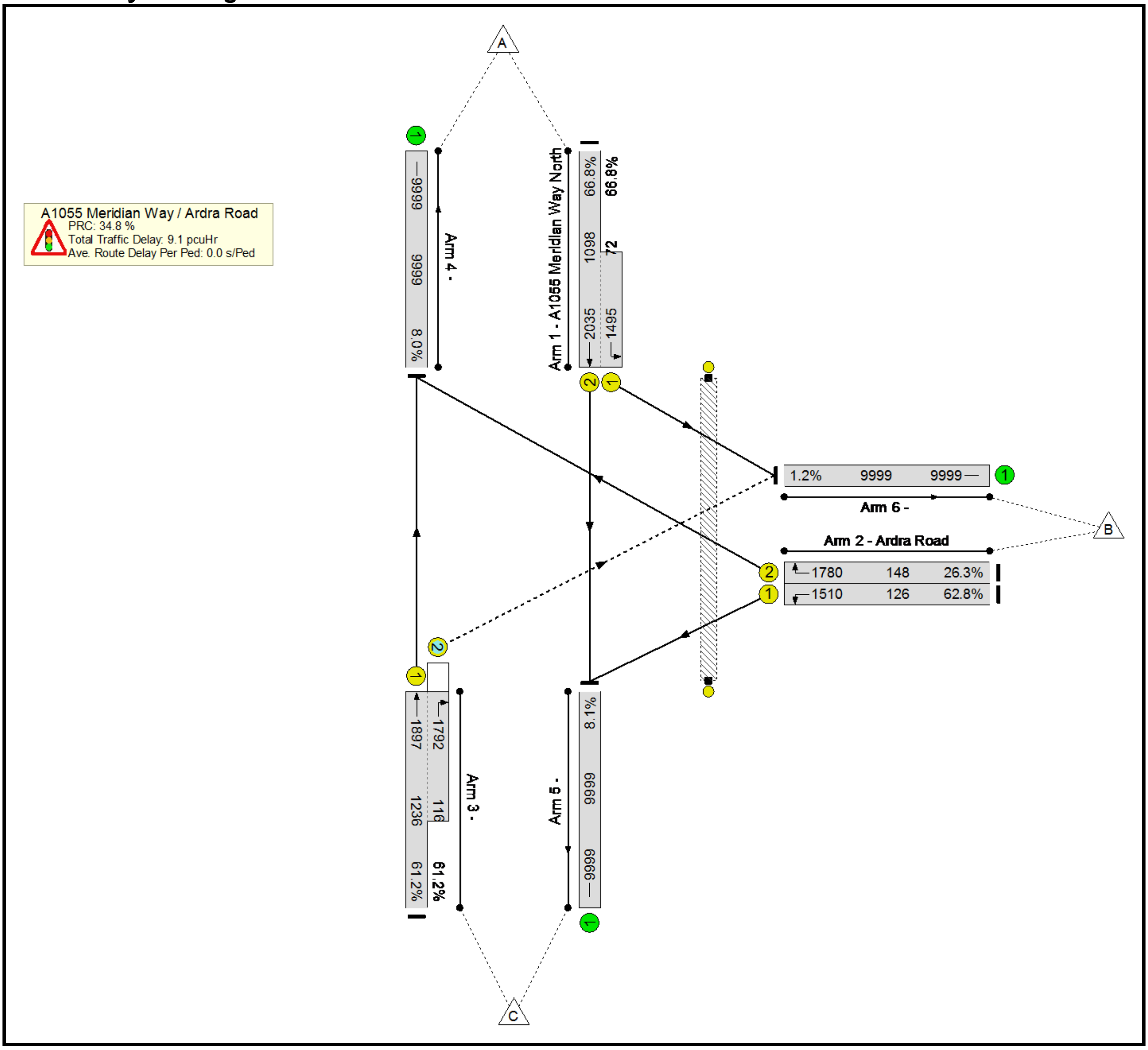
Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **84.5%** | **40** | **5** | **1** | **14.0** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **84.5%** | **40** | **5** | **1** | **14.0** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 988 | 2035:1495 | 1136+33 | 84.5 : 84.5% | - | - | - | 7.2 | 26.3 | 24.1 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 94 | 1510 | 126 | 74.7% | - | - | - | 2.5 | 95.1 | 3.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 61 | 1780 | 148 | 41.1% | - | - | - | 1.1 | 62.2 | 1.9 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 887 | 1897:1792 | 1271+70 | 66.1 : 66.1% | 40 | 5 | 1 | 3.2 | 12.8 | 13.4 |
| 4/1 | | U | - | | - | - | - | 902 | 9999 | 9999 | 9.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1054 | 9999 | 9999 | 10.5% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 74 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 6.5 Total Delay for Signalled Lanes (pcuHr): 13.93 Cycle Time (s): 96
PRC Over All Lanes (%): 6.5 Total Delay Over All Lanes(pcuHr): 14.04

Basic Results Summary
**Scenario 6: 'Inter peak hour 2024'** (FG6: 'Interpeak hour 2024', Plan 1: 'Network Control Plan 1')
## Network Layout Diagram



Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **66.8%** | **62** | **7** | **1** | **9.1** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **66.8%** | **62** | **7** | **1** | **9.1** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 781 | 2035:1495 | 1098+72 | 66.8 : 66.8% | - | - | - | 3.9 | 18.2 | 14.6 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 79 | 1510 | 126 | 62.8% | - | - | - | 1.7 | 79.7 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 39 | 1780 | 148 | 26.3% | - | - | - | 0.6 | 57.7 | 1.1 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 827 | 1897:1792 | 1236+116 | 61.2 : 61.2% | 62 | 7 | 1 | 2.7 | 11.6 | 11.2 |
| 4/1 | | U | - | | - | - | - | 795 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 812 | 9999 | 9999 | 8.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 119 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 34.8 Total Delay for Signalled Lanes (pcuHr): 8.98 Cycle Time (s): 96
PRC Over All Lanes (%): 34.8 Total Delay Over All Lanes(pcuHr): 9.07

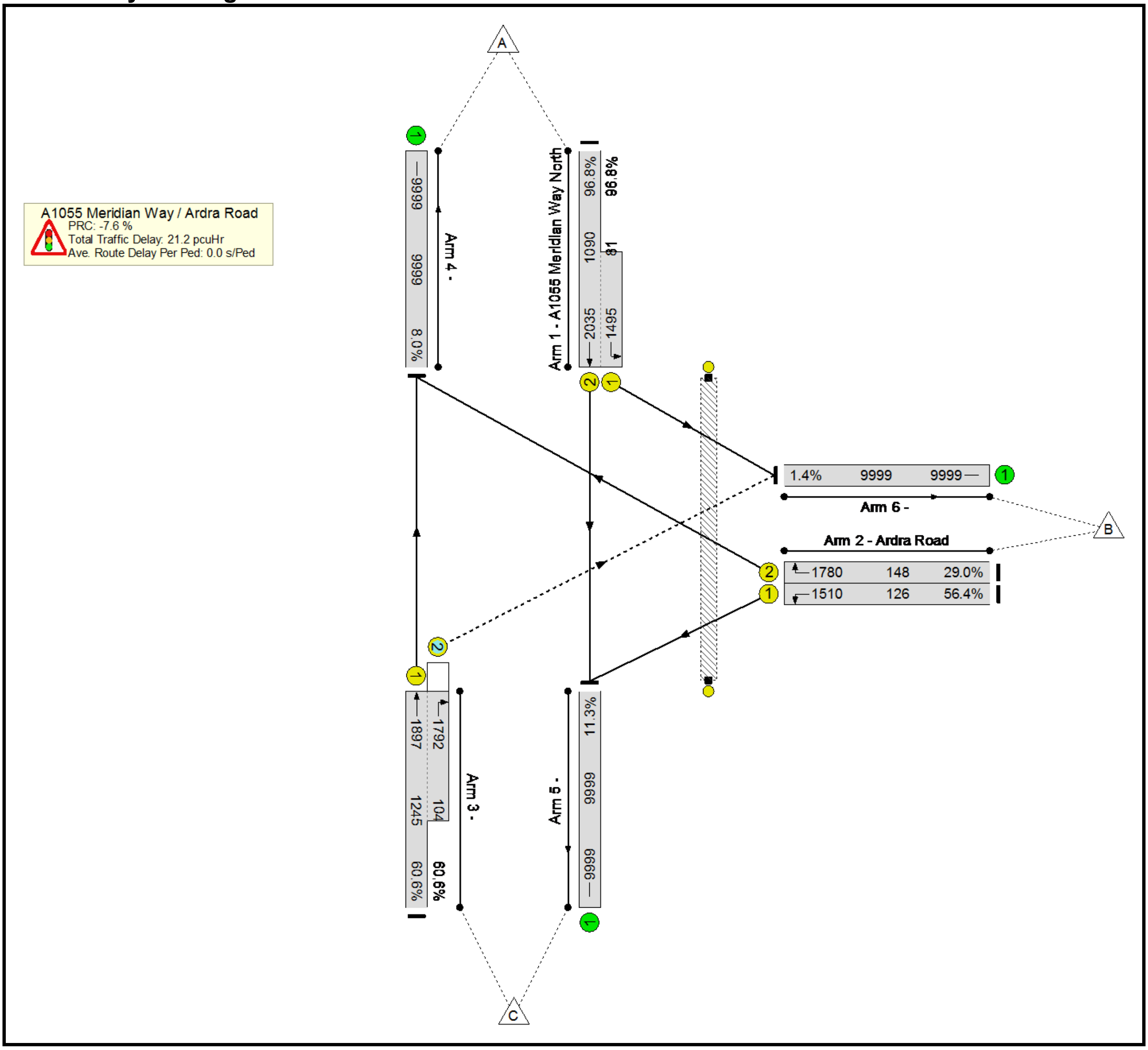
Basic Results Summary
# Basic Results Summary

## User and Project Details

| | |
|---|---|
| **Project:** | **NLHPP** |
| **Title:** | **Meridian Way / Ardra Road** |
| **Location:** | |
| **File name:** | Meridian Way-Ardra Road - Total.lsg3x |
| **Author:** | David McCann |
| **Company:** | Arup |
| **Address:** | London |
| **Notes:** | |

**Scenario 1: 'AM peak hour'** (FG1: 'AM peak hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

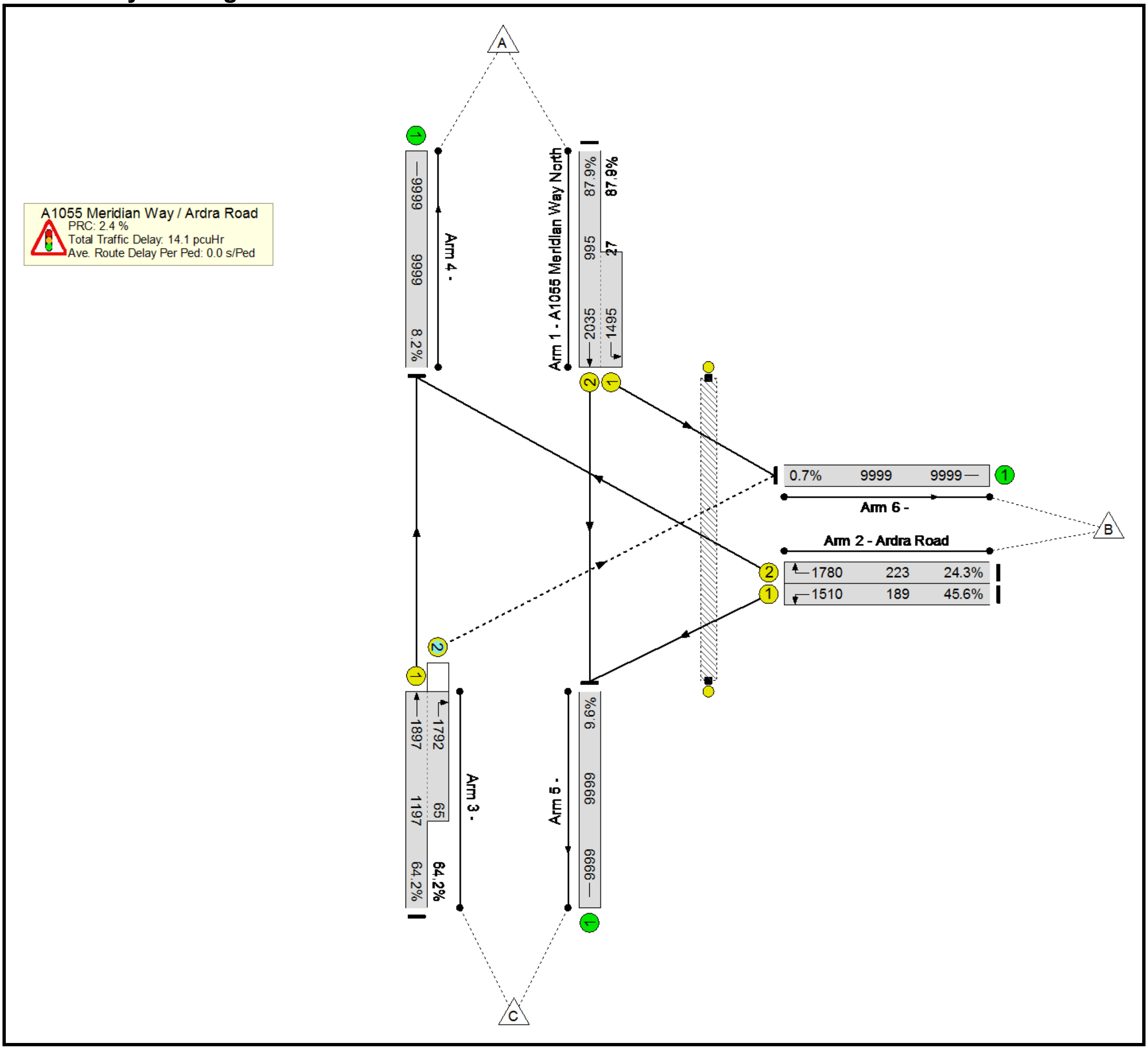
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **96.8%** | **6** | **56** | **1** | **21.2** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **96.8%** | **6** | **56** | **1** | **21.2** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1133 | 2035:1495 | 1090+81 | 96.8 : 96.8% | - | - | - | 15.9 | 50.6 | 38.0 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 71 | 1510 | 126 | 56.4% | - | - | - | 1.5 | 74.4 | 2.4 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 43 | 1780 | 148 | 29.0% | - | - | - | 0.7 | 58.4 | 1.3 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 818 | 1897:1792 | 1245+104 | 60.6 : 60.6% | 6 | 56 | 1 | 3.0 | 13.0 | 11.1 |
| 4/1 | | U | - | | - | - | - | 798 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1126 | 9999 | 9999 | 11.3% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 141 | 9999 | 9999 | 1.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -7.6 Total Delay for Signalled Lanes (pcuHr): 21.04 Cycle Time (s): 96
PRC Over All Lanes (%): -7.6 Total Delay Over All Lanes(pcuHr): 21.15

Basic Results Summary

**Scenario 2: 'PM peak hour'** (FG2: 'PM peak hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

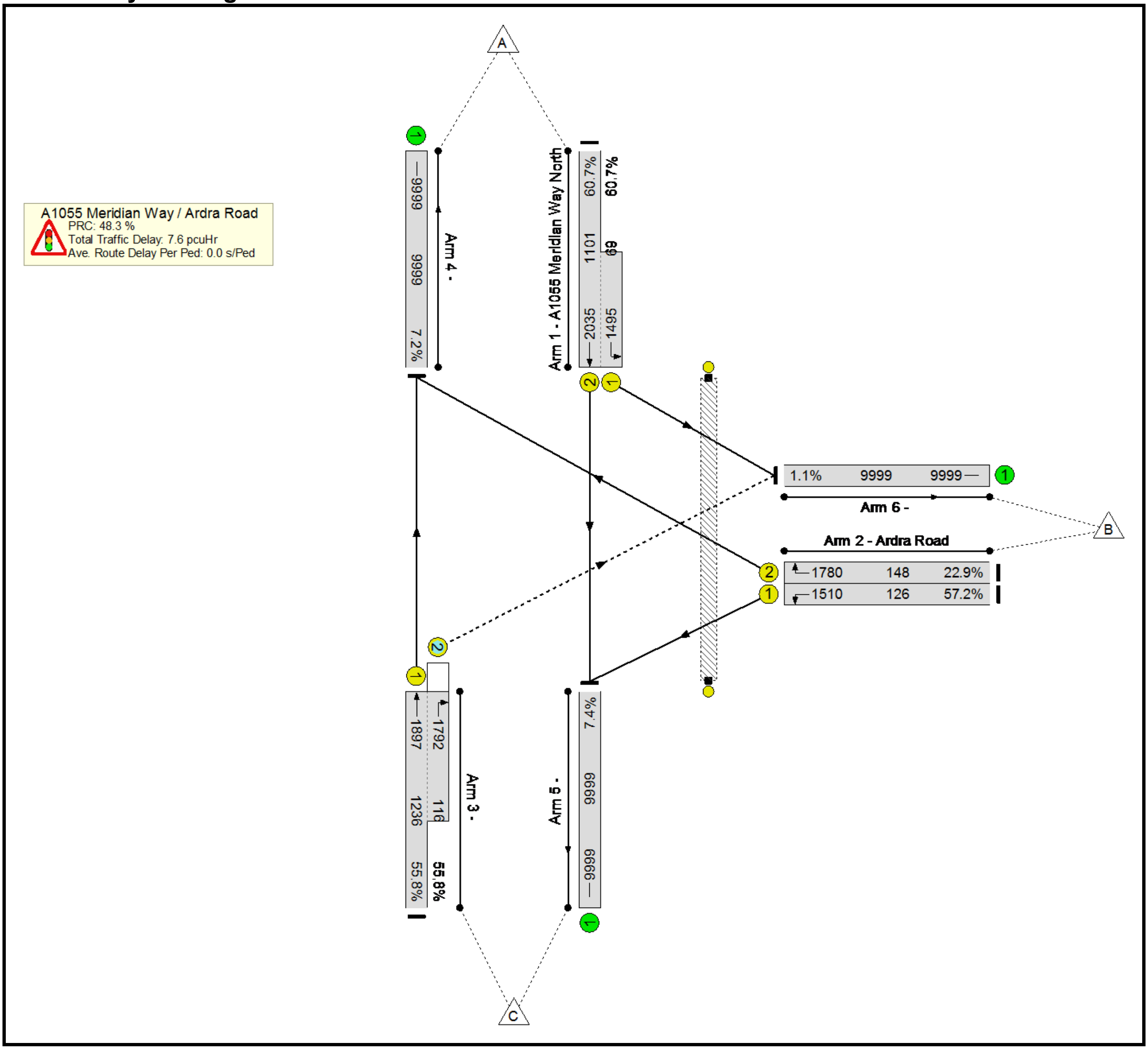
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **87.9%** | **35** | **6** | **1** | **14.1** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **87.9%** | **35** | **6** | **1** | **14.1** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 47 | - | 898 | 2035:1495 | 995+27 | 87.9 : 87.9% | - | - | - | 8.7 | 34.9 | 24.4 |
| 2/1 | Ardra Road Left | U | B | | 1 | 11 | - | 86 | 1510 | 189 | 45.6% | - | - | - | 1.3 | 56.4 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 11 | - | 54 | 1780 | 223 | 24.3% | - | - | - | 0.7 | 48.6 | 1.4 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 62 | - | 810 | 1897:1792 | 1197+65 | 64.2 : 64.2% | 35 | 6 | 1 | 3.3 | 14.5 | 12.8 |
| 4/1 | | U | - | | - | - | - | 822 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 960 | 9999 | 9999 | 9.6% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 66 | 9999 | 9999 | 0.7% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 2.4 Total Delay for Signalled Lanes (pcuHr): 14.05 Cycle Time (s): 96
PRC Over All Lanes (%): 2.4 Total Delay Over All Lanes(pcuHr): 14.15

Basic Results Summary

**Scenario 3: 'Inter-peak hour'** (FG3: 'Interpeak Hour', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

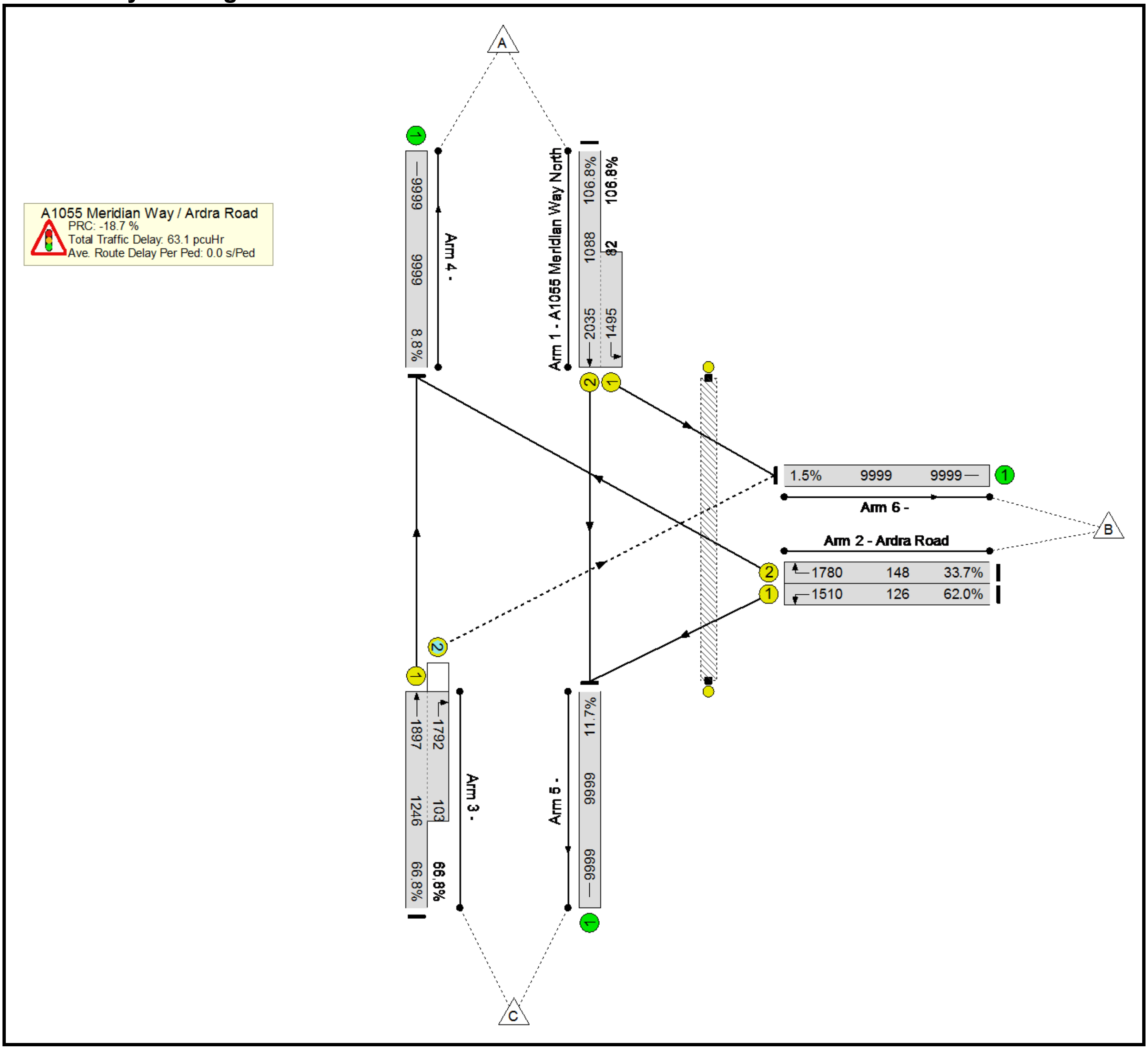
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **60.7%** | **57** | **7** | **1** | **7.6** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **60.7%** | **57** | **7** | **1** | **7.6** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 710 | 2035:1495 | 1101+69 | 60.7 : 60.7% | - | - | - | 3.3 | 16.8 | 12.3 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 72 | 1510 | 126 | 57.2% | - | - | - | 1.5 | 75.0 | 2.5 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 34 | 1780 | 148 | 22.9% | - | - | - | 0.5 | 56.9 | 1.0 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 755 | 1897:1792 | 1236+116 | 55.8 : 55.8% | 57 | 7 | 1 | 2.2 | 10.6 | 9.3 |
| 4/1 | | U | - | | - | - | - | 724 | 9999 | 9999 | 7.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 740 | 9999 | 9999 | 7.4% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 107 | 9999 | 9999 | 1.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 48.3 Total Delay for Signalled Lanes (pcuHr): 7.56 Cycle Time (s): 96
PRC Over All Lanes (%): 48.3 Total Delay Over All Lanes(pcuHr): 7.65

Basic Results Summary

**Scenario 4: 'AM peak hour 2025'** (FG4: 'AM peak hour 2025', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary
## Network Results

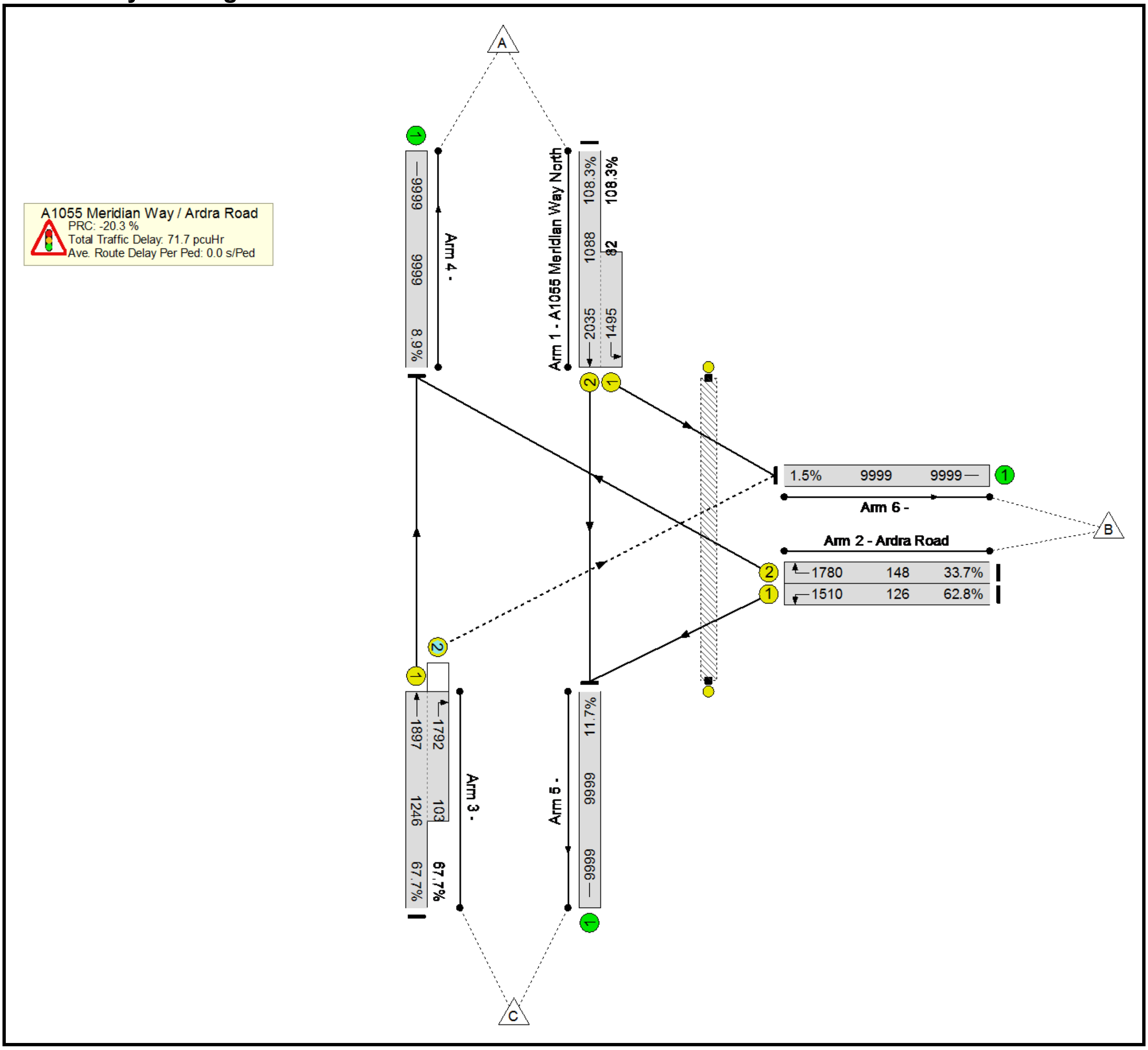
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **106.8%** | **0** | **68** | **1** | **63.1** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **106.8%** | **0** | **68** | **1** | **63.1** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1250 | 2035:1495 | 1088+82 | 106.8 : 106.8% | - | - | - | 56.9 | 164.0 | 83.5 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 78 | 1510 | 126 | 62.0% | - | - | - | 1.7 | 79.0 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 50 | 1780 | 148 | 33.7% | - | - | - | 0.8 | 59.8 | 1.5 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 901 | 1897:1792 | 1246+103 | 66.8 : 66.8% | 0 | 68 | 1 | 3.5 | 14.2 | 13.5 |
| 4/1 | | U | - | | - | - | - | 882 | 9999 | 9999 | 8.8% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1240 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 157 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -18.7 Total Delay for Signalled Lanes (pcuHr): 63.02 Cycle Time (s): 96
PRC Over All Lanes (%): -18.7 Total Delay Over All Lanes(pcuHr): 63.15

Basic Results Summary

**Scenario 5: 'AM peak hour 2027'** (FG5: 'AM peak hour 2027', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

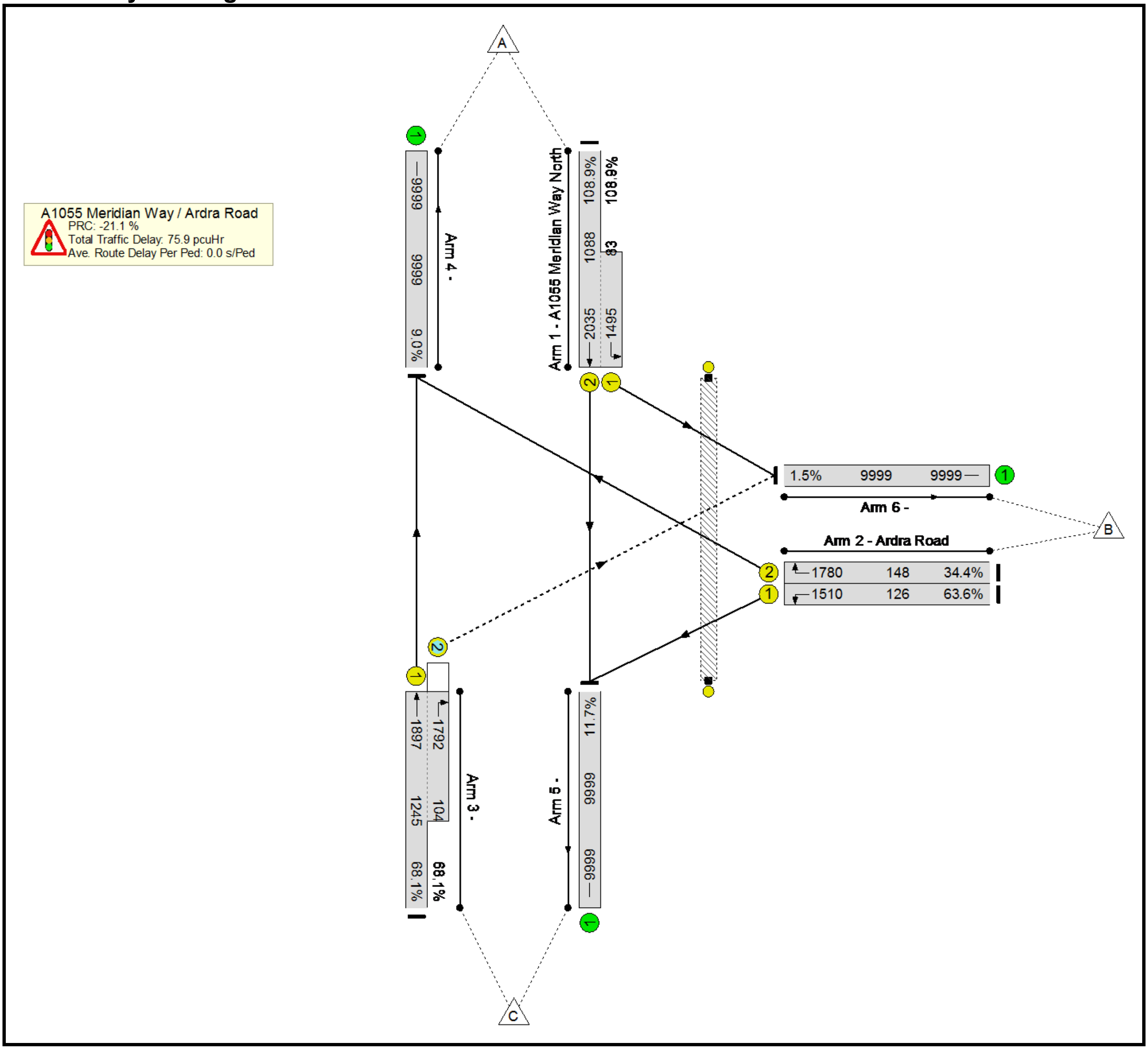
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **108.3%** | **0** | **69** | **1** | **71.7** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **108.3%** | **0** | **69** | **1** | **71.7** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1267 | 2035:1495 | 1088+82 | 108.3 : 108.3% | - | - | - | 65.4 | 185.8 | 92.1 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 79 | 1510 | 126 | 62.8% | - | - | - | 1.7 | 79.7 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 50 | 1780 | 148 | 33.7% | - | - | - | 0.8 | 59.8 | 1.5 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 913 | 1897:1792 | 1246+103 | 67.7 : 67.7% | 0 | 69 | 1 | 3.6 | 14.3 | 13.8 |
| 4/1 | | U | - | | - | - | - | 893 | 9999 | 9999 | 8.9% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1257 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 159 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -20.3 Total Delay for Signalled Lanes (pcuHr): 71.62 Cycle Time (s): 96
PRC Over All Lanes (%): -20.3 Total Delay Over All Lanes(pcuHr): 71.75

Basic Results Summary

**Scenario 6: 'AM peak hour 2028'** (FG6: 'AM peak hour 2028', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

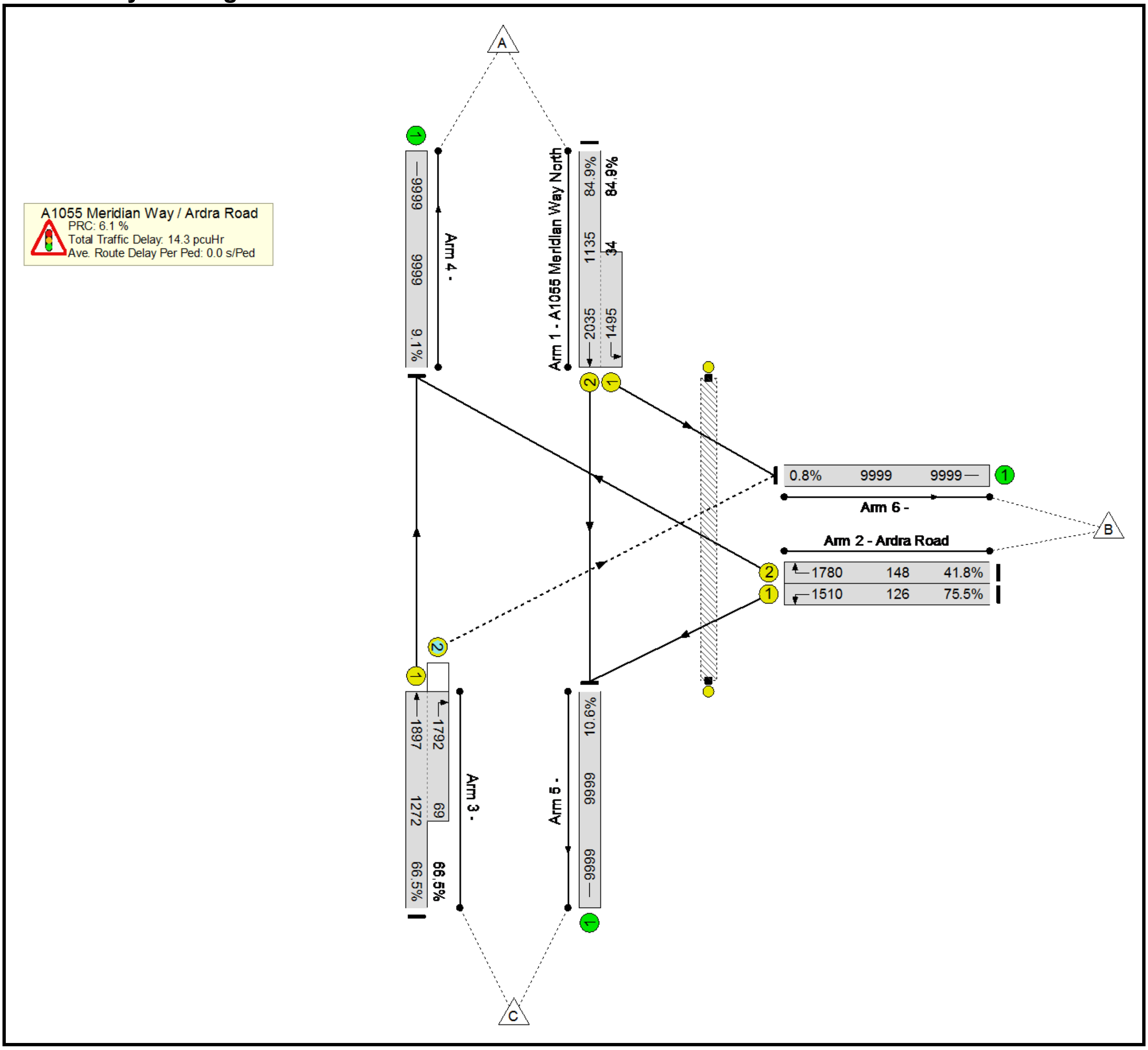
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **108.9%** | **0** | **70** | **1** | **75.9** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **108.9%** | **0** | **70** | **1** | **75.9** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1275 | 2035:1495 | 1088+83 | 108.9 : 108.9% | - | - | - | 69.4 | 196.1 | 96.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 80 | 1510 | 126 | 63.6% | - | - | - | 1.8 | 80.5 | 2.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 51 | 1780 | 148 | 34.4% | - | - | - | 0.8 | 60.0 | 1.5 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 919 | 1897:1792 | 1245+104 | 68.1 : 68.1% | 0 | 70 | 1 | 3.7 | 14.5 | 13.9 |
| 4/1 | | U | - | | - | - | - | 899 | 9999 | 9999 | 9.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1265 | 9999 | 9999 | 11.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 161 | 9999 | 9999 | 1.5% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): -21.1 Total Delay for Signalled Lanes (pcuHr): 75.78 Cycle Time (s): 96
PRC Over All Lanes (%): -21.1 Total Delay Over All Lanes(pcuHr): 75.90

Basic Results Summary

**Scenario 7: 'PM peak hour 2025'** (FG7: 'PM peak hour 2025', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

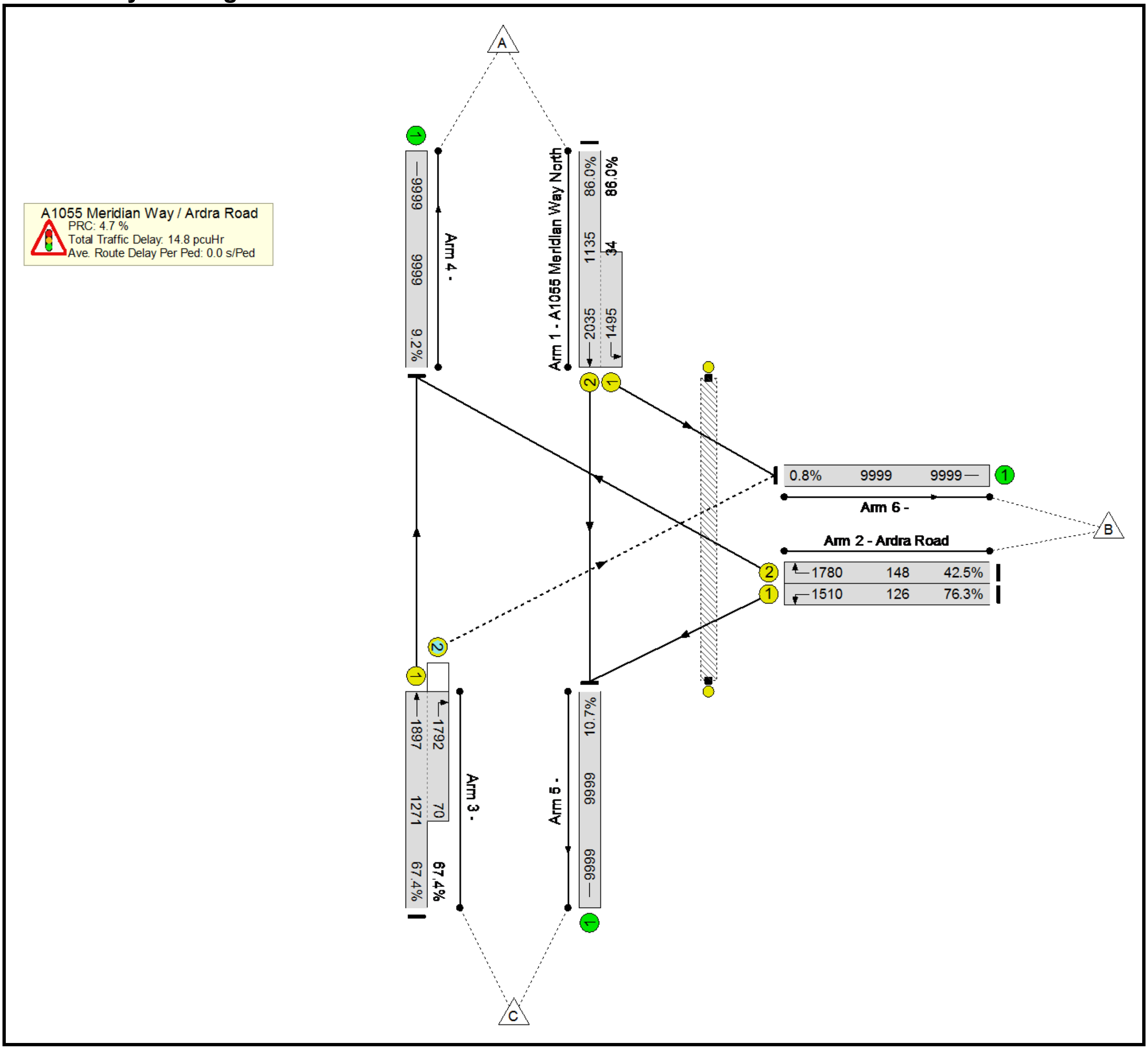
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **84.9%** | **40** | **5** | **1** | **14.3** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **84.9%** | **40** | **5** | **1** | **14.3** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 992 | 2035:1495 | 1135+34 | 84.9 : 84.9% | - | - | - | 7.3 | 26.6 | 24.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 95 | 1510 | 126 | 75.5% | - | - | - | 2.5 | 96.5 | 3.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 62 | 1780 | 148 | 41.8% | - | - | - | 1.1 | 62.5 | 1.9 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 892 | 1897:1792 | 1272+69 | 66.5 : 66.5% | 40 | 5 | 1 | 3.2 | 12.9 | 13.5 |
| 4/1 | | U | - | | - | - | - | 908 | 9999 | 9999 | 9.1% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 1058 | 9999 | 9999 | 10.6% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 75 | 9999 | 9999 | 0.8% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 6.1 Total Delay for Signalled Lanes (pcuHr): 14.16 Cycle Time (s): 96
PRC Over All Lanes (%): 6.1 Total Delay Over All Lanes(pcuHr): 14.28

Basic Results Summary

**Scenario 8: 'PM peak hour 2027'** (FG8: 'PM peak hour 2027', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

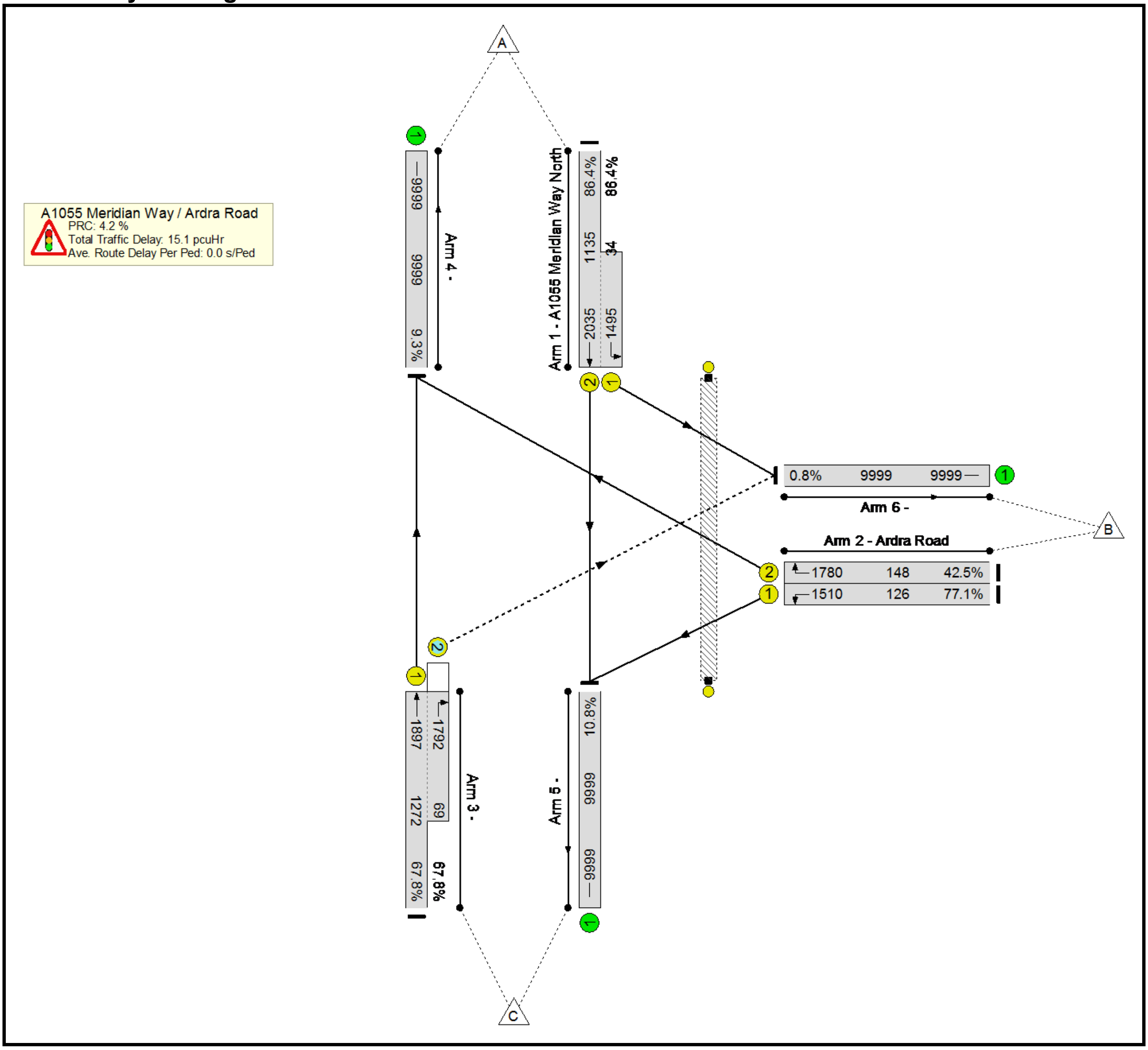
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **86.0%** | **41** | **5** | **1** | **14.8** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **86.0%** | **41** | **5** | **1** | **14.8** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1005 | 2035:1495 | 1135+34 | 86.0 : 86.0% | - | - | - | 7.7 | 27.6 | 25.1 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 96 | 1510 | 126 | 76.3% | - | - | - | 2.6 | 98.0 | 3.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 63 | 1780 | 148 | 42.5% | - | - | - | 1.1 | 62.8 | 2.0 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 904 | 1897:1792 | 1271+70 | 67.4 : 67.4% | 41 | 5 | 1 | 3.3 | 13.2 | 14.0 |
| 4/1 | | U | - | | - | - | - | 920 | 9999 | 9999 | 9.2% | - | - | - | 0.1 | 0.2 | 0.1 |
| 5/1 | | U | - | | - | - | - | 1072 | 9999 | 9999 | 10.7% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 76 | 9999 | 9999 | 0.8% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 4.7 Total Delay for Signalled Lanes (pcuHr): 14.72 Cycle Time (s): 96
PRC Over All Lanes (%): 4.7 Total Delay Over All Lanes(pcuHr): 14.83

Basic Results Summary

**Scenario 9: 'PM peak hour 2028'** (FG9: 'PM peak hour 2028', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

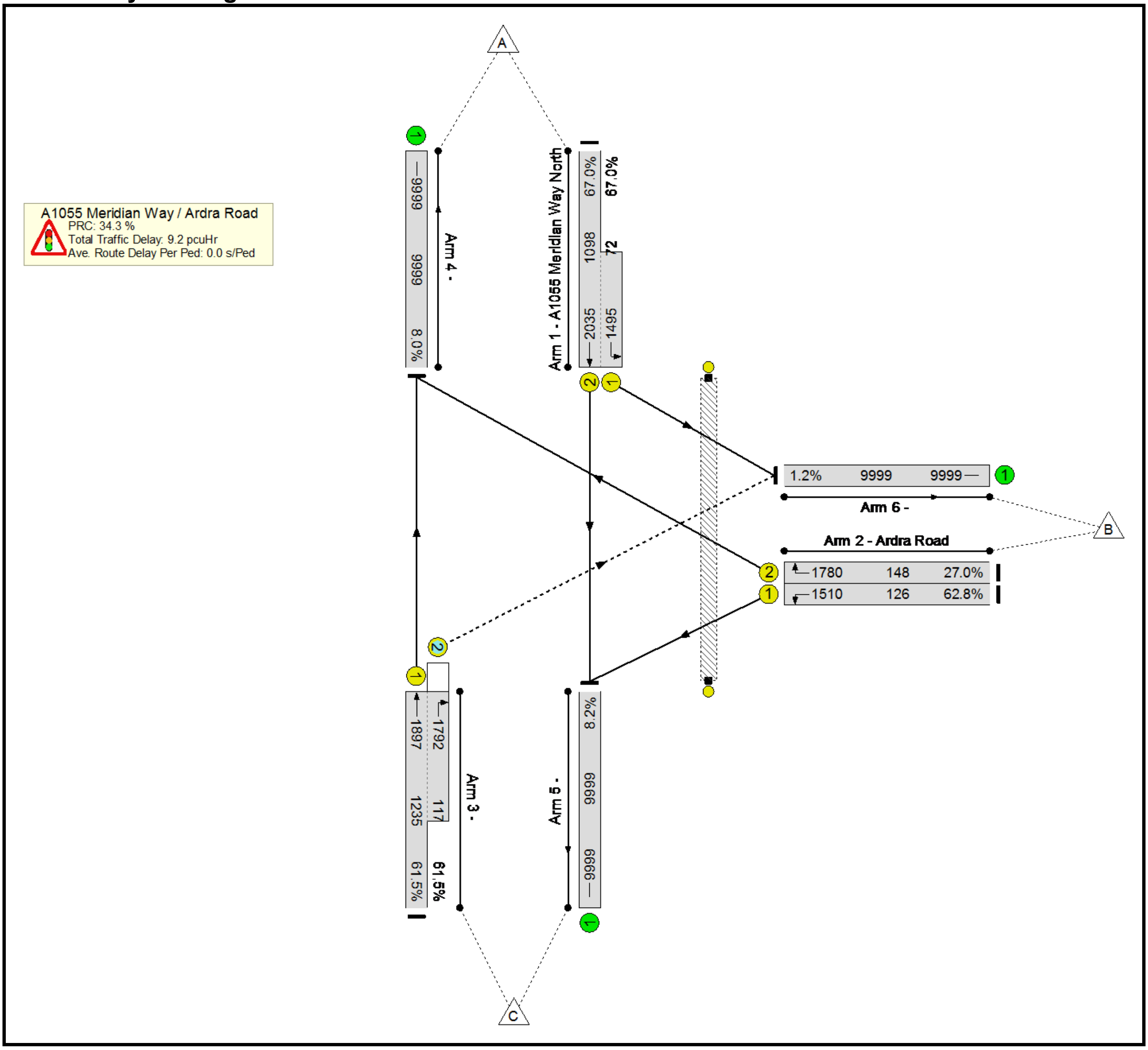
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **86.4%** | **41** | **5** | **1** | **15.1** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **86.4%** | **41** | **5** | **1** | **15.1** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 1010 | 2035:1495 | 1135+34 | 86.4 : 86.4% | - | - | - | 7.8 | 27.9 | 25.3 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 97 | 1510 | 126 | 77.1% | - | - | - | 2.7 | 99.6 | 4.1 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 63 | 1780 | 148 | 42.5% | - | - | - | 1.1 | 62.8 | 2.0 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 909 | 1897:1792 | 1272+69 | 67.8 : 67.8% | 41 | 5 | 1 | 3.4 | 13.3 | 14.1 |
| 4/1 | | U | - | | - | - | - | 925 | 9999 | 9999 | 9.3% | - | - | - | 0.1 | 0.2 | 0.1 |
| 5/1 | | U | - | | - | - | - | 1078 | 9999 | 9999 | 10.8% | - | - | - | 0.1 | 0.2 | 0.1 |
| 6/1 | | U | - | | - | - | - | 76 | 9999 | 9999 | 0.8% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 4.2 Total Delay for Signalled Lanes (pcuHr): 14.98 Cycle Time (s): 96
PRC Over All Lanes (%): 4.2 Total Delay Over All Lanes(pcuHr): 15.09

Basic Results Summary

**Scenario 10: 'Inter peak hour 2025'** (FG10: 'Interpeak hour 2025', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

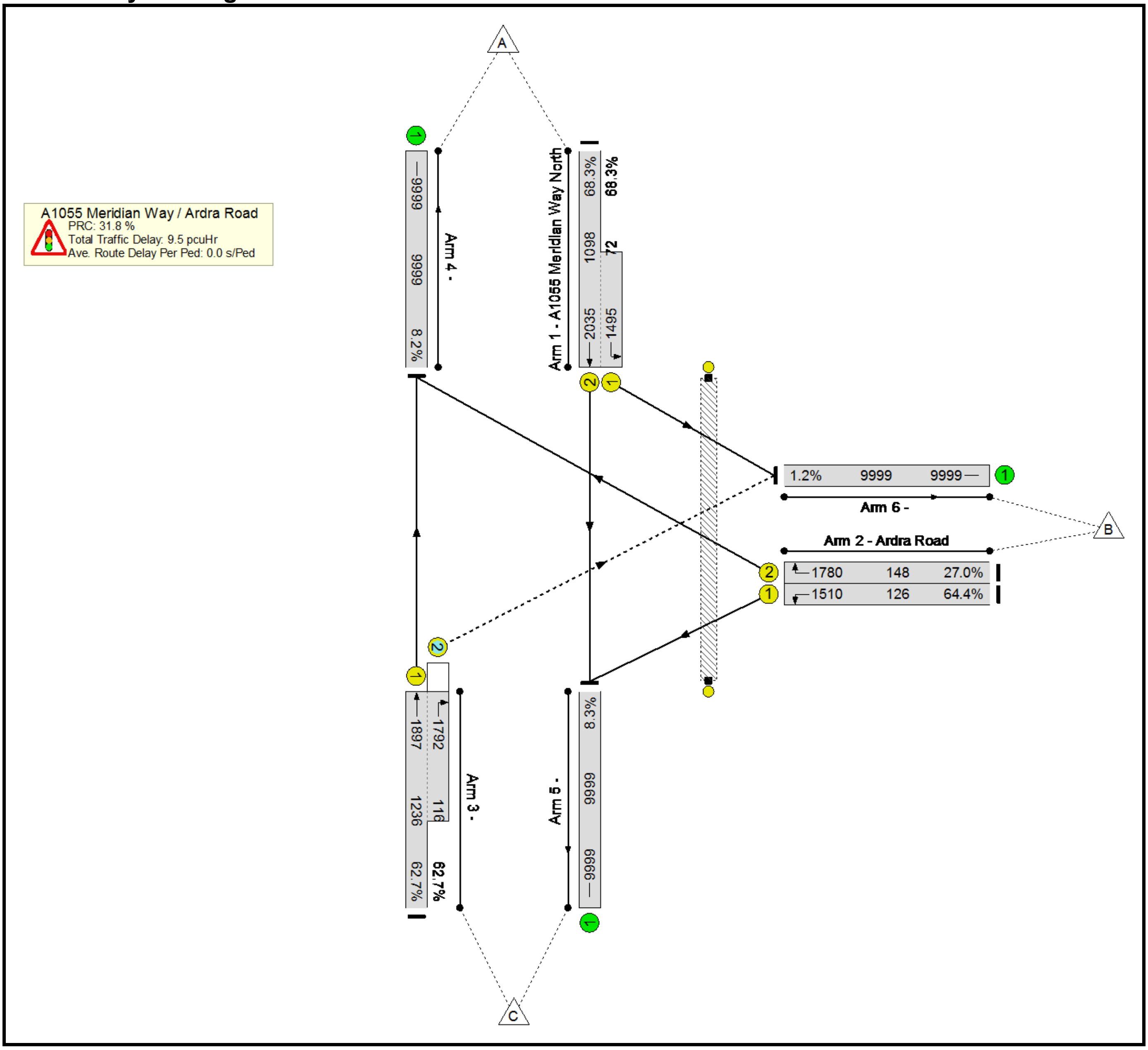
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **67.0%** | **63** | **8** | **2** | **9.2** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **67.0%** | **63** | **8** | **2** | **9.2** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 784 | 2035:1495 | 1098+72 | 67.0 : 67.0% | - | - | - | 4.0 | 18.3 | 14.6 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 79 | 1510 | 126 | 62.8% | - | - | - | 1.7 | 79.7 | 2.8 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 40 | 1780 | 148 | 27.0% | - | - | - | 0.6 | 57.8 | 1.2 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 832 | 1897:1792 | 1235+117 | 61.5 : 61.5% | 63 | 8 | 2 | 2.7 | 11.6 | 11.2 |
| 4/1 | | U | - | | - | - | - | 800 | 9999 | 9999 | 8.0% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 815 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 120 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 34.3 Total Delay for Signalled Lanes (pcuHr): 9.06 Cycle Time (s): 96
PRC Over All Lanes (%): 34.3 Total Delay Over All Lanes(pcuHr): 9.16

Basic Results Summary

**Scenario 11: 'Inter peak hour 2027'** (FG11: 'Interpeak hour 2027', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary
## Network Results

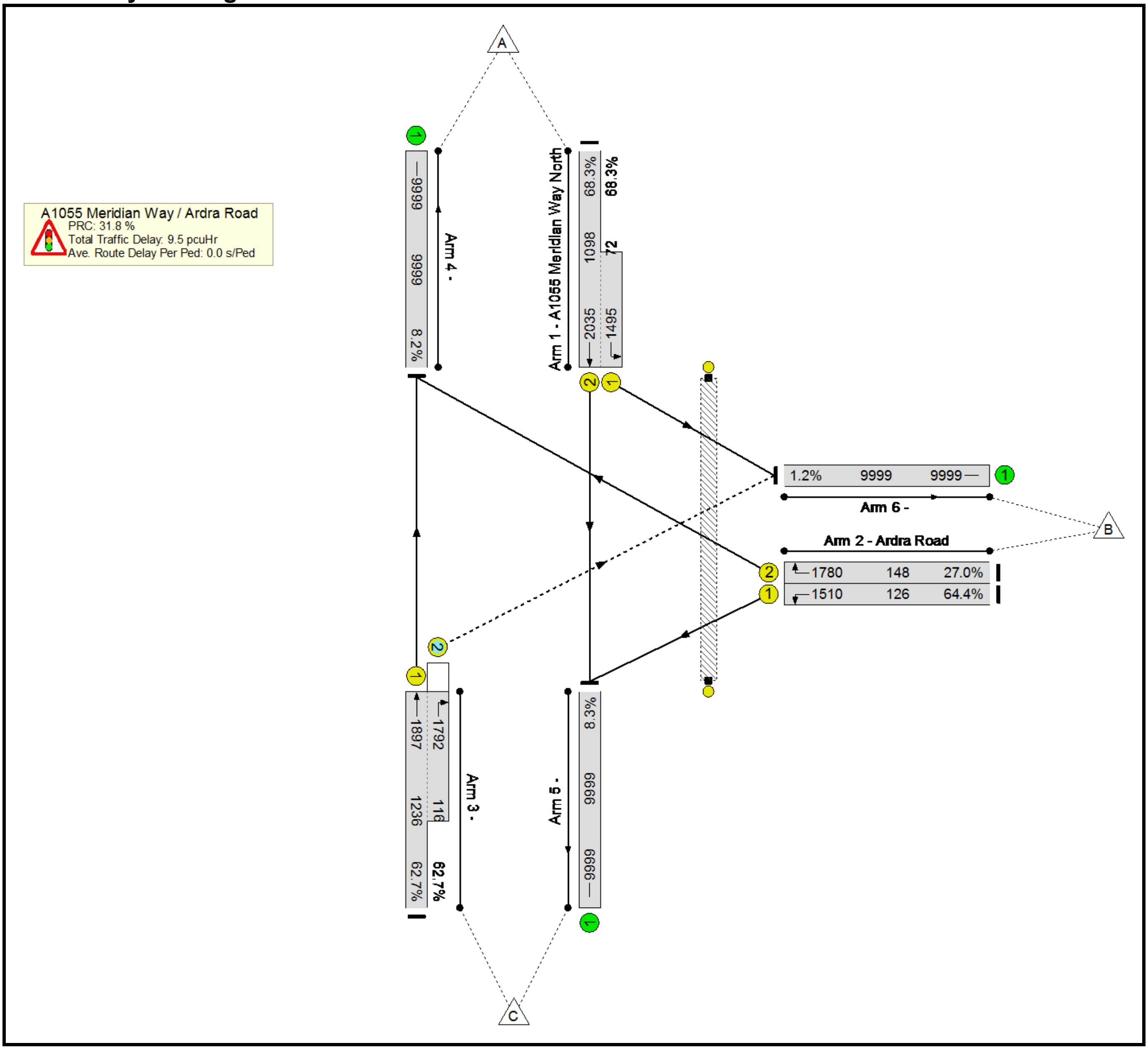
| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **68.3%** | **64** | **8** | **2** | **9.5** | **-** | **-** |
| **A1055 Meridian Way / Ardra Road** | **-** | **-** | **-** | | **-** | **-** | **-** | **-** | **-** | **-** | **68.3%** | **64** | **8** | **2** | **9.5** | **-** | **-** |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 799 | 2035:1495 | 1098+72 | 68.3 : 68.3% | - | - | - | 4.1 | 18.6 | 15.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 81 | 1510 | 126 | 64.4% | - | - | - | 1.8 | 81.3 | 2.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 40 | 1780 | 148 | 27.0% | - | - | - | 0.6 | 57.8 | 1.2 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 848 | 1897:1792 | 1236+116 | 62.7 : 62.7% | 64 | 8 | 2 | 2.8 | 11.9 | 11.7 |
| 4/1 | | U | - | | - | - | - | 815 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 831 | 9999 | 9999 | 8.3% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 122 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 31.8 Total Delay for Signalled Lanes (pcuHr): 9.40 Cycle Time (s): 96
PRC Over All Lanes (%): 31.8 Total Delay Over All Lanes(pcuHr): 9.50

Basic Results Summary

**Scenario 12: 'Inter peak hour 2028'** (FG12: 'Interpeak hour 2028', Plan 1: 'Network Control Plan 1')

## Network Layout Diagram



Basic Results Summary

## Network Results

| Item | Lane Description | Lane Type | Full Phase | Arrow Phase | Num Greens | Total Green (s) | Arrow Green (s) | Demand Flow (pcu) | Sat Flow (pcu/Hr) | Capacity (pcu) | Deg Sat (%) | Turners In Gaps (pcu) | Turners When Unopposed (pcu) | Turners In Intergreen (pcu) | Total Delay (pcuHr) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Network: Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **68.3%** | **64** | **8** | **2** | **9.5** | - | - |
| **A1055 Meridian Way / Ardra Road** | - | - | - | | - | - | - | - | - | - | **68.3%** | **64** | **8** | **2** | **9.5** | - | - |
| 1/2+1/1 | A1055 Meridian Way North Ahead Left | U | A | | 1 | 54 | - | 799 | 2035:1495 | 1098+72 | 68.3 : 68.3% | - | - | - | 4.1 | 18.6 | 15.2 |
| 2/1 | Ardra Road Left | U | B | | 1 | 7 | - | 81 | 1510 | 126 | 64.4% | - | - | - | 1.8 | 81.3 | 2.9 |
| 2/2 | Ardra Road Right | U | B | | 1 | 7 | - | 40 | 1780 | 148 | 27.0% | - | - | - | 0.6 | 57.8 | 1.2 |
| 3/1+3/2 | Ahead Right | U+O | C | | 1 | 66 | - | 848 | 1897:1792 | 1236+116 | 62.7 : 62.7% | 64 | 8 | 2 | 2.8 | 11.9 | 11.7 |
| 4/1 | | U | - | | - | - | - | 815 | 9999 | 9999 | 8.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| 5/1 | | U | - | | - | - | - | 831 | 9999 | 9999 | 8.3% | - | - | - | 0.0 | 0.2 | 0.0 |
| 6/1 | | U | - | | - | - | - | 122 | 9999 | 9999 | 1.2% | - | - | - | 0.0 | 0.2 | 0.0 |
| Ped Link: P1 | Ardra Road | - | F | | 1 | 4 | - | 0 | - | 0 | 0.0% | - | - | - | - | - | - |

C1 PRC for Signalled Lanes (%): 31.8 Total Delay for Signalled Lanes (pcuHr): 9.40 Cycle Time (s): 96
PRC Over All Lanes (%): 31.8 Total Delay Over All Lanes(pcuHr): 9.50

# **Appendix D** – Road Safety Audits

North London Waste Authority

# North London Heat and Power Project

## Stage 1 Road Safety Audit

RSA1.1

Issue | 10 August 2015



Job number 235271-30

Central Square
Forth Street
Newcastle upon Tyne NE1 3PL
United Kingdom
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ARUP

# Contents



## Figures



## Appendices

# 1 Introduction

Arup was appointed by The London Waste Authority to conduct a Stage 1 Road Safety Audit on proposals to alter access to their existing site.

The agreed Audit Team consisted of:

- Mr C van Lottum MEng (Hons), MCIHT, MSoRSA, MAIRSO, AMRSGB
- Ms E Pickett MEng (Hons)

The audit was undertaken in accordance with the brief submitted to the Audit Team on 11th June 2015. The Audit Team visited the site together on Tuesday 28th July 2015; weather conditions at the time of the site visit were bright and the road surface was dry. Traffic was free flowing.

A list of information provided to the Audit Team has been included as Appendix A to this Report.

The following information was not made available to the Audit Team and as such any specific influence of these details on road user safety has not been considered by this audit:

- Departures from Standard
- Road profiles
- Cross sections
- Drainage
- Landscaping proposals
- Utilities
- Traffic signs
- Street lighting
- Surface finishes
- Road restraint systems
- Road traffic accident history

It is understood that no previous Road Safety Audits have been conducted on this scheme.

This audit has been undertaken in accordance with the Terms of Reference set out in HD19/15 'Road Safety Audit'; and the Audit Team members meet the training and experience requirements set out therein. The Audit Team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the design to any other criteria. However, to clearly explain a problem or recommendation the Audit Team may occasionally refer to design standards without engaging in technical audit.

All problems and recommendations identified by this audit are referenced to the design drawings and the locations have been indicated on the attached plan.

Other issues, including safety issues identified during the Audit but excluded from this report by the Terms of Reference, which the Audit Team wishes to draw to the attention of the Audit Project Sponsor, are set out in separate correspondence.

The Road Safety Audit team has reviewed the documents listed in Appendix A and has identified hazards relating to the road layouts contained therein. Road

Safety Audit is based upon a qualitative risk assessment process and there is no measure of the success achieved by any recommendations given herein. Whilst the Road Safety Audit process is proven to enhance the safety performance of the scheme under consideration, it cannot guarantee its safe operation as accidents are rare and random events and are largely caused by factors outside the Audit Team's influence, such as driving behaviour and to a lesser extent vehicle condition. The Road Safety Audit team has used reasonable skill, care and diligence in the performance of their services.

## 1.1 Site Description


**Scheme Location**

The existing London Eco Park site is situated to the north of the A406 North Circular and to the west of the Lee Navigation.

All access is via local roads.

## 1.2 Scheme Description

The overall scheme to redevelop the existing waste site with a modern facility will consider four access points:

- A Temporary Laydown Area will be provided during construction; this will have an HGV access from Walthamstow Avenue;
- A Light vehicle access to the Temporary Laydown Area and a staff entrance to the new waste facility will be made via Lee Park Way.
- The main HGV access to the new waste facility will be via Advent Way; and
- A further HGV access will be restored on Deephams Farm Road Access.

# 2 Stage 1 Road Safety Audit

The Recommendations below are numbered as follows:

STAGE . AUDIT NUMBER . RECOMMENDATION NUMBER

| | | |
|---|---|---|
| | **Location:** | Lee Park Way Access<br>00_0304 |
| | **Summary:** | Poor location of cycle crossing leading to cycle / vehicle conflicts. |
| | **Description:** | It is proposed to introduce a cycle crossover at the mouth of the Lee Park Way site access adjacent to the Enfield Ditch to join a two-way cycle lane to two separate one-way cycle lanes.<br><br>Cycles traveling towards the site on the nearside verge path will have to stop and look behind them to see traffic approaching the crossing from the south. Similarly the 90° corners to the north restrict visibility of oncoming vehicles at the crossing. This could lead to injudicious crossing movements by cyclists leading to cycle / vehicle conflicts and cyclist injuries. |
| **S1.1.1** | **Recommendation:** | Provide a two-way cycle lane on one side of the Lee Park Way Access and the footway on the other, eliminating the crossover. |

| | |
|---|---|
| **Location:** | Lee Park Way Access<br>00_0304 |
| **Summary:** | Low parapet leading to cycle injuries. |
| **Description:** | It is proposed to introduce a cycleway on both sides of the Lee Park Way Access. The existing canal bridge has a pedestrian parapet. |

IMG_8352.jpg

A pedestrian parapet is too low to prevent an errant cyclist being thrown into the canal.

**S1.1.2** **Recommendation:** Increase the height of the bridge parapet as appropriate for cycles.

---

**Location:** Temporary Laydown Area Access off Lee Park Way

00_0304

**Summary:** Limited visibility leading to turning conflicts.

**Description:** The visibility for/of vehicles approaching the Temporary Laydown Area Access off Lee Park Way is obstructed by vegetation.

IMG_8341.jpg

| | | |
|---|---|---|
| | | Limited visibility is likely to result in shunt collisions with vehicles waiting to turn into the site and turning conflicts with emerging traffic. |
| **S1.1.3** | **Recommendation:** | Remove the vegetation from the visibility splay. |

---

| | | |
|---|---|---|
| | **Location:** | Temporary Laydown Area Access off Lee Park Way<br>00_0304 |
| | **Summary:** | Poorly placed street furniture leading to collisions. |
| | **Description:** | There is a lighting column proposed in the Temporary Laydown Area Access off Lee Park Way.<br>Street furniture in vulnerable locations can be struck by passing vehicles and could result in a secondary collision with another road user as it falls. |
| **S1.1.4** | **Recommendation:** | Relocate the lighting column. |

---

| | | |
|---|---|---|
| | **Location:** | Lee Park Way Access<br>304 |
| | **Summary:** | Poor location of vehicle barrier leading to highway obstruction and collisions. |
| | **Description:** | The vehicle barrier proposed for the mouth of the Lee Park Way Access is too close to Advent Way. |

IMG_8338.jpg

If a large vehicle arrives at the site to find the barrier closed it will be stopped part on, and part off the highway. This could result in a collision either between a passing vehicle and that obstructing the highway, or between a passing vehicle and one negotiating the obstruction.

**S1.1.5** **Recommendation:** Set back the vehicle barrier so as to accommodate a vehicle in front of the barrier but off the highway.

---

**Location:** Lee Park Way Access

00_0304

**Summary:** Poorly located cycle and footway crossing leading to overrun and shunt collisions.

**Description:** There is a shared use pedestrian and cycle path crossing of the Lee Park Way Access some 10m from the give way line.

The proximity of the crossing point to the access is likely to result in vehicles failing to stop and overrunning the crossing. There is also a risk of shunt collisions as stopping for the crossing will be unexpected.

**S1.1.6** **Recommendation:** Consolidate the crossing points to the mouth of the junction, adjacent to the give way line.

---

**Location:** Lee Park Way Access

00_0304

**Summary:** Limited visibility leading to turning conflicts.

**Description:** The visibility for/of vehicles approaching the Lee Park Way Access from the A406 Cooks Ferry Roundabout is obstructed by vegetation.

IMG_8315.jpg

Limited visibility is likely to result in shunt collisions with vehicles waiting to turn into the site and turning conflicts with emerging traffic.

**S1.1.7 Recommendation:** Remove the vegetation from the visibility splay.

---

**Location:** Temporary Laydown Area Access

00_0304

**Summary:** Poorly located cycle and footway crossing leading to vulnerable road user injuries.

**Description:** There is a shared use pedestrian and cycle path crossing of the Temporary Laydown Area Access some 30m from the give way line.


IMG_8330.jpg

It is proposed to provide HGV access to the laydown area across a pedestrian and cycle path. HGV traffic and vulnerable road users in close proximity can lead to collisions, particularly given the size of vulnerable users and the blind spots around large goods vehicles.

**S1.1.8** **Recommendation:** Relocate the path so as to minimise conflict with HGV traffic.

---

**Location:** Temporary Laydown Area Access

00_0304

**Summary:** Access at merge leading to shunt and turning conflicts.

**Description:** Whilst the proposed HGV access to the Temporary Laydown Area Access is existing. It is situated at the end of a free-flow left-turn slip-lane.


IMG_8327.jpg

Numerous near miss incidents were noted on site at this location with vehicles braking heavily at the merge to avoid a collision with slow moving HGVs turning right towards the Cooks Ferry Roundabout. Increasing the activity at this access is likely to increase the risk of a collision between a slow moving HGV and fast moving traffic from the roundabout or left-turn lane.

**S1.1.9** **Recommendation:** Remove the free flow left-turn lane for the duration of the works.

---

**Location:** Temporary Laydown Area Access

00_0304

**Summary:** Steep access leading to turning conflicts.

**Description:** The Temporary Laydown Area Access has a steep incline for vehicles exiting the site.


IMG_8328.jpg

Steep gradients at the give-way line can make it difficult for HGV traffic emerging from the site. As a result the HGV will take longer to complete their turn leading to misjudgements by approaching traffic and collisions.

**S1.1.10** **Recommendation:** Improve the junction for HGVs by providing a low gradient plateau at the give-way line.

---

**Location:** Advent Way Access

00_0306

**Summary:** Poor location of vehicle barrier leading to highway obstruction and collisions.

**Description:** The vehicle barrier proposed for the mouth of the Advent Way Access is located close to Advent Way.

IMG_8302.jpg

If a large vehicle arrives at the site to find the barrier closed it will be stopped part on, and part off the highway. This could result in a collision either between a passing vehicle and that obstructing the highway, or between a passing vehicle and one negotiating the obstruction.

**S1.1.11** **Recommendation:** Set back the vehicle barrier so as to accommodate a vehicle in front of the barrier but off the highway.

---

**Location:** Advent Way Access

00_0306

**Summary:** Limited visibility leading to turning conflicts.

**Description:** The visibility for/of vehicles approaching the Advent Way Access is obstructed by vegetation.

IMG_8306.jpg

Limited visibility is likely to result in shunt collisions with vehicles waiting to turn into the site and turning conflicts with emerging traffic.

**S1.1.12** **Recommendation:** Remove the vegetation from the visibility splay.

---

**Location:** Advent Way Access

Arup_TF13_DWG02_P2

**Summary:** HGV turning on narrow carriageway leading to sideswipe collisions.

**Description:** Advent way is narrow and constrained by VRS on the south side opposite the southern access.

Large vehicles turning left to the east out of the plant will encroach on the westbound carriageway and depending on the positioning of any through or waiting vehicles this could result in a sideswipe collision.

**S1.1.13** **Recommendation:** Provide a tapered junction mouth to safely accommodate HGVs.

---

**Location:** Deephams Farm Road Access junction with Ardra Road

00_0308

**Summary:** Overhanging trees leading to vehicle damage.

**Description:** There are a number of trees overhanging the western edge of the northbound carriageway of Ardra Road.

IMG_8364.jpg

| | | |
|---|---|---|
| | | These could damage; or be damaged by a large vehicle. |
| **S1.1.14** | **Recommendation:** | Cut back the trees adjacent to Ardra Road to prevent vehicle damage. |

---

| | | |
|---|---|---|
| | **Location:** | Deephams Farm Road Access junction with Ardra Road<br>00_0308 |
| | **Summary:** | Lack of priority leading to turning conflicts. |
| | **Description:** | There is no traffic priority shown at the junction of Deephams Farm Road with Ardra Road on drawing 00_0308.<br>Priority is in fact marked for the north south movement, despite the existing gate. Existing traffic is used to running on Ardra road unopposed at the junction which could lead to collisions if traffic exiting the site also considers it has right of way. |
| **S1.1.15** | **Recommendation:** | Provide road markings to assure priority for through traffic. |

---

| | | |
|---|---|---|
| | **Location:** | Deephams Farm Road Access<br>00_0308 |
| | **Summary:** | No footway provision leading to vehicle / pedestrian conflicts |
| | **Description:** | There is no footway provided along Deephams Farm Road. |

IMG_8363.jpg

Failing to provide for pedestrians, if only security staff manning the gate, could result in pedestrians walking in the carriageway and coming in to conflict with pedestrians.

**S1.1.16 Recommendation:** Assess demand for pedestrian access at this location, and if appropriate, extend existing footway into the site.

---

**End of list of problems identified and recommendations offered in this Stage 1 Road Safety Audit**

# 3 Road Safety Audit Statement

I certify that this audit has been carried out in accordance with HD19/15.

## Audit Team Leader

Mr C van Lottum MEng (Hons), MCIHT, MSoRSA, MAIRSO, AMRSGB

Senior Engineer

Arup

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. . . . . . . . . . . . . . .

10 August 2015

## Audit Team Member

Ms E Pickett MEng (Hons)

Engineer

Arup

The Arup Campus, Blythe Gate, Blythe Valley Park, Solihull, B90 8AE

. . . . . . . . . . . . . . .

10 August 2015

# Figures

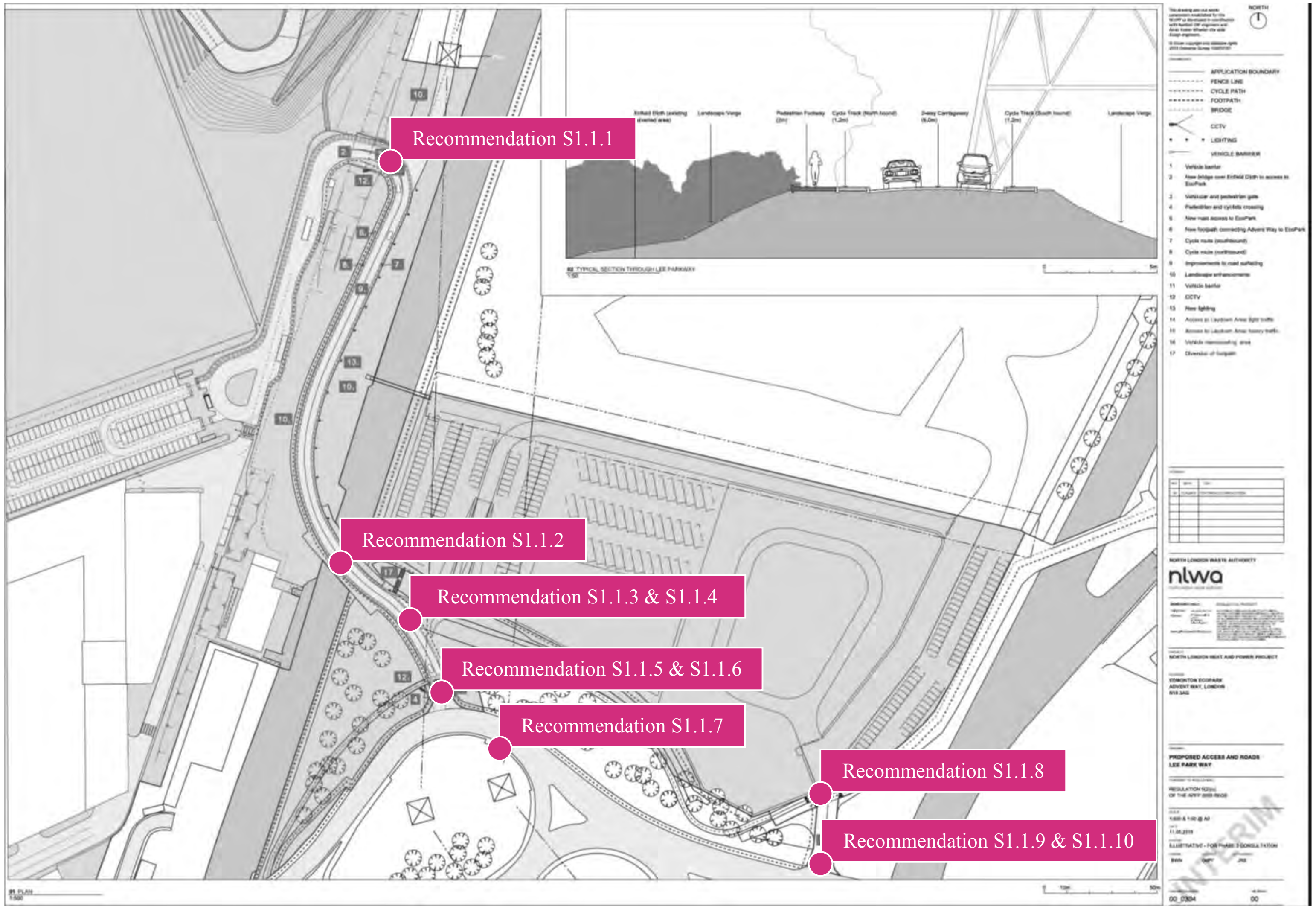



Figure 1 Location of Recommendations

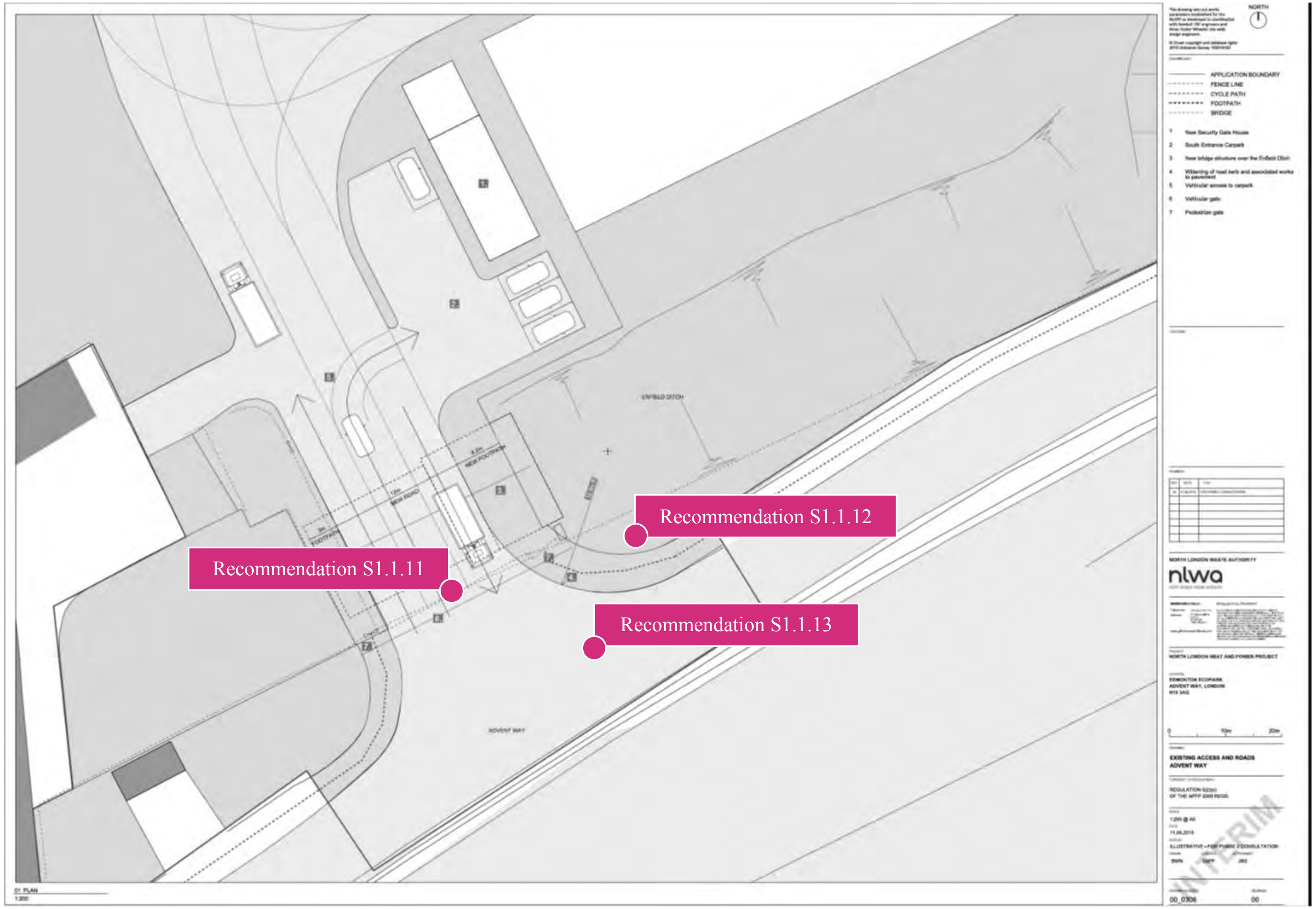



Figure 2 Location of Recommendations

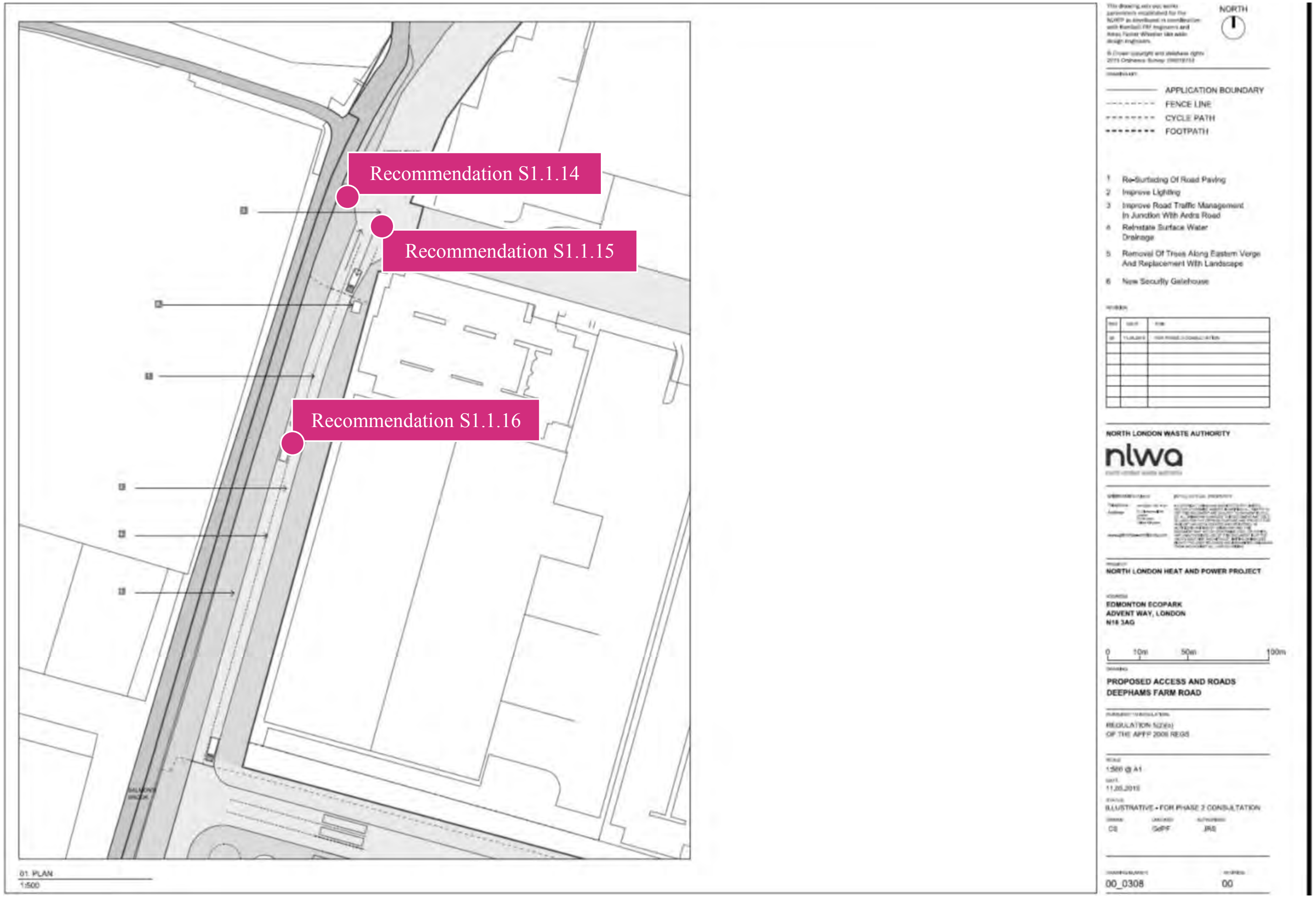



Figure 3 Location of Recommendations

# Appendix A

Documents and Drawings

# A1 Documents and Drawings

The following documents and drawings were supplied to the Audit Team by the Designer and have been examined in the course of conducting this audit.

## A1.1 Documents

| Title | Reference | Revision |
|---|---|---|
| Stage 1 Road Safety Audit Brief | - | - |

## A1.2 Drawings

| Title | Reference | Revision |
|---|---|---|
| Existing Site | 00_0100 | 00 |
| Proposed Access and Roads - Site | 00_0302 | 00 |
| Proposed Access and Roads - Lee Park Way | 00_0304 | 00 |
| Proposed Access and Roads - Advent Way | 00_0305 | 00 |
| Existing Access and Roads - Advent Way | 00_0306 | 00 |
| Existing Access and Roads - Deephams Farm Road | 00_0307 | 00 |
| Proposed Access and Roads - Deephams Farm Road | 00_0308 | 00 |
| Southern Site Access - Swept Path Analysis | Arup_TF13_DWG02_P2 | P2 |

North London Waste Authority

# North London Heat and Power Project

## Stage 1 Road Safety Audit – Designer's Response

AD05.11_Appendix D2

The Planning Act 2008 The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5 (2)(q)

Issue | October 2015

Arup



ARUP

nlwa
north london waste authority

# Contents



## Tables



## Figures



## Appendices

# 1 Introduction

1.1.1 A Stage 1 Road Safety Audit (RSA) has been undertaken on proposals to make changes to the access arrangements for the North London Heat and Power Project (the Project). The RSA has been undertaken by an independent team of Arup road safety auditors on behalf of the North London Waste Authority (the Applicant).

1.1.2 This report outlines the Designer's Response to this Stage 1 RSA, which has been undertaken by Arup (as members of the design team) on behalf of the Applicant.

1.1.3 In this Designer's Response, the Stage 1 Safety Audit has been repeated in italics with the Designer's Response in normal font.

1.1.4 The access arrangements for the Application Site, which includes the existing Edmonton EcoPark, would comprise the existing southern site access on Advent Way as well a new eastern access on Lee Park Way and a new northern access from Deephams Farm Road and use of an existing access from Walthamstow Avenue to a Temporary Laydown Area provided in an area of open scrubland located to the east of the River Lee Navigation. A new access would be provided to the Temporary Laydown Area from Lee Park Way.

# 2 Stage1 Road Safety Audit

## 2.1 Recommendation S1.1.1

| | |
|---|---|
| **Location** | Lee Park Way access |
| **Summary** | *Poor location of cycle crossing leading to cycle / vehicle conflicts* |
| **Description** | *It is proposed to introduce a cycle crossover at the mouth of the Lee Park Way site access adjacent to the Enfield Ditch to join a two-way cycle lane to two separate one-way cycle lanes.*<br><br>*Cycles traveling towards the site on the nearside verge path will have to stop and look behind them to see traffic approaching the crossing from the south. Similarly the 90° corners to the north restrict visibility of oncoming vehicles at the crossing. This could lead to injudicious crossing movements by cyclists leading to cycle / vehicle conflicts and cyclist injuries.* |
| **Recommendation** | *Provide a two-way cycle lane on one side of the Lee Park Way Access and the footway on the other, eliminating the crossover.* |
| **Designer's Response** | The cycle lane was designed to accommodate one-way, on-carriageway cycle lanes as the restricted width on the bridge means that if segregated two-way cycle lane were provided, the width of the general traffic lanes would not be sufficient. Arup, does, however, agree that a two-way cycle lane may be more appropriate and will ensure that this is reviewed at detailed design stage with a view to providing a two-way cycle lane if appropriate. |

## 2.2 Recommendation S1.1.2

| | |
|---|---|
| **Location** | Lee Park Way access |
| **Summary** | *Low parapet leading to cycle injuries* |
| **Description** | *It is proposed to introduce a cycleway on both sides of the Lee Park Way Access. The existing canal bridge has a pedestrian parapet.*<br><br>*A pedestrian parapet is too low to prevent an errant cyclist being thrown into the canal.* |
| **Recommendation** | *Increase the height of the bridge parapet as appropriate for cycles.* |
| **Designer's Response** | Arup agrees with the recommendation and the Applicant commits to incorporating this into the design at detailed design stage. |

## 2.3 Recommendation S1.1.3

| | |
|---|---|
| **Location** | Laydown Area access off Lee Park Way |
| **Summary** | *Limited visibility leading to turning conflicts* |
| **Description** | *The visibility for/of vehicles approaching the Temporary Laydown Area Access off Lee Park Way* [connecting Lee Park Way to the Temporary Laydown Area] *is obstructed by vegetation.*<br><br>*Limited visibility is likely to result in shunt collisions with vehicles waiting to turn into the site and turning conflicts with emerging traffic.* |
| **Recommendation** | *Remove the vegetation from the visibility splay.* |
| **Designer's Response** | There will be no issue with the landscaping in this area. Arup agrees with the recommendation and will ensure that this is clear from the design at detailed design stage. |

## 2.4 Recommendation S1.1.4

| | |
|---|---|
| **Location** | Laydown Area access off Lee Park Way |
| **Summary** | *Poorly placed street furniture leading to collisions.* |
| **Description** | *There is a lighting column proposed in the Temporary Laydown Area Access off Lee Park Way.*<br><br>*Street furniture in vulnerable locations can be struck by passing vehicles and could result in a secondary collision with another road user as it falls.* |
| **Recommendation** | *Relocate the lighting column.* |
| **Designer's Response** | Arup agrees with the recommendation and will ensure that the location of all street furniture is reviewed at detailed design stage with a view to providing all lighting columns in appropriate locations. |

## 2.5 Recommendation S1.1.5

| | |
|---|---|
| **Location** | Lee Park Way access |
| **Summary** | *Poor location of vehicle barrier leading to highway obstruction and collisions.* |
| **Description** | *The vehicle barrier proposed for the mouth of the Lee Park Way Access is too close to Advent Way.*<br><br>*If a large vehicle arrives at the site to find the barrier closed it will be stopped part on, and part off the highway. This could result in a collision either between a passing vehicle and that obstructing the highway, or between a passing vehicle and one negotiating the obstruction.* |
| **Recommendation** | *Set back the vehicle barrier so as to accommodate a vehicle in front of the barrier but off the highway.* |
| **Designer's Response** | Arup notes the recommendation but does not agree that the barrier should be set-back further than already provided. Access to the Application Site via Lee Park Way would only be for small vehicles (cars and vans up to 6m in length) and there would be sufficient space between Advent Way and the barrier to accommodate a vehicle. However, appropriate signage will be considered to ensure that large vehicles are aware that they cannot use Lee Park Way and also to provide the times during which public access is provided. |

## 2.6 Recommendation S1.1.6

| | |
|---|---|
| **Location** | Lee Park Way access |
| **Summary** | *Poorly located cycle and footway crossing leading to overrun and shunt collisions.* |
| **Description** | *There is a shared use pedestrian and cycle path crossing of the Lee Park Way Access some 10m from the give way line.*<br><br>*The proximity of the crossing point to the access is likely to result in vehicles failing to stop and overrunning the crossing. There is also a risk of shunt collisions as stopping for the crossing will be unexpected.* |
| **Recommendation** | *Consolidate the crossing points to the mouth of the junction, adjacent to the give way line.* |
| **Designer's Response** | Arup notes the recommendation. However, the crossing has been located to provide continuity for the cycle route, which forms part of the National Cycle Network. Priority for vehicles has been maintained through the provision of stoplines on the cycle lane. Vehicle speeds will be very low. |

## 2.7 Recommendation S1.1.7

| | |
|---|---|
| **Location** | Lee Park Way access |
| **Summary** | *Limited visibility leading to turning conflicts.* |
| **Description** | *The visibility for/of vehicles approaching the Lee Park Way Access from the A406 Cooks Ferry Roundabout is obstructed by vegetation.*<br><br>*Limited visibility is likely to result in shunt collisions with vehicles waiting to turn into the site and turning conflicts with emerging traffic.* |
| **Recommendation** | *Remove the vegetation from the visibility splay.* |
| **Designer's Response** | Arup notes the recommendation. However, the land within which the vegetation is located is not within the Application Site and is TfL land. The treatment of this vegetation will be discussed with TfL but any decision regarding its removal will lie with TfL. It is, however, anticipated that traffic departing the Application Site via Lee Park Way would be turning left on to Advent Way and not turning right. Signage would be provided to this effect. |

## 2.8 Recommendation S1.1.8

| | |
|---|---|
| **Location** | Laydown Area access |
| **Summary** | *Poorly located cycle and footway crossing leading to vulnerable road user injuries* |
| **Description** | *There is a shared use pedestrian and cycle path crossing of the Temporary Laydown Area Access some 30m from the give way line.*<br><br>*It is proposed to provide HGV access to the laydown area across a pedestrian and cycle path. HGV traffic and vulnerable road users in close proximity can lead to collisions, particularly given the size of vulnerable users and the blind spots around large goods vehicles.* |
| **Recommendation** | *Relocate the path so as to minimise conflict with HGV traffic.* |
| **Designer's Response** | Arup notes the recommendation and will ensure that this is reviewed at detailed design stage. |

## 2.9 Recommendation S1.1.9

| | |
|---|---|
| **Location** | Laydown Area access |
| **Summary** | *Access at merge leading to shunt and turning conflicts.* |
| **Description** | *Whilst the proposed HGV access to the Temporary Laydown Area Access is existing. It is situated at the end of a free-flow left-turn slip-lane.*<br><br>*Numerous near miss incidents were noted on site at this location with vehicles braking heavily at the merge to avoid a collision with slow moving HGVs turning right towards the Cooks Ferry Roundabout. Increasing the activity at this access is likely to increase the risk of a collision between a slow moving HGV and fast moving traffic from the roundabout or left-turn lane.* |
| **Recommendation** | *Remove the free flow left-turn lane for the duration of the works.* |
| **Designer's Response** | Arup notes the recommendation and will ensure that this is reviewed at detailed design stage. An option to address this issue would be to increase the stop line at the Advent Way approach to the junction to include the nearside lane. |

## 2.10 Recommendation S1.1.10

| | |
|---|---|
| **Location** | Laydown Area access |
| **Summary** | *Steep access leading to turning conflicts.* |
| **Description** | *The Temporary Laydown Area Access has a steep incline for vehicles exiting the site.*<br><br>*Steep gradients at the give-way line can make it difficult for HGV traffic emerging from the site. As a result the HGV will take longer to complete their turn leading to misjudgements by approaching traffic and collisions.* |
| **Recommendation** | *Remove the free flow left-turn lane for the duration of the works.* |
| **Designer's Response** | Arup agrees the recommendation and will ensure that it is incorporated into the design at detailed design stage. |

## 2.11 Recommendation S1.1.11

| | |
|---|---|
| **Location** | Southern access on Advent Way |
| **Summary** | *Poor location of vehicle barrier leading to highway obstruction and collisions.* |
| **Description** | *The vehicle barrier proposed for the mouth of the Advent Way Access is located close to Advent Way.*<br><br>*If a large vehicle arrives at the site to find the barrier closed it will be stopped part on, and part off the highway. This could result in a collision either between a passing vehicle and that obstructing the highway, or between a passing vehicle and one negotiating the obstruction.* |
| **Recommendation** | *Set back the vehicle barrier so as to accommodate a vehicle in front of the barrier but off the highway.* |
| **Designer's Response** | Arup notes the recommendation. However, it is not intended that the vehicle barrier be relocated. Currently, the gate is open between 06:00 and 18:00 when 88% of the daily operational traffic travels to the Edmonton EcoPark. It is expected that the Edmonton EcoPark would continue to operate in this way. The gate can be opened quickly when a vehicle does arrive when the gate is closed. |

## 2.12 Recommendation S1.1.12

| | |
|---|---|
| **Location** | Southern access on Advent Way |
| **Summary** | *Limited visibility leading to turning conflicts.* |
| **Description** | *The visibility for/of vehicles approaching the Advent Way Access is obstructed by vegetation.*<br><br>*Limited visibility is likely to result in shunt collisions with vehicles waiting to turn into the site and turning conflicts with emerging traffic.* |
| **Recommendation** | *Remove the vegetation from the visibility splay.* |
| **Designer's Response** | Arup agrees with the recommendation and will ensure that this is incorporated into the design at detailed design stage. |

## 2.13 Recommendation S1.1.13

| | |
|---|---|
| **Location** | Southern access on Advent Way |
| **Summary** | *HGV turning on narrow carriageway leading to sideswipe collisions.* |
| **Description** | *Advent way is narrow and constrained by VRS on the south side opposite the southern access.*<br><br>*Large vehicles turning left to the east out of the plant will encroach on the westbound carriageway and depending on the positioning of any through or waiting vehicles this could result in a sideswipe collision.* |
| **Recommendation** | *Provide a tapered junction mouth to safely accommodate HGVs.* |
| **Designer's Response** | Arup notes the recommendation and will ensure that this is reviewed at detailed design stage. |

## 2.14 Recommendation S1.1.14

| | |
|---|---|
| **Location** | Deephams Farm Road access junction with Ardra Road |
| **Summary** | *Overhanging trees leading to vehicle damage.* |
| **Description** | *There are a number of trees overhanging the western edge of the northbound carriageway of Ardra Road.*<br><br>*These could damage; or be damaged by a large vehicle.* |
| **Recommendation** | *Cut back the trees adjacent to Ardra Road to prevent vehicle damage.* |
| **Designer's Response** | Arup agrees with the recommendation and will ensure that this is undertaken, subject to any necessary agreements being in place. |

## 2.15 Recommendation S1.1.15

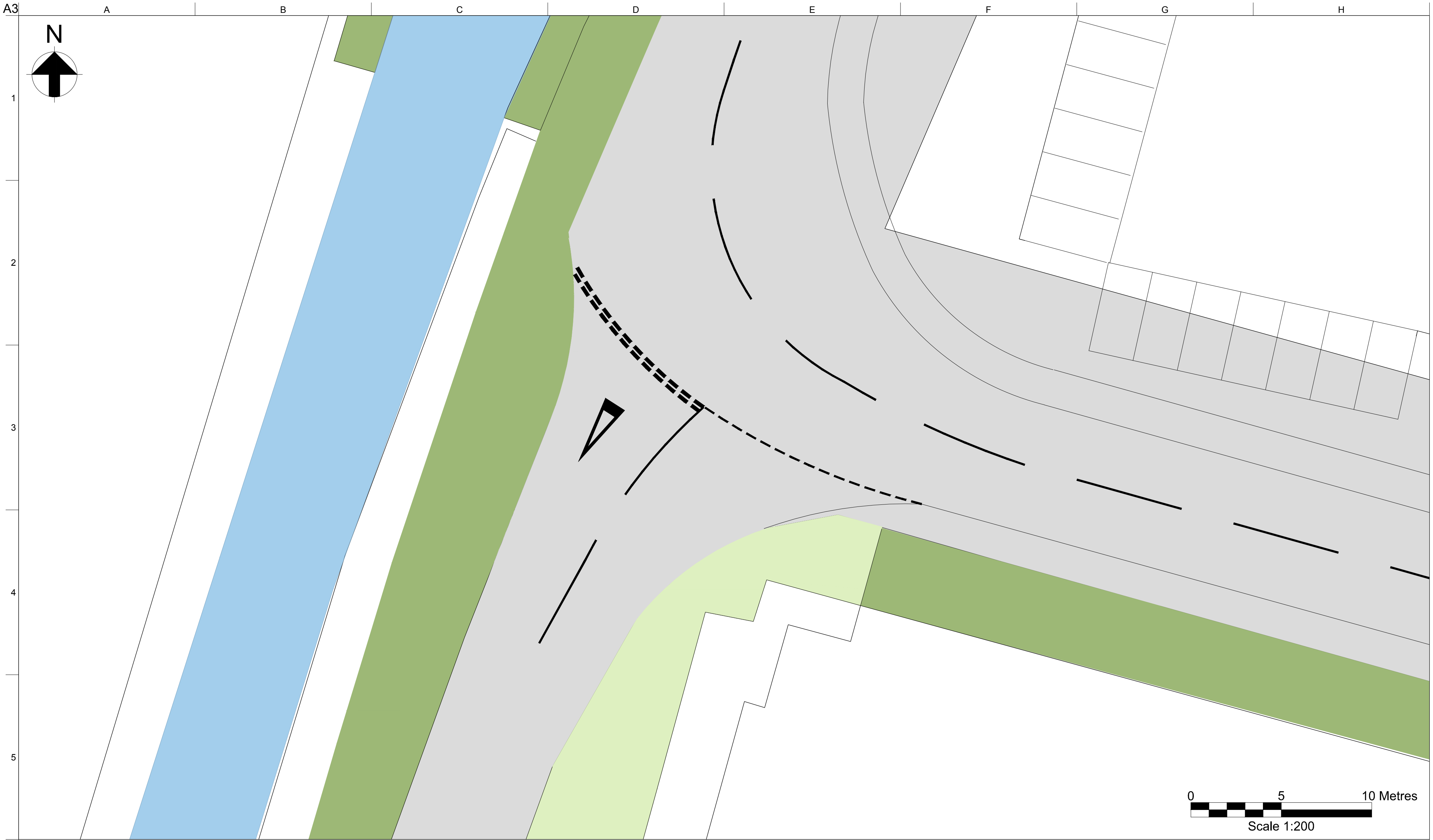
| | |
|---|---|
| **Location** | Deephams Farm Road access junction with Ardra Road |
| **Summary** | *Lack of priority leading to turning conflicts.* |
| **Description** | *There is no traffic priority shown at the junction of Deephams Farm Road with Ardra Road.*<br><br>*Priority is in fact marked for the north south movement, despite the existing gate. Existing traffic is used to running on Ardra road unopposed at the junction which could lead to collisions if traffic exiting the site also considers it has right of way.* |
| **Recommendation** | *Provide road markings to assure priority for through traffic.* |
| **Designer's Response** | Arup agrees with the recommendation and road marking will be provided as shown on Drawing Arup_TF13_DWG08_P1_NorthAccessJunction shown in Appendix A. |

## 2.16 Recommendation S1.1.16

| | |
|---|---|
| **Location** | Deephams Farm Road access junction with Ardra Road |
| **Summary** | *No footway provision leading to vehicle / pedestrian conflicts* |
| **Description** | *There is no footway provided along Deephams Farm Road.*<br><br>*Failing to provide for pedestrians, if only security staff manning the gate, could result in pedestrians walking in the carriageway and coming in to conflict with pedestrians.* |
| **Recommendation** | *Assess demand for pedestrian access at this location, and if appropriate, extend existing footway into the site.* |
| **Designer's Response** | Arup notes the recommendation. However, the Applicant has confirmed there will be no demand for pedestrian access at this point and no provision for pedestrians will be made. Access for pedestrians is proposed from Lee Park Way. As such, no changes are proposed. |

# Appendix A: Drawings

A3




Note
Existing road markings are indicative and to be confirmed on site

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P1 | 26/02/15 | TB | DM | GW |
| | Issued for Information | | | |

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Job Title
North London Heat and Power Project

Client
North London Waste Authority

Northern Site Access
Junction Layout

Scale at A3 1:200

Discipline Planning

Job No 235271-30

Drawing Status For Information

Drawing No Arup_TF13_DWG08_P1

Issue P1

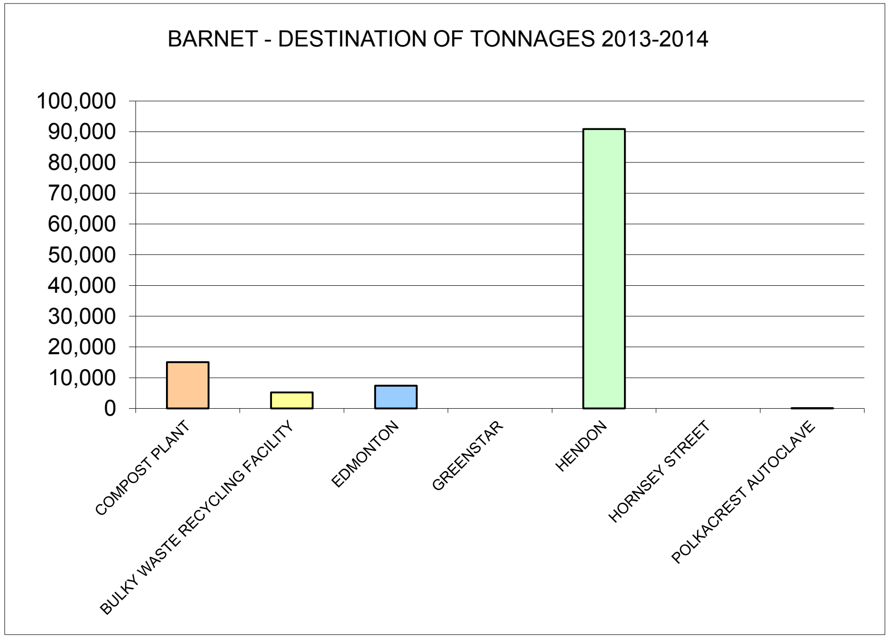
Do not scale

# Appendix E – Edmonton EcoPark Existing Site Supporting Information

**Waste Destinations for Barnet 2013-14**

**ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14**

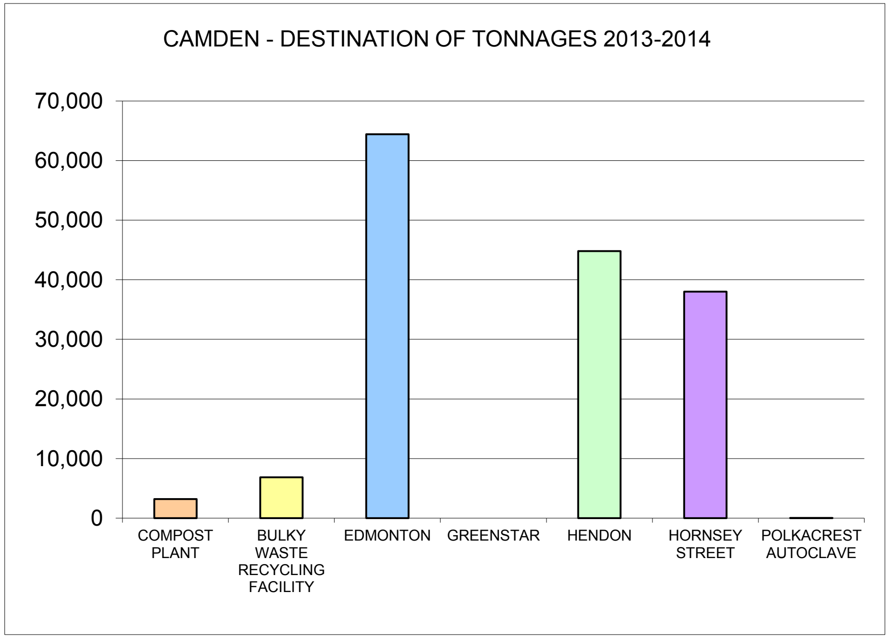
| | DESTINATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
| BIOK | 11,100 | 1,738 | 0 | 0 | 0 | 0 | 0 | 12,838 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 49 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN WASTE | 3,948 | 1,640 | 0 | 0 | 0 | 0 | 0 | 5,587 |
| RESIDUAL WASTE | 0 | 1,826 | 7,398 | 0 | 90,877 | 0 | 0 | 100,101 |
| TOTAL | 15,047 | 5,204 | 7,398 | 0 | 90,877 | 0 | 49 | 118,575 |
| % SPLIT TO EACH SITE | 12.69% | 4.39% | 6.24% | 0.00% | 76.64% | 0.00% | 0.04% | |



## Waste Destinations for Camden 2013-14

**ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14**

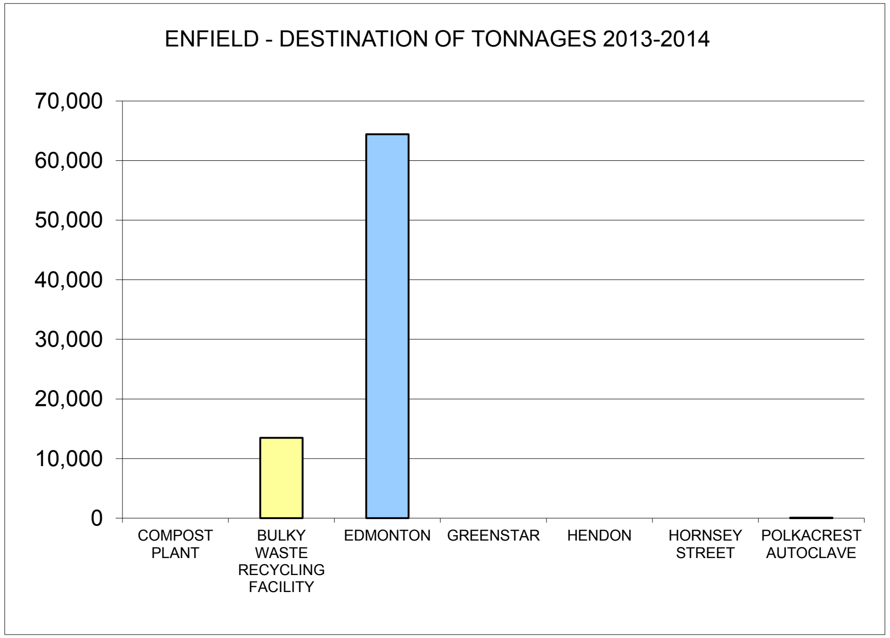
| | DESTINATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
| BIOK | 3,200 | 81 | 0 | 0 | 0 | 0 | 0 | 3,281 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 11,008 | 0 | 11,008 |
| GREEN WASTE | | 0 | 0 | 0 | 0 | 354 | 0 | 354 |
| RESIDUAL WASTE | 0 | 6,774 | 64,424 | 0 | 44,812 | 26,650 | 0 | 142,660 |
| TOTAL | 3,200 | 6,855 | 64,424 | 0 | 44,812 | 38,011 | 0 | 157,302 |
| % SPLIT TO EACH SITE | 2.03% | 4.36% | 40.96% | 0.00% | 28.49% | 24.16% | 0.00% | |



**Waste Destinations for Enfield 2013-14**

ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

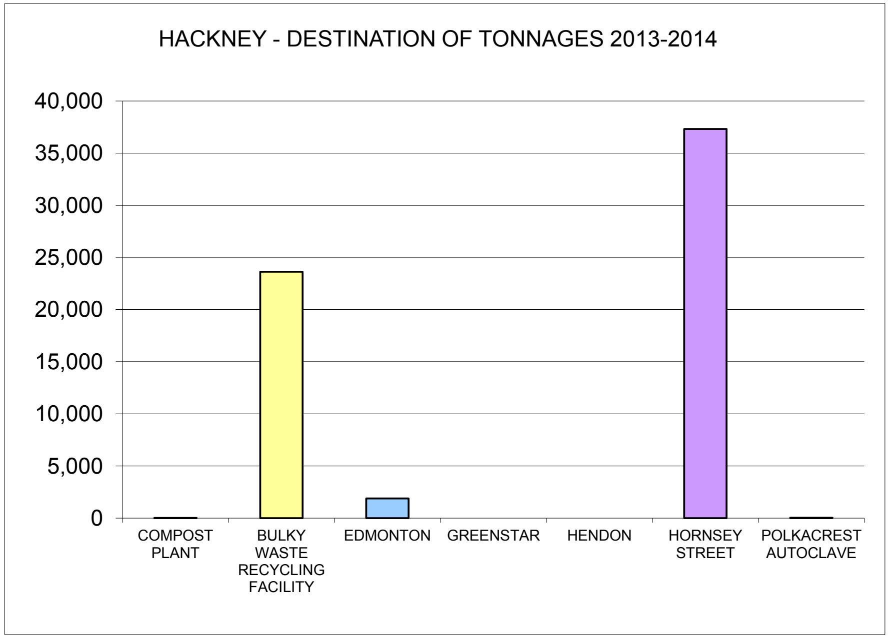
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | DESTINATION | | | | | | | |
| BIOK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 75 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN WASTE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RESIDUAL WASTE | 0 | 13,477 | 64,424 | 0 | 0 | 0 | 0 | 77,901 |
| TOTAL | 0 | 13,477 | 64,424 | 0 | 0 | 0 | 75 | 77,976 |
| % SPLIT TO EACH SITE | 0.00% | 17.28% | 82.62% | 0.00% | 0.00% | 0.00% | 0.10% | |



**Waste Destinations for Hackney 2013-14**

ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

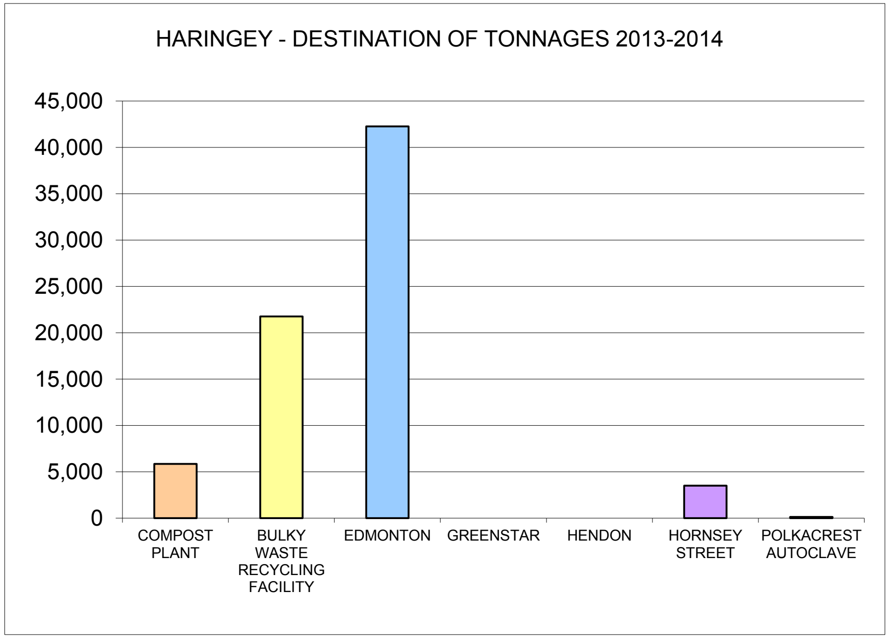
| | DESTINATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
| BIOK | 3 | 2,247 | 0 | 0 | 0 | 0 | 0 | 2,249 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 37 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN WASTE | | 2,232 | 0 | 0 | 0 | 19 | 0 | 2,250 |
| RESIDUAL WASTE | 0 | 19,151 | 1,890 | 0 | 0 | 37,303 | 0 | 58,344 |
| TOTAL | 3 | 23,630 | 1,890 | 0 | 0 | 37,321 | 37 | 62,880 |
| % SPLIT TO EACH SITE | 0.00% | 37.58% | 3.01% | 0.00% | 0.00% | 59.35% | 0.06% | |



**Waste Destinations for Haringey 2013-14**

ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

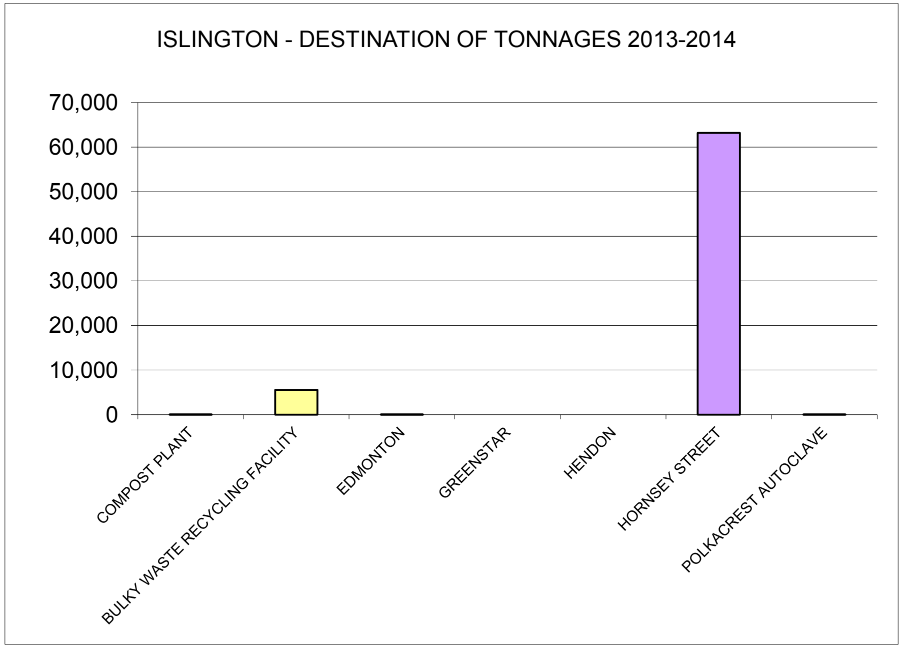
| | DESTINATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
| BIOK | 5,851 | 697 | 0 | 0 | 0 | 0 | 0 | 6,548 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 130 | 130 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 246 | 0 | 246 |
| GREEN WASTE | | 819 | 0 | 0 | 0 | 0 | 0 | 819 |
| RESIDUAL WASTE | 0 | 20,243 | 42,262 | 0 | 0 | 3,259 | 0 | 65,764 |
| TOTAL | 5,851 | 21,758 | 42,262 | 0 | 0 | 3,505 | 130 | 73,506 |
| % SPLIT TO EACH SITE | 7.96% | 29.60% | 57.49% | 0.00% | 0.00% | 4.77% | 0.18% | |



**Waste Destinations for Islington 2013-14**

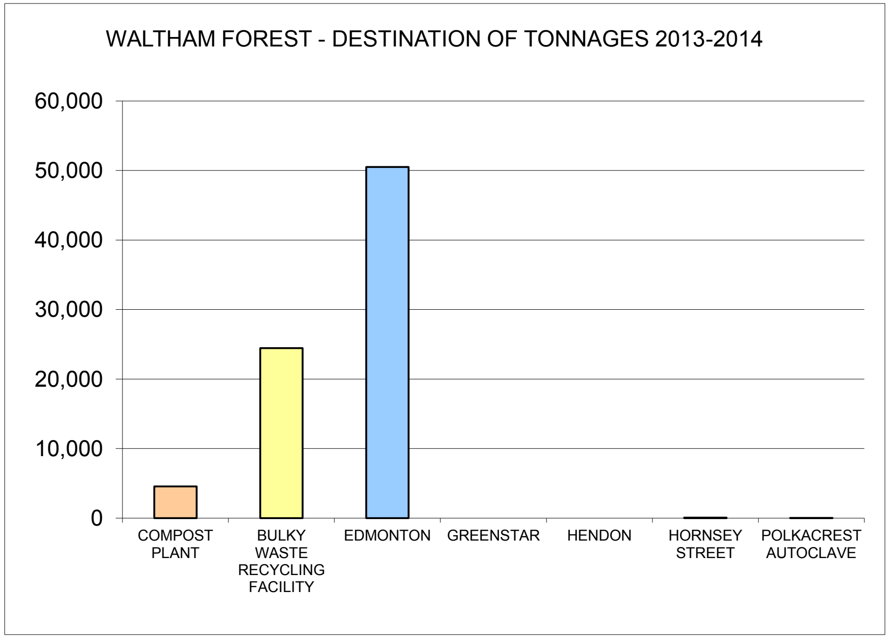
ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

| WASTE TYPE | DESTINATION: COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| BIOK | 3 | 18 | 0 | 0 | 0 | 2,650 | 0 | 2,670 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 26 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 10,253 | 0 | 10,253 |
| GREEN WASTE | | 0 | 0 | 0 | 0 | 488 | 0 | 488 |
| RESIDUAL WASTE | 0 | 5,546 | 18 | 0 | 0 | 49,784 | 0 | 55,349 |
| TOTAL | 3 | 5,564 | 18 | 0 | 0 | 63,175 | 26 | 68,787 |
| % SPLIT TO EACH SITE | 0.00% | 8.09% | 0.03% | 0.00% | 0.00% | 91.84% | 0.04% | |



**Waste Destinations for Waltham Forest 2013-14** ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

| | DESTINATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
| BIOK | 4,565 | 4,292 | 0 | 0 | 0 | 0 | 0 | 8,858 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 15 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GREEN WASTE | | 1,138 | 0 | 0 | 0 | 0 | 0 | 1,138 |
| RESIDUAL WASTE | 0 | 19,026 | 50,508 | 0 | 0 | 72 | 0 | 69,606 |
| TOTAL | 4,565 | 24,456 | 50,508 | 0 | 0 | 72 | 15 | 79,617 |
| % SPLIT TO EACH SITE | 5.73% | 30.72% | 63.44% | 0.00% | 0.00% | 0.09% | 0.02% | |



## Residual Waste Outputs for NLWA 2013-14

ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

| SITE | DESTINATION: INCINERATION (DIRECT TO ED) | LANDFILL | RESIDUAL RECYCLATES | BWRF (SECONDARY DEPOSITS) |
|---|---|---|---|---|
| HORNSEY STREET | 2,549 | 15,793 | 58 | 100,105 |
| BULKY WASTE | 91,493 | 47,064 | 12,517 | 0 |
| EDMONTON | 164,447 | 0 | 0 | 0 |
| HENDON | 11 | 135,688 | 0 | 0 |
| TOTAL | 258,501 | 198,545 | 12,575 | 100,105 |
| TOTAL WASTE DISPOSED | | 469,621 | | |
| END DESTINATION SPLIT | 55% | 42% | 3% | |

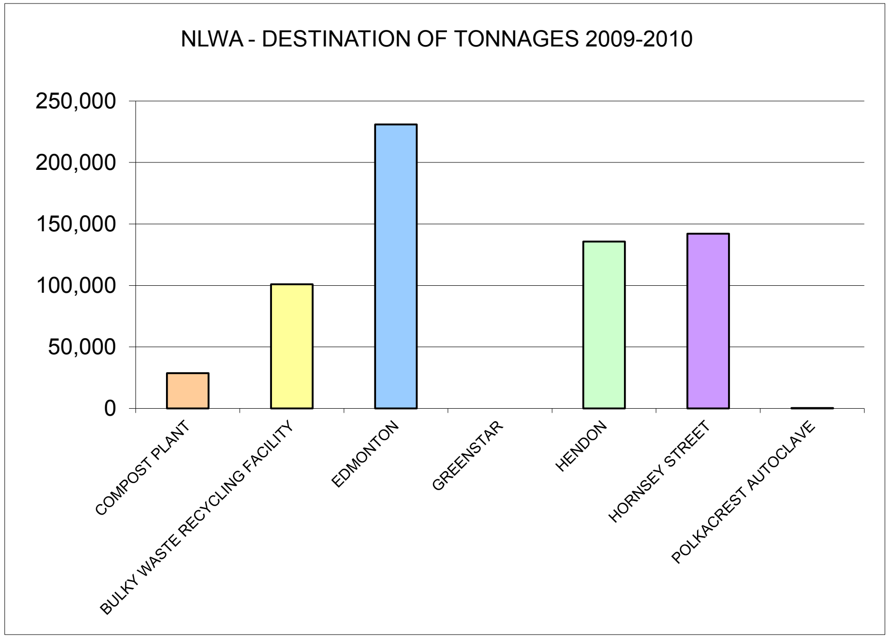
A large proportion of residual waste from Hornsey Street was sent to the BWRF to be shredded before incineration.

Residual recyclates are materials reclaimed from mixed waste inputs.

**Waste Destinations for NLWA 2013-14**

ALL NUMBERS ARE TONNES PER ANNUM FOR 2013/14

| | DESTINATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| WASTE TYPE | COMPOST PLANT | BULKY WASTE RECYCLING FACILITY | EDMONTON | GREENSTAR | HENDON | HORNSEY STREET | POLKACREST AUTOCLAVE | TOTAL |
| BIOK | 24,721 | 9,072 | 0 | 0 | 0 | 2,650 | 0 | 36,443 |
| CLINICAL | 0 | 0 | 0 | 0 | 0 | 0 | 332 | 332 |
| COMMINGLED | 0 | 0 | 0 | 0 | 0 | 21,507 | 0 | 21,507 |
| GREEN WASTE | 3,948 | 5,828 | 0 | 0 | 0 | 860 | 0 | 10,636 |
| RESIDUAL WASTE | 0 | 86,045 | 230,924 | 0 | 135,689 | 117,068 | 0 | 569,726 |
| TOTAL | 28,669 | 100,945 | 230,924 | 0 | 135,689 | 142,085 | 332 | 638,644 |
| % SPLIT TO EACH SITE | 4.49% | 15.81% | 36.16% | 0.00% | 21.25% | 22.25% | 0.05% | |




Recyclables such as commingled and kitchen and green garden waste received at the Bulky Waste facility and Hornsey Street were transferred to appropriate reprocessors/composters.

Commingled waste was received at the BWRF unitil 01/10/09 and then the boroughs that delivered there began delivering to Greenstar under a new contract.

Reference number 235716-30

Dated 13-Aug-14

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| **TOTAL** | **54,410** | **7,215** | **94,629** | **7,634** | **163,888** |
| 01/04/2013 | 188 | 21 | 152 | 7 | 368 |
| 02/04/2013 | 219 | 29 | 320 | 35 | 603 |
| 03/04/2013 | 215 | 30 | 335 | 27 | 607 |
| 04/04/2013 | 247 | 31 | 317 | 28 | 623 |
| 05/04/2013 | 227 | 37 | 308 | 36 | 608 |
| 06/04/2013 | 59 | 28 | 133 | 11 | 231 |
| 07/04/2013 | 0 | 0 | 122 | 0 | 122 |
| 08/04/2013 | 231 | 29 | 335 | 23 | 618 |
| 09/04/2013 | 243 | 27 | 330 | 39 | 639 |
| 10/04/2013 | 226 | 27 | 324 | 27 | 604 |
| 11/04/2013 | 219 | 30 | 335 | 28 | 612 |
| 12/04/2013 | 208 | 37 | 318 | 38 | 601 |
| 13/04/2013 | 36 | 28 | 141 | 3 | 208 |
| 14/04/2013 | 19 | 0 | 120 | 0 | 139 |
| 15/04/2013 | 238 | 31 | 321 | 27 | 617 |
| 16/04/2013 | 220 | 29 | 323 | 36 | 608 |
| 17/04/2013 | 227 | 28 | 327 | 29 | 611 |
| 18/04/2013 | 260 | 26 | 319 | 24 | 629 |
| 19/04/2013 | 221 | 35 | 322 | 38 | 616 |
| 20/04/2013 | 42 | 24 | 143 | 2 | 211 |
| 21/04/2013 | 0 | 1 | 146 | 0 | 147 |
| 22/04/2013 | 246 | 30 | 327 | 27 | 630 |
| 23/04/2013 | 228 | 30 | 323 | 17 | 598 |
| 24/04/2013 | 203 | 29 | 344 | 32 | 608 |
| 25/04/2013 | 203 | 31 | 356 | 33 | 623 |
| 26/04/2013 | 196 | 38 | 314 | 36 | 584 |
| 27/04/2013 | 42 | 21 | 145 | 3 | 211 |
| 28/04/2013 | 22 | 0 | 134 | 0 | 156 |
| 29/04/2013 | 230 | 27 | 341 | 28 | 626 |
| 30/04/2013 | 234 | 32 | 333 | 38 | 637 |
| 01/05/2013 | 225 | 26 | 336 | 30 | 617 |
| 02/05/2013 | 241 | 25 | 339 | 29 | 634 |
| 03/05/2013 | 215 | 29 | 309 | 34 | 587 |
| 04/05/2013 | 59 | 18 | 152 | 1 | 230 |
| 05/05/2013 | 0 | 0 | 142 | 0 | 142 |
| 06/05/2013 | 232 | 26 | 171 | 5 | 434 |
| 07/05/2013 | 243 | 26 | 360 | 39 | 668 |
| 08/05/2013 | 247 | 26 | 363 | 26 | 662 |
| 09/05/2013 | 248 | 30 | 345 | 32 | 655 |
| 10/05/2013 | 210 | 35 | 327 | 32 | 604 |

Reference number 235716-30

Dated 13-Aug-14

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 11/05/2013 | 61 | 19 | 179 | 13 | 272 |
| 12/05/2013 | 27 | 0 | 134 | 0 | 161 |
| 13/05/2013 | 265 | 26 | 333 | 25 | 649 |
| 14/05/2013 | 238 | 26 | 325 | 35 | 624 |
| 15/05/2013 | 197 | 27 | 352 | 30 | 606 |
| 16/05/2013 | 223 | 26 | 327 | 35 | 611 |
| 17/05/2013 | 206 | 31 | 311 | 40 | 588 |
| 18/05/2013 | 60 | 21 | 142 | 2 | 225 |
| 19/05/2013 | 0 | 0 | 133 | 0 | 133 |
| 20/05/2013 | 221 | 26 | 326 | 26 | 599 |
| 21/05/2013 | 198 | 28 | 335 | 33 | 594 |
| 22/05/2013 | 205 | 25 | 336 | 37 | 603 |
| 23/05/2013 | 225 | 30 | 305 | 27 | 587 |
| 24/05/2013 | 197 | 24 | 320 | 41 | 582 |
| 25/05/2013 | 59 | 18 | 140 | 3 | 220 |
| 26/05/2013 | 20 | 0 | 127 | 0 | 147 |
| 27/05/2013 | 195 | 21 | 181 | 6 | 403 |
| 28/05/2013 | 210 | 27 | 338 | 41 | 616 |
| 29/05/2013 | 238 | 27 | 321 | 28 | 614 |
| 30/05/2013 | 257 | 27 | 336 | 36 | 656 |
| 31/05/2013 | 239 | 35 | 310 | 34 | 618 |
| 01/06/2013 | 38 | 16 | 151 | 8 | 213 |
| 02/06/2013 | 1 | 0 | 118 | 0 | 119 |
| 03/06/2013 | 183 | 28 | 336 | 24 | 571 |
| 04/06/2013 | 206 | 32 | 327 | 33 | 598 |
| 05/06/2013 | 203 | 21 | 342 | 27 | 593 |
| 06/06/2013 | 207 | 29 | 304 | 28 | 568 |
| 07/06/2013 | 183 | 26 | 347 | 39 | 595 |
| 08/06/2013 | 25 | 18 | 167 | 3 | 213 |
| 09/06/2013 | 1 | 0 | 133 | 0 | 134 |
| 10/06/2013 | 193 | 22 | 314 | 21 | 550 |
| 11/06/2013 | 187 | 20 | 329 | 38 | 574 |
| 12/06/2013 | 198 | 21 | 311 | 32 | 562 |
| 13/06/2013 | 181 | 24 | 319 | 24 | 548 |
| 14/06/2013 | 176 | 29 | 317 | 46 | 568 |
| 15/06/2013 | 28 | 17 | 142 | 3 | 190 |
| 16/06/2013 | 2 | 0 | 123 | 0 | 125 |
| 17/06/2013 | 180 | 21 | 295 | 27 | 523 |
| 18/06/2013 | 182 | 26 | 307 | 36 | 551 |
| 19/06/2013 | 178 | 21 | 308 | 32 | 539 |
| 20/06/2013 | 184 | 25 | 310 | 31 | 550 |
| 21/06/2013 | 165 | 28 | 315 | 40 | 548 |
| 22/06/2013 | 39 | 17 | 147 | 3 | 206 |
| 23/06/2013 | 1 | 0 | 124 | 0 | 125 |
| 24/06/2013 | 202 | 23 | 296 | 31 | 552 |
| 25/06/2013 | 202 | 20 | 287 | 32 | 541 |
| 26/06/2013 | 194 | 22 | 311 | 30 | 557 |
| 27/06/2013 | 183 | 24 | 309 | 30 | 546 |
| 28/06/2013 | 173 | 26 | 305 | 30 | 534 |

Reference number 235716-30

Dated 13-Aug-14

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 29/06/2013 | 18 | 24 | 120 | 39 | 201 |

Reference number 235716-30

Dated 13-Aug-14

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 30/06/2013 | 0 | 0 | 131 | 3 | 134 |
| 01/07/2013 | 199 | 14 | 305 | 28 | 546 |
| 02/07/2013 | 215 | 17 | 344 | 34 | 610 |
| 03/07/2013 | 195 | 24 | 327 | 29 | 575 |
| 04/07/2013 | 194 | 20 | 302 | 32 | 548 |
| 05/07/2013 | 186 | 24 | 324 | 47 | 581 |
| 06/07/2013 | 25 | 13 | 165 | 2 | 205 |
| 07/07/2013 | 2 | 0 | 136 | 0 | 138 |
| 08/07/2013 | 191 | 21 | 328 | 38 | 578 |
| 09/07/2013 | 207 | 20 | 312 | 24 | 563 |
| 10/07/2013 | 187 | 20 | 304 | 39 | 550 |
| 11/07/2013 | 200 | 18 | 321 | 25 | 564 |
| 12/07/2013 | 195 | 27 | 314 | 37 | 573 |
| 13/07/2013 | 30 | 18 | 149 | 3 | 200 |
| 14/07/2013 | 1 | 0 | 147 | 0 | 148 |
| 15/07/2013 | 161 | 17 | 343 | 34 | 555 |
| 16/07/2013 | 189 | 20 | 369 | 26 | 604 |
| 17/07/2013 | 168 | 22 | 358 | 28 | 576 |
| 18/07/2013 | 175 | 26 | 309 | 26 | 536 |
| 19/07/2013 | 168 | 28 | 349 | 41 | 586 |
| 20/07/2013 | 32 | 26 | 152 | 3 | 213 |
| 21/07/2013 | 1 | 0 | 131 | 0 | 132 |
| 22/07/2013 | 186 | 24 | 362 | 26 | 598 |
| 23/07/2013 | 205 | 25 | 327 | 35 | 592 |
| 24/07/2013 | 203 | 24 | 325 | 31 | 583 |
| 25/07/2013 | 211 | 30 | 325 | 26 | 592 |
| 26/07/2013 | 177 | 23 | 315 | 38 | 553 |
| 27/07/2013 | 37 | 22 | 199 | 3 | 261 |
| 28/07/2013 | 1 | 0 | 135 | 0 | 136 |
| 29/07/2013 | 224 | 20 | 325 | 25 | 594 |
| 30/07/2013 | 231 | 23 | 331 | 42 | 627 |
| 31/07/2013 | 196 | 25 | 331 | 30 | 582 |
| 01/08/2013 | 211 | 26 | 319 | 30 | 586 |
| 02/08/2013 | 188 | 27 | 309 | 36 | 560 |
| 03/08/2013 | 40 | 16 | 155 | 3 | 214 |
| 04/08/2013 | 1 | 0 | 144 | 0 | 145 |
| 05/08/2013 | 187 | 25 | 330 | 22 | 564 |
| 06/08/2013 | 205 | 23 | 317 | 35 | 580 |
| 07/08/2013 | 199 | 26 | 339 | 24 | 588 |
| 08/08/2013 | 202 | 24 | 320 | 26 | 572 |
| 09/08/2013 | 196 | 29 | 336 | 35 | 596 |
| 10/08/2013 | 44 | 20 | 146 | 2 | 212 |
| 11/08/2013 | 3 | 0 | 135 | 0 | 138 |
| 12/08/2013 | 232 | 23 | 323 | 26 | 604 |
| 13/08/2013 | 252 | 23 | 338 | 28 | 641 |
| 14/08/2013 | 215 | 28 | 314 | 34 | 591 |
| 15/08/2013 | 213 | 23 | 319 | 32 | 587 |
| 16/08/2013 | 191 | 31 | 304 | 34 | 560 |
| 17/08/2013 | 39 | 24 | 142 | 3 | 208 |

| Reference number | 235716-30 | EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT. |
|---|---|---|
| Dated | 13-Aug-14 | |

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 18/08/2013 | 1 | 0 | 131 | 0 | 132 |
| 19/08/2013 | 209 | 22 | 311 | 25 | 567 |
| 20/08/2013 | 207 | 24 | 316 | 37 | 584 |
| 21/08/2013 | 205 | 22 | 321 | 24 | 572 |
| 22/08/2013 | 211 | 25 | 322 | 29 | 587 |
| 23/08/2013 | 179 | 33 | 320 | 38 | 570 |
| 24/08/2013 | 44 | 22 | 141 | 3 | 210 |
| 25/08/2013 | 2 | 0 | 114 | 0 | 116 |
| 26/08/2013 | 175 | 18 | 163 | 6 | 362 |
| 27/08/2013 | 196 | 23 | 332 | 42 | 593 |
| 28/08/2013 | 205 | 24 | 315 | 27 | 571 |
| 29/08/2013 | 219 | 27 | 316 | 29 | 591 |
| 30/08/2013 | 194 | 27 | 327 | 33 | 581 |
| 31/08/2013 | 49 | 28 | 148 | 7 | 232 |
| 01/09/2013 | 1 | 0 | 137 | 0 | 138 |
| 02/09/2013 | 209 | 23 | 320 | 25 | 577 |
| 03/09/2013 | 213 | 24 | 337 | 37 | 611 |
| 04/09/2013 | 204 | 8 | 319 | 27 | 558 |
| 05/09/2013 | 205 | 25 | 316 | 25 | 571 |
| 06/09/2013 | 198 | 28 | 286 | 36 | 548 |
| 07/09/2013 | 43 | 18 | 139 | 5 | 205 |
| 08/09/2013 | 1 | 21 | 123 | 0 | 145 |
| 09/09/2013 | 217 | 25 | 320 | 28 | 590 |
| 10/09/2013 | 215 | 25 | 334 | 33 | 607 |
| 11/09/2013 | 191 | 28 | 313 | 25 | 557 |
| 12/09/2013 | 214 | 28 | 316 | 28 | 586 |
| 13/09/2013 | 214 | 32 | 306 | 34 | 586 |
| 14/09/2013 | 41 | 26 | 136 | 4 | 207 |
| 15/09/2013 | 8 | 0 | 117 | 0 | 125 |
| 16/09/2013 | 201 | 22 | 315 | 28 | 566 |
| 17/09/2013 | 163 | 24 | 323 | 35 | 545 |
| 18/09/2013 | 170 | 25 | 317 | 28 | 540 |
| 19/09/2013 | 173 | 26 | 311 | 24 | 534 |
| 20/09/2013 | 157 | 32 | 296 | 39 | 524 |
| 21/09/2013 | 15 | 29 | 133 | 3 | 180 |
| 22/09/2013 | 2 | 0 | 114 | 0 | 116 |
| 23/09/2013 | 165 | 25 | 289 | 29 | 508 |
| 24/09/2013 | 203 | 25 | 310 | 35 | 573 |
| 25/09/2013 | 203 | 30 | 305 | 27 | 565 |
| 26/09/2013 | 199 | 28 | 297 | 28 | 552 |
| 27/09/2013 | 178 | 33 | 305 | 36 | 552 |
| 28/09/2013 | 40 | 28 | 131 | 4 | 203 |
| 29/09/2013 | 1 | 0 | 137 | 0 | 138 |
| 30/09/2013 | 201 | 22 | 294 | 24 | 541 |
| 01/10/2013 | 207 | 24 | 288 | 36 | 555 |
| 02/10/2013 | 199 | 25 | 286 | 31 | 541 |
| 03/10/2013 | 215 | 6 | 305 | 27 | 553 |
| 04/10/2013 | 208 | 27 | 287 | 33 | 555 |
| 05/10/2013 | 46 | 18 | 136 | 3 | 203 |

| Reference number | 235716-30 | EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT. |
|---|---|---|
| Dated | 13-Aug-14 | |

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 06/10/2013 | 0 | 0 | 127 | 0 | 127 |
| 07/10/2013 | 199 | 24 | 298 | 24 | 545 |
| 08/10/2013 | 205 | 24 | 290 | 33 | 552 |
| 09/10/2013 | 203 | 25 | 311 | 28 | 567 |
| 10/10/2013 | 201 | 31 | 287 | 25 | 544 |
| 11/10/2013 | 204 | 28 | 308 | 31 | 571 |
| 12/10/2013 | 46 | 15 | 134 | 4 | 199 |
| 13/10/2013 | 14 | 0 | 105 | 0 | 119 |
| 14/10/2013 | 198 | 15 | 321 | 33 | 567 |
| 15/10/2013 | 204 | 21 | 318 | 28 | 571 |
| 16/10/2013 | 205 | 21 | 297 | 27 | 550 |
| 17/10/2013 | 214 | 27 | 310 | 31 | 582 |
| 18/10/2013 | 215 | 23 | 332 | 34 | 604 |
| 19/10/2013 | 30 | 26 | 134 | 4 | 194 |
| 20/10/2013 | 15 | 0 | 116 | 0 | 131 |
| 21/10/2013 | 217 | 20 | 315 | 27 | 579 |
| 22/10/2013 | 186 | 21 | 351 | 37 | 595 |
| 23/10/2013 | 213 | 24 | 361 | 28 | 626 |
| 24/10/2013 | 150 | 23 | 318 | 30 | 521 |
| 25/10/2013 | 146 | 27 | 324 | 36 | 533 |
| 26/10/2013 | 48 | 27 | 133 | 4 | 212 |
| 27/10/2013 | 0 | 0 | 139 | 0 | 139 |
| 28/10/2013 | 210 | 19 | 351 | 19 | 599 |
| 29/10/2013 | 184 | 21 | 381 | 27 | 613 |
| 30/10/2013 | 179 | 19 | 368 | 27 | 593 |
| 31/10/2013 | 185 | 22 | 370 | 23 | 600 |
| 01/11/2013 | 169 | 29 | 338 | 25 | 561 |
| 02/11/2013 | 48 | 23 | 139 | 8 | 218 |
| 03/11/2013 | 2 | 0 | 146 | 0 | 148 |
| 04/11/2013 | 195 | 26 | 379 | 17 | 617 |
| 05/11/2013 | 211 | 28 | 362 | 30 | 631 |
| 06/11/2013 | 161 | 16 | 365 | 25 | 567 |
| 07/11/2013 | 173 | 22 | 337 | 21 | 553 |
| 08/11/2013 | 176 | 29 | 332 | 36 | 573 |
| 09/11/2013 | 53 | 20 | 153 | 2 | 228 |
| 10/11/2013 | 1 | 0 | 122 | 0 | 123 |
| 11/11/2013 | 209 | 19 | 339 | 19 | 586 |
| 12/11/2013 | 186 | 20 | 362 | 31 | 599 |
| 13/11/2013 | 182 | 20 | 328 | 21 | 551 |
| 14/11/2013 | 191 | 19 | 354 | 18 | 582 |
| 15/11/2013 | 176 | 25 | 318 | 30 | 549 |
| 16/11/2013 | 25 | 23 | 149 | 4 | 201 |
| 17/11/2013 | 2 | 0 | 143 | 0 | 145 |
| 18/11/2013 | 196 | 19 | 335 | 23 | 573 |
| 19/11/2013 | 208 | 21 | 328 | 38 | 595 |
| 20/11/2013 | 171 | 19 | 363 | 27 | 580 |
| 21/11/2013 | 200 | 24 | 338 | 24 | 586 |
| 22/11/2013 | 173 | 29 | 317 | 32 | 551 |
| 23/11/2013 | 29 | 21 | 146 | 3 | 199 |

Reference number 235716-30

Dated 13-Aug-14

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 24/11/2013 | 2 | 0 | 121 | 0 | 123 |
| 25/11/2013 | 206 | 9 | 358 | 18 | 591 |
| 26/11/2013 | 200 | 22 | 342 | 26 | 590 |
| 27/11/2013 | 202 | 18 | 347 | 23 | 590 |
| 28/11/2013 | 204 | 22 | 332 | 25 | 583 |
| 29/11/2013 | 202 | 22 | 319 | 24 | 567 |
| 30/11/2013 | 36 | 25 | 139 | 0 | 200 |
| 01/12/2013 | 0 | 0 | 123 | 0 | 123 |
| 02/12/2013 | 223 | 18 | 343 | 24 | 608 |
| 03/12/2013 | 227 | 23 | 321 | 39 | 610 |
| 04/12/2013 | 207 | 22 | 340 | 23 | 592 |
| 05/12/2013 | 204 | 21 | 315 | 26 | 566 |
| 06/12/2013 | 220 | 24 | 327 | 31 | 602 |
| 07/12/2013 | 54 | 27 | 161 | 3 | 245 |
| 08/12/2013 | 3 | 0 | 136 | 0 | 139 |
| 09/12/2013 | 234 | 20 | 308 | 20 | 582 |
| 10/12/2013 | 216 | 19 | 338 | 35 | 608 |
| 11/12/2013 | 205 | 21 | 296 | 25 | 547 |
| 12/12/2013 | 208 | 7 | 341 | 25 | 581 |
| 13/12/2013 | 196 | 20 | 317 | 36 | 569 |
| 14/12/2013 | 32 | 27 | 129 | 6 | 194 |
| 15/12/2013 | 1 | 0 | 126 | 0 | 127 |
| 16/12/2013 | 185 | 11 | 313 | 22 | 531 |
| 17/12/2013 | 200 | 12 | 362 | 36 | 610 |
| 18/12/2013 | 187 | 15 | 321 | 23 | 546 |
| 19/12/2013 | 210 | 9 | 316 | 24 | 559 |
| 20/12/2013 | 212 | 11 | 315 | 34 | 572 |
| 21/12/2013 | 44 | 26 | 147 | 11 | 228 |
| 22/12/2013 | 1 | 0 | 131 | 0 | 132 |
| 23/12/2013 | 227 | 18 | 283 | 20 | 548 |
| 24/12/2013 | 210 | 18 | 240 | 33 | 501 |
| 25/12/2013 | 1 | 0 | 35 | 0 | 36 |
| 26/12/2013 | 35 | 0 | 65 | 0 | 100 |
| 27/12/2013 | 230 | 16 | 226 | 21 | 493 |
| 28/12/2013 | 193 | 18 | 163 | 7 | 381 |
| 29/12/2013 | 29 | 0 | 262 | 0 | 291 |
| 30/12/2013 | 246 | 18 | 261 | 23 | 548 |
| 31/12/2013 | 211 | 19 | 248 | 29 | 507 |
| 01/01/2014 | 30 | 0 | 102 | 0 | 132 |
| 02/01/2014 | 211 | 17 | 276 | 22 | 526 |
| 03/01/2014 | 255 | 23 | 276 | 36 | 590 |
| 04/01/2014 | 162 | 22 | 144 | 6 | 334 |
| 05/01/2014 | 1 | 0 | 124 | 0 | 125 |
| 06/01/2014 | 202 | 20 | 313 | 25 | 560 |
| 07/01/2014 | 201 | 21 | 312 | 37 | 571 |
| 08/01/2014 | 194 | 18 | 299 | 25 | 536 |
| 09/01/2014 | 198 | 21 | 318 | 18 | 555 |
| 10/01/2014 | 190 | 23 | 311 | 31 | 555 |
| 11/01/2014 | 30 | 20 | 133 | 1 | 184 |

Reference number 235716-30

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

Dated 13-Aug-14

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 12/01/2014 | 2 | 0 | 125 | 0 | 127 |
| 13/01/2014 | 187 | 18 | 315 | 30 | 550 |
| 14/01/2014 | 209 | 22 | 302 | 25 | 558 |
| 15/01/2014 | 183 | 17 | 304 | 23 | 527 |
| 16/01/2014 | 185 | 25 | 296 | 21 | 527 |
| 17/01/2014 | 186 | 23 | 277 | 35 | 521 |
| 18/01/2014 | 31 | 20 | 124 | 2 | 177 |
| 19/01/2014 | 2 | 0 | 117 | 0 | 119 |
| 20/01/2014 | 189 | 16 | 312 | 22 | 539 |
| 21/01/2014 | 192 | 20 | 294 | 33 | 539 |
| 22/01/2014 | 161 | 19 | 302 | 40 | 522 |
| 23/01/2014 | 181 | 21 | 285 | 36 | 523 |
| 24/01/2014 | 192 | 26 | 277 | 6 | 501 |
| 25/01/2014 | 33 | 28 | 121 | 0 | 182 |
| 26/01/2014 | 1 | 0 | 117 | 22 | 140 |
| 27/01/2014 | 185 | 19 | 276 | 37 | 517 |
| 28/01/2014 | 184 | 22 | 275 | 32 | 513 |
| 29/01/2014 | 181 | 21 | 282 | 22 | 506 |
| 30/01/2014 | 187 | 20 | 256 | 26 | 489 |
| 31/01/2014 | 178 | 26 | 283 | 29 | 516 |
| 01/02/2014 | 30 | 28 | 143 | 2 | 203 |
| 02/02/2014 | 1 | 0 | 130 | 0 | 131 |
| 03/02/2014 | 206 | 19 | 284 | 23 | 532 |
| 04/02/2014 | 206 | 20 | 289 | 30 | 545 |
| 05/02/2014 | 206 | 21 | 275 | 23 | 525 |
| 06/02/2014 | 204 | 23 | 271 | 23 | 521 |
| 07/02/2014 | 180 | 24 | 265 | 29 | 498 |
| 08/02/2014 | 33 | 28 | 118 | 2 | 181 |
| 09/02/2014 | 0 | 0 | 119 | 0 | 119 |
| 10/02/2014 | 212 | 20 | 299 | 21 | 552 |
| 11/02/2014 | 204 | 20 | 290 | 34 | 548 |
| 12/02/2014 | 194 | 19 | 280 | 20 | 513 |
| 13/02/2014 | 192 | 19 | 298 | 18 | 527 |
| 14/02/2014 | 195 | 25 | 269 | 27 | 516 |
| 15/02/2014 | 52 | 27 | 116 | 5 | 200 |
| 16/02/2014 | 0 | 0 | 135 | 0 | 135 |
| 17/02/2014 | 205 | 19 | 247 | 21 | 492 |
| 18/02/2014 | 191 | 20 | 286 | 33 | 530 |
| 19/02/2014 | 202 | 19 | 272 | 23 | 516 |
| 20/02/2014 | 195 | 21 | 278 | 21 | 515 |
| 21/02/2014 | 184 | 27 | 271 | 30 | 512 |
| 22/02/2014 | 40 | 30 | 129 | 1 | 200 |
| 23/02/2014 | 0 | 0 | 125 | 0 | 125 |
| 24/02/2014 | 198 | 18 | 301 | 21 | 538 |
| 25/02/2014 | 195 | 23 | 293 | 37 | 548 |
| 26/02/2014 | 170 | 19 | 276 | 25 | 490 |
| 27/02/2014 | 161 | 22 | 281 | 19 | 483 |
| 28/02/2014 | 180 | 26 | 251 | 30 | 487 |
| 01/03/2014 | 36 | 28 | 135 | 3 | 202 |

Reference number 235716-30

Dated 13-Aug-14

EACH VEHICLE MOVEMENT LISTED IS AN "IN" AND AN "OUT" MOVEMENT.

| Ecopark vehicle movements | ESWIP 2013/14 | IVC 2013/14 | BWRF 2013/14 | Clinical Waste Treatment Plant 2013/14 | Total 2013/14 |
|---|---|---|---|---|---|
| 02/03/2014 | 1 | 0 | 133 | 0 | 134 |
| 03/03/2014 | 183 | 21 | 286 | 15 | 505 |
| 04/03/2014 | 160 | 20 | 274 | 26 | 480 |
| 05/03/2014 | 168 | 22 | 268 | 17 | 475 |
| 06/03/2014 | 173 | 21 | 274 | 20 | 488 |
| 07/03/2014 | 189 | 28 | 269 | 22 | 508 |
| 08/03/2014 | 28 | 26 | 133 | 1 | 188 |
| 09/03/2014 | 1 | 0 | 136 | 0 | 137 |
| 10/03/2014 | 215 | 22 | 300 | 23 | 560 |
| 11/03/2014 | 207 | 23 | 285 | 30 | 545 |
| 12/03/2014 | 187 | 22 | 291 | 21 | 521 |
| 13/03/2014 | 205 | 18 | 262 | 23 | 508 |
| 14/03/2014 | 197 | 19 | 276 | 29 | 521 |
| 15/03/2014 | 39 | 17 | 161 | 4 | 221 |
| 16/03/2014 | 20 | 0 | 134 | 0 | 154 |
| 17/03/2014 | 197 | 19 | 297 | 21 | 534 |
| 18/03/2014 | 211 | 2 | 289 | 33 | 535 |
| 19/03/2014 | 208 | 19 | 275 | 22 | 524 |
| 20/03/2014 | 209 | 21 | 275 | 24 | 529 |
| 21/03/2014 | 194 | 27 | 283 | 28 | 532 |
| 22/03/2014 | 39 | 17 | 162 | 3 | 221 |
| 23/03/2014 | 1 | 0 | 138 | 0 | 139 |
| 24/03/2014 | 195 | 22 | 279 | 19 | 515 |
| 25/03/2014 | 194 | 21 | 272 | 28 | 515 |
| 26/03/2014 | 167 | 20 | 271 | 20 | 478 |
| 27/03/2014 | 182 | 21 | 263 | 27 | 493 |
| 28/03/2014 | 181 | 29 | 242 | 29 | 481 |
| 29/03/2014 | 28 | 26 | 141 | 2 | 197 |
| 30/03/2014 | 0 | 0 | 115 | 0 | 115 |
| 31/03/2014 | 176 | 21 | 275 | 17 | 489 |

***Vehicle flow into and out of the EcoPark from May 2013 Surveys***

**Inbound:**

| Car | Taxi | LGV | OGV1 | OGV2 | Bus | Coach | M/Cyc | Cycle | Total |
|---|---|---|---|---|---|---|---|---|---|
| 311 | 0 | 268 | 318 | 150 | 0 | 0 | 7 | 10 | 1064 |
| 29% | 0% | 25% | 30% | 14% | 0% | 0% | 1% | 1% | 100% |

**Outbound:**

| Car | Taxi | LGV | OGV1 | OGV2 | Bus | Coach | M/Cyc | Cycle | Total |
|---|---|---|---|---|---|---|---|---|---|
| 312 | 0 | 266 | 323 | 147 | 0 | 0 | 7 | 7 | 1062 |
| 29% | 0% | 25% | 30% | 14% | 0% | 0% | 1% | 1% | 100% |

| Existing Throughput: | tpa (Annual) | Vehicles (Annual) | Average Vehicle Size (tph) | Daily Flow |
|---|---|---|---|---|
| ***Input Waste*** | | | | |
| EfW Facility | 546,696 | 54410 | **10** | **237** |
| IVC | 34,910 | 7215 | **5** | **32** |
| BWRC & FPP | 105,711 | 94629 | **1** | **362** |
| CWTP | 10,566 | 7634 | **1** | **35** |
| ***Output Waste*** | | | | |
| Ash Recycling | 29,825 | 711 | **42** | **3** |
| Clinical Waste | 883 | 49 | **18** | **1** |
| Compost | 66,156 | 1647 | **40** | **6** |
| Bulky Waste | 291,596 | 7930 | **37** | **31** |
| Flu Gas Residue | 40,725 | 991 | **41** | **4** |
| EfW Rejects/Output | 54,670 | 9505 | **22** | **37** |
| ***Staff/Other*** | | | | **317** |
| Total | | | | **1063** |
| | | | | |
| **Total two-way flow** | | | | **2126** |

***Daily profiles (obtained from May 2013 surveys)***

**Staff/other trips**

| | **Inbound** | **Outbound** | **Two-way** |
|---|---|---|---|
| 00:00 - 01:00 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 |
| 04:00 - 05:00 | 11 | 0 | 11 |
| 05:00 - 06:00 | 54 | 3 | 57 |
| 06:00 -07:00 | 77 | 12 | 90 |
| 07:00 - 08:00 | 26 | 1 | 28 |
| 08:00 - 09:00 | 16 | 8 | 24 |
| 09:00 - 10:00 | 22 | 8 | 31 |
| 10:00 - 11:00 | 10 | 7 | 17 |
| 11:00 - 12:00 | 11 | 20 | 32 |
| 12:00 - 13:00 | 16 | 44 | 60 |
| 13:00 - 14:00 | 24 | 31 | 56 |
| 14:00 - 15:00 | 12 | 28 | 41 |
| 15:00 - 16:00 | 4 | 26 | 30 |
| 16:00 - 17:00 | 8 | 41 | 49 |
| 17:00 - 18:00 | 4 | 39 | 43 |
| 18:00 - 19:00 | 9 | 30 | 40 |
| 19:00 - 20:00 | 7 | 7 | 14 |
| 20:00 - 21:00 | 0 | 2 | 2 |
| 21:00 - 22:00 | 0 | 6 | 6 |
| 22:00 - 23:00 | 2 | 2 | 4 |
| 23:00 - 00:00 | 0 | 0 | 0 |
| **Total** | **317** | **317** | **634** |

**HGV/LGV trips**

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 1 | 0 | 1 |
| 01:00 - 02:00 | 4 | 5 | 9 |
| 02:00 - 03:00 | 7 | 6 | 13 |
| 03:00 - 04:00 | 5 | 4 | 9 |
| 04:00 - 05:00 | 11 | 15 | 26 |
| 05:00 - 06:00 | 7 | 11 | 18 |
| 06:00 -07:00 | 33 | 35 | 69 |
| 07:00 - 08:00 | 29 | 33 | 63 |
| 08:00 - 09:00 | 56 | 49 | 104 |
| 09:00 - 10:00 | 79 | 74 | 153 |
| 10:00 - 11:00 | 90 | 68 | 158 |
| 11:00 - 12:00 | 100 | 101 | 202 |
| 12:00 - 13:00 | 85 | 84 | 169 |
| 13:00 - 14:00 | 75 | 72 | 147 |
| 14:00 - 15:00 | 48 | 56 | 103 |
| 15:00 - 16:00 | 31 | 33 | 65 |
| 16:00 - 17:00 | 22 | 26 | 49 |
| 17:00 - 18:00 | 8 | 20 | 28 |
| 18:00 - 19:00 | 11 | 8 | 19 |
| 19:00 - 20:00 | 7 | 8 | 15 |
| 20:00 - 21:00 | 19 | 12 | 31 |
| 21:00 - 22:00 | 12 | 18 | 30 |
| 22:00 - 23:00 | 1 | 3 | 4 |
| 23:00 - 00:00 | 2 | 2 | 4 |
| **Total** | **746** | **746** | **1492** |

**Total**

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 1 | 0 | 1 |
| 01:00 - 02:00 | 4 | 5 | 9 |
| 02:00 - 03:00 | 7 | 6 | 13 |
| 03:00 - 04:00 | 5 | 4 | 9 |
| 04:00 - 05:00 | 22 | 15 | 38 |
| 05:00 - 06:00 | 61 | 14 | 75 |
| 06:00 -07:00 | 111 | 48 | 159 |
| 07:00 - 08:00 | 56 | 34 | 90 |
| 08:00 - 09:00 | 72 | 57 | 129 |
| 09:00 - 10:00 | 101 | 82 | 184 |
| 10:00 - 11:00 | 100 | 75 | 175 |
| 11:00 - 12:00 | 112 | 122 | 233 |
| 12:00 - 13:00 | 101 | 128 | 229 |
| 13:00 - 14:00 | 99 | 103 | 203 |
| 14:00 - 15:00 | 60 | 84 | 144 |
| 15:00 - 16:00 | 35 | 60 | 95 |
| 16:00 - 17:00 | 30 | 67 | 97 |
| 17:00 - 18:00 | 12 | 59 | 71 |
| 18:00 - 19:00 | 20 | 39 | 59 |
| 19:00 - 20:00 | 14 | 15 | 29 |
| 20:00 - 21:00 | 19 | 14 | 33 |
| 21:00 - 22:00 | 12 | 24 | 37 |
| 22:00 - 23:00 | 3 | 5 | 8 |
| 23:00 - 00:00 | 2 | 2 | 4 |
| **Total** | **1063** | **1063** | **2126** |

**Total (%)**

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 0.1% | 0.0% | 0.0% |
| 01:00 - 02:00 | 0.4% | 0.5% | 0.4% |
| 02:00 - 03:00 | 0.7% | 0.6% | 0.6% |
| 03:00 - 04:00 | 0.5% | 0.4% | 0.4% |
| 04:00 - 05:00 | 2.1% | 1.4% | 1.8% |
| 05:00 - 06:00 | 5.7% | 1.3% | 3.5% |
| 06:00 -07:00 | 10.4% | 4.5% | 7.5% |
| 07:00 - 08:00 | 5.3% | 3.2% | 4.3% |
| 08:00 - 09:00 | 6.8% | 5.3% | 6.1% |
| 09:00 - 10:00 | 9.5% | 7.7% | 8.6% |
| 10:00 - 11:00 | 9.4% | 7.1% | 8.3% |
| 11:00 - 12:00 | 10.5% | 11.4% | 11.0% |
| 12:00 - 13:00 | 9.5% | 12.0% | 10.8% |
| 13:00 - 14:00 | 9.4% | 9.7% | 9.5% |
| 14:00 - 15:00 | 5.6% | 7.9% | 6.8% |
| 15:00 - 16:00 | 3.3% | 5.6% | 4.5% |
| 16:00 - 17:00 | 2.9% | 6.3% | 4.6% |
| 17:00 - 18:00 | 1.1% | 5.5% | 3.3% |
| 18:00 - 19:00 | 1.9% | 3.6% | 2.8% |
| 19:00 - 20:00 | 1.3% | 1.4% | 1.4% |
| 20:00 - 21:00 | 1.8% | 1.3% | 1.6% |
| 21:00 - 22:00 | 1.1% | 2.3% | 1.7% |
| 22:00 - 23:00 | 0.3% | 0.5% | 0.4% |
| 23:00 - 00:00 | 0.2% | 0.2% | 0.2% |
| **Total** | **100%** | **100%** | **100%** |

**HGV (%)**

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 0.1% | 0.0% | 0.1% |
| 01:00 - 02:00 | 0.5% | 0.7% | 1.2% |
| 02:00 - 03:00 | 1.0% | 0.8% | 1.8% |
| 03:00 - 04:00 | 0.7% | 0.5% | 1.2% |
| 04:00 - 05:00 | 1.5% | 2.0% | 3.5% |
| 05:00 - 06:00 | 1.0% | 1.5% | 2.4% |
| 06:00 -07:00 | 4.5% | 4.8% | 9.2% |
| 07:00 - 08:00 | 3.9% | 4.5% | 8.4% |
| 08:00 - 09:00 | 7.5% | 6.5% | 14.0% |
| 09:00 - 10:00 | 10.6% | 9.9% | 20.5% |
| 10:00 - 11:00 | 12.1% | 9.1% | 21.2% |
| 11:00 - 12:00 | 13.5% | 13.6% | 27.0% |
| 12:00 - 13:00 | 11.4% | 11.3% | 22.7% |
| 13:00 - 14:00 | 10.1% | 9.6% | 19.7% |
| 14:00 - 15:00 | 6.4% | 7.5% | 13.9% |
| 15:00 - 16:00 | 4.2% | 4.5% | 8.7% |
| 16:00 - 17:00 | 3.0% | 3.5% | 6.5% |
| 17:00 - 18:00 | 1.1% | 2.7% | 3.8% |
| 18:00 - 19:00 | 1.5% | 1.1% | 2.6% |
| 19:00 - 20:00 | 1.0% | 1.1% | 2.0% |
| 20:00 - 21:00 | 2.6% | 1.6% | 4.2% |
| 21:00 - 22:00 | 1.6% | 2.4% | 4.1% |
| 22:00 - 23:00 | 0.1% | 0.4% | 0.5% |
| 23:00 - 00:00 | 0.3% | 0.3% | 0.5% |
| **Total** | **100%** | **100%** | **200%** |

# **Appendix F** – Operation Trip Generation Supporting Information

***FUTURE COMPLETED SITE TRIP GENERATION***

| | | | | ANNUAL TRIPS | | | | | DAILY TRIPS | | | | | ADJUSTED DAILY TRIPS (weekday) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ERF throughput** | **ktpa** | **RRF to ERF** | **RRF (only)** | **Average incoming payload** | **Annual trips - In** | **Average outgoing payload** | **Annual trips - Out** | **Annual trips - Internal to RRF** | **Average incoming payload** | **Daily trips - In** | **Average outgoing payload** | **Daily trips - Out** | **Daily trips - Internal to RRF** | **Average incoming payload** | **Daily trips - In** | **Average outgoing payload** | **Daily trips - Out** | **Daily trips - Internal to RRF** |
| ERF external waste (no bulking) | 262,803 | - | - | 8.00 | 32,850 | - | - | - | 8.00 | 115 | - | - | - | 8.00 | 115 | - | - | - |
| ERF external waste (bulked) | 188,741 | | | 22.20 | 8,503 | | | | 22.20 | 30 | | | | 22.20 | 30 | | | |
| Throughput from RRF | 248,456 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Total throughput* | *700,000* | - | - | - | *41,353* | - | - | - | - | *145* | - | - | - | - | *145* | - | - | - |
| **ERF output** | | | | | | | | | | | | | | | | | | |
| Bottom ash output | 140000 | - | - | - | - | 42 | 3,333 | - | - | - | 42 | 13 | - | - | - | 42 | 13 | - |
| Air pollution control residues output | 35000 | - | - | - | - | 41 | 852 | - | - | - | 41 | 3 | - | - | - | 41 | 3 | - |
| *Total output to network* | *175,000* | - | - | - | - | - | *4,185* | - | - | - | - | *16* | - | - | - | - | *16* | - |
| | | | | | | | | | | | | | | | | | | |
| **RRF throughput / output** | | | | | | | | | | | | | | | | | | |
| HWRC residual waste | 30,000 | 0 | 30,000 | 5.59 | 5,363 | - | - | - | 5.59 | 23 | - | - | - | 5.59 | 23 | - | - | - |
| Bulky waste (direct) | 15,978 | 0 | 15,978 | 0.66 | 24,207 | - | - | - | 0.66 | 104 | - | - | - | 0.66 | 104 | - | - | - |
| Bulky waste (bulked) | 5,022 | 5,022 | 0 | 18.76 | 268 | 18.76 | - | 268 | 18.76 | 1 | 18.76 | - | 1 | 18.76 | 1 | 18.76 | - | 1 |
| Other residual waste (direct) | 35,000 | 35,000 | 0 | 1.43 | 24,423 | 18.76 | - | 1,866 | 1.43 | 105 | 18.76 | - | 8 | 1.43 | 105 | 18.76 | - | 8 |
| Other residual waste (bulked) | 11,000 | 11,000 | 0 | 18.76 | 586 | 18.76 | - | 586 | 18.76 | 3 | 18.76 | - | 3 | 18.76 | 3 | 18.76 | - | 3 |
| Trade waste for pre-treatment | 23,000 | 23,000 | 0 | 6.39 | 3,598 | 22.00 | - | 1,045 | 6.39 | 16 | 22.00 | - | 5 | 6.39 | 16 | 22.00 | - | 5 |
| Third party residual waste | 128,000 | 128,000 | 0 | 22.00 | 5,818 | 22.00 | - | 5,818 | 22.00 | 25 | 22.00 | - | 25 | 22.00 | 25 | 22.00 | - | 25 |
| HWRC wood for bulking | 11,000 | 0 | 11,000 | 2.01 | 5,483 | 19.50 | 564 | - | 2.01 | 24 | 19.50 | 2 | - | 2.01 | 24 | 19.50 | 2 | - |
| HWRC plastic for bulking | 200 | 0 | 200 | 1.49 | 135 | 5.98 | 33 | - | 1.49 | 1 | 5.98 | 0 | - | 1.49 | 1 | 5.98 | 0 | - |
| HWRC inert for bulking (weekend peak) | 12,000 | 0 | 12,000 | 12.72 | 943 | 17.02 | 705 | - | 12.72 | 4 | 17.02 | 3 | - | 12.72 | 4 | 17.02 | 3 | - |
| Green waste for bulking (kerbside) | 3,000 | 0 | 3,000 | 5.16 | 581 | 21.47 | 140 | - | 5.16 | 4 | 21.47 | 1 | - | 5.16 | 4 | 21.47 | 1 | - |
| Green waste for bulking (HWRC) | 11,000 | 0 | 11,000 | 19.29 | 570 | 21.47 | 512 | - | 19.29 | 4 | 21.47 | 3 | - | 19.29 | 4 | 21.47 | 3 | - |
| Mixed organic waste for bulking | 70,000 | 0 | 70,000 | 4.18 | 16,736 | 21.47 | 3,261 | - | 4.18 | 96 | 21.47 | 19 | - | 4.18 | 96 | 21.47 | 19 | - |
| Gully wastes | 4,000 | 2,934 | 1,066 | 0.56 | 7,127 | 3.57 | - | 822 | 0.56 | 31 | 3.57 | - | 4 | 0.56 | 31 | 3.57 | - | 4 |
| Street Cleansing | 21,000 | 21,000 | 0 | 0.66 | 31,607 | 18.76 | - | 1,119 | 0.66 | 136 | 18.76 | - | 5 | 0.66 | 136 | 18.76 | - | 5 |
| HWRC household waste | 4,000 | 0 | 4,000 | 0.06 | 66,667 | 0.06 | - | - | 0.06 | 206 | 0.06 | - | - | 0.06 | 154 | 0.06 | - | - |
| HWRC Trade waste | 4,000 | 0 | 4,000 | 0.15 | 26,667 | 0.15 | - | - | 0.15 | 83 | 0.15 | - | - | 0.15 | 61 | 0.15 | - | - |
| Sorted wood for bulking - BWRF | 9,000 | 0 | 9,000 | - | - | 19.50 | 461 | - | - | - | 0.00 | 2 | - | - | - | 0.00 | 2 | - |
| BWRF residual waste | 22,500 | 22,500 | 0 | - | - | 18.76 | | 1,199 | - | - | 0.00 | | 5 | - | - | 0.00 | - | 5 |
| BWRF separated materials to recycling (excluding wood) | 13,500 | 0 | 13,500 | - | - | 8.47 | 1,594 | - | - | - | 0.00 | 7 | - | - | - | 0.00 | 7 | - |
| HWRC Ro-Ro containers | 6,000 | 0 | 6,000 | - | - | 3.19 | 1,883 | - | - | - | 3.19 | 8 | - | - | - | 3.19 | 8 | - |
| *Total RRF throughout* | *439,200* | - | - | - | *220,779* | - | *21,878* | | - | *865* | - | *100* | | - | *791* | - | *100* | |
| *Total internal output to RRF* | - | *248,456* | - | - | - | - | - | *12,724* | - | - | - | - | *55* | - | - | - | - | *55* |
| *Total output to network* | - | | *190,744* | - | - | - | *9,154* | - | - | - | - | *46* | - | - | - | - | *46* | - |

***Daily profile*** *(based on existing profile)*

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 1 | 0 | 1 |
| 01:00 - 02:00 | 5 | 7 | 12 |
| 02:00 - 03:00 | 9 | 8 | 18 |
| 03:00 - 04:00 | 7 | 5 | 12 |
| 04:00 - 05:00 | 15 | 20 | 35 |
| 05:00 - 06:00 | 9 | 15 | 24 |
| 06:00 -07:00 | 45 | 47 | 92 |
| 07:00 - 08:00 | 39 | 45 | 84 |
| 08:00 - 09:00 | 75 | 65 | 140 |
| 09:00 - 10:00 | 106 | 99 | 205 |
| 10:00 - 11:00 | 121 | 91 | 211 |
| 11:00 - 12:00 | 134 | 135 | 270 |
| 12:00 - 13:00 | 114 | 112 | 226 |
| 13:00 - 14:00 | 100 | 96 | 196 |
| 14:00 - 15:00 | 64 | 75 | 138 |
| 15:00 - 16:00 | 42 | 45 | 87 |
| 16:00 - 17:00 | 30 | 35 | 65 |
| 17:00 - 18:00 | 11 | 27 | 38 |
| 18:00 - 19:00 | 15 | 11 | 26 |
| 19:00 - 20:00 | 9 | 11 | 20 |
| 20:00 - 21:00 | 26 | 16 | 42 |
| 21:00 - 22:00 | 16 | 24 | 41 |
| 22:00 - 23:00 | 1 | 4 | 5 |
| 23:00 - 00:00 | 3 | 3 | 5 |
| **Total** | **997** | **997** | **1994** |

***Daily profile (RRF)***

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 1 | 0 | 1 |
| 01:00 - 02:00 | 5 | 6 | 10 |
| 02:00 - 03:00 | 8 | 7 | 15 |
| 03:00 - 04:00 | 6 | 5 | 10 |
| 04:00 - 05:00 | 12 | 17 | 30 |
| 05:00 - 06:00 | 8 | 12 | 20 |
| 06:00 -07:00 | 37 | 40 | 77 |
| 07:00 - 08:00 | 33 | 37 | 70 |
| 08:00 - 09:00 | 62 | 55 | 117 |
| 09:00 - 10:00 | 89 | 83 | 172 |
| 10:00 - 11:00 | 101 | 76 | 177 |
| 11:00 - 12:00 | 112 | 114 | 226 |
| 12:00 - 13:00 | 95 | 94 | 190 |
| 13:00 - 14:00 | 84 | 81 | 165 |
| 14:00 - 15:00 | 53 | 62 | 116 |
| 15:00 - 16:00 | 35 | 37 | 73 |
| 16:00 - 17:00 | 25 | 30 | 55 |
| 17:00 - 18:00 | 9 | 23 | 32 |
| 18:00 - 19:00 | 12 | 9 | 22 |
| 19:00 - 20:00 | 8 | 9 | 17 |
| 20:00 - 21:00 | 22 | 14 | 35 |
| 21:00 - 22:00 | 14 | 20 | 34 |
| 22:00 - 23:00 | 1 | 3 | 5 |
| 23:00 - 00:00 | 2 | 2 | 5 |
| **Total** | **836** | **836** | **1673** |

***Daily profile (ERF)***

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 0 | 0 | 0 |
| 01:00 - 02:00 | 1 | 1 | 2 |
| 02:00 - 03:00 | 2 | 1 | 3 |
| 03:00 - 04:00 | 1 | 1 | 2 |
| 04:00 - 05:00 | 2 | 3 | 6 |
| 05:00 - 06:00 | 2 | 2 | 4 |
| 06:00 -07:00 | 7 | 8 | 15 |
| 07:00 - 08:00 | 6 | 7 | 14 |
| 08:00 - 09:00 | 12 | 10 | 22 |
| 09:00 - 10:00 | 17 | 16 | 33 |
| 10:00 - 11:00 | 19 | 15 | 34 |
| 11:00 - 12:00 | 22 | 22 | 43 |
| 12:00 - 13:00 | 18 | 18 | 36 |
| 13:00 - 14:00 | 16 | 16 | 32 |
| 14:00 - 15:00 | 10 | 12 | 22 |
| 15:00 - 16:00 | 7 | 7 | 14 |
| 16:00 - 17:00 | 5 | 6 | 10 |
| 17:00 - 18:00 | 2 | 4 | 6 |
| 18:00 - 19:00 | 2 | 2 | 4 |
| 19:00 - 20:00 | 2 | 2 | 3 |
| 20:00 - 21:00 | 4 | 3 | 7 |
| 21:00 - 22:00 | 3 | 4 | 7 |
| 22:00 - 23:00 | 0 | 1 | 1 |
| 23:00 - 00:00 | 0 | 0 | 1 |
| **Total** | **161** | **161** | **321** |

***Staff/other trips***

| | |
|---|---|
| Proposed number of employees | 153 |
| Proposed staff/other trips (one-way) | 153 |
| Proposed staff/other trips (two-way) | 306 |

*Proposed staff trips assume one vehicular movement per member of staff per day. On-site café will reduce the lunch time movements when compared with existing*

***Daily profile*** *(based on existing profile)*

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 |
| 04:00 - 05:00 | 5 | 0 | 5 |
| 05:00 - 06:00 | 26 | 1 | 28 |
| 06:00 -07:00 | 37 | 6 | 43 |
| 07:00 - 08:00 | 13 | 0 | 13 |
| 08:00 - 09:00 | 8 | 4 | 12 |
| 09:00 - 10:00 | 11 | 4 | 15 |
| 10:00 - 11:00 | 5 | 3 | 8 |
| 11:00 - 12:00 | 5 | 10 | 15 |
| 12:00 - 13:00 | 8 | 21 | 29 |
| 13:00 - 14:00 | 12 | 15 | 27 |
| 14:00 - 15:00 | 6 | 14 | 20 |
| 15:00 - 16:00 | 2 | 13 | 15 |
| 16:00 - 17:00 | 4 | 20 | 24 |
| 17:00 - 18:00 | 2 | 19 | 21 |
| 18:00 - 19:00 | 4 | 15 | 19 |
| 19:00 - 20:00 | 3 | 3 | 7 |
| 20:00 - 21:00 | 0 | 1 | 1 |
| 21:00 - 22:00 | 0 | 3 | 3 |
| 22:00 - 23:00 | 1 | 1 | 2 |
| 23:00 - 00:00 | 0 | 0 | 0 |
| **Total** | **153** | **153** | **306** |

***Daily profile (RRF & EcoPark House)***

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 |
| 04:00 - 05:00 | 3 | 0 | 3 |
| 05:00 - 06:00 | 16 | 1 | 16 |
| 06:00 -07:00 | 22 | 4 | 26 |
| 07:00 - 08:00 | 8 | 0 | 8 |
| 08:00 - 09:00 | 5 | 2 | 7 |
| 09:00 - 10:00 | 6 | 2 | 9 |
| 10:00 - 11:00 | 3 | 2 | 5 |
| 11:00 - 12:00 | 3 | 6 | 9 |
| 12:00 - 13:00 | 5 | 13 | 17 |
| 13:00 - 14:00 | 7 | 9 | 16 |
| 14:00 - 15:00 | 4 | 8 | 12 |
| 15:00 - 16:00 | 1 | 8 | 9 |
| 16:00 - 17:00 | 2 | 12 | 14 |
| 17:00 - 18:00 | 1 | 11 | 12 |
| 18:00 - 19:00 | 3 | 9 | 11 |
| 19:00 - 20:00 | 2 | 2 | 4 |
| 20:00 - 21:00 | 0 | 1 | 1 |
| 21:00 - 22:00 | 0 | 2 | 2 |
| 22:00 - 23:00 | 1 | 1 | 1 |
| 23:00 - 00:00 | 0 | 0 | 0 |
| **Total** | **91** | **91** | **182** |

***Daily profile (ERF)***

| | Inbound | Outbound | Two-way |
|---|---|---|---|
| 00:00 - 01:00 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 |
| 04:00 - 05:00 | 2 | 0 | 2 |
| 05:00 - 06:00 | 11 | 1 | 11 |
| 06:00 -07:00 | 15 | 2 | 18 |
| 07:00 - 08:00 | 5 | 0 | 5 |
| 08:00 - 09:00 | 3 | 2 | 5 |
| 09:00 - 10:00 | 4 | 2 | 6 |
| 10:00 - 11:00 | 2 | 1 | 3 |
| 11:00 - 12:00 | 2 | 4 | 6 |
| 12:00 - 13:00 | 3 | 9 | 12 |
| 13:00 - 14:00 | 5 | 6 | 11 |
| 14:00 - 15:00 | 2 | 6 | 8 |
| 15:00 - 16:00 | 1 | 5 | 6 |
| 16:00 - 17:00 | 2 | 8 | 10 |
| 17:00 - 18:00 | 1 | 8 | 8 |
| 18:00 - 19:00 | 2 | 6 | 8 |
| 19:00 - 20:00 | 1 | 1 | 3 |
| 20:00 - 21:00 | 0 | 0 | 0 |
| 21:00 - 22:00 | 0 | 1 | 1 |
| 22:00 - 23:00 | 0 | 0 | 1 |
| 23:00 - 00:00 | 0 | 0 | 0 |
| **Total** | **62** | **62** | **124** |

**Census (2011) Data**

| SOA | **Underground** | **Train** | **Bus** | **Taxi** | **Motorcycle** | **Car (Driver)** | **Car (Passenger)** | **Cycle** | **Walk** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| Enfield 030 | 204 | 314 | 871 | 14 | 47 | 2778 | 150 | 99 | 346 | **4823** |
| Enfield 033 | 303 | 285 | 819 | 24 | 26 | 2049 | 127 | 60 | 445 | **4138** |
| **Total** | **507** | **599** | **1690** | **38** | **73** | **4827** | **277** | **159** | **791** | **8961** |
| % | 6% | 7% | 19% | 0% | 1% | 54% | 3% | 2% | 9% | **100%** |
| | | | | | | | | | | |
| Enfield 030 % | 4% | 7% | 18% | 0% | 1% | 58% | 3% | 2% | 7% | 100% |
| Enfield 033 % | 7% | 7% | 20% | 1% | 1% | 50% | 3% | 1% | 11% | 100% |

***Mode share***

| | **Underground** | **Train** | **Bus** | **Taxi** | **Motorcycle** | **Car (Driver)** | **Car (Passenger)** | **Cycle** | **Walk** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| Peak Construction | 4% | 4% | 10% | 0% | 1% | 50% | 25% | 5% | 1% | **100%** |
| General Construction | 1% | 1% | 7% | 0% | 1% | 75% | 10% | 4% | 1% | **100%** |
| Operation | 1% | 1% | 7% | 0% | 1% | 80% | 5% | 4% | 1% | **100%** |

*Estimated HWRC annual throughput*

| | | |
|---|---|---|
| Household waste | 4,000 | |
| Trade waste | 4,000 | |
| | | |
| Household waste tonnage | 0.06 | tonnes per vehicle (car) |
| Trade waste tonnage | 0.15 | tonnes per vehicle (van) |
| | | |
| Household waste annual trips | 66667 | |
| Trade waste annual trips | 26667 | |
| Total annaul trips | 93333 | |
| Average weekly trips | 1805 | *Site operational 362 days a year (assumes no seasonal variation)* |

*HWRC weekly profile (obtained from NLWA HWRC data)*

| | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday | **Total** |
|---|---|---|---|---|---|---|---|---|
| Average | 204 | 175 | 176 | 179 | 184 | 294 | 329 | **1541** |
| % | 13% | 11% | 11% | 12% | 12% | 19% | 21% | **100%** |

*Weekly profile for proposed HWRC*

| | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday | **Total** |
|---|---|---|---|---|---|---|---|---|
| Average | 239 | 205 | 206 | 209 | 215 | 345 | 385 | **1805** |
| % | 13% | 11% | 11% | 12% | 12% | 19% | 21% | **100%** |

Weekday average: 215

**Average household waste trips:** **154**
**Average trade waste trips:** **61**

# **Appendix G**– Construction Trip Generation Supporting Information

***Construction trip generation summary***

| Phase | Vehicle trips | | | | |
|---|---|---|---|---|---|
| | Construction | EfW + IVC + BWRC | RRF/EcoPark House | ERF | Total (one-way) |
| Phase 1B | 83 | 710 | 0 | 0 | 794 |
| Phase 1C | 71 | 280 | 836 | 0 | 1187 |
| Phase 1D | 9 | 280 | 836 | 0 | 1125 |
| Phase 2 | 0 | 140 | 836 | 80 | 1057 |
| Phase 3 | 80 | 0 | 836 | 161 | 1077 |

| Phase | Employee vehicle trips | | | | |
|---|---|---|---|---|---|
| | Construction | EfW + IVC + BWRC | RRF/EcoPark House | ERF | Total (one-way) |
| Phase 1B | 17 | 317 | 0 | 0 | 334 |
| Phase 1C | 13 | 158 | 91 | 0 | 263 |
| Phase 1D | 275 | 158 | 91 | 0 | 525 |
| Phase 2 | 0 | 79 | 91 | 31 | 202 |
| Phase 3 | 12 | 0 | 91 | 62 | 165 |

| Phase | Total trips | | | | |
|---|---|---|---|---|---|
| | Construction | EfW + IVC + BWRC | RRF/EcoPark House | ERF | Total (one-way) |
| Phase 1B | 101 | 1027 | 0 | 0 | 1128 |
| Phase 1C | 84 | 439 | 928 | 0 | 1450 |
| Phase 1D | 284 | 439 | 928 | 0 | 1650 |
| Phase 2 | 0 | 219 | 928 | 111 | 1258 |
| Phase 3 | 92 | 0 | 928 | 223 | 1242 |

**Construction traffic daily profile (two-way)**

| | Phase 1B | | Phase 1C | | Phase 1D | | Phase 2 | | Phase 3 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound |
| 00:00 - 01:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04:00 - 05:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 05:00 - 06:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06:00 -07:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 07:00 - 08:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08:00 - 09:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 09:00 - 10:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 10:00 - 11:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 11:00 - 12:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 12:00 - 13:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 13:00 - 14:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 14:00 - 15:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 15:00 - 16:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 16:00 - 17:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 17:00 - 18:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 18:00 - 19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:00 - 20:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20:00 - 21:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:00 - 22:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:00 - 23:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:00 - 00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **83** | **83** | **71** | **71** | **9** | **9** | **0** | **0** | **80** | **80** |

**Construction employee traffic daily profile (two-way)**

| | Phase 1B | | Phase 1C | | Phase 1D | | Phase 2 | | Phase 3 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound |
| 00:00 - 01:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04:00 - 05:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 05:00 - 06:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06:00 -07:00 | 2 | 0 | 1 | 0 | 28 | 0 | 0 | 0 | 1 | 0 |
| 07:00 - 08:00 | 14 | 0 | 10 | 0 | 220 | 0 | 0 | 0 | 10 | 0 |
| 08:00 - 09:00 | 2 | 0 | 1 | 0 | 28 | 0 | 0 | 0 | 1 | 0 |
| 09:00 - 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:00 - 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:00 - 12:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:00 - 13:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:00 - 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:00 - 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:00 - 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:00 - 17:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:00 - 18:00 | 0 | 2 | 0 | 1 | 0 | 28 | 0 | 0 | 0 | 1 |
| 18:00 - 19:00 | 0 | 14 | 0 | 10 | 0 | 220 | 0 | 0 | 0 | 10 |
| 19:00 - 20:00 | 0 | 2 | 0 | 1 | 0 | 28 | 0 | 0 | 0 | 1 |
| 20:00 - 21:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:00 - 22:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:00 - 23:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:00 - 00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **17** | **17** | **13** | **13** | **275** | **275** | **0** | **0** | **12** | **12** |

**Construction total traffic daily profile (two-way)**

| | Phase 1B | | Phase 1C | | Phase 1D | | Phase 2 | | Phase 3 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound | Inbound | Outbound |
| 00:00 - 01:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01:00 - 02:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 02:00 - 03:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 03:00 - 04:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04:00 - 05:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 05:00 - 06:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06:00 -07:00 | 2 | 0 | 1 | 0 | 28 | 0 | 0 | 0 | 1 | 0 |
| 07:00 - 08:00 | 14 | 0 | 10 | 0 | 220 | 0 | 0 | 0 | 10 | 0 |
| 08:00 - 09:00 | 10 | 8 | 8 | 7 | 28 | 1 | 0 | 0 | 9 | 8 |
| 09:00 - 10:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 10:00 - 11:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 11:00 - 12:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 12:00 - 13:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 13:00 - 14:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 14:00 - 15:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 15:00 - 16:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 16:00 - 17:00 | 8 | 8 | 7 | 7 | 1 | 1 | 0 | 0 | 8 | 8 |
| 17:00 - 18:00 | 8 | 10 | 7 | 8 | 1 | 28 | 0 | 0 | 8 | 9 |
| 18:00 - 19:00 | 0 | 14 | 0 | 10 | 0 | 220 | 0 | 0 | 0 | 10 |
| 19:00 - 20:00 | 0 | 2 | 0 | 1 | 0 | 28 | 0 | 0 | 0 | 1 |
| 20:00 - 21:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21:00 - 22:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22:00 - 23:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23:00 - 00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **101** | **101** | **84** | **84** | **284** | **284** | **0** | **0** | **92** | **92** |

**Census (2011) Data**

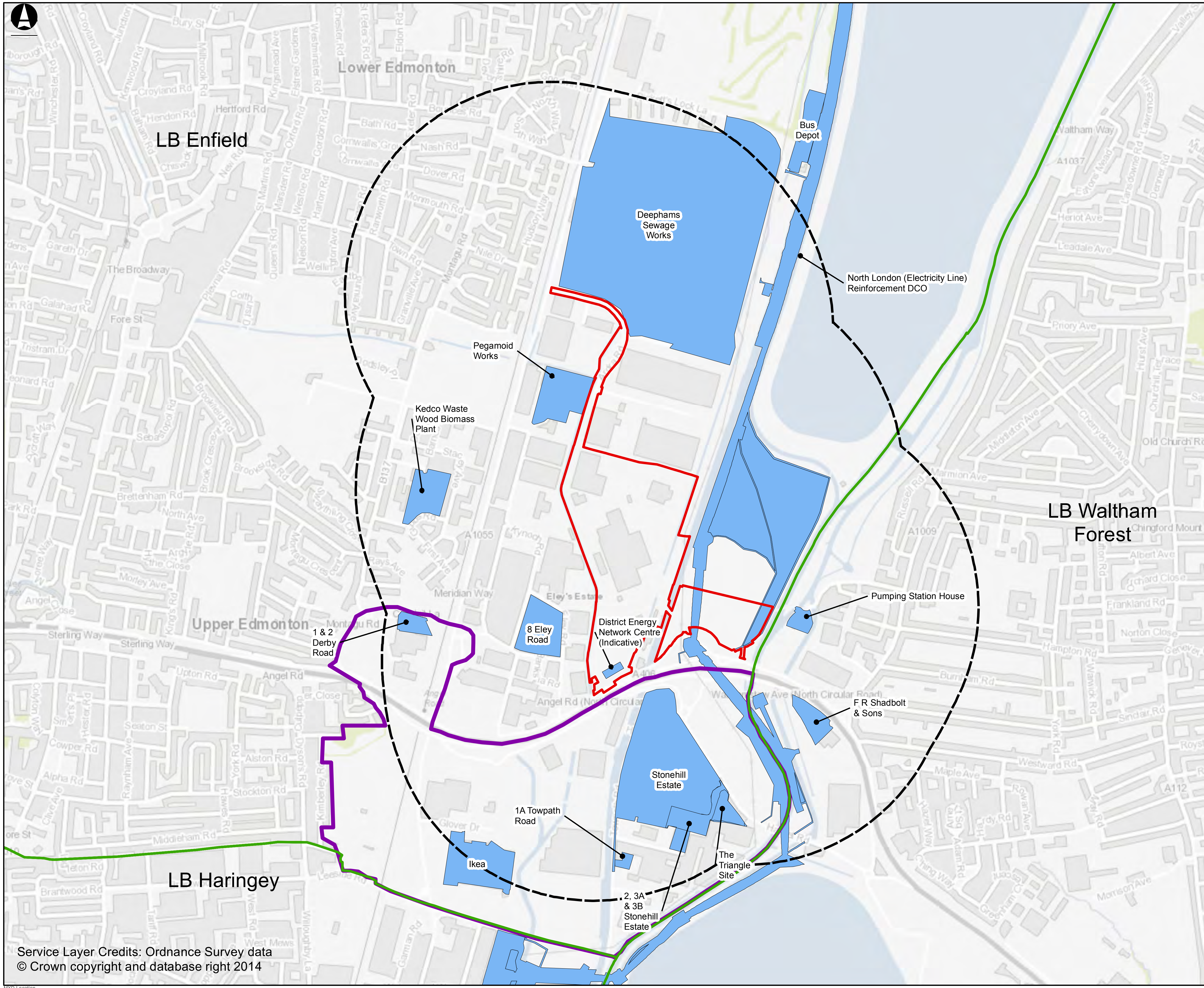
| SOA | **Underground** | **Train** | **Bus** | **Taxi** | **Motorcycle** | **Car (Driver)** | **Car (Passenger)** | **Cycle** | **Walk** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| Enfield 030 | 204 | 314 | 871 | 14 | 47 | 2778 | 150 | 99 | 346 | **4823** |
| Enfield 033 | 303 | 285 | 819 | 24 | 26 | 2049 | 127 | 60 | 445 | **4138** |
| **Total** | **507** | **599** | **1690** | **38** | **73** | **4827** | **277** | **159** | **791** | **8961** |
| % | 6% | 7% | 19% | 0% | 1% | 54% | 3% | 2% | 9% | **100%** |
| | | | | | | | | | | |
| Enfield 030 % | 4% | 7% | 18% | 0% | 1% | 58% | 3% | 2% | 7% | 100% |
| Enfield 033 % | 7% | 7% | 20% | 1% | 1% | 50% | 3% | 1% | 11% | 100% |

***<u>Mode share</u>***

| | **Underground** | **Train** | **Bus** | **Taxi** | **Motorcycle** | **Car (Driver)** | **Car (Passenger)** | **Cycle** | **Walk** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| Peak Construction | 4% | 4% | 10% | 0% | 1% | 50% | 25% | 5% | 1% | **100%** |
| General Construction | 1% | 1% | 7% | 0% | 1% | 75% | 10% | 4% | 1% | **100%** |
| Operation | 1% | 1% | 7% | 0% | 1% | 80% | 5% | 4% | 1% | **100%** |

# **Appendix H** – Cumulative Scheme Information

A3




MXD Location

**Legend**

- Application Boundary
- 600m Catchment
- London Borough Boundary
- Meridian Water Masterplan Area
- Cumulative Development



| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P3 | 05-03-15 | FD | AF | PT |

Metres 0 140 280 560

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Client
**North London Waste Authority**

Job Title
**North London Heat and Power Project**

Drawing Title
**Volume 1 Figure 4.1**
**EIA Cumulative Developments**
**(June 2015 update)**

Scale at A3
**1:10,500**

Job No **235271-10**
Drawing Status **Issue**
Drawing No **002**
Issue **P3**

# **Appendix I** – Peter Brett Associates Water Transport Report

## North London Waste Authority

# Review of the feasibility to transport Incinerator Bottom Ash and Municipal Waste to Edmonton EcoPark by water

**Final Report**

**Project Ref: 30996**

**Doc Ref: R02**

**30 March 2015**


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## Tables

## Figures

## Appendices

See separate volume

# Glossary

| | |
|---|---|
| Air draught | Headroom required to pass under structures |
| Beam | Width of water craft |
| $CO_2$ | Carbon dioxide |
| CRT | Canal and River Trust |
| Cu M | Cubic metre |
| DEFRA | Department for Environment, Food and Rural Affairs |
| DfT | Department for Transport |
| Dumb barge | Barge that does not have a motor and has to be moved by a tug or workboat |
| EcoPark | North London Waste Authority site at Edmonton |
| EfW | Energy from Waste |
| Euro V or VI | Emission standards for commercial vehicle diesel engines |
| GHG | Greenhouse Gas |
| HGV | Heavy Goods Vehicle |
| GLA | Greater London Authority |
| GVW | Gross Vehicle Weight |
| Kpa | Thousand per annum |
| LBE | London Borough of Enfield |
| NLWA | North London Waste Authority |
| NLWP | North London Waste Plan |
| NPPF | National Planning Policy |
| PLA | Port of London Authority |
| Reachstacker | Machine for lifting and moving containers |
| RLN | River Lea Navigation |
| SRF | Solid Recovered Fuel |
| T or Te | Metric tonne |
| TEU | Twenty-foot Equivalent Unit |
| TfL | Transport for London |
| TKm | Tonne Kilometres |
| £/Te | Cost unit per tonne |

# Addendum

## Use of Ash Wharf

Since the commissioning of this report in July 2014 the design and layout of the EcoPark site has progressed such that the use of the wharf for crane operations as part of the water transport infrastructure has become increasingly unviable.

The wharf area is the site of the proposed EcoPark House which would serve as the site reception (where visitors would come to register onto site), house some administration staff and serve as a visitor and education centre for visiting groups such as schools. In addition, EcoPark House would also serve to accommodate the Sea Cadets (for example, class rooms, drill hall, amenities, boat house and canal access).

Site preparation and construction are phased over a number of years and is expected to commence around 2020. Construction would be implemented in a phased manner to ensure that essential operations remain functioning throughout. This is especially relevant for the existing Energy from Waste (EfW) and associated support facilities to the north of the site, including the bulking waste recycling facility and the fuel preparation plant.

EcoPark House would be built during the initial construction phase alongside the Resource Recovery Facility (RRF) [(1)]. Once the facilities to the north of the existing facility are moved to the RRF work would begin to construct the proposed Enerty Recovery Facility (ERF). The final stage would involve the demolition of the existing facility in around 2026/27. It would not be possible to construct EcoPark House at a later time than planned owing to the nature of the site plan and ongoing operations. The RRF would also house a publically accessible Reuse and Recycling Centre (RCC) which would become open to the public once the RRF (and EcoPark House) is complete. The mixing of light and heavy vehicles around the Ash Wharf area would introduce significant safety concerns in particular to public users of the RRC.

In addition to the above, as the existing wharf building and facilities would be removed, the Sea Cadets would be re-located under a temporary arrangement within the existing Energy from Waste facility. Once EcoPark House is constructed the Sea Cadets would be located back to the wharf area. Therefore, EcoPark House would be required prior to the demolition of the existing facility.

The new IT server system for the site would be housed in EcoPark House. This system would be essential in order to support new services such as the RRF, RRC, vehicle weigh bridges and connections to other NLWA facilities around north London, including other RRCs and a waste transfer station. Owing to these additional services, the system would be required before construction of the proposed ERF and as early as possible during the build, and would therefore be located within EcoPark House.

[1] The Resource Recovery Facility (RRF) serves a number of functions including waste bulking and some waste pre-treatment such as sorting and shredding. The RRF includes a RRC where members of the public and small business vehicles may deposit waste for disposal or recycling.

# Executive Summary

## Introduction

0.0 North London Waste Authority (NLWA) commissioned Peter Brett Associates LLP (PBA) to review the viability of transporting incinerator bottom ash (IBA) from, and household waste to, the Edmonton EcoPark Energy from Waste (EfW) facility by water.

0.1 The aim of the review is to consider the options for transporting these materials by water compared with a base case of using road. Therefore, it takes account of the enabling infrastructure requirements for handling and transportation of the materials, potential locations to which IBA could be transported, potential 'other' sources of household waste and the indicative costs that are associated with waterborne transport versus road.

0.2 NLWA is the body responsible for managing the disposal of municipal waste for seven boroughs in north London (Barnet, Camden, Enfield, Hackney, Haringey, Islington, and Waltham Forest). During 2012/13, the Authority handled approximately 823,000 tonnes (Te) of municipal waste, comprising 670,000Te of local authority collected waste from households and 153,000Te of local authority collected waste from commercial and industrial producers. Approximately 49 per cent of the waste is used as fuel at the Authority's EfW facility at Edmonton, while waste moved to landfill is transported by rail from the Hendon transfer station.

0.3 The Edmonton facility currently comprises a number of waste treatment systems (EfW plant, composting, recycling), as well as being a transfer station. The strategy now being pursued and subject of the Development Consent Order (DCO) is based on the eventual renewal of the existing incinerator facility by 2025. The existing EfW facility has a capacity to handle 600,000Te of waste per annum (pa), while it is proposed that the new plant will have an increased capacity of 700,000Te/pa.

## Scope of the study

0.4 The key objectives of the study are:

a. Establish the potential technical feasibility for the movement of IBA arising from the Edmonton EcoPark by water compared with road and the potential to move the demolition materials during the plant renewal phase

b. Describe a possible strategy for movement of freight by water and advise on the infrastructure required – including wharfage, operational infrastructure - e.g. containers and barges

c. Examine the feasibility of water transport for the delivery of household waste from other sources that could exploit the use of the River Lee Navigation

d. Indicate the potential environmental benefits, for example carbon dioxide savings and reductions in lorry miles through the use of the water compared with transport by road

e. Identify indicative capital expenditure and operational expenditure for the various phases

f. Identify major barriers/constraints to delivery and make recommendations for further actions

0.5 The quantity of IBA that could be ultimately produced by the EfW facility is dependent upon the volumes of waste being sent to Edmonton. It is assumed that the quantity of IBA derived from the incineration process is 20 per cent of the raw waste quantity. The quantities assumed for the study are shown in the Table 1.

Table 1: Assumed quantities of raw waste and produced IBA (Te/pa)

| Scenario | Quantity of raw waste (tonnes per annum) | Quantity of IBA (tonnes per annum) |
|---|---|---|
| NLWA boroughs | 530,000 | 106,000 |
| NLWA boroughs | 530,000+ | 140,000 |
| NLWA + OSEL lower limit | 530,000 + 150,000 | 180,000 |
| NLWA + OSEL upper limit | 530,000 + 300,000 | |
| OSEL = Other Sources in East London | | |

## Study approach

0.6 To consider the viability and practicality of moving the IBA and municipal waste by water, a series of scenarios were devised. Since it is was assessed that IBA would not be treated north of Edmonton, only options on the Thames were included. Two locations, Rainham Landfill and Greenwich Aggregate Zone were selected as they offer a real prospect of facilities to process IBA. The scenarios tested are shown in the Table 2.

Table 2: Scenarios for delivering IBA and raw waste from and to Edmonton

| Transport Scenario | Commodity | Tonnage | Origin | Destination | Transport Modes Investigated | Method of handling |
|---|---|---|---|---|---|---|
| **Scenario 1** | IBA | 106kpa | Edmonton | Rainham Landfill | Water and road | Loose bulk |
| **Scenario 2** | IBA | 106kpa | Edmonton | Greenwich Agg Zone | Water and road | Loose bulk |
| **Scenario 3** | IBA | 140kpa | Edmonton | Rainham Landfill | Water and road | Loose bulk |
| **Scenario 4** | IBA | 140kpa | Edmonton | Greenwich Agg Zone | Water and road | Loose bulk |
| **Scenario 5** | IBA | 180kpa | Edmonton | Rainham Landfill | Water and road | Loose bulk |
| **Scenario 6** | Raw Waste | 150kpa | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 7** | IBA | 180kpa | Edmonton | Greenwich Agg Zone | Water and road | Loose bulk |
| **Scenario 8** | Raw Waste | 300kpa | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 9** | IBA<br>Raw Waste | 180kpa<br>150kpa | Edmonton<br>Barking Creek | Rainham Landfill<br>Edmonton | Water<br>Water | Container<br>Container |
| **Scenario 10** | IBA<br>Raw Waste | 180kpa<br>300kpa | Edmonton<br>Barking Creek | Rainham Landfill<br>Edmonton | Water<br>Water | Container<br>Container |

0.7 The broad approach adopted for the study comprises a detailed technical assessment of the practicality and feasibility of transport by road and water including equipment, operational plans and infrastructure requirements. The outputs from these various work streams provided the data and inputs to the calculation of costs and environmental indicators for the scenarios assessed. In summary these tasks were as follows:

- Estimate the number of containers required for the transport of IBA and raw waste
- Estimate the number of road vehicles required for the road elements of the transport scenarios
- Estimate the number of barges and tugs to carry out the transport
- Examine and compare the environmental and financial implications of using the two modes

## Equipment

0.8 As part of this assessment a range of equipment has been considered that could be used in facilitating the transport operation. In the context of an operation to move large quantities of bulk commodities, the type of equipment plays an important part in determining the cost of the options available, how efficient the operation would be and the environmental impact the transport could have on the wider community.

## Road transport (Scenarios 1 to 4)

Operation and cost

0.9 Road transport is the base case against which water is measured. Therefore, each scenario is first considered as a road movement to establish the comparable costs and environmental impact. The components included in the road assessment are loading the materials into vehicles at Edmonton and the transport to the processing site. Using the length of the road route between Edmonton and the IBA processing site and daily quantity to be transported, an estimate of vehicle requirements was produced.

0.10 Based on this approach, it is estimated that to transport 106Ktpa of IBA, road transport would generate 30nr 1-way journeys/day, while for 140Ktpa would require 38nr -way journeys/day. The cost related to this transport is shown in Table 3,

Table 3: Annual road operating cost for Scenarios 1, 2, 3 and 4 (£)

| Activity | Scenario 1 Edmonton/ Rainham | Scenario 2 Edmonton/ Greenwich | Scenario 3 Edmonton/ Rainham | Scenario 4 Edmonton/ Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000** | **106,000** | **140,000** | **140,000** |
| Loading operation | £74,500 | £74,500 | £75,300 | £75,300 |
| Transport operation | £423,300 | £415,100 | £582,400 | £571,500 |
| **Total operating costs** | **£497,800** | **£489,600** | **£657,700** | **£646,800** |
| Cost / tonne on operating cost | £4.70 | £4.62 | £4.70 | £4.62 |

Environmental impact

0.11 Environmental impact is measured in terms of the quantity of $CO_2$ produced during the actual transport journey. These are calculated based on data published by DEFRA as part of the Government conversion factors for company reporting. Table 4 below provides a summary of the annual levels of $CO_2e$ produced by road transport for each scenario.

Table 4: Annual quantities of $CO_2e$ for road transport

| Annual quantities of $CO_2e$ for road transport | Scenario 1 Edmonton/ Rainham | Scenario 2 Edmonton/ Greenwich | Scenario 3 Edmonton/ Rainham | Scenario 4 Edmonton/ Greenwich |
|---|---|---|---|---|
| Annual tonnage IBA | 106,000 | 106,000 | 140,000 | 140,000 |
| **Tonnes of $CO_2e$ per annum** | **340t** | **330t** | **450t** | **430t** |

**Water transport (Scenarios 1 to 4)**

0.12 The basis for assessing water transport is same as that for road, except a greater number of components have to be included, because effectively a new transport system is being set up.

0.13 This means that the range of components includes not only the operational costs of handling and transporting IBA by water, but also the necessary costs to refurbish the locks on the waterway, installing a suitable wharf at Edmonton, and the provision of tugs and barges. For the four scenarios considered at this stage, containers are not included as IBA is assumed to be transported as a loose bulk commodity in hopper barges.

0.14 The water route for the scenarios requires navigating the River Lee Navigation, tidal River Lea (Bow Creek) and the River Thames. It is assumed that the barges can be moved on a canal and tidal waters and a different tug will undertake hauling the barges on these watercourses.

Waterway infrastructure

0.15 An assessment of the River Lee Navigation was completed to establish the level of infrastructure refurbishment required and what this might cost. The transport along this waterway would require passing through three locks. However, locks on the section of the Lee to be used each have two parallel chambers, with the aim of IBA barges having exclusive use of one chamber. These chambers would be, where necessary, refurbished and upgraded to permit fast passage of barges. The costs to ensure that the locks are refurbished to this standard are shown in the Table 5 below.

Table 5: Cost to refurbish locks between Edmonton and Old Ford

| Lock | Capital cost with landing stages (£) | Capital cost without landing stages (£) |
|---|---|---|
| Stonebridge | £350,000 | £230,000 |
| Tottenham | £410,000 | £230,000 |
| Old Ford | £370,000 | £250,000 |
| Remote opening system | £50,000 | £50,000 |
| **Total** | **£1,180,000** | **£760,000** |

0.16 The tidal lock at Bow Locks was not included in the assessment as this would not require a high speed passage of barges.

0.17 As part of the assessment the dimensions of the locks were checked to establish the maximum size of barge that could be used. This found that Old Ford was the smallest and consequently barges that would not be able to exceed 24m length by 5.5m width.

0.18 At Edmonton, Ash Wharf would require a complete refurbishment to enable the water operation to take place. The wharf available to NLWA at Edmonton is a small area on the east side of the existing EfW plant, and is currently used by a Sea Cadets unit (TS Plymouth). For this area to be converted into an operational wharf, the Sea Cadets would have to be relocated. The existing useable wharf area is approximately 1,300m$^2$ and has a water frontage that is about 36m long.

0.19 The site is bounded to the west by a drainage ditch, but it would be worth investigating whether this could be culverted to provide a larger wharf area. It is estimated if the ditch was covered and the site extended to the north within the existing boundary, an additional 1,000m$^2$ might be available. This would offer a total area of approximately 2,300m$^2$ to support a wharf.

0.20 It is assumed that Ash Wharf would have to be completely renewed, including the canal wall and the estimated cost for this is £472,000 for an area of 1,300m$^2$. If the wharf area was expanded to 2,300m$^2$, it is estimated that the overall cost would be £772,800.

On site operations

0.21 In order to load barges, the IBA will need to be transferred from the incinerator stockpile to the wharf area. It is envisaged that IBA would be stockpiled at the wharf in readiness for loading. To achieve the transfer would require equipment on site - a loader and lorry - while the loading is assumed to use a tracked excavator. There is a requirement for capital investment in this equipment and the operation would incur running costs. The estimated annual cost for these operations is shown in the Table 6 below.

Table 6: Cost of on-site handling at Edmonton

| Cost item | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000** | **106,000** | **140,000** | **140,000** |
| On-site transfer operation | £111,700 | £111,700 | £161,400 | £161,400 |
| Barge loading | £79,300 | £79,300 | £82,700 | £82,700 |

Water transport

0.22 The water transport operation between Edmonton and Rainham or Greenwich is quite complex and would involve the use of three barging operations. Critical to the operation is the use of barges that can navigate the three different sections of waterway which comprise a complete journey in either direction. It is assumed that each barge would be able to carry 120 tonnes of IBA.

Method of assessing tug and barge requirements

0.23 The inclusion of three different waterways means that it is necessary to understand how these would influence the number of tugs and barges needed to carry out the transport. Since the tidal rivers do not include locks the assumptions are vessels can move freely on the river creeks when the tidal conditions are suitable and at any time on the Thames. In the case of the Lee Navigation, the inclusion of locks means that vessels incur stops that impact upon the overall time of the journey, which in turn influences the number of tugs and barges required.

0.24 To understand these requirements a time-space model has been developed to illustrate how resources would have to used and located. This approach also is the basis for costing the different operational scenarios that are examined. For each of the different waterway sections, the model is used to assess how many tugs and barges are needed and indicates the optimal cycle for moving barges on the different watercourses. It is assumed tugs on the Lee Navigation move one barge in each direction, tugs on the Bow Creek move two barges and between three and six barge hitched together on the Thames.

Tug and barge requirement

0.25 The number of tugs and barges needed to support the operation varies between the scenarios and is not the same for each watercourse. This is a consequence of optimising capacity rates of barges in each scenario. The estimated quantity of equipment for the scenarios is shown in the Table 7 below.

Table 7: Numbers of tugs and barges for each operational scenario

| | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000Te** | **106,000Te** | **140,000Te** | **140,000Te** |
| **Tugs** | | | | |
| River Lee Navigation | 5 | 5 | 6 | 6 |
| Bow Creek | 1 | 1 | 1 | 1 |
| River Thames | 1 | - | 1 | - |
| **Barges** | | | | |
| Minimum number | 18 | 12 | 31 | 13 |

0.26 The capital cost of equipment is approximately £110,000 per barge and £66,000 per Lee tug and £300,000 for Bow Creek tug. No estimate is made for tugs on the Thames as it is assumed this part of the operation would be contracted in.

Tug and barge operations

0.27 The water transport operation is based on varying cycle lengths which aim: to synchronise up and downstream barge movements through the Lee Navigation locks; ensure sufficient barges are moved up and down Bow Creek within the tidal constraints; and circulate sufficient barges on the Thames. This results in bespoke cycles for each scenario. The estimated cost for each scenario is based on the distance of the round trip, and the equipment and time required to perform each cycle.

Environmental impact

0.28 The method to estimate carbon emissions for water transport is the same as that used for road, the outcomes of which are present in the Table 8 below.

Table 8: Annual quantities of $CO_2$ for water transport

| Annual quantities of $CO_2$ for water transport | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| Annual tonnage IBA | 106,000 | 106,000 | 140,000 | 140,000 |
| **Tonnes of $CO_2$ per annum** | **200t** | **120t** | **270t** | **160t** |

Overall estimates of using water transport

0.29 The use of water transport for moving IBA between Edmonton and Rainham or Greenwich involves a number of operations that need to be combined in order to estimate an overall cost. These comprise: waterways infrastructure, waterways maintenance, wharf construction, on-site transfer costs, barge loading costs, transport costs - Lee Navigation, transport costs - Bow Creek, and transport costs - River Thames. Table 9 below presents the composition of the costs.

Table 9: Overall estimated annual costs of using water transport for IBA

| Cost item | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000Te** | **106,000Te** | **140,000Te** | **140,000Te** |
| | All costs in £ | | | |
| Waterways infrastructure (annualised) | 47,200 | 47,200 | 47,200 | 47,200 |
| Waterways maintenance | 15,000 | 15,000 | 15,000 | 15,000 |
| Wharf construction (annualised) | 18,900 | 18,900 | 18,900 | 18,900 |
| On-Site transfer costs | 111,700 | 111,700 | 161,400 | 161,400 |
| Barge Loading costs | 79,300 | 79,300 | 82,700 | 82,700 |
| Transport costs - Lee Navigation | 491,400 | 484,800 | 674,000 | 571,600 |
| Transport costs - Bow Creek | 434,700 | 399,100 | 454,500 | 464,300 |
| Transport costs - River Thames | 110,800 | 14,000 | 143,000 | 14,000 |
| **Total (£)** | **1,309,000** | **1,170,000** | **1,596,700** | **1,375,100** |
| Cost / tonne | £12.35 | £11.04 | £11.41 | £9.82 |

**Comparison of road and water transport costs for IBA**

Overall cost

0.30 The overall estimated cost of each activity is summarised in Table 10 below, which uses costs road costs presented in Chapter 4 and water costs presented in Chapter 5 or the report.

Table 10: Comparison of estimated annual costs of using road and water transport for IBA

| Costs p.a. (£) | Scenario 1 Edmonton / Rainham | Scenario 2 Edmonton / Greenwich | Scenario 3 Edmonton / Rainham | Scenario 4 Edmonton / Greenwich |
|---|---|---|---|---|
| IBA/yr (Te) | 106,000 | 106,000 | 140,000 | 140,000 |
| **Road Total cost** | **497,800** | **497,800** | **497,800** | **497,800** |
| **Water** | **1,309,000** | **1,170,000** | **1,467,700** | **1,596,700** |

0.31 It can be seen in table above that the road transport has a significant cost advantage over the water transport options. The two key reasons for this are:

- the set up costs that would have to be incurred to start a water transport operation; and
- the potential number of tug operations needed to move the barges on the three waterways.

Comparison of carbon emissions

0.32 Estimates of carbon emissions have been produced for the road and water operations, which enables a comparison of their impacts to be made. They do not take account of any on-site movement of IBA whether being transported off site by lorries or transferred from the energy plant to the wharf.

0.33 Table 11 below shows the estimated quantities of $CO_2$e produced by road and water transport, and the difference between the estimated quantities produce each year.

Table 11: Comparison of annual quantities of $CO_2$e for delivery of IBA by road and water to the same reprocessing facilities

| Annual quantities of CO2e by mode | Scenario 1 Rainham | Scenario 2 Rainham | Scenario 3 Greenwich | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage - IBA** | **106,000** | **106,000** | **140,000** | **140,000** |
| Tonnes of $CO_2$e per annum (road) | 340t | 330t | 450t | 430t |
| Tonnes of $CO_2$e per annum (water) | 200t | 120t | 270t | 160t |
| **Difference** | **140t** | **210t** | **180t** | **270t** |

0.34 Based on these estimates it is suggested that water transport would reduce the level of $CO_2$e by around 41 per cent for journeys to Rainham and 63 per cent to Greenwich compared with road haulage.

**IBA from and additional municipal waste to Edmonton (Scenarios 5 to 10)**

0.35 Under these scenarios IBA would be removed from Edmonton as assessed previously, but a new stream of waste would be delivered to the EfW plant. It is assumed that the new source would be the waste collected in the East London area, which is consolidated for disposal at a facility in the proximity of Barking Creek.

0.36 The assumed quantities of waste to be assessed are 180,000Te of IBA out and, 150,000Te and 300,000Te municipal waste in, at Edmonton. Table 12 below presents the scenarios considered.

Table 12: Road and water scenarios for transporting both IBA and municipal waste

| Transport Scenario | Commodity | Tonnage | Origin | Destination | Mode options | Method of handling |
|---|---|---|---|---|---|---|
| **Scenario 5** | IBA | 180,000Te | Edmonton | Rainham Landfill | Water and Road | Loose bulk |
| **Scenario 6** | Raw Waste | 150,000Te | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 7** | IBA | 180,000Te | Edmonton | Greenwich Agg Zone | Water and Road | Loose bulk |
| **Scenario 8** | Raw Waste | 300,000Te | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 9** | IBA | 180,000Te | Edmonton | Rainham Landfill | Water | Container |
| | Raw Waste | 150,000Te | Barking Creek | Edmonton | Water | Container |
| **Scenario 10** | IBA | 180,000Te | Edmonton | Rainham Landfill | Water | Container |
| | Raw Waste | 300,000Te | Barking Creek | Edmonton | Water | Container |

**Road transport options - 180,000 Te IBA**

Operation and cost

0.37 The road transport operation for the larger quantity of IBA would emulate that previous considered. Given the increase in quantity the number of vehicles required to complete the transport, which is reflected in the overall cost for the operation. In terms of vehicle journeys, this would equate to 48 daily 1-way trips per day, or approximate 6 per hour based on eight working hours.

0.38 The overall annual costs for the road transport are shown in the Table 13 below.

Table 13: Annual road operating cost for Scenarios 5 and 7

| Cost item | Scenario 5 | Scenario 7 |
|---|---|---|
| | Edmonton/ Rainham | Edmonton/ Greenwich |
| **Annual tonnage** | **180,000** | **180,000** |
| **Operating costs (£)** | | |
| Loading operation | 76,900 | 76,900 |
| Transport costs | 686,600 | 653,500 |
| **Total** | **763,700** | **730,400** |
| Cost / tonne | £4.24 | £4.06 |

Environmental impacts

0.39 The criteria for assessing the $CO_2e$ emissions for moving 180,000Te of IBA is same as stated previously. The estimated quantities of $CO_2e$ for road transport to the two IBA processing facilities are presented in Table 14.

Table 14: Annual quantities of $CO_2e$ for road transport (180,000Te IBA)

| Annual quantities of $CO_2e$ for road transport | Scenario 5 | Scenario 7 |
|---|---|---|
| | Edmonton/ Rainham | Edmonton/ Greenwich) |
| Annual tonnage IBA | 180,000 | 180,000 |
| **Tonnes of $CO_2e$ per annum** | **580t** | **550t** |

**Water transport options - 180,000 Te IBA**

0.40 The movement of IBA in Scenarios 5 and 7 is also assessed for water transport, as it would be possible to move it by this mode if municipal waste was delivered by road to Edmonton.

Equipment

0.41 The water transport of the higher quantity of IBA would be the same as previously discussed. However, there is an impact on the level of equipment required and frequency of the operational cycles, although the number of tugs would remain the same. This means that for either scenario 6 tugs would be require, while 30 and 20 barges needed for Scenario 5 and 7, respectively. There would also be need for an additional lorry for the on-site transfers the IBA at Edmonton.

Cost of water transport operation

0.42 A summary of the cost of the water operation by scenario is present in Table 15.

Table 15: Annual operating cost of water operations

| Cost item | Scenario 5 Rainham | Scenario 7 Greenwich |
|---|---|---|
| **Annual tonnage** | **180,000Te** | **180,000Te** |
| **Operational cost (£)** | | |
| Transport costs - Lee Navigation | 696,200 | 602,600 |
| Transport costs - Bow Creek | 463,500 | 437,700 |
| Transport costs - River Thames | 159,500 | 14,000 |
| **Total (£)** | **1,319,200** | **1,054,300** |
| Cost / Tonne | £7.33 | £5.86 |

<u>Environmental impact</u>

0.43 The criteria for assessing the $CO_2$e emissions for moving 180,000Te of IBA is same as stated previously. The estimate quantities of $CO_2$e for road transport to the two IBA processing facilities are presented in the Table 16 below.

Table 16: Annual quantities of $CO_2$e water transport operations (180,000Te IBA)

| Annual quantities of $CO_2$e | Scenario 5 Edmonton/ Rainham | Scenario 7 Edmonton/ Greenwich |
|---|---|---|
| Annual tonnage IBA | 180,000 | 180,000 |
| **Tonnes of $CO_2$e per annum** | **350t** | **200t** |

<u>Overall cost estimates of using water transport and comparison with road</u>

0.44 The water transport operation for 180,000Te of IBA incurs the same range cost elements as the lower quantities in the previous scenarios. The overall cost of the two water transport scenarios is summarised in Table 17.

Table 17: Overall estimated annual costs of using water transport for IBA

| Cost item | Scenario 5 Edmonton / Rainham | Scenario 7 Edmonton / Greenwich |
|---|---|---|
| **Annual tonnage** | **180,000Te** | **180,000Te** |
| | All costs in £ | |
| **Total** | **1,617,900** | **1,353,000** |
| Cost / tonnes | £8.99 | £7.52 |

0.45 When compared with road transport it is found that the costs associated with the water transport option are substantially greater.

**Municipal waste by road from Barking Creek to Edmonton**

0.46 Within the study this waste stream represents an inbound movement to Edmonton, which is assumed to originate in east London. To assess this transport, two approaches are assumed, the use of road carrying loose bulk waste, and the use of water where the IBA and raw waste are carried in containers that circulate in a closed loop system. When comparing the road and water options, the overall cost of the two road operations to move 180,000Te of IBA and 150,000Te or 300,000Te of municipal waste are combined.

Cost of transport and environmental impact

0.47 The cost for transporting the municipal waste only includes the actual lorry haul as the loading cost is assumed to be borne by the waste transfer station and unloading at Edmonton is direct into the EfW waste hoppers. The annual operating costs and quantities of $CO_2$e for Scenarios 6 and 8 are shown in Table 18 below.

Table 18: Annual operating cost for Scenarios 6 and 8

| Cost item | Scenario 6<br><br>East London Source / Edmonton | Scenario 8<br><br>East London Source / Edmonton |
|---|---|---|
| **Annual tonnage** | **150,000** | **300,000** |
| Transport costs | 640,000 | 1,263,100 |
| Cost / tonne | £4.27 | £4.21 |
| **Tonnes of $CO_2$e per annum** | **300t** | **600t** |

**Transporting municipal waste by water from Barking Creek to Edmonton**

0.48 It is assumed that municipal waste would be compacted into containers for transport by water, as this method already takes place on the Thames. Consequently, IBA being removed from Edmonton would utilise the same containers, as it is assessed that two different handling operations could not be accommodated on Ash Wharf.

0.49 In considering the options for using water transport to move raw waste from Barking Creek to Edmonton, it is felt that only where IBA is delivered to Rainham is the operation potentially workable. Therefore the containerisation approach has not been tested for the Greenwich scenario.

0.50 The proposed closed loop transport system would carry IBA containers to Rainham, while empty containers would be carried to Barking Creek for filling with municipal waste. These full containers would then be transported to Edmonton.

Wharf space and potential container handling

0.51 It has been assessed that the most suitable method of handling containers on/off barges would be with the installation of a gantry crane on Ash Wharf. Transfer of containers on-site would be by lorry fitted with a hooklift. Containers would be designed to be lifted by port industry standard mechanisms and for use with hookift systems.

0.52 It is assumed that only the existing 1,300$m^2$ of space would be used for the wharf, although as noted early, there is potential to expand the area to around 2,300$m^2$ if the drainage ditch were culverted.

0.53 To completely upgrade the wharf and install a gantry crane is estimated to cost in the region of £2,317,000.

0.54 For the transfer of containers on/off barges at Barking, a suitable container handling method would be required, although the cost of installation this is not taken into account in this study.

Tugs, barges and containers

0.55 To move the containers by water, the design of the barge would have to be different to that for carrying loose IBA. It is assessed that a bespoke designed barge could carry six containers, providing a total carrying capacity per barge of about 100Te. The tugs for this operation would be the same as those for moving loose bulk IBA.

0.56 The total annual quantity of IBA and municipal waste would be 330,000Te for Scenario 9 and 480,000Te for Scenario 10. Table 19 below shows the estimated number vessels and containers for each of the scenarios.

Table 19: Numbers of containers, tugs, barges and mooring for operational scenarios 9 and 10

| | Scenario 9 Edmonton/Rainham/Barking 180,000Te IBA 150,000Te municipal waste | Scenario 10 Edmonton/Rainham/Barking 180,000Te IBA 300,000Te municipal waste |
|---|---|---|
| **Containers** | 351 | 406 |
| **Tugs** | | |
| River Lee Navigation | 6 | 11 |
| Bow Creek | 2 | 2 |
| River Thames | 1 | - |
| Barking Creek | 1 | 2 |
| **Barges** | 37 | 68 |

Overall cost estimate of using water transport

0.57 As with the transport of only IBA by water, the Lee Navigation would still require lock refurbishment and on-going maintenance, the cost of which is included in the overall costing for these scenarios.

0.58 The overall cost of the various water transport options is summarised in Table 20.

Table 20: Overall estimated annual costs of using water transport for IBA

| **Cost p.a.** | Scenario 9 Edmonton/Rainham/Barking 180,000Te IBA 150,000Te municipal waste | Scenario 10 Edmonton/Rainham/Barking 180,000Te IBA 300,000Te municipal waste |
|---|---|---|
| | All costs in £ | |
| **Total** | **2,167,100** | **4,521,300** |
| Cost / tonnes | £6.57 | £9.42 |

0.59 Regarding costs, when compared with road, the water transport options are revealed to be substantially more expensive.

Environment impact

0.60 Although using road transport for IBA and municipal waste would effectively be two separate operations, by combining the quantity of $CO_2$e from each it is possible to compare this with water. Table 21 below presents the quantities of $CO_2$e for each mode.

Table 21: Comparison of annual quantities of $CO_2$e for moving IBA and Municipal Waste by road and water to same facilities

| Quantities of $CO_2$e | Scenario 5 | Scenario 7 | Scenario 6 | Scenario 8 | Scenario 9 | Scenario 10 |
|---|---|---|---|---|---|---|
| | Edmonton/ Rainham | Edmonton/ Greenwich | East London Location / Edmonton | East London Location / Edmonton | Edmonton / Rainham / Barking 180,000Te IBA 150,000Te | Edmonton / Rainham / Barking 180,000Te IBA 300,000Te |
| | IBA | IBA | MW | MW | IBA + MW | IBA + MW |
| Tonne p.a. | 180,000 | 180,000 | 150,000 | 300,000 | 330,000 | 480,000 |
| **Road** | 580t | 550t | 300t | 600t | 880t | 1,150t |
| **Water** | 350t | 200t | n/a | n/a | 510t | 740t |
| **Difference** | 230t | 350t | 300t | 600t | 150t | 220t |
| **Percentage reduction** | 40% | 64% | n/a | n/a | 40% | 36% |

0.61 Based on these estimates it is suggested that, on average, water transport would reduce the level of $CO_2e$ by between 36 and 64 per cent for journeys to Rainham, Greenwich and Barking compared with road haulage.

**Other considerations for the water transport operation**

0.62 In using water to transport IBA and possibly municipal waste, there are a range of factors that need to be considered. These are particularly relevant to the River Lee Navigation, which has not experienced commercial barging for many years and consequently houseboats and leisure activities have gradually taken the opportunity to use the waterway.

0.63 With respect to using the tidal waters of the Thames, most of the issues would be technical and any operation would have to meet Port of London requirements.

**Other opportunities for using water transport at Edmonton**

0.64 If water was chosen for the movement of IBA and possibly municipal waste, there may be opportunities to use Ash Wharf and water transport. For the study it was thought that main opportunities would be the movement of demolition waste and construction materials connected to the expansion of the Edmonton facility, and the delivery of household waste from the London Borough of Hackney's Millfields Road Depot.

Demolition waste and construction materials

0.65 An examination of the various options was completed, looking at each prospect separately. For the demolition waste it was found that no suitable disposal sites were located on the Lee Navigation and any removal by water would require transport to facilities on the Thames. A similar position was found for construction materials, with suppliers either located on the Thames or having no water access. The only opportunity identified is aggregates from Aggregate Industries' facility at Bow West, but a method of loading barges would have to found as no wharf currently exists at this location.

0.66 A major concern is how demolition waste and construction materials could be accommodated on Ash Wharf if IBA was being removed. The wharf is unable to accommodate two barges and the handling of different materials is likely to be problematic if at all possible. It certainly could not take place if containers were being transported.

0.67 Given the lack of origins and destinations for these materials it is considered that there is no opportunity for moving demolition waste and construction materials by waters.

Household waste from Millfields Road Depot

0.68 This opportunity would only exist if containers were used at Edmonton and it is assumed that if this happens, there would be a large throughput of containers at Ash Wharf. DEFRA sources indicate that LB Hackney produced 53,000Te of regularly collected household waste that did not go to recycling in the period 2012/13. This equates to around 5,900 loaded refuse vehicle trips per year or two barges per day each carrying six containers.

0.69 An assessment has been completed to examine whether waste could be carried either as part of the IBA/municipal waste transport using these containers and barge or moved using a separate self-supporting, parallel operation.

0.70 Both Hackney scenarios were modelled against Scenarios 9 and 10 quantities and operations. It was found that neither of the Hackney scenarios could be integrated with the main Edmonton transport operation. For the standalone approach, it was found that, in theory, it might be possible to run the Hackney and Scenario 9 together, but the system, in terms of capacity and conflict at the locks, was very tight and any operational difficulties for either operation is very likely to impact on the other. In the case of Scenario 10, the Lee Navigation did not appear to have the capacity to accommodate both operations.

0.71 Based on these operational outcomes it is felt that there is no opportunity to move Hackney waste from Millfields Road Depot.

**Conclusions**

0.72 The overall conclusions to the study are set out below.

Road transport options

0.73 Road transport is a relatively straightforward transport solution, using equipment that is readily available and commonly used in the logistics sector.

0.74 The failure of vehicles or absence of drivers can be easily remedied in the short-term through the spot hire market or agencies.

0.75 The overall number of daily trips to move the IBA is relatively modest with the lowest being 30nr 1-way journeys/day for 106,000tkpa to 48nr 1-way journeys/day for 180,000tkpa. Over a an eight hour day this equates to approximate 4 to 6 vehicles movements per hour.

0.76 It is important to optimise the transport flow and therefore it is a prerequisite to use articulated lorries capable of carrying at least a 22Te payload.

0.77 The overall capital investment for a road operation transporting 106,000Te of IBA between Edmonton and Rainham Landfill (Scenario 1), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£4.8M**.

0.78 The overall capital investment for a road operation transporting 106,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 2), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£4.7M**.

0.79 The overall capital investment for a road operation transporting 140,000Te of IBA between Edmonton and Rainham Landfill (Scenario 3), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£6.3M**.

0.80 The overall capital investment for a road operation transporting 140,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 4), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£6.2M**.

0.81 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham Landfill (Scenario 5), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.3M**.

0.82 The overall capital investment for a road operation transporting 150,000Te of Municipal Waste between Barking Creek and Edmonton (Scenario 6), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£6.3M**.

0.83 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 7), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.0M**.

0.84 The overall capital investment for a road operation transporting 300,000Te of Municipal Waste between Barking Creek and Edmonton (Scenario 8), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£11.7M**.

0.85 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 150,000Te of municipal waste to Edmonton (Scenario 5 plus Scenario 6) taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.3M** for the IBA and **£6.3M** for the municipal waste.

0.86 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 300,000Te of municipal waste to Edmonton (Scenario 5 plus Scenario 8) taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.3M** for the IBA and **£11.7M** for the municipal waste.

0.87 The amount of $CO_2e$ emissions from the road transport operations is estimated to be between 36 and 64 per cent higher than if using water, depending on the water operation used.

<u>Water transport option</u>

0.88 Works would be required to bring the waterway and locks up to a standard that can support continuous water transport between Edmonton and Bow Locks.

0.89 Lock restoration and upgrade should include the provision of an automated lock setting system, which can exploit current and future telecommunications technology. Suitable safety systems would need to accompany this approach such as a fenced off lock and a visual and audible warning system

0.90 Lock gates have been renewed in last 11 years and it is considered they will last the duration of a 25 year contract, notwithstanding periodic painting and maintenance.

0.91 There might be a need to provide alternative landing stages at the locks that would be form commercial boat operators use only.

0.92 The waterway is unlikely to need dredging in order to start barge operations. However, it is thought that there would be a need to carry out spot dredging as and when necessary.

0.93 It is estimated that to bring the locks up to a commercial operational standard will cost approximately £740K to £1.2M.

0.94 The constraining lock on the dimensions of barges is Old Ford, which was measured as 24.75m long by 5.59m wide. With respect to air draught, the critical bridge soffit is on Lea Bridge, which was measured as 2.43m above water.

0.95 The space available on Edmonton wharf is quite constrained, but could be expanded by up to 80 per cent if it was possible to build a culvert over the drainage channel at the rear of the site. This will require further investigation, but is considered to broaden the operational potential if this were possible.

0.96 The type of wharf handling equipment would depend on the water operation chosen. For movement of loose bulk IBA an excavator would be suitable, but if containers are used it is felt that an on-shore cantilever gantry crane would be the most efficient option for lifting containers on/off barges. However, the main drawback with this latter proposal is the lack of access to the waterway using the wharf in the event of mechanical problems.

0.97 The Edmonton wharf will require a complete rebuild in order to ensure it is of a standard to meet the demands of accommodating an excavator or container crane. It is estimated that the cost to develop the wharf and install the handling equipment would range between £500,000 and £2M. A full engineering assessment determine the exact extent of the works required

0.98 The number of tugs and barges required to support the water operation is dependent upon the location of the IBA processing facility and if municipal waste water delivered to Edmonton by water. While it is estimated that the numbers used on the Thames and its tidal creek are in the order of one or two, for the River Lee Navigation the range is between four and eleven. For barges, it is estimated that between 16 and 68 would be required.

0.99 The overall capital investment for a water operation transporting 106,000Te of IBA between Edmonton and Rainham Landfill (Scenario 1), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£14.3M**.

0.100 The overall capital investment for a water operation transporting 106,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 2), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£12.6M**.

0.101 The overall capital investment for a water operation transporting 140,000Te of IBA between Edmonton and Rainham Landfill (Scenario 3), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£18.2M**.

0.102 The overall capital investment for a water operation transporting 140,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 4), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£14.6M**.

0.103 The overall capital investment for a water operation transporting 180,000Te of IBA between Edmonton and Rainham Landfill (Scenario 5), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£18.5M**.

Scenario 6 is not been considered separately for water, but assessed as part of Scenario 9.

0.104 The overall capital investment for a water operation transporting 180,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 7), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£15.4M**.

Scenario 8 is not been considered separately for water, but assessed as part of Scenario 10.

0.105 The overall capital investment for a water operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 150,000Te of municipal waste to Edmonton (Scenario 9). taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£25.0M**.

0.106 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 300,000Te of municipal waste to Edmonton (Scenario 10) taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£48.7M**.

Combined use of road and water transport option

0.107 The transport scenarios assessed offer the opportunity to combine the road and water options for the removal of IBA from and delivery of municipal waste to Edmonton. The overall cost would depend on the location of the IBA processing facility and municipal waste source, but are estimated as shown in Table 22.

Table 22: Indication of transport costs if other combinations of road and water are used

| Combined scenarios | IBA | MW | Total |
|---|---|---|---|
| 180k Te IBA to Rainham by Water<br>150k Te MW to Edmonton by Road | £18.5M | £6.3M | £24.8M |
| 180k Te IBA to Greenwich by Water<br>150k Te MW to Edmonton by Road | £15.5M | £6.3M | £21.8M |
| 180k Te IBA to Rainham by Water<br>300k Te MW to Edmonton by Road | £18.5M | £11.7M | £30.2M |
| 180k Te IBA to Greenwich by Water<br>300k Te MW to Edmonton by Road | £15.5M | £11.7M | £27.2M |

Barging operations

0.108 The operation will need to ensure that a sufficient quantity of full and empty barges or barges/containers are positioned at the right locations for uninterrupted processing and transport of IBA and MW to takes place.

0.109 The most efficient use of barge resources on the River Lee Navigation is to have one tug move one barge for the entire journey up or down the waterway.

0.110 In the area of pontoon moorings north of Stonebridge Lock it would be necessary to ensure no boats moor opposite, or on the approaches to, this section of the waterway to prevent navigation constraints.

0.111 Although other leisure craft are moored along the length of the Lee Navigation, these are unlikely to be significantly affected by the barge operations in case of only IBA transport. However, if IBA and MW are moved the frequency of daily trips would be much higher and a potential impact needs to be recognised.

0.112 The most sensitive issue would be accommodating the rowing club activities which have developed in the absence of water freight on the Lee. This group is likely to be concerned about the re-introduction of freight services, and whilst the Lee is classed as a Commercial Waterway, early dialogue with the club is advised, if the decision is made to use water transport.

0.113 Barge traffic is unlikely to cause bank erosion due the predominantly steel and concrete campshot embankment, but its wash could disturb artificial habitat placements.

0.114 It would be necessary that the provision of fuelling, welfare and servicing of craft be fully considered in any contractual arrangements for the supplier of the barge services.

Potential risk

0.115 Generally, the risks to a water operation a considered to be relatively low risk. However, closure of the waterway for maintenance and a failure of a crane in the case of transporting containers are regarded as high risk, while freezing of the waterway or difficulties with water depth are thought to pose a medium to high risk. A summary of the overall risks for water and road are shown in Table 24.

Table 24: Summary of water and road related

| **Risk** | **Potential Severity** | **Consequence** |
|---|---|---|
| Waterway closure for maintenance | High | Major disruption to water freight operations. Alternative transport arrangements via the road network would be needed. |
| Dredging | Low/medium | Periodic (e.g. once per year) spot dredging may be required, but unlikely to halt barge operation, but could potentially slow passage. Might require supplementary road haulage should IBA stockpile become critical if operational frequency impeded. |
| Waterway freezing in winter | Medium/High | Dependent on severity of conditions, but could slow passage, or if severe, block waterway. Road haulage would be required as supplement and possibly temporarily replace water transport. |
| Lack of water in waterway | Medium/High | Potentially to reduce operational frequency or halt barges. Road haulage would be required as supplement and possibly temporarily replace water transport. |

| | | |
|---|---|---|
| Problems with lock(s) | Low/Medium | Locks on Lee Navigation comprise two parallel chambers, but the freight lock would be fast fill. Should a freight lock become unavailable, operation could still function, using the slower fill locks. Prolonged problem might require supplementary road haulage should IBA stockpile become critical if operational frequency impeded. |
| Other waterway users | Low/Medium | Potential conflict, slowing of barge traffic, and waterway restrictions could arise due to other users in waterway when barge operations taking place. Agreements might need to be put in place on when barge operations should be suspended or retimed. |
| Increasing road congestion for Rainham, Greenwich or inbound MW loads | Medium | Would slow operational frequency of IBA transport. Compensate by increasing number of tippers used in operation to maintain delivery requirements - potential impact on operating costs |
| Accelerated cost of fuel | Medium | Potential impact on operating costs increasing above long-term average for crude oil (3¾% real oil price trend [(2)]).This would have a greater impact on road transport, as fuel currently represents about 35%[(3)] of total operating costs compared with about 16%[(4)] for inland water transport. Road transport is more sensitive to fuel price increases than water. |
| Future Road Pricing | Low/Medium | Potential impact on operating costs not currently included in costs estimates |
| Failure of wharf handling equipment:<br>Excavator fails<br>Gantry crane fail | Low<br>High | Excavator can be changed relatively quickly with a hired in machine - no significant impact on barge operations<br>Gantry crane failure would require temporary use of road transport as access to canal would not be available |
| Reliance on hooklift lorries for on-site haulage at Edmonton | Medium | Depends on number of lorries available, but unavailability of one would reduce on-site capabilities to move required number of containers. Specialist equipment, so potential difficulty hiring in replacement at short notice. Overall temporary impact is reduced operational capacity. |
| Failure of tug or barge | Low/Medium | Assumed spare tug and barges would be included in overall system requirement. Failure of tug could slow operation as shunting at wharf could be impeded and therefore potentially reduce overall operational efficiency. Might require supplementary road haulage should IBA stockpile become critical if operational frequency impeded. Barge failure likely to be low impact as spare would cover maintain full fleet capacity. |
| Tug/barge maintenance and servicing | Low | If planned maintenance low impact as tug and barge will be out of action limited period and spare equipment should cover temporary removal from service. |

Overall conclusion

0.116 The potential to transport IBA from Edmonton is considered to be a technically feasible option and the River Lee Navigation has the capacity to accommodate annual flows of 106,000Te, 140,000Te and 180,000Te. When combined with the delivery of municipal waste from East London, the modelling has

2 DECC Fossil Fuel Price Projections, Dept. Energy and Climate Change, Sept 2014
3 FTA's Manager's Guide to Distribution Costs - October 2014 Update Report
4 Information from London barge operator

shown that 150,000Te to Edmonton by water would be achievable. For the higher quantity of 300,000Te, the capacity of the overall system is nearing its limit. An issue with this scenario would be sheer number of containers and rapidity at which they can be handled, turned round and if necessary stored; this operation would also have to extend into a double shift pattern and require running barges on the River Lee Navigation between 07.00 and 23.00 hours.

0.117 The assessment has examined a water transport option to move IBA, and possibly municipal waste, using a waterway that is likely to require enhancement, as well as the provision of necessary infrastructure to support the operation at Edmonton. The work carried out indicates that a high level of investment would be required to commence a water-based scheme, even if it is only for transporting IBA as a loose bulk commodity in barges.

0.118 Without such investment the use of water as a means of transport would not be feasible. By comparison road transport has a readymade infrastructure and would only require the procurement of the necessary vehicles and handling plant.

0.119 While the initial investment cost is greater than that needed for road transport, the on-going operations and maintenance costs are also estimated to be higher, as the water operation involves several transport legs that incur their own costs and which are not applicable to road.

0.120 However, counter to the capital and operational cost is the question of environmental impact from using lorries. Overall, road transport is shown to produce higher levels of $CO_2e$ per annum. Furthermore, this assessment has not considered the total air quality impact resulting from the emission of Particular Matter ($PM_{10}$ and $PM_{2.5}$) and $NO_x$, the concern about which is rising up the political agenda.

0.121 Any decision to adopt water transport will require engagement with stakeholders, including CRT, the PLA, London planning authorities, the Environment Agency and groups that use the River Lee Navigation for leisure and other activities.

0.122 For the transport of demolition waste and construction materials, it is assessed that only the delivery of aggregates offers the best opportunity at this time.

0.123 With regards to the delivery of household waste from the Millfields Road Depot, given the potential impact this operation might have on the primary water transport, it is assessed that this is not practical or viable option.

# 1 Introduction

1.1.1 On 25th July 2014 the North London Waste Authority (NLWA) commissioned Peter Brett Associates LLP (PBA) to review the viability of transporting incinerator bottom ash (IBA) from, and household waste to, the Edmonton EcoPark Energy from Waste (EfW) facility by water.

1.1.2 The aim of the review is to consider the options for transporting these materials by water compared with a base case of using road. Therefore, it takes account of the enabling infrastructure requirements for handling and transportation of the materials, potential locations to which IBA could be transported, potential 'other' sources of household waste and the indicative costs that are associated with waterborne transport versus road.

## 1.2 NLWA and the Edmonton EcoPark facility

1.2.1 NLWA is the body responsible for managing the disposal of municipal waste for seven boroughs in north London (Barnet, Camden, Enfield, Hackney, Haringey, Islington, and Waltham Forest). Its primary function is to arrange the processing, transport and disposal of waste collected by these seven boroughs and to promote waste minimisation and recycling. During 2012/13, the Authority handled approximately 823,000 tonnes (Te) of municipal waste, comprising 670,000Te of local authority collected waste from households and 153,000Te of local authority collected waste from commercial and industrial producers.(5) Currently, the disposal methods are recycling, composting, landfill or the recovery of energy from waste. Approximately 49 per cent of the waste is used as fuel at the Authority's energy from waste facility at Edmonton, while waste moved to landfill is transported by rail from the Hendon transfer station.(6)

1.2.2 The Edmonton EcoPark facility is located adjacent to the North Circular Road (A406) and bounded along its eastern edge by the River Lee Navigation. The site can be directly accessed from the A406 (North Circular Road) and it has potential access to the Lee Navigation via Ash Wharf which is currently used by Edmonton Sea Cadets Corps (TS Plymouth).

1.2.3 At present the transport of all inbound household refuse and the export of on-site processed IBA are carried out by road. Household waste arrives either in the refuse vehicles direct from their rounds, or in bulk carrier articulated lorries (gross vehicle weight (GVW) of 40Te) from borough waste transfer stations. During 2012/13 the number of lorries visiting the EcoPark was approximately 15,000

1.2.4 The Edmonton facility currently comprises a number of waste treatment systems (EfW plant, composting, recycling), as well as being a transfer station. The strategy now being pursued and subject of the Development Consent Order (DCO) is based on the eventual renewal of the existing incinerator facility by 2025. The existing EfW facility has a capacity to handle 600,000Te of waste per annum (pa), while it is proposed that the new plant will have an increased capacity of 700,000Te/pa.

1.2.5 Currently, IBA is processed on-site by Ballast Phoenix, with metals being removed from the ash before the other solids are graded and/or ground, and transported by road to customers' facilities or point of use/storage.

1.2.6 The decision to renew the incinerator facility will result in the need to move IBA processing off-site, although the final location of this plant is not identified in this review. The location(s) used in this review are set out in the assumptions provided in Appendix A.

## 1.3 Report Structure

1.3.1 The remainder of this report comprises:

5 NLWA, Annual Monitoring Report, 2012/13, p12
6 Op. cit, p48

Chapter 2: Study approach

Chapter 3: Equipment

Chapter 4: Road transport options for only IBA

Chapter 5: Water transport options for only IBA

Chapter 6: Comparison of road and water transport costs for IBA

Chapter 7: IBA from, and additional municipal waste to Edmonton

Chapter 8: Comparison of road and water transport costs for IBA and municipal waste

Chapter 9: Financial appraisal

Chapter 10: Other considerations for the water transport operation

Chapter 11: Other opportunities for using water transport at Edmonton

Chapter 12: Conclusions

# 2 Study approach

## 2.1 Key objectives

2.1.1 This feasibility review study has been structured to address the following key objectives:

a. Establish the potential technical feasibility for the movement of IBA arising from the Edmonton EcoPark by water compared with road and the potential to move the demolition materials during the plant renewal phase

b. Describe a possible strategy for movement of freight by water and advise on the infrastructure required – including wharfage, operational infrastructure - e.g. containers and barges

c. Examine the feasibility of water transport for the delivery of household waste from other sources that could exploit the use of the River Lee Navigation

d. Indicate the potential environmental benefits, for example carbon dioxide savings and reductions in lorry miles through the use of the water compared with transport by road

e. Identify indicative capital expenditure and operational expenditure for the various phases

f. Identify major barriers/constraints to delivery and make recommendations for further actions

## 2.2 Summary of potential IBA and waste quantities

2.2.1 The quantity of IBA that could be ultimately produced by EfW facility is dependent upon the volumes of waste being sent to Edmonton. It is assumed that the quantity of IBA derived from the incineration process is 20 per cent of the raw waste quantity. Two scenarios are considered for the source of the raw waste that dictate the quantity of IBA:

a. Waste sourced from NLWA boroughs

b. Waste sourced from NLWA boroughs, plus that sourced from other sources in East London (OSEL) - lower and upper limit

2.2.2 The quantities related to these scenarios are shown in Table 2-1:

Table 2-1: Assumed quantities of raw waste and produced IBA (Te/pa)

<table>
<tr><th>Scenario</th><th>Quantity of raw waste (tonnes per annum)</th><th>Quantity of IBA (tonnes per annum)</th></tr>
<tr><td>NLWA boroughs</td><td>530,000</td><td>106,000</td></tr>
<tr><td>NLWA boroughs</td><td>530,000+</td><td>140,000</td></tr>
<tr><td>NLWA + OSEL lower limit</td><td>530,000 + 150,000</td><td rowspan="2">180,000</td></tr>
<tr><td>NLWA + OSEL upper limit</td><td>530,000 + 300,000</td></tr>
<tr><td colspan="3">OSEL = Other Sources in East London</td></tr>
</table>

## 2.3 Summary of potential methods to transport IBA and raw waste

### Overview

2.3.1 NLWA have suggested that the IBA would travel from Edmonton to a processing plant potentially located along the River Thames. It is unlikely that such a plant would be available north of Edmonton with access to the River Lee Navigation, and therefore this scenario has not been considered.

2.3.2 Since it assumed that IBA would be exported in an untreated state, two methods of water transport are available:

a. loading IBA as a loose material into hopper barges for the journey to the processing plant; and

b. filling 20-foot waste containers at Edmonton and loading these into barges for the journey to the processing plant.

2.3.3 The locations assumed for the processing plant are Rainham Landfill in Essex and Greenwich Aggregate Zone.

2.3.4 For the import of raw waste, the NLWA has suggested that a future potential source could be municipal waste collected in East London. The existing waste transfer station for waste collected in this area is in Jenkins Lane, which is located about 400m from the River Roding (Barking Creek). There are working wharves on this river and this might present an opportunity to use water transport. To transport the raw waste from Jenkins Lane to Edmonton would require the use of containers loaded into barges.

2.3.5 The findings of this Report are based upon the information provided by NLWA, PBA's site visit and meetings, and the information made available by the parties contacted by PBA. It should be noted that any costs shown in this Report are based on information obtained from third parties and PBA's own databases and reflect market conditions in 2012.

### Assumed operational scenarios

2.3.6 Table 2-2 indicates the possible operations and the transport method options for the movement of IBA and raw waste that are tested in this study.

Table 2-2: Scenarios for delivering IBA and raw waste from and to Edmonton

| Transport Scenario | Commodity | Tonnage | Origin | Destination | Water Distance (Km)* | Road Distance (Km)* |
|---|---|---|---|---|---|---|
| **Scenario 1** | IBA | 106kpa | Edmonton | Rainham Landfill | 31 | 26 |
| **Scenario 2** | IBA | 106kpa | Edmonton | Greenwich Agg Zone | 18 | 24.5 |
| **Scenario 3** | IBA | 140kpa | Edmonton | Rainham Landfill | 31 | 26 |
| **Scenario 4** | IBA | 140kpa | Edmonton | Greenwich Agg Zone | 18 | 24.5 |
| **Scenario 5** | IBA | 180kpa | Edmonton | Rainham Landfill | 31 | 26 |
| **Scenario 6** | Raw Waste | 150kpa | Barking Creek | Edmonton | 26 | 16 |
| **Scenario 7** | IBA | 180kpa | Edmonton | Greenwich Agg Zone | 18 | 24.5 |
| **Scenario 8** | Raw Waste | 300kpa | Barking Creek | Edmonton | 26 | 16 |
| **Scenario 9** | IBA | 180kpa | Edmonton | Rainham Landfill | 18 | n/a |
| | Raw Waste | 150kpa | Barking Creek | Edmonton | 26 | n/a |
| **Scenario 10** | IBA | 180kpa | Edmonton | Rainham Landfill | 18 | n/a |
| | Raw Waste | 300kpa | Barking Creek | Edmonton | 26 | n/a |

* This is the distance for a 1-way trip

2.3.7 Since the all the assumed locations have direct access to water transport, the water and road distances are included as a direct comparison of cost provided later in this report.

2.3.8 The mode of transport and method of materials handling provide a number of options for each scenario. Table 2-3, indicates the possible options that are available for the logistics operation, which form the basis of the comparison analysis.

Table 2-3: Scenarios for delivering IBA and raw waste from and to Edmonton by mode and method materials handling

| Transport Scenario | Commodity | Tonnage | Origin | Destination | Transport Modes Investigated | Method of handling |
|---|---|---|---|---|---|---|
| **Scenario 1** | IBA | 106kpa | Edmonton | Rainham Landfill | Water and road | Loose bulk |
| **Scenario 2** | IBA | 106kpa | Edmonton | Greenwich Agg Zone | Water and road | Loose bulk |
| **Scenario 3** | IBA | 140kpa | Edmonton | Rainham Landfill | Water and road | Loose bulk |
| **Scenario 4** | IBA | 140kpa | Edmonton | Greenwich Agg Zone | Water and road | Loose bulk |
| **Scenario 5** | IBA | 180kpa | Edmonton | Rainham Landfill | Water and road | Loose bulk |
| **Scenario 6** | Raw Waste | 150kpa | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 7** | IBA | 180kpa | Edmonton | Greenwich Agg Zone | Water and road | Loose bulk |
| **Scenario 8** | Raw Waste | 300kpa | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 9** | IBA<br>Raw Waste | 180kpa<br>150kpa | Edmonton<br>Barking Creek | Rainham Landfill<br>Edmonton | Water<br>Water | Container<br>Container |
| **Scenario 10** | IBA<br>Raw Waste | 180kpa<br>300kpa | Edmonton<br>Barking Creek | Rainham Landfill<br>Edmonton | Water<br>Water | Container<br>Container |

2.3.9 Scenarios 6 and 8 only test road transport of raw waste to Edmonton, as these assume the movement of loose bulk waste, which cannot be performed by water.

2.3.10 Scenarios 9 and 10 only relate to water transport and test the combined movement of IBA/raw waste operations using containers. This means that IBA would be removed from Edmonton to Rainham in containers, empty containers would be transported by water from Rainham to Barking Creek for filling with raw waste and these full containers would then be transported back to Edmonton - offering a closed loop operation.

2.3.11 The containerisation approach has not been tested for the Greenwich scenario, however, because: first, it is unlikely that container handling facilities could be setup here due to space constraints; and second, to close the operational loop would require a long distance movement of empty containers from Greenwich to Barking Creek.

2.3.12 Flow diagrams indicating the sequence of barge movements and transfers during a cycle of delivering only IBA and a combined operation with IBA out and raw waste into Edmonton are provided in Appendix B.

## 2.4 Study methodology

2.4.1 The broad study approach adopted comprised a detailed technical assessment of the practicality and feasibility of transport by road and water including equipment, operational plans and infrastructure requirements. The outputs from these various work streams provided the data and inputs to the calculation of costs and environmental indicators for the scenarios assessed. In summary these tasks were as follows:

a. Estimate the number of containers required for the transport of IBA and raw waste over the whole supply chain of road and water. Following consultation with NLWA, it is assumed that road vehicles would carry a containerised payload of 11Te and barges 17Te [(7)];

b. Estimate the number of road vehicles required for the road elements of the transport scenarios, based on the tonnes to be moved and payloads of containers. This task also takes into account factors such as, distance, journey time, and drivers' hours;

c. Estimate the number of barges and tugs to carry out the transport on the Lee Navigation whether using containers or hopper barges for carrying loose material. As with road transport, distance and journey time are taken into account, but this transport also has to consider other elements, such as passing through locks and whether whole or partial journeys are more efficient solution;

d. Examine potential infrastructure changes and/or improvements for transport by water. This is also includes for the latter, the works needed to provide operational wharves at Edmonton and another location for household waste;

7 The maximum tonnages that would enable road vehicles not to exceed their weight limit and barges their carrying capacity.

e. Examine and compare the environmental and financial implications at high level of using the two modes; and

f. Develop spreadsheet models that would estimate the environmental and financial implications, as well as indicating the most appropriate operations for the water transport.

2.4.2 An underlying assumption regarding IBA transported in 20ft containers is that they comply with International Organization for Standardization (ISO) size and lifting standards, although actual specification would be suited to the effective handling of IBA. A list of the general assumptions used in the study is provided in Appendix C, while more specific assumptions are set out within the relevant section.

2.4.3 In preparing this Report, PBA visited the various sites connected with the scheme and study team met the NLWA to discuss the options in more detail. PBA has also had discussions with other waste authorities, waste management operators, navigation authorities and marine operators.

# 3 Equipment

3.1.1 As part of this assessment a range of equipment has been considered that could be used in facilitating the transport operation. In the context of an operation to move large quantities of bulk commodities, the type of equipment plays an important part in determining the cost of the options available, how efficient the operation would be and the environmental impact the transport could have on the wider community.

3.1.2 For this study review, equipment is classified under following headings:

- **On-site handling:** equipment for handling and moving IBA and potentially municipal waste within the Edmonton site;
- **Road transport:** vehicles for transporting the IBA and municipal waste to the Edmonton site;
- **Wharf handling:** equipment for handling and moving IBA and potentially municipal waste on and off barges;
- **Water transport:** craft equipment for handling and moving IBA and potentially municipal waste.

3.1.3 Table 3-1 summarises the type of equipment reviewed, while more details are available in Appendix D.

Table 3-1: Types of equipment reviewed for the transport options

| Classification | Equipment | Indicative cost |
|---|---|---|
| On-site handling | Mechanical shovel<br>Hooklift lorry<br>Tippers lorry<br>Dumper truck<br>Reachstacker | £120,000<br>£96,000<br>£97,000<br>£180,000<br>£350,000 |
| Road transport | Articulate skeletal lorry<br>Articulate tipper lorry<br>Articulate waste carrying lorry | £90,000<br>£115,000<br>£123,000 |
| Wharf handling | Tracked excavator<br>Gantry Crane | £88,000<br>£1,600,00 |
| Water transport | Tug/workboat (canal)<br>Tug/workboat (tidal creek)<br>Barge<br>Container | £66,000<br>£300,000<br>£110,000<br>£8,000 |

3.1.4 As well as understanding the capital cost of the equipment, all aspects of their capabilities and running costs are taken into account and form the basis of the cost estimates included in the operation assessments presented in this report. The elements cover:

- Driver/operator costs
- Fuel use
- Maintenance
- Capacity/payload

3.1.5 Assessments are based on a combination of running time and distance, depending on the type of equipment.

# 4 Road transport options for only IBA

## 4.1 Introduction

4.1.1 This chapter considers the options for transporting IBA by road from the Edmonton to Rainham Landfill and Greenwich Aggregate Zone. Both locations are able to process IBA. These options are effectively the base cases against which the feasibility and cost of the water transport option would be compared and are considered as the core scenarios.

4.1.2 Based on the scenarios in Table 2-2, the quantity of IBA transported under each of these is:

- **Scenario 1**: 106,000Te per annum Edmonton to Rainham Landfill;
- **Scenario 2:** 106,000Te per annum Edmonton to Greenwich Aggregate Zone;
- **Scenario 3:** 140,000Te per annum Edmonton to Rainham Landfill;
- **Scenario 4**: 140,000Te per annum Edmonton to Greenwich Aggregate Zone.

4.1.3 The stages included in the logistics process are the loading of the materials at Edmonton and the transport to the recycling facility. These are considered in this section.

## 4.2 Materials Handling

4.2.1 The handling of IBA in the context of transporting the commodity off site, is confined to the loading of tipper lorries at Edmonton.

4.2.2 The equipment required to undertake this task could be achieved by either a wheeled mechanical shovel or a tracked / wheeled excavator. Both classes of equipment are commonly used in the aggregates industry for handling of loose bulk materials, which are similar in nature to IBA.

4.2.3 The final type of equipment used at Edmonton is dependent on factors such as would it be used for other duties when not loading lorries, the available operating space, or proximity of overhanging structures.

4.2.4 At the time of writing this report, the ultimate operating environment has not been finalised. Given this unknown it is felt that the mechanical shovel is probably a more flexible option as it is better suited to working on a loading orientated operation.

### Operation and cost

4.2.5 It is assumed that the mechanical shovel would be loading lorries from a small stockpile of IBA that is deposited from the incinerator. The rate at which a lorry is loaded will depend on the size of shovel on the machine and the distance it has to travel between the stockpile and vehicle. From timing examples available on the internet, 30 seconds per lift is not an unreasonable time to assume.

4.2.6 Table 4-1 indicates the estimated turnaround time for loading articulated tipper lorries at Edmonton.

Table 4-1: Loading rates of mechanical shovel at Edmonton

| Annual tonnage | Scenario 1&2 106,000Te | Scenario 3&4 140,000Te |
|---|---|---|
| Days/year | 258 | 258 |
| T/day | 411 | 543 |
| Tipper capacity (T) | 29 | 29 |
| Loads/day | 15 | 19 |
| Shovel capacity (t) | 2.5 | 2.5 |
| Lifts/loading | 12 | 12 |
| Time/lift | 00:00:30 | 00:00:30 |
| Time to load | 00:06:00 | 00:06:00 |
| Tot loading time/day | 01:30:00 | 01:54:00 |
| Contingency | 00:30:00 | 00:30:00 |
| Assumed loading time/day | 2:00:00 | 2:24:00 |
| Rounded | 2:00:00 | 2:30:00 |

4.2.7 Table 4-1 shows that the actual time a mechanical shovel is physically loading lorries is about 25 per cent of the time in a working day of nine hours. Based on this assessment it is envisaged that a single mechanical shovel would be sufficient for loading the tipper lorries.

4.2.8 To estimate the cost, machine use not associated directly with loading lorries that remove the IBA from site has been ignored. Table 4-2 indicates the estimate annual operations cost for a single shovel being used for two hours for Scenario 1and 2, and two and a half hours for Scenario 3 and 4. The annual depreciation rate is shown, but is included the operating costs and assumed to be a straight-line to zero, based on eight years of service at which point the machine would be renewed.

Table 4-2: Estimated annual operating cost of mechanical shovel at Edmonton

| | Scenario 1&2<br>Edmonton/ Rainham/Greenwich | Scenario 3&4<br>Edmonton/ Rainham/Greenwich |
|---|---|---|
| **Annual tonnage** | **106,000** | **140,000** |
| Number of vehicles required | 1 | 1 |
| Mechanical shovel acquisition cost | £120,000 | £120,000 |
| Annual depreciated value | 15,000 | 15,000 |
| Annual operating costs | 74,500 | 75,300 |

## 4.3 Road Transport

4.3.1 The routes assumed for the scenarios would be consistent for Scenarios 1 and 2 and Scenarios 3 and 4 and will use the routes indication in Figure 4-1 for Rainham and Figure 4-2 for Greenwich.

Figure 4-1: Lorry routes for transporting IBA between Edmonton and Rainham Landfill

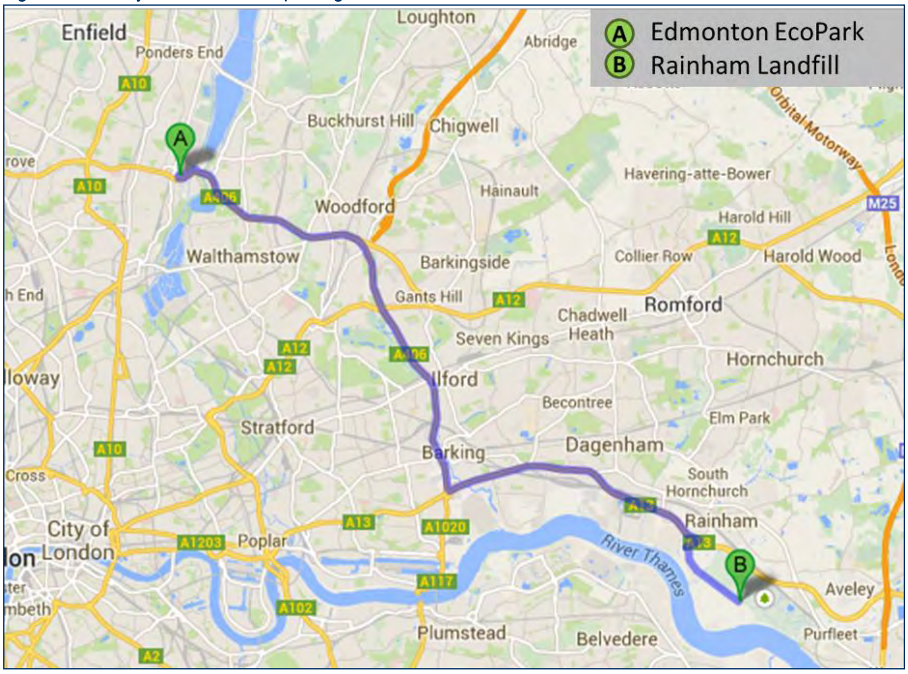
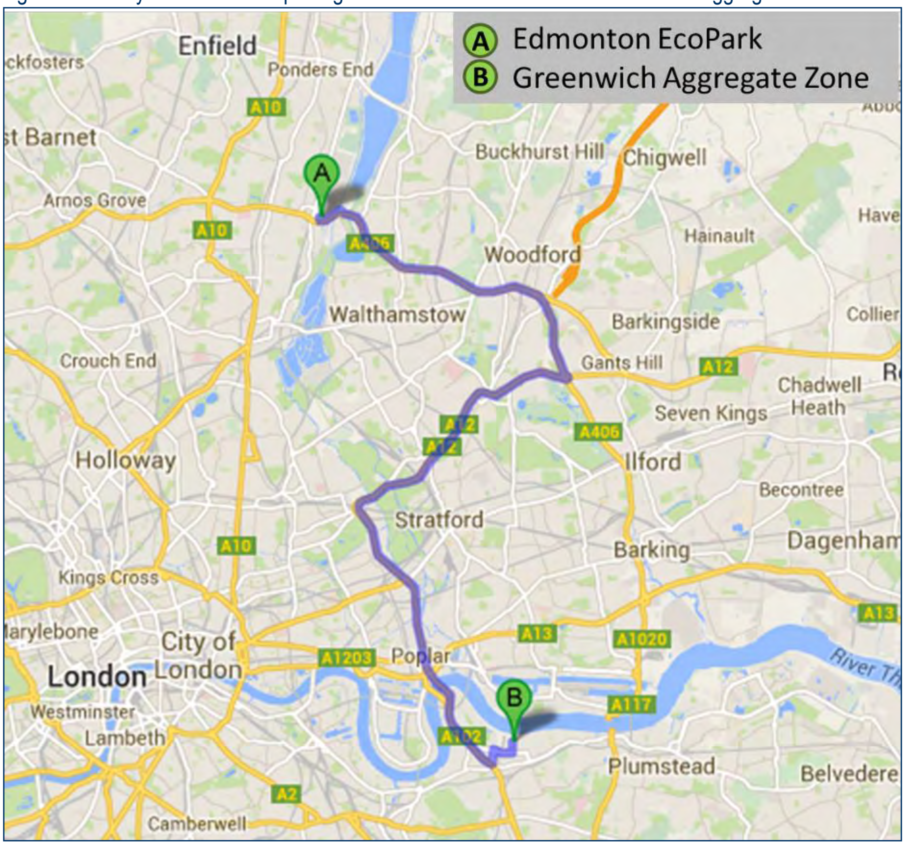



Figure 4-2: Lorry routes for transporting IBA between Edmonton and Greenwich Aggregate Zone




4.3.2 For the movement of IBA on these routes, it is assumed that the vehicles used would be articulated bulk tipper lorries, with a gross vehicle weight (GVW) of 44 tonnes.

4.3.3 Costs used in the estimate are calculated from first principles. However, to indicate how these might differ from third-party rates, enquiries were made with a number of hauliers based on providing a contract for 5 years and are compared with the study figures later.

## 4.4 Road options

4.4.1 In order to assess the road transport operation, the following is assumed:

- IBA payload per articulated tipper lorry = 29Te;
- One-way road trip distances Edmonton/Rainham is = 26km;
- One-way road trip distances Edmonton/Greenwich = 24.5km;
- Working days per year = 258; and
- It is assumed the lorries used for the future contract will take advantage of latest engine and suspension technology in order to benefit from the lowest vehicle excise duty rates and minimise their impact on road infrastructure and air quality.

4.4.2 It should be noted that the procurement of road vehicles is typically completed by lease agreements that run for up to six or seven years, and the on-the-road-price will depend on the purchasing power of the company, although the study is working from first principles and does not assess leasing costs.

## 4.5 Road vehicle activity

4.5.1 Road activity refers to the actual amount of transport that is required in order to move the necessary quantity of IBA between Edmonton and the processing facility each day. To develop the estimates, a number of assumptions have been made that cover a variety factors. The most relevant are listed below:

- IBA production is constant across the year, such that the same quantity is transported each working day;
- lorries are full and return empty;
- lorries are based at Edmonton;
- the route mileages were measured using Google Maps;
- the maximum number of return trips per day includes 25 minutes to load or unload the vehicle and complies with rules on good vehicle drivers' hours (DfT, 2011);
- the average road speed of vehicles is a assumed to be 15mph, which is 3mph below the approximate average traffic speed on major road in London (TfL, 2012);
- vehicle running costs are based on information, as published in Road Haul Association Cost Tables 2012 (RHA, 2013);
- fuel cost is based on published daily fuel prices available on the Freight Transport Association website [(8);] and
- annual $CO_2$ emissions are calculated using the DEFRA Conversion Factors for Company Reporting spreadsheet tool (DEFRA, 2012).

### Transport movements and routes

4.5.2 The estimated number of lorry trips that would be generated between Edmonton and the processing facilities is shown in Table 4-3. This assumes operations would be run over 258 days per year.

[8] FTA Daily fuel prices, Prices effective as of 25-Sep-2012, http://www.fta.co.uk/policy_and_compliance/fuel_prices_and_economy/fuel_prices/daily_fuel_prices.html

4.5.3 Note numbers in the tables included in this report are subjecting to rounding and therefore totals might not tally exactly.

Table 4-3: Estimated number of lorry trips by scenario

| | Scenario 1 Edmonton/ Rainham (106Ktpa) | Scenario 2 Edmonton/ Greenwich (106Ktpa) | Scenario 3 Edmonton/ Rainham (140Ktpa) | Scenario 4 Edmonton/ Greenwich (140Ktpa) |
|---|---|---|---|---|
| IBA/day (t) | 410 | 410 | 540 | 540 |
| Round road trips/day | 15 | 15 | 19 | 19 |
| 1-way journeys/day | 30 | 30 | 38 | 38 |
| Round trips/year | 3,665 | 3,665 | 4,828 | 4,828 |
| 1-way journeys/year | 7,330 | 7,330 | 9,656 | 9,656 |

4.5.4 The principal roads which lorries will use to Rainham are the North Circular (A406) and A13, as well as short sections of other local roads leading to the entrances of the processing facilities.

4.5.5 For vehicles travelling between Edmonton and Greenwich, the route comprises the A406, A12 and A102, which includes the Blackwall Tunnel, as well as short sections of other local roads leading to the entrances of the processing facilities.

## Transport costs

### Study estimate

4.5.6 The costs associated with this operation are based on the fixed cost of procuring the vehicles and the cost incurred through operating them. The capital cost of a complete lorry and articulated bulk tipper trailer is £123,000.

4.5.7 The annual operating costs for Scenarios 1, 2, 3 and 4 are shown in Table 4-4. This type of vehicle is typically retained by haulage operators for six or seven years and if procured by lease could include the maintenance. Trailers are typically retained for periods ranging from seven to ten years depending on the freight market in which they are used. To provide yearly operating costs, the capital cost of the lorry unit has been depreciated over six years and the trailer over ten, with a 50 per cent residual value.

Table 4-4: Annual road operating cost for Scenarios 1, 2, 3 and 4

| | Scenario 1 Edmonton/ Rainham | Scenario 2 Edmonton/ Greenwich | Scenario 3 Edmonton/ Rainham | Scenario 4 Edmonton/ Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000** | **106,000** | **140,000** | **140,000** |
| Number of vehicles required | 5 | 5 | 7 | 7 |
| **Depreciated capital** | | | | |
| 44T Tipper Lorries | 45,600 | 45,600 | 63,000 | 63,000 |
| **Operating costs** | | | | |
| Transport operation | 423,300 | 415,100 | 582,400 | 571,500 |
| Cost / tonne | £3.99 | £3.92 | £4.16 | £4.08 |

4.5.8 No allowance has been made for spare vehicles, as it is felt that this type of tractor and/or trailer are readily available through the hire market should either be required for a short period. A detailed breakdown of the operating costs for the road vehicle is provided in Appendix E.

## Overall cost by scenario

4.5.9 The overall estimated cost of using lorries to remove IBA from Edmonton comprises the cost of loading lorries and the transport itself.

Table 4-5: Total annual road operating cost for Scenarios 1, 2, 3 and 4

| | Scenario 1 Edmonton/ Rainham | Scenario 2 Edmonton/ Greenwich | Scenario 3 Edmonton/ Rainham | Scenario 4 Edmonton/ Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000** | **106,000** | **140,000** | **140,000** |
| Total depreciated capital | 60,600 | 60,600 | 78,000 | 78,000 |
| Total operating costs | 497,800 | 489,600 | 657,700 | 646,800 |
| Cost / tonne on operating cost | £4.70 | £4.62 | £4.70 | £4.62 |

4.5.10 The overall costs for these scenarios are very similar, because the difference in round trip distance is only 3.7km and the high quantity of IBA can still be handled by a single mechanical shovel.

## Environmental indicators

### Carbon emissions

4.5.11 A notable feature of using road transport is the emission of atmospheric pollutants. Although the DEFRA Conversion Factor Tables will indicate the level of certain pollutants in terms of greenhouse gas produced from lorry trips, they do not provide similar information for inland waterways craft.

4.5.12 During 2011, DEFRA published a report on emissions generated by inland waterways, but it stated "Emissions from vessels used on inland waterways are not currently reported in the UK Greenhouse Gas Inventory (GHGI). This is because there are no national fuel consumption statistics on the amount of fuel used by this sector. As all fuel consumed by all sources in the UK **is** captured by the inventory, it effectively means that emissions from inland waterways are also captured, but are being misallocated to other sectors using the same types of fuels." (DEFRA, 2011)

4.5.13 Therefore, in this study annual emission estimates for lorries are limited to the $CO_2e$ component [9], as this measure can be compared with inland waterways craft, although for the latter $CO_2e$ values do not originate from DEFRA, but are based on data published in *Guidelines for Measuring and Managing $CO_2$ Emission from Freight Transport Operations* [10].

4.5.14 The emission factors used in the estimations are 0.06162 kg $CO_2e$/tkm for road and 0.031 kg $CO_2$/tkm for water.

Table 4-6: Annual quantities of $CO_2e$ for road transport

| Annual quantities of $CO_2e$ for road transport | Scenario 1 Edmonton/ Rainham | Scenario 2 Edmonton/ Greenwich | Scenario 3 Edmonton/ Rainham | Scenario 4 Edmonton/ Greenwich |
|---|---|---|---|---|
| Annual tonnage IBA | 106,000 | 106,000 | 140,000 | 140,000 |
| **Tonnes of $CO_2e$ per annum** | **340t** | **330t** | **450t** | **430t** |

[9] DEFRA show $CO_2e$ as consisting of three elements $CO_2$, $CH_4$, and $N_2O$
[10] Guidelines for Measuring and Managing $CO_2$ Emission from Freight Transport Operations, Cefic and ECTA, ISSUE 1 / MARCH 2011

# 5 Water transport options for only IBA

## 5.1 Introduction

5.1.1 This chapter considers the options for transporting IBA by inland waterway from the Edmonton. The scenarios to move IBA discussed in the previous section can be similarly achieved by using water transport. Both Edmonton and the Rainham and Greenwich options have direct access to River Lee Navigation and River Thames, respectively, meaning water transport could be used as a direct substitute without the need for other forms of transfer to and from wharves.

5.1.2 Therefore this section will consider the same scenarios as presented for road:

- **Scenario 1** 106,000Te per annum Edmonton to Rainham Landfill;
- **Scenario 2:** 106,000Te per annum Edmonton to Greenwich Aggregate Zone;
- **Scenario 3:** 140,000Te per annum Edmonton to Rainham Landfill;
- **Scenario 4**: 140,000Te per annum Edmonton to Greenwich Aggregate Zone.

## 5.2 Routes for water transport

5.2.1 The route from Edmonton to either of the assumed IBA processing facilities would involve navigating the River Lee Navigation, River Lee (Bow Creek) and the River Thames. This means that there is a combination of using a commercial water (Lee Navigation) a small tidal river (Bow Creek) and large tidal river (River Thames). The responsible authorities for these waterways in Canal and River Trust (Lee Navigation and part of Bow Creek) and the Port of London Authority (part of Bow Creek and River Thames). Licences and fees for using their respective waterways would be payable to these authorities.

5.2.2 The water routes that would be used for transporting IBA to Rainham and Greenwich are shown in Figure 5-1 and Figure 5-2.

Figure 5-1: Water route between Edmonton EcoPark and Rainham

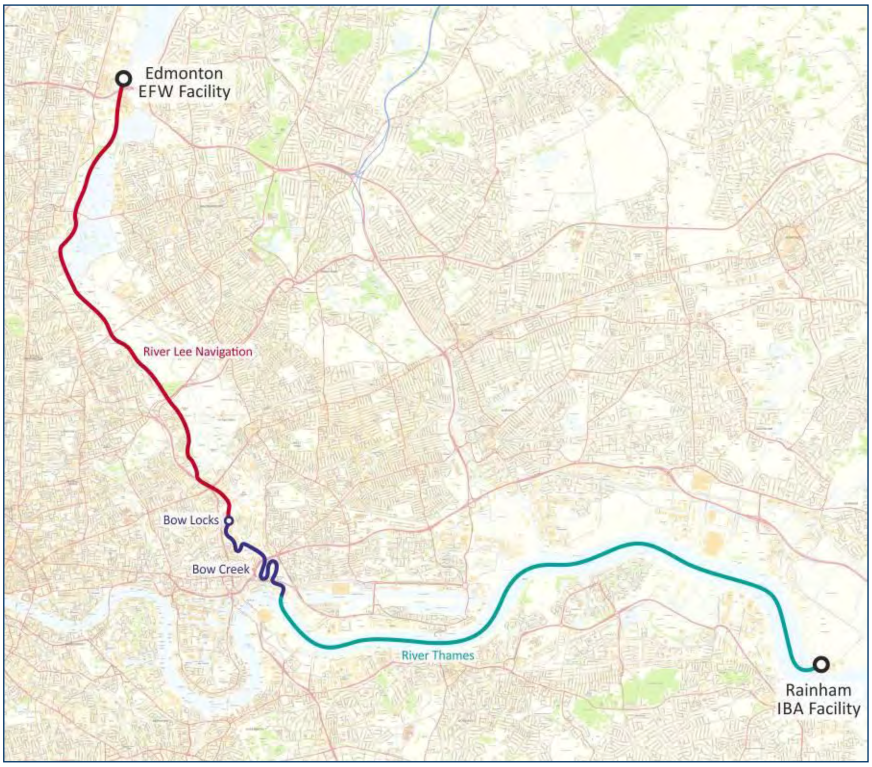
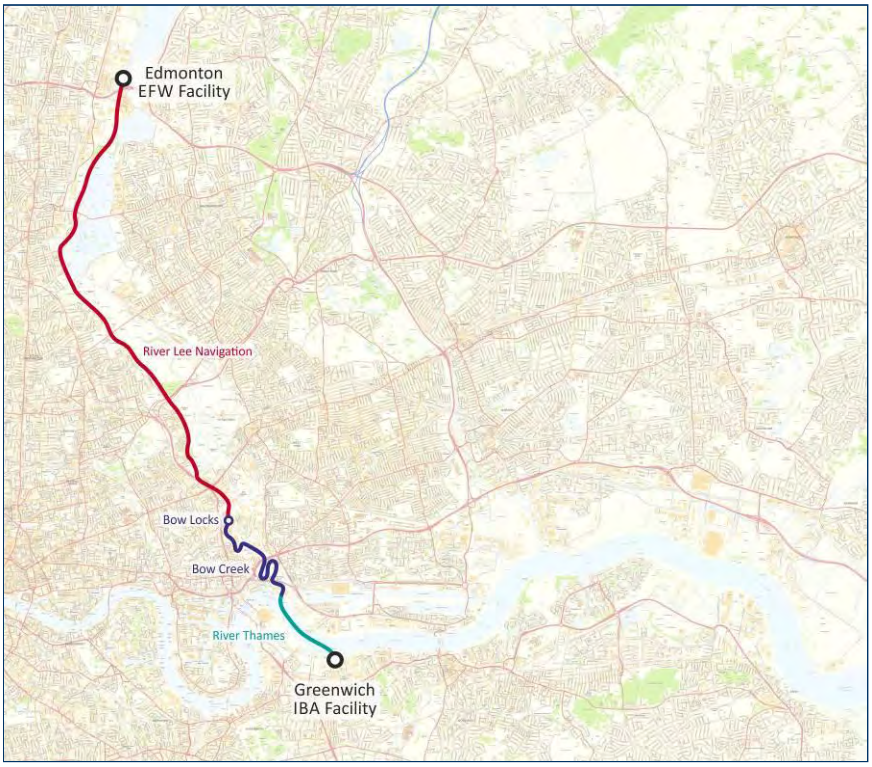



Figure 5-2: Water route between Edmonton EcoPark and Greenwich



5.2.3 The water transport option is considered only in so far as it would replace the road transport link, and comprises:

- The loading of barges;
- The transport of IBA loaded into hopper barges;
- The routes between the Edmonton and Rainham and Greenwich facilities;
- The overall requirement for tugs and barges to cover the complete logistics chain between the principle origin and destinations.

5.2.4 As part of the study brief it has also been a requirement to assess the network capacity of the River Lee Navigation. This task has involved inspecting the locks and assessing what measures might be needed to ensure they are at a standard capable of handling a regular, commercial traffic flow. Commercial locks are designed to fill and empty more rapidly than those used by leisure craft, and to ensure that any future transport operation runs smoothly, it is important that locks operate at a relatively high speed.

## 5.3 Network assessment and capacity

### Introduction

5.3.1 This section of the report discusses the investment that might be required to ensure the River Lee Navigation infrastructure satisfies the standard necessary to support commercial barging operations. As part of the study the locks have been visually inspected and their dimensions checked, but a detailed engineering survey has not been undertaken. Bridge heights have also been checked to confirm the lowest air draught on the waterway between Edmonton and the A13 road bridge.

### Lock asset investment

5.3.2 There are four locks along the proposed freight route on the River Lee Navigation;

- Stonebridge;
- Tottenham;
- Old Ford; and
- Bow.

5.3.3 All of these locks have a similar arrangement with twin locks side-by-side. The following sections set out the capital investment and maintenance requirements at each site for the duration of the 25 year contract to ensure suitability for continued freight operation.

### Gate operating systems

5.3.4 Each Lock has one lock with powered hydraulics and one lock with hand-pumped hydraulics. Both locks are operable at each site, but due to their speed and ease of operation, leisure boaters generally use the lock with the powered hydraulics. The photographs in Figures 6-1 and 6-2 show the powered and manual hydraulic operating systems at Stonebridge lock.

Figure 5-3: Powered lock system control panel

Figure 5-4: Hand-pumped hydraulic system

5.3.5 Discussions with the Canal & River Trust (CRT) indicated that the preferred approach for freight operations would be to retain the current powered lock for use by leisure boaters and to upgrade the hand-pumped locks so that the operating system is suitable for dedicated use by freight operations. Such an upgrade would require the installation of electrically powered hydraulic pumps, replacement hydraulic hoses and the installation of a control panel similar to that at the adjacent lock. The wear on the operating system resulting from the increased frequency of lock use will require regular maintenance throughout the 25 year contract.

5.3.6 In addition to the upgrade of the hydraulics and control system, it would be beneficial to consider the installation of a remote operating system for the locks. The current systems used on the River Lee Navigation have control software built in and so this proposal would allow those operating the barge to access this control system remotely. The proposals would include networked CCTV systems at each lock, and remote network access to the control system to establish lock water levels and which gates are open or closed. A mobile devise or computer on each barge would enable a ‘dial-in’ to these systems and remotely operate them. This would allow the barge operators to prepare the lock that they are approaching in advance so that the water level is correct and the relevant lock gates are open. Such a system would allow significant time savings as the barges would not need to moor up and wait whilst the lock is prepared for use, thereby decreasing the barge downtime in the operation. The CRT has considered the installation of such systems previously, but they are not aware of a physical installation at any of their sites.

5.3.7 No cost data of such a system is available, but the proposals are considered to be fairly straightforward as they exploit existing telecommunications systems.

5.3.8 Any such system that is installed would require suitable safety systems such as fenced off lock and a visual and audible warning system which operates when the locks begin to fill or empty prior to a boats arrival.

### Lock chambers and gate works

5.3.9 The CRT has provided copies of their most recent principal inspection reports for each of the locks, except Bow Locks. These date from 2001 for Stonebridge, 2002 for Tottenham and 2009 for Old Ford. These reports consider the condition of the asset at the time of inspection and then set out any works which are required to maintain satisfactory and safe operation of the asset. These reports have been reviewed and supplemented by further basic walkover surveys of each asset. A full condition survey was beyond the scope of this study but may need to be carried out at a later stage.

5.3.10 In general, the lock walls require up-front capital investment to carry out masonry repairs and re-pointing to make the locks serviceable (see Figure 5-5). Further maintenance repairs would be required during the course of the 25-year contract to mitigate the effect of increased usage. Consideration could be given to guniting the lock chamber walls to improve durability, particularly above water, but this has been excluded from the cost estimates at this time [11].

Figure 5-5: Typical lock wall condition (Tottenham)

5.3.11 The lock gates at each lock have been replaced in recent years with steel gates and so with an adequate maintenance regime, these gates will last for the duration of the 25 year contract. To reactivate the second chamber at Bow Locks a new set of outer gates to the tidal creek will be required. Re-painting of steel gates is typically required at 25 year intervals and so it is expected that all lock gates will need to be lifted out for re-painting part-way through the 25 year contract or prior to the start of the contract. Other gate maintenance tasks would be needed for the duration of the 25 year term and have been budgeted for in the long term cost (see Appendix F).

5.3.12 The sluice paddles were deemed to be in serviceable condition at the time of the principal inspections, though these were some time ago. Capital investment has been assumed necessary to provide new sluice paddles and therefore ensure that the chamber filling and emptying times are as efficient as possible.

### Landing stages

5.3.13 The CRT has a minimum safety standard that requires that the landing stages on the upstream and downstream approaches to a lock are not shared between commercial and leisure users. Currently, each lock has a landing stage at each end, but if the commercial lock becomes operational it might be necessary to provide additional landing stages for these locks. Due to the size of the barges and the frequency of lock the new landing stages will need to be 30m long and constructed using steel sheet piles with mooring bollards along their length. This outline specification needs to be agreed between CRT and the barge operator.

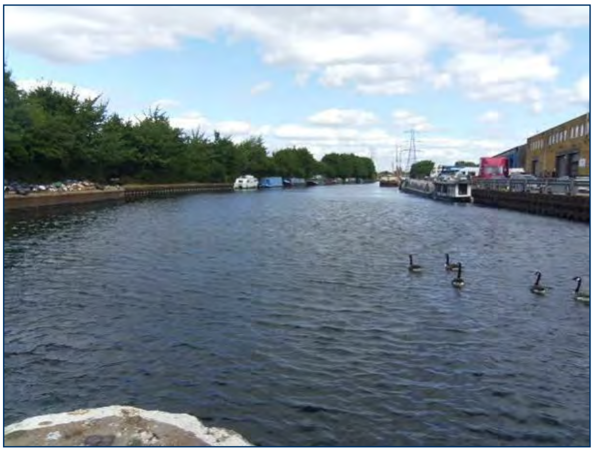
5.3.14 At Old Ford, there is a temporary floating pontoon on the west bank of the navigation on the downstream side (see Figure 5-6). This would be the proposed location for the new landing stage. However, discussions with the CRT have established that they will not commit to a long term licence for this pontoon until the freight proposals are more thoroughly understood. The cost estimates here have assumed that the landing stage would be positioned in this location.

5.3.15 At Tottenham, leisure boaters generally use the upstream west bank landing stage for the eastern lock due to the upstream east bank landing stage being unsuitable for use (see Figure 5-7). As there is minimal space for a new landing stage on the eastern bank it has been assumed that an off-shore landing stage between the two locks would be necessary. This landing stage would then be for use by the leisure boaters, leaving the western landing stage for the freight users. Again the final decision on whether landing stages are required is matter that needs to be agreed between CRT and the barge operator.

[11] Guniting is the process of spraying a dry concrete mixture

Figure 5-6: Floating pontoon downstream of Old Ford lock

Figure 5-7: View upstream from Tottenham Lock



## Cost estimates

5.3.16 In summary, the following capital cost investments are estimated necessary at the lock assets, including all of the capital items mentioned above. Table 5-1 illustrates the estimates of the capital investment with and without the provision of landing stages [12]. If landing stages were not required the overall cost would be in the region of £470,000 less.

Table 5-1: Cost to refurbish locks between Edmonton and Old Ford

| Lock | Capital cost with landing stages (£) | Capital cost without landing stages (£) |
|---|---|---|
| Stonebridge | £350,000 | £230,000 |
| Tottenham | £410,000 | £230,000 |
| Old Ford | £370,000 | £250,000 |
| Remote opening system | £50,000 | £50,000 |
| **Total** | **£1,180,000** | **£760,000** |

5.3.17 The likely maintenance costs, as outlined above, have also been estimated, and are assumed to be £375,000 over 25 years for the portion of the River Lee Navigation being used.

5.3.18 Calculating these costs on a Net Present Value (NPV) basis such that all freight options under consideration are cost comparable, theNPV, including all capital and maintenance cost items for the lock assets, is £1,430,000. The full details of the costs for the refurbishment of the locks and associated works is provided in Appendix F.

5.3.19 The fourth lock that any barge operation would have to use is Bow Locks. However, no refurbishment cost for this lock has been made, as it is assumed CRT would want to maintain overall control of this lock since it is the interface with the tidal creek. Although, based on the refurbishment costs for the other locks it is assumed that any cost could be in the region of £370,000, but this is not taken into account in the study.

5.3.20 CRT has indicated that the barge operator would pay to use the waterway through a leasing arrangement whereby the operator would lease the three locks on a repair and maintenance basis. CRT has said that this would be a peppercorn lease, but has not indicated what the cost might be. However, the £1.18M or £760K canal restoration costs outlined above, plus on-going maintenance for the period of the contract would be incurred by the operator. At the end of the contract the locks would be 'handed' back to CRT. However, if other freight services emerge in the interim, it is envisaged that the primary operator would be able to levy a 'toll' if the operation was through another operator. A

[12] Floating pontoons to enable tug crews to board and land at the locks

detailed assessment of how this arrangement could work would need to be negotiated with CRT, in order to prevent anticompetitive barriers being introduced by the primary operator.

### Dredging

5.3.21 Consultations with CRT and two barge operators indicates that the Lee Navigation is unlikely to require any large scale dredging in order for the proposed barges to navigate freely throughout the section of the waterway that would be used for the transport of IBA. Barges navigate the Lee Navigation with a draught of about 1m, which is sufficient for the waterway which has a depth of about 1.3m. Furthermore, if the operation were to start, the frequent passage of freight barges would maintain a clear navigation channel. Therefore, it is assumed no dredging cost would be incurred to begin the IBA transport operation.

5.3.22 It is acknowledged that occasion dredging may be required at specific points (e.g. Pymmes Brook, or River Lea below Tottenham Lock) or to clear erroneous obstructions. Thus, it is assumed that spot dredging would be required on an ‘as and when’ basis, but no cost is allocated to this requirement, since it would be governed by what is needed at the time.

### Navigation restrictions

5.3.23 The size of barge which can be used along the navigation is restricted by various critical dimensions. These include, but are not limited to, bridge soffit levels above water level, lock length between cills and lock widths between walls. Table 5-2 indicates the measurements made as part of the study.

Table 5-2: Measured lock dimensions

| Name of lock | Length | Width |
|---|---|---|
| Old Ford Lock | 24.75m | 5.59m |
| Tottenham Lock | 27.50m | 5.62m |
| Stonebridge Lock | 25.00m | 5.74m |

5.3.24 No measurements of Bow Locks have been made as part of the study, but using aerial photography to estimate the dimensions suggests that the chambers are approximately 27m long by 6m wide.

5.3.25 In terms of air draught, the critical bridge soffit is at Lea Bridge and was measured to be 2.43m at the time of the survey. CRT information suggested that 2.4m was the critical dimension. This difference is likely to result from fluctuations in the water level. Other bridges along the reach are generally 2.7m or more.

## 5.4 Wharf infrastructure requirements

5.4.1 In this section of the report, the infrastructure requirements for the potential Edmonton are considered. It is assumed that all aspects of the wharf would be a new build, including the replacement of the existing wharf wall.

### Available wharf space and materials handling

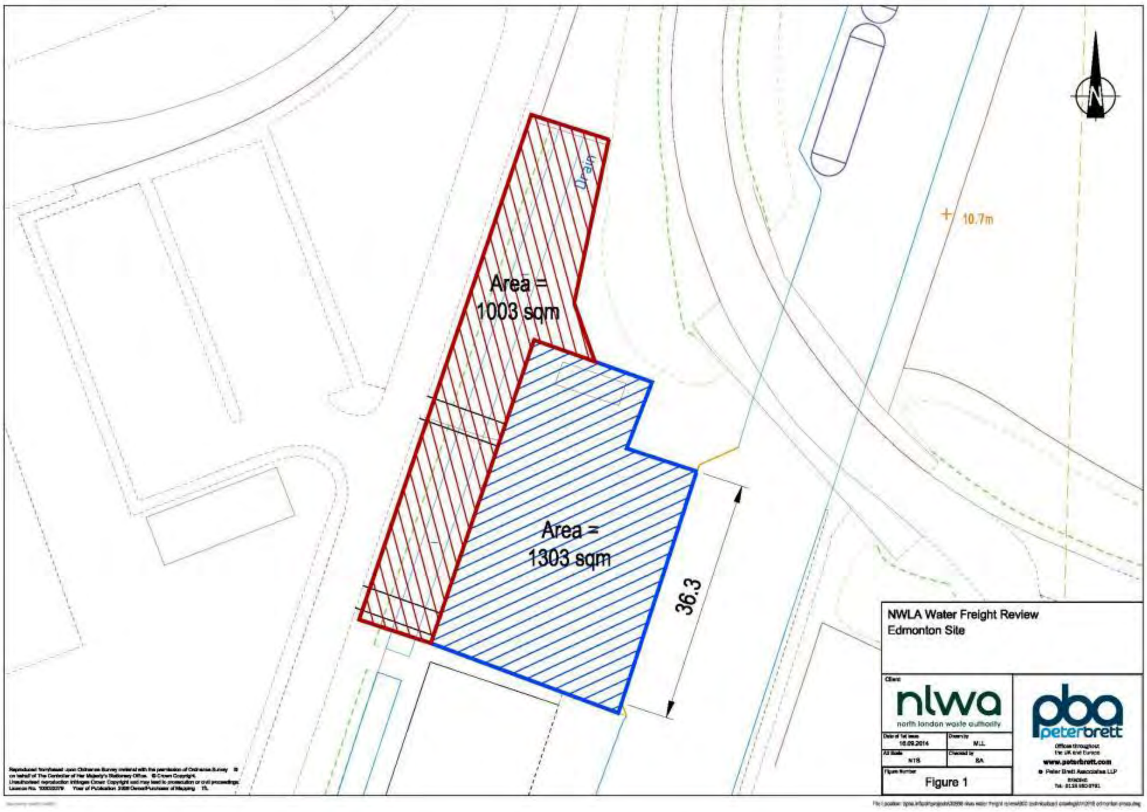
5.4.2 The wharf available to NLWA at Edmonton is a small area on the east side of the existing EfW plant, and is currently used by a Sea Cadets unit (TS Plymouth). For this area to be converted into an operational wharf, the Sea Cadets would have to be relocated. CRT has identified a potential site that they own at Stonebridge Lock which could be a possible site to which the Sea Cadets could be relocated. There is likely to be an associated cost to NLWA for this relocation, but at this time this is unknown.

5.4.3 The existing useable wharf area at Edmonton is approximately 1,300m$^2$ (which is about 300m$^2$ less than Walbrook Wharf in the City of London (see Figure 7-5), and has a water frontage that is approximately 36m long. The site is bounded to the west by a drainage ditch, but it would be worth investigating whether this could be culverted to provide a larger wharf area, as this would enhance the operational area of the wharf.

5.4.4 It is estimated if the drainage ditch was covered and the site extended to the north within the existing boundary, an additional 1,000m$^2$ might be available. This would offer a total area of approximately 2,300m$^2$ to support a wharf.

5.4.5 Currently, only one bridge exists at the northwest end of the wharf, which can accommodate the passage of a single 32Te GVW heavy goods vehicle moving on or off the site. Any extension of the wharf site to the west and covering the drainage ditch, would offer improved access to the site. Figure 5-8 provides an illustration of the existing and potential areas mentioned above. The blue hatched area is the currently used part of the wharf, while the red indicates the possible extension area.

Figure 5-8: Existing and potential areas on Ash Wharf




5.4.6 The extension of the wharf site is assessed to provide a number of operational advantages over the existing area, in particular:

- overall site layout with regards to location of IBA storage bins and small office facility;
- lorry access on and off the wharf site;
- lorry turning and manoeuvring on the wharf;
- removal of the need to enlarge the existing bridge or provide a second bridge for access;
- ensure one-way access and exit could take place to improve vehicle circulation; and
- enhance overall health and safety considerations regarding layout of wharf site and vehicular movements.

5.4.7 For the loading of barges the options are either to use a tracked or wheeled excavator, conveyor system or a basic chute up to which tipper vehicles would arrive and pours the IBA directly into the barge. The latter option has been used historically on canals to load barges, but every delivery has to be loaded and no storage at the wharf is possible. A conveyor system could be installed but these are typically used where there is a need for high volume loading and normally require other equipment for the loading operation. Given the inflexibility or additional cost that a chute or conveyor system imply, it is felt that a tracked or wheeled excavator would best suited for loading IBA into barges.

### Wharf and ground works

5.4.8 Since the wharf area is limited ideally it should be design such that no buildings inhibit the operation of an excavator that can turn through 360°. A detailed assessment of the available space would help determine the final design of the wharf.

#### Wharf wall

5.4.9 The existing wharf wall is concrete construction, but is in a mixed condition and as noted previously it is assumed that this would be renewed. A replacement would probably be constructed using heavy sheet piling, but could require concrete piling in order to support the potential use of heavier equipment in the future. A full engineering survey would determine the exact works needed.

#### Wharf surface

5.4.10 A completely new surface would be required on the wharf, which would include piling to support the gantry crane rails. Other ground works to protect the drainage ditch wall may also be required. If the drainage channel were culverted, this would expand the size of the wharf support area by an estimated 80 per cent of the current area.

#### Positioning of the loading excavator

5.4.11 As the excavator is mobile equipment, it is able to move itself on the wharf to move material into position for loading and loading barges. This equipment would only be able to load a barge moored to the wharf and not reach over a moored barge to load a second located further into the waterway. Load barges would have to be moved off the wharf and replaced by one which is empty.

## 5.5 Cost of infrastructure

5.5.1 The main cost components for the provision of the wharf are:

- Replacement wharf wall; and
- Wharf surface;

5.5.2 Other elements not costed, but which need to be taken into account, include:

- Ground works;
- Welfare facilities for work staff; and
- Potential second bridge at south end of site.

5.5.3 The cost estimate for the installation of the main components is set out in Table 7-20.

Table 5-3: Cost estimate for provision of infrastructure at Edmonton Wharf

| Component | Quantity | Unit cost | Total cost |
|---|---|---|---|
| Wharf wall | 36m | £1800/m | £68,400 |
| Wharf fenders | 40m | £150/m | £6,000 |
| Wharf surface[13] | 1,300m$^2$ | £300/m$^3$ | £390,000 |
| Power supply | 100m | £110/m | £11,000 |
| **Total** | | | **£471,800** |

5.5.4 If the wharf area was expanded to 2,300m$^2$, it is estimated that the overall cost would be £772,800. The on-going maintenance costs for the wharf have not been assessed.

## 5.6 On site operations

### Transfer of IBA to wharf

5.6.1 In order to load barges the IBA will need to be transferred from the incinerator stockpile to the wharf area. It is envisaged that IBA would be stockpiled at the wharf in readiness for loading.

5.6.2 Moving the IBA from the EfW plant to the wharf could be achieved by using either 32Te GVW tipper lorries, typically used by the construction industry or specialist heavy duty dumper truck. Both vehicles are capable of moving at least 17Te loads and would shuttle between the EfW plant and the wharf.

5.6.3 The capital cost of this equipment is estimated to be between £97,000 for the tipper lorry and £180,000 for the dumper. Renewal would take place after about five years for the tipper and eight for the dumper. Given that the dumper truck is about double the cost of a tipper lorry, the review has opted to include the lower cost tipper lorry as the vehicle to complete the on-site transfer of IBA. Table 5-4 indicates the estimated cost of using this vehicle for the transfer of IBA to the wharf.

5.6.4 As part of this operation the lorry will have to be loaded, which is assumed to be from a stockpile at the EfW plant. This action would be performed by a mechanical shovel and the cost of its use is included in the transfer operation.

Table 5-4: Annual operating cost for transporting IBA to the wharf at Edmonton

| | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000** | **106,000** | **140,000** | **140,000** |
| Mechanical shovels required | 1 | 1 | 1 | 1 |
| 17T Tipper lorries required | 1 | 1 | 2 | 2 |
| **Depreciated capital** | | | | |
| Mechanical shovels | £15,000 | £15,000 | £15,000 | £15,000 |
| 17T Tipper lorries | £8,100 | £8,100 | £16,200 | £16,200 |
| **Operating costs** | | | | |
| Transfer operation | £111,700 | £111,700 | £161,400 | £161,400 |
| Cost / tonne | £1.05 | £1.05 | £1.15 | £1.15 |

### Loading of barges

5.6.5 As indicated in section 5.4, the barge loading operation would be completed using a tracked or wheeled excavator. This type of equipment is commonly used to load and unload barges and offers flexibility to move materials into position when waiting for another barge to arrive or leave the wharf. Table 5-5 indicated the estimated cost of loading IBA in to barges.

[13] Cost of laid concrete from Amex Technical Report, July 2012

Table 5-5: Annual operating cost for excavators for loading barges

| Cost item | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000** | **106,000** | **140,000** | **140,000** |
| Vehicle Cost (average) | £88,000 | £88,000 | £88,000 | £88,000 |
| Number needed | 1 | 1 | 1 | 1 |
| **Depreciated capital** | | | | |
| Tracked excavator | £11,000 | £11,000 | £11,000 | £11,000 |
| **Operating costs** | | | | |
| Barge loading | 79,300 | 79,300 | 82,700 | 82,700 |
| Cost / tonne | £0.75 | £0.75 | £0.59 | £0.59 |

## 5.7 Water transport

5.7.1 The water transport operation between Edmonton and Rainham or Greenwich is quite complex and would involve the use of three barging operations. Critical to the operation is the use of barges that can navigate the different watercourses, which comprise a complete journey in either direction.

5.7.2 As noted in Section 5.2, any movement would require using three different types of waterway, one non-tidal and two tidal. Any vessel that is moves on the Thames and its tidal tributaries, they must comply with specific standards that are associated to the water condition on which they navigate. The barges used for this operation would have to comply with standard so they can navigate:

- Category C: Tidal rivers and estuaries and large, deep lakes and lochs where the significant wave height could not be expected to exceed 1.2 metres at any time.

5.7.3 The barge design would be such that its freeboard is sufficient to prevent it becoming awash when on the Thames.

### Method of assessing tug and barge requirements

5.7.4 The inclusion on three different waterways means that it is necessary to understand how these would influence the number of tugs and barges needed to carry out the transport. Since the tidal rivers do not include locks the assumptions are vessels can move freely on the river creeks when the tidal conditions are suitable and at any time on the Thames. In the case of the Lee Navigation, the inclusion of locks means that vessels incur stops that impact upon the overall time of the journey, which in turn influences the number of tugs and barges required.

5.7.5 To understand these requirements a time-space model has been developed to illustrate how resources would have to used and located. This approach also is the basis for costing the different operational scenarios that are examined. For each of the different waterway sections, the model is used to assess how many tugs and barges are needed. The models are then integrated to produce an indication of the overall requirement and refined to ensure the most efficient transport system is forecast.

5.7.6 The results of the model provide a numeric output of the tugs and barges needed, which is used as the basis for costing the transport operation, and a diagram that illustrates how tugs operations should work on each waterway. These diagrams, along with a summary of the operation are provided with the following paragraph that address the tug and barge requirement.

### Tug and barge requirement

5.7.7 The size of the barges proposed for the operation is governed by the smallest waterway, which is the River Lee Navigation. Barges could not exceed 24m length by 5.35m beam. This would ensure that they pass through the smallest lock; the assumed barge payload is 120Te. The number of tugs barges and moorings required for scenarios1to 4 are presented in Table 5-6.

Table 5-6: Numbers of tugs, barges and mooring for each operational scenario

| | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000Te** | **106,000Te** | **140,000Te** | **140,000Te** |
| **Tugs** | | | | |
| River Lee Navigation | 4 | 4 | 5 | 5 |
| Contingency tug (1 extra) | 1 | 1 | 1 | 1 |
| Bow Creek | 1 | 1 | 1 | 1 |
| River Thames | 1 | - | 1 | - |
| **Barges** | | | | |
| Minimum number | 16 | 11 | 28 | 12 |
| Contingency (approx. 10%) | 2 | 1 | 3 | 1 |
| **Mooring berths** | | | | |
| River Lee Navigation | 3 | 3 | 4 | 4 |
| Bow Locks | 3 | 4 | 4 | 4 |
| Bow Creek mouth | 5 | - | 10 | - |
| River Thames at facility | 5 | 4 | 10 | 4 |

5.7.8 An estimate for the capital cost of the tugs and barges is presented Table 5-7, but this does not include a main haul tug on the Thames as this would be hired in from an established operator. Costs of barges and tugs for the Lee Navigation and Bow Creek operations were obtained from a boatyard which has manufactured these types of vessels previously. The difference in cost between scenarios reflects the varying number of barges that are required to achieve the transport.

Table 5-7: Capital cost of tugs and barges

| Equipment | Cost per unit | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|---|
| **Annual tonnage** | | **106,000Te** | **106,000Te** | **140,000Te** | **140,000Te** |
| **Tugs** | | | | | |
| River Lee Navigation | £66,000 | £330,000 | £330,000 | £396,000 | £396,000 |
| Bow Creek | £300,000 | £300,000 | £300,000 | £300,000 | £300,000 |
| River Thames | n/a | n/a | n/a | n/a | n/a |
| **Barges** | | | | | |
| Hopper or container | £110,000 | £1,980,000 | £1,320,000 | £3,410,000 | £1,430,000 |

## Tug and barge operations

5.7.9 The movement of barges to the two assumed processing facilities would require slightly different approaches, although navigating the Lee Navigation and Bow Creek would use the same methods in both cases.

5.7.10 For journeys to Rainham it is proposed to use a lash barge approach whereby up to six barges would be tethered together using a multi-barge linkage system and towed as a single unit. This approach was commonly used on the Thames in the past and is still used elsewhere in the world with much larger barges than those proposed for this operation.

5.7.11 In the case of Greenwich, the tug used for the Bow Creek leg of the journey would also carry out the movement of barges between the mouth of the creek and Murphy's Wharf (Greenwich) during either the same tidal period or the next tide as the distance is relatively short. Table 5-8 indicates the number of barges towed by tugs on each leg of the transport chain.

Table 5-8: Tugs and barges tows

| Waterway | Edmonton / Rainham Landfill | | Edmonton / Greenwich Agg Zone | |
|---|---|---|---|---|
| | Single tug | Barges towed | Single tug | Barges towed |
| River Lee Navigation | 1 | 1 | 1 | 1 |
| Bow Creek | 1 | 2 | 1 | 2 |
| River Thames | 1 | Up to 6 | 1 | 2 |

5.7.12 The following sections summarise the operations for each scenario.

### Scenario 1: Edmonton / Rainham Landfill - 106K tonnes IBA

- **River Lee Navigation:** 2 round trips (one barge each) between Edmonton and Bow Locks on the first day of the cycle; 3 round trips on the second day of the cycle;
- **Bow Creek:** Bow Lock to Bow Mouth - note that this section is subject to tides and the starting time may vary;

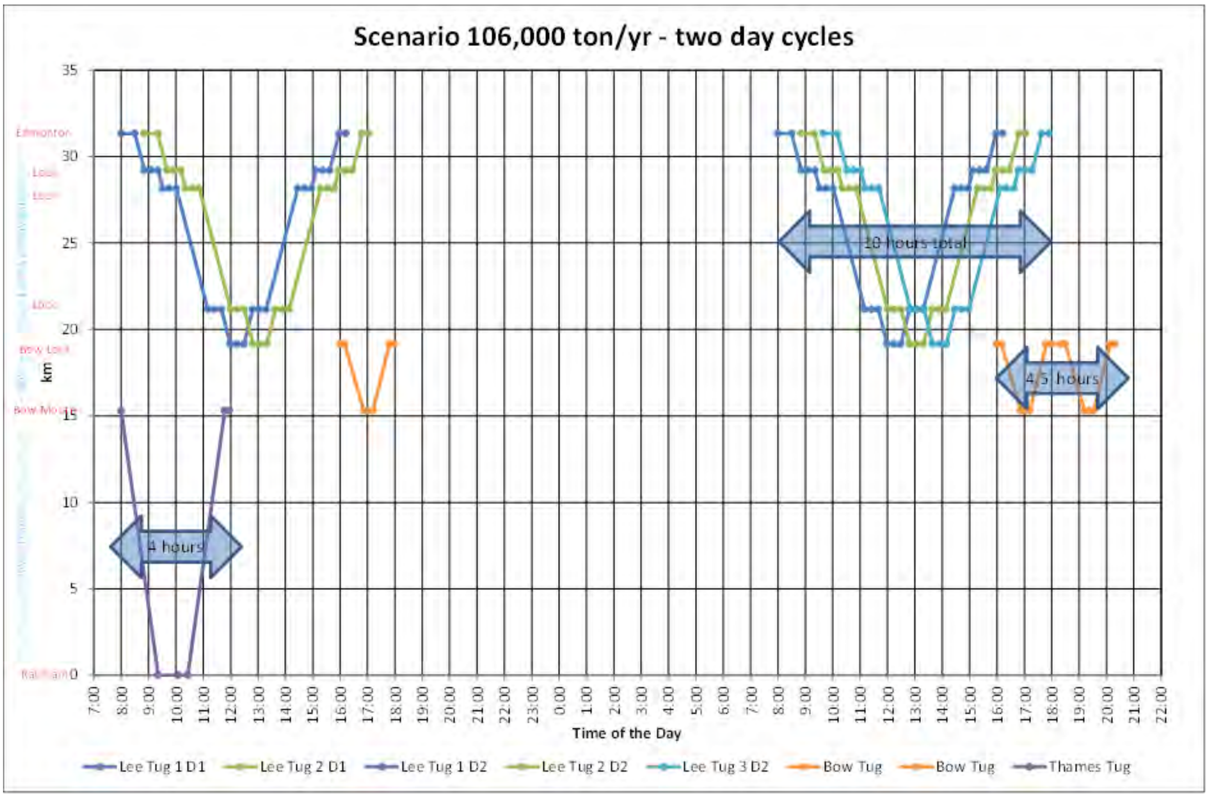
  1 round trip – two barges on the first day of the cycle

  1 round trip – two barges on the second day of the cycle

  1 round trip – one barge on the second day of the cycle
- **River Thames:** 1 round trip – five barges every two days between Bow Creek Mouth and Rainham

5.7.13 It is suggested that the operation is done in cycles of two days, since this way the barge usage is maximised to 99 per cent. The operation is illustrated in Figure 5-9.

Figure 5-9: Schedule of barge operations between Edmonton and Rainham Landfill - 106,000Te per annum




### Scenario 2: Edmonton / Greenwich Aggregate Zone - 106K tonnes IBA

5.7.14 The operation cycle is summarised as follows:

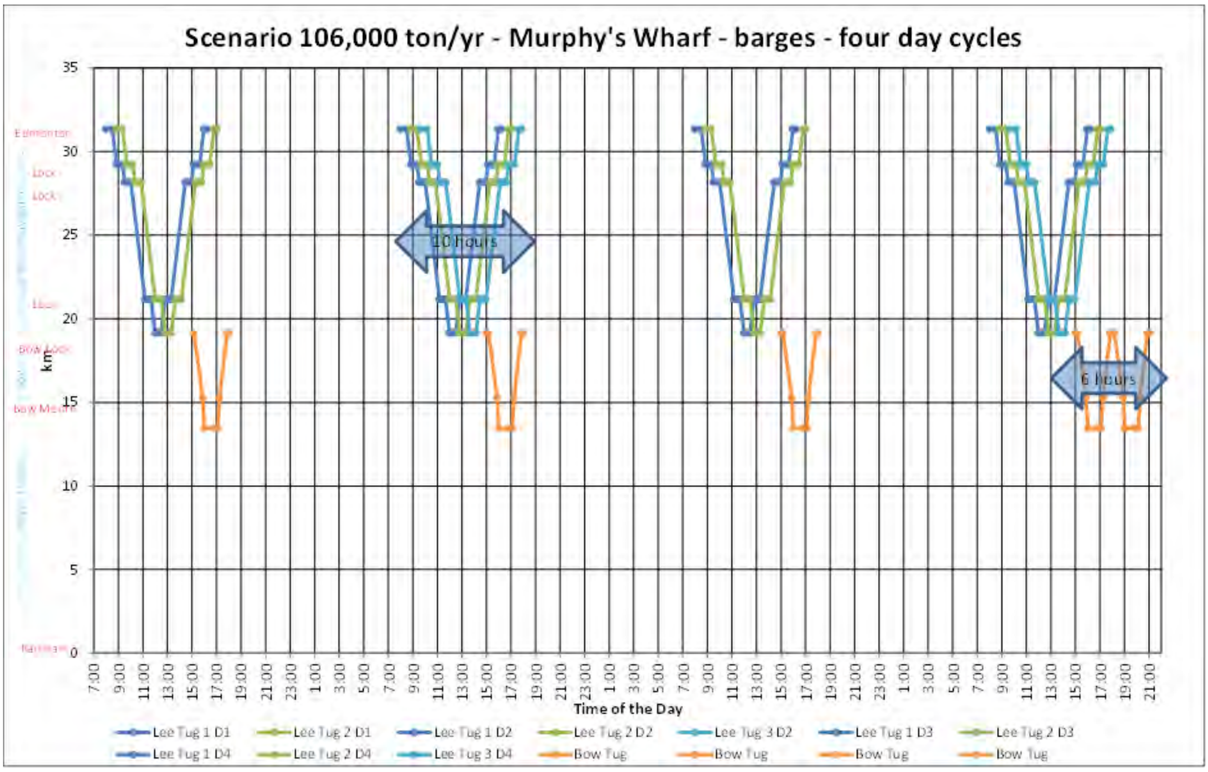
- **River Lee Navigation:** 2 round trips (one barge each) between Edmonton and Bow Locks on days one and three of the cycle;

  3 round trips (one barge each) from Edmonton to Bow Locks on days two and four of the cycle;
- **Bow Creek:** 1 round trip (two barges) between Bow Lock and Murphy's Wharf on the first three days of the cycle;

  2 round trips (two barges each) between Bow Lock and Murphy's Wharf on the fourth day of the cycle. Note that this section is subject to tides and the starting time may vary.

5.7.15 It is suggested that the operation is carried out over cycles of 4 days, since this way the barge usage is maximised to 99 per cent. The operation is illustrated in Figure 5-10.

Figure 5-10: Schedule of barge operations between Edmonton and Greenwich Aggregate Zone - 106,000Te per annum



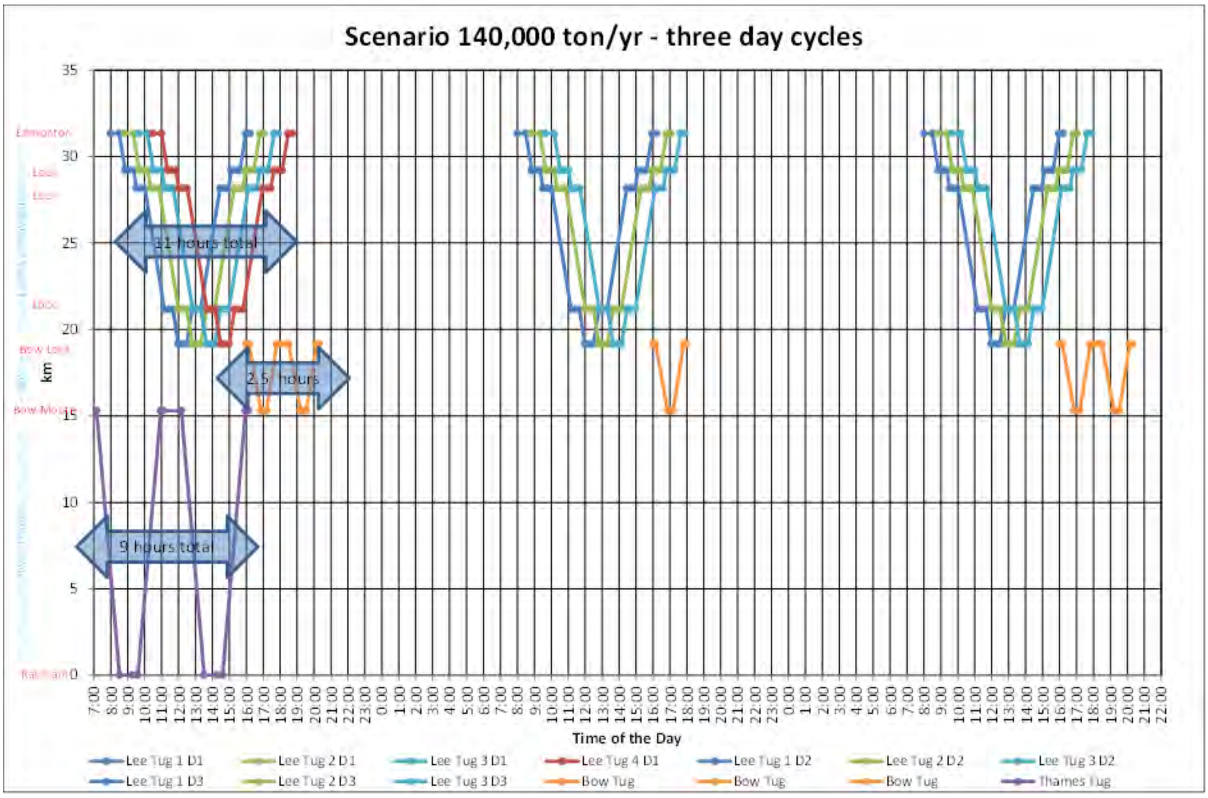

### Scenario 3: Edmonton / Rainham Landfill - 140K tonnes IBA

5.7.16 The operation cycle is summarised as follows:

- **River Lee Navigation:** 4 round trips (one barge per tug) between Edmonton and Bow Locks on the first day of the cycle; 3 round trips in the second and third days of the cycle;
- **Bow Creek:** 2 trips (two barges per tug) between Bow Locks and Bow Creek mouth on the first and third day of the cycle; 1 trip in the second day; note that this section is subject to tides and the starting time may vary;
- **River Thames:** 2 return trips every three days between Bow Creek mouth and Rainham; one trip would carry 6 barges and the second 4 barges, or, both trips can carry 5 barges each.

5.7.17 It is suggested that the operation is carried out over cycles of three days, since this approach would maximised the barge usage to 98 per cent. The operation is illustrated in Figure 5-11.

Figure 5-11: Schedule of barge operations between Edmonton and Rainham Landfill - 140,000Te per annum



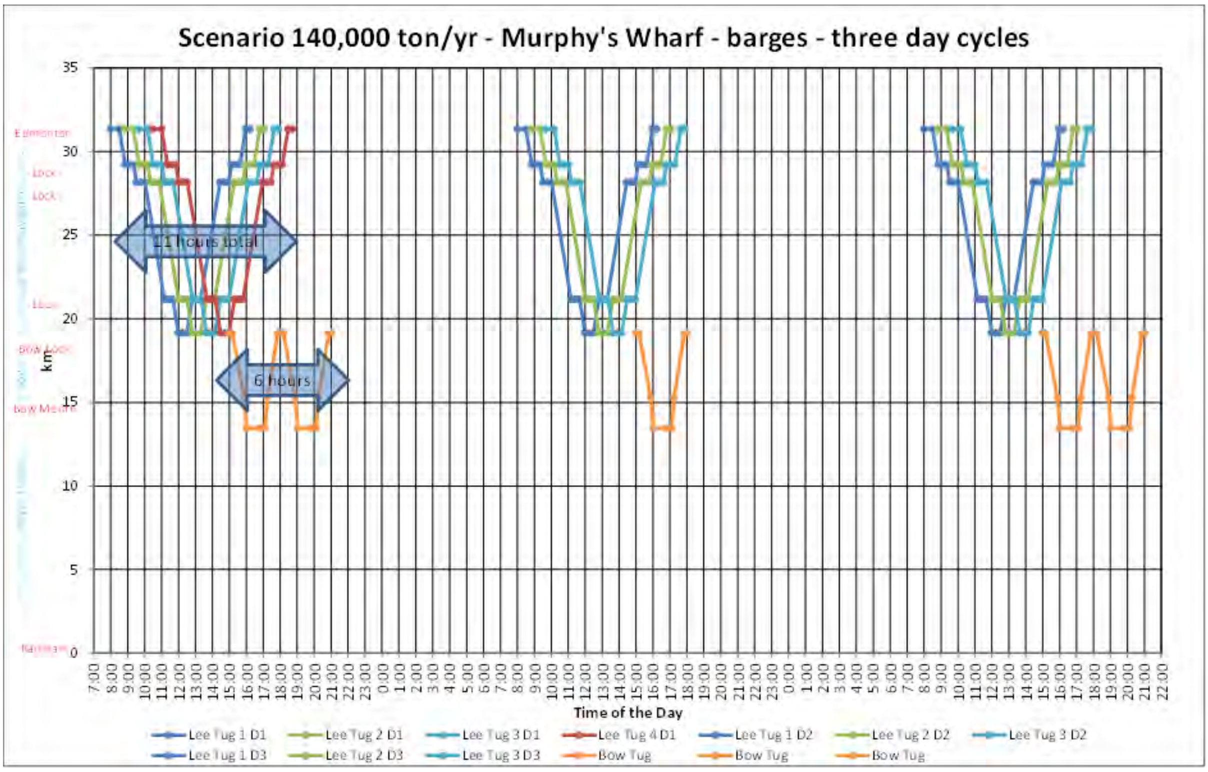

### Scenario 4: Edmonton / Greenwich Aggregate Zone - 140K tonnes IBA

5.7.18 The operation cycle is summarised as follows:

- **River Lee Navigation:** 4 round trips (one barge each) between Edmonton and Bow Lock on the first day of the cycle; 3 trips in the second and third days of the cycle;
- **Bow Creek:** 2 round trips (two barges each) between Bow Locks and Murphy's Wharf on the first and third day on the cycle; 1 round trip on the second day. Note that this section is subject to tides and the starting time may vary.

5.7.19 It is suggested that the operation is carried out over cycles of three days, since this way the barge usage is maximised to 98 per cent. The operation is illustrated in Figure 5-12.

Figure 5-12: Schedule of barge operations between Edmonton and Greenwich Aggregate Zone - 140,000Te per annum




### Cost of water transport operation

5.7.20 A summary of the cost of the water operation by scenario is present in Table 5-9. The cost of tugs and barges is depreciated over 25 years in a straight-line to zero. However, since this equipment can, with regular maintenance operate beyond this time it is possible that the original vessels could be kept in operation.

Table 5-9: Annual operating cost of water operations

| Cost item | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000Te** | **106,000Te** | **140,000Te** | **140,000Te** |
| **Depreciated capital cost (£)** | | | | |
| Tugs & barges | 104,400 | 78,000 | 164,200 | 85,000 |
| **Operational cost (£)** | | | | |
| Transport costs - Lee Navigation | 491,400 | 484,800 | 674,000 | 571,600 |
| Transport costs - Bow Creek | 434,700 | 399,100 | 454,500 | 464,300 |
| Transport costs - River Thames | 110,800 | 14,000 | 143,000 | 14,000 |
| **Total (£)** | **1,036,900** | **897,900** | **1,271,500** | **1,049,900** |
| Cost / Tonne | £9.78 | £8.47 | £9.08 | £7.50 |

### Environmental impact

#### Carbon emissions

5.7.21 The estimate of carbon emissions produced by water transport is based on the same principles as used for road. However, as noted previously the DEFRA Conversion Factor Tables do not provide $CO_2e$ information for inland waterways craft. Therefore, in this study annual emission estimates for tugs is based on data published in *Guidelines for Measuring and Managing $CO_2$ Emission from Freight Transport Operations*.

Table 5-10: Annual quantities of $CO_2$ for water transport

| Annual quantities of $CO_2$ for water transport | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| Annual tonnage IBA | 106,000 | 106,000 | 140,000 | 140,000 |
| **Tonnes of $CO_2$ per annum** | **200t** | **120t** | **270t** | **160t** |

### Overall estimates of using water transport

5.7.22 The use of water transport for moving IBA between Edmonton and Rainham or Greenwich involves a number of operations that need to be combined in order to estimate an overall cost. The type of operation would be determined according to the location of the processing facility. The overall cost of the various water transport options is summarised in Table 5-11.

Table 5-11: Overall estimated annual costs of using water transport for IBA

| Cost item | Scenario 1 Rainham | Scenario 2 Greenwich | Scenario 3 Rainham | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage** | **106,000Te** | **106,000Te** | **140,000Te** | **140,000Te** |
| | All costs in £ | | | |
| Waterways infrastructure (annualised) | 47,200 | 47,200 | 47,200 | 47,200 |
| Waterways maintenance | 15,000 | 15,000 | 15,000 | 15,000 |
| Wharf construction (annualised) | 18,900 | 18,900 | 18,900 | 18,900 |
| On-Site transfer costs | 111,700 | 111,700 | 161,400 | 161,400 |
| Barge Loading costs | 79,300 | 79,300 | 82,700 | 82,700 |
| Transport costs - Lee Navigation | 491,400 | 484,800 | 674,000 | 571,600 |
| Transport costs - Bow Creek | 434,700 | 399,100 | 454,500 | 464,300 |
| Transport costs - River Thames | 110,800 | 14,000 | 143,000 | 14,000 |
| **Total (£)** | **1,309,000** | **1,170,000** | **1,596,700** | **1,375,100** |
| Cost / tonne | £12.35 | £11.04 | £11.41 | £9.82 |

# 6 Comparison of road and water transport costs for IBA

## 6.1 Introduction

6.1.1 In comparing the cost of using road with water transport a number of elements must be taken into account:

- The equipment and operations for loading lorries and barges
- The transport operation
- The unloading operation

6.1.2 In this review only the first two bullet points have been examined, because the last is regarding as a cost associated with the receiving facility's operation.

6.1.3 The comparisons in the next section are for:

- Scenario 1: Edmonton / Rainham Landfill - 106K tonnes IBA
- Scenario 2: Edmonton / Greenwich Aggregate Zone - 106K tonnes IBA
- Scenario 3: Edmonton / Rainham Landfill - 140K tonnes IBA
- Scenario 4: Edmonton / Greenwich Aggregate Zone - 140K tonnes IBA

## 6.2 Comparison of costs

6.2.1 The overall estimated cost of each activity is summarised in Table 6-1, which uses costs road costs presented in section 4 and water costs presented in section 5.

Table 6-1: Comparison summary of estimated costs of using road and water for the transport IBA from Edmonton

| Costs p.a. (£) | Scenario 1<br>Edmonton / Rainham | Scenario 2<br>Edmonton / Greenwich | Scenario 3<br>Edmonton / Rainham | Scenario 4<br>Edmonton / Greenwich |
|---|---|---|---|---|
| IBA/yr (Te) | 106,000 | 106,000 | 140,000 | 140,000 |
| **Road** | | | | |
| Loading operation | 74,500 | 74,500 | 75,300 | 75,300 |
| Transport operation | 423,300 | 415,100 | 582,400 | 571,500 |
| **Total cost** | **497,800** | **497,800** | **497,800** | **497,800** |
| **Cost / tonne** | £4.70 | £4.62 | £4.70 | £4.62 |
| | | | | |
| **Water** | | | | |
| Waterways infrastructure (annualised) | 47,200 | 47,200 | 47,200 | 47,200 |
| Waterways maintenance | 15,000 | 15,000 | 15,000 | 15,000 |
| Wharf construction (annualised) | 18,900 | 18,900 | 18,900 | 18,900 |
| On-Site transfer costs | 111,700 | 111,700 | 161,400 | 161,400 |
| Barge Loading costs | 79,300 | 79,300 | 82,700 | 82,700 |
| Transport costs - Lee Navigation | 491,400 | 484,800 | 674,000 | 571,600 |
| Transport costs - Bow Creek | 434,700 | 399,100 | 454,500 | 464,300 |
| Transport costs - River Thames | 110,800 | 14,000 | 143,000 | 14,000 |
| **Total cost** | **1,309,000** | **1,170,000** | **1,467,700** | **1,596,700** |
| Cost / tonnes | £12.35 | £11.04 | £10.48 | £11.41 |
| * Assumes no landing stage at locks | | | | |

6.2.2 It can be seen in Table 6-1 that the road transport has a significant cost advantage over the water transport options. The two key reasons for this are:

- the set up costs that would have to be incurred to start a water transport operation; and
- the potential number of tug operations needed to move the barges on the three waterways.

## 6.3 Comparison of carbon emissions

6.3.1 Estimates of $CO_2$e have been produced for the road and water operations, which enables a comparison of their impacts to be made. They do not take account of any on-site movement of IBA whether being transported off site by lorries or transferred from the energy plant to the wharf.

6.3.2 The route lengths for road transport are shown in Table 6-2.

Table 6-2: Road and water route lengths from Edmonton the Rainham and Greenwich reprocessing facilities

| Origin | Destination | Water Distance (Km) | Road Distance (Km) |
|---|---|---|---|
| Edmonton | Rainham Landfill | 31 | 26 |
| Edmonton | Greenwich Agg Zone | 18 | 24.5 |

6.3.3 Table 6-3 shows the estimated quantities of $CO_2$e produced by road and water transport, and the difference between the estimated quantities produce each year.

Table 6-3: Comparison of annual quantities of $CO_2$e for delivery of IBA by road and water to the same reprocessing facilities

| Annual quantities of $CO_2$e by mode | Scenario 1 Rainham | Scenario 2 Rainham | Scenario 3 Greenwich | Scenario 4 Greenwich |
|---|---|---|---|---|
| **Annual tonnage - IBA** | **106,000** | **106,000** | **140,000** | **140,000** |
| Tonnes of $CO_2$e per annum (road) | 340t | 330t | 450t | 430t |
| Tonnes of $CO_2$e per annum (water) | 200t | 120t | 270t | 160t |
| **Difference** | **140t** | **210t** | **180t** | **270t** |

6.3.4 Based on these estimates it is suggested that water transport would reduce the level of $CO_2$e by around 41 per cent for journeys to Rainham and 63 per cent to Greenwich compared with road haulage.

# 7 IBA from and additional municipal waste to Edmonton

## 7.1 Introduction

7.1.1 Under these scenarios IBA would be removed from Edmonton as assess previously, but a new stream of waste would be delivered to the EfW plant. It is assumed that the new source would be the waste collected in the East London area, which is consolidated for disposal at a facility in the proximity of Barking Creek. For modelling purposes the Jenkins Lane Reuse and Recycling Centre (RRC) in the London Borough of Newham is used as the origin of the waste source.

7.1.2 The assumed quantities of waste to be assessed are 180,000Te of IBA out and, 150,000Te and 300,000Te municipal waste in, at Edmonton. Table 7-1 shows the scenarios that are used.

Table 7-1: Road and water scenarios for transporting both IBA and municipal waste

| Transport Scenario | Commodity | Tonnage | Origin | Destination | Mode options | Method of handling |
|---|---|---|---|---|---|---|
| **Scenario 5** | IBA | 180,000Te | Edmonton | Rainham Landfill | Water and Road | Loose bulk |
| **Scenario 6** | Raw Waste | 150,000Te | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 7** | IBA | 180,000Te | Edmonton | Greenwich Agg Zone | Water and Road | Loose bulk |
| **Scenario 8** | Raw Waste | 300,000Te | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 9** | IBA | 180,000Te | Edmonton | Rainham Landfill | Water | Container |
| | Raw Waste | 150,000Te | Barking Creek | Edmonton | Water | Container |
| **Scenario 10** | IBA | 180,000Te | Edmonton | Rainham Landfill | Water | Container |
| | Raw Waste | 300,000Te | Barking Creek | Edmonton | Water | Container |

7.1.3 To compare road and water for the scenarios shown is Table 7-1, the road movements for IBA and municipal waste (e.g. Scenario 5 and Scenario 6, Scenario 7 and Scenario 8) would be considered together and compared with the solely water scenarios 9 and 10. However, the movement of IBA in scenarios 5 and 7 is also assessed for water transport, as it would be possible to move it by this mode if municipal waste was delivered by road to Edmonton.

7.1.4 Note as with the previous sections numbers presented in the table are rounded and therefore may not tally as expected.

## 7.2 Road transport options - 180,000 Te IBA

### Materials Handling

7.2.1 The handling of IBA would be the same as previously discussed using either a wheeled mechanical shovel or a tracked / wheeled excavator. It is assumed a mechanical shovel is used for the loading operation.

### Operation and cost

7.2.2 It is assumed that the mechanical shovel would be loading lorries from a small stockpile of IBA that is deposited from the incinerator. The rate at which a lorry is loaded will depend on the size of shovel on the machine and the distance it has to travel between the stockpile and vehicle. Again a 30 seconds per lift is assumed. Table 4-1 indicates the estimated turnaround time for loading articulated tipper lorries at Edmonton.

Table 7-2: Loading rates of mechanical shovel at Edmonton

| **Annual tonnage** | **Scenarios 5 & 7 180,000Te** |
|---|---|
| Days/year | 258 |
| T/day | 698 |
| Tipper capacity (T) | 29 |
| Loads/day | 25 |
| Shovel capacity (t) | 2.5 |
| Lifts/loading | 12 |
| Time/lift | 00:00:30 |
| Time to load | 00:06:00 |
| Tot loading time/day | 02:30:00 |
| Contingency | 00:30:00 |
| Assumed loading time/day | 3:00:00 |
| Rounded | 3:00:00 |

7.2.3 Table 4-1 shows that the actual time a mechanical shovel is physically loading lorries is about 30 per cent of the time in a working day of nine hours. Based on this assessment it is envisaged that a single mechanical shovel would be sufficient for loading the tipper lorries.

7.2.4 To estimate the cost, machine use not associated directly with loading lorries the remove the IBA from site has been ignored. Table 7-3 indicates the estimate annual operations cost for a single shovel being used for two hours for Scenario 5 and two and a half hours for Scenario 7. Depreciation is included as a standing cost and assumed to be a straight-line to zero, based on eight years of service at which point the machine would be renewed. Variable costs are fuel and maintenance.

Table 7-3: Estimated annual operating cost of mechanical shovel at Edmonton

| **Cost item** | **Scenarios 5 & 7 180,000Te** |
|---|---|
| Mechanical shovel acquisition cost | £120,000 |
| Depreciated capital cost | £15,000 |
| Operational cost | £76,100 |
| **Total annual cost** | **£91,100** |

## Road Transport

7.2.5 The routes assumed for the scenarios 5 and 7 would be consistent with the routes indication in Figure 4-1 for Rainham and Figure 4-2 for Greenwich. Also, the previous assumptions regard lorry size and payloads, route distances, working days and the assumption on vehicle activity are still valid.

### Transport movements and routes

7.2.6 The estimated number of lorry trips that would be generated between Edmonton the processing facilities is shown in Table 4-3. This assumes operations would be run over 258 days per year.

Table 7-4: Estimated number of lorry trips by site for Scenarios 5 and 7

| | Scenario 5 Edmonton/ Rainham | Scenario 7 Edmonton/ Greenwich |
|---|---|---|
| **Annual tonnage** | **180,000** | **180,000** |
| IBA/day | 698 | 698 |
| Round road trips/day | 24 | 24 |
| 1-way journeys/day | 48 | 48 |
| Round trips/year | 6,207 | 6,207 |
| 1-way journeys/year | 12,414 | 12,414 |

7.2.7 The principal roads which lorries would use to Rainham are the North Circular (A406) and A13, as well as short sections of other local roads leading to the entrances of the processing facilities.

7.2.8 For vehicles travelling between Edmonton and Greenwich, the route comprises the A406, A12 and A102, which includes the Blackwall Tunnel, as well as short sections of other local roads leading to the entrances of the processing facilities.

### Transport costs

7.2.9 The costs associated with this operation are based on the fixed cost of procuring the vehicles and the cost incurred through operating them. The capital cost of a complete lorry and articulated bulk tipper trailer is £123,000.

7.2.10 The annual operating costs for Scenarios 5 and 7 are shown in Table 4-4. This type of vehicle is typically retained by haulage operators for six or seven years and if procured by lease could include the maintenance. Trailers are typically retained for periods ranging from seven to ten years depending on the freight market in which they are used. To provide yearly operating costs the capital cost of the lorry unit has been depreciated over seven years and the trailer over ten.

Table 7-5: Annual road operating cost for Scenarios 5 and 7

| Cost item | Scenario 5 Edmonton/ Rainham | Scenario 7 Edmonton/ Greenwich |
|---|---|---|
| **Annual tonnage** | **180,000** | **180,000** |
| Number of vehicles required | 8 | 8 |
| **Depreciated capital** | | |
| Mechanical shovel | 15,000 | 15,000 |
| 44T Tipper Lorry | 71,800 | 71,800 |
| **Total** | **86,800** | **86,800** |
| **Operating costs** | | |
| Loading operation | 76,900 | 76,900 |
| Transport costs | 686,600 | 653,500 |
| **Total** | **762,700** | **730,400** |
| Cost / tonne | £4.24 | £4.06 |

7.2.11 No allowance has been made for spare vehicles, as it is felt that this type of tractor and/or trailer are readily available through the hire market should either be required for a short period.

### Environmental impact

#### Carbon emissions

7.2.12 The criteria for assessing the $CO_2$e emissions for moving 180,000Te of IBA is same as stated in paragraph 4.5.14. The estimate quantities of $CO_2$e for road transport to the two IBA processing facilities are presented in Table 7-6.

Table 7-6: Annual quantities of $CO_2$e for road transport (180,000Te IBA)

| **Annual quantities of $CO_2$e for road transport** | **Scenario 5** | **Scenario 7** |
|---|---|---|
| | **Edmonton/ Rainham** | **Edmonton/ Greenwich)** |
| Annual tonnage IBA | 180,000 | 180,000 |
| **Tonnes of $CO_2$e per annum** | **580t** | **550t** |

## 7.3 Water transport options - 180,000 Te IBA

### Waterways and wharf infrastructure requirements

7.3.1 As discussed in Section 5.3, the River Lee Navigation is likely to need improvement works for an efficient water transport operation to succeed. It is estimated that to refurbish the locks for a commercial operation to commence and investment of £1,180,000 would be required.

7.3.2 The wharf infrastructure requirements for these scenarios are the same as those for the lower quantities of IBA set out in Section 5.5. It is estimated that an investment of approximately £471,800 would be required to establish a usable wharf.

### On site operations

#### Transfer of IBA to wharf

7.3.3 The transfer operation would involve loading 32Te GVW tipper lorries at the incinerator and moving a 17Te payload to the wharf. The capital cost of a lorry is estimated to be £97,000. It is assumed lorries would be loaded using a mechanical shovel.

Table 7-7: Annual operating cost for transporting 180,000t IBA to the wharf at Edmonton

| | **Scenarios 5 & 7**<br>**Edmonton/ Rainham & Greenwich** |
|---|---|
| **Annual tonnage** | **180,000** |
| Mechanical shovels required | 1 |
| 17T Tipper lorries required | 2 |
| **Depreciated capital** | |
| Mechanical shovels | £15,000 |
| 17T Tipper lorries | £16,200 |
| **Operating costs** | |
| Transfer operation | £131,500 |
| Cost / tonne | £0.73 |

#### Loading of barges

7.3.4 As indicated in section 5.4, the barge loading operation would be completed using a tracked or wheeled excavator. This type of equipment is commonly used to load and unload barges and offers flexibility to move materials into position when waiting for another barge to arrive or leave the wharf. Table 5-5Table 7-8 indicates the estimated cost of loading IBA in to barges.

Table 7-8: Annual operating cost for excavators for loading barges

| Cost item | Scenarios 5 & 7<br>Edmonton/ Rainham & Greenwich |
|---|---|
| **Annual tonnage** | **180,000** |
| Vehicle Cost (average) | £88,000 |
| Number needed | 1 |
| **Depreciated capital** | |
| Tracked excavator | £11,000 |
| **Operating costs** | |
| Barge loading | £86,100 |
| Cost / tonne | £0.48 |

## Water transport

7.3.5 The water transport operation between Edmonton and Rainham or Greenwich is quite complex and would involve the use of three barging operations. All requirement discussed in Section 5.7 remain valid. Appendix G provides details of the capital and operating cost for water transport.

### Tug and barge requirement

7.3.6 The number of tugs barges and moorings required for scenarios 5 and 7 are presented in Table 7-9.

Table 7-9: Numbers of tugs, barges and mooring for each operational scenario

| | Scenario 5 Rainham 180,000Te | Scenario 7 Greenwich 180,000Te |
|---|---|---|
| **Annual tonnage** | **180,000** | |
| **Tugs** | | |
| River Lee Navigation | 5 | 5 |
| Contingency tug (1 extra) | 1 | 1 |
| Bow Creek | 1 | 1 |
| River Thames | 1 | - |
| **Barges** | | |
| Minimum number | 27 | 18 |
| Contingency (approx. 10%) | 3 | 2 |
| **Mooring berths** | | |
| River Lee Navigation | 5 | 5 |
| Bow Locks | 4 | 5 |
| Bow Creek mouth | 8 | - |
| Rainham / Greenwich | 6 | 4 |

7.3.7 An estimate for the capital cost of the tugs and barges is presented Table 7-10, but this does not include a main haul tug on the Thames as this would be hired in from an established operator. Costs of barges and tugs for the Lee Navigation and Bow Creek operations were obtained from a boatyard which has manufactured these types of vessels previously. The difference in cost between scenarios reflects the varying number of barges that are required to achieve the transport.

Table 7-10: Capital cost of tugs and barges

| Equipment | Cost per unit | Scenario 5 Rainham | Scenario 7 Greenwich |
|---|---|---|---|
| **Annual tonnage** | | **180,000Te** | **180,000Te** |
| **Tugs** | | | |
| River Lee Navigation | £66,000 | £396,000 | £396,000 |
| Bow Creek | £300,000 | £300,000 | £300,000 |
| River Thames | n/a | n/a | n/a |
| **Barges** | | | |
| Hopper or container | £110,000 | £3,300,000 | £2,200,000 |

### Tug and barge operations

7.3.8 The barging operation scenarios to move the 180,000T IBA to Rainham or Greenwich is summarised in the following sections.

#### Scenario 5: Edmonton / Rainham Landfill - 180K tonnes IBA

- **River Lee Navigation:** 4 round trips (one barge each) between Edmonton and Bow Lock on the first three days of the cycle;

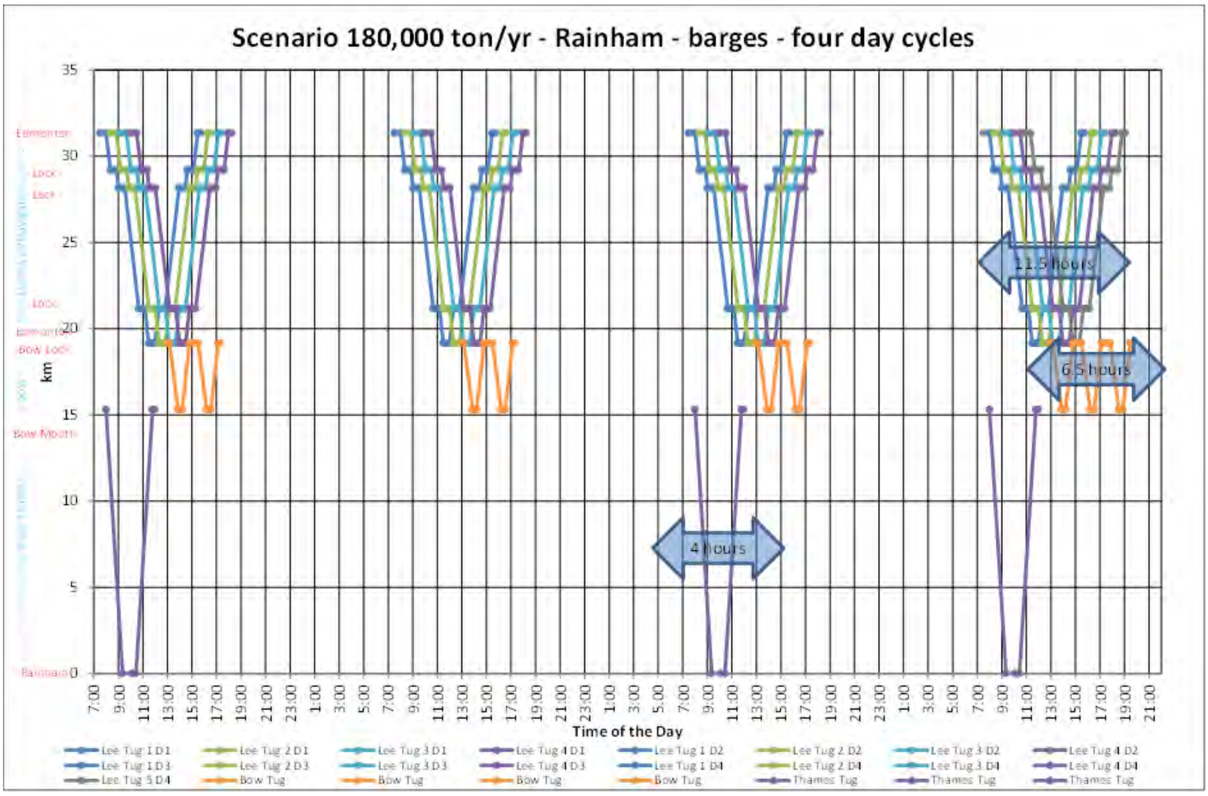
  5 round trips on the fourth day of the cycle;
- **Bow Creek:** 2 round trips (two barges each) between Bow Lock and Bow Mouth on the first three days of the cycle; 3 trips in the fourth day of the cycle;

  3 round trips on the fourth day of the cycle;

  Note that this section is subject to tides and the starting time may vary.
- **River Thames:** 3 round trips every four days, with 5 barges on the first, 6 barges on the third and 6 barges on the fourth day of the cycle between Bow Mouth and Rainham.

7.3.9 It is suggested that the operation is done in cycles of 4 days, since this way the barge usage is maximised to 99 per cent. The operation is illustrated in Figure 7-1.

Figure 7-1: Schedule of barge operations between Edmonton and Rainham Landfill - 180,000Te per annum




### Scenario 7: Edmonton / Greenwich Aggregate Zone - 180K tonnes IBA

7.3.10 The operation cycle is summarised as follows:

- **River Lee Navigation:**4 round trips (one barge each) between Edmonton and Bow Locks on the first three days of the cycle;

  5 round trips on the fourth day of the cycle;

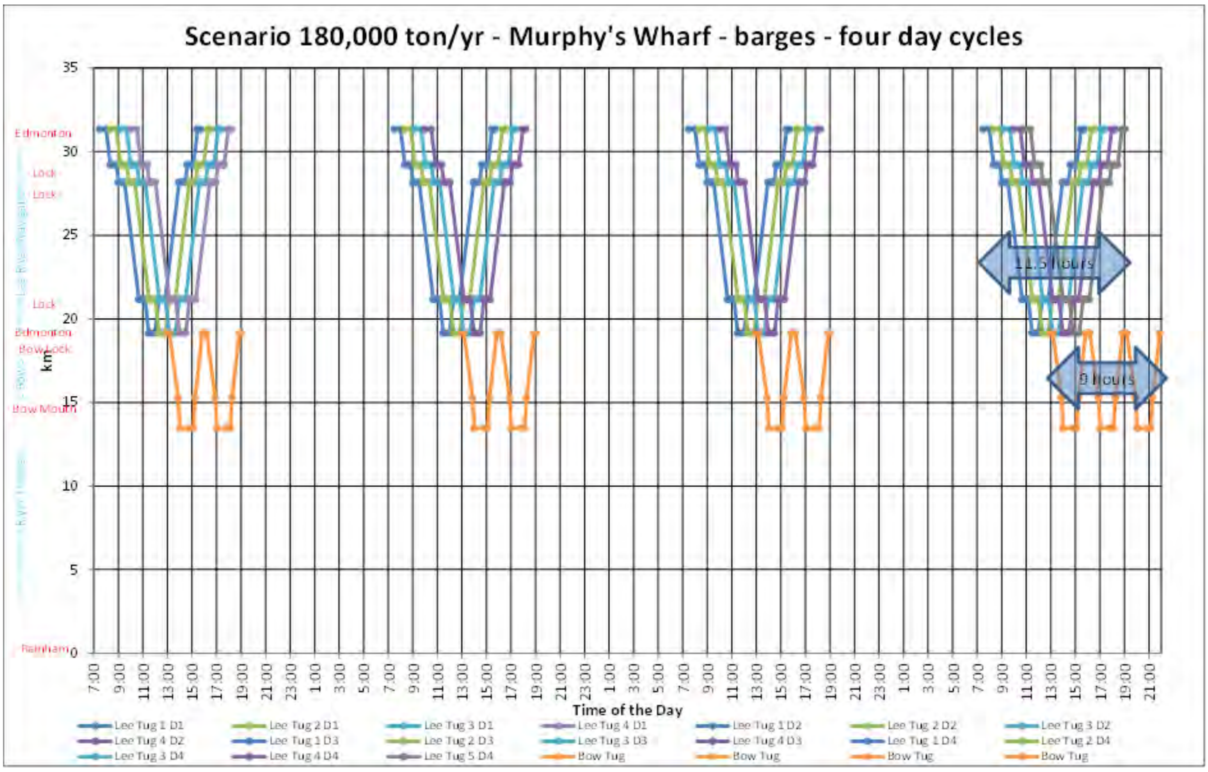
- **Bow Creek:** 2 round trips (two barges each) between Bow Lock and Murphy's Wharf on the first three days of the cycle;

  3 round trips (two, two and one barges) in the fourth day of the cycle;

  Note that this section is subject to tides and the starting time may vary.

7.3.11 It is suggested that the operation is done in cycles of 4 days, since this way the barge usage is maximised to 98 per cent. The operation is illustrated in Figure 7-2.

Figure 7-2: Schedule of barge operations between Edmonton and Rainham Landfill - 180,000Te per annum




## Cost of water transport operation

7.3.12 A summary of the cost of the water operation by scenario is present in Table 7-11. The cost of tugs and barges is depreciated over 25 years in a straight-line to zero. However, since this equipment can, with regular maintenance operate beyond this time it is possible that the original vessels could be kept in operation.

Table 7-11: Annual operating cost of water operations

| Cost item | Scenario 5 Rainham | Scenario 7 Greenwich |
|---|---|---|
| **Annual tonnage** | **180,000Te** | **180,000Te** |
| **Depreciated capital cost (£)** | | |
| Tugs & barges | 159,800 | 105,800 |
| **Operational cost (£)** | | |
| Transport costs - Lee Navigation | 696,200 | 602,600 |
| Transport costs - Bow Creek | 463,500 | 437,700 |
| Transport costs - River Thames | 159,500 | 14,000 |
| **Total (£)** | **1,319,200** | **1,054,300** |
| Cost / Tonne | £7.33 | £5.86 |

## Environmental impact

### Carbon emissions

7.3.13 The estimate of carbon emissions produced by water transport is based on the same principles as used for road. However, as noted previously the DEFRA Conversion Factor Tables do not provide $CO_2e$ information for inland waterways craft. Therefore, in this study annual emission estimates for tugs is based on data published in *Guidelines for Measuring and Managing $CO_2$ Emission from Freight Transport Operations.*

Table 7-12: Annual quantities of $CO_2e$ water transport operations (180,000Te IBA)

| Annual quantities of $CO_2e$ | Scenario 5<br>Edmonton/ Rainham | Scenario 7<br>Edmonton/ Greenwich |
|---|---|---|
| Annual tonnage IBA | 180,000 | 180,000 |
| **Tonnes of $CO_2e$ per annum** | **350t** | **200t** |

### Overall cost estimates of using water transport

7.3.14 The use of water transport for moving IBA between Edmonton and Rainham or Greenwich involves a number of operations that need to be combined in order to estimate an overall cost. The type of operation would be determined according to the location of the processing facility. The overall cost of the two water transport scenarios is summarised in Table 7-13.

Table 7-13: Overall estimated annual costs of using water transport for IBA

| Cost item | Scenario 5<br>Edmonton / Rainham | Scenario 7<br>Edmonton / Greenwich |
|---|---|---|
| **Annual tonnage** | **180,000Te** | **180,000Te** |
| | All costs in £ | |
| Waterways infrastructure | 47,200 | 47,200 |
| Waterways maintenance | 15,000 | 15,000 |
| Wharf construction | 18,900 | 18,900 |
| On-Site transfer costs | 131,500 | 131,500 |
| Barge Loading Costs | 86,100 | 86,100 |
| Transport Costs - Lee Navigation | 696,200 | 602,600 |
| Transport Costs - Bow Creek | 463,500 | 437,700 |
| Transport Costs - River Thames | 159,500 | 14,000 |
| **Total** | **1,617,900** | **1,353,000** |
| Cost / tonnes | £8.99 | £7.52 |

## 7.4 Comparison of costs

7.4.1 The overall estimated cost of each activity is summarised in Table 7-14.

Table 7-14: Comparison summary of estimated costs of using road and water for the transport IBA from Edmonton

| Costs p.a. (£) | Scenario 5<br>Edmonton / Rainham | Scenario 7<br>Edmonton / Greenwich |
|---|---|---|
| IBA/yr (Te) | 180,000 | 180,000 |
| **Road** | | |
| Loading operation | 76,100 | 76,900 |
| Transport operation | 686,600 | 653,500 |
| **Total cost** | **762,700** | **730,400** |
| **Cost / tonne** | £4.24 | £4.06 |
| **Water** | | |
| Waterways infrastructure | 47,200 | 47,200 |

| | | |
|---|---|---|
| Waterways maintenance | 15,000 | 15,000 |
| Wharf construction | 18,900 | 18,900 |
| On-Site transfer costs | 131,500 | 131,500 |
| Barge Loading Costs | 86,100 | 86,100 |
| Transport Costs - Lee Navigation | 696,200 | 602,600 |
| Transport Costs - Bow Creek | 463,500 | 437,700 |
| Transport Costs - River Thames | 159,500 | 14,000 |
| **Total (£)** | **1,617,900** | **1,353,000** |
| Cost / tonnes | £8.99 | £7.52 |

7.4.2 It can be seen in Table 7-14 that the road transport has a substantial cost advantage over water for moving to IBA to Rainham and Greenwich from Edmonton.

## 7.5 Comparison of carbon emissions

7.5.1 Estimates of $CO_2$e have been produced for the road and water operations, which enables a comparison of their impacts to be made. The route lengths for road and water transport provide in Sections 4 and 5 are still valid.

7.5.2 Table 7-15 shows the estimated quantities of $CO_2$e produced by road and water transport, and the difference between the estimated quantities produce each year.

Table 7-15: Comparison of annual quantities of $CO_2$e for delivery of IBA by road and water to the same reprocessing facilities

| Annual quantities of $CO_2$e by mode | Scenario 5 Edmonton/ Rainham | Scenario 7 Edmonton/ Greenwich |
|---|---|---|
| Annual tonnage - IBA | 180,000 | 180,000 |
| Tonnes of $CO_2$e per annum (road) | 580t | 550t |
| Tonnes of $CO_2$e per annum (water) | 350t | 200t |
| **Difference** | **230t** | **350t** |

7.5.3 Based on these estimates it is suggested that water transport would reduce the level of $CO_2$e by 40 per cent for journeys to Rainham and 64 per cent to Greenwich compared with road haulage.

## 7.6 Transporting municipal waste by road from Barking Creek to Edmonton

7.6.1 This section considers the delivery of 150,000Te and 180,000Te municipal waste to Edmonton from other sources in East London. However, for modelling purposes, the Jenkins Lane Reuse and Recycle Centre is used as the origin due to its official status as a key waste transfer station in this part of London. Note that some of the numbers in the tables in this section may not tally exactly due to rounding of figures.

7.6.2 The transport of the waste could be achieved potentially by road or water. The method used by road would involve moving the waste in articulated bulk tipper specifically design for handling loose bulk waste. If the waste was to travel by water, it is assumed waste would be carried in containers, as is the current practice for waste moved by water for Western Riverside Waste Authority on the River Thames.

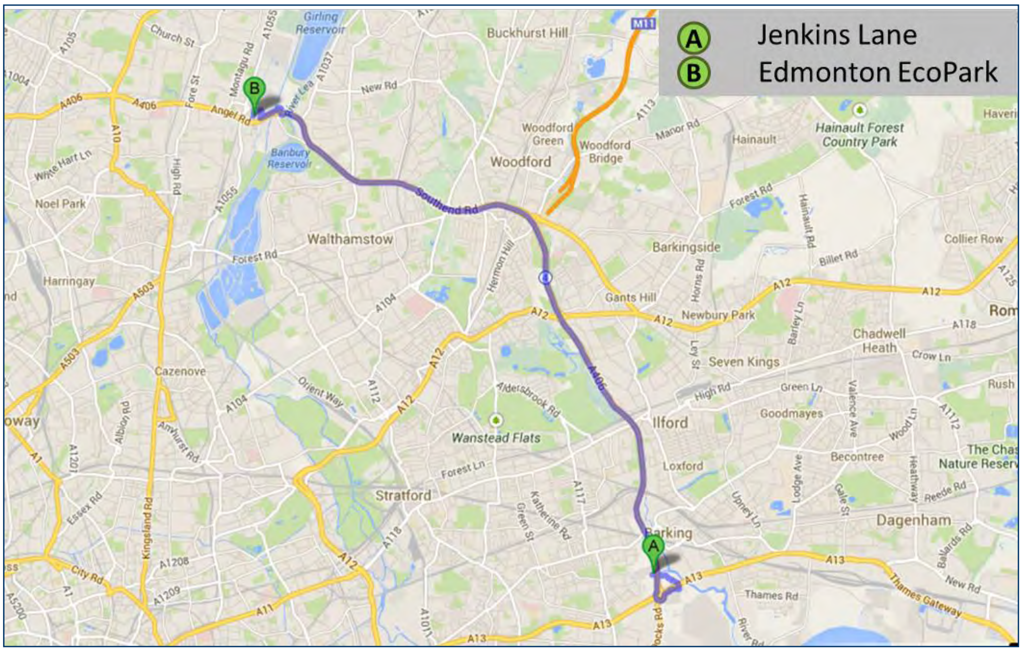
7.6.3 The following is assumed regarding the road transport:

- a bulk waste lorry would have a payload to 22 tonnes;
- a container would have a payload to 11 tonnes; and
- a lorry would carry to two containers and therefore have a payload of 22 tonnes

### Road transport - route and distance

7.6.4 The distance that lorries would travel from Jenkins Lane to Edmonton is 16.7km, along a route that would comprises only the North Circular Road (A406). It is estimated that the journey time would be approximately 40 minutes at an assumed average speed of 15mph, which is 3mph below the average road speed for London was a whole.

Figure 7-3: Road route between Jenkins Lane and Edmonton for delivery of municipal waste.




7.6.5 The estimated number of lorry trips that would be generated between Jenkins Lane and Edmonton is shown in Table 7-16. This assumes operations would be run over 258 days per year.

Table 7-16: Estimated number of lorry trips from by site

| | Scenario 6<br>East London Source / Edmonton | Scenario 8<br>East London Source / Edmonton |
|---|---|---|
| **Annual tonnage** | **150,000** | **300,000** |
| Tonnes/day | 581 | 1,163 |
| Round road trips/day | 26 | 53 |
| 1-way journeys/day | 52 | 106 |
| Round trips/year | 6,818 | 13,636 |
| 1-way journeys/year | 13,636 | 27,272 |

### Transport costs

7.6.6 The costs associated with these operations are based on the cost of procuring the vehicles and the cost incurred through operating them. The capital cost of a lorry tractor unit and an articulated moving floor or ejector trailer required to transport and handle the waste is in the region of £128,000 (see Appendix D for details).

7.6.7 The annual operating costs for Scenarios 6 and 8 are shown in Table 4-4. The tractor unit of a lorry is typically retained by haulage operators for six or seven years and if procured by lease could include the maintenance. Trailers are typically retained for periods ranging from seven to ten years depending on the freight market in which they are used. However, given the high level of use and the type of loads the trailers would be carrying, it is assumed that they would be renewed after seven years.

Table 7-17: Annual operating cost for Scenarios 6 and 8

| Cost item | Scenario 6<br>East London Source / Edmonton | Scenario 8<br>East London Source / Edmonton |
|---|---|---|
| **Annual tonnage** | **150,000** | **300,000** |
| Number of vehicles required | 7 | 14 |
| Depreciated capital - 44T Bulk Waste Lorry | 74,100 | 136,400 |
| Transport costs | 640,000 | 1,263,100 |
| Cost / tonne | £4.27 | £4.21 |

7.6.8 No allowance has been made for spare vehicles, as it is felt that this type of tractor and/or trailer are available through the hire market should either be required for a short period. A detailed breakdown of the operating costs for the road vehicle is provided in Appendix E.

### Environmental impact

#### Carbon emissions

7.6.9 The criteria for assessing the $CO_2e$ emissions for moving 150,000Te and 300,000Te of municipal waste is the same as stated in paragraph 4.5.14. The estimated quantities of $CO_2e$ for road transport from Jenkins Lane to Edmonton are presented in Table 7-18.

Table 7-18: Annual quantities of $CO_2e$ for road transport - Jenkins Lane

| Annual quantities of $CO_2e$ for road transport | Scenario 6<br>East London Source / Edmonton | Scenario 8<br>East London Source / Edmonton |
|---|---|---|
| Annual tonnage IBA | 150,000 | 300,000 |
| **Tonnes of $CO_2e$ per annum** | **300t** | **600t** |

## 7.7 Transporting municipal waste by water from Barking Creek to Edmonton

7.7.1 In considering the options for using water transport to move raw waste from Barking Creek to Edmonton, it is felt that only where IBA is delivered to Rainham is the potentially workable. Therefore the containerisation approach has not been tested for the Greenwich scenario, because:

- first, it is unlikely that container handling facilities could be setup here due to space constraints; and
- second, to close the operational loop would require a long distance movement of empty containers from Greenwich to Barking Creek.

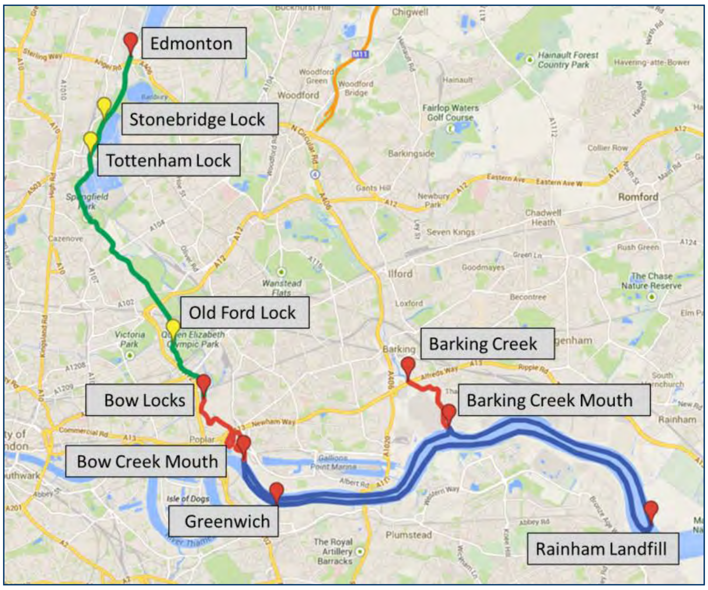
7.7.2 The Rainham option would involve the following steps:

- the containerised delivery of IBA from Edmonton to Rainham Landfill
- the transfer of empty containers from Rainham to a wharf within the proximity of the A13 road bridge on Barking Creek; and
- the containerised delivery of raw waste from Barking Creek to Edmonton

7.7.3 In order for this operation to take place would require the installation of specialist container handing equipment at Edmonton and the Barking Creek wharf.

7.7.4 An illustration of the route and journey stages is shown in Figure 7-4.

Figure 7-4: Water route between for moving IBA and municipal waste between Edmonton, Rainham and Barking Creek.




7.7.5 To model this operation two scenarios are considered:

- Scenario 9 - 180,000Te IBA from and 150,000Te municipal waste to Edmonton
- Scenario 10 - 180,000Te IBA from and 300,000Te municipal waste to Edmonton

## Edmonton

### Available wharf space and potential container handling

7.7.6 The wharf area at Edmonton would be the same as described previously in Section 5.4.

7.7.7 For the wharf to function it would require the installation of container handling equipment and it is felt that there are several design options:

- An open wharf on which a reachstacker would operate moving and handling container is on/off barges;
- The installation of an on-shore cantilever gantry crane that sits parallel to the waterway;
- The installation of a cantilever gantry crane which has one of its travelling rails built about 6m into the waterway and the other about 8m into the wharf area, such that it travels parallel to the waterway and straddles the moored barge; and
- The construction of a finger dock at 90º to the waterway which would extend into the southern end wharf site and would be about 26m long by 12m wide, so 2 barges could be moored abreast. The dock would be straddled by a gantry crane with cantilever extension to handle containers stored on the north side of the dock.

7.7.8 Each option has its own strengths and weaknesses, but the key feature of any installation must be the ability to efficiently handle containers and provide quick barge turnarounds. A high level review was made of each option to assess which could potentially offer a suitable solution and be used as a basis for estimating the likely cost to install a fully equipped wharf. Table 7-19 provides a summary of the strength and weaknesses of the options considered.

Table 7-19: Possible container handling scheme for Edmonton Wharf

| Wharf design | Strength | Weaknesses |
|---|---|---|
| Reachstacker wharf | ▪ Able to move around wharf<br>▪ Can move containers to different locations on wharf<br>▪ Can stack containers<br>▪ Can load/unload road vehicles<br>▪ Can load/unload barges<br>▪ Variants can load/unload containers below ground level<br>▪ Relatively low cost if one unit is being used | ▪ Very heavy machine<br>▪ Requires extremely thick paving on which to operate<br>▪ Emit relatively high levels of $CO_2$ emissions |
| On-shore cantilever gantry crane | ▪ Specifically designed to suit working environment<br>▪ Efficient at handling containers<br>▪ Can stack containers within the footprint of the crane<br>▪ Can work over containers stacked two high<br>▪ Could potential lift out barges for repair on wharf<br>▪ Powered by electric motors reducing $CO_2$ emissions<br>▪ Can run traverse wharf to load barges<br>▪ Potential to lift two containers at once in parallel, which helps mitigate barge roll during loading/unloading | ▪ Relatively high cost to procure and install<br>▪ Structure can be high, which might impact upon surrounding environment<br>▪ Would not be able to load barges if mechanical problem arises |
| Shore and channel cantilever gantry crane | ▪ Specifically designed to suit working environment<br>▪ Efficient at handling containers<br>▪ Can stack containers adjacent to crane<br>▪ Can work over containers stacked two high<br>▪ Powered by electric motors reducing $CO_2$ emissions<br>▪ Permits barge to sit directly below crane<br>▪ Can run along length of barges during handling operations<br>▪ Potential to lift two containers at once in parallel, which helps mitigate barge roll during loading/unloading<br>▪ If mechanical problem occurs, might still be able to load barges using a mobile crane, providing in situ crane is moved to one side | ▪ Relatively high cost to procure and install<br>▪ Structure can be high, which might impact upon surrounding environment<br>▪ Requires piling into canal bed for in-water traversing rail<br>▪ May hamper mooring of barges due to position in water<br>▪ Could possibly require use of reachstacker to move containers into temporary storage points |
| Gantry crane straddling dock | ▪ Specifically designed to suit working environment<br>▪ Efficient at handling containers<br>▪ Can stack containers adjacent to | ▪ Relatively high cost to procure and install<br>▪ Structure can be high, which might impact upon surrounding environment |

| | | |
|---|---|---|
| | crane<br>▪ Can work over containers stacked two high<br>▪ Powered by electric motors reducing $CO_2$ emissions<br>▪ Permits barge to sit directly below crane<br>▪ Can run along length of barges during handling operations<br>▪ Potential to lift two containers at once in parallel, which helps mitigate barge roll during loading/unloading<br>▪ If mechanical problem occurs, might still be able to load barges using a mobile crane, providing in situ crane is moved to one side | ▪ Could possibly require use of reachstacker to move containers into temporary storage points<br>▪ Associated difficulty, dock would require broad entrance to ensure barges could navigate in/out of dock |

7.7.9 From the analysis it was felt that a wharf-based cantilever gantry crane is likely to offer the most practical solution. However, the alternative options listed above should not be discounted immediately. Before any decision to proceed with the removal of IBA and delivery of raw waste using containers and water transport, all options should be examined in more detail. For the study it is assumed gantry cranes would be installed at Edmonton and the Barking Creek wharves, as this equipment is felt to offer the most practical and efficient method of handling containers on and off barges.

7.7.10 It should be noted that the scale of the crane installed on the Edmonton wharf would be a large structure and therefore is likely to have a visual impact to users of the canal and its towpath. This could be mitigated by painting it sympathetically, an approach used for the gantry crane at Walbrook Wharf in the City of London (see Figure 7-5).

Figure 7-5: Gantry crane on Walbrook Wharf, City of London

## Wharf and crane ground works

7.7.11 With a gantry crane located such that it travels parallel to the waterway, two alternatives for the more precise location on the wharf are possible:

i) maintaining the existing embankment alignment; and

ii) cutting the wharf into the embankment by around 2m

7.7.12 From examining technical sketches of the alternatives, it is felt that option i) would be most suitable, as it does not involve losing any land on the site, since there is sufficient room to moor two barges abreast at the wharf, without impeding passing craft. Appendix H illustrates the possible layout of the two options.

### Wharf wall

7.7.13 The existing wharf wall is concrete construction, but is in a mixed condition and as noted previously it is assumed that this would be renewed. A replacement would probably be constructed using heavy sheet piling, but could require concrete piling in order to support the gantry crane located between 3 and 7m back from the water's edge. A full engineering survey would determine the exact works needed.

### Wharf surface

7.7.14 A complete new surface would be required on the wharf, which would include piling to support the gantry crane rails. Other ground works to protect the drainage ditch wall may also be required. If the drainage channel were culverted, this would expand the size of the wharf support area by an estimated 80 per cent of the current area.

### Positioning of the crane

7.7.15 The position of the crane would be determined by an engineering survey, although two positions could be considered:

- 3m from the wharf wall; or
- 7m from the wharf wall, such that barges and tugs could be lifted and lowered into the space for routine maintenance at weekends

7.7.16 The exact position could potentially have an impact on the construction cost with regards to the type of, or extra piling, needed for the wharf wall.

## Cost of infrastructure

7.7.17 The main cost components for the provision of the wharf are:

- Replacement wharf wall;
- Piled gantry crane rails;
- Wharf surface; and
- Gantry crane and container spreader
- Provision of power supply for crane

7.7.18 Other elements not costed, but which need to be taken into account, include:

- Ground works;
- Welfare facilities for work staff; and
- Potential second bridge at south end of site.

7.7.19 The cost estimate for the installation of the main components is set out in Table 7-20.

Table 7-20: Cost estimate for provision of infrastructure at Edmonton Wharf

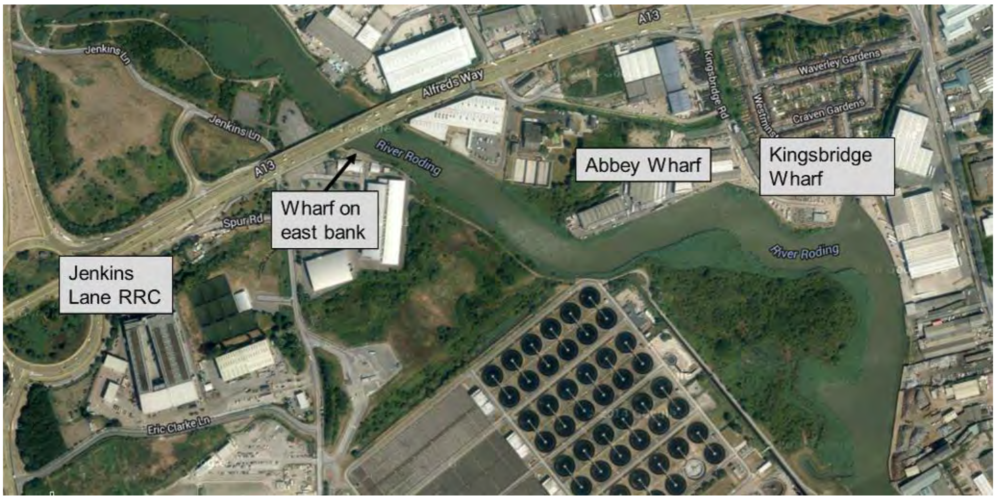
| Component | Quantity | Unit cost | Total cost |
|---|---|---|---|
| Wharf wall | 36m | £1800/m | £64,800 |
| Wharf fenders | 40m | £150/m | £6,000 |
| Piled crane rails [14] | 40m | | £300,000 |
| Wharf surface[15] | 1,300m$^2$ | £300/m$^3$ at 500mm depth | £195,000 |
| Power supply | 100m | £110/m | £11,000 |
| Gantry crane* | 1 | | £1,620,000 |
| Container spreader | 1 | | £120,000 |
| **Total** | | | **£2,316,800** |
| * Fully installed, commissioned and staff training | | | |
| | | | |
| Cost £/Te | | | |
| 150,000Te MW 180,000Te IBA | 330,000Te | | £7.02 |
| 300,000Te MW 180,000Te IBA | 480,000Te | | £4.82 |

## Barking Creek

### Available wharf space and potential container handling

7.7.20 There are a number of possible wharves on Barking Creek that could be converted into a transfer location for containers. These are: Abbey Wharf, and Kingbridge Wharf on the east bank and a wharf on the west bank close the A13 which is adjacent to Frankie & Benny's restaurant. However, last this option would require the relocation of the restaurant and acquisition of land at this location. The main advantage of this location is that it does not require the movement of containers from the Barking Creek site to the east bank of Barking Creek via the A13. Figure 7-6 indicates the potential wharf locations on Barking Creek.

Figure 7-6: Potential wharf locations on Barking Creek




7.7.21 Barking Creek is a tidal tributary of the Thames and at low water the wharves are dry. This means that navigating to and from any wharf would have to be completed within a four hour timeframe

[14] Transport Study, Draft Report to NLWA, Arup, March 2011
[15] Cost of laid concrete from Amex Technical Report, July 2012

starting two hours after low water up high water. The PLA does not favour tugs pushing or towing barges to navigate out of the creek on the ebb tide. The options provided here would require a full survey to assess their usability, as well as an investigation into their availability.

7.7.22 It is assumed that the necessary infrastructure to support a water transport operation using containers would be procured by the ELWA. The cost of set up is expected to be not dissimilar to the costs incurred for Edmonton, depending on the location chosen, but a full feasibility study would be needed to establish the overall viability of the water transport option.

## 7.8 Tugs and barges

7.8.1 This section of the report considers the number of barges that would be required to undertake the transport operation. It provides an estimate for the procurement and on-going running costs over a 25 year period.

### Approach to estimate tug requirement

7.8.2 The modelling method used to understand the tug operations in this scenario, is the same as that used previously for the loose bulk transport of IBA in Section 5.7.

7.8.3 Other assumptions that were used for the assessment are:

- a tug will only ever push/pull a single barge on the River Lee Navigation;
- a Lee Navigation tug will complete one round trip per day;
- barges would be consolidated at Bow Locks for movement to the River Thames and back to Edmonton;
- operations would be between 0700 and 1800 hours each day, Monday to Friday; and
- during one working shift of 10 hours 53 x 20ft containers would be transported in either direction, equivalent to 150,000Te per annum. Two shifts would equate to 300,000Te per annum.
- 180,000Te of IBA would be removed from Edmonton using the same transport resources - i.e. a closed-loop operation

7.8.4 As a result, the total number of 20ft containers required in the system, including a 30 per cent contingency, is estimated to be between 350 and 405, depending on the operation scenario.

### Tug and barge requirement

7.8.5 The number of tugs barges and moorings required for scenarios 9 and 10 are presented in Table 7-21.

Table 7-21: Numbers of tugs, barges and mooring for operational scenarios 9 and 10

| | Scenario 9<br>Edmonton/Rainham/Barking<br>180,000Te IBA<br>150,000Te municipal waste | Scenario 10<br>Edmonton/Rainham/Barking<br>180,000Te IBA<br>300,000Te municipal waste |
|---|---|---|
| **Containers** | | |
| 20 foot units - night loading / day loading | 180 / 270 | 312 |
| Contingency (approx. 30%) - night / day loading | 54 / 81 | 94 |
| **Tugs** | | |
| River Lee Navigation | 5 | 10 |
| Contingency tug (1 extra) | 1 | 1 |
| Bow Creek | 2 | 2 |
| River Thames | 1 | - |
| Barking Creek | 1 | 2 |
| **Barges** | | |
| Minimum nr - night loading / day loading | 30 / 34 | 52/62 |
| Contingency (approx. 10%) | 3 | 6 |
| **Mooring berths** | | |
| River Lee Navigation | 5 | 10 |
| Bow Locks | 5 | 7 |
| Bow Creek mouth | 5 | 10 |
| Rainham | 5 | 5 |
| Barking Mouth | 4 | 10 |
| Barking Wharf | 5 | 10 |

7.8.6 An estimate for the capital cost of the tugs and barges is presented Table 5-7, but this does not include a main haul tug on the Thames as this would be hired in from an established operator. Costs of barges and tugs for the Lee Navigation and Bow Creek operations were obtained from a boatyard which has manufactured these types of vessels previously. The difference in cost between scenarios reflects the varying number of barges that are required to achieve the transport.

Table 7-22: Capital cost of tugs and barges

| Equipment | Cost per unit | Scenario 6 Edmonton/Rainham/Barking 180,000Te IBA 150,000Te municipal waste | Scenario 8 Edmonton/Rainham/Barking 180,000Te IBA 300,000Te municipal waste |
|---|---|---|---|
| **Containers** | | | |
| 20 foot units - night | £6,000 | £1,404,000 | £2,430,000 |
| 20 foot units - day | £6,000 | £2,106,000 | |
| **Tugs** | | | |
| River Lee Navigation | £66,000 | £396,000 | £726,000 |
| Bow Creek | £300,000 | £600,000 | £600,000 |
| River Thames | n/a | n/a | |
| Barking Creek | £300,000 | £300,000 | £600,000 |
| **Barges** | | | |
| Container - night | £110,000 | £2,178,000 | £6,380,000 |
| Container - day | £110,000 | £2,442,000 | £7,480,000 |

## Tug and barge operations

7.8.7 The barge operation will follow the sequence of movements described in Section 7.11. The following sections summarise the operations for scenarios 9 and 10.

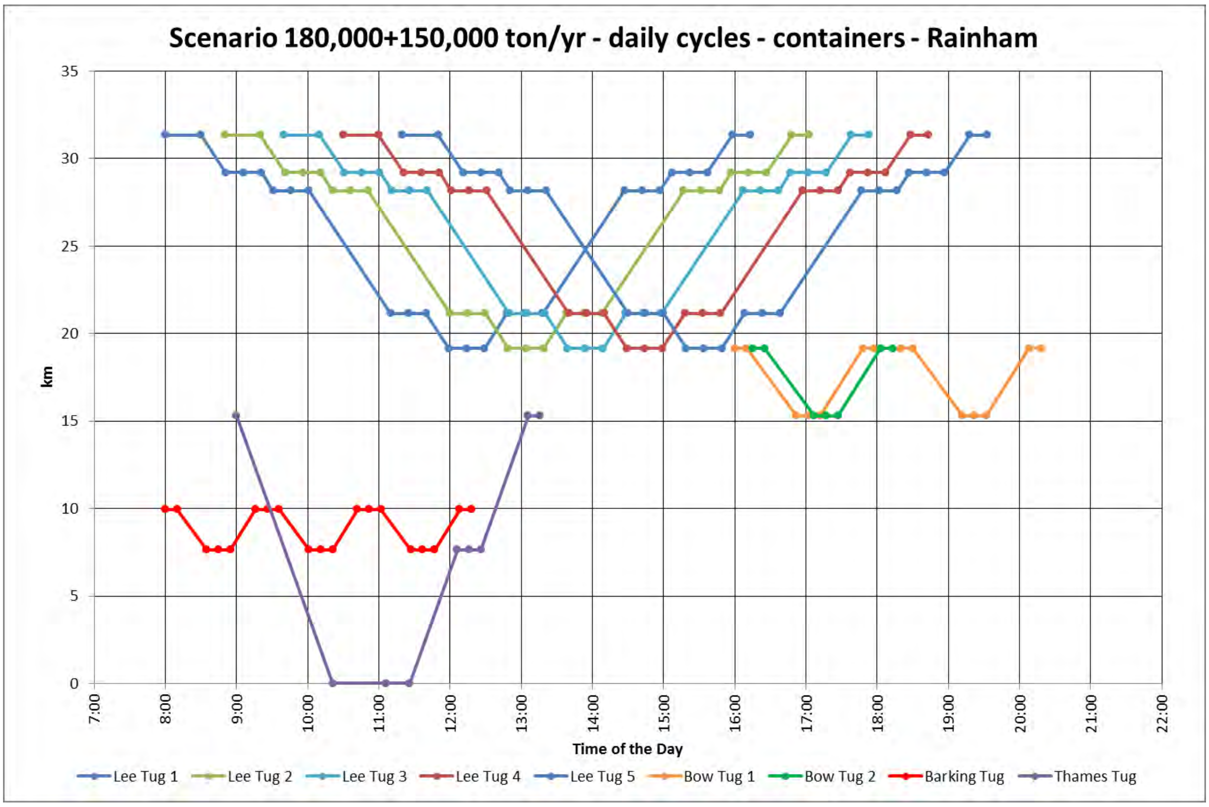
### Scenario 6: Containers from Edmonton to Rainham; 180,000Te pa IBA

### Containers from Barking Wharf to Edmonton: 150,000 ton/year municipal waste

- **River Lee Navigation:** 5 round trips (one barge each) between Edmonton and Bow Locks daily;
- **Bow Creek:** 3 round trips (2 trips of two barges and 1 trip of one barge) between Bow Lock and Bow Mouth;
- **River Thames:** 3 round trips between Barking Wharf and Barking Mouth
- **River Thames:** 1 circular trip Bow Mouth -> Rainham -> Barking Mouth -> Bow Mouth

7.8.8 It is suggested that the operation is done in daily cycles, the containers usage is maximised to 99 per cent for IBA and 100 per cent for waste. The operation is illustrated in Figure 7-7.

Figure 7-7: Schedule of barge operations between Edmonton, Rainham Landfill and Barking Wharf - 180,000Te IBA & 150,000 MW per annum



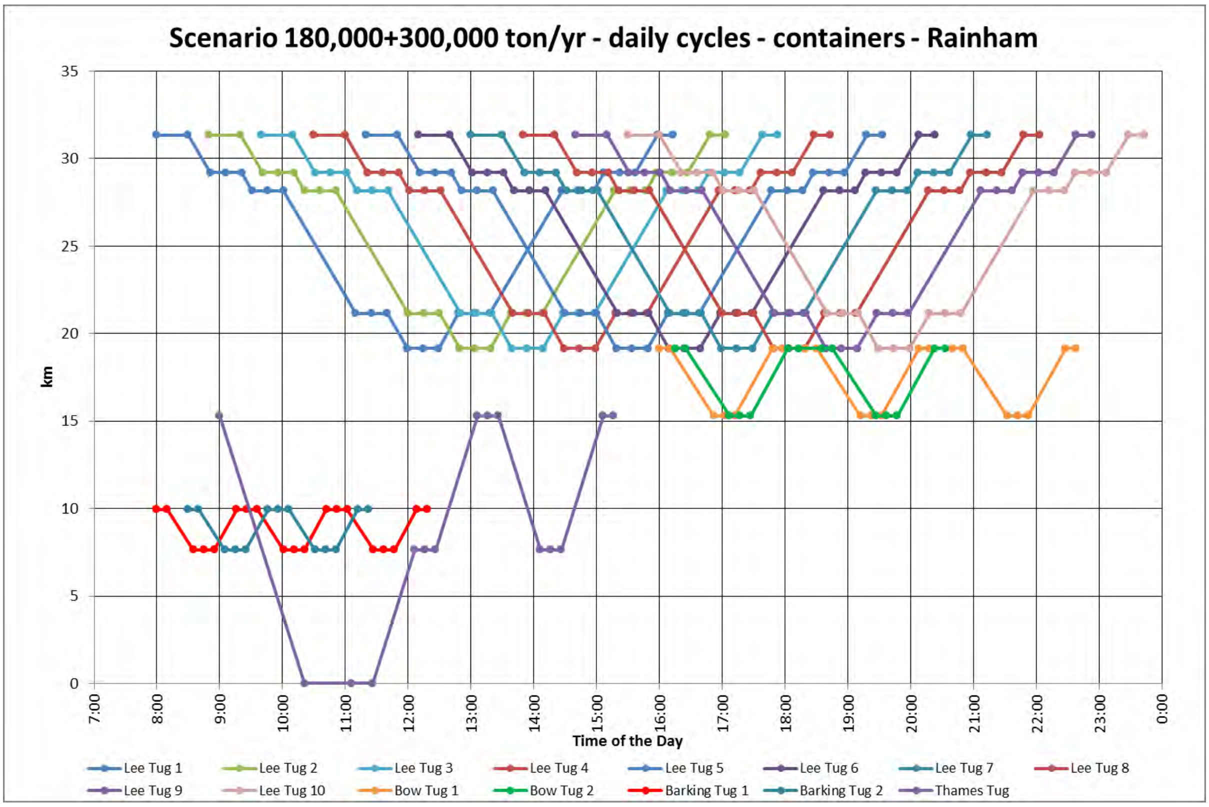

**Scenario 8: Containers from Edmonton to Rainham; 180,000Te pa IBA**

**Containers from Barking Wharf to Edmonton: 300,000 ton/year municipal waste**

- **River Lee Navigation:** 10 round trips (one barge each) between Edmonton and Bow Locks daily;
- **Bow Creek:** 5 round trips (two barges each) between Bow Lock and Bow Mouth towing 5 barges with IBA and 5 empty barges downstream, and 10 barges of waste upstream;
- **River Thames:** 5 trips (two barges each) between Barking Wharf and Barking Mouth
- **River Thames:** 1 circular trip Bow Mouth -> Rainham (IBA) -> Barking Mouth (empty) -> Bow Mouth (waste) + 1 circular trip Bow Mouth -> Barking Mouth (empty) -> Bow Mouth (waste)

7.8.9 It is suggested that the operation is done in daily cycles, the containers usage is maximised to 99 per cent for IBA and 100 per cent for waste. The operation is illustrated in Figure 7-8.

Figure 7-8: Schedule of barge operations between Edmonton, Rainham Landfill and Barking Wharf - 180,000Te IBA & 300,000 MW per annum




## 7.9 Cost of barging operations

7.9.1 A summary of the cost of the water operation by scenario is present in Table 7-23. The cost of tugs and barges is depreciated over 25 years in a straight-line to zero. However, since this equipment can, with regular maintenance operate beyond this time it is possible that the original vessels could be kept in operation. The tonnages in each scenario are combined to indicate the per-tonne cost - Scenario 9: 330,000Te pa; Scenario 10: 480,000Te pa.

Table 7-23: Annual operating cost of water operations

| **Cost item** | **Scenario 9 Edmonton/Rainham/Barking 180,000Te IBA 150,000Te municipal waste** | **Scenario 10 Edmonton/Rainham/Barking 180,000Te IBA 300,000Te municipal waste** |
|---|---|---|
| **Depreciated capital cost (£)** | | |
| Tugs & barges | 214,600 | 376,200 |
| **Operational cost (£)** | | |
| Transport costs - Lee Navigation | 569,400 | 1,735,900 |
| Transport costs - Bow Creek | 381,400 | 873,000 |
| Transport costs - Barking Creek | 524,700 | 1,023,900 |
| Transport costs - River Thames | 207,500 | 207,500 |
| **Total (£)** | **1,683,000** | **3,840,300** |
| Cost / Tonne | £5.10 | £8.00 |

## Environmental indicators

### Carbon emissions

7.9.2 The estimate of carbon emissions produced by water transport is based on the same principles as used for road. However, as noted previously the DEFRA Conversion Factor Tables do not provide $CO_2$e information for inland waterways craft. Therefore, in this study annual emission estimates for tugs is based on data published in *Guidelines for Measuring and Managing $CO_2$ Emission from Freight Transport Operations.*

Table 7-24: Annual quantities of $CO_2$e for water transport operations

| **Annual quantities of $CO_2$e** | **Scenario 9 Edmonton/Rainham/Barking 180,000Te IBA 150,000Te municipal waste** | **Scenario 10 Edmonton/Rainham/Barking 180,000Te IBA 300,000Te municipal waste** |
|---|---|---|
| Annual tonnage IBA | 180,000 | 180,000 |
| Annual tonnage MW | 150,000 | 300,000 |
| Total tonnage transported | 330,000 | 480,000 |
| **Tonnes of $CO_2$e per annum** | **510t** | **740t** |

## Overall cost estimate of using water transport

7.9.3 The use of water transport for moving IBA between Edmonton and Rainham or Greenwich involves a number of operations that need to be combined in order to estimate an overall cost. The type of operation would be determined according to the location of the processing facility. The overall cost of the various water transport options is summarised in Table 7-25.

Table 7-25: Overall estimated annual costs of using water transport for IBA

| **Cost item** | **Scenario 9 Edmonton/Rainham/Barking 180,000Te IBA 150,000Te municipal waste** | **Scenario 10 Edmonton/Rainham/Barking 180,000Te IBA 300,000Te municipal waste** |
|---|---|---|
| | All costs in £ | |
| Waterways infrastructure | 47,200 | 47,200 |
| Waterways maintenance | 15,000 | 15,000 |
| Wharf construction | 92,700 | 92,700 |
| On-Site Haulage Costs | 100,500 | 188,100 |
| Barge Loading Costs | 228,700 | 338,000 |
| Transport Costs - Lee Navigation | 569,400 | 1,735,900 |
| Transport Costs - Bow Creek | 381,400 | 873,000 |
| Transport Costs - Barking Creek | 524,700 | 1,023,900 |
| Transport Costs - River Thames | 207,500 | 207,500 |
| **Total (£)** | **2.167,100** | **4,521,300** |
| Cost / tonnes | £6.57 | £9.42 |

# 8 Comparison of road and water transport costs for IBA and municipal waste

## 8.1 Comparison of costs

8.1.1 A comparison of the overall estimated costs for scenarios 5 to 10, is summarised in Table 8-1.

Table 8-1: Comparison summary of estimated costs of using road and water for the transport IBA from, and municipal waste to Edmonton

| **Costs p.a. (£)** | **Scenario 5** | **Scenario 7** | **Scenario 6** | **Scenario 8** | **Scenario 9** | **Scenario 10** |
|---|---|---|---|---|---|---|
| | **Edmonton / Rainham** | **Edmonton / Greenwich** | **East London location / Edmonton** | **East London location / Edmonton** | **Edmonton/Rainham /Barking 180,000Te IBA 150,000Te municipal waste** | **Edmonton/Rainham/ Barking 180,000Te IBA 300,000Te municipal waste** |
| | **IBA** | **IBA** | **MW** | **MW** | **IBA + MW** | **IBA + MW** |
| Tonnes per annum | 180,000 | 180,000 | 150,000 | 300,000 | 330,000 | 480,000 |
| **Road** | | | | | | - |
| Loading operation | 76,100 | 76,900 | n/a | n/a | - | - |
| Transport operation | 686,600 | 653,500 | 640,000 | 1,263,100 | - | - |
| **Total cost** | **762,700** | **730,400** | **640,000** | **1,263,100** | - | - |
| **Cost / tonne** | £4.24 | £4.06 | £4.27 | £4.21 | - | - |
| | | | | | | |
| **Water** | **Scenario 5** | **Scenario 7** | | | **Scenario 9** | **Scenario 10** |
| Waterways Infrastructure | 47,200 | 45,200 | - | - | 47,200 | 47,200 |
| Waterways maintenance | 15,000 | | | | 15,000 | 15,000 |
| Wharf Construction | 18,900 | 18,700 | - | - | 92,700 | 92,700 |
| On-site Transfer Costs | 131,500 | 131,500 | - | - | 100,500 | 188,100 |
| Barge Loading Costs | 86,100 | 98,600 | - | - | 228,700 | 338,000 |
| Transport Costs - Lee Navigation | 696,200 | 602,600 | - | - | 569,400 | 1,735,900 |
| Transport Costs - Bow Creek | 463,500 | 437,700 | - | - | 381,400 | 873,000 |
| Transport Costs - Barking Creek | - | - | - | - | 524,700 | 1,023,900 |
| Transport Costs - River Thames | 159,500 | 14,000 | - | - | 207,500 | 207,500 |
| **Total annual cost** | **1,617,900** | **1,353,000** | - | - | **2,167,100** | **4,521,300** |
| **Cost / tonne** | £8.99 | £7.52 | - | - | £6.57 | £9.42 |

8.1.2 There are several permutations which can be used regarding the options shown in Table 8-1. These are indicated in Table 8-2:

Table 8-2: Permutations of transport options for moving IBA and municipal waste

| IBA | Municipal waste | Type of operation |
|---|---|---|
| By road to Greenwich | By road to Edmonton | Separate |
| By road to Rainham | By road to Edmonton | Separate |
| By water to Greenwich | By road to Edmonton | Separate |
| By water to Rainham | By road to Edmonton | Separate |
| By water to Rainham | By water to Edmonton | Combined |

8.1.3 Consequently, the cost of the operation would depend on the options chosen. However, it can be seen that road transport has a cost advantage over for all of the water options.

## 8.2 Comparison of carbon emissions

8.2.1 Estimates of $CO_2e$ have been produced for the road and water operations, which enables a comparison of their impacts to be made. The route lengths for road and water transport provide in Section 4 5 are still valid. The estimated quantity of $CO_2e$ related to road transport in Scenarios 9 and 10, is derived from adding the quantity that is estimated for Scenario 5 with that in Scenario 6, and Scenario 5 with Scenario 7, respectively.

8.2.2 Table 8-3 shows the estimated quantities of $CO_2e$ produced by road and water transport, and the difference between the estimated quantities produced each year.

Table 8-3: Comparison of annual quantities of $CO_2e$ for moving IBA and Municipal Waste by road and water to same facilities

| Quantities of $CO_2e$ | Scenario 5 | Scenario 7 | Scenario 6 | Scenario 8 | Scenario 9 | Scenario 10 |
|---|---|---|---|---|---|---|
| | Edmonton/ Rainham | Edmonton/ Greenwich | East London Location / Edmonton | East London Location / Edmonton | Edmonton / Rainham / Barking 180,000Te IBA 150,000Te | Edmonton / Rainham / Barking 180,000Te IBA 300,000Te |
| | IBA | IBA | MW | MW | IBA + MW | IBA + MW |
| Tonne p.a. | 180,000 | 180,000 | 150,000 | 300,000 | 330,000 | 480,000 |
| **Road** | 580t | 550t | 300t | 600t | 880t | 1,150t |
| **Water** | 350t | 200t | n/a | n/a | 510t | 740t |
| **Difference** | 230t | 350t | 300t | 600t | 150t | 220t |
| **Percentage reduction** | 40% | 64% | n/a | n/a | 40% | 36% |

8.2.3 Based on these estimates it is suggested that, on average, water transport would reduce the level of $CO_2e$ by between 36 and 64 per cent for journeys to Rainham, Greenwich and Barking compared with road haulage.

8.2.4 The operation predicted to have the least impact on $CO_2e$ emissions is Scenario 10, where a substantial number of tugs would be required on the River Lee Navigation to maintain an optimum operation.

# 9 Financial appraisal

## 9.1 Underlying methodology

9.1.1 Whilst a detailed financial appraisal has not been completed, a high level assessment is included based on the costing estimates provided in the previous section. To complete this, the Department for Transport (DfT) appraisal approach has been adopted, which compares the net present cost of the water proposal with the net present cost of the road operation, using a discount rate of 8 per cent.

9.1.2 The appraisal considers actual cash flow and takes into account the ability to offset operating costs and capital allowances against tax, with a one year lag. The residual value of capital assets, calculated on a straight line basis using standard lifetimes for different types of equipment, is included at the end of the appraisal period. The appraisal only takes into account the initial investment, and not any future replacement costs of infrastructure.

9.1.3 The financial appraisal examines those scenarios for the transport of IBA and municipal waste that are performed all by water and can directly substitute the road transport. Table 9-1 summarises the scenarios assessed.

Table 9-1: Financial assessment of transport by scenarios

| Transport Scenario | Commodity | Origin | Destination | Mode of Transport | Method of handling |
|---|---|---|---|---|---|
| **Scenario 1** | IBA | Edmonton | Rainham Landfill | Water & Road | Loose bulk |
| **Scenario 2** | IBA | Edmonton | Greenwich Agg Zone | Water & Road | Loose bulk |
| **Scenario 3** | IBA | Edmonton | Rainham Landfill | Water & Road | Loose bulk |
| **Scenario 4** | IBA | Edmonton | Greenwich Agg Zone | Water & Road | Loose bulk |
| **Scenario 5** | IBA | Edmonton | Rainham Landfill | Water & Road | Loose bulk |
| **Scenario 6** | Raw Waste | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 7** | IBA | Edmonton | Greenwich Agg Zone | Water & Road | Loose bulk |
| **Scenario 8** | Raw Waste | Barking Creek | Edmonton | Road | Loose bulk |
| **Scenario 9** | IBA/Raw Waste | Edmonton/Barking Creek | Barking Creek/Edmonton | Water | Container |
| **Scenario 10** | IBA/Raw Waste | Edmonton/Barking Creek | Barking Creek/Edmonton | Water | Container |

## 9.2 Financial assessment of the water and water/road transport scenarios

9.2.1 The assessment of financial need has been carried out for a 25 year period and assumes that mobile plant would be replaced twice during the period. A summary of the results is shown in Table 9-2.

Table 9-2: Summary of financial assessments all scenarios considered

| ROAD TRANSPORT OPTIONS | | WATER TRANSPORT OPTIONS | |
|---|---|---|---|
| **RAINHAM LANDFILL** | | | |
| **NLWA OPTION 1: 106k TPA IBA EDMONTON/RAINHAM** | | **NLWA OPTION 1: 106k TPA IBA EDMONTON/RAINHAM** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £758,000 | Capital Cost | £4,095,000 |
| Annual Operating Cost | £415,605 | Annual Operating Cost | £1,242,779 |
| Post Tax NPC over 25 years | £4,747,023 | Post Tax NPC over 25 years | £14,306,771 |
| Cost per tonne | £1.79 | Cost per tonne | £5.40 |

| GREENWICH AGGREGATE ZONE | | | |
|---|---|---|---|
| **NLWA OPTION 2: 106k TPA IBA FROM EDMONTON** | | **NLWA OPTION 2: 106k TPA IBA FROM EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £758,000 | Capital Cost | £3,435,000 |
| Annual Operating Cost | £407,358 | Annual Operating Cost | £1,103,902 |
| Post Tax NPC over 25 years | £4,676,927 | Post Tax NPC over 25 years | £12,559,581 |
| Cost per tonne | £1.76 | Cost per tonne | £4.74 |
| **RAINHAM LANDFILL** | | | |
| **NLWA OPTION 3: 140k TPA IBA FROM EDMONTON** | | **NLWA OPTION 3: 140k TPA IBA FROM EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £998,000 | Capital Cost | £5,688,000 |
| Annual Operating Cost | £550,894 | Annual Operating Cost | £1,530,555 |
| Post Tax NPC over 25 years | £6,281,484 | Post Tax NPC over 25 years | £18,146,496 |
| Cost per tonne | £1.79 | Cost per tonne | £5.18 |
| **GREENWICH AGGREGATE ZONE** | | | |
| **NLWA OPTION 4: 140k TPA IBA FROM EDMONTON** | | **NLWA OPTION 4: 140k TPA IBA FROM EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £998,000 | Capital Cost | £3,708,000 |
| Annual Operating Cost | £540,003 | Annual Operating Cost | £1,308,962 |
| Post Tax NPC over 25 years | £6,188,904 | Post Tax NPC over 25 years | £14,609,152 |
| Cost per tonne | £1.77 | Cost per tonne | £4.17 |
| **RAINHAM LANDFILL** | | | |
| **NLWA OPTION 5: 180k TPA IBA FROM EDMONTON** | | **NLWA OPTION 5: 180k TPA IBA FROM EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £1,118,000 | Capital Cost | £5,578,000 |
| Annual Operating Cost | £643,559 | Annual Operating Cost | £1,582,999 |
| Post Tax NPC over 25 years | £7,261,399 | Post Tax NPC over 25 years | £18,544,185 |
| Cost per tonne | £1.61 | Cost per tonne | £4.12 |
| **MUNICIPAL WASTE EDMONTON** | | | |
| **NLWA OPTION 6: 150k TPA MW TO EDMONTON** | | **NLWA OPTION 6: 150k TPA MW TO EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £942,000 | Capital Cost | - |
| Annual Operating Cost | £554,800 | Annual Operating Cost | - |
| Post Tax NPC over 25 years | £6,271,705 | Post Tax NPC over 25 years | - |
| Cost per tonne | £1.67 | Cost per tonne | N/A |

| GREENWICH AGGREGATE ZONE | | | |
|---|---|---|---|
| **NLWA OPTION 7: 180k TPA IBA FROM EDMONTON** | | **NLWA OPTION 7: 180k TPA IBA FROM EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £1,118,000 | Capital Cost | £4,478,000 |
| Annual Operating Cost | £599,397 | Annual Operating Cost | £1,318,192 |
| Post Tax NPC over 25 years | £7,045,288 | Post Tax NPC over 25 years | £15,348,756 |
| Cost per tonne | £1.57 | Cost per tonne | £3.41 |
| **MUNICIPAL WASTE EDMONTON** | | | |
| **NLWA OPTION 8: 300k TPA MW TO EDMONTON** | | **NLWA OPTION 8: 300k TPA MW TO EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £1,718,000 | Capital Cost | - |
| Annual Operating Cost | £1,109,601 | Annual Operating Cost | - |
| Post Tax NPC over 25 years | £11,738,062 | Post Tax NPC over 25 years | - |
| Cost per tonne | £1.57 | Cost per tonne | N/A |

9.2.2 With respect to the transport of IBA and municipal waste by road and water, in the case of road to understand the full cost implications of these movements it is necessary to add the two separate operational costs together, such that the total can be compared with water, because with this mode the transport of both commodities would be integrated into one operation. Therefore, the cost comparisons are shown in Table 9-3.

Table 9-3: Summary of financial assessments all scenarios considered

| IBA RAINHAM LANDFILL / MUNICIPAL WASTE EDMONTON | | | |
|---|---|---|---|
| **NLWA OPTION 9: 180k/150k TPA IBA/MW FROM/TO EDMONTON** | | **NLWA OPTION 9: 180k/150k TPA IBA/MW FROM/TO EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £2,060,000 | Capital Cost | £8,844,000 |
| Annual Operating Cost | £1,198,360 | Annual Operating Cost | £2,027,261 |
| Post Tax NPC over 25 years | £13,236,313 | Post Tax NPC over 25 years | £24,968,726 |
| Cost per tonne | £1.60 | Cost per tonne | £3.03 |
| | | | |
| **NLWA OPTION 10: 180k/300k TPA IBA/MW FROM/TO EDMONTON** | | **NLWA OPTION 10: 180k/300k TPA IBA/MW FROM/TO EDMONTON** | |
| **Proposed Road Operation** | | **Proposed Water Operation** | |
| Capital Cost | £2,836,000 | Capital Cost | £13,208,000 |
| Annual Operating Cost | £1,753,160 | Annual Operating Cost | £4,381,342 |
| Post Tax NPC over 25 years | £18,989,374 | Post Tax NPC over 25 years | £48,726,143 |
| Cost per tonne | £1.58 | Cost per tonne | £4.06 |

## 9.3 Summary

This section has provided a high level indication of the potential costs that are associated with using road and water for the transport of IBA and municipal waste.

In all cases road is estimated to be the lower cost option for both capital investment and on-going operational costs. The high investment costs to establish a water operation means that this method of transport is between two and three times more costly than road.

# 10 Other considerations for the water transport operation

10.1.1 In carrying out the water operation a number of other aspects need to be considered, as they might have an impact of the transport operation. These are classified as:

- refuelling;
- crew welfare; and
- servicing of craft

### Refuelling

10.1.2 Discussions with canal barge operators in London, indicates that over the course of a day, each tug will use around 175 litres of fuel. The location of refuelling points will therefore be important and need to be placed at points where tugs can easily access them and, importantly, they can be easily refilled. The obvious locations are the Edmonton and midway at Lee Valley Marina, it may be necessary to have another fuelling station in the area of Bow Locks, possibly a floating bowser, but this does raise security concerns. To ensure that tugs do not have to remain at the refuelling point for too long, a high speed filling system should be used, not dissimilar to that used for filling domestic heating oil tanks. A programme to refill the bunkers will need to be devised.

### Staff Welfare

10.1.3 The welfare of the boat crews must be taken into consideration and, as with refuelling, crew welfare facilities would be need to be provided. Again the best locations are considered to be at the Edmonton and Lee Valley Marina, and at Bow Locks it might be possible to position the facility on a pontoon. However, if welfare facilities are placed on the pontoon, option a review of health and safety regulations would be required. If it were it found that these arrangements prove inadequate, it would be necessary to review the provision.

### Craft servicing

10.1.4 Tugs and barges will require on-going and periodic servicing and maintenance. Apart from Lee Valley Marina there are no other locations in the proximity of the service route that offer these facilities. Use of the marina’s land or facilities would need to be agreed with the owners and organised by the barge operator.

10.1.5 An idea suggested by one of the study validation operators, is to include an area between the crane and wharf edge at Edmonton, enabling craft to be lifted from the water by the crane and placed in situ for servicing and short term maintenance at weekends.

10.1.6 The servicing of craft would be an important provision in any barge operation and it is felt this aspect should be a requirement of the supply contract.

## 10.2 Impact on other aspects of the waterway

10.2.1 Currently, the Lee Navigation experiences a relatively low rate of other boat traffic. As a waterway it is linked to the Regent’s Canal via the Hertford Union just north of Old Ford, and at Hoddesdon the waterway splits into the Lee Navigation to Hertford and Stort Navigation to Bishop’s Stortford. However, both tributaries are dead ends, meaning craft can only enter the Lee Navigation from the south, with the prospect of only being able to travel up and down it.

### Leisure craft mooring

10.2.2 On the Lee Navigation between Edmonton and Bow East, CRT has 43 leisure craft moorings south of Stonebridge Lock and another 16 north of the lock (BW, 2012). The north of lock moorings are arranged as a chevron pontoon alignment to the waterway, resulting in moored craft projecting into the edge of the channel, narrowing the passage to about 10m. This is regarded as a notable restriction, since two SRF barges would be unable to pass and as such constrains this section of waterway to single track working. Figure 10-1 provides an aerial view of the constraint at Stonebridge Lock north moorings.

Figure 10-1: Stonebridge Lock north moorings


10.2.3 There are many other boats moored along the waterway, but many of these are quite likely to be unofficially moored. In addition, there is the privately run Lee Valley Marina at Springfield, which is off the waterway, and a further large number of boats moored on the waterway in this area who's mooring status is not known. Were barge operations to start, it very likely that some craft would have to be moved, for example, boats moored on the towpath side in the vicinity of Stonebridge Lock north moorings and close to the A12 road bridge.

10.2.4 The modelling in Section 8 implies that there would be a barge movement about every 40 minutes between 0700 and 1800. This activity is likely to produce a certain amount of wash as the barges used would generally be larger than those moored and might cause a slight disturbance. One option to overcome this difficulty would be to slow passing barges at these points, but this would have to be assessed in terms of impact on overall operations co-ordination.

### Leisure craft

10.2.5 In the proximity of Lee Valley Marina, but based on the opposite bank at Spring Hill, is Lea Valley Rowing Club. Rowers and canoeist use the waterway from this club and as noted in the Entec report, oar-spans on some boats are 7m across which have implications for navigation. It was also noted that the Club has objected previously to the re-introduction of freight operations. The club has links with local schools and offer the opportunity to use the waterway, which means that it is not only individuals present in the water on regular occasions. Most rowing activity tends to take place at weekends and this is confirmed by other survey work that has looked at waterway use on the Thames around Putney, where rowing clubs are present. Therefore, any re-introduction of freight services would require sensitive communications with this group.

10.2.6 Thus, this study concurs with the approach outlined in the Entec report which states, "Many pleasure craft users are pleased to see the waterways used for freight and objections can often be overcome by good communication to users in advance of the traffic starting and possibly information provision (through waterway press, display boards at locks and so on), explaining the environmental benefits of the operation."

### Embankment damage

10.2.7 Much of the waterway route is lined with steel or concrete piling, which would be unaffected by the wash from craft. The main area where the embankment does not appear to have a canal wall is in the Lea Valley Regional Park. It might be advisable to arrange a closer examination of this section to confirm the bank would be unaffected by wash from freight traffic if the operation were to proceed. Although not seen, the BW annual accounts for 2010/11 stated that there has been action taken to replant floating reed rafts that provide spawning opportunities for fish, encourages other wildlife and creates habitats for nesting birds on the River Lee (BW, 2011). It is possible that these habitat interventions might be disturbed, but this should be confirmed by ecology experts.

## 10.3 Best practice

10.3.1 The introduction of containerised freight on a waterway of the Lee Navigation's size would be a leader in terms of best practice. Currently, container transfer operations are operated on larger waterways, in Britain the Thames being the prime example with respect to waste management. However, even on the Continent the shipment of containerised waste is carried out by vessels that carry 24 plus containers, which are regarded as small capacity craft by inland waterway standards in Europe.

10.3.2 By using container systems such a gantry cranes a best practice approach is maintained as these are powered by electric motors and therefore a greener option that relying on diesel powered reachstacker, although it is acknowledged such machines might have to be used for some container handling operations. This method of handling containers is recognised as being the most efficient, which is supported by their widespread use in the container transport industry.

10.3.3 Whether there would be opportunities to use craft fitted with alternative propulsion systems is an aspect that requires further investigation and is considered in the next section of the report.

## 10.4 Potential operational risk

10.4.1 Although the use of the Lee Navigation will only involve using about seven miles of the waterway it is considered there would be certain risks that could affect the transport operation. These are summarised in Table 10-1, and outline the risk, a brief description, potential severity level (High, Medium & Low) and possible mitigation measures.

Table 10-1: Potential risks to using waterborne transport

| Risk | Description | Potential Severity | Mitigation measures |
|---|---|---|---|
| **Waterway related** | | | |
| Waterway closure for maintenance or unforeseen incident/accident | Waterway maintenance normally carried out over winter period and can require emptying water from sections of the canal | High | Use of road transport.<br>Would require comprehensive planning for example inclusion of alternative container handling equipment to permit articulated lorries to ensure |

| | | | |
|---|---|---|---|
| | | | transport levels of containers is maintained. |
| Dredging | Removal of canals bed sediment to ensure the depth of water is sufficient for unhindered passage of barges | Low/medium | Carry out survey to ensure navigation channel has necessary depth<br>Carry out spot dredging at affected locations<br>Monitor vulnerable points such that a suitable dredging programme can be established |
| Waterway freezing in winter | Could prevent passage of tugs/barges if extreme conditions experienced | Medium/High | Have the necessary icebreaking equipment available for fitting to tug(s)<br>Use of road transport if prolonged icing experienced |
| Lack of water in waterway | Could occur during a dry period or if problems arose with waterway bed, embankment or sluice gates causing it to loose large quantities of water. | Medium/High | Use of road transport.<br>Negotiation with CRT to rectify problem as soon as possible.<br>Review long term provision of water to waterway. |
| Problems with lock(s) | A problem with a lock would reduce the potential capacity of the waterway. Length of time to rectify problem would be a primary concern. | Low/Medium | Use of non-commercial lock, although passage times might be longer than normal.<br>Lengthen working day to ensure adequate number of containers transported. |
| Other waterway users | Potential conflict, slowing of barge traffic, and waterway restrictions could arise due to other users in waterway when barge operations taking place. | Low/Medium | Might require setting up a communications/liaison channel to ensure good dialogue with other user groups.<br>Likely agreements might need to be put in place on when barge operations should be suspended or retimed.<br>Warning systems on parts of waterway where potential conflict could occur. |
| **Road related** | | | |
| Increasing road congestion for Rainham, Greenwich or inbound MW loads | Journey time reliability declines substantially over the period of the contract. | Medium | Increase the number of lorries used to perform collection and delivery trips.<br>Use water transport which has few or no capacity constraints. |
| Accelerated cost of fuel | As peak oil production is passed, fuel prices rises accelerate making road transport less economic | Medium | Build in contingency plan to switch fuel source in renewal programme for vehicles<br>Use water transport with alternative power propulsion from the beginning of the |

| | | | |
|---|---|---|---|
| | | | contract |
| Future Road Pricing | Currently London only has a road charging scheme that covers the central boroughs. However, central Government has hinted that a future national road pricing system may be implemented, and it is not unreasonable think this would be within the timeframe of the IBA Contract. | Low/Medium | Depends on roads included, but unlikely to be avoided. |
| **Operations related** | | | |
| Failure of wharf handling equipment | System dependent:<br><br>Excavator fails<br><br>Gantry crane fails due to a mechanical problem at either Edmonton or Rainham or MW wharf.<br><br>Knock on affects:<br>• Difficulty finding supply of hooklift vehicles<br>• Long delay might have implications on container supply | <br><br>Low<br><br>High | <br><br>Hire in excavator<br><br>Use of road transport as a temporary measure. |
| Reliance on hooklift lorries for on-site haulage at Edmonton | Specialist vehicle which means only one container can be carried at a time.<br><br>It is unlikely that other types of container handling equipment would be on-site in the case of problems with wharf crane, meaning reliance on hooklift vehicles.<br><br>If containers have to be moved by road, need adequate supply of hooklift vehicles to ensure transport can meet delivery/collection schedules. | Medium | Temporary use of mobile crane to lift containers on/off articulated skeletal trailer lorries.<br><br>Consider using tug and container trailer and use of reachstacker for on-site container transfers at Edmonton. |
| Failure of tug or barge | Tug could experience mechanical problems or barge could be damaged during operations. | Low/Medium | Important that operator includes at least one spare tug in fleet to cover tug failure events.<br><br>Devise a recovery plan should barge become damaged or immobilised during operations.<br><br>Wharf design should incorporate spare capacity and enable permit crane extended |

| | | | |
|---|---|---|---|
| | | | coverage of wharf ends to ensure operations can continue albeit at a reduced rate. |
| Tug/barge maintenance and servicing | There is a lack of boat yards facilities on the Lee Navigation and therefore steps need to be taken to ensure a facility can be included in the planning or the water operation.<br><br>This aspects need to also cover fuel supply, stations and storage | Low | Only Lee Valley Marina offers the potential to set up a facility to service and maintain the tug and barge fleet.<br><br>An early agreement should be put in place with the Marina regarding use of services or land to install the necessary maintenance workshop. |

# 11 Other opportunities for using water transport at Edmonton

## 11.1 Demolition waste and construction materials

### Demolition waste

11.1.1 With the expansion of the incinerator, a substantial quantity of demolition waste is likely to be produced. The type of demolition waste is not known, but it is assumed there would be quantities of concrete, brick, metal, and ground preparation excavations.

11.1.2 There is potential to remove these materials to locations on the Thames, but there are none which can be easily reached on the River Lee Navigation. The primary locations for demolition waste could be companies such as Hanson at Victoria Deep or Day Aggregates at Murphy's Wharf, and for metal at EMR at Port of Tilbury and Van Dalen at East Jetty, Dagenham. Excavation waste might have to go to landfill or possibly re-use at, for example, RSPB's Cliffe Pools wetland management project. It might be possible to carry out such an operation if there were sufficient, suitable barges available, but it is unclear what barge stock is available that can navigate be used on the River Lee Navigation and River Thames.

11.1.3 The operation would require barges passing through Bow Locks to enter the Thames via Bow Creek, with possibly a number being hitched together to form a secure raft that would be hauled to the unloading point by a larger Thames tug.

11.1.4 No cost estimate has been made for this option, since the quantity of material is unknown and it is not certain if older barges are a safe option.

11.1.5 If IBA was already being removed from Edmonton by water, any spare barges might be able to facilitate the removal of demolition waste. However, it would need to be assessed whether both operations could be accommodated on the Ash Wharf as the removal of IBA would have to take priority.

### Construction materials

11.1.6 The proximity of Ash Wharf to the Edmonton facility provides a potential opportunity to deliver construction materials to site during the expansion works. In theory, deliveries could arrive from both north and south along the waterway, but the proximity of the Edmonton facility to the M25 effectively rules out transhipment from the north, as the cost of the operation is unlikely to make it a viable options.

11.1.7 To clarify this point, the Edmonton facility is approximately 8km from the M25 motorway via the River Lee Navigation. Along this stretch of waterway, four potential points have been identified where goods which first arrive by road into the London area could be transferred on to barges for the final delivery to site.Table 11-1 indicates the locations and distance between Edmonton and these 'wharves', and the M25 and the 'wharves'.

Table 11-1: Potential loading points for transferring inbound materials to water

| Potential wharf location | Water distance between wharf and Edmonton | Road distance M25 to Edmonton | Road distance M25 to Wharves |
|---|---|---|---|
| Canal and River trust - South Ordnance Road | 6.0km | 12km | 4.0km |
| Duck Lees Lane Industrial Estate | 3.5km | | 6.0km |

| | | | |
|---|---|---|---|
| Wharf Road, off Lea Valley Road | 3.0km | | 6.5km |
| Pickett's Lock | 1.3km | | 8.5km |
| Note: Distances estimated from Junction 25 on the M25 | | | |

11.1.8 It can be seen in Table 11-1 that the road distance to Edmonton from the M25 is around 12km, but to reach a suitable wharf a vehicle would have to travel between a third and two thirds of the M25 to Edmonton distance. If vehicles have travelled a long distance to reach this point of the delivery journey, the Edmonton/M25 leg would be marginal cost.

11.1.9 To tranship the inbound consignments would require the hire of tugs and barges, the hire of a crane and perhaps other lifting equipment, fuel and fees and charges for use of the wharf. In addition, a cost would be incurred related to the additional time needed to facilitate the transhipment. Combined this constitutes much effort to tranship deliveries to water for what would be at most around 8km of an *en route* 12km road journey

11.1.10 Given these factors it is assessed that deliveries from the south are, at present, the most sensible option.

11.1.11 The quantity and type of construction materials that could be transported on the waterway will depend on the design and size of the new facilities and the timescale over which these are built. Potentially, a substantial range of materials could be delivered by barge, but at this stage the most noteworthy prospects would cover aggregates, steel, cladding, and some heavy machinery and plant.

### Aggregates

11.1.12 If concrete is batched on-site there may be an opportunity to deliver sand and aggregate from suppliers on the Thames (providing suitable barges are available) or Aggregate Industries Lee-side plant at Bow West, although currently there are no loading facilities for barges at the latter plant.

### Steel

11.1.13 Heavier materials such as construction and reinforcement steel can be sourced along the Thames - e.g. ASD Metal Service at Thames Wharf Bow Creek mouth and Kierbeck on Barking Creek which both have direct river access. Flat top (also referred to a 'pontoon'), barges are commonly used for transporting such materials and these types of barges have been recently working on the River Lee Navigation in the area of Bow Locks. Conventional barges (i.e. with a hold) into which steel products would be placed, could also be used to move and thus there are transport options available.

### Cladding

11.1.14 As with steel products, cladding materials could be moved by water either using flat top or hold barges. If there were suppliers on the Thames this would be an advantage as direct water access would remove the need to tranship to barges. The Port of Tilbury would seem the obvious transfer point from road or water to barges, because:

- it has the facilities to handle different types of consignments;
- is easily accessible for inbound road deliveries for transfer to water;
- consignments arriving in container could be broken down into smaller deliveries or transferred on to barges to delivery to site; and
- closest general purpose port facility to Edmonton.

11.1.15 It should be noted that any onward movement of consignments by water to Edmonton from the Port of Tilbury would depend on the availability of suitable barges.

#### Oversized and overseas sources

11.1.16 If the new facilities require oversize loads there may be an opportunity to deliver these via the waterway, providing they fit within the barge or do not infringe the 2.4m height restriction on Lea Bridge. This might be attractive if the equipment is first arriving by water at the Port of Tilbury where it can be transferred to barge, but this would need to be assessed on a case-by-case basis.

11.1.17 If materials are sourced from abroad and are arriving into the country by ship, they could be routed through ports such the Port of Tilbury or Thames Gateway, where they could be transhipped to barges (providing suitable barges are available).

#### Other building materials

11.1.18 For other materials there is a general lack of suppliers with direct water access, which effectively rules out using the mode as a cost effective means of transport. Only Jewsons at Waltham Abbey, which is north of Edmonton, meets this criterion, as their premises are located next to an off-channel dock.

### Overall viability and practicalities

#### Viability

11.1.19 The use of water for moving demolition waste and construction materials will very much depend on the origin and destination for the transport.

11.1.20 The cost of the operation would be depend on a number of factors such as, type of material, quantity to be transported, handling requirements, whether it is transported on just the River Lee Navigation or would start/finish at a point on the Thames and if the wharf at Edmonton needs to refurbished.

11.1.21 No cost estimates have been calculated, as data on materials and quantities is unavailable at this stage. However, it is assumed that an operation on just the River Lee Navigation would be less costly than if including any further transport on the Thames, since only one type of tug would be required and barges would not have to be of a specification for operating on tidal waters. Other costs associated with water transport would be unloading at Edmonton and internal transfer from the wharf to where they are being used.

#### Practicality

11.1.22 The practicality would very dependent on the materials or consignments to be transported and if Ash Wharf was being used for IBA removal from Edmonton.

11.1.23 In terms of transporting and landing loose bulk materials such as aggregates, the process is very simple and no special operational requirements are envisaged. Standard construction plant would be sufficient. Barges are available on the London canal network which could fulfil movements of this commodity, for example, those used for an aggregates traffic that has now ceased in West London.

11.1.24 For materials and consignments that originate or are destined for locations on the Thames, the transport would be more involved as different types of tugs and river-going barges would be required. In the past there were high number of barges that could navigated the Thames and River Lee, but today it is unclear how many such barges exist. If the transport was going to be prolonged and of a large quantity, it might be possible to hire or procure second hand barges that meet the requirements, but this is only a speculative assumption.

11.1.25 In the case of other materials, these would need to be assessed on a case-by-case basis, but recent use of the Lee for the construction of the 2012 Olympic Games and developments in the Bow area, demonstrates that water can be used with either conventional barges or pontoons.

11.1.26 From an air quality stand point, water has an advantage over road and is very likely to offer lower emission levels, especially if the journey distance is very similar for both modes For example, Aggregate Industries at Bow is 14km by road and 11km by water, while the Port of Tilbury is 42km by road and 43km by water.

### Summary

11.1.27 Without actual information on the type and quantities of materials to be removed or delivered to/from Edmonton, it is difficult to assess whether water would be competitive, in price terms, with road transport.

11.1.28 For demolition waste, it is assessed that such materials would have to be transported to facilities on the River Thames and this would be somewhat involved, as barges that could navigate all waterways would be needed and changes of tugs required. This would have implications on cost and could only be properly assessed with full information of the demolition to take place, but does place doubt on the viability of water.

11.1.29 For loose bulk materials such as aggregates there is one supplier with direct access to the River Lee Navigation - Aggregate Industries at Bow. Providing a satisfactory means of loading barges at this supplier could be set up the transport of aggregate products could be easily moved from this location to Edmonton. Other suppliers are located on the Thames relatively close to the mouth of Bow Creek, deliveries from these would be more involved as barges that could navigate all waterways would be needed and changes of tugs required. The extent to which Ash Wharf could accommodate the deliveries would depend on available capacity if IBA were being removed by water.

11.1.30 For other materials and consignments much depends on where they are start their journey. If they arrive into the country by water, and could go through the Port of Tilbury, then there might be opportunities to tranship to barges. However, the quantity/volume would really determine the viability and practicality for the use of water, which are not expected to be that large. Overall, it is thought that transhipping from road or water to barge transport to Edmonton is not a viable option.

11.1.31 At this stage the use of water for demolition waste and materials deliveries should not be entirely ruled out, but of the materials that could be moved it is thought that delivery of aggregates offers the greatest opportunity.

## 11.2 Municipal Waste from Millfields Road Depot

11.2.1 Millfields Road Waste Depot is the location where London Borough (LB) of Hackney accepts commercial waste and is the depot at which the Borough's fleet of refuse collection vehicles (RCVs) are based. The depot is next to the River Lee Navigation and offers direct access to the waterway.

11.2.2 Statistics published by DEFRA show that in the period 2012/13 LB Hackney produced about 53,000Te of regularly collected household waste that did not go to recycling[16].Currently, this refuse is driven to Edmonton in the RCVs once they are full or at the end of their rounds. Assuming that the average payload of each RCV is 9Te, this equates to around 5,900 loaded trips per year. However, if the transport of other municipal waste on the River Lee Navigation was to materialise, this might offer an opportunity to transfer a large proportion of Hackney's delivery trips from road to water.

11.2.3 Based on the volume of waste stated above, it is estimated that, on average, it would require around two barges per day each carrying six containers to maintain a constant removal of arriving waste. The time for a round trip between Millfields Road Depot and Edmonton is estimated to be about 4.25

[16] Local Authority Collected Waste Management, DEFRA, November 2013

hours, which means one tug could achieve two round trips in a day[17]. However, to ensure an efficient operation could be maintained a minimum of two tugs would be needed.

11.2.4 It is assessed that there are two options to transport household waste from Millfields Road Depot to Edmonton via the River Lee Navigation:

i) integrating the transport of the Millfields Road household waste with the east London sourced operation; and

ii) setting up a standalone operation that would run parallel to the delivery of household waste from the east London source.

### Integrated operation

11.2.5 For this operation to work would require a surplus of empty containers on the principal Edmonton/Rainham/Barking transport cycle. The approach assumes empty containers being returned to Edmonton would be off-loading from the barges at the Millfields Road Deport. The full RCVs would drive to the depot where their waste would be unloaded and compacted into the returning, empty IBA containers. These would then be reloaded onto the barges and transported to Edmonton. for this and the standalone operation, suitable wharf and handling facilities would have to be provided by LB Hackney.

11.2.6 However, the modelling for Scenario 9 (180ktpa IBA to Rainham and 150ktpa municipal waste to Edmonton) indicated that the number of containers delivering IBA coincidentally equals the number required for delivery municipal waste, meaning that there are no surplus containers in the system. If the Millfields Road waste stream was to be included, it would require additional containers and barges to meet the demand empty containers being transported through the systems for delivery to Millfields Road, making the overall operation less efficient.

11.2.7 Given this need, integrating a Millfields Road waste stream with principal operation is discounted as not practical or viable.

### Standalone operation

11.2.8 This operation would be self-contained, require its own resources of barges, containers and tugs, and run in parallel to the principal IBA/municipal waste operation. However, it would also have to function within the parameters of the IBA and east London sourced waste deliveries. This option has been modelled to understand how the operation might fit with that of the IBA, and east London waste.

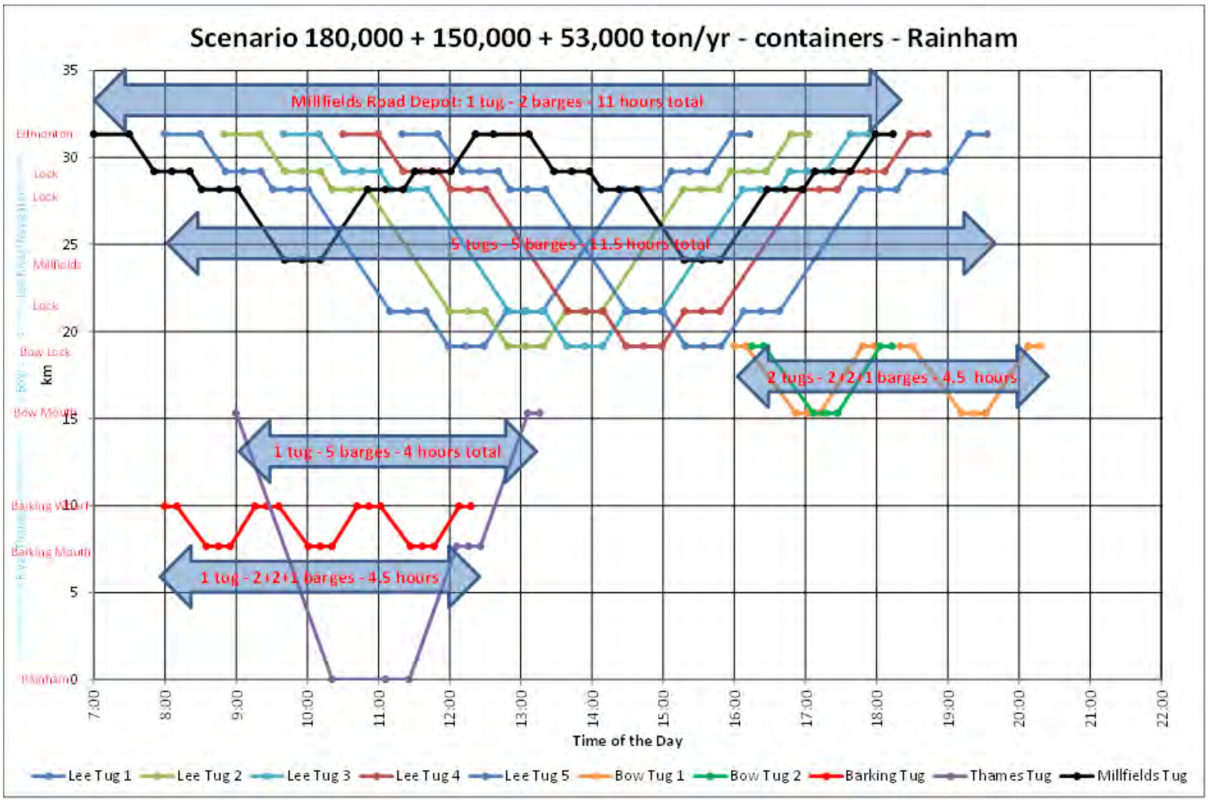
**Scenario Millfields Road: Containers from Millfields Road to Edmonton; 53,000Te pa municipal waste**

- **River Lee Navigation:** 2 round trips (one barge each) between Millfields Road and Edmonton daily;

11.2.9 It is suggested that the operation is completed on daily cycles, with the containers' capacity utilised at 88 per cent. The operation is illustrated as the black line in Figure 11-1 and is overlaid on the principal operation Edmonton/Rainham/Barking for IBA and municipal waste. .

17 Estimated using CanalPlan AC, http://canalplan.org.uk

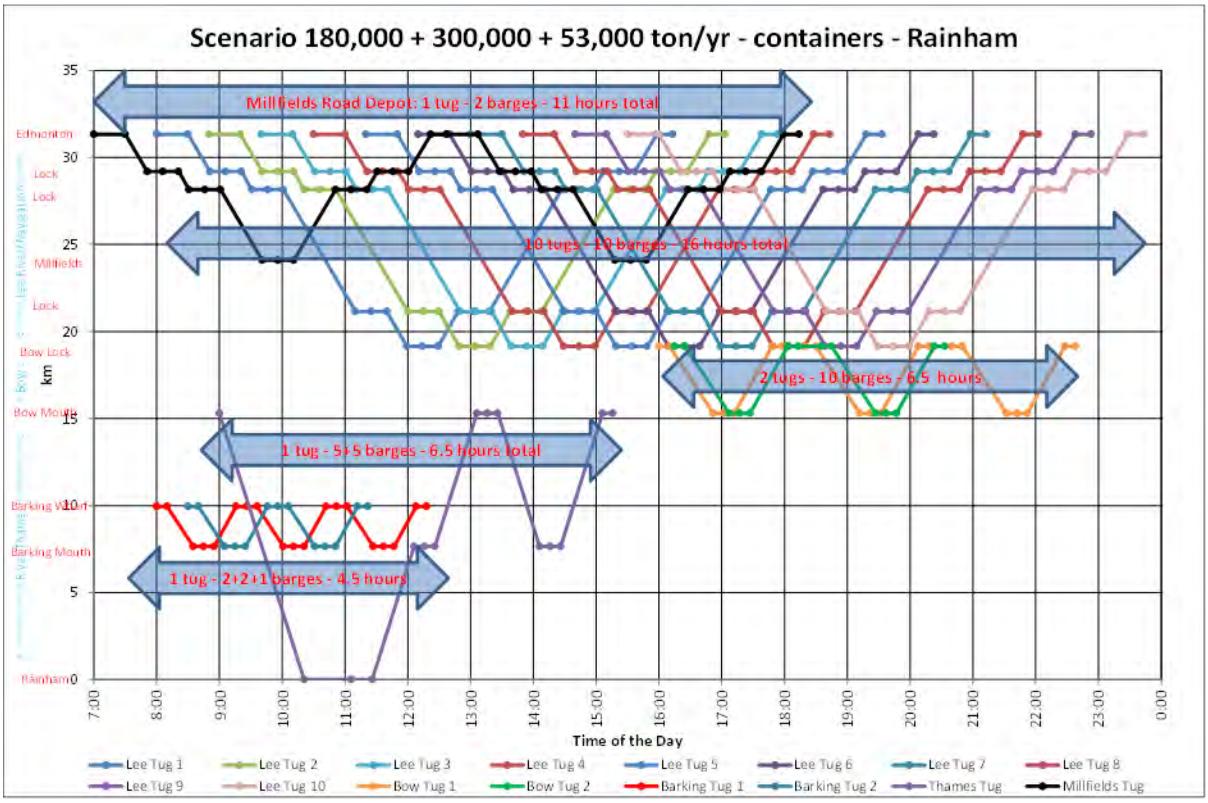
Figure 11-1: Schedule of barge operations Millfields Road to Edmonton overlaid on the Edmonton, Rainham Landfill and Barking Wharf - 180,000Te IBA & 150,000 MW per annum




11.2.10 From this modelling it is indicated that the Millfields Road operation could possibly be accommodated. However, it can be seen in Figure 11-1 that there is potential for conflict at Stonebridge and Tottenham Locks between the two operations.

11.2.11 In Figure 11-2, the Millfields Road operation is overlaid on the principal operation Edmonton/Rainham/Barking for where 180ktpa of IBA and 300ktpa of municipal waste are transported. In this diagram it can be clearly seen that the Millfields Road operation would conflict with that of Edmonton on six occasions at the locks, as well as at Edmonton’s Ash Wharf.

Figure 11-2: Schedule of barge operations Millfields Road to Edmonton overlaid on the Edmonton, Rainham Landfill and Barking Wharf - 180,000Te IBA & 300,000 MW per annum




11.2.12 The estimated equipment requirement for an operation involving Millfields Depot is shown in Table 11-2. This is based on the assumption that two tugs would each perform one round trip per day moving one barge, carrying six containers.

Table 11-2: Estimate of tugs, barges and containers for transporting municipal waste from Millfields Road Depot

| Equipment required | Units |
|---|---|
| Tugs | 2 |
| Barges | 4 |
| Containers | 18 |
| Container contingency | 9 |

11.2.13 It is estimated that, overall, 27 containers would be required to cover fluctuations in the quantity of waste in the system.

### Estimated cost

11.2.14 For both of the operations from Millfields Road the level of equipment and therefore the cost would be the same.

11.2.15 For the operation it is assessed that the unloading and loading of containers at Millfields Road could be achieved with the use of a reachstacker. The 53,000Te of waste is estimated to require 3,786 container trips, which would require approximately 7,572 lifts on and off of barges. Assuming 258 working days per year this is equivalent to about 30 lifts per day or about 4 per hour over an eight hour working day. It is anticipated that a single container could be lifted into/out of a barge in no more than 3 minutes which means around 20 lifts an hour could be achieved, more than required for the number of containers that would have to be handle in a day. Based on this handling rate assumption, it is assessed that a reachstacker would be sufficient for handling containers on and off barges at Millfields Road, and therefore the design of the wharf would be relatively simple and not require a gantry crane operation. An estimate of the capital costs has been made for this Millfields Road operation, which are presented in Table 11-3.

Table 11-3: Estimate of capital cost for Millfields Road operations

| Capital cost items | Units | Cost |
|---|---|---|
| **Annual tonnage** | **53,000t** | |
| Wharf | 1 | £566,000 |
| Reachstacker | 1 | £350,000 |
| Tugs | 2 | £132,000 |
| Barges | 4 | £440,000 |
| Containers | 27 | £162,000 |
| **Total** | | **£1,650,000** |

11.2.16 Table 11-4 presents estimates of the annual depreciated costs, which are assumed to 25 years for all, except for the reachstacker which is eight years with no residual value.

Table 11-4: Estimate of depreciated capital cost for Millfields Road infrastructure

| Capital cost items | Cost |
|---|---|
| **Annual tonnage** | **53,000t** |
| Waterways infrastructure | 8,000 |
| Wharf construction | 22,600 |
| Containers | 6,480 |
| Tugs & barges | 22,900 |
| Reachstacker | 43,800 |
| **Total** | **103,780** |

11.2.17 The yearly operating costs take account of running the barge operation from Millfields Road and include contribution to the waterway and infrastructure, based on the additional quantity of waste (approximately 17 per cent). The estimated annual costs for the Millfields Road barge operation is presented in Table 11-5

Table 11-5: Estimate of capital cost for Millfields Road operations

| Capital cost items | Cost |
|---|---|
| **Annual tonnage** | **53,000t** |
| Waterways infrastructure | £8,000 |
| Waterways maintenance | £2,550 |
| Wharf construction | £22,600 |
| On-Site Haulage Costs | £450,200 |
| Barge Loading Costs | £121,100 |
| Transport Costs - Lee Navigation | £263,200 |
| Total | £867,650 |
| Cost per tonnes | £16.37 |

11.2.18 The cost of introducing and running the Millfields Road transport is estimated as being quite high when viewed on a cost per tonne basis. This is because the quantity of waste is relatively low and whole new transport system has to be implemented.

### Other considerations

11.2.19 In addition to the direct operations outlined above, transporting municipal waste from Millfields Road Depot is thought to have other implications that are not costed into this assessment:

- to move containers on-site at Edmonton may require an additional hooklift lorry;
- the additional containers at Edmonton might impact upon storage space on Ash Wharf and therefore a further storage area could be required and the need for a reachstacker to handle containers around this area;
- containers used for the Edmonton and Millfields Road operation would have to be interchangeable, as keeping them separate would require alternative holding areas for each and have an impact on the operational efficiency of the wharf;
- although the modelling indicates that Ash Wharf could accommodate the additional barges, the on-site retrieval and provision of empty and full containers would have to be well managed, as the combined activity of both operations is likely to place the wharf at close to capacity;
- it is assessed that a container operation to Edmonton from Millfields Road would be difficult to introduce if the removal of IBA was as loose bulk in hopper barges. The primary constraint is considered to be accommodating of both operations on Ash Wharf as the water frontage is in the region of 35m and two different crane operations would have to share the space. A finger dock layout (see Sketch 4 in Appendix H) might alleviate this conflict, but this has not been examined in this study.

### Summary

11.2.20 Two alternative options to deliver municipal waste from Millfields Road Depot to Edmonton were considered: integrated with the Edmonton IBA and municipal waste operation; and a standalone operation. The modelling demonstrated that the integrated approach was not practical or viable and therefore discounted.

11.2.21 The Millfields Road standalone operation would have to fit with the Edmonton IBA and municipal waste operation, but the modelling indicated that this could only be achieved on the lower municipal waste quantity of 150,000Te p.a.

11.2.22 It has been assessed that an operation from Millfields Road could be accommodated using a plain wharf and a reachstacker for container handling. However, even with this more modest cost approach the cost per tonne of waste handled would still be high.

11.2.23 There are a number of factors not costed into the assessment that might impact upon the overall cost of handling the Millfields Road waste at Edmonton.

11.2.24 There are doubts as to whether Millfields Road waste could be delivered to Edmonton by water if IBA was being removed as a loose bulk commodity, due to wharf operation constraints.

## 11.3 Conclusions

### Demolition waste and construction materials

11.3.1 There are no demolition waste facilities along the River Lee Navigation, meaning these materials would have to be transported to those available on the Thames. To do this would require barges that could navigate both waterways, and it is not clear whether such barges exist.

11.3.2 If IBA operations were running, spare barges might be able to remove demolition waste, but at this stage it is not clear if Ash Wharf could accommodate both operations and whether there would be spare barges.

11.3.3 At this stage it is not possible to state conclusively or not whether demolition waste could be removed by water as there too many unknowns. However, given the locations of the demolition waste facilities and what is needed to reach them, water does not present the most attractive option.

11.3.4 In the case of construction materials, at this stage only the delivery of aggregates is felt to offer the best opportunity.

### Municipal Waste from Millfields Road Depot

11.3.5 Since the primary activity of transporting IBA and municipal waste by water to/from east London would maximise the use of containers in that system, there is no scope to integrate further quantities of municipal waste from Millfields Road Depot.

11.3.6 The inclusion of further containers and barges into the primary IBA and municipal waste operation would have an impact on the over efficiency and cost of that operation. Consequently, an operation to move municipal waste from Millfields Road Depot to Edmonton would have to be separate to the primary water transport activity.

11.3.7 Any standalone operation from Millfields Road Depot to Edmonton would have to fit with the primary activity of transporting IBA and municipal waste to/from east London. The modelling shows this as possible for Scenario 9, but not practical proposition for Scenario 10. However, even in the case of running alongside Scenario 9, there would be potential conflicts at locks as barge movements from the two operations could very easily coincide.

11.3.8 It is assessed that a plain wharf and reachstacker would be sufficient for a container handling operation at Millfields Road Depot. The cost of installing the wharf is relatively modest (about £600,000). However, the relatively low quantity of waste that would be transported by water means the cost per tonne is going to be high when the whole operational cost is taken into account.

11.3.9 Although not included in the costing, there are other potential costs for Edmonton as additional equipment or space might be required to provide to accommodate the Millfields Road waste.

11.3.10 Given the prevailing factors and potential impact a Millfields Road operation might have on the primary water transport, it is assessed that the delivery of waste from the Millfields Road Depot is not practical or viable.

# 12 Conclusions

12.1.1 The overall conclusions to the study are set out below.

## 12.2 Road transport options

12.2.1 Road transport is a relatively straightforward transport solution, using equipment that is readily available and commonly used in the logistics sector.

12.2.2 The failure of vehicles or absence of drivers can be easily remedied in the short-term through the spot hire market or agencies.

12.2.3 The overall number of daily trips to move the IBA is relatively modest with the lowest being 30nr 1-way journeys/day for 106,000tkpa to 48nr 1-way journeys/day for 180,000tkpa. Over a an eight hour day this equates to approximate 4 to 6 vehicles movements per hour.

12.2.4 It is important to optimise the transport flow and therefore it is a prerequisite to use articulated lorries capable of carrying at least a 22Te payload.

12.2.5 The overall capital investment for a road operation transporting 106,000Te of IBA between Edmonton and Rainham Landfill (Scenario 1), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£4.8M**.

12.2.6 The overall capital investment for a road operation transporting 106,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 2), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£4.7M**.

12.2.7 The overall capital investment for a road operation transporting 140,000Te of IBA between Edmonton and Rainham Landfill (Scenario 3), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£6.3M**.

12.2.8 The overall capital investment for a road operation transporting 140,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 4), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£6.2M**.

12.2.9 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham Landfill (Scenario 5), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.3M**.

12.2.10 The overall capital investment for a road operation transporting 150,000Te of Municipal Waste between Barking Creek and Edmonton (Scenario 6), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£6.3M**.

12.2.11 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 7), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.0M**.

12.2.12 The overall capital investment for a road operation transporting 300,000Te of Municipal Waste between Barking Creek and Edmonton (Scenario 8), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£11.7M**.

12.2.13 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 150,000Te of municipal waste to Edmonton (Scenario 5 plus Scenario 6) taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.3M** for the IBA and **£6.3M** for the municipal waste.

12.2.14 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 300,000Te of municipal waste to Edmonton (Scenario 5 plus Scenario 8) taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£7.3M** for the IBA and **£11.7M** for the municipal waste.

12.2.15 The amount of $CO_2e$ emissions from the road transport operations is estimated to be between 36 and 64 per cent higher than if using water, depending on the water operation used.

## 12.3 Water transport option

12.3.1 Works would be required to bring the waterway and locks up to a standard that can support continuous water transport between Edmonton and Bow Locks.

12.3.2 Lock restoration and upgrade should include the provision of an automated lock setting system, which can exploit current and future telecommunications technology. Suitable safety systems would need to accompany this approach such as a fenced off lock and a visual and audible warning system

12.3.3 Lock gates have been renewed in last 11 years and it is considered they will last the duration of a 25 year contract, notwithstanding periodic painting and maintenance.

12.3.4 There might be a need to provide alternative landing stages at the locks that would be form commercial boat operators use only.

12.3.5 The waterway is unlikely to need dredging in order to start barge operations. However, it is thought that there would be a need to carry out spot dredging as and when necessary.

12.3.6 It is estimated that to bring the locks up to a commercial operational standard will cost approximately £740K to £1.2M.

12.3.7 The constraining lock on the dimensions of barges is Old Ford, which was measured as 24.75m long by 5.59m wide. With respect to air draught, the critical bridge soffit is on Lea Bridge, which was measured as 2.43m above water.

12.3.8 The space available on Edmonton wharf is quite constrained, but could be expanded by up to 80 per cent if it was possible to build a culvert over the drainage channel at the rear of the site. This will require further investigation, but is considered to broaden the operational potential if this were possible.

12.3.9 The type of wharf handling equipment would depend on the water operation chosen. For movement of loose bulk IBA an excavator would be suitable, but if containers are used it is felt that an on-shore cantilever gantry crane would be the most efficient option for lifting containers on/off barges. However, the main drawback with this latter proposal is the lack of access to the waterway using the wharf in the event of mechanical problems.

12.3.10 The Edmonton wharf will require a complete rebuild in order to ensure it is of a standard to meet the demands of accommodating an excavator or container crane. It is estimated that the cost to develop the wharf and install the handling equipment would range between £500,000 and £2M. A full engineering assessment determine the exact extent of the works required

12.3.11 The number of tugs and barges required to support the water operation is dependent upon the location of the IBA processing facility and if municipal waste water delivered to Edmonton by water. While it is estimated that the numbers used on the Thames and its tidal creek are in the order of one or two, for the River Lee Navigation the range is between four and eleven. For barges, it is estimated that between 16 and 68 would be required.

12.3.12 The overall capital investment for a water operation transporting 106,000Te of IBA between Edmonton and Rainham Landfill (Scenario 1), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£14.3M**.

12.3.13 The overall capital investment for a water operation transporting 106,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 2), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£12.6M**.

12.3.14 The overall capital investment for a water operation transporting 140,000Te of IBA between Edmonton and Rainham Landfill (Scenario 3), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£18.2M**.

12.3.15 The overall capital investment for a water operation transporting 140,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 4), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£14.6M**.

12.3.16 The overall capital investment for a water operation transporting 180,000Te of IBA between Edmonton and Rainham Landfill (Scenario 5), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£18.5M**.

12.3.17 Scenario 6 is not been considered separately for water, but assessed as part of Scenario 9.

12.3.18 The overall capital investment for a water operation transporting 180,000Te of IBA between Edmonton and Greenwich Aggregates Zone (Scenario 7), taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£15.4M**.

12.3.19 Scenario 8 is not been considered separately for water, but assessed as part of Scenario 10.

12.3.20 The overall capital investment for a water operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 150,000Te of municipal waste to Edmonton (Scenario 9). taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£25.0M**.

12.3.21 The overall capital investment for a road operation transporting 180,000Te of IBA between Edmonton and Rainham and delivering 300,000Te of municipal waste to Edmonton (Scenario 10) taking into account the renewal of mobile equipment over the 25 year period, is estimated to be approximately **£48.7M**.

## 12.4 Combined use of road and water transport option

12.4.1 The transport scenarios assessed offer the opportunity to combine the road and water options for the removal of IBA from and delivery of municipal waste to Edmonton. The overall cost would depend on the location of the IBA processing facility and municipal waste source, but are estimated as shown in Table 12-1.

Table 12-1: Indication of transport costs if other combinations of road and water are used

| Combined scenarios | IBA | MW | Total |
|---|---|---|---|
| 180k Te IBA to Rainham by Water<br>150k Te MW to Edmonton by Road | £18.5M | £6.3M | £24.8M |
| 180k Te IBA to Greenwich by Water<br>150k Te MW to Edmonton by Road | £15.5M | £6.3M | £21.8M |
| 180k Te IBA to Rainham by Water<br>300k Te MW to Edmonton by Road | £18.5M | £11.7M | £30.2M |
| 180k Te IBA to Greenwich by Water<br>300k Te MW to Edmonton by Road | £15.5M | £11.7M | £27.2M |

## 12.5 Barging operations

12.5.1 The operation will need to ensure that a sufficient quantity of full and empty barges or barges/containers are positioned at the right locations for uninterrupted processing and transport of IBA and MW to takes place.

12.5.2 The most efficient use of barge resources on the River Lee Navigation is to have one tug move one barge for the entire journey up or down the waterway.

12.5.3 In the area of pontoon moorings north of Stonebridge Lock it would be necessary to ensure no boats moor opposite, or on the approaches to, this section of the waterway to prevent navigation constraints.

12.5.4 Although other leisure craft are moored along the length of the Lee Navigation, these are unlikely to be significantly affected by the barge operations in case of only IBA transport. However, if IBA and MW are moved the frequency of daily trips would be much higher and a potential impact needs to be recognised.

12.5.5 The most sensitive issue would be accommodating the rowing club activities which have developed in the absence of water freight on the Lee. This group is likely to be concerned about the re-introduction of freight services, and whilst the Lee is classed as a Commercial Waterway, early dialogue with the club is advised, if the decision is made to use water transport.

12.5.6 Barge traffic is unlikely to cause bank erosion due the predominantly steel and concrete campshot embankment, but its wash could disturb artificial habitat placements.

12.5.7 It would be necessary that the provision of fuelling, welfare and servicing of craft be fully considered in any contractual arrangements for the supplier of the barge services.

## 12.6 Potential risk

12.6.1 Generally, the risks to a water operation a considered to be relatively low risk. However, closure of the waterway for maintenance and a failure of a crane in the case of transporting containers are regarded as high risk, while freezing of the waterway or difficulties with water depth are thought to pose a medium to high risk.

## 12.7 Overall conclusion

12.7.1 The potential to transport IBA from Edmonton is considered to be a technically feasible option and the River Lee Navigation has the capacity to accommodate annual flows of 106,000Te, 140,000Te and 180,000Te. When combined with the delivery of municipal waste from East London, the modelling has shown that 150,000Te to Edmonton by water would be achievable. For the higher quantity of 300,000Te, the capacity of the overall system is nearing its limit. An issue with this scenario would be shear number of containers and rapidity at which they can be handled, turned round and if necessary stored; this operation would also have to extend into a double shift pattern and require running barges on the River Lee up between 07.00 and 23.00 hours.

12.7.2 The assessment has examined a water transport option to move IBA, and possibly municipal waste, using a waterway that is likely to require enhancement, as well as the provision of necessary infrastructure to support the operation at Edmonton. The work carried out indicates that a high level of investment would be required to commence a water-based scheme, even if it is only for transporting IBA as a loose bulk commodity in barges.

12.7.3 Without such investment the use of water as a means of transport would not be feasible. By comparison road transport has a readymade infrastructure and would only require the procurement of the necessary vehicles and handling plant.

12.7.4 While the initial investment cost is greater than that needed for road transport, the on-going operations and maintenance costs are also estimated to be higher, as the water operation involves several transport legs that incur their own costs and which are not applicable to road.

12.7.5 However, counter to the capital and operational cost is the question of environmental impact from using lorries. Overall, road transport is shown to produce higher levels of $CO_2e$ per annum. Furthermore, this assessment has not considered the total air quality impact resulting from the emission of Particular Matter ($PM_{10}$ and $PM_{2.5}$) and $NO_x$, the concern about which is rising up the political agenda.

12.7.6 Any decision to adopt water transport will require engagement with stakeholders, including CRT, the PLA, London planning authorities, the Environment Agency and groups that use the River Lee Navigation for leisure and other activities.

12.7.7 For the transport of demolition waste and construction materials, it is assessed that only the delivery of aggregates offers the best opportunity at this time.

12.7.8 With regards to the delivery of household waste from the Millfields Road Depot, given the potential impact this operation might have on the primary water transport, it is assessed that this is not practical or viable option.

## North London Waste Authority

# Review of the feasibility to transport Incinerator Bottom Ash and Municipal Waste to Edmonton EcoPark by water

## Final Report Appendices

**Project Ref: 30996**

**Doc Ref: R01**

**30 March 2015**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# Review of the feasibility to transport Incinerator Bottom Ash and Municipal Waste to Edmonton EcoPark by water

Final Report Appendices

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# Review of the feasibility to transport Incinerator Bottom Ash and Municipal Waste to Edmonton EcoPark by water

Final Report Appendices

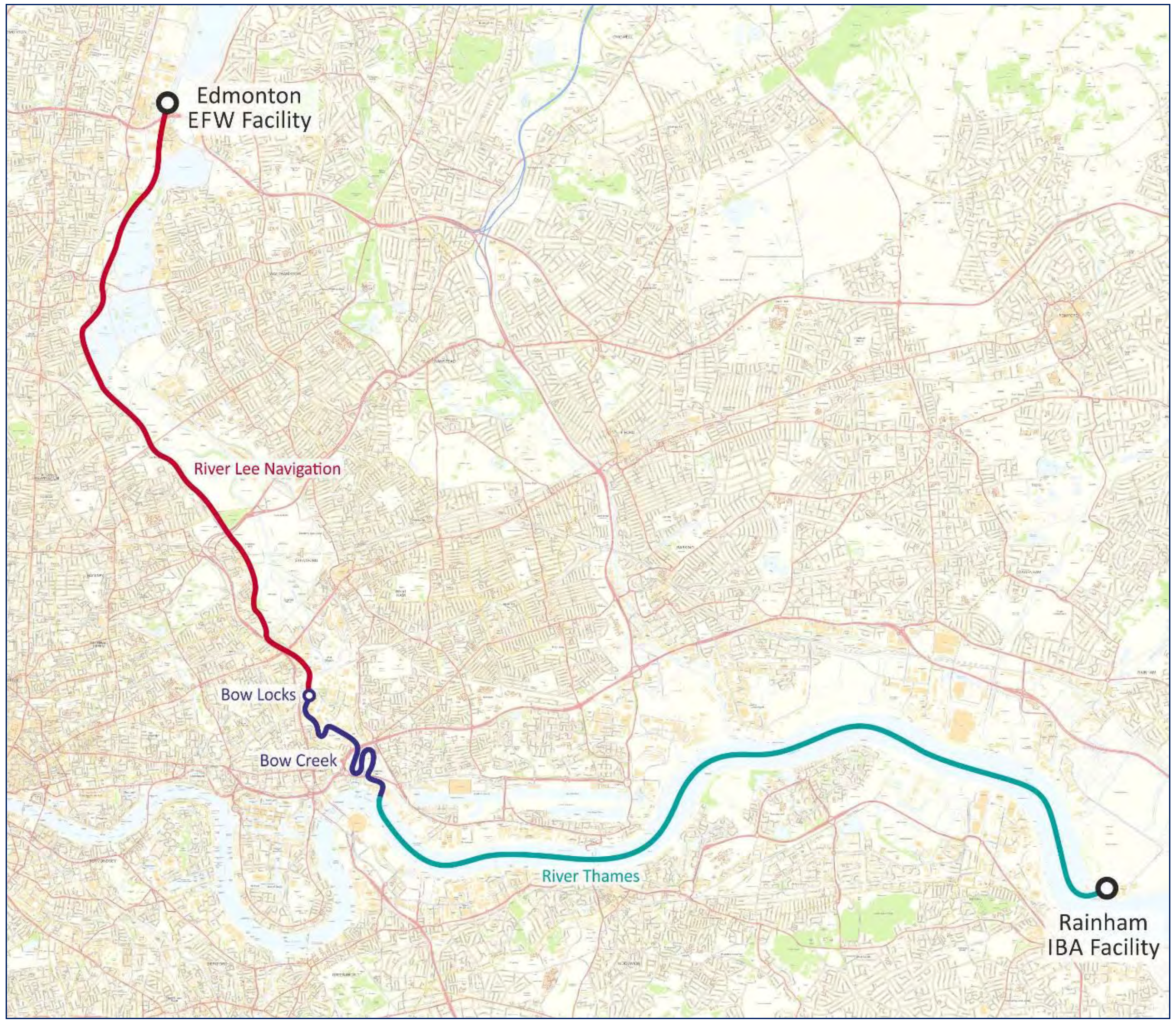
# Appendices

## Glossary

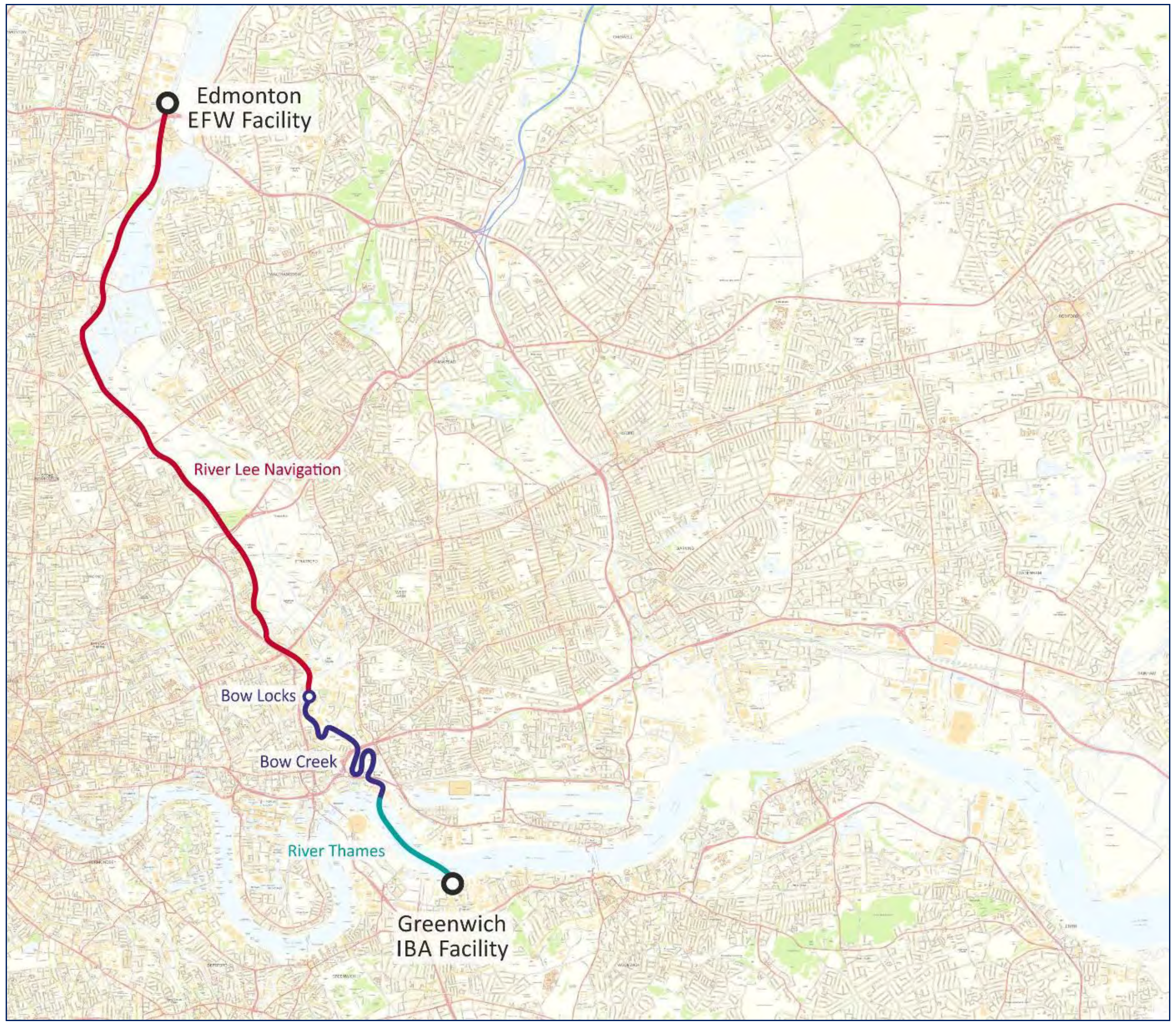
| | |
|---|---|
| Air draught | Headroom required to pass under structures |
| Beam | Width of water craft |
| $CO_2$ | Carbon dioxide |
| CRT | Canal and River Trust |
| Cu M | Cubic metre |
| DEFRA | Department for Environment, Food and Rural Affairs |
| DfT | Department for Transport |
| Dumb barge | Barge that does not have a motor and has to be moved by a tug or workboat |
| EcoPark | North London Waste Authority site at Edmonton |
| EfW | Energy from Waste |
| Euro V or VI | Emission standards for commercial vehicle diesel engines |
| GHG | Greenhouse Gas |
| HGV | Heavy Goods Vehicle |
| GLA | Greater London Authority |
| GVW | Gross Vehicle Weight |
| Kpa | Thousand per annum |
| LBE | London Borough of Enfield |
| NLWA | North London Waste Authority |
| NLWP | North London Waste Plan |
| NPPF | National Planning Policy |
| PLA | Port of London Authority |
| Reachstacker | Machine for lifting and moving containers |
| RLN | River Lea Navigation |
| SRF | Solid Recovered Fuel |
| T or Te | Metric tonne |
| TEU | Twenty-foot Equivalent Unit |
| TfL | Transport for London |
| TKm | Tonne Kilometres |
| £/Te | Cost unit per tonne |

## Appendix A: Location Maps

Water route to Rainham Landfill Wharf




Water Route to Greenwich Aggregate Zone

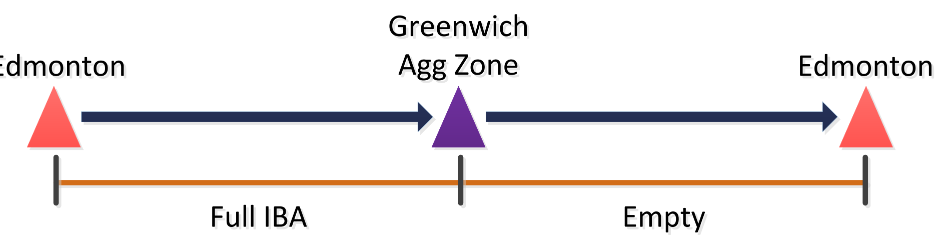


# Appendix B: Supply chains for road and water transport

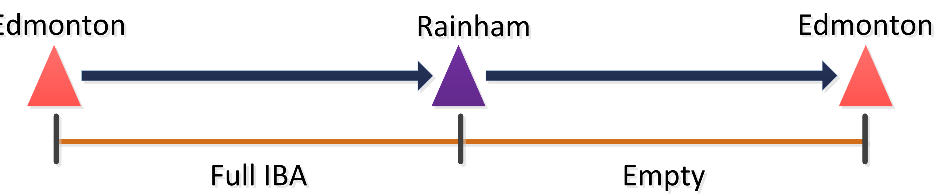
## Water route to Rainham Landfill Wharf and Greenwich Aggregate Zone

### Road Transport Options

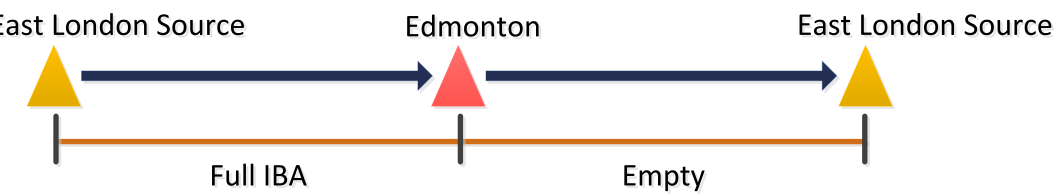
**Transport options: 106k IBA; 140k IBA; 180k IBA**




**Transport options: 106k IBA; 140k IBA; 180k IBA**



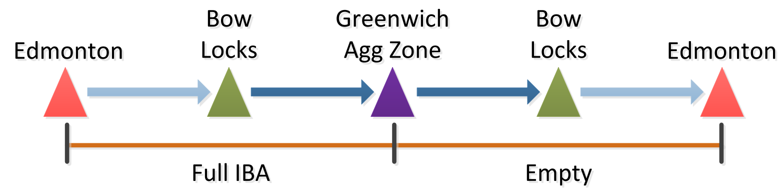

**Transport options: 150k MW; 300k MW**



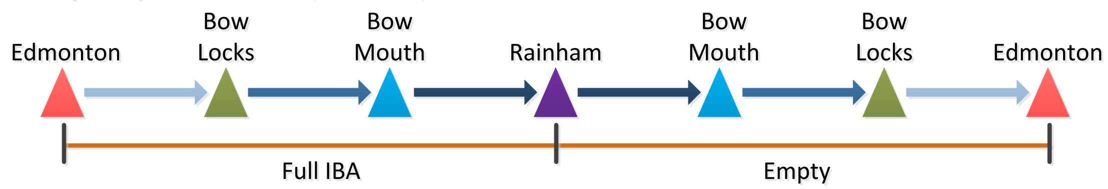

## Water Route to Rainham Landfill Wharf and Greenwich Aggregate Zone

### Water Transport Options

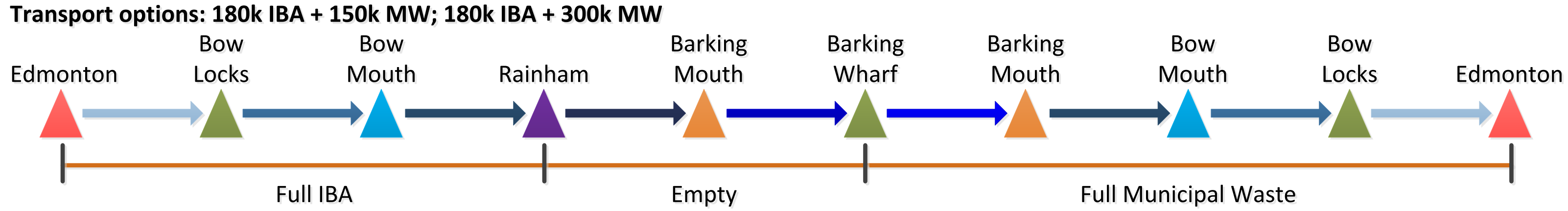
**Transport options: 106k IBA; 140k IBA; 180k IBA**




**Transport options: 106k IBA; 140k IBA; 180k IBA**




**Transport options: 180k IBA + 150k MW; 180k IBA + 300k MW**



# Appendix C: General assumptions for road and water transport

**Potential transport options:**

| Transport Scenario | Commodity | Tonnage | Origin | Destination | Water Distance (Km)* | Road Distance (Km)* |
|---|---|---|---|---|---|---|
| **Scenario 1** | IBA | 106kpa | Edmonton | Rainham Landfill | 31 | 26 |
| **Scenario 2** | IBA | 106kpa | Edmonton | Greenwich Agg Zone | 18 | 24.5 |
| **Scenario 3** | IBA | 140kpa | Edmonton | Rainham Landfill | 31 | 26 |
| **Scenario 4** | IBA | 140kpa | Edmonton | Greenwich Agg Zone | 18 | 24.5 |
| **Scenario 5** | IBA | 180kpa | Edmonton | Rainham Landfill | 31 | 26 |
| **Scenario 6** | Raw Waste | 150kpa | East London | Edmonton | 26 | 16 |
| **Scenario 7** | IBA | 180kpa | Edmonton | Greenwich Agg Zone | 18 | 24.5 |
| **Scenario 8** | Raw Waste | 300kpa | East London | Edmonton | 26 | 16 |

* This the distance for a 1-way trip

**Potential container sizes**

20ft long x 8.5ft high x 8ft wide
- capacity: 30.5m$^3$
- IBA and Municipal Waste payload for road transport: 11 tonnes
- IBA payload for water transport: 17 tonnes
- Municipal Waste payload for water transport: 14 tonnes

**Lorry size and capacity**

Articulated 44t GVW, 29t payload IBA loose bulk
22t payload Municipal Waste loose bulk
22t payload 2 x 11t containers

**Lorry trips per day**

| Transport Scenario | Tonnage | Origin | Destination | Number of trips p.a. |
|---|---|---|---|---|
| **Scenario 1** | 106kpa | Edmonton | Rainham LW | 3,655 |
| **Scenario 2** | 106kpa | Edmonton | Greenwich AZ | 3,655 |
| **Scenario 3** | 140kpa | Edmonton | Rainham LW | 4,828 |
| **Scenario 4** | 140kpa | Edmonton | Greenwich AZ | 4,828 |
| **Scenario 5** | 180kpa | Edmonton | Rainham LW | 6,207 |
| **Scenario 6** | 150kpa | East London | Edmonton | 6,818 |
| **Scenario 7** | 180kpa | Edmonton | Greenwich AZ | 6,207 |
| **Scenario 8** | 300kpa | East London | Edmonton | 13,636 |

**Barge and tug capacity**

Carrying:
IBA - 20ft containers: 6 x 17Te = 102Te
Municipal waste - 20ft containers: 6 x 14Te = 84Te
1 barge per tug on River Lee
2 barges per tug on Bow Creek and Barking Creek
3 to 6 barges per tug on River Thames

**Barge trips per annum**

| Transport Scenario | Tonnage | Origin | Destination | Number of trips p.a. from / to Edmonton |
|---|---|---|---|---|
| **Scenario 1** | 106kpa | Edmonton | Rainham L | 892 |
| **Scenario 2** | 106kpa | Edmonton | Greenwich AZ | 892 |
| **Scenario 3** | 140kpa | Edmonton | Rainham L | 1,167 |
| **Scenario 4** | 140kpa | Edmonton | Greenwich AZ | 1,167 |
| **Scenario 5** | 180kpa | Edmonton | Rainham L | 1,500 |
| **Scenario 6** | 150kpa | East London | Edmonton | n/a |
| **Scenario 7** | 180kpa | Edmonton | Rainham L | 1,500 |
| **Scenario 8** | 300kpa | East London | Edmonton | n/a |
| **Scenario 9** | 330kpa | Edmonton | Rainham L<br>East London | 1,785 |
| **Scenario 10** | 480kpa | Edmonton | Rainham L<br>East London | 3,570 |

**IBA Contract period**

25 years

**Depreciation**

Assumes straight line depreciate with zero residual for equipment that is replaced on regular periods, such as lorries and reachstackers

**Time**

258 days per year
10 hours per day

# Appendix D: Types of equipment for road and water transport

# Equipment

This appendix outlines the type of equipment that would be required for the various transport operations to move IBA and Municipal Waste by road and water. Generally, the equipment will be standard, but some items will be of a bespoke design to fit the local conditions.

In selecting the equipment it has been the aim to choose plant and machinery that would offer the best economic and functional value, although the final selection should be full assessed and compared. Some equipment is included as it is NLWA's preference to use certain handling methods for containers; these are addressed below.

## Loose bulk IBA

**On-site handling:**
Loading of vehicles would be completed by mechanical shovel, which are commonly used industries where large quantities of loose bulk commodities have to be shifted or loading into vehicles.

For on-site transfers between the energy plant and wharf the choice is between using conventional tipper lorries or special list large volume dumper truck. Tipper lorries were selected as they are far cheaper to procure and two could be obtained with greater carrying capacity for a similar price to one dumper truck.

On the wharf an excavator grab was selected to load barges. This equipment is available with tracks or wheels and is of a similar cost and is commonly used for loading and unloading barges and is available in long reach format for this work.

**Water transport:**
For the movement of bulk material, open hopper barges are commonly used and would be suitable for carrying IBA. They would be a bespoke designed to suit the IBA operation and for group towage, a lash system (enabling barges to be rigidly locked together so up to six could be moved at once on the Thames) would be required.

Tugs (also called workboats) would be multipurpose for pushing and pulling barges. Three types would be required to work the Lee Navigation canal, Bow Creek and Barking Creek (small tidal rivers), and the River Thames. They would have to be designed to meeting Canal and River Trust, Port of London Authority and Marine Management Organisation requirements.

**Road transport:**
To move IBA by road the choice is to use standard 44t articulated tipper lorries, which are commonly used in the aggregates industry.

## Containerised IBA and municipal waste

**On-site handling:**
NLWA would like to use containers that can be self-loaded by hooklift lorries and therefore incorporate the necessary hitching point. Containers would be designed for use in the waste industry, but would comply with ISO dimensions and handling requirements.

On-site transport of containers is assumed to be carried out by hooklift lorries that are equipped with a self-loading mechanism which is commonly used in the waste industry. The lorry itself is a standard 32t rigid vehicle, available from all heavy goods vehicle manufacturers.

At the wharf a gantry crane system has been selected as they are efficient at loading/unloading containers and used at four waste handling wharves on the Thames. For lifting containers in and out of barges a bespoke 'spreader' (container lift gear) has been selected and could have the capacity to lift four 20 foot container at once.

**Water transport:**
For the movement of containerised material, barges designed to specifically carry six containers would be required. The design would have to be such that they can work on the River Lee Navigation and the River Thames and the creeks, and for group towage, a lash system (enabling barges to be rigidly locked together so up to six could be moved at once on the Thames) would be required.

Tugs would be the same as for loose bulk above.

### Loose bulk municipal waste

**Road transport:**
To move municipal waste by road a 44t articulated lorry with an bulk ejector trailer, has been selected as these are commonly used for transporting waste between waste transfer station and to landfill.

### Other transport equipment in the is appendices by not costed into study

**Road transport:**
The use of containers that comply with ISO standards for handling, in the event of a difficulty with water transport a standard 44t articulated skeletal lorry could be used.

**On-site handling:**
The movement and stacking of containers and the potential loading/unloading of barges could be achieved with the use of reachstackers that are commonly used at port and rail terminals.

## Containers

It is assumed that both IBA and household waste would be transported in containers that are similar to those used in other operations - e.g. by Cory Environmental on the Thames and Shanks for rail. The containers used should comply with international dimension standards (ISO) in terms of dimensions, referred to as 20-foot (ft) containers and handling (twistlock lifting points).

However, it should be noted that within the ISO standards there are different heights containers. The original height standard was 8ft (2.44m) when containers were introduced in the early 1960s. Today the *defacto* height standard is 8’ 6”, as freight carried has become lighter and increased volume is required. The need for volume is also important in the carriage of household waste, given its low density, but not so critical for IBA which has a higher mass per cubic metre.

For the on-site movement of containers at Edmonton, NLWA have indicated that this would be carried out using lorries fitted with a hooklift system. As this system requires guide rails and rollers on the bottom of the container, it means the overall capacity of containers is reduced from that of a standard, non-modified unit, because the floor sits above the rails which are about 180cm high. It is estimated that the overall capacity of the 20ft container would be reduced by around 7 per cent.

Table 1, sets out the dimensions of the 8’ and 8’ 6” x 20ft container and includes a column that indicates the maximum volume for the hooklift variant of the same size. The 8’ 6” high container is used by Cory Environmental in their operation for Western Riverside Waste Authority.

Table 1: Container sizes

| Container type | Length | Width | Height | Tare weight [1] | Capacity (vol) | Max Capacity (weight) | Max Capacity (vol) |
|---|---|---|---|---|---|---|---|
| *20ft Container* | Metres | Metres | Metres | Tonnes | $m^3$ | Tonnes | $m^3$ |
| 8ft high | 6.09 | 2.44 | 2.44 | 2.5-3.5 | 31 | 28 | 28.5 |
| 8’ 6” high | 6.09 | 2.44 | 2.59 | 2.5-3.5 | 33 | 30 | 30.5 |

[1] Unladen weight of container, vehicle or vessel

The final design specification of the containers would be in line with those currently used for rail and water waste transport - e.g. constructed from steel to a ribbed sided design, with twistlock lifting points.

The maximum payload capacities of the containers are much higher than required for transport of the IBA and household waste, due to the weight restrictions for road and water(2). The working capacities for the container would be in the region of 11Te and 17Te for road and water haulage, respectively.

The mass densities of IBA and household are an important consideration in the loading of containers, since these will determine whether the commodities need compacting into the containers. To show the likely impact that the density would have on payload, Table 2 sets out the estimated weights and volumes of IBA and Household Waste that containers could accommodate and whether compacting is required to meet the desired payload for movement by road and water.

Table 2: Container sizes and the quantity of IBA and Household Waste they could accommodate

| **20ft Container** | | **8’’’ High Max Payload (T)** | **8’’’ High Max Volume (Cu M)** | **Need for compaction** |
|---|---|---|---|---|
| **Container capacity** | | **26.6** | **28.5** | |
| IBA 2000kg/m$^3$ | 17Te payload (W) | 17 | 8.5 | × |
| | 11Te payload (Rd) | 11 | 5.5 | × |
| Household waste 500kg/m$^3$ | 14Te payload (W) | 14 | 28 | × |
| | 11Te payload (Rd) | 11 | 22 | × |
| | | | | |
| **20ft Container** | | **8’6” High Max Payload (T)** | **8’6” High Max Volume (Cu M)** | **Need for compaction** |
| **Container capacity** | | **28.5** | **30.5** | |
| IBA 2000kg/m$^3$ | 17Te payload (W) | 17 | 8.5 | × |
| | 11Te payload (Rd) | 11 | 5.5 | × |
| Household waste 500kg/m$^3$ | 14Te payload (W) | 14 | 28 | × |
| | 11Te payload (Rd) | 11 | 22 | × |

The quantity of household waste loaded into containers moved on the River Thames by Cory Environmental is 12.5Te, although for the purposes of this study a 14Te payload is assumed for waste transport from East London by water.

The cost to supply the containers varies from £6,000 to £10,000 per 20ft container, based on the quotations obtained from suppliers. The delivery lead time for this equipment is around 15 weeks.

The number of containers needed to meet demand is discussed in the Section 7 of the report.

## Mechanical shovel

This type of machinery is commonly used for loading loose materials into tipper vehicles and holds of barges and ships. It is able to operate in relatively confined areas and as it is mobile can be used at different locations. This equipment is available in a large range of sizes and the one chosen as an example for this study has a Tipping load of 8,500 kg and can be fitted with buckets ranging in capacity of between 2.1 and 6.0 m$^3$.

[2] Maximum road vehicle weight = 44Te; Water is constrained by available draft in the waterway and draft of the barge

Source: Liebherr website: Wheel loaders

The cost of the mechanical shovel is about £120,000, with maintenance cost of around £800 every 500 hours of use. Delivery lead times are between 12 and 16 weeks.

## Road lorry and trailers

The transport of IBA by road does not require any special equipment or container and could be carried out using an articulated bulk tipper, capable of carrying a load of up to 30Te.

### Containers

For the road option the most effective method to carry containers is to use a skeletal articulated trailer. This trailer comprises a basic solid frame on to which the container is loaded and is held in place by twistlocks [3]. The designs considered for the study are:

- 13.6 metre long semi-trailer for an articulated lorry fitted with 8 fixed twistlock locations for carrying two 20ft containers;
- 13.6 metre long semi-trailer for an articulated lorry with sliding cross beams that permit twistlock positions to be adjusted; and
- Bespoke length semi-trailer for an articulated lorry fitted with 8 fixed twist lock locations for carrying two 15 foot units

The maximum weight up to which an articulated lorry using a skeletal trailer can operate is 44Te gross vehicle weight (GVW) on six axles. The payload of IBA or household waste carried by the vehicles will depend upon the tare weight of the tractor and trailer and the container, and the mass density of the IBA and compaction rate of the household waste, but the maximum is estimated to be up to around 22Te.

In terms of procurement for a quantity of 2 to 5 trailers the lead time to supply could be expected to be around 10 to 12 weeks. The cost of the trailers is in the region of:

- £13,000 - for 20ft container with fixed position twist locks
- £14,000 - for twist locks on sliding beam
- £15,000 - for 15ft container with fixed position twist locks

[3] A twistlock and corner casting together form a standardised rotating connector for securing shipping containers. The primary uses are for locking a container into place on container ships, lorries or railway wagons; and for lifting of containers by container cranes and handlers.

Figure 1: Typical articulated lorry carrying waste container

Figure 2: Container with hooklift attachment

## Bulk articulated trailers

### IBA transport

Bulk trailers are essentially a hopper in which loose commodities can be carried - e.g. aggregates, grain, demolition waste, etc. They are available in various sizes and typically designed to suit the commodity they will be predominantly carrying. The maximum payload for such trailers is around 29 to 30 tonnes, although the cubic capacity is dependent on how voluminous the commodity is to be carried. For the purpose of the study it is assumed that unprocessed damped IBA has a density and volume similar to aggregates (2000kg/$m^3$ & 1.3 bulking factor) and would be transported in a 30$m^3$ articulated tipper trailer, as shown in Figure 3.

Figure 3: Articulated tipper lorry


Source: Wilcox Commercial Vehicles Ltd

The lead time to supply could be expected to be around 8 to 26 weeks. The cost of the trailers is in the range of £33,000 to £43,000.

**Raw waste transport**

Modern trailers for carrying raw waste are today designed to discharge without tipping. There are two type of trailer commonly used in the UK, one is a moving floor system that shifts the waste to the rear door by incorporating a floor comprising slats that move back and forth; the contents of the trailer a gradually shift to the rear of the trail and fall out. The second is an ejector trailer which incorporates moving front wall that pushes the contents out of the rear door. Both trailers are visually similar and can be top loaded but are covered when in transit.

Source: Newton Trailers Limited

The payload for such trailers is around 22 tonnes, although the cubic capacity is dependent on how voluminous the commodity is to be carried.

The lead time to supply could be expected to be around 8 to 26 weeks. The cost of the trailers is in the around of £46,000.

### Lorry tractor unit

The vehicles used for hauling either of the trailers could be purchased from any of the major manufacturers. Assuming they are new, the vehicles would comply with the latest European emissions standards, which from December 2013 increased to Euro VI, a more stringent restriction of pollutant emissions than previously required. Consequently, it is assumed that all vehicles used for transporting containers would comply with the latest standards.

The cost of a typical tractor unit is around £77,000 and would have to be added to the cost of either a skeletal or tripper trailer.

## On-site lorry transport

The on-site movement of IBA and potentially household between the energy plant and wharf at Edmonton will depend on the whether only IBA is exported or if a combined ‘IBA out/household waste in’ operation is adopted. This leads to two options: movement of loose IBA or IBA/household waste filled containers.

### Loose material

### Tipper lorry

If IBA is moved as a loose commodity, this could be carried out by a conventional 32 tonne rigid tipper lorry. The options are to use a body with a tailgate, or one without which would make unloading more efficient. However, there could be health and safety concerns on the latter option, although nontailgated dumpers are used on larger construction projects where substantial earthworks are involved. An example of tipper lorries unloading and fitted with a tailgate is shown in Figure 4.

Figure 4: Example of a rigid tipper lorry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The cost of tipper lorries is about £97,000

## Dumper trucks

This type of vehicle is specifically designed for moving large quantities of loose material. They are available in various formats, depending manufacturer. The cab unit is articulated and the lack of a rear tailgate permits quick and easy discharge of loads. Their carrying capacity for the type of work envisaged at Edmonton ranges from 11 to 15m$^3$, with a payload of 24 tonnes. Figure 1 illustrates the type of specialised dumper truck that could be used.

Figure 5: Specialised dumper truck for moving loose materials


Source: Volvo website: Volvo Construction Equipment

Engine emissions from 2014 have to comply with Stage IV standards as stipulated by European Commission Directives on emissions from non-road mobile machinery (NNMM) which apply to heavy port and construction plant.(4)

The cost of such equipment is around £180,000. Maintenance is typically charge at £2 per running hour with a service required every 500 hours. The delivery times are in the order of 6 to 8 weeks

[4] Directive 97/68/EC, the amendments Directive 2002/88/EC, Directive 2004/26/EC, Directive 2006/105/EC, Directive 2011/88/EU and the last amendment Directive 2012/46/EU

## Containerised material

As with loose IBA, if containers are used for the in- and outbound transport by water at the Edmonton facility, it will be necessary to transfer them between the EfW plant and wharf area. Given the likely configuration of the site following re-development this would require the use of some form of specialist truck or lorry. Two options for the carriage of the containers are considered possible:

- Specialised single seat 'tug' tractor unit and articulated trailer; or
- Rigid lorry fitted with a hooklift

## Tug and trailer

This equipment is specially designed for hauling containers and is widely used in the ports industry. The tug is essentially a lorry tractor unit with a single seat cab, which hitches to an articulated trailer. Its design means that it has good all-round vision for the driver and built specifically for short, stop-start type of work. Engine emissions from 2014 have to comply with Stage IV standards as stipulated by European Commission Directives on emissions from non-road mobile machinery which apply to heavy port and construction plant.

The trailers are designed to withstand the high levels of on/off loading that is associated with frequent container handling. They are available with or without suspension depending on the operating environment in which they are used. These trailers are not equipped with twist locks, but are fitted with raised rims in which the container sits to permit quick and uninhibited on/off loading.

Since the trailers are detachable one tug unit can potentially perform in the region of 180 round trips in a 9 hour shift (assuming it is hitching to trailers with preloaded full and empty containers). At the wharf, handling containers would be undertaken by the crane. However, at the processing plant it would require the use of a container handling machine.

The cost of the tug and trailer is in the region of:

- Tug tractor unit: £65,000
- Container carrying articulated trailer: £20,000

The delivery lead time for this equipment is around 16 weeks.

## Hooklift rigid lorry

This vehicle is a standard road going lorry that is fitted with a skeletal assembly and a hydraulic hooklift mechanism which lifts the containers on and off the vehicle. In order to ensure the vehicle is not overloaded, an 8 wheeled, 32Te GVW rigid lorry would be required. It is assumed a basic version of the vehicle would be obtained, as it would never travel on the public road network.

The engine would comply with a minimum emissions standard of Euro VI, since this standard becomes the legal requirement for commercial vehicles over 7.5Te from 2014.

The cost of the fully fitted hooklift vehicle is in the region of £96,000.

Figure 6: Hooklift lorry


Figure 7: Loading/unloading hooklift lorry

## Reachstackers/container handlers

These machines are used for loading containers on and off different modes of transport and moving them around at terminals. They are fitted with a lifting device called a ‘spreader’ which attaches to the corners of the containers using twistlocks. There are a number of variants that enable the machines to stack containers to different heights or load/unload barges where containers are loaded two abreast. The figures below illustrate the types of machines available (see Figure 8 and Figure 9).

Figure 8: Reachstacker loading a barge

Figure 9: Reachstacker stacking containers


Any machine used at Edmonton would require a reach capability to stack containers and the capability to lift containers in and out of barges or on and off lorries or on-site tractor/trailer vehicles.

The engines in this machinery would be compliant to Stage IV emissions standard which the legal requirement for such machinery from 2014.

The price of a reachstacker ranges between £300,000 for lifting and stacking machine and £350,000 for a machine capable of loading a barge. Maintenance is charged is typically charge at £7.50 to £10.50 per running hour and pro rata-ed over the weeks used if running times do not match the estimated maintenance contract. This rate will vary depending on the supplier.

The lead time for delivery would be up to 12 months depending on manufacturer and specification.

## Excavator

Excavator machines are available with either tracks (referred to as crawlers) or wheels and offer a versatile method of loading a barge with loose IBA with that is tipped on the wharf. They are able to swivel through 360° and can be fitted with different sizes and types of loading buckets.

Figure 10: Tracked excavator


Source: JCB Website

Figure 11: Wheeled excavator


Source: John Deere Website

The cost of these machines depends on the model and its specification, but they would probably be in the range of:

- Tracked excavator £75,000 to £100,000
- Wheeled excavator £100,000 to £140,000

Lead time for delivery on this type of equipment is typically between 8 to 12 weeks.

## Waterway tugs

### River Lee Navigation

The tugs would push/pull unpowered ‘dumb’ barges on the River Lee Navigation waterway. They will need to be sufficiently powerful to navigate and shunt barges that could be carrying payloads of around 120Te. To ensure that operations remain efficient, the tug design should include:

- a shallow draught (e.g.1m) such that the craft can navigate without fear of grounding on the waterway;
- a retractable propeller such that it can be lifted from the water to permit easy removal of weed and other items that might become ensnared;
- automated hitch mechanism for tethering barges, which would speed up turnaround times and improve health and safety;
- low or no emission propulsion system;
- raising and lowering wheelhouses to help tug crew see over the top of the empty containers; and
- installation of cameras in protective housings on the bows of the barge that link into a screen in the tug wheelhouse.

Operators’ opinions differ on the type of tug to be used for this operation. All agree that new vessels would be needed and that automated hitching systems and the latest engines and propulsion systems used. However, the two operators consulted for study have different views on the power of engines required and the cost to provide the craft.

Land and Water's view is that the tug should be fitted with an engine producing between 150 and 200 horse power (hp) and would cost in the region of £150,000. Wood, Hall & Heward are of the opinion that a tug powered by a 70 to 80hp engine would be sufficient and cost around £66,000.

Figure 12: Type of tugs used on Lee Navigation


For the purpose of the study it is assumed that the lower powered, less costly craft would be used.

### Bow Creek

The tugs used on Bow Creek and Barking Creek would have to be more powerful as they have to cope with tidal flows and stronger river currents. The design would be a similar, larger version of the canal tug (workboat) shown above, fitted with a 250HP engine.

The cost of such craft is in the order of £300,000.

## Barges

Any craft used on the waterway will have to comply with the maximum dimensions criteria stated by CRT to ensure that they fit into the locks efficiently and safely. According to CRT published information, barges used on the Lee Navigation between the River Thames and Ponders End must not exceed the following dimensions (CRT, 2012):

| Length | Beam | Headroom |
|---|---|---|
| 26m (85'3") | 5.69m (18'8") | 2.45m (8') |

However, measurements of the lock chamber dimensions made as part of the study suggest that a barge would not be able to exceed around 24m in length due the chamber length at Old Ford Lock.

The barges that could carry containers would be 'dumb' barges - they do not have their own propulsion and must be tow/pushed by a tug. Depending on the container size used, the maximum length would be around 24m long with a beam of up to 5.35m. The hold into which the containers would fit would be approximately:

- 18.3m long and 4.9m wide and would accommodate 6 x 20ft containers, that would fit 2 abreast across the beam and 3 in line along the length; and

The draught of the barge would have be about 1.3m, as it would need to provide an air draught (headroom to pass under low structures) of about 2.35m. Barges would be constructed from steel and be specifically designed to carry containers, including guides within the hold to aid the loading of containers.

The transport of empty containers will mean barges sitting higher in the water on the return journey from Bow Locks. As a result the view of the tug crew would be inhibited by the height of the container in front of them. The installation of cameras in protective housings on the bows of the barge that link into a screen in the tug wheelhouse could alleviate this difficulty. It would also reduce the risk of incident and remove the need for the use of ballast in the barge to adjust the trim in the water. Loading ballast at the wharf would extend the turnaround time of delivery and collection of barges and removal of this necessity would improve the overall system efficiency.

In order to be moved on the Thames, the barge would have to meet standards that enable it to navigate Class C waters, which means it would have to have a freeboard that could cope with 1.2m waves.

The cost of a barge is about £110,000. Maintenance to the hull (e.g. new steel plate and rubbing strips) is likely every 5 years and would cost around £20,000.

Figure 13: Modern barge on the Grand Union Canal

## Wharf cranes

Although there are many different types of crane that could handle containers on and off barges, after reviewing the options the design considered to be the most suitable for Edmonton is gantry crane.

This type of crane is the industry standard for handling containers on/off ships and barges at ports and wharves, and railway wagons at intermodal facilities. They are available in various formats depending on the operating environment and mode being served. Within London they are used by the waste management sector for handling containers at five wharves and one railway terminal. These are:

- Smugglers Way
- Cringle Dock
- Walbrook Wharf
- Northumberland Wharf
- Middleton Jetty
- Hendon Rail Terminal

Those used at five of the wharves are referred to as a cantilever design, whilst one wharf and the rail terminal use non-cantilever designs.

The cantilever design has the ability to lift containers outside of its upright supports, while it is set on rail tracks, to permit movement along a wharf, such that it has access to the entire moored vessel or train length. Containers are lifted using a spreader that is attached to the hoist mechanism and once airborne they can be moved within the crane's frame. The open framework of the crane permits containers to be stored between its travelling rails. Whilst a lift is taking place containers can be rotated through 90º such that they can be repositioned for ground storage or stacking, or loaded on to other transport.

The size of the cranes is dependent upon the operational demands it has to meet and the spatial environment within which it is located. Walbrook Wharf in the City of London (Figure 14) provides a good example of a gantry crane operating in a confined area, where it is used to handle 20ft waste containers on to river barges. The figures below illustrate how the cranes are designed to meet their operational and environmental requirements.

Figure 14: Walbrook Wharf, City of London

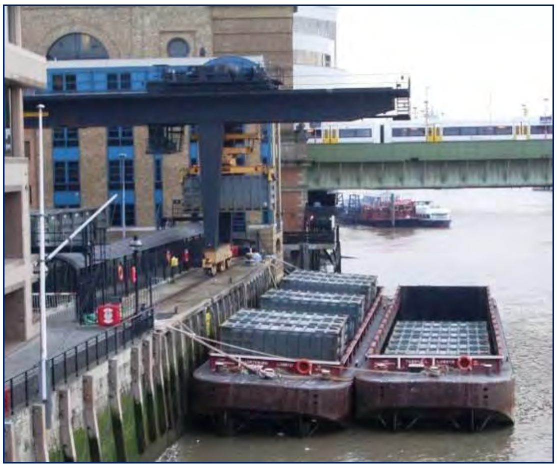


Figure 15: Smuggler's Way Wharf, Wandsworth

The overhead gantry crane comprises two upright supports and a cross beam along which the hoist mechanism and spreader operate. This design of crane is used in operations where it extends over the vessel or wagon it is loading and typically a parallel holding area for arriving, departing or stored containers. This type of crane is used at Cringle Dock on the Thames to handle containers where the barges are moored in a finger dock (5).

The cost of this type of crane is dependent upon the specification, but range from £850,000 to £1.5M. The study team has assumed the upper limit for its cost calculations as the exact specification of the cranes are not known for the study. In addition to this would be ground works which again vary in cost depending on ground conditions, but range from £300,000 to almost £1M.

The lead time to design, build and install the crane is around 30/32 weeks and within this period ideally the ground works should be completed.

[5] A finger dock is a facility that permits craft to moor out of the river or canal and is at angle (e.g. 90º) to the channel.

# Appendix E: Lorry operating cost assumptions

| | | |
|---|---|---|
| **Road vehicles (IBA loose bulk)** | | |
| Tractor Units | | £82,000 |
| Bulk Materials Trailers | | £38,000 |
| Licences | £/vehicle | £1,350 |
| Insurances | £/vehicle | £4,600 |
| Staff Costs | £/vehicle | £43,092 |
| Fuel | £/Lt | £1.13 |
| Lubricants | £/mile | £0.01 |
| Tyres & Maintenance - Tractor | £/mile | £0.13 |
| Tyres & Maintenance - Trailer | £/mile | £0.07 |
| Fuel consumption | mpg | 7 |
| **Road vehicles (MSW loose bulk)** | | |
| Tractor Units | | £82,000 |
| Bulk Materials Trailers | | £46,000 |
| Licences | £/vehicle | £1,350 |
| Insurances | £/vehicle | £4,600 |
| Staff Costs | £/vehicle | £43,092 |
| Fuel | £/Lt | £1.13 |
| Lubricants | £/mile | £0.01 |
| Tyres & Maintenance - Tractor | £/mile | £0.13 |
| Tyres & Maintenance - Trailer | £/mile | £0.07 |
| Fuel consumption | mpg | 7 |
| **On-site vehicles (Container op)** | | |
| Hooklift lorry | | £96,000 |
| Staff Costs hooklift | £/year | £40,432 |
| Fuel - hooklift | £/litre | £0.64 |
| Maintenance - Hooklift | £/mile | £0.18 |
| Fuel consumption | mpg | 4 |
| **On-site vehicles (IBA loose bulk)** | | |
| Tipper Lorry | | £97,000 |
| Staff Costs tipper | £/year | £40,432 |
| Fuel - hooklift | £/litre | £0.64 |
| Maintenance - tipper | £/mile | £0.18 |
| Fuel consumption | mpg | 4 |

# Appendix F: River Lee Navigation infrastructure budget

**Stonebridge**

| | Item | Cost | Notes |
|---|---|---|---|
| 1 | Installation of hydraulic control system | £90,000 | Information provided by Canal and Rivers Trust for typical control system refurbishments being carried out on the river. |
| 2 | New hydraulic pumps, rams and hoses | £40,000 | Based on Teddington Lock pre-PAR estimates + pump costs. CRT info suggested that electrical supply would be sufficient to power system. |
| 3 | Lock chamber refurbishment (brickwork repairs, repointing etc.) | £50,000 | £25k estimated in 2001 by CRT. Increased to allow for increased use of chamber and by larger barges meaning better condition required at start of project. |
| 4 | Improvement to downstream approach wall | £10,000 | £5k estimated in 2001 by CRT. Increased to allow for increased use of chamber and by larger barges meaning better condition required at start of project. |
| 5 | 2 no. 30m long sheet piled lay-bys at upstream and downstream ends of the lock. | £120,000 | Piling costs between £1500 and £1800/m based on EA UCD (£1.6k) and L&W estimates (£1.5k - £1.8k) for a 6m cantilevered pile length. Extra over costs for backfill (6A material or similar), mooring bollards and walkways = £2k/m run of wall. |
| 6 | Alterations to sluices to increase capacity | £40,000 | New sluice paddles. |
| | Total | £350,000 | |

**Tottenham**

| | Item | Cost | Notes |
|---|---|---|---|
| 1 | Installation of hydraulic control system | £90,000 | Information provided by Canal and Rivers Trust for typical control system refurbishments being carried out on the river. |
| 2 | New hydraulic pumps, rams and hoses | £40,000 | Based on Teddington Lock pre-PAR estimates + pump costs. CRT info suggested that electrical supply would be sufficient to power system. |
| 3 | Lock chamber refurbishment (brickwork repairs, repointing etc.) | £60,000 | £40k estimated in 2002 by CRT. Increased to allow for increased use of chamber and by larger barges meaning better condition required at start of project. |
| 5 | 2 no. 30m long sheet piled lay-bys at upstream and downstream ends of the lock. | £180,000 | Piling costs between £1500 and £1800/m based on EA UCD (£1.6k) and L&W estimates (£1.5k - £1.8k) for a 6m cantilevered pile length. Extra over costs for backfill (6A material or similar), mooring bollards and walkways = £2k/m run of wall. Note: off-shore layby required at upstream end for use by leisure boaters. |
| 6 | Alterations to sluices to increase capacity | £40,000 | New sluice paddles. |
| | Total | £410,000 | |

**Old Ford**

| | Item | Cost | Notes |
|---|---|---|---|
| 1 | Installation of hydraulic control system | £90,000 | Information provided by Canal and Rivers Trust for typical control system refurbishments being carried out on the river. |
| 2 | New hydraulic pumps, rams and hoses | £40,000 | Based on Teddington Lock pre-PAR estimates + pump costs. CRT info suggested that electrical supply would be sufficient to power system. |
| 3 | Lock chamber refurbishment (brickwork repairs, repointing etc.) | £50,000 | 2009 Principal Inspection identified eastern wall as in need of repair. |
| 4 | Repairs to downstream bullnoses and approach walls | £30,000 | Estimated based on visual inspection. |
| 5 | 2 no. 30m long sheet piled lay-bys at upstream and downstream ends of the lock. | £120,000 | Piling costs between £1500 and £1800/m based on EA UCD (£1.6k) and L&W estimates (£1.5k - £1.8k) for a 6m cantilevered pile length. Extra over costs for backfill (6A material or similar), mooring bollards and walkways = £2k/m run of wall. |
| 6 | Alterations to sluices to increase capacity | £40,000 | New sluice paddles. |
| | Total | £370,000 | |

**Remote operating system**

| | Item | Cost | Notes |
|---|---|---|---|
| 1 | Remote operating system | £50,000 | To include networked CCTV cameras, connections to the lock control software, laptops for each barge and the control room and any software needed to link everything up. |
| | Total | £50,000 | |

**GRAND TOTAL** **£1,180,000**

**MAINTENANCE COST ESTIMATES**

| | Item | Cost | Interval | Notes |
|---|---|---|---|---|
| 1 | Refurbishment of lock control system | £30,000 | 10 | Likely to include replacement ram seals, broken hoses and electrical components |
| 2 | Gate repainting/refurbishment | £60,000 | 25 | Gates to be lifted out and removed from site for complete repainting. 25 year interval is typical for repainting (depending on current spec) but gates could be up to 10 years old so repainting will be assumed necessary after 15 years from year 0. |
| 3 | Chamber refurbishments | £25,000 | 10 | Miscellaneous chamber refurbishments brick repairs, repointing etc. |
| 4 | General annual maintenance tasks | £10,000 | 1 | |

**Dredging**

Were any dredging to be required, it is thought that it would be limited to the section not previously dredged in 2009. This covered the stretch of watercourse from Tottenham Lock to Lea Bridge (3.2km) and removed 30,000 tonnes of sediment at a cost of £2m. From the information available, the silt was contaminated with heavy metals and oils and was therefore a mixture of hazardous and non-hazardous waste and so required bio-remediation treatment prior to disposal to landfill.

The most recent hydrographic survey of the full reach was undertaken in 2007 - i.e. prior to the above dredging operation. From this information, it is difficult to establish the quantity of silt in the Lee navigation between Edmonton and Tottenham (3.2km) or between Lea Bridge and Pudding Mill (3.9km). It is also likely that localised areas of silt deposition have occurred between Tottenham and Lea Bridge, since the dredging operation in 2009. Therefore, if the remainder of the waterway required dredging, based on the 2009 rate of £625,000/km, it is estimated that the dredging cost could be up to £4.4M. However, changes in landfill legislation mean that disposal costs would be higher than those in 2009. It is recommended that a full hydrographic survey and/or topographic survey of the silt depths is carried out in order to establish the quantity of silt that needs to be removed. A disposal strategy can then be produced to establish the most cost-effective disposal route.

# Appendix G: Barge operation costs

## Water Costs - Bulk IBA Edmonton to Rainham - Scenarios 1, 3 and 5

### NLWA SCENARIO 1: 106k TPA IBA LOOSE BULK FROM EDMONTON / RAINHAM

| COST OF WATER OPERATION | | | | | |
|---|---|---|---|---|---|
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| Mechanical shovel | | 120,000 | 1 | 120,000 | |
| Tipper Lorry | | 97,000 | 1 | 97,000 | |
| Excavator Grab | | 88,000 | 1 | 88,000 | |
| **Waterway Costs - Lee Navigation** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Wharf construction** | | | | | |
| Wharf wall | | 36 | 1800 | 64800 | |
| Wharf fenders | | 40 | 150 | 6000 | |
| Wharf surface | | 1300 | 300 | 390000 | |
| Power supply | | 100 | 110 | 11000 | 471,800 |
| **Tugs and Barges** | | | | | |
| Tugs | | 66,000 | 5 | 330,000 | |
| Barges | | 110,000 | 18 | 1,980,000 | |
| | | | | | |
| **Waterway Costs - Bow Creek** | | | | | |
| Tugs | | 300,000 | 1 | 300,000 | 2,610,000 |
| | | | | | |
| **Total Capital Costs** | | | | **4,095,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |
| Staff Costs shovel | £/hour | 16 | 2580 | 41,177 | |
| Staff Costs tipper | £/year | 1 | 40,432 | 40,432 | |
| Fuel - shovel | £/litre | 0.64 | 3612 | 2,312 | |
| Fuel - tipper | £/litre | 0.64 | 4246 | 2,718 | |
| Tyres | £/mile | 0.07 | 3741 | 243 | |
| Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 | |

### NLWA SCENARIO 3: 140k TPA IBA LOOSE BULK FROM EDMONTON / RAINHAM

| COST OF WATER OPERATION | | | | |
|---|---|---|---|---|
| **CAPITAL COSTS** | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost |
| Mechanical shovel | | 120,000 | 1 | 120,000 |
| Tipper Lorry | | 97,000 | 2 | 194,000 |
| Excavator Grab | | 88,000 | 1 | 88,000 |
| **Waterway Costs** | | | | |
| Stonebridge Lock | | | | 350,000 |
| Tottenham Lock | | | | 410,000 |
| Old Ford Lock | | | | 370,000 |
| Bow Locks | | | | 0 |
| Electric opening | | | | 50,000 |
| Dredging | | | | 0 |
| **Wharf construction** | | | | |
| Wharf wall | | 36 | 1800 | 64800 |
| Wharf fenders | | 40 | 150 | 6000 |
| Wharf surface | | 1300 | 300 | 390000 |
| Power supply | | 100 | 110 | 11000 |
| **Tug & Barges** | | | | |
| Tugs | | 66,000 | 6 | 396,000 |
| Barges | | 110,000 | 31 | 3,410,000 |
| | | | | |
| **Waterway Costs - Bow Creek** | | | | |
| Tugs | | 300,000 | 1 | 300,000 |
| | | | | |
| **Total Capital Costs** | | | | **5,688,000** |
| | | | | |
| | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year |
| **Waterways maintenance** | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | |
| Staff Costs shovel | £/hour | 16 | 2580 | 41,177 |
| Staff Costs tipper | £/year | 2 | 40,432 | 80,864 |
| Fuel - shovel | £/litre | 0.64 | 3612 | 2,312 |
| Fuel - tipper | £/litre | 0.64 | 5608 | 3,589 |
| Tyres | £/mile | 0.07 | 4941 | 321 |
| Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 |

| | | | | | |
|---|---|---|---|---|---|
| Maintenance - tipper | £/year | 0.18 | 3741 | 662 | 88,575 |
| **Edmonton Barge Loading Costs** | | | | | |
| Fuel | £/litre | 0.64 | 11610 | 7,430 | |
| Lighting | £/hour | 1.93 | 516 | 997 | |
| Maintenance | £/run.hour | 8 | 774 | 6,192 | |
| Staff Costs | £/person | 20.8 | 2580 | 53,664 | 68,283 |
| **Water Transport Costs - Lee Navigation** | | | | | |
| Lock Maintenance | £/year | - | - | 10,000 | |
| Dredging | - | - | - | 0 | |
| Crew Costs | £/hr | 20.8 | 12900 | 268,320 | |
| Insurance | £/year | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 96522 | 61,774 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 1,248 | |
| Tug Maintenance | £/unit | 3500 | 5 | 17,500 | |
| Barge Maintenance | £/unit | 1100 | 18 | 19,800 | |
| Waterway Tolls | - | - | - | 0 | |
| Waterway Licences | - | - | - | 17,800 | |
| Wharf Labour Costs | £/hr | 16 | 5160 | 82,560 | 491,402 |
| **Water Transport Costs - Bow Creek** | | | | | |
| Tug operations | £/day | 360 | 0 | 0 | |
| Crew Costs | £/hr | 20.8 | 10320 | 214,656 | |
| Insurance | £/year | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 37100 | 23,744 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 1,248 | |
| Tug Maintenance | £/unit | 3500 | 5 | 17,500 | |
| Wharf Labour Costs | £/hr | 16 | 10320 | 165,120 | 434,668 |
| | | | | | |
| **Water Transport Costs - River Thames** | | | | | |
| Tug operations | £/day | £750 | 129 | 96,750 | |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 110,750 |
| | | | | | |
| **Other Overhead Costs** | | | | | |
| **Mechanical shovel** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 15,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 15,000 |
| **Tipper** | | | | | |
| Depreciation | £/vehicle | 6 | 1 | 8,100 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 8,100 |
| **Excavator** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 11,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 11,000 |
| **Total Other Overhead Costs** | | | | **34,100** | |
| | | | | | |

| | | | | |
|---|---|---|---|---|
| Maintenance - tipper | £/mile | 0.18 | 4941 | 875 |
| **Edmonton Barge Loading Costs** | | | | |
| Fuel | £/litre | 0.64 | 14513 | 9,288 |
| Lighting | £/hour | 1.93 | 516 | 997 |
| Maintenance | £/run.hour | 8 | 968 | 7,740 |
| Staff Costs | £/person | 20.8 | 2580 | 53,664 |
| **Water Transport Costs** | | | | |
| Lock Maintenance | - | - | - | 10,000 |
| Dredging | - | - | - | 0 |
| Staff Costs | £/hr | 20.8 | 15480 | 321,984 |
| Insurance | - | - | - | 12,400 |
| Fuel | £/mile | 0.64 | 127482 | 81,589 |
| Lubricants/Hydraulics | £/week | 24 | 52 | 9,984 |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 |
| Barge Maintenance | £/unit | 1100 | 31 | 34,100 |
| Waterway Tolls | - | - | - | 0 |
| Waterway Licences | - | - | - | 17,800 |
| Wharf Labour Costs | £/hr | 32 | 5160 | 165,120 |
| **Water Transport Costs - Bow Creek** | | | | |
| Tug operations | £/shift | 360 | 0 | 0 |
| Crew Costs | £/hr | 20.8 | 10320 | 214,656 |
| Insurance | - | - | - | 12,400 |
| Fuel | £/mile | 0.64 | 49000 | 31,360 |
| Lubricants/Hydraulics | £/week | 24 | 52 | 9,984 |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 |
| Wharf Labour Costs | £/hr | 16 | 10320 | 165,120 |
| | | | | |
| **Water Transport Costs - River Thames** | | | | |
| Tug operations | £/shift | £750 | 172 | 129,000 |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 |
| | | | | |
| **Other Overhead Costs** | | | | |
| **Mechanical shovel** | | | | |
| Depreciation | £/vehicle | 8 | 1 | 15,000 |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 |
| **Tipper** | | | | |
| Depreciation | £/vehicle | 6 | 2 | 16,200 |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 |
| **Excavator** | | | | |
| Depreciation | £/vehicle | 8 | 1 | 11,000 |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 |
| **Total Other Overhead Costs** | | | | **42,200** |
| | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Total Operating Costs** | | **1,242,779** | | | **Total Operating Costs** | | **1,530,555** |

## NLWA SCENARIO 5: 180k TPA IBA LOOSE BULK FROM EDMONTON / RAINHAM

**COST OF WATER OPERATION**

| | | | | | |
|---|---|---|---|---|---|
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| Mechanical shovel | | 120,000 | 1 | 120,000 | |
| Tipper Lorry | | 97,000 | 2 | 194,000 | |
| Excavator Grab | | 88,000 | 1 | 88,000 | |
| **Waterway Costs** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Wharf construction** | | | | | |
| Wharf wall | | 36 | 1800 | 64800 | |
| Wharf fenders | | 40 | 150 | 6000 | |
| Wharf surface | | 1300 | 300 | 390000 | |
| Power supply | | 100 | 110 | 11000 | 471,800 |
| | | | | | |
| Tugs | | 66,000 | 6 | 396,000 | |
| Barges | | 110,000 | 30 | 3,300,000 | |
| | | | | | |
| | | | | | |
| Tugs | | 300,000 | 1 | 300,000 | 3,996,000 |
| | | | | | |
| **Total Capital Costs** | | | | **5,578,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |
| Staff Costs shovel | £/hour | 16 | 2580 | 41,177 | |
| Staff Costs tipper | £/year | 2 | 40,432 | 80,864 | |
| Fuel - shovel | £/day | 0.64 | 3612 | 2,312 | |
| Fuel - tipper | £/litre | 0.64 | 7211 | 4,615 | |
| Tyres | £/mile | 0.07 | 6353 | 413 | |

| | | | | | |
|---|---|---|---|---|---|
| Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 | |
| Maintenance - tipper | £/mile | 0.18 | 6353 | 1,124 | 131,537 |
| **Edmonton Barge Loading Costs** | | | | | |
| Fuel | £/lift | 0.64 | 17415 | 11,146 | |
| Lighting | £/hour | 1.93 | 516 | 997 | |
| Maintenance | £/run.hour | 8 | 1161 | 9,288 | |
| Staff Costs | £/hour | 20.8 | 2580 | 53,664 | 75,095 |
| **Water Transport Costs** | | | | | |
| Lock Maintenance | - | - | - | 10,000 | |
| Dredging | - | - | - | 0 | |
| Staff Costs | £/hr | 20.8 | 15480 | 321,984 | |
| Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 163906 | 104,900 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 9,984 | |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 | |
| Barge Maintenance | £/unit | 1100 | 30 | 33,000 | |
| Waterway Tolls | - | - | - | 0 | |
| Waterway Licences | - | - | - | 17,800 | |
| Wharf Labour Costs | £/hr | 32 | 5160 | 165,120 | 696,188 |
| **Water Transport Costs - Bow Creek** | | | | | |
| Tug operations | £/shift | 360 | 0 | 0 | |
| Crew Costs | £/hr | 20.8 | 10320 | 214,656 | |
| Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 63000 | 40,320 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 9,984 | |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 | |
| Wharf Labour Costs | £/hr | 16 | 10320 | 165,120 | 463,480 |
| | | | | | |
| **Water Transport Costs - River Thames** | | | | | |
| Tug operations | £/shift | £750 | 194 | 145,500 | |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 159,500 |
| | | | | | |
| **Other Overhead Costs** | | | | | |
| **Mechanical shovel** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 15,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 15,000 |
| **Tipper** | | | | | |
| Depreciation | £/vehicle | 6 | 2 | 16,200 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 16,200 |
| **Excavator** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 11,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 11,000 |
| **Total Other Overhead Costs** | | | | **42,200** | |

| | | | |
|---|---|---|---|
| **Total Operating Costs** | | **1,582,999** | |

## Water Costs - Bulk IBA Edmonton to Greenwich- Scenarios 1, 3 and 5

### NLWA SCENARIO 2: 106k TPA IBA LOOSE BULK FROM EDMONTON / GREENWICH

| **COST OF WATER OPERATION** | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| Mechanical shovel | | 120,000 | 1 | 120,000 | |
| Tipper Lorry | | 97,000 | 1 | 97,000 | |
| Excavator Grab | | 88,000 | 1 | 88,000 | |
| **Waterway Costs - Lee Navigation** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Wharf construction** | | | | | |
| Wharf wall | | 36 | 1800 | 64800 | |
| Wharf fenders | | 40 | 150 | 6000 | |
| Wharf surface | | 1300 | 300 | 390000 | |
| Power supply | | 100 | 110 | 11000 | 471,800 |
| **Tugs and Barges** | | | | | |
| Tugs | | 66,000 | 5 | 330,000 | |
| Barges | | 110,000 | 12 | 1,320,000 | |
| | | | | | |
| **Waterway Costs - Bow Creek** | | | | | |
| Tugs | | 300,000 | 1 | 300,000 | 1,950,000 |
| | | | | | |
| **Total Capital Costs** | | | | **3,435,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |
| Staff Costs shovel | £/hour | 16 | 2580 | 41,177 | |
| Staff Costs tipper | £/year | 1 | 40,432 | 40,432 | |
| Fuel - shovel | £/litre | 0.64 | 3612 | 2,312 | |
| Fuel - tipper | £/litre | 0.64 | 4246 | 2,718 | |
| Tyres | £/mile | 0.07 | 3741 | 243 | |
| Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 | |

### NLWA SCENARIO 4: 140k TPA IBA LOOSE BULK FROM EDMONTON / GREENWICH

| **COST OF WATER OPERATION** | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| Mechanical shovel | | 120,000 | 1 | 120,000 | |
| Tipper Lorry | | 97,000 | 2 | 194,000 | |
| Excavator Grab | | 88,000 | 1 | 88,000 | |
| **Waterway Costs** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Wharf construction** | | | | | |
| Wharf wall | | 36 | 1800 | 64800 | |
| Wharf fenders | | 40 | 150 | 6000 | |
| Wharf surface | | 1300 | 300 | 390000 | |
| Power supply | | 100 | 110 | 11000 | 471,800 |
| **Tug & Barges** | | | | | |
| Tugs | | 66,000 | 6 | 396,000 | |
| Barges | | 110,000 | 13 | 1,430,000 | |
| | | | | | |
| **Waterway Costs - Bow Creek** | | | | | |
| Tugs | | 300,000 | 1 | 300,000 | 2,126,000 |
| | | | | | |
| **Total Capital Costs** | | | | **3,708,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |
| Staff Costs shovel | £/hour | 16 | 2580 | 41,177 | |
| Staff Costs tipper | £/year | 2 | 40,432 | 80,864 | |
| Fuel - shovel | £/litre | 0.64 | 3612 | 2,312 | |
| Fuel - tipper | £/litre | 0.64 | 5608 | 3,589 | |
| Tyres | £/mile | 0.07 | 4941 | 321 | |
| Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 | |

| | | | | | |
|---|---|---|---|---|---|
| Maintenance - tipper | £/year | 0.18 | 3741 | 662 | 88,575 |
| **Edmonton Barge Loading Costs** | | | | | |
| Fuel | £/litre | 0.64 | 11610 | 7,430 | |
| Lighting | £/hour | 1.93 | 516 | 997 | |
| Maintenance | £/run.hour | 8 | 774 | 6,192 | |
| Staff Costs | £/person | 20.8 | 2580 | 53,664 | 68,283 |
| **Water Transport Costs - Lee Navigation** | | | | | |
| Lock Maintenance | £/year | - | - | 10,000 | |
| Dredging | - | - | - | 0 | |
| Crew Cost | £/hr | 20.8 | 12900 | 268,320 | |
| Insurance | £/year | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 96522 | 61,774 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 1,248 | |
| Tug Maintenance | £/unit | 3500 | 5 | 17,500 | |
| Barge Maintenance | £/unit | 1100 | 12 | 13,200 | |
| Waterway Tolls | - | - | - | 0 | |
| Waterway Licences | - | - | - | 17,800 | |
| Wharf Labour Costs | £/hr | 16 | 5160 | 82,560 | 484,802 |
| **Water Transport Costs - Bow Creek** | | | | | |
| Tug operations | £/shift | 360 | 0 | 0 | |
| Crew Costs | £/hr | 16 | 10320 | 165,120 | |
| Insurance | £/year | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 58989 | 37,753 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 1,248 | |
| Tug Maintenance | £/unit | 3500 | 5 | 17,500 | |
| Wharf Staff Costs | £/hr | 16 | 10320 | 165,120 | 399,141 |
| | | | | | |
| **Water Transport Costs - River Thames** | | | | | |
| Tug operations | £/day | £750 | 0 | 0 | |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 14,000 |
| | | | | | |
| **Other Overhead Costs** | | | | | |
| **Mechanical shovel** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 15,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 15,000 |
| **Tipper** | | | | | |
| Depreciation | £/vehicle | 6 | 1 | 8,100 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 8,100 |
| **Excavator** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 11,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 11,000 |
| **Total Other Overhead Costs** | | | | **19,100** | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Maintenance - tipper | £/mile | 0.18 | 4941 | 875 | 130,170 |
| **Edmonton Barge Loading Costs** | | | | | |
| Fuel | £/litre | 0.64 | 14513 | 9,288 | |
| Lighting | £/hour | 1.93 | 516 | 997 | |
| Maintenance | £/run.hour | 8 | 968 | 7,740 | |
| Staff Costs | £/person | 20.8 | 2580 | 53,664 | 71,689 |
| **Water Transport Costs** | | | | | |
| Lock Maintenance | - | - | - | 10,000 | |
| Dredging | - | - | - | 0 | |
| Staff Costs | £/hr | 20.8 | 15480 | 321,984 | |
| Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 127482 | 81,589 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 9,984 | |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 | |
| Barge Maintenance | £/unit | 1100 | 13 | 14,300 | |
| Waterway Tolls | - | - | - | 0 | |
| Waterway Licences | - | - | - | 17,800 | |
| Wharf Staff Costs | £/hr | 16 | 5160 | 82,560 | 571,617 |
| **Water Transport Costs - Bow Creek** | | | | | |
| Tug operations | £/shift | 360 | 0 | 0 | |
| Wharf Staff Costs | £/hr | 20.8 | 10320 | 214,656 | |
| | £/year | - | - | 12,400 | |
| | £/mile | 0.64 | 77910 | 49,862 | |
| | £/week | 24 | 52 | 1,248 | |
| | £/unit | 3500 | 6 | 21,000 | |
| | £/hr | 16 | 10320 | 165,120 | 464,286 |
| | | | | | |
| **Water Transport Costs - River Thames** | | | | | |
| Tug operations | £/day | £750 | 0 | 0 | |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 14,000 |
| | | | | | |
| **Other Overhead Costs** | | | | | |
| **Mechanical shovel** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 15,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 15,000 |
| **Tipper** | | | | | |
| Depreciation | £/vehicle | 6 | 2 | 16,200 | |
| | £/vehicle | 6% | 0 | 0 | 16,200 |
| **Excavator** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 11,000 | |
| | £/vehicle | 6% | 0 | 0 | 11,000 |
| **Total Other Overhead Costs** | | | | **27,200** | |
| | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Total Operating Costs** | | **1,103,902** | | | **Total Operating Costs** | | **1,308,962** | |

| **NLWA SCENARIO 7: 180k TPA IBA LOOSE BULK FROM EDMONTON / GREENWICH** | | | | | |
|---|---|---|---|---|---|
| **COST OF WATER OPERATION** | | | | | |
| | | | | | |
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| Mechanical shovel | | 120,000 | 1 | 120,000 | |
| Tipper Lorry | | 97,000 | 2 | 194,000 | |
| Excavator Grab | | 88,000 | 1 | 88,000 | |
| **Waterway Costs** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Wharf construction** | | | | | |
| Wharf wall | | 36 | 1800 | 64800 | |
| Wharf fenders | | 40 | 150 | 6000 | |
| Wharf surface | | 1300 | 300 | 390000 | |
| Power supply | | 100 | 110 | 11000 | 471,800 |
| **Tug & Barges** | | | | | |
| Tugs | | 66,000 | 6 | 396,000 | |
| Barges | | 110,000 | 20 | 2,200,000 | |
| | | | | | |
| **Waterway Costs - Bow Creek** | | | | | |
| Tugs | | 300,000 | 1 | 300,000 | 2,896,000 |
| | | | | | |
| **Total Capital Costs** | | | | **4,478,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |
| Staff Costs shovel | £/hour | 16 | 2580 | 41,177 | |
| Staff Costs tipper | £/year | 2 | 40,432 | 80,864 | |
| Fuel - shovel | £/day | 0.64 | 3612 | 2,312 | |

| | | | | | |
|---|---|---|---|---|---|
| Fuel - tipper | £/litre | 0.64 | 7211 | 4,615 | |
| Tyres | £/mile | 0.07 | 6353 | 413 | |
| Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 | |
| Maintenance - tipper | £/mile | 0.18 | 6353 | 1,124 | 131,537 |
| **Edmonton Barge Loading Costs** | | | | | |
| Fuel | £/lift | 0.64 | 17415 | 11,146 | |
| Lighting | £/hour | 1.93 | 516 | 997 | |
| Maintenance | £/run.hour | 8 | 1161 | 9,288 | |
| Staff Costs | £/hour | 20.8 | 2580 | 53,664 | 75,095 |
| **Water Transport Costs** | | | | | |
| Lock Maintenance | - | - | - | 10,000 | |
| Dredging | - | - | - | 0 | |
| Staff Costs | £/hr | 20.8 | 15480 | 321,984 | |
| Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 163906 | 104,900 | |
| Lubricants/Hydraulics | £/week | 24 | 52 | 9,984 | |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 | |
| Barge Maintenance | £/unit | 1100 | 20 | 22,000 | |
| Waterway Tolls | - | - | - | 0 | |
| Waterway Licences | - | - | - | 17,800 | |
| Wharf Staff Costs | £/hr | 16 | 5160 | 82,560 | 602,628 |
| **Water Transport Costs - Bow Creek** | | | | | |
| Tug operations | £/shift | 360 | 0 | 0 | |
| Wharf Staff Costs | £/hr | 16 | 10320 | 165,120 | |
| | £/year | - | - | 12,400 | |
| | £/mile | 0.64 | 100170 | 64,109 | |
| | £/week | 24 | 52 | 9,984 | |
| | £/unit | 3500 | 6 | 21,000 | |
| | £/hr | 16 | 10320 | 165,120 | 437,733 |
| | | | | | |
| **Water Transport Costs - River Thames** | | | | | |
| Tug operations | £/day | £750 | 0 | 0 | |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 14,000 |
| | | | | | |
| **Other Overhead Costs** | | | | | |
| **Mechanical shovel** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 15,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 15,000 |
| **Tipper** | | | | | |
| Depreciation | £/vehicle | 6 | 2 | 16,200 | |
| | £/vehicle | 6% | 0 | 0 | 16,200 |

| | | | | | |
|---|---|---|---|---|---|
| **Excavator** | | | | | |
| Depreciation | £/vehicle | 8 | 1 | 11,000 | |
| | £/vehicle | 6% | 0 | 0 | 11,000 |
| **Total Other Overhead Costs** | | | | **27,200** | |
| | | | | | |
| **Total Operating Costs** | | | | **1,318,192** | |

## Water Costs - Combine IBA and MW transport Edmonton / Rainham Landfill / Barking Creek- Scenarios 9 and 10

### NLWA OPTION 9: 180k/150k TPA IBA/WASTE CONTAINER BULK FROM & TO MW EDMONTON

| COST OF WATER OPERATION | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| **Edmonton Wharf & Crane** | | | | | |
| Wharf wall | | 1800 | 36 | 64,800 | |
| Wharf fenders | | 150 | 40 | 6,000 | |
| Piled crane rails | | 7500 | 40 | 300,000 | |
| Wharf surface | | 150 | 1300 | 195,000 | |
| Gantry crane | | 1620000 | 1 | 1,620,000 | |
| Container spreader | | 120000 | 1 | 120,000 | |
| Power supply cable | | 110 | 100 | 11,000 | 2,316,800 |
| Reachstacker | | 350,000 | 0 | 0 | |
| Hooklift Units | | 96,000 | 2 | 192,000 | 192,000 |
| **Waterway Costs - Lee Navigation** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Tugs and Barges** | | | | | |
| Tugs | | 66,000 | 6 | 396,000 | |
| Barges | | 110,000 | 37 | 4,070,000 | 4,466,000 |
| Containers | | 6,000 | 351 | 2,106,000 | 2,106,000 |
| | | | | | |
| **Waterway Costs - Bow Creek** | | | | | |
| Tugs | | 300,000 | 2 | 600,000 | |
| | | | | | |
| **Waterway Costs - Barking Creek** | | | | | |
| Tugs | | 300,000 | 1 | 300,000 | 5,366,000 |
| | | | | | |
| **Total Capital Costs** | | | | **8,844,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |

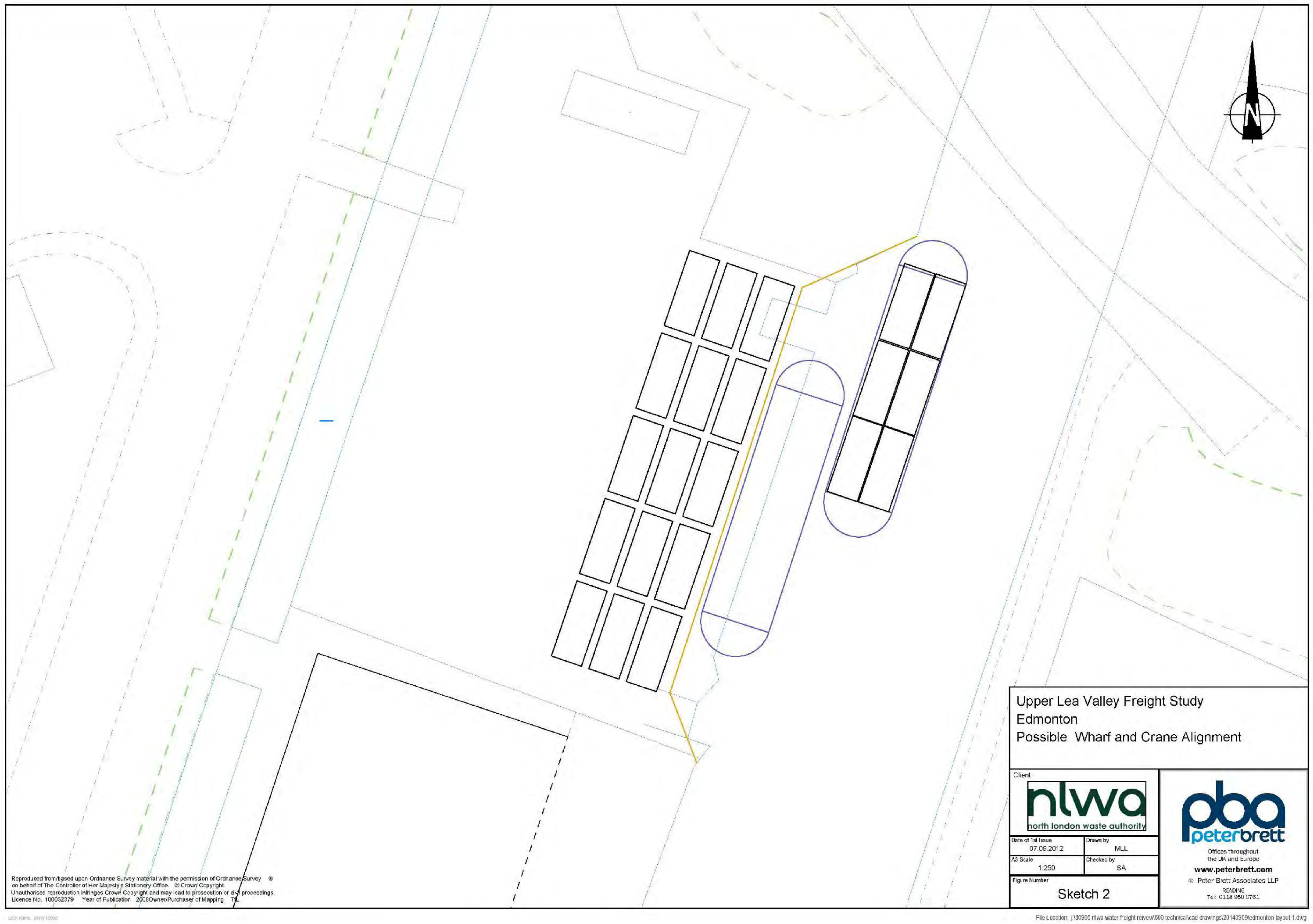
### NLWA OPTION 10: 180k/300k TPA IBA CONTAINER BULK FROM & MW TO EDMONTON

| COST OF WATER OPERATION - DAY | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **CAPITAL COSTS** | | | | | |
| **Edmonton Costs** | | Cost per unit | Number of units | Total cost | |
| **Edmonton Wharf & Crane** | | | | | |
| Wharf wall | | 1800 | 36 | 64,800 | |
| Wharf fenders | | 150 | 40 | 6,000 | |
| Piled crane rails | | 7500 | 40 | 300,000 | |
| Wharf surface | | 150 | 1300 | 195,000 | |
| Gantry crane | | £1,620,000 | 1 | 1,620,000 | |
| Container spreader | | 120000 | 1 | 120,000 | |
| Power supply cable | | 110 | 100 | 11,000 | 2,316,800 |
| Reachstacker | | 350,000 | 0 | 0 | |
| Hooklift Units | | 96,000 | 2 | 192,000 | 192,000 |
| **Waterway Costs** | | | | | |
| Stonebridge Lock | | | | 350,000 | |
| Tottenham Lock | | | | 410,000 | |
| Old Ford Lock | | | | 370,000 | |
| Bow Locks | | | | 0 | |
| Electric opening | | | | 50,000 | 1,180,000 |
| Dredging | | | | 0 | |
| **Tug & Barges** | | | | | |
| Tugs | | 66,000 | 11 | 726,000 | |
| Barges | | 110,000 | 68 | 7,480,000 | 8,206,000 |
| Containers | | 6,000 | 405 | 2,430,000 | 2,430,000 |
| | | | | | |
| **Waterway Costs - Bow Creek** | | | | | |
| Tugs | | 300,000 | 2 | 600,000 | |
| | | | | | |
| **Waterway Costs - Barking Creek** | | | | | |
| Tugs | | 300,000 | 2 | 600,000 | 9,406,000 |
| | | | | | |
| **Total Capital Costs** | | | | **13,208,000** | |
| | | | | | |
| | | | | | |
| **ANNUAL OPERATING COSTS** | | | | £/year | Subtotal |
| **Waterways maintenance** | | | | | |
| Annualised cost | Annual | 375,000 | 25 | 15,000 | 15,000 |
| **Edmonton On-Site Haulage Costs** | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Staff Costs shovel | £/hour | 16 | 0 | 0 | | Staff Costs shovel | £/hour | 16 | 0 | 0 | |
| Staff Costs hooklift | £/year | 2 | 40,432 | 80,864 | | Staff Costs hooklift | £/year | 2 | 80,864 | 161,728 | |
| Fuel - shovel | £/litre | 0.64 | 0 | 0 | | Fuel - shovel | £/litre | 0.64 | 0 | 0 | |
| Fuel - hooklift | £/litre | 0.64 | 4246 | 2,718 | | Fuel - hooklift | £/litre | 0.64 | 4246 | 2,718 | |
| Tyres | £/mile | 0.07 | 3741 | 243 | | Tyres | £/mile | 0.07 | 3741 | 243 | |
| Maintenance - shovel | £/run.hour | 0 | 516 | 0 | | Maintenance - shovel | £/run.hour | 2 | 516 | 1,032 | |
| Maintenance - Hooklift | £/year | 0.18 | 3741 | 662 | | Maintenance - Hooklift | £/mile | 0.18 | 3741 | 662 | |
| Operator - Reachstacker | £/hour | 21 | 0 | 0 | | Operator - Reachstacker | £/hour | 21 | 0 | 0 | |
| Fuel - Reachstacker | £/litre | 0.64 | 0 | 0 | | Fuel - Reachstacker | £/litre | 0.64 | 0 | 0 | |
| Maintenance - Reachstacker | £/run.hour | 10.00 | 0 | 0 | 84,487 | Maintenance - Reachstacker | £/run.hour | 10.00 | 0 | 0 | 166,383 |
| | | | | | | | | | | | |
| **Edmonton Barge Loading Costs** | | | | | | **Edmonton Barge Loading Costs** | | | | | |
| Crane Power Cost | £/lift | 0.28 | 6,818 | 1,909 | | Crane Power Cost | £/lift | 0.28 | 13,636 | 3,818 | |
| Lighting | £/hour | 1.93 | 516 | 997 | | Lighting | £/hour | 1.93 | 516 | 997 | |
| Crane Maintenance | £/run.hour | 10 | 2580 | 25,800 | | Crane Maintenance | £/run.hour | 10 | 2580 | 25,800 | |
| Staff Costs | £/person | 20.8 | 5160 | 107,328 | 136,034 | Staff Costs | £/person | 20.8 | 10320 | 214,656 | 245,271 |
| **Water Transport Costs - Lee Navigation** | | | | | | **Water Transport Costs** | | | | | |
| Lock Maintenance | £/year | - | - | 10,000 | | Lock Maintenance | - | - | - | 10,000 | |
| Dredging | - | - | - | 0 | | Dredging | - | - | - | 0 | |
| Tug Crew | £/hr | 20.8 | 15480 | 321,984 | | Tug Crew | £/hr | 20.8 | 56760 | 1,180,608 | |
| Insurance | £/year | - | - | 12,400 | | Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 96522 | 61,774 | | Fuel | £/mile | 0.64 | 96522 | 61,774 | |
| Lubricants/Hydraulics | £/week | 24 | 51 | 1,224 | | Lubricants/Hydraulics | £/week | 24 | 51 | 9,792 | |
| Tug Maintenance | £/unit | 3500 | 6 | 21,000 | | Tug Maintenance | £/unit | 3500 | 11 | 38,500 | |
| Barge Maintenance | £/unit | 1100 | 37 | 40,700 | | Barge Maintenance | £/unit | 1100 | 68 | 74,800 | |
| Waterway Tolls | - | - | - | 0 | | Waterway Tolls | - | - | - | 0 | |
| Waterway Licences | - | - | - | 17,800 | | Waterway Licences | - | - | - | 17,800 | |
| Wharf Staff Costs | £/hr | 16 | 5160 | 82,560 | 569,442 | Wharf Staff Costs | £/hr | 32 | 10320 | 330,240 | 1,735,914 |
| **Water Transport Costs - Bow Creek** | | | | | | **Water Transport Costs - Bow Creek** | | | | | |
| Tug operations | £/shift | 0 | 1548 | 0 | | Tug operations | £/shift | 0 | 1548 | 0 | |
| Tug Crew | £/hr | 20.8 | 7740 | 160,992 | | Tug Crew | £/hr | 20.8 | 30960 | 643,968 | |
| Insurance | £/year | - | - | 12,400 | | Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 54180 | 34,675 | | Fuel | £/mile | 0.64 | 54180 | 34,675 | |
| Lubricants/Hydraulics | £/week | 24 | 51 | 1,224 | | Lubricants/Hydraulics | £/week | 24 | 51 | 9,792 | |
| Tug Maintenance | £/unit | 3500 | 2 | 7,000 | | Tug Maintenance | £/unit | 3500 | 2 | 7,000 | |
| Wharf Labour Costs | £/hr | 16 | 10320 | 165,120 | 381,411 | Wharf Labour Costs | £/hr | 16 | 10320 | 165,120 | 872,955 |
| **Water Transport Costs - Barking Creek** | | | | | | **Water Transport Costs - Barking Creek** | | | | | |
| Tug operations | £/shift | 0 | 774 | 0 | | Tug operations | £/shift | 0 | 1548 | 0 | |
| Tug Crew | £/hr | 20.8 | 15480 | 321,984 | | Tug Crew | £/hr | 20.8 | 30960 | 643,968 | |
| Insurance | £/year | - | - | 12,400 | | Insurance | - | - | - | 12,400 | |
| Fuel | £/mile | 0.64 | 31966.2 | 20,458 | | Fuel | £/mile | 0.64 | 31966.2 | 20,458 | |
| Lubricants/Hydraulics | £/week | 24 | 51 | 1,224 | | Lubricants/Hydraulics | £/week | 24 | 51 | 9,792 | |
| Tug Maintenance | £/unit | 3500 | 1 | 3,500 | | Tug Maintenance | £/unit | 3500 | 2 | 7,000 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wharf Labour Costs | £/hr | 16 | 10320 | 165,120 | 524,686 | | Wharf Labour Costs | £/hr | 16 | 20640 | 330,240 | 1,023,858 |
| | | | | | | | | | | | | |
| **Water Transport Costs - River Thames** | | | | | | | **Water Transport Costs - River Thames** | | | | | |
| Tug operations | £/day | £750 | 258 | 193,500 | | | Tug operations | £/shift | £750 | 258 | 193,500 | |
| PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 207,500 | | PLA Mooring licences | £ | 14,000 | 1 | 14,000 | 207,500 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Other Overhead Costs** | | | | | | | **Other Overhead Costs** | | | | | |
| **Wharf and Crane** | | | | | | | **Wharf and Crane** | | | | | |
| Depreciation | £/vehicle | 25 | 2,316,800 | 92,700 | | | Depreciation | £/vehicle | 25 | 2,316,800 | 92,700 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 92,700 | | Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 92,700 |
| **Hooklift** | | | | | | | **Hooklift** | | | | | |
| Depreciation | £/vehicle | 6 | 2 | 16,000 | | | Depreciation | £/vehicle | 6 | 2 | 16,000 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 16,000 | | Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 2 | 5,760 | 21,760 |
| **Reachstacker** | | | | | | | **Reachstacker** | | | | | |
| Depreciation | £/vehicle | 8 | 0 | 0 | | | Depreciation | £/vehicle | 8 | 0 | 0 | |
| Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 0 | | Interest on Capital (6.0%) - Assumes 50% residual price | £/vehicle | 6% | 0 | 0 | 0 |
| **Total Other Overhead Costs** | | | | **16,000** | | | **Total Other Overhead Costs** | | | | **21,760** | |
| | | | | | | | | | | | | |
| **Total Operating Costs** | | | | **2,027,261** | | | **Total Operating Costs** | | | | **4,381,342** | |

# Appendix H: Illustration of potential Edmonton Wharf layout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Upper Lea Valley Freight Study
Edmonton
Possible Wharf and Crane Alignment
Client
nlwa
north london waste authority
Date of 1st Issue
07.09.2012
Drawn by
MLL
A3 Scale
1:250
Checked by
SA
Figure Number
Sketch 2
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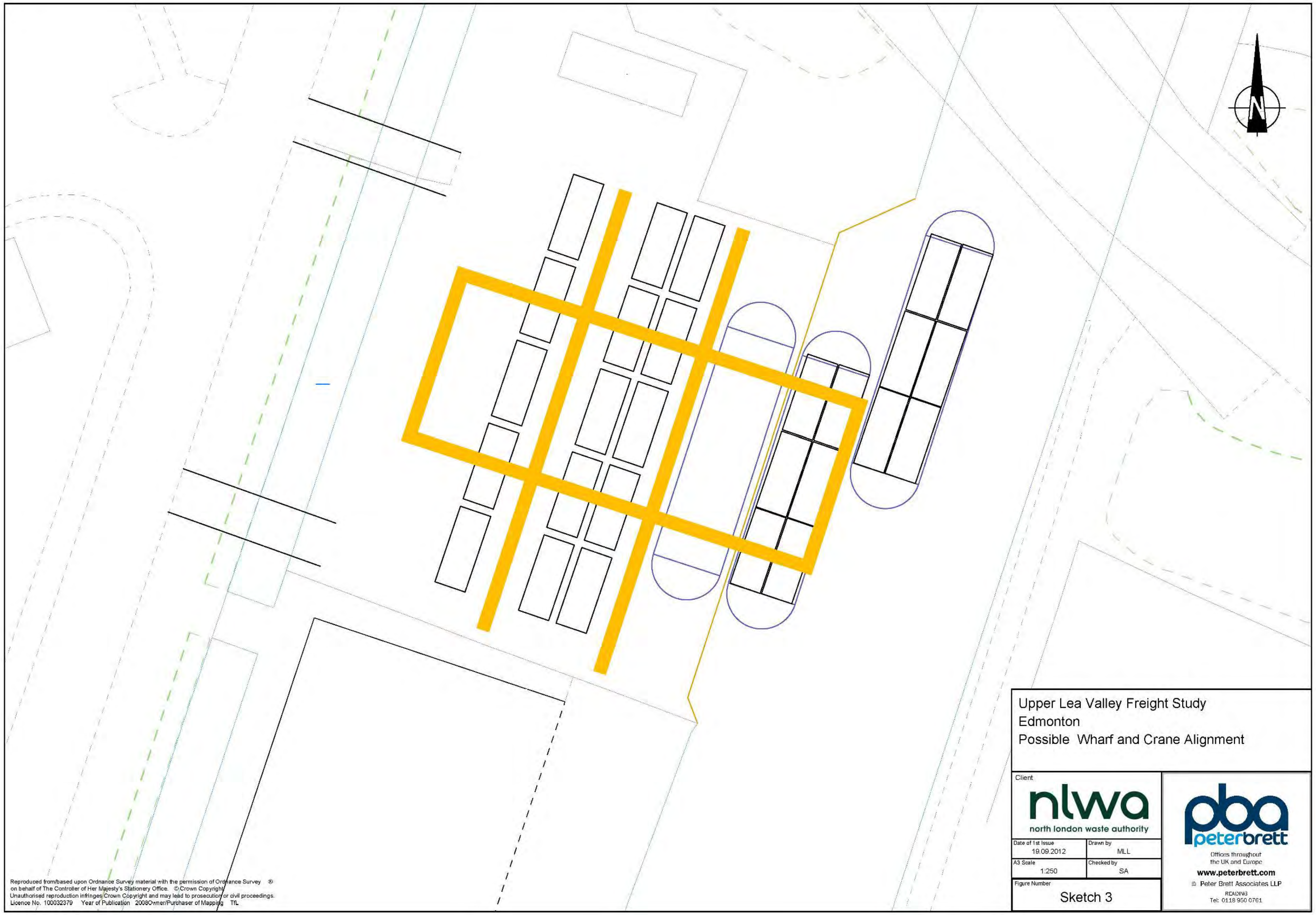


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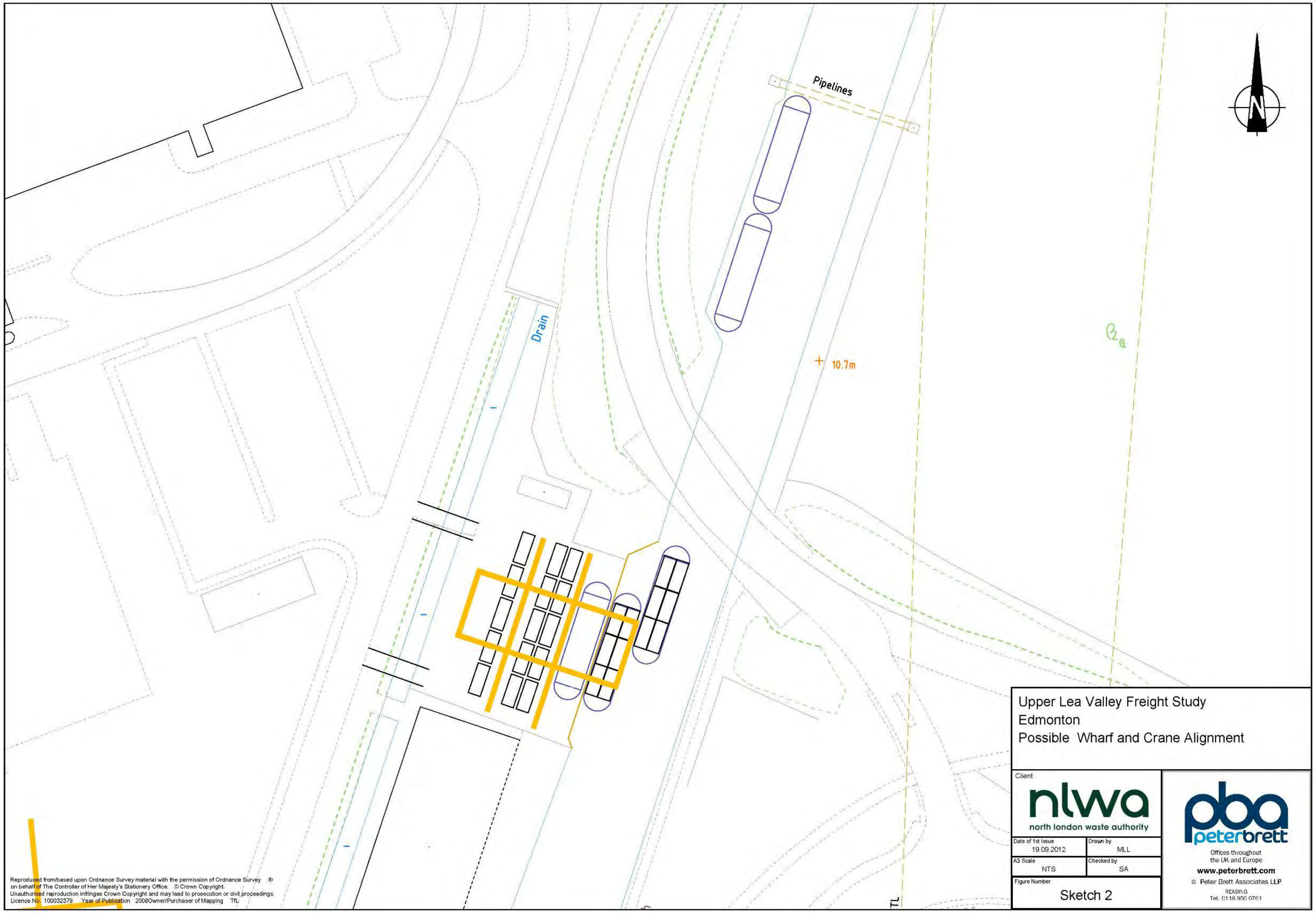


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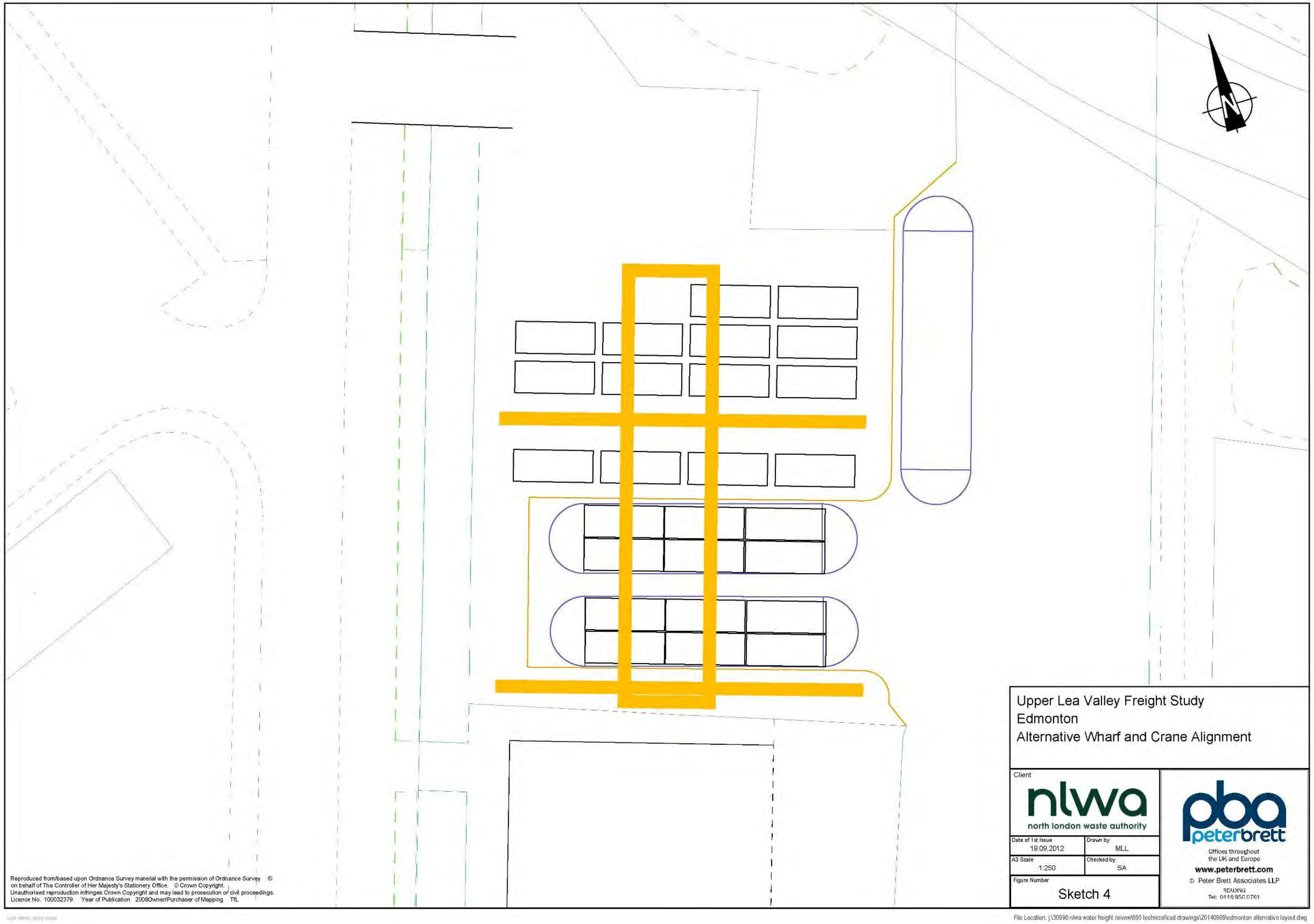
Upper Lea Valley Freight Study
Edmonton
Alternative Wharf and Crane Alignment
Client
nlwa
north london waste authority
Date of 1st Issue
19.09.2012
Drawn by
MLL
A3 Scale
1:250
Checked by
SA
Figure Number
Sketch 4
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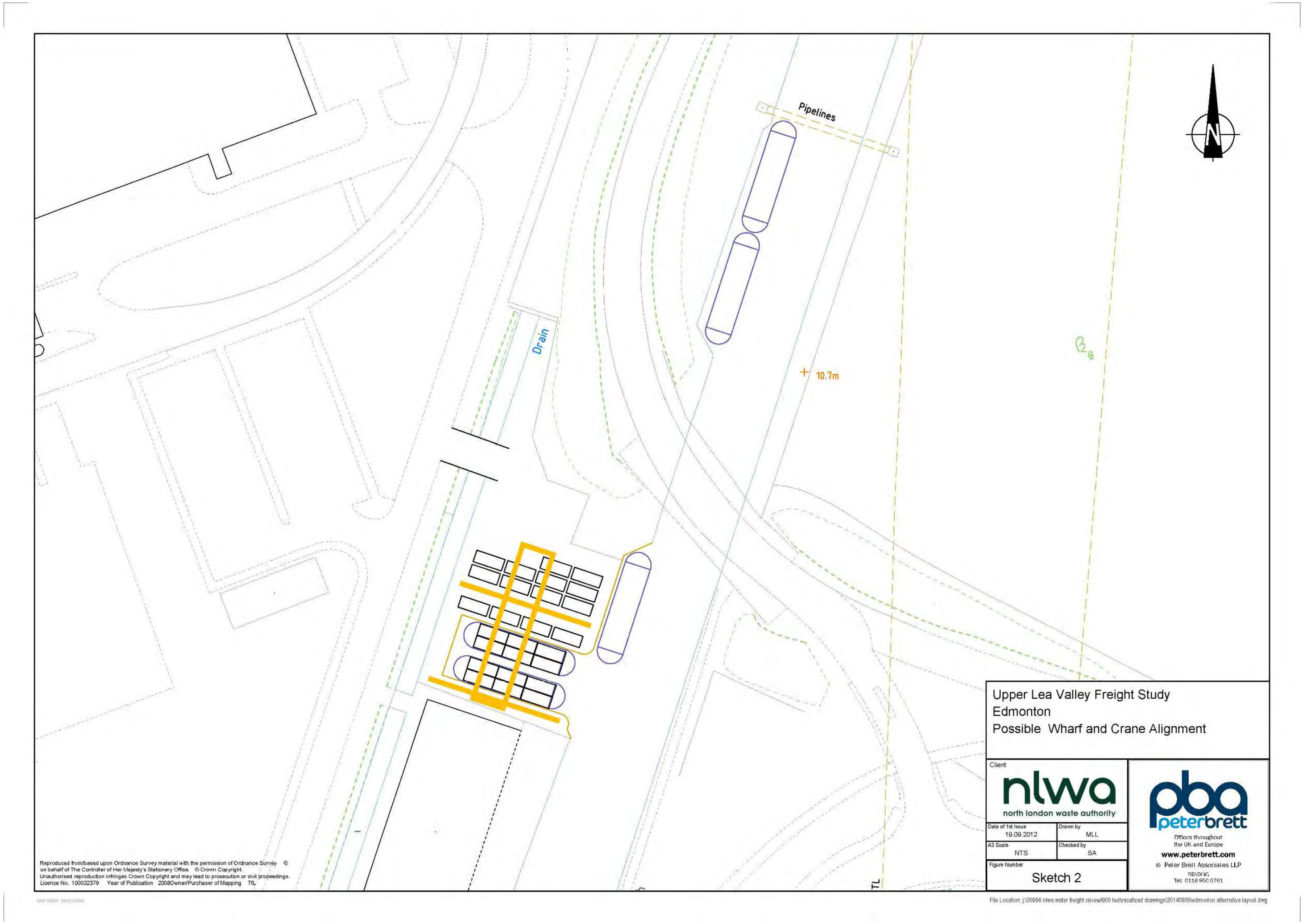
Pipelines
Drain
10.7m
TL
N
Upper Lea Valley Freight Study
Edmonton
Possible Wharf and Crane Alignment
Client
nlwa
north london waste authority
Date of 1st Issue
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A3 Scale
NTS
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# **Appendix J**– Framework Construction Travel Plan

North London Waste Authority

# North London Heat and Power Project

## Framework Construction Travel Plan

The Planning Act 2008 The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5 (2)(q)

Issue | October 2015

Arup



ARUP

nlwa
north london waste authority

# Contents

## Tables

# Glossary

| | |
|---|---|
| DCO | Development Consent Order |
| EfW | Energy from Waste |
| ERF | Energy Recovery Facility |
| ktpa | Kilo-tonnes per annum |
| LB Enfield | London Borough of Enfield |
| LCN+ | London Cycle Network Plus |
| LVRP | Lee Valley Regional Park |
| LWL | London Waste Limited |
| MW | Mega Watts |
| NLHPP | North London Heat and Power Project |
| NLWA | North London Waste Authority |
| PTAL | Public Transport Accessibility Level |
| RRF | Resource Recovery Facility |
| SRN | Strategic Transport Network |
| STW | Sewage Treatment Works |
| TA | Transport Assessment |
| TfL | Transport for London |
| TLRN | Transport for London Route Network |
| TRICS® | Trip Rate Information Computer System |
| UKPN | United Kingdom Power Networks |

# 1 Introduction

## 1.1 Introduction

1.1.1 The North London Waste Authority (Authority) is preparing an application for a Development Consent Order (DCO) pursuant to the Planning Act 2008 (as amended) (Application). The Application will be for the North London Heat and Power Project (the Project) comprising construction, operation and maintenance of an Energy Recovery Facility (ERF) of around 70 megawatts (MWe) and associated development, including a Resource Recovery Facility (RRC) at the Edmonton EcoPark site in north London. The proposed ERF will replace the existing Energy from Waste (EfW) facility at the Edmonton EcoPark.

1.1.2 This Framework Construction Travel Plan (Version 1) has been prepared to support the Application for a DCO.

## 1.2 Scope of the Travel Plan

1.2.1 The scope of this Travel Plan covers the construction employees and visitors to the Application Site during the construction phases of the Project. The Framework Construction Travel Plan should be considered in conjunction with the Code of Construction Practice (CoCP) (AD05.12) for the construction works.

## 1.3 Framework Construction Travel Plan structure

1.3.1 The Construction Travel Plan will form a central element of the overall transport strategy during the construction period of the Project and as part of a systematic approach to influence long term travel choice. This Framework Construction Travel Plan document:

a. provides a summary of the existing transport network;

b. articulates a series of objectives for the Project;

c. provides an indicative set of targets;

d. identifies and describes the initiatives proposed to support the objectives; and

e. proposes a management strategy for delivery and monitoring.

1.3.2 This Framework Construction Travel Plan should be read in conjunction with the Transport Assessment (TA) (AD05.11) accompanying the Application.

1.3.3 A separate Framework Operational Travel Plan has been prepared for employees and visitors to the Application Site during the operational phase of the Project. The aims and objectives of both Travel Plans seek to minimise the effect of employee travel on the local highway network. However, the measures contained within the Framework Operational Travel Plan have been tailored to account for the smaller workforce and varying shift times.

# 2 Context

## 2.1 The Application Site

2.1.1 The Application Site, as shown on the Site Location Plan (A_0001 and A_0002), extends to approximately 22 hectares and is located wholly within the London Borough of Enfield (LB Enfield). The Application Site comprises the existing waste management site known as the Edmonton EcoPark where the permanent facilities would be located, part of Ardra Road, land around the existing water pumping station at Ardra Road, Deephams Farm Road, part of Lee Park Way and land to the west of the River Lee Navigation, and land to the north of Advent Way and east of the River Lee Navigation (part of which would form the Temporary Laydown Area and new Lee Park Way access road). The post code for the site is N18 3AG and the grid reference for the proposed development is TQ 35750 92860.

2.1.2 The Application Site includes all land required to deliver the Project. This includes land that would be required temporarily to facilitate the development.

2.1.3 Both the Application Site and the Edmonton EcoPark (existing and proposed) are shown on Plan A_0003 contained within the Book of Plans (AD02.01). Throughout this report references to the Application Site refer to the proposed extent of the Project works, and Edmonton EcoPark refers to the operational site. Upon completion of the Project the operational site would consist of the Edmonton EcoPark and additional land required to provide new access arrangements and for a water pumping station adjacent to the Deephams Sewage Treatment Works outflow channel.

### Edmonton EcoPark

2.1.4 The Edmonton EcoPark is an existing waste management complex of around 16 hectares, with an EfW facility which treats circa 540,000 tonnes per annum (tpa) of residual waste and generates around 40$MW_e$ (gross) of electricity; an In-Vessel Composting (IVC) facility; a Bulky Waste Recycling Facility (BWRF) and Fuel Preparation Plant (FPP); an Incinerator Bottom Ash (IBA) Recycling Facility; a fleet management and maintenance facility; associated offices, car parking and plant required to operate the facility; and a former wharf and single storey building utilised by the Edmonton Sea Cadets under a lease

2.1.5 In order to construct the proposed ERF, the existing BWRF and FPP activities would be relocated within the Application Site; the IVC facility would be decommissioned and the IBA recycling would take place off-site.

### Temporary Laydown Area and eastern access

2.1.6 The proposed Temporary Laydown Area is an area of open scrubland located to the east of the River Lee Navigation and north of Advent Way. There is no public access to this area. The Temporary Laydown Area would be reinstated after construction and would not form part of the ongoing operational site.

2.1.7 In addition to the Temporary Laydown Area the Application Site includes land to the east of the existing Edmonton EcoPark which would be used for the new Lee Park Way entrance and landscaping along the eastern boundary.

**Northern access**

2.1.8 The Application Site also includes Deephams Farm Road and part of Ardra Road with land currently occupied by the EfW facility water pumping station between the junction of Meridian Way and Deephams Farm Road.

## 2.2 Surrounding area

2.2.1 The Application Site is located to the north of the A406 North Circular Road in an area that is predominantly industrial. The Lee Valley Regional Park (LVRP) is located to the east of the Edmonton EcoPark.

2.2.2 Land to the north and west of the Application Site is predominantly industrial in nature. Immediately to the north of the Edmonton EcoPark is an existing Materials Recovery Facility (MRF), which is operated by a commercial waste management company, alongside other industrial buildings. Further north is Deephams Sewage Treatment Works. Beyond the industrial area to the north-west is a residential area with Badma Close being the nearest residential street to the Application Site (approximately 60m from the nearest part of the boundary) and Zambezie Drive the nearest to the Edmonton EcoPark at approximately 125m west.

2.2.3 Eley Industrial Estate, located to the west of the Application Site, comprises a mixture of retail, industrial and warehouse units.

2.2.4 Advent Way is located to the south of the Application Site adjacent to the A406 North Circular Road. Beyond the A406 North Circular Road are retail and trading estates; this area is identified for future redevelopment to provide a housing-led mixed use development known as Meridian Water.

2.2.5 The LVRP and River Lee Navigation are immediately adjacent to the eastern boundary of the Edmonton EcoPark, and Lee Park Way, a private road which also forms part of National Cycle Route 1, runs alongside the River Lee Navigation. To the east of the River Lee Navigation is the William Girling Reservoir along with an area currently occupied by Camden Plant Ltd which is used for the crushing, screening and stockpiling of waste concrete, soil and other recyclable materials from construction and demolition. The nearest residential areas to the east of the Application Site and LVRP are located at Lower Hall Lane, approximately 550m from the Edmonton EcoPark and 150m from the eastern edge of the Application Site.

## 2.3 The Project

2.3.1 The Project would replace the existing EfW facility at Edmonton EcoPark, which is expected to cease operations in 2025, with a new and more efficient ERF which would produce energy from residual waste, and associated development, including temporary works required to facilitate construction, demolition and commissioning. The proposed ERF would surpass the requirement under the Waste Framework Directive (Directive

2008/98/EC) to achieve an efficiency rating in excess of the prescribed level, and would therefore be classified as a waste recovery operation rather than disposal.

2.3.2 The main features of the Project once the proposed ERF and permanent associated works are constructed and the existing EfW facility is demolished are set out in the Book of Plans (AD02.01) and comprise:

a. a northern area of the Edmonton EcoPark accommodating the proposed ERF;

b. a southern area of the Edmonton EcoPark accommodating the RRF and a visitor, community and education centre with offices and a base for the Edmonton Sea Cadets (‘EcoPark House’);

c. a central space, where the existing EfW facility is currently located, which would be available for future waste-related development;

d. a new landscape area along the edge with the River Lee Navigation; and

e. new northern and eastern site access points.

2.3.3 During construction there is a need to accommodate a Temporary Laydown Area outside of the future operational site because of space constraints. This would be used to provide parking and accommodation for temporary staff (offices, staff welfare facilities), storage and fabrication areas, and associated access and utilities.

2.3.4 Schedule 1 of the draft DCO sets out the authorised development and the works are shown in the Book of Plans, supplemented by Illustrative Plans (included in the Design Code Principles, AD02.02) that set out the indicative form and location of buildings, structures, plant and equipment, in line with the limits of deviation established by the draft DCO (AD03.01).

## 2.4 Stages of development

2.4.1 The proposed ERF is intended to be operational before the end of 2025, but with the precise timing of the replacement to be determined. In order to do this, the following key steps are required:

a. obtain a DCO for the new facility and associated developments;

b. obtain relevant environmental permit(s) and other licences, consents and permits needed;

c. identify a suitable technology supplier;

d. agree and arrange source(s) of funding;

e. enter into contract(s) for design, build and operation of new facility and associated development;

f. move to operation of new facility; and

g. decommission and demolish the existing EfW facility.

2.4.2 Site preparation and construction would be undertaken over a number of years and it is expected that the earliest construction would commence is

2019/20, although this may be later. Construction would be implemented in stages to ensure that essential waste management operations remain functioning throughout. This is especially relevant for the existing EfW facility and associated support facilities.

2.4.3 The stages of the Project are as follows:

a. Stage 1a: site preparation and enabling works;
b. Stage 1b: construction of RRF, EcoPark House and commencement of use of Temporary Laydown Area;
c. Stage 1c: operation of RRF, EcoPark House and demolition/clearance of northern area;
d. Stage 1d: construction of ERF;
e. Stage 2: commissioning of ERF alongside operation of EfW facility, i.e. transition period;
f. Stage 3: operation of ERF, RRF and EcoPark House, demolition of EfW facility; and
g. Stage 4: operation of ERF, RRF and EcoPark House, i.e. final operational situation.

## 2.5 Travel demand for the construction phase

2.5.1 It is possible that, at the peak of construction of the Project, there could up to 500 or 600 employees on-site. It is expected that the construction workforce will be travelling to (and from) the Application Site from (and to) a wide variety of locations across north and greater London. The anticipated number of employees at the peak of each phase of construction is shown in Table 2.1.

Table 2.1: Construction Stage and number of employees

| Stage | Construction employees |
|---|---|
| Stage 1b | 21 |
| Stage 1c | 17 |
| Stage 1d | 550 |
| Stage 2 | 0 |
| Stage 3 | 16 |

2.5.2 The anticipated mode share for construction employees is set out in Table 2.2**Error! Reference source not found.**. This is based on the location of the Application Site and reflects the current public transport accessibility level (PTAL) of 1b[1]. It therefore acknowledges that public transport services are poor and that many construction workers may drive to the Application Site. The mode share is the baseline mode share and does not account for the measures aimed at reducing travel by private car set out within this Framework Construction Travel Plan.

[1] Source: Transport for London (TfL) Planning Information Database

Table 2.2: Construction employee peak hour trips by mode (main mode) - by stage

| **Mode** | **Stage 1b, 1c and 3** | **Stage 1d** | **Stage 2** |
|---|---|---|---|
| Car (as driver) | 75% | 50% | 80% |
| Car (as passenger) | 10% | 25% | 5% |
| Underground/rail | 2% | 8% | 2% |
| Bus | 7% | 10% | 7% |
| Motorcycle | 1% | 1% | 1% |
| Walk | 1% | 1% | 1% |
| Cycle | 4% | 5% | 4% |
| **Total** | **100%** | 100% | **100%** |

2.5.3 The resulting number of trips by mode for each phase of construction are set out in Table 2.3.

Table 2.3: Construction employee trips by mode for each construction stage

| **Mode** | **Stage 1b** | **Stage 1c** | **Stage 1d** | **Stage 2** | **Stage 3** |
|---|---|---|---|---|---|
| Car (as driver) | 16 | 13 | 275 | 127 | 12 |
| Car (as passenger) | 2 | 2 | 137 | 8 | 2 |
| Underground/rail | 0 | 0 | 44 | 4 | 0 |
| Bus | 2 | 1 | 55 | 11 | 1 |
| Motorcycle | 0 | 0 | 6 | 2 | 0 |
| Walk | 0 | 0 | 6 | 2 | 0 |
| Cycle | 1 | 1 | 27 | 6 | 1 |
| **Total** | **21** | **17** | **550** | **160** | **16** |

# 3 Site assessment

## 3.1 Baseline conditions

3.1.1 Existing transport conditions in the vicinity of the Project have been established to provide baseline data against which the potential effects arising from the Project can effectively be assessed. Baseline observations have been informed by a series of site visits.

## 3.2 Local highway network

3.2.1 The key route in the vicinity of the Application Site is the A406 North Circular Road. This forms part of the Transport for London Route Network (TLRN) and provides the main east to west connection across north London. While there is no direct access to the Strategic Road Network (SRN) in the vicinity of the Application Site, it can be accessed to the west of the Application Site on the A1010 Fore Street and to the east of the Application Site on the A112 Chingford Mount Road. Both of these routes travel in a north to south direction.

3.2.2 In the direct vicinity of the Application Site, the key highway links are:

a. A1055 Meridian Way;
b. Advent Way;
c. Argon Road;
d. Walthamstow Avenue;
e. A1009 Hall Lane;
f. Montagu Road;
g. Eley Road;
h. Nobel Road;
i. Ardra Road;
j. Deephams Farm Road; and
k. Lee Park Way.

## 3.3 Public transport

3.3.1 The Application Site currently has a PTAL of 1b. This is rated as 'very poor' (with 1a being the lowest accessibility and 6b being the highest accessibility).

3.3.2 The closest London Underground station to the Application Site is Tottenham Hale which is approximately 3.7km (walking distance) to the south of the Edmonton EcoPark. Victoria line London Underground trains are accessible at this station and operate to Walthamstow Central in the northbound direction and to Brixton, via Finsbury Park, Kings Cross St Pancras, Euston and Victoria in the southbound direction. Trains operate from both Tottenham Hale every two to three minutes in both directions during the peak hours while southbound trains depart Walthamstow Central every two to three minutes during the peak hours.

3.3.3 National Rail services are available at Angel Road station, located approximately 600m (walking distance) to the west of the Edmonton EcoPark. National Rail services from Angel Road operate to Stratford in the southbound direction with one train serving the station per hour during the peak hours. Train services to and from Angel Road are operated by National Express East Anglia. It is proposed that National Rail services from Angel Road be improved and it is understood that the frequency of services will increase to four trains per hour per direction.

3.3.4 There are no direct trains to Liverpool Street station from Angel Road. However, services operating to and from Liverpool Street can be accessed by interchanging at Tottenham Hale station.

3.3.5 There are two London Bus routes operating in close proximity to the Edmonton EcoPark. Routes 34 and 444 are served by bus stop on the eastbound off-slip and westbound on-slip at the junction of the A406 North Circular Road and Advent Way. These bus stops are almost 500m walking distance from the Edmonton EcoPark with route 34 serving the bus stop every six to 10 minutes throughout the day and route 344 serving the bus stop every 15 minutes throughout the day.

3.3.6 Routes 192 and 341 are also accessible on Glover Drive (adjacent to the Angel Road Superstores) to the south of the A406 North Circular Road, some 800m walking distance from the Edmonton EcoPark. Buses on Route 192 serve these bus stops every eight to 12 minutes while buses on Route 341, which operates in the southbound direction only, also serve the bus stop every eight to 12 minutes.

## 3.4 Pedestrian and cycle Networks

3.4.1 Footways are provided along the main routes leading to and from the Application Site and public transport nodes. In particular, there is a continuous footway on the north side of Advent Way although on the approach to the roundabout where the A406 North Circular Road on/off slips meet Advent Way, the footway widths are narrow and are overgrown with vegetation in places. There are no crossing facilities at this junction.

3.4.2 A pedestrian route is also provided along the east side of the River Lee Navigation connecting through to the LVRP to the north and towards the Tottenham Marshes to the south. There is no direct access to this pedestrian route from the Edmonton EcoPark or from Lee Park Way.

3.4.3 The pedestrian environment is generally poor and the quality of the environment is reduced by noise associated with high traffic flows on the A406 North Circular Road. The A406 North Circular Road also acts as a barrier to pedestrian movements in the vicinity of the Application Site. A footbridge is, however, provided over the dual carriageway approximately 160m to the west of the entrance to the Edmonton EcoPark.

3.4.4 There are a number of cycle routes within the vicinity of the Edmonton EcoPark. The following routes are available:

a. a north to south route along the River Lee Navigation;
b. an off-carriageway route adjacent to the A406 North Circular Road to the east of the Edmonton EcoPark and along Advent Way to the west; and
c. an off-carriageway route in a north to south direction along A1055 Meridian Way both to the north and south of the A406 North Circular Road.

3.4.5 The London Cycle Network Plus (LCN+) is also accessible from the Application Site. LCN+ Link 202 runs in a north to south direction on the A112 Chingford Hall Road north and south of the A406 North Circular Road.

## 3.5 Parking

3.5.1 Parking for 212 cars/vans/operational vehicles is currently provided at the Edmonton EcoPark. These parking spaces are all provided at grade.

# 4 Aims and objectives

## 4.1 Sustainable transport aims

4.1.1 The Construction Travel Plan will be focussed on construction employees and visitors to the Application Site during the construction period. The measures suggested within this Framework Construction Travel Plan are intended to encourage travel by modes of transport more sustainable than by private car as far as is reasonably practicable.

4.1.2 The overarching aims of the Construction Travel Plan seek to:

a. influence the travel behaviour of construction employees and visitors;

b. encourage, where practical, travel by cycle, on foot and by public transport by highlighting their availability;

c. minimise the number of single-occupancy car trips generated by construction employees; and

d. promote healthy lifestyles and sustainable travel.

## 4.2 Construction Travel Plan objectives

4.2.1 The Construction Travel Plan for the Application Site will respond to the aims through:

a. reducing car use through the implementation of Travel Plan measures;

b. promoting the existing public transport connections in the area including National Rail services, London Underground services and London Bus services; and

c. reducing the environmental effect associated with vehicle movements by raising travel awareness, encouraging travel by more sustainable modes of transport and minimising the number of single occupancy vehicle trips.

# 5 Construction Travel Plan measures

5.1.1 This section of the Construction Travel Plan describes the potential initiatives that can influence sustainable travel choices for construction workers and visitors. In conjunction with CoCP (AD05.12) and the Construction Travel Plan initiatives set out below, the construction workers and visitors will have a realistic travel alternative to the private car and a range of sustainable travel modes to use. A key factor in encouraging the use of these sustainable travel modes will be awareness.

5.1.2 The measures that are set out in this section will be dependent on the number of employees and may need to be adjusted during different stages of construction depending on the size of the construction workforce at that time and the space that is available at the Application Site.

## 5.2 Construction hours

5.2.1 It is expected that the construction hours of operation will be between 08:00 and 18:00 from Monday to Friday, and from 08:00 to 13:00 on Saturday. While the main shift patterns are expected to be during these hours, some activities may be undertaken outside of these hours with the prior agreement of LB Enfield and TfL. In particular, longer working hours may be considered to reduce the potential effects of construction activities on the local highway network.

## 5.3 On-site measures

5.3.1 This section sets out a set of measures that would require physical implementation at the Application Site.

### Travel information

5.3.2 Transport information will be provided on notice boards that are displayed in prominent locations that are accessible to construction employees and visitors to the Application Site. The information displayed will include:

a. public transport maps, routes, timetables and fares;
b. details of taxi/private hire vehicle (minicab) operators;
c. walking and cycling maps; and
d. information about access to various services and facilities in the local area.

5.3.3 The noticeboards will also provide information which promotes the health benefits of walking and cycling.

### Cycle parking

5.3.4 Cycle parking will also be provided for construction employees. Cycle parking will be provided for 5 per cent of the construction workforce. However, the level of provision will be reviewed through the Travel Plan (see Section 8) and additional spaces will be provided, if required.

5.3.5 While the mode share for cycling is likely to be low in this area given its location, additional cycle parking for construction employees will be considered in order to encourage and promote cycling. This will be complemented by showers, lockers and changing facilities. A pool of cycling equipment (bicycle pumps, lights, locks, helmets, etc) could also be stored on site and loaned to construction employees on a temporary basis.

**Car parking**

5.3.6 During construction, parking for construction employees will be provided on the Temporary Laydown Area. At the peak of construction (during Phase 1d), approximately 225 parking spaces are proposed which will be for use by:

a. employee cars/vans;

b. contractor vans; and

c. shuttle buses (for transporting employees to and from the construction site).

5.3.7 Additional short term parking for light goods vehicles (LGVs) and heavy goods vehicles (HGVs) is proposed on the Application Site for vehicles directly associated with the construction activity.

5.3.8 It is acknowledged that there will be a requirement for car parking for construction workers and operational needs during construction. However, consideration will be given to limiting construction employee car parking in order to encourage a lower mode share by car. A number of car parking spaces for specific use by those who car share will be provided. The number of spaces could be adjusted depending on the number of employees on-site during each stage of construction and on demand for parking.

## 5.4 Other measures

5.4.1 This section sets out a range of additional measures that would promote sustainable travel.

**Employee travel website**

5.4.2 Consideration will be given to setting-up a construction employee specific travel website. This will provide links to public transport maps, routes, timetables and fares, walking and cycling maps and other transport details. Links to travel planning and 'live update' websites (for road traffic and public transport) will be provided as well as promotional material to outline the health benefits of travelling by sustainable modes of transport.

**Car sharing**

5.4.3 Car sharing will be encouraged among construction employees and consideration will be given to setting up a car sharing scheme or providing links to other car sharing schemes to help facilitate this.

### Cycle training

5.4.4 All construction employees, and particularly those who are interested in cycling to work, will be encouraged to take part in cycle training. Free cycle training is offered by LB Enfield as part of the 'Cycle Enfield' programme. Consideration will be given to operating a bespoke training programme for employees at the Application Site.

### Shuttle bus service

5.4.5 Consideration will be given to the provision of a shuttle bus service between the Application Site and the local station(s), such as Tottenham Hale (Underground and National Rail) or Angel Road (National Rail), following the completion of the service enhancements. Such a service would increase the accessibility of the Application Site to public transport. A shuttle service could run between the Temporary Laydown Area and the Edmonton EcoPark to allow employees to park off-site. The frequency of any such services would need to be considered against the number of employees that are expected to be on site at each phase of construction.

# 6 Preliminary targets

## 6.1 Introduction

6.1.1 In order for the Construction Travel Plan to succeed, and to enable a measurement of success, targets need to be set which allow for the assessment of its measures and data. Such targets need to be Specific, Measurable, Achievable, Realistic and Timed (SMART) ensuring that wherever possible targets for modal split can be achieved.

6.1.2 Monitoring of the Construction Travel Plan will be undertaken throughout its duration and, if necessary, changes to the implementation of the Construction Travel Plan or the type of measures that it includes will be made to ensure that the overall targets are achieved within the timeframe set.

6.1.3 A set of preliminary targets has been developed using the mode share outlined in the TA (AD05.11). As the Construction Travel Plan will be an evolving document these initial targets will be continually reviewed and revised if necessary in agreement with the reviewing authorities.

## 6.2 Targets

6.2.1 The overall strategy of the Construction Travel Plan is to reduce the number of single occupancy vehicle trips and increase the number of trips undertaken by sustainable modes, where practical. This is represented in the preliminary targets as shown in Table 6.1 to Table 6.5. The daily total number of trips by mode for are also shown. The targets have been set for the different stages of construction to reflect the varying number of construction employees anticipated to be on the Application Site and the varying length of each phase. The timeframe for achieving the targets will be the mid-way point of each stage of construction.

6.2.2 The preliminary target mode shares presented will be subject to change as these figures are based upon the current best estimate of mode split for the Project. An initial Travel Survey during Phase 1b will update the estimated mode split to a confirmed baseline. Once this data has been obtained, the future year targets can be amended (if required) in line with the proportions presented.

6.2.3 However, given that the initial set of mode shares have sought to take account of existing travel patterns in the immediate area, it is considered that the initial targets and proposed mode shifts will provide a sound basis for the continued development of the Construction Travel Plan.

6.2.4 If by the end of a particular year the data collected indicates that mode shifts are not following the aspired patterns, the Travel Plan Coordinator will assess which measures have been effective and which ineffective. They will then make further decisions with regards to which measures to maintain and which to replace with alternatives. Likewise, if it appears that the targets are not sufficiently challenging, or indeed too challenging, the Travel Plan Coordinator will revise these in consultation with LB Enfield and TfL.

Table 6.1: Construction employee daily mode split future year targets for Stage 1b

| Mode | Baseline | | Stage 1b | |
|---|---|---|---|---|
| | **%** | **Trips** | **%** | **Trips** |
| Car (as driver) | 75% | 16 | 73% | 15 |
| Car (as passenger) | 10% | 2 | 11% | 2 |
| Underground/rail | 2% | 0 | 2% | 0 |
| Bus | 7% | 2 | 8% | 2 |
| Motorcycle | 1% | 0 | 1% | 0 |
| Walk | 1% | 0 | 1% | 0 |
| Cycle | 4% | 1 | 4% | 1 |
| **Total** | **100%** | **21** | **100%** | 21 |

Table 6.2: Construction employee daily mode split future year targets for Stage 1c

| Mode | Baseline | | Stage 1c | |
|---|---|---|---|---|
| | **%** | **Trips** | **%** | **Trips** |
| Car (as driver) | 75% | 13 | 71% | 12 |
| Car (as passenger) | 10% | 2 | 12% | 2 |
| Underground/rail | 2% | 0 | 2% | 0 |
| Bus | 7% | 1 | 9% | 2 |
| Motorcycle | 1% | 0 | 1% | 0 |
| Walk | 1% | 0 | 1% | 0 |
| Cycle | 4% | 1 | 4% | 1 |
| **Total** | **100%** | **17** | **100%** | **17** |

Table 6.3: Construction employee daily mode split future year targets for Stage 1d

| Mode | Baseline | | Stage 1d | |
|---|---|---|---|---|
| | **%** | **Trips** | **%** | **Trips** |
| Car (as driver) | 50% | 275 | 40% | 220 |
| Car (as passenger) | 25% | 137 | 35% | 193 |
| Underground/rail | 8% | 44 | 5% | 28 |
| Bus | 10% | 55 | 13% | 72 |
| Motorcycle | 1% | 6 | 1% | 6 |
| Walk | 1% | 6 | 1% | 6 |
| Cycle | 5% | 27 | 5% | 28 |
| **Total** | 100% | **550** | **100%** | **550** |

Table 6.4: Construction employee daily mode split future year targets for Stage 2

| Mode | Baseline | | Stage 2 | |
|---|---|---|---|---|
| | % | Trips | % | Trips |
| Car (as driver) | 80% | 127 | 75% | 120 |
| Car (as passenger) | 5% | 8 | 8% | 13 |
| Underground/rail | 2% | 4 | 2% | 3 |
| Bus | 7% | 11 | 8% | 13 |
| Motorcycle | 1% | 2 | 1% | 2 |
| Walk | 1% | 2 | 1% | 2 |
| Cycle | 4% | 6 | 5% | 8 |
| Total | **100%** | **160** | **100%** | **160** |

Table 6.5: Construction employee daily mode split future year targets for Stage 3

| Mode | Baseline | | Stage 3 | |
|---|---|---|---|---|
| | % | Trips | % | Trips |
| Car (as driver) | 75% | 12 | 69% | 11 |
| Car (as passenger) | 10% | 2 | 13% | 2 |
| Underground/rail | 2% | 0 | 2% | 0 |
| Bus | 7% | 1 | 9% | 1 |
| Motorcycle | 1% | 0 | 1% | 0 |
| Walk | 1% | 0 | 1% | 0 |
| Cycle | 4% | 1 | 5% | 1 |
| **Total** | **100%** | **16** | **100%** | **16** |

# 7 Management of the Construction Travel Plan

7.1.1 In order to maximise the chances of success, it is important to have a clear implementation strategy, identifying roles and responsibilities to maintain the momentum of the Construction Travel Plan.

7.1.2 Prior to the commencement of construction, a Travel Plan Coordinator will be appointed to oversee the implementation and monitoring of the Construction Travel Plan. The Travel Plan Coordinator will have overall responsibility for:

a. establishing and coordinating a Travel Plan Steering Group comprising construction workers and representative from the main and other contractors with meetings as required;

b. identifying key milestones, deliverables and a programme to oversee the development and implementation of specific initiatives;

c. development and dissemination of appropriate marketing/information materials;

d. overseeing implementation of Construction Travel Plan measures in a timely manner;

e. liaison with any appropriate groups/organisations (e.g. the LB Enfield's Travel Plan Officer) to ensure coordinated working;

f. undertaking appropriate monitoring of the Construction Travel Plan, including any appropriate review and revisions;

g. monitoring and reviewing progress and identifying targets for taking the Construction Travel Plan forward;

h. ensuring that the work of the Construction Travel Plan is coordinated with other activities of the Project; and

i. ensuring that there is sufficient amount of time to spend on the Construction Travel Plan and perform all their duties.

7.1.3 Both the Travel Plan Coordinator and Travel Plan Steering Group will play an important role in liaising and collaborating with the other local Travel Plan Coordinators and Steering Groups, particularly those associated with the other land uses in the vicinity of the Application Site.

# 8 Monitoring and review

## 8.1 Introduction

8.1.1 An important part of any Travel Plan is the on-going monitoring and reviewing of its effectiveness. It is important that a Travel Plan is not just a one-off event but a continually evolving process. Regular monitoring and reviewing will help to gauge progress towards achieving targets and objectives, and if necessary, allow the Travel Plan to be refined and adapted.

## 8.2 Monitoring

8.2.1 The first Construction Travel Plan monitoring survey(s) will be carried out six months from the commencement of construction of the Project. The surveys will be analysed against a number of indicators in order to establish how well the Construction Travel Plan measures are achieving its aims and if any modifications are required to better meet these objectives.

8.2.2 Monitoring of the Construction Travel Plan will be based upon feedback forms which will have been distributed to employees. This will allow for site-specific travel characteristics to be reconfirmed against which the targets set can be reviewed and adjusted accordingly.

8.2.3 The Construction Travel Plan will be monitored at the mid-way point of each stage of construction. The monitoring will be the responsibility of the Travel Plan Coordinator(s). Based on published TfL guidance the monitoring will include the following elements as a minimum:

a. multi-modal counts of all trips undertaken to and from the Application Site;

b. full site audit;

c. parking counts (all vehicles including bicycles); and

d. uptake of travel planning measures.

8.2.4 Based on the relevant thresholds set out by TfL, the Construction Travel Plan will be monitored using TRICS® (Trip Rate Information Computer System) or iTrace (innovation in Travel Plan Management Software).

## 8.3 Reporting

8.3.1 A full monitoring report will be prepared by the Travel Plan Coordinator(s) and will be issued to all appropriate stakeholders including LB Enfield as well as TfL. The report will include comprehensive details of all survey data and measures which have been implemented.

8.3.2 A key element of the report will be comparing the surveyed modal share to the target set; if the data shows that the targets have not been met or are not on course to be met, the report will outline the reasons behind this and how the matter will be resolved.

8.3.3 In order to make the results accessible to employees, who are all stakeholders in the plan, a summarised version of the report will be distributed. This can also be made available to other local interest groups.

# 9 Action plan

9.1.1 Table 9.1 outlines a provisional action plan for the Construction Travel Plan and sets out the activities that are needed in order to implement the measures which have been proposed, alongside an indicative timetable for implementation. This timetable will be reviewed with the key stakeholders and updated within future versions of the Construction Travel Plan document.

Table 9.1: Action plan

| Activity | Responsibility | Programme |
|---|---|---|
| Employ Travel Plan Coordinator(s) | The Applicant/ contractor | Six months prior to commencement of construction |
| Identification of Travel Plan Requirements | The Applicant/ contractor | Six months prior to commencement of construction |
| Preparation of Interim Travel Plans | The Applicant/ contractor | Three months prior to commencement of construction |
| Inform LB Enfield of Travel Plan Coordinator(s) appointment | Travel Plan Coordinator | Within 1 month of appointment |
| Establishment of a car sharing database | Travel Plan Coordinator | Upon commencement of construction |
| Establish a Travel Plan Steering Group | Travel Plan Coordinator | Within 6 months of commencement of construction |
| Distribution of Welcome Packs | Travel Plan Coordinator | On-going |
| Initial travel surveys | Travel Plan Coordinator | Six months after commencement of Phase 1b |
| Update Travel Plan | Travel Plan Coordinator | After surveys, as appropriate |
| Subsequent travel surveys and updating of the Travel Plans | Travel Plan Coordinator | Mid-way through each construction phase |
| Consultation with LB Enfield | Travel Plan Coordinator | On-going |

# **Appendix K** – Framework Operation Travel Plan

North London Waste Authority

# North London Heat and Power Project

## Framework Operational Travel Plan

The Planning Act 2008 The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5 (2)(q)

Issue | October 2015

Arup



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nlwa
north london waste authority

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# Tables

# Glossary

| | |
|---|---|
| DCO | Development Consent Order |
| EfW | Energy from Waste |
| ERF | Energy Recovery Facility |
| ktpa | Kilo-tonnes per annum |
| LB Enfield | London Borough of Enfield |
| LVRP | Lee Valley Regional Park |
| LWL | London Waste Limited |
| MW | Mega Watts |
| NLHPP | North London Heat and Power Project |
| NLWA | North London Waste Authority |
| PTAL | Public Transport Accessibility Level |
| RRF | Resource Recovery Facility |
| SRN | Strategic Transport Network |
| STW | Sewage Treatment Works |
| TA | Transport Assessment |
| TfL | Transport for London |
| TLRN | Transport for London Route Network |
| TRICS® | Trip Rate Information Computer System |
| UKPN | United Kingdom Power Networks |

# 1 Introduction

## 1.1 Background

## 1.2 Introduction

1.2.1 The North London Waste Authority (Authority) is preparing an application for a Development Consent Order (DCO) pursuant to the Planning Act 2008 (as amended) (Application). The Application will be for the North London Heat and Power Project (the Project) comprising construction, operation and maintenance of an Energy Recovery Facility (ERF) of around 70 megawatts (MWe) and associated development, including a Resource Recovery Facility (RRC) at the Edmonton EcoPark site in north London. The proposed ERF will replace the existing Energy from Waste (EfW) and other facilities at the Edmonton EcoPark.

1.2.2 This Framework Operational Travel Plan (Version 1) has been prepared to support the Application for a DCO.

## 1.3 Scope of the Travel Plan

1.3.1 The scope of this Travel Plan covers the employees and visitors to the Edmonton EcoPark for the final operational situation of the Project.

## 1.4 Framework Operational Travel Plan structure

1.4.1 The Operational Travel Plan will form a central element of the overall transport strategy for operational employees from the start of Project implementation, as part of a systematic approach to influence long term travel choice. This Framework Operational Travel Plan document:

a. provides a summary of the existing transport network;

b. articulates a series of objectives for the Project;

c. provides an indicative set of targets;

d. identifies and describes the initiatives proposed to support the objectives; and

e. proposes a management strategy for delivery and monitoring.

1.4.2 This Framework Operational Travel Plan should be read in conjunction with the Transport Assessment (TA) (AD05.11) accompanying the Application.

1.4.3 A separate Framework Construction Travel Plan has been prepared for employees and visitors to the Application Site during the construction stage of the Project. The aims and objectives of both Travel Plans seek to minimise the effect of employee travel on the local highway network. However, the measures contained within the Framework Construction Travel Plan have been tailored to account for the larger workforce.

# 2 Context

## 2.1 The Application Site

2.1.1 The Application Site, as shown on the Site Location Plan (A_0001 and A_0002), extends to approximately 22 hectares and is located wholly within the London Borough of Enfield (LB Enfield). The Application Site comprises the existing waste management site known as the Edmonton EcoPark where the permanent facilities would be located, part of Ardra Road, land around the existing water pumping station at Ardra Road, Deephams Farm Road, part of Lee Park Way and land to the west of the River Lee Navigation, and land to the north of Advent Way and east of the River Lee Navigation (part of which would form the Temporary Laydown Area and new Lee Park Way access road). The post code for the site is N18 3AG and the grid reference for the proposed development is TQ 35750 92860.

2.1.2 The Application Site includes all land required to deliver the Project. This includes land that would be required temporarily to facilitate the development.

2.1.3 Both the Application Site and the Edmonton EcoPark (existing and proposed) are shown on Plan A_0003 contained within the Book of Plans (AD02.01). Throughout this report references to the Application Site refer to the proposed extent of the Project works, and Edmonton EcoPark refers to the operational site. Upon completion of the Project the operational site would consist of the Edmonton EcoPark and additional land required to provide new access arrangements and for a water pumping station adjacent to the Deephams Sewage Treatment Works outflow channel.

### Edmonton EcoPark

2.1.4 The Edmonton EcoPark is an existing waste management complex of around 16 hectares, with an EfW facility which treats circa 540,000 tonnes per annum (tpa) of residual waste and generates around $40MW_e$ (gross) of electricity; an In-Vessel Composting (IVC) facility; a Bulky Waste Recycling Facility (BWRF) and Fuel Preparation Plant (FPP); an Incinerator Bottom Ash (IBA) Recycling Facility; a fleet management and maintenance facility; associated offices, car parking and plant required to operate the facility; and a former wharf and single storey building utilised by the Edmonton Sea Cadets under a lease

2.1.5 In order to construct the proposed ERF, the existing BWRF and FPP activities would be relocated within the Application Site; the IVC facility would be decommissioned and the IBA recycling would take place off-site.

### Temporary Laydown Area and eastern access

2.1.6 The proposed Temporary Laydown Area is an area of open scrubland located to the east of the River Lee Navigation and north of Advent Way. There is no public access to this area. The Temporary Laydown Area would be reinstated after construction and would not form part of the ongoing operational site.

2.1.7 In addition to the Temporary Laydown Area the Application Site includes land to the east of the existing Edmonton EcoPark which would be used for the new Lee Park Way entrance and landscaping along the eastern boundary.

**Northern access**

2.1.8 The Application Site also includes Deephams Farm Road and part of Ardra Road with land currently occupied by the EfW facility water pumping station between the junction of Meridian Way and Deephams Farm Road.

## 2.2 Surrounding area

2.2.1 The Application Site is located to the north of the A406 North Circular Road in an area that is predominantly industrial. The Lee Valley Regional Park (LVRP) is located to the east of the Edmonton EcoPark.

2.2.2 Land to the north and west of the Application Site is predominantly industrial in nature. Immediately to the north of the Edmonton EcoPark is an existing Materials Recovery Facility (MRF), which is operated by a commercial waste management company, alongside other industrial buildings. Further north is Deephams Sewage Treatment Works. Beyond the industrial area to the north-west is a residential area with Badma Close being the nearest residential street to the Application Site (approximately 60m from the nearest part of the boundary) and Zambezie Drive the nearest to the Edmonton EcoPark at approximately 125m west.

2.2.3 Eley Industrial Estate, located to the west of the Application Site, comprises a mixture of retail, industrial and warehouse units.

2.2.4 Advent Way is located to the south of the Application Site adjacent to the A406 North Circular Road. Beyond the A406 North Circular Road are retail and trading estates; this area is identified for future redevelopment to provide a housing-led mixed use development known as Meridian Water.

2.2.5 The LVRP and River Lee Navigation are immediately adjacent to the eastern boundary of the Edmonton EcoPark, and Lee Park Way, a private road which also forms part of National Cycle Route 1, runs alongside the River Lee Navigation. To the east of the River Lee Navigation is the William Girling Reservoir along with an area currently occupied by Camden Plant Ltd which is used for the crushing, screening and stockpiling of waste concrete, soil and other recyclable materials from construction and demolition. The nearest residential areas to the east of the Application Site and LVRP are located at Lower Hall Lane, approximately 550m from the Edmonton EcoPark and 150m from the eastern edge of the Application Site.

## 2.3 The Project

2.3.1 The Project would replace the existing EfW facility at Edmonton EcoPark, which is expected to cease operations in 2025, with a new and more efficient ERF which would produce energy from residual waste, and associated development, including temporary works required to facilitate construction, demolition and commissioning. The proposed ERF would surpass the requirement under the Waste Framework Directive (Directive

2008/98/EC) to achieve an efficiency rating in excess of the prescribed level, and would therefore be classified as a waste recovery operation rather than disposal.

2.3.2 The main features of the Project once the proposed ERF and permanent associated works are constructed and the existing EfW facility is demolished are set out in the Book of Plans (AD02.01) and comprise:

a. a northern area of the Edmonton EcoPark accommodating the proposed ERF;
b. a southern area of the Edmonton EcoPark accommodating the RRF and a visitor, community and education centre with offices and a base for the Edmonton Sea Cadets (‘EcoPark House’);
c. a central space, where the existing EfW facility is currently located, which would be available for future waste-related development;
d. a new landscape area along the edge with the River Lee Navigation; and
e. new northern and eastern site access points.

2.3.3 During construction there is a need to accommodate a Temporary Laydown Area outside of the future operational site because of space constraints. This would be used to provide parking and accommodation for temporary staff (offices, staff welfare facilities), storage and fabrication areas, and associated access and utilities.

2.3.4 Schedule 1 of the draft DCO sets out the authorised development and the works are shown in the Book of Plans, supplemented by Illustrative Plans (included in the Design Code Principles, AD02.02) that set out the indicative form and location of buildings, structures, plant and equipment, in line with the limits of deviation established by the draft DCO (AD03.01).

## 2.4 Stages of development

2.4.1 The proposed ERF is intended to be operational before the end of 2025, but with the precise timing of the replacement to be determined. In order to do this, the following key steps are required:

a. obtain a DCO for the new facility and associated developments;
b. obtain relevant environmental permit(s) and other licences, consents and permits needed;
c. identify a suitable technology supplier;
d. agree and arrange source(s) of funding;
e. enter into contract(s) for design, build and operation of new facility and associated development;
f. move to operation of new facility; and
g. decommission and demolish the existing EfW facility.

2.4.2 Site preparation and construction would be undertaken over a number of years and it is expected that the earliest construction would commence is

2019/20, although this may be later. Construction would be implemented in stages to ensure that essential waste management operations remain functioning throughout. This is especially relevant for the existing EfW facility and associated support facilities.

2.4.3 The stages of the Project are as follows:

a. Stage 1a: site preparation and enabling works;
b. Stage 1b: construction of RRF, EcoPark House and commencement of use of Temporary Laydown Area;
c. Stage 1c: operation of RRF, EcoPark House and demolition/clearance of northern area;
d. Stage 1d: construction of ERF;
e. Stage 2: commissioning of ERF alongside operation of EfW facility, i.e. transition period;
f. Stage 3: operation of ERF, RRF and EcoPark House, demolition of EfW facility; and
g. Stage 4: operation of ERF, RRF and EcoPark House, i.e. final operational situation.

## 2.5 Travel demand for the Project

2.5.1 As the Edmonton EcoPark will be operational for 24 hours a day, employees will be on site at all times of the day, with three shift times likely (morning to afternoon/evening, afternoon/evening to night and night to morning). As such, there is likely to be an overlap in the starting and finishing workforce at the shift change-over times.

2.5.2 The anticipated mode share for employees and the daily trips by mode are set out in Table 2.1. This is based on the location of the Edmonton EcoPark and reflects the current public transport accessibility level (PTAL) of 1b[1]. It therefore acknowledges that public transport services are poor and that many employees may drive to the Edmonton EcoPark. The mode share is the baseline mode share and does not account for the measures aimed at reducing travel by private car set out within this Framework Operational Travel Plan.

[1] Source: Transport for London (TfL) Planning Information Database

Table 2.1: Employee peak hour trips by mode (main mode)

| Mode | % mode share | Operation |
|---|---|---|
| Car (as driver) | 80% | 122 |
| Car (as passenger) | 5% | 8 |
| Underground/rail | 2% | 3 |
| Bus | 7% | 11 |
| Motorcycle | 1% | 1 |
| Walk | 1% | 2 |
| Cycle | 4% | 6 |
| **Total** | **100%** | **153** |

# 3 Site assessment

## 3.1 Baseline conditions

3.1.1 Existing transport conditions in the vicinity of the Project have been established to provide baseline data against which the potential effects arising from the Project can effectively be assessed. Baseline observations have been informed by a series of site visits.

## 3.2 Local highway network

3.2.1 The key route in the vicinity of the Edmonton EcoPark is the A406 North Circular Road. This forms part of the Transport for London Route Network (TLRN) and provides the main east to west connection across north London. While there is no direct access to the Strategic Road Network (SRN) in the vicinity of the proposed site, it can be accessed to the west of the Edmonton EcoPark on the A1010 Fore Street and to the east of the Edmonton EcoPark on the A112 Chingford Mount Road. Both of these routes travel in a north to south direction.

3.2.2 In the direct vicinity of the Edmonton EcoPark, the key highway links are:

a. A1055 Meridian Way;
b. Advent Way;
c. Argon Road;
d. Walthamstow Avenue;
e. A1009 Hall Lane;
f. Montagu Road;
g. Eley Road;
h. Nobel Road;
i. Ardra Road;
j. Deephams Farm Road; and
k. Lee Park Way.

## 3.3 Public transport

3.3.1 The Edmonton EcoPark currently has a Public Transport Accessibility Level (PTAL) of 1b, measured from the entrance to the Application Site. This has an Accessibility index of 3.35 and is rated as 'very poor' (with 1a being the lowest accessibility and 6b being the highest accessibility).

3.3.2 The closest London Underground station to the Edmonton EcoPark is Tottenham Hale which is approximately 3.7km (walking distance) to the south of the Edmonton EcoPark. Victoria line London Underground trains are accessible at this station and operate to Walthamstow Central in the northbound direction and to Brixton, via Finsbury Park, Kings Cross St Pancras, Euston and Victoria in the southbound direction. Trains operate from Tottenham Hale every two to three minutes in both directions during the peak hours while southbound trains depart Walthamstow Central every two to three minutes during the peak hours.

3.3.3 National Rail services are available at Angel Road station, located approximately 600m (walking distance) to the west of the Edmonton EcoPark. National Rail services from Angel Road operate to Stratford in the southbound direction with one train per hour in each direction during the peak hours. Train services to and from Angel Road are operated by National Express East Anglia. It is proposed that National Rail services from Angel Road be improved and it is understood that the frequency of services will increase to four trains per hour per direction.

3.3.4 There are no direct trains to Liverpool Street station from Angel Road. However, services operating to and from Liverpool Street can be accessed by interchanging at Tottenham Hale station.

3.3.5 There are two London Bus routes operating in close proximity to the Edmonton EcoPark. Routes 34 and 444 are served by bus stop on the eastbound off-slip and westbound on-slip at the junction of the A406 North Circular Road and Advent Way. These bus stops are almost 500m walking distance from the Edmonton EcoPark with route 34 serving the bus stop every six to 10 minutes throughout the day and route 344 serving the bus stop every 15 minutes throughout the day.

3.3.6 Routes 192 and 341 are also accessible on Glover Drive (adjacent to the Angel Road Superstores) to the south of the A406 North Circular Road, some 800m walking distance from the Edmonton EcoPark. Buses on Route 192 serve these bus stops every eight to 12 minutes while buses on Route 341, which operates in the southbound direction only, also serve the bus stop every eight to 12 minutes.

## 3.4 Pedestrian and cycle Networks

3.4.1 Footways are provided along the main routes leading to and from the Application Site and public transport nodes. In particular, there is a continuous footway on the north side of Advent Way although on the approach to the roundabout where the A406 North Circular Road on/off slips meet Advent Way, the footway widths are narrow and are overgrown with vegetation in places. There are no crossing facilities at this junction.

3.4.2 A pedestrian route is also provided along the east side of the River Lee Navigation connecting through to the LVRP to the north and towards the Tottenham Marshes to the south. There is no direct access to this pedestrian route from the Edmonton EcoPark or from Lee Park Way.

3.4.3 The pedestrian environment is generally poor and the quality of the environment is reduced by noise associated with high traffic flows on the A406 North Circular Road. The A406 North Circular Road also acts as a barrier to pedestrian movements in the vicinity of the Application Site. A footbridge is, however, provided over the dual carriageway approximately 160m to the west of the entrance to the Edmonton EcoPark.

3.4.4 There are a number of cycle routes within the vicinity of the Edmonton EcoPark. The following routes are available:

a. a north to south route along the River Lee Navigation;

b. an off-carriageway route adjacent to the A406 North Circular Road to the east of the Edmonton EcoPark and along Advent Way to the west; and

c. an off-carriageway route in a north to south direction along A1055 Meridian Way both to the north and south of the A406 North Circular Road.

3.4.5 The London Cycle Network Plus (LCN+) is also accessible in close proximity to the Edmonton EcoPark. LCN+ Link 202 runs in a north to south direction on the A112 Chingford Hall Road north and south of the A406 North Circular Road.

## 3.5 Parking

3.5.1 Parking for 212 cars/vans/operational vehicles is currently provided at the Edmonton EcoPark. These parking spaces are all provided at grade.

# 4 Aims and objectives

## 4.1 Sustainable transport aims

4.1.1 The Operational Travel Plan will be focussed on employees and visitors to the Edmonton EcoPark when the ERF is completed and operational. The measures suggested within this Framework Operational Travel Plan are intended to encourage travel by modes of transport more sustainable than by private car as far as is reasonably practicable.

4.1.2 The overarching aims of the Operational Travel Plan for the Project seek to:

a. influence the travel behaviour of operational employees and visitors;

b. encourage, where practical, travel by cycle, on foot and by public transport by highlighting their availability;

c. minimise the number of single-occupancy car trips generated by the Project; and

d. promote healthy lifestyles and sustainable travel.

## 4.2 Operational Travel Plan objectives

4.2.1 The Operational Travel Plan for the Edmonton EcoPark will respond to the aims through:

a. reducing car use through the implementation of Travel Plan measures;

b. promoting the existing public transport connections in the area including National Rail services, London Underground services and London Bus services.

c. reducing the environmental effect associated with vehicle movements by raising travel awareness, encouraging travel by more sustainable modes of transport and minimising the number of single occupancy vehicle trips; and

d. linking the development to the surrounding community by the strong promotion of walking, cycling and public transport, thus minimising the effect on the highway infrastructure in the vicinity of the Project.

# 5 Operational Travel Plan measures

5.1.1 This section of the Operational Travel Plan describes the potential initiatives that can influence sustainable travel choices for operational employees and visitors. In conjunction with the associated legal agreement and the Operational Travel Plan initiatives set out below, the occupiers of the Project will have a realistic travel alternative to the private car and a range of sustainable travel modes to use. A key factor in encouraging the use of these sustainable travel modes will be awareness.

## 5.2 On-site measures

5.2.1 This section sets out a set of measures that would require physical implementation at the Edmonton EcoPark.

### Travel information

5.2.2 Transport information will be provided on notice boards that are displayed in prominent locations that are accessible to employees and visitors to the Edmonton EcoPark at all times of the day. The information displayed should include:

a. public transport maps, routes, timetables and fares;
b. details of taxi/private hire vehicle (minicab) operators;
c. walking and cycling maps; and
d. information about access to various services and facilities in the local area.

5.2.3 The noticeboards will also provide information which promotes the health benefits of walking and cycling.

### Cycle parking

5.2.4 It is proposed to provide 19 cycle parking spaces for employees with seven additional spaces for visitors.

5.2.5 The cycle mode share for employees of the operational site is likely to be low given the location of the Edmonton EcoPark and the likely employee shift times. However, an adequate quantum of cycle parking should be provided for employees to encourage cycling. Cycle parking will be secure, sheltered and conveniently located within 100m of the building entrance(s). Cycle parking will be complemented by showers, lockers and changing facilities. Showers do not need to be provided for the sole use of cyclists but any facilities provided for contractors/employees as a result of the work undertaken on the Edmonton EcoPark should also be accessible to cyclists.

## 5.3 Car parking

5.3.1 It is proposed that 132 car parking spaces be provided for the completed Project. It is proposed that 14 accessible spaces be provided and 26 spaces will be equipped with electric vehicle charging points (in line with London

Plan[2] policy requirements) equating to 20 per cent of the total provision. The passive provision for electric vehicle charging points will be provided for a further 10 per cent of spaces.

5.3.2 It is acknowledged that there will be a requirement for car parking for employees given the likely high mode share by car and the nature of the shift working that will be undertaken. Specific spaces for those who car share or travel using electric vehicles should be considered.

## 5.4 Other measures

5.4.1 This section sets out a range of additional measures that would promote sustainable travel.

**Employee travel website**

5.4.2 Consideration will be given to setting-up an employee specific travel website or a travel/transport section on an existing intranet or other existing employee website. This will provide links to public transport maps, routes, timetables and fares, walking and cycling maps and other transport details. Links to travel planning and 'live update' websites (for road traffic and public transport) will be provided as well as promotional material to outline the health benefits of travelling by sustainable modes of transport.

**Car sharing**

5.4.3 Car sharing will be encouraged among employees and consideration will be given to setting up a car sharing website to help facilitate this or providing links to other car sharing scheme. Those who wish to join the car sharing website could provide postcode information or typical shift patterns to help to identify those travelling from a similar location and those who work at similar times. While this would provide environmental benefits by reducing the number of vehicles on the highway network, it could also be financially beneficial for employees who share by reducing fuel costs.

5.4.4 There are a number of car sharing platforms already available although it is recommended that, if implemented, one of these be adapted for use by Edmonton EcoPark employees only. A simplified version could be operated on an internal intranet or similar and rolled out into a more formal scheme if this is a success.

**Cycle training**

5.4.5 All employees who are interested in cycling to work will be encouraged to take part in cycle training. Free cycle training is offered by the LB Enfield as part of the 'Cycle Enfield' programme. Consideration will be given to operating a bespoke training programme for employees.

[2] Greater London Authority (GLA), The London Plan, the Spatial Development Strategy for London Consolidated with Alterations since 2015, March 2015.

### Travel loans and cycle discounts

5.4.6 Consideration will be given to offering interest-free travel loans to assist in the purchase of annual season tickets or travel-cards where practicable.

5.4.7 The provision of discounts on cycling equipment and bicycles themselves will also be considered. Local cycle shops will be approached to arrange discounts for cycle equipment for all interested employees.

### Cycle to work scheme

5.4.8 If appropriate administratively, consideration will also be given to taking part in the Government cycle to work scheme. This provides a Government approved tax incentive for employees to hire a new bicycle and safety equipment providing the main use of the bike is for commuting to work. The benefits of the scheme include incurring no income tax or national insurance.

### Flexible working practices

5.4.9 Flexible working practices will be considered for office based employees to reduce the travel demands of the Site. Flexible working practices may not be practical and will need to be considered against the needs of the business. At the very least, the Operational Travel Plan will include a mechanism that would allow for this to be reviewed periodically to enable flexible working practices to be introduced at a later date, if appropriate.

### Shuttle bus service

5.4.10 Consideration will be given to the provision of a shuttle bus service between the Edmonton EcoPark and the local station(s), such as Tottenham Hale (Underground and National Rail) or Angel Road (National Rail). This would increase the attractiveness of travelling to the Edmonton EcoPark by public transport.

# 6 Preliminary targets

## 6.1 Introduction

6.1.1 In order for the Operational Travel Plan to succeed, and to enable a measurement of success, targets need to be set which allow for the assessment of its measures and data. Such targets need to be Specific, Measurable, Achievable, Realistic and Timed (SMART) ensuring that wherever possible targets for modal split can be achieved.

6.1.2 Monitoring of the Operational Travel Plan will be undertaken throughout its duration and, if necessary, changes to the implementation of the Operational Travel Plan or the type of measures that it includes will be made to ensure that the overall targets are achieved within the timeframe set.

6.1.3 A set of preliminary targets has been developed using the mode share forecasts outlined in the TA (AD05.11). As the Operational Travel Plan will be an evolving document these initial targets will be continually reviewed and revised if necessary in agreement with the reviewing authorities.

## 6.2 Targets

6.2.1 The overall strategy of the Travel Plan is to reduce the number of single occupancy vehicle trips and increase the number of trips undertaken by sustainable modes, where practical. This is represented in the targets as shown in Table 6.1. The daily total number of trips by mode for the peak hour (the highest peak hour throughout the day) are also shown in Table 6.1.

6.2.2 The preliminary target mode shares presented will be subject to change as these figures are based upon the current best estimate of mode split for the Project. An initial Travel Survey will update the estimated mode split to a confirmed baseline. Once this data has been obtained, the future year targets can be amended (if required) in line with the proportions presented.

6.2.3 However, given that the initial set of mode shares have sought to take account of existing travel patterns in the immediate area, it is considered that the initial targets and proposed mode shifts will provide a sound basis for the continued development of the Operational Travel Plan.

6.2.4 If by the end of a particular year the data collected indicates that mode shifts are not following the aspired patterns, the Travel Plan Coordinator will assess which measures have been effective and which ineffective. They will then make further decisions with regards to which measures to maintain and which to replace with alternatives. Likewise, if it appears that the targets are not sufficiently challenging, or indeed too challenging, the Travel Plan Coordinator will revise these in consultation with LB Enfield and TfL.

Table 6.1: Employee daily mode split future year targets

| Mode | Baseline | | Year 1 | | Year 3 | | Year 5 | |
|---|---|---|---|---|---|---|---|---|
| | % | Trips | % | Trips | % | Trips | % | Trips |
| Car (as driver) | 80% | 122 | 78% | 120 | 75% | 115 | 70% | 107 |
| Car (as passenger) | 5% | 8 | 6% | 9 | 7% | 10 | 9% | 14 |
| Underground/rail | 2% | 3 | 2% | 3 | 2% | 3 | 3% | 5 |
| Bus | 7% | 11 | 8% | 12 | 9% | 14 | 10% | 15 |
| Motorcycle | 1% | 1 | 1% | 1 | 1% | 1 | 1% | 1 |
| Walk | 1% | 2 | 1% | 2 | 1% | 2 | 1% | 2 |
| Cycle | 4% | 6 | 4% | 6 | 5% | 8 | 6% | 9 |
| **Total** | **100%** | **153** | **100%** | **153** | **100%** | **153** | **100%** | **153** |

# 7 Management of the Operational Travel Plan

7.1.1 In order to maximise the chances of success, it is important to have a clear implementation strategy, identifying roles and responsibilities to maintain the momentum of the Operational Travel Plan.

7.1.2 Upon completion of the Project, a Travel Plan Co-ordinator will be appointed to oversee the implementation and monitoring of the Operational Travel Plan. The Travel Plan Co-ordinator will have overall responsibility for:

a. establishing and co-ordinating a Travel Plan Steering Group comprised of employees with meetings as required;

b. identifying key milestones, deliverables and a programme to oversee the development and implementation of specific initiatives;

c. development and dissemination of appropriate marketing/information materials;

d. overseeing implementation of Operational Travel Plan measures in a timely manner;

e. liaison with any appropriate groups/organisations (e.g. the LB Enfield's Travel Plan Officer) to ensure co-ordinated working;

f. undertaking appropriate monitoring of the Operational Travel Plan, including any appropriate review and revisions;

g. monitoring and reviewing progress and identifying targets for taking the Operational Travel Plan forward;

h. ensuring that the work of the Operational Travel Plan is co-ordinated with other activities of the Project; and

i. ensuring that there is sufficient amount of time to spend on the Operational Travel Plan and perform all their duties.

7.1.3 Both the Travel Plan Coordinator and Travel Plan Steering Group will play an important role in liaising and collaborating with other local Travel Plan Coordinators and Steering Groups, particularly those associated with the other land uses in the vicinity of the Edmonton EcoPark.

# 8 Monitoring and review

## 8.1 Introduction

8.1.1 An important part of any Travel Plan is the on-going monitoring and reviewing of its effectiveness. It is important that a Travel Plan is not just a one-off event but a continually evolving process. Regular monitoring and reviewing will help to gauge progress towards achieving targets and objectives, and if necessary, allow the Travel Plan to be refined and adapted.

## 8.2 Monitoring

8.2.1 The first Operational Travel Plan monitoring survey(s) will be carried out six months from the implementation of the Project. The surveys will be analysed against a number of indicators in order to establish how well the Operational Travel Plan measures are achieving its aims and if any modifications are required to better meet these objectives.

8.2.2 Monitoring of the Operational Travel Plan will be based upon feedback forms which will have been distributed to employees. This will allow for site-specific travel characteristics to be reconfirmed against which the targets set can be reviewed and adjusted accordingly.

8.2.3 The Operational Travel Plan will be monitored after one, three and five years. The monitoring will be the responsibility of the Travel Plan Coordinator(s). Based on published TfL guidance the monitoring will include the following elements as a minimum:

a. multi-modal counts of all trips undertaken to and from the Application Site;

b. full site audit;

c. parking counts (all vehicles including bicycles); and

d. uptake of travel planning measures.

8.2.4 Based on the relevant thresholds set out by TfL, the Operational Travel Plan will be monitored using TRICS® (Trip Rate Information Computer System) or iTrace (innovation in Travel Plan Management Software).

## 8.3 Reporting

8.3.1 A full monitoring report will be prepared by the Travel Plan Coordinator(s) and will be issued to all appropriate stakeholders including LB Enfield as well as TfL. The report will include comprehensive details of all survey data and measures which have been implemented.

8.3.2 A key element of the report will be comparing the surveyed modal share to the target set; if the data shows that the targets have not been met or are not on course to be met, the report will outline the reasons behind this and how the matter will be resolved.

8.3.3 In order to make the results accessible to employees, who are all stakeholders in the plan, a summarised version of the report will be distributed. This can also be made available to other local interest groups.

# 9 Action plan

9.1.1 Table 9.1 outlines a provisional action plan for the Operational Travel Plan and sets out the activities that are needed in order to implement the measures which have been proposed, alongside an indicative timetable for implementation. This timetable will be reviewed with the key stakeholders and updated within future versions of the Operational Travel Plan document.

Table 9.1: Action plan

| **Activity** | | |
|---|---|---|
| Employ Travel Plan Coordinator(s) | The Applicant/Site Manager | Six months prior to implementation of the Project |
| Identification of Travel Plan Requirements | The Applicant/Site Manager | Six months prior implementation of the Project |
| Preparation of Interim Travel Plans | The Applicant/Site Manager | Three months prior to implementation of the Project |
| Inform LB Enfield of Travel Plan Coordinator(s) appointment | Travel Plan Coordinator | Within 1 month of appointment |
| Establishment of a car sharing database | Travel Plan Coordinator | Upon implementation of the Project |
| Establish a Travel Plan Steering Group | Travel Plan Coordinator | Within 6 months of implementation of the Project |
| Distribution of Welcome Packs | Travel Plan Coordinator | Upon implementation of the Project |
| Initial travel surveys | Travel Plan Coordinator | Six months after implementation of the Project |
| Update Travel Plan | Travel Plan Coordinator | After surveys, as appropriate |
| Subsequent travel surveys and updating of the Travel Plans | Travel Plan Coordinator | After one, three and five years |
| Consultation with LB Enfield | Travel Plan Coordinator | On-going |

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