URS

Lincolnshire Lakes AAP Support

Highway Assessment

April 2013

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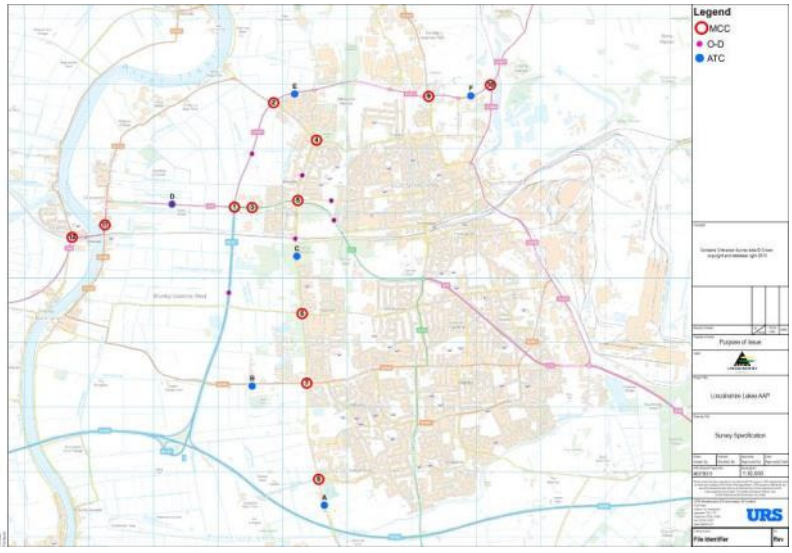
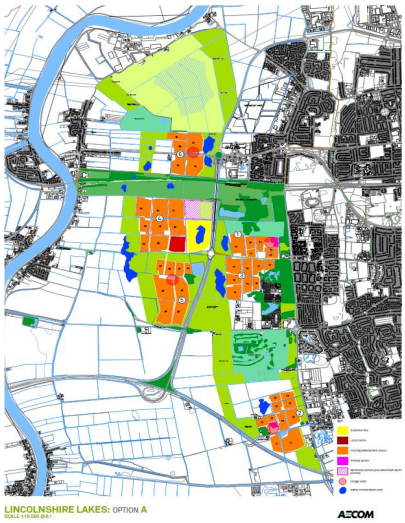
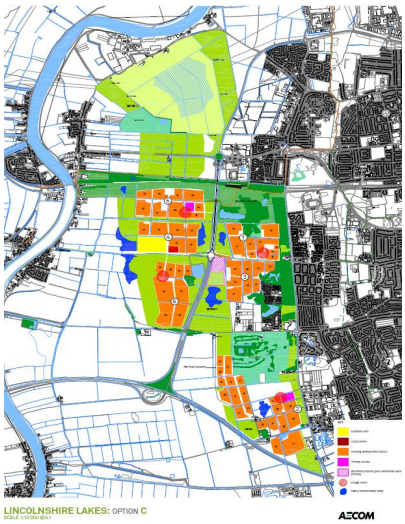
Prepared for:
North Lincs Council

UNITED KINGDOM & IRELAND







NORTH LINCOLNSHIRE COUNCIL

Rev	Date	Details	Prepared by	Checked by	Approved by
1	24 Aug 2012	DRAFT presenting baseline only	Stephen Morris Senior Transport Planner	Mark Anslow Technical Director	
2	7 Feb 2013	DRAFT including future development	Stephen Morris Senior Transport Planner	Mark Anslow Associate	
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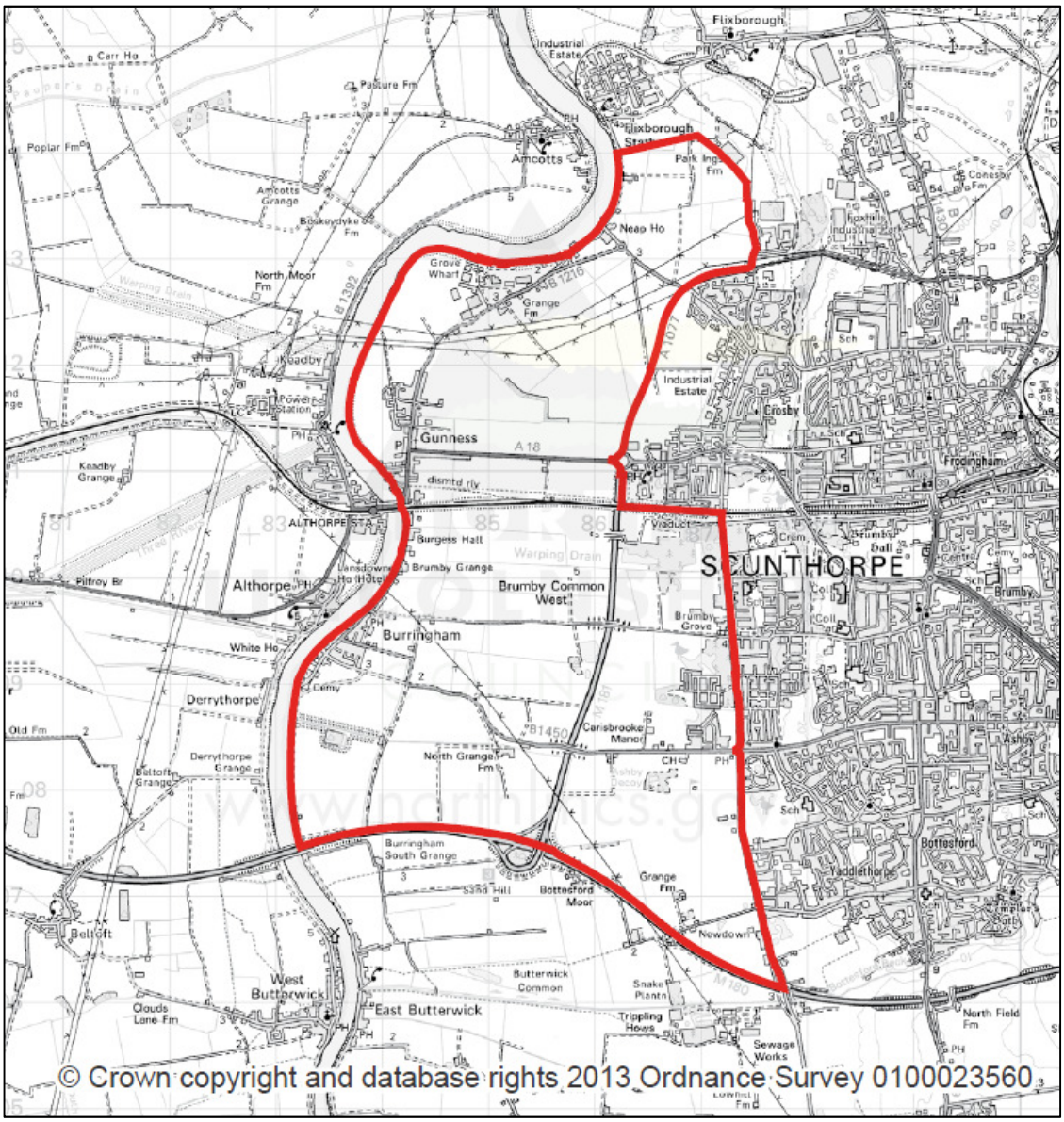
1. INTRODUCTION

1.1 Background

1.1.1 In 2011, GVA Grimley Ltd. (GVA), together with Aecom and URS, were commissioned by North Lincolnshire Council (NLC) to provide a baseline study for the Lincolnshire Lakes Area Action Plan (AAP). The baseline study forms a key element of the evidence base for the production and development of the AAP.

1.1.2 The purpose of this baseline study was to objectively report on the current status of the Lincolnshire Lakes area across a range of socio-economic and physical indicators; and to describe the area relative to appropriate spatial geographies (Scunthorpe, the North Lincolnshire area, the Humber sub region, the Yorkshire & Humber region and nationally). Given that the AAP will seek to develop a significant area of land in proximity to the existing settlement of Scunthorpe, the current characteristics of the town is an important consideration that has informed the baseline assessment, which was presented in *Lincolnshire Lakes Area Action Plan Evidence Base* (March 2012). The location of Lincolnshire Lakes is shown in Figure 1.

Figure 1: Lincolnshire Lakes AAP Location



1.2 Objectives of this Document

1.2.1 The review of the transport evidence base established an information gaprelated to current junction and link performance, which restricted informed and effective decision making. URS recommended further data collection and analysis to comprehensive evidence base and enlighten the optioneering exercise for the AAP. This report presents the outcome of that work, commissioned by NLC as an extension to the original project.

The objectives off this Highway Assessment are therefore to:

- Update the evidence base and fill in identified gaps;

- Assess options for the spatial distribution of development at Lincolnshire Lakes;
- Provide analysis of the impacts of the different options on highway infrastructure in the immediate area; and
- Identify the preferred option considered within this assessment.

1.2.2 It is not within the scope of the Highways Assessment to provide junction designs and assess in detail wider route choice impacts that may be caused by the development of Lincolnshire Lakes and its infrastructure. This and other more detailed assessments will be the subject of further work before finalisation of detailed proposals.

1.3 Scope of Work

1.3.1 The additional work was comprised of data collection and junction assessments, incorporating the redistribution effects of a new junction located along the M181. This report therefore considers

- The development scenarios agreed for testing in Section 2
- The method of assessment in Section 3
- Baseline assessment in Sections 4;
- The impact on traffic distribution of a new M181 junction is examined in Section 5
- Testing of future year scenarios in Sections 6 to 9
- A comparison of impacts in Section 10; and
- Conclusions and Recommendations in Section 11.

2. DEVELOPMENT SCENARIOS

2.1.1 NLC commissioned URS to test two agreed options (named Option A and Option C) to assess the varying impacts that alternative distribution of development within the Lincolnshire Lakes area may have. These options were developed by AECOM with input from GVA and URS and formed the basis of stakeholder consultation in October 2012.

- **Option A** is comprised of 6 villages plus development at Grove Wharf. The villages are mainly residential with the exception of Village 4 that also contains a Business Park (plus leisure uses) and would incorporate a supermarket[1]. Option A would provide a new strategic link from the M181 to Scotter Road along the approximate alignment of Brumby Common Lane.

- **Option C** is also comprised of 6 villages but does not include development at Grove Wharf. The Business Park (plus leisure) would again be located in Village 4. In addition to the strategic link a further link road would be provided from Brumby Common Lane to B1450 Burringham Road and then on through Village 2 to Scotter Road South.

2.1.2 The tested scenarios are summarised in Table 1 with Option A and Option C illustrated in Figure 2 and Figure 3 respectively. It must be noted that the options tested in this document do not reflect a favoured layout. The location of elements within the options may be located elsewhere within the Lakes in the preferred option for the AAP including the spatial distribution of residential, employment and community development or the location of the supermarket.

Table 1: Tested Scenarios

Scenario	2012	2017	2033	Comments
Baseline	✓			Existing conditions
Reference Case		✓	✓	Future years without Lincolnshire Lakes but with background growth
Option A		✓	✓	Reference Case plus Lincolnshire Lakes with agreed Option A
Option C		✓	✓	Reference Case plus Lincolnshire Lakes with agreed Option C

2.1.3 The strategic link from the M181 to Scotter Road would provide a route to both the M181 and Scotter Road for Lincolnshire Lakes traffic, avoiding current congestion 'hot spots'. It would also provide relief for existing traffic, particularly along the A18 at Berkeley Circle. Details of the need for, and best location for, a junction on the M181 (which would be de-trunked to the north) and a link to Scotter Road is presented in *M181 Junction Location Assessment* (URS, October 2012).

[1] The location for the supermarket that has been tested for this assessment is Village 3 not Village 4 as shown on the plan.

Figure 2: Option A - Settlement Pattern

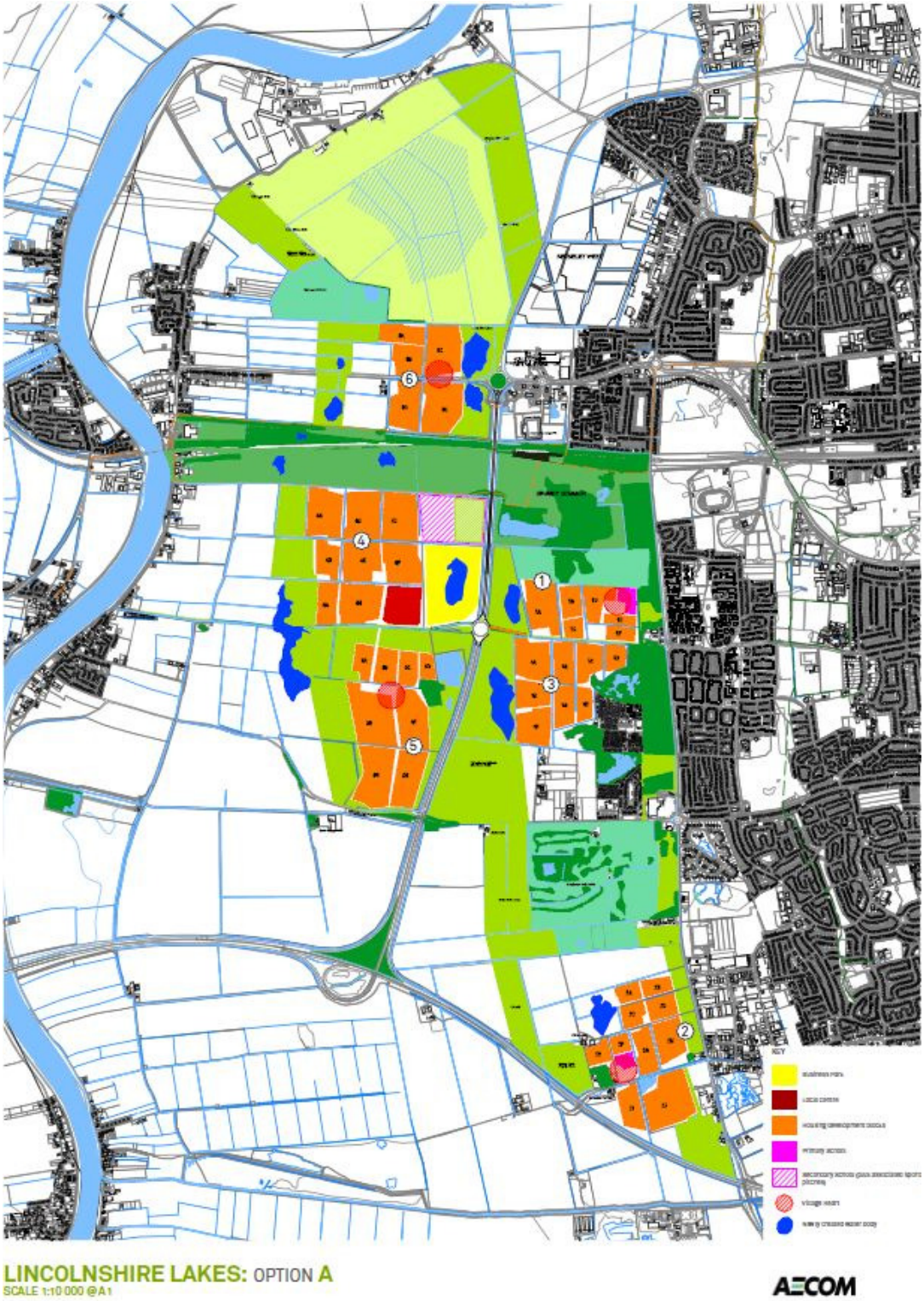
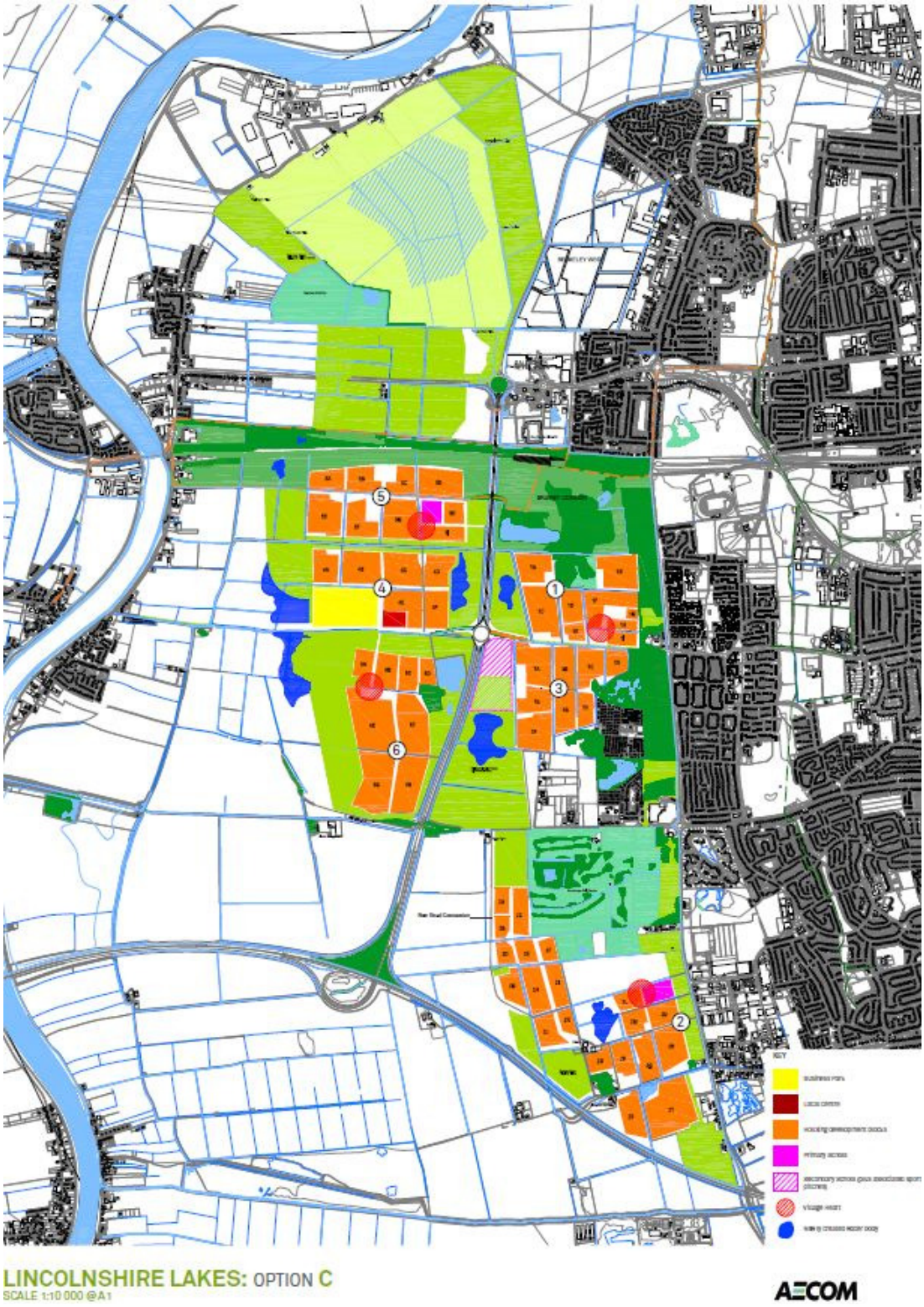


Figure 3: Option C – Settlement Pattern



2.1.4 The quantum of each land use type in each option is presented in Table 2.

Table 2: Land-Use Scenarios

Land Use	Per	Option A	Option C
Residential	Dwelling	6,000	6,000
B1	sqm	21,000	25,500
B2	sqm	17,625	-
Supermarket	sqm	3,450	-
Hotel &Public House	Rooms	60	60
Gym	sqm	1,300	1,300

3. METHOD

3.1 Traffic Surveys

3.1.1 URS commissioned traffic surveys to support this study on behalf of NLC. The surveys comprised Manual Turning Counts (MCCs), Origin-Destination using Automatic Number Plate Recognition (ANPR) and Automatic Traffic Counts (ATCs). The locations for each of these elements are presented in Figure 4 and Table 3 to Table 5.

Figure 4: Traffic Survey Specification

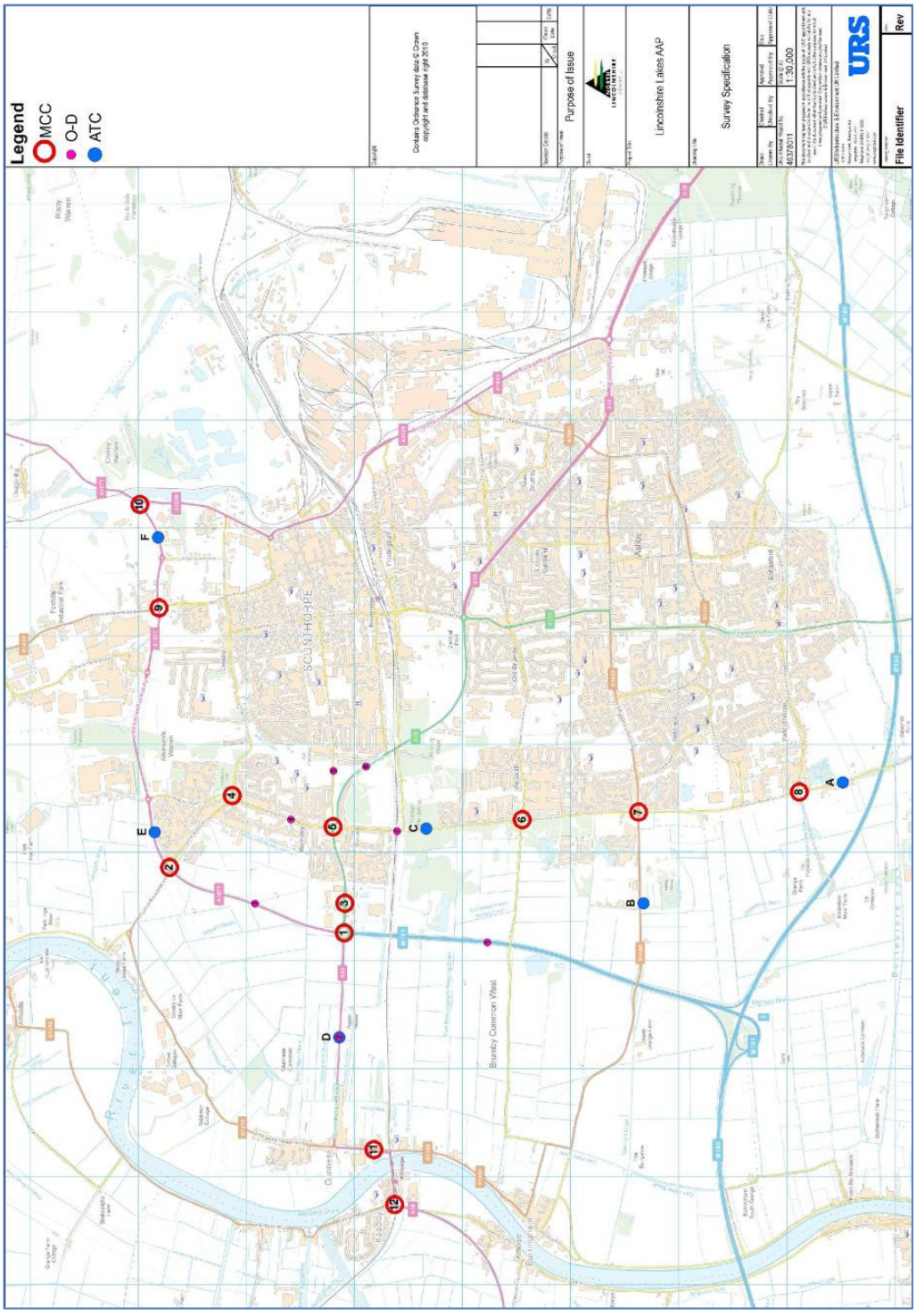


Table 3: Turning Count Junctions

ID	Junction	Junction Type
1	M181/ A18 Doncaster Road/ A1077	Priority roundabout
2	A1077/ Ferry Road West	Staggered cross roads
3	A18 Doncaster Road/ Retail Park	Priority roundabout
4	Ferry Road West/ Scotter Road	Priority roundabout
5	A18/ Scotter Road/ Doncaster Road	Priority roundabout
6	Scotter Road/ Brumby Common Lane	Priority cross roads
7	Scotter Road/ B1450 Burringham Road	Priority roundabout
8	Scotter Road/ Moorwell Road	Priority cross roads
9	A1077 Phoenix Parkway/ Normanby Road	Priority roundabout
10	A1077 Mannaberg Way/ A1029 Winterton Road	Priority roundabout
11	A18 Station Road/ B1450 Burringham Road	Priority T
12	A18 Station Road/ B1392 Station Road	Priority T

Table 4: ANPR Locations

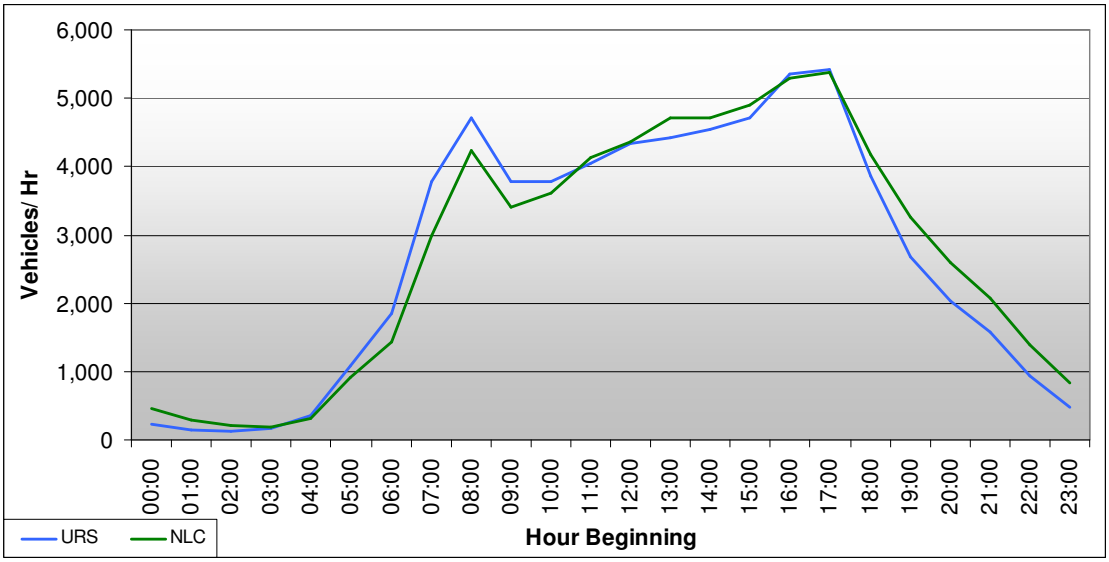
ID	Zone
1	M181
2	A18 Doncaster Road between M181 and Neap House Road
3	A1077 between A18 and Ferry Road West
4	Scotter Road between A18 and Ferry Road West
5	Doncaster Road west of Cliff Closes Road
6	Kingsway north of Brumby Wood Lane
7	Scotter Road between Brumby Wood Lane and A18

Table 5: ATC Link Count Sites

ID	Location
A	Scotter Road between M180 and Moorwell Road
B	B1450 Burringham Road between M181 and Scotter Road
C	Scotter Road between Brumby Wood Lane and Bristol Road
D	A18 Doncaster Road between M181 and Neap House Road
E	A1077 between Ferry Road West and Luneburg Way
F	A1077 between Bessemer Way and A1029

3.1.2 Data collection was completed from Wednesday 11 July to Tuesday 17 July. The link count sites were located to allow data to be factored for time of year as necessary based upon comparison with data previously collected by NLC between May 2005 and April 2012. A comparison of the profile and volume of traffic flows at these locations is summarised in Figure 5, indicating that the URS data has a good profile match compared with the NLC data and in peak hours has the same or higher traffic volumes. This combined analysis masks variation across the sites as some NLC sites were up to 10% higher than the URS data at the same location within peak hours and other sites where the NLC data has AM and PM peak periods delayed by several hours from the traditional peak hours leading to a decrease from the URS observations of over 400 vehicles (84%). This suggests that there may be unreliable variation in some of the NLC ATC data. In light of this comparison it was judged that no factoring for seasonality was necessary of the traffic survey data commissioned by URS.

Figure 5: All Sites Traffic Data Profile Comparison

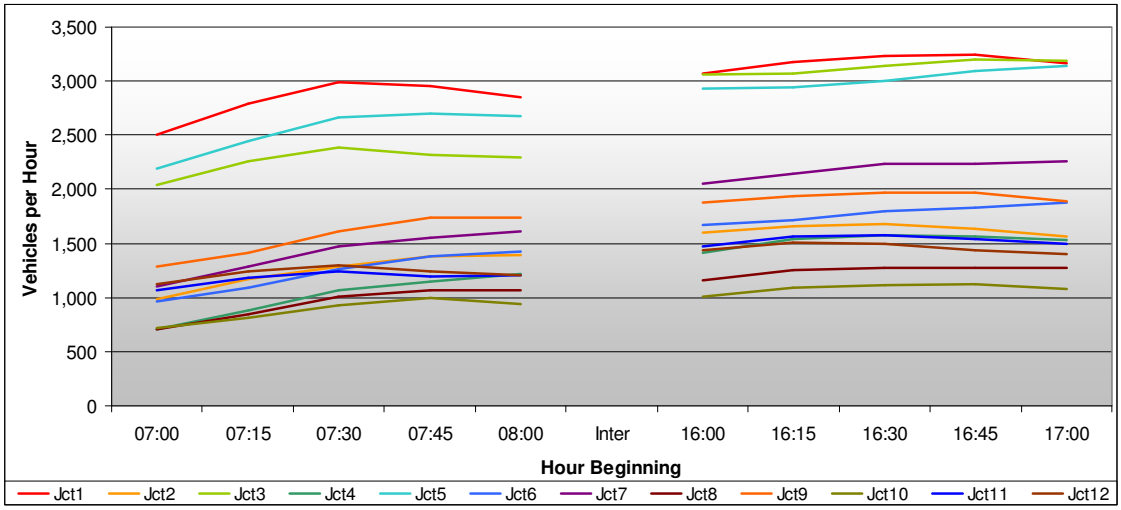


3.1.3 The MCC data was collected on Thursday 12 July. The purpose of this data was to provide the basis of the baseline junction assessment and to which future year traffic could be added. The ANPR survey was conducted on the same day. The data collected from this exercise was to

allow for the impact of a new junction on the M181 to be assessed on the baseline and future year reference case traffic.

3.1.4 Based upon the profile of traffic from the MCC surveys the assessment periods chosen are 08:00 to 09:00hrs and 16:45 to 17:45hrs, representing the busiest 60 minute periods at most junctions within the periods surveyed (see Figure 6). Baseline traffic is illustrated in Appendix A using the MCCs from the traffic surveys.

Figure 6: MCC Traffic Profile at Individual Junctions



3.2 Forecasting Background Traffic

Background Traffic Growth

3.2.1 Growth in background traffic was forecast using TEMPRO v6.2 dataset 6.2. The TEMPRO settings are indicated below with NTM adjusted growth factors to future years listed in Table 6.

- Scunthorpe
- Trip Ends by time period
- Car Driver
- Weekday peak periods
- Origin/ Destination
- Urban Principal Roads

Table 6: Traffic Growth Factors

From	To	Period	Factor
2012	2017	AM	1.029934
2012	2017	PM	1.032423
2012	2033	AM	1.197514
2012	2033	PM	1.207915

Redistribution Effects of New Strategic Access

3.2.2 The origin/ destination survey was commissioned to forecast the potential impact on traffic distribution of a new Strategic Access on the M181. The proportion of traffic between each origin and destination pair for the AM and PM Peaks is shown in Section 5.

3.2.3 This information was used to redistribute traffic based upon assumptions that:

- All traffic between points 1 and 7 exit via the new junction;
- Traffic between points 2 and 7 is split equally between the de-trunked M181 and Scotter Road;
- Traffic between points 3 and 7 is split equally between the de-trunked M181 and Scotter Road;
- The distribution of traffic using West Common Lane and Scotter Road south of Brumby Common Lane and of traffic using B1450 Burringham Road and Scotter Road South at the junction of Scotter Road/ B1450 Burringham Road is based upon the current distribution taken from the commissioned traffic count at this junction;
- 10% of traffic travelling along the M181 and A18 Doncaster Road into central Scunthorpe uses West Common Lane; and
- All other traffic is unchanged

3.2.4 The impact of this on 2012 baseline traffic is presented in Appendix A . It was assumed that development traffic would be in addition to this redistributed traffic in the Opening and Future Years, with the background traffic increased using the appropriate growth factors from Table 6.

3.3 Trip Generation and Distribution

Trip Generation

3.3.1 Person trip generation was based upon the trip rates used in the *Lincolnshire Lakes Transport Strategy* (Pell Frischmann, October 2010) for residential, B1 and B2 land uses. Supermarket, Hotel andPublic House, and Gym vehicle trip rates were obtained from TRICS 2013(a)v6.11.1. A summary of the person trip rates adopted is provided as Table 7. URS has assumed that trips to schools, local amenities and local convenience shopping will be internalised within each village.

Table 7: Person Trip Rates

		AM Peak			PM Peak		
Land Use	**Per**	**Inbound**	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Residential	Dwelling	0.197	0.836	1.033	0.537	0.320	0.857
B1	100sqm	2.430	0.162	2.592	0.355	2.114	2.469
B2	100sqm	1.042	0.492	1.534	0.382	0.952	1.334
Supermarket	100sqm	4.563	3.289	7.852	8.922	9.295	18.217
Hotel &Public House	Bed	0.227	0.414	0.641	1.038	0.438	1.476
Gym	100sqm	0.431	0.977	1.408	1.745	1.338	3.083

3.3.2 Based upon the total development at Lincolnshire Lakes identified in Table 2 this generates the total trips shown in Table 8 and Table 9.

Table 8: Total Person Trips Option A

	AM Peak			PM Peak		
Land Use	**Inbound**	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Residential	1,182	5,016	6,198	3,222	1,920	5,142
B1	510	34	544	75	444	518
B2	184	87	270	67	168	235
Supermarket	157	113	271	308	321	628
Hotel &Public House	26	25	51	62	26	89
Gym	59	43	102	116	121	237
Total	**2,119**	**5,318**	**7,436**	**3,850**	**3,000**	**6,849**

Table 9: Total Person Trips Option C

	AM Peak			PM Peak		
Land Use	**Inbound**	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Residential	1,182	5,016	6,198	3,222	1,920	5,142
B1	620	41	661	91	539	630
B2	-	-	-	-	-	-
Supermarket	1,182	5,016	6,198	3,222	1,920	5,142
Hotel &Public House	14	25	38	62	26	89
Gym	59	43	102	116	121	237
Total	**1,875**	**5,125**	**6,999**	**3,491**	**2,606**	**6,097**

3.3.3 The mode share assumptions used in the *Lincolnshire Lakes Transport Strategy*, based upon journey to work mode share, were reviewed and considered to be robust for Residential, B1 and B2 land uses. They were therefore adopted for this study and are summarised in Table 10. However because Supermarket, Hotel and Public House, and Gym land uses are not journeys to work URS considered it was more appropriate to adopt the vehicle trip rates from TRICS for these land uses. These vehicle trip rates are presented in Table 11.

Table 10: Adopted Mode Share

Mode	Percent Share
Home	7%
Bus	4%
Driving	64%
Passenger	9%
Motorcycle	2%
Cycle	5%
Walk	7%

Table 11: Vehicle Trip Rates

		AM Peak			PM Peak		
Land Use	**Per**	**Inbound**	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Supermarket	100sqm	3.305	2.377	5.682	5.676	6.053	11.729
Hotel&Pub	Bed	0.176	0.257	0.433	0.586	0.281	0.867
Gym	100sqm	0.314	0.791	1.105	1.303	1.094	2.397

3.3.4 This results in the total private vehicle trips shown in Table 12. This does not include Heavy Duty Vehicles (HDVs) or other commercial traffic generated by Lincolnshire Lakes however, it is anticipated that because of the land use types adopted this element of traffic will be small and it's omission from this study does not present a risk to the conclusions.

Table 12: Total Vehicle Trips Option A

	AM Peak			PM Peak		
Land Use	**Inbound**	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Residential	781	3,311	4,092	2,126	1,268	3,394
B1	337	22	359	49	293	342
B2	121	57	178	44	111	155
Supermarket	157	113	270	308	321	629
Hotel &Public House	11	15	26	35	17	52
Gym	4	10	14	17	14	31
Total	**1,411**	**3,528**	**4,939**	**2,579**	**2,024**	**4,603**

Table 13: Total Vehicle Trips Option C

	AM Peak			PM Peak		
Land Use	**Inbound**	**Outbound**	**Total**	**Inbound**	**Outbound**	**Total**
Residential	780	3,310	4,090	2,127	1,266	3,393
B1	409	27	436	60	356	416
B2	-	-	-	-	-	-
Supermarket	-	-	-	-	-	-
Hotel &Public House	11	15	26	35	17	52
Gym	4	10	14	17	14	31
Total	**1,204**	**3,362**	**4,566**	**2,239**	**1,653**	**3,892**

Trip Distribution

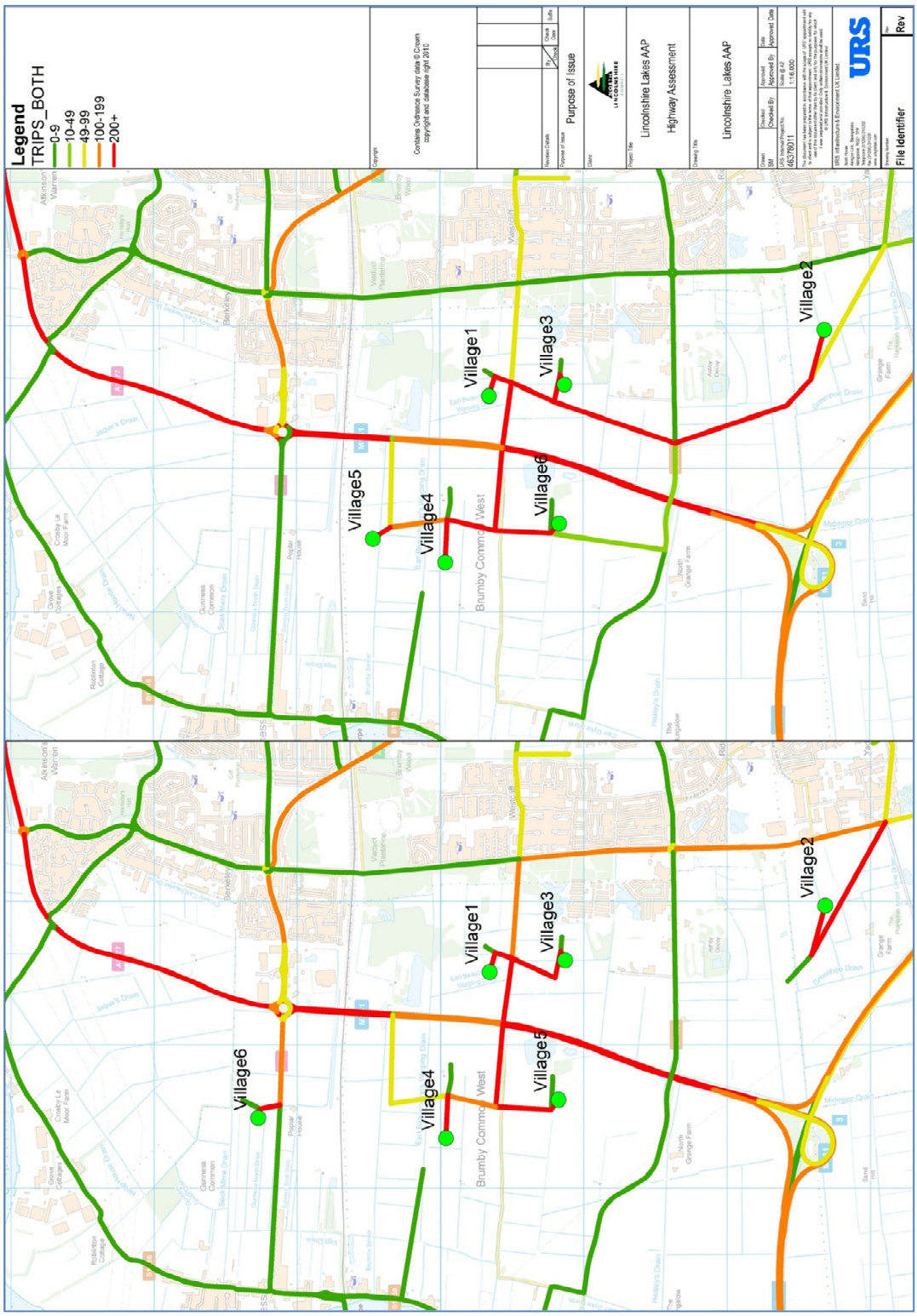
3.3.5 Traffic distribution was derived from ODYSSEUS model runs[2]. For each option the new strategic link at Brumby Common Lane was added to the existing highway network. For Option C the additional link to Scotter Road South via Burringham Road was also added.

3.3.6 ODYSSEUS allows for the traffic from each development to be separately identified. Trip distribution is subtly different for each village because of the differing starting locations and varying route choices available. Indeed because of additional highway links in Option C compared with Option A the distribution also varies between options. Using ODYSSEUS link based distribution for each village, turning movements at each junction were derived and the total trips for each village distributed accordingly.

3.3.7 Figure 7 shows a comparison of the distribution for both options. Scotter Road north of Brumby Common Lane was identified as lightly used in both options because the new strategic link provides a quicker alternative to Berkeley Circle via the M181 and Doncaster Road. The distribution for Option C has a considerably reduced impact on Scotter Road between Brumby Common Lane and Moor Road. This is because of the additional link via B1450 Burringham Road and Village 2. Figure 7 also highlights that in both options on both B1450 Burringham Road and the A18 west of Option A Village 6 there are likely to be limited vehicle trips generated by Lincolnshire Lakes on the road network. This is because of the limited residential and employment development immediately west of Scunthorpe and because there are alternative more time efficient routes to locations further west, most notably the M180.

[2] ODYSSEUS is a URS gravity modelling tool that distributes residential trips based upon jobs per ward and commercial trips based upon ward resident populations. The gravity function incorporates this into the journey time based upon existing network link speeds.

Figure 7: Comparison of Options Distribution



3.4 Assessment of Junctions

Priority Junctions

3.4.1 Priority junctions (numbered 1 to 12 and 14) were assessed using ARCADY v7.1 for roundabouts and PICADY v5.1 for T-junctions and Staggered Cross Roads. Traffic data was obtained from the commissioned traffic counts and future year forecasts. Ratio of Flow to Capacity (RFC) was used as a measure of junction stress and queues are reported to the nearest whole vehicle. An RFC of 0.85 was used to indicate that junction is operating at or above effective capacity and at 1.00 or greater to be significantly above effective capacity. As the RFC exceeds and continues to rise above 1.00, queue forecasts become increasingly unreliable and should be used to indicate large queues rather than realistic forecasts.

Assessment of M180 J3

3.4.2 The traffic flow data used for this assessment was taken from Highways Agency (HA) TRADS[3] sites on the M180 and M181 (see Figure 8) with HDV proportions taken from the commissioned traffic count at the junction of the M181/ A18 Doncaster Road. The method of assessment was taken from *DMRB Volume 13 Section 1 Part 6 Junctions in COBA* (May 2002) incorporating:

- Capacity of Merges at Grade Separated Junctions; and
- Queuing Delay Formula for Grade Separated Merges.

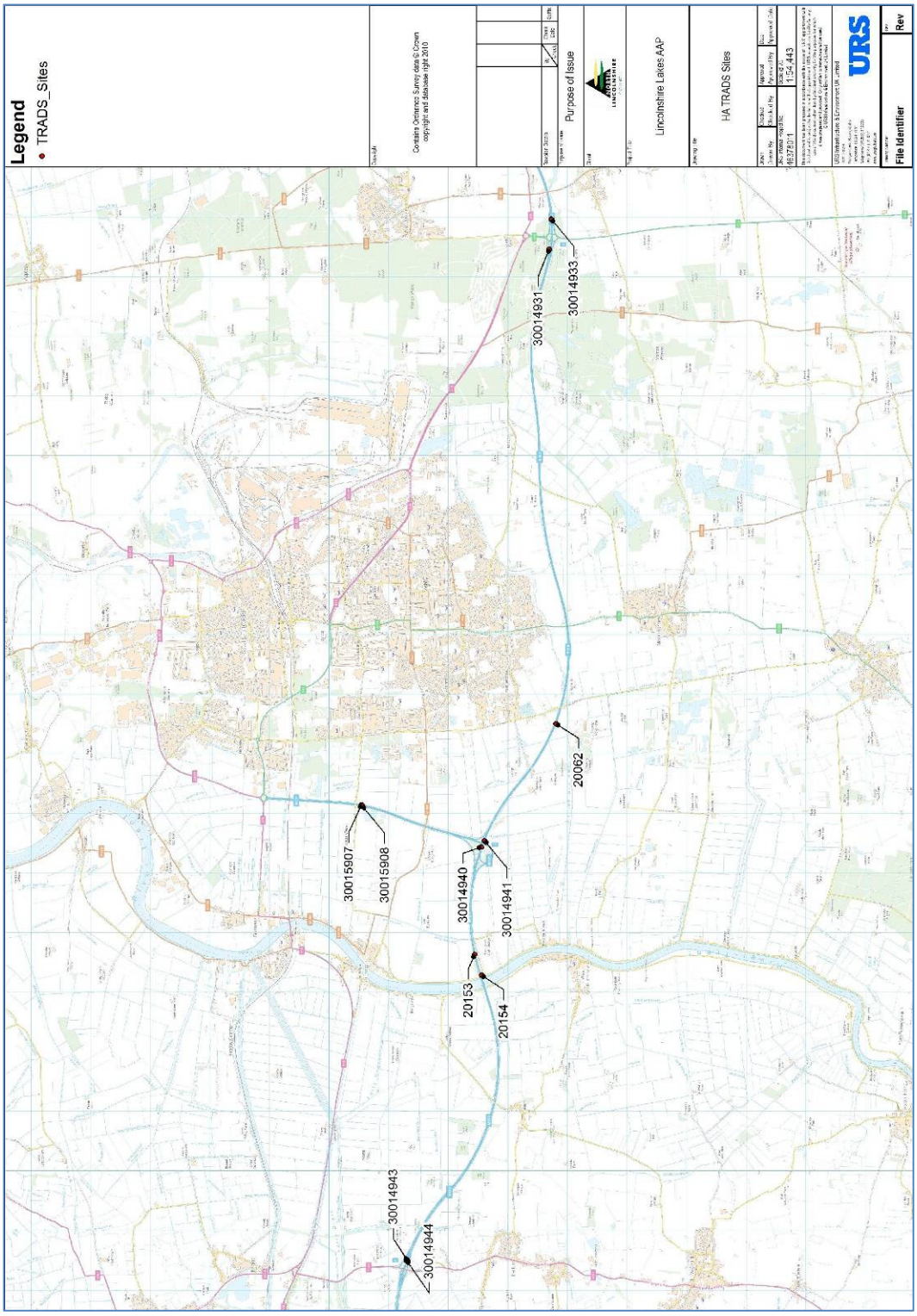
3.4.3 This method was adopted for the assessment of the merges of the M181 with the M180 for all scenarios and was recently adopted for the assessment of HA schemes in agreement with HA Traffic Appraisal, Modelling and Economics (TAME) team. Single hour Annual Average Weekday Total (AAWT) data for 2011 was used for the assessment. Comparison with 2010 and 2012 to date shows that there was little variation in either northbound or southbound traffic (see Table 14). 2011 is therefore considered an appropriate mid-point and more robust than 2012 because the data is not available for the whole year.

Table 14: M181 Traffic Flows

	08:00-09:00		17:00-18:00	
	Northbound	Southbound	Northbound	Southbound
2010 Traffic	1,128	618	710	911
2011 Traffic	1,110	611	709	913
2012 Traffic	1,080	615	704	898
2010 Index	100	100	100	100
2011 Index	98	99	100	100
2012 Index	96	100	99	99

[3] TRADS stands for Traffic Information Database, which contains information from data collection sites at locations on the Highways Agency road network.

Figure 8: HA TRADS Sites



Assessment of New Junctions

3.4.4 In the 'with development' scenarios it is anticipated that because of Lincolnshire Lakes traffic and its distribution, revised junction layouts will be needed at Junction 6 (Brumby Common Lane/ West Common Lane) and Junction 8 (Scotter Road/ Moorwell Road). To accommodate this requirement the geometry of Junction 7 (Scotter Road/ B1450 Burringham Road) was assumed.

3.4.5 Furthermore a new junction on the M181 will be required to accommodate the new strategic link and villages to the west of the motorway. In this case the geometry of Junction 1 (M181/ A18 Doncaster Road) was used. This includes that the access from the north is a single carriageway, assuming that the de-trunked section of the M181 to the north of the junction will be re-modelled to be in keeping with its new urban environment. This was assessed as Junction 14 in this study.

3.4.6 In all cases the geometry used does not prejudice future junction design. The *M181 Junction Location Assessment* (URS, October 2012) indicated that the junction must be a roundabout but does not identify a detailed design. Similarly Junctions 6 and 8 may be more suitable as signalised junctions to accommodate cycle and pedestrian facilities.

4. BASELINE ASSESSMENT

4.1.1 Using the traffic counts outlined in Section 3.1 the 2012 Baseline was assessed. The results are described below. Traffic flows are shown in Appendix A and show differences in flow between junctions 3 and 5, 5 and 6 and 6 and 7 in particular. This is because of other junctions in between those that form the scope of this Highway Assessment. These junctions, including that with Brumby Wood Lane on Scotter Road, will allow future background and development traffic to avoid major junctions in the same way that existing traffic can. The implications of development traffic impacts on these junctions will need to be considered in more detail for the preferred option than the scope of this Highway Assessment allows for.

Junction 1: M181/ A18 Doncaster Road

4.1.2 There is spare capacity on all approaches in both peak periods, with negligible queues. These results are comparable to those presented in *Site of the Valley Garden Centre Transport Assessment* (August 2011) for the Glanford Retail Park.

Table 15: Junction 1 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077	A	0.27	0	0.59	1
A180 Doncaster Rd (E)	B	0.28	0	0.48	1
M181	C	0.72	2	0.58	1
A180 Doncaster Rd (W)	D	0.42	1	0.31	0

Junction 2: A1077/ Ferry Road West

4.1.3 The junction is operating with significant spare capacity and no effective queuing.

Table 16: Junction 2 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Phoenix Parkway	A	0.17	0	0.12	0
Ferry Road West	B	0.21	0	0.43	1
A1077	C	0.30	0	0.63	2
B1216 Ferry Road West	D	0.14	0	0.15	0

Junction 3: A18 Doncaster Road/ Retail Park

4.1.4 This junction is operating well within capacity on all approaches with negligible queuing.

4.1.5 The results vary from those in the transport assessment for the 2012 baseline of the Glanford Retail Park transport assessment. In general this URS assessment shows less capacity in the AM peak and more capacity in the PM peak than the Glanford transport assessment. This is due to a significant difference in the traffic observed in the URS traffic counts compared with

those used for the transport assessment. Although there is no clear reason for this it may be because of seasonal variance.

Table 17: Junction 3 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.16	0	0.45	1
A18 Doncaster Road (E)	B	0.32	0	0.60	1
Retail Park (S)	C	0.07	1	0.25	0
A18 Doncaster Road (W)	D	0.04	0	0.43	1

Junction 4: Scotter Road/ Ferry Road West

4.1.6 Operating well within capacity on all approaches.

Table 18: Junction 4 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Luneburg Way	A	0.26	0	0.35	1
B1216 Ferry Road	B	0.16	0	0.31	0
Scotter Road	C	0.30	0	0.37	1
Ferry Road West	D	0.20	0	0.24	0

Junction 5: Scotter Road/ A18/ Doncaster Road

4.1.7 The results of the assessment for show that it is generally operating well within capacity with minimal queuing. The exception to this is Scotter Road (N).

4.1.8 The results of this junction assessment are comparable to Glanford Retail Park transport assessment. Scotter Road (S) and A18 Doncaster Road in the AM peak is better in this assessment, while Scotter Road (N) in the PM peak is worse in this assessment. In the AM peak this can be explained by less traffic on these approaches. In the PM peak traffic flows suggest that a marginal increase of 61 vehicles in the URS observations compared with the Glanford Transport Assessment is sufficient to cause a significant impact on junction operation (RFC of 0 90 compared with 1.11 in this assessment).

Table 19: Junction 5 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.80	4	1.11	38
Doncaster Road	B	0.24	0	0.42	1
A18 Kingsway	C	0.46	1	0.59	1
Scotter Road (S)	D	0.60	1	0.74	3
A18 Doncaster Road	E	0.66	2	0.70	2

4.1.9 Local observations by NLC suggest severe queuing on A18 Doncaster Road (west) back to the car sales place, Scotter Road south towards Minster Road and A18 Kingsway to the end of the houses. The location of the pedestrian crossing on the A18 Doncaster Road (west) can hinder the operation of the roundabout because when in use it can cause traffic to queue onto roundabout.

Junction 6: Scoter Road/ Brumby Common Lane

4.1.10 In both peak periods is operating well within capacity with no queuing.

Table 20: Junction 6 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.01	0	0.01	0
West Common Lane	B	0.17	0	0.47	1
Scotter Road (S)	C	0.16	0	0.31	0
Brumby Common Lane	D	0.06	0	0.06	0

Junction 7: Scotter Road/ B1450 Burringham Road

4.1.11 Currently operating within capacity and experiences only negligible queuing.

Table 21: Junction 7 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road	A	0.32	0	0.69	2
B1450 Burringham Road (E)	B	0.30	0	0.47	1
Scotter Road South	C	0.72	2	0.68	2
B1450 Burringham Road (W)	D	0.19	0	0.42	1

Junction 8: Scotter Road/ Moorwell Road

4.1.12 The junction is operating within capacity and with minimal queuing.

Table 22: Junction 8 Baseline Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	0.01	0	0.01	0
Moorwell Road	B	0.80	4	0.71	2
Scotter Road (S)	C	0.12	0	0.11	0
Moor Road	D	0.02	0	0.01	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

4.1.13 The junction is operating effectively with negligible queuing.

Table 23: Junction 9 Baseline Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
B1430 Normanby Road (N)	A	0.32	0	0.40	1
A1077 Mannaberg Way	B	0.24	0	0.25	0
B1430 Normanby Road (S)	C	0.28	0	0.42	1
A1077 Phoenix Parkway	D	0.56	1	0.56	1

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

4.1.14 This junction operates with significant spare capacity and no queuing.

Table 24: Junction 10 Baseline Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077 Winterton Road	A	0.48	1	0.25	0
A1029 Winterton Road	B	0.09	0	0.37	1
A1077 Mannaberg Way	C	0.16	0	0.33	0
Dragonby Vale	D	0.00	0	0.02	0

Junction 11: A18 Station Road/ B1450 Burringham Road

4.1.15 There is no queuing and significant spare capacity in both peak periods.

Table 25: Junction 11 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.20	0	0.34	1
A18 Station Road (S)	C	0.24	0	0.33	0

Junction 12: A18 Station Road/ B1392 Station Road

4.1.16 This junction is over capacity in the AM peak on the B1392 approach, causing significant queuing. The junction throughput of this priority junction is larger than a number of the roundabouts included in this assessment, with the movement from the south accounting for half of the total vehicles (602 of 1,201). This is an arrival rate at the junction from the south of 1 vehicle every 6 seconds. In addition to this the layout of the junction is such that drivers exiting from the minor arm cannot be sure whether vehicles approaching from the south are continuing on the A18 or exiting into the B1392. This uncertainty combined with the relatively high arrival rate could make it difficult for vehicles exiting the minor road. Although junction throughput is greater in the PM peak traffic from the south is less (433 vehicles of 1,441) and there is less traffic approaching from the B1392 (AM 229 vehicles, PM 194 vehicles).

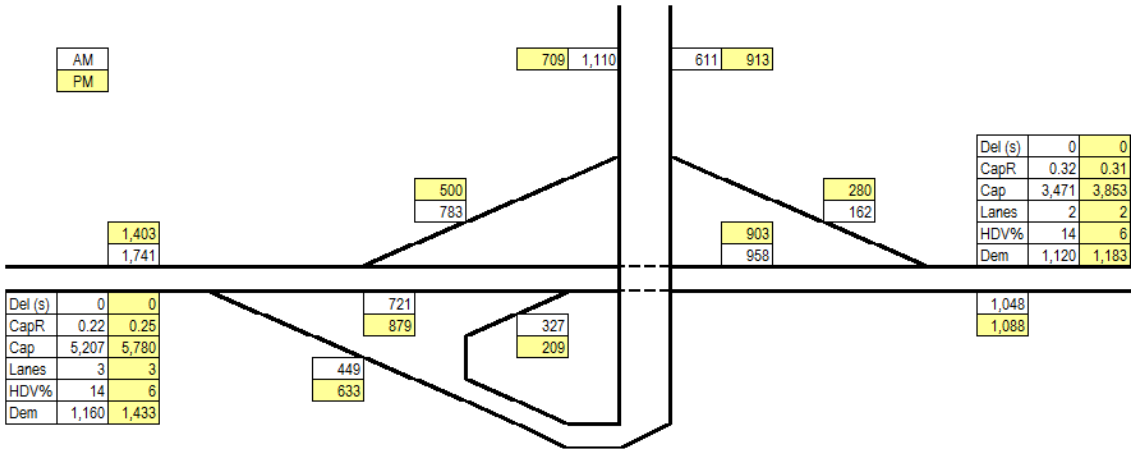
Table 26: Junction 12 Baseline Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.13	25	0.25	1
A18 Station Road	B	0.59	1	0.40	0
A18 Trunk Road	C	0.00	0	0.00	0

Junction 13: M180 Junction 3

4.1.17 The merge capacity assessment of M180 Jct 3 indicates that the junction is operating well within capacity at a maximum of 32% in the AM peak on the eastbound merge; resulting in no merge delay. This is illustrated in Figure 9.

Figure 9: Baseline Merge Capacity Assessment



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

4.1.18 A summary of the 2012 Baseline junction assessments in Table 27 shows that with the exception of Berkeley Circle and the A18 west of the River Trent the highway network is operating within capacity.

Table 27: Summary of Baseline Junction Assessment (Worst Approach)

Location	AM Peak	PM Peak	Comments
Jct 1 M181/ A18 Doncaster Road/ A1077	0.72	0.59	Within capacity
Jct 2 A1077/ Ferry Road West	0.30	0.63	Within capacity
Jct 3 A18 Doncaster Road/ Retail Park	0.32	0.60	Within capacity
Jct 4 Ferry Road West/ Scotter Road	0.30	0.37	Within Capacity
Jct 5 A18/ Scotter Road/ Doncaster Road	0.80	1.11	Significantly over capacity in the PM peak
Jct 6 Scotter Road/ Brumby Common Lane	0.17	0.47	Well within capacity
Jct 7 Scotter Road/ B1450 Burringham Road	0.72	0.69	Within capacity
Jct 8 Scotter Road/ Moorwell Road	0.80	0.71	Within capacity
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.56	0.56	Within capacity
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.48	0.37	Well within capacity
Jct 11 A18 Station Road/ B1450 Burringham Road	0.24	0.34	Well within capacity
Jct 12 A18 Station Road/ B1392 Station Road	1.13	0.40	Significantly over capacity in the AM peak
Jct 13 M180 Junction 3	0.32	0.31	Well within capacity
Jct 14 New M181 Junction	-	-	

5. DISTRIBUTION IMPACT OF A NEW M181 JUNCTION

5.1 Baseline Distribution

5.1.1 The Origin Destination survey was validated alongside the MCCs from junctions 1, 3 and 5. It generates the distribution matrix shown in Table 28 and Table 29.

Table 28: Origin Destination Traffic Distribution AM Peak

Zone From/To	1	2	3	4	5	6	7	Retail	Stadium	Total
1	X	3%	41%	2%	11%	18%	7%	13%	5%	**100%**
2	5%	X	36%	1%	13%	23%	2%	14%	5%	**100%**
3	49%	21%	X	5%	0%	8%	7%	7%	3%	**100%**
4	6%	3%	4%	X	5%	37%	40%	4%	2%	**100%**
5	21%	17%	3%	12%	X	7%	23%	11%	5%	**100%**
6	18%	13%	8%	36%	2%	X	7%	10%	5%	**100%**
7	16%	5%	8%	41%	14%	5%	X	8%	4%	**100%**
Retail	25%	12%	11%	2%	13%	23%	6%	X	8%	**100%**
Stadium	21%	10%	9%	2%	15%	27%	6%	8%	X	**100%**

Table 29: Origin Destination Traffic Distribution PM Peak

Zone From/To	1	2	3	4	5	6	7	Retail	Stadium	Total
1	X	4%	29%	3%	7%	15%	12%	24%	6%	**100%**
2	17%	X	23%	3%	8%	15%	6%	21%	6%	**100%**
3	43%	24%	X	4%	2%	4%	8%	12%	3%	**100%**
4	2%	2%	6%	X	4%	26%	54%	5%	2%	**100%**
5	15%	18%	2%	15%	X	6%	17%	19%	7%	**100%**
6	19%	14%	2%	31%	2%	X	5%	19%	8%	**100%**
7	17%	7%	6%	30%	11%	7%	X	16%	6%	**100%**
Retail	25%	19%	9%	3%	10%	15%	12%	X	8%	**100%**
Stadium	22%	17%	8%	3%	9%	15%	12%	14%	X	**100%**

5.1.2 Based upon these matrices, between 7% and 17% (traffic between Zones 1 and 7) of one-way traffic passing through could divert away from Jct 1: M181/ A18 Doncaster Road/ A1077 and instead use a new junction along the M181 and connections with Scotter Road directly to the east. This excludes traffic that currently accesses Scunthorpe Town centre via A18 Kingsway, some of which is likely to re-route via a new junction providing more direct access to the

southern parts of Scunthorpe town centre. To assess the potential benefits of a new junction on the M181 the average journey times observed during the OD surveys have been used between each origin-destination pair. The average journey time saving is 4 minutes 38 seconds. The monetised benefit in a single year amounts to £87,126.60 (2002 values and prices) using WebTAG principles including an average value of time of £11.28 per hour. The steps in the calculation are shown in Table 30. The benefit calculated above represents only the benefit to diverting vehicles for the 2012 baseline between Zones 1 and 7 and must be used as a guide only; it does not account for benefit to reduced journey time on other routes or the disbenefit of greater journey time to negotiate the new junction for traffic on the M181.

Table 30: Benefits to 2012 Diverting Traffic with New M181 Junction

	AM Peak		PM Peak	
	Northbound	Southbound	Northbound	Southbound
Total Vehicles	1,164	592	761	992
Diverting Vehicles	78	104	92	117
Time saved	5m 16s	3m 44s	4m 39s	4m 53s
Benefit per vehicle	£0.99	£0.70	£0.87	£0.92
Total Benefit	**£77.22**	**£72.80**	**£80.04**	**£107.64**
Annual Benefit	£19.9k	£18.8k	£20,7k	£27,8k

Note: Value of time saved is in 2002 values and prices, benefits should be considered indicative only

5.1.3 The calculations suggest a valuable benefit to those vehicles that are most likely to change their route with a new M181 junction. The assessment assumes a junction no further north than Brumby Common Lane; if the junction is further north, then journey time savings will be reduced. A new junction further south is likely to increase the journey time benefits.

5.1.4 The assessment does not and cannot consider induced demand in detail, which is likely to increase the benefits generated by the new junction. In this case induced demand is likely to result in more traffic using M180 Jct3 compared with the baseline from locations within southern Scunthorpe. This traffic may currently use M180 Jct4 but is likely to re-route because of the time savings offered by a new junction on the M181 and also the ease of access to southern Scunthorpe from the east while avoiding travelling through Scunthorpe itself. Induced demand was considered as part of the *M181 Junction Location Assessment* (URS, October 2012). Key points raised in that report are:

- Re-routing from Ashby, Kingsway with Lincoln Gardens, and Frodingham appears to be minimal;
- Principal traffic re-routing induced by the new link and junction is from Bottesford and Brumby, the most south westerly wards;
- The southwesterly wards access the M181 via Jct 3 with a new link road, which is likely to increase traffic associated with them along the M181 to the east of Jct 3;
- Traffic on non-strategic roads such as those north and south of the M181 is reduced; and

- There may be some relief to roads through northwest Scunthorpe (including Berkeley Circle) as it becomes easier to access employment opportunities along Phoenix Way via the new junction and the A1077.

5.1.5 It is important to note that the volume of diverting traffic may decline if the junction is moved further north as the journey time benefit will be reduced. This is discussed in more detail in *M181 Junction Location Assessment* (URS, October 2012).

6. OPENING YEAR REFERENCE CASE ASSESSMENT

6.1.1 Reference Case traffic flows were calculated based upon the Baseline flows in Section 4 and the traffic growth factor in Table 6. The traffic flows are presented in Appendix B and the results of the junction assessments are presented below.

Junction 1: M181/ A18 Doncaster Road

6.1.2 This junction continues to operate within capacity in both peak periods with only minimal queuing on the A1077 and M181 approaches.

Table 31: Junction 1 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077	A	0.28	0	0.62	2
A180 Doncaster Rd (E)	B	0.29	0	0.50	1
M181	C	0.75	3	0.61	2
A180 Doncaster Rd (W)	D	0.44	1	0.32	0

Junction 2: A1077/ Ferry Road West

6.1.3 This junction is well within capacity at all times.

Table 32: Junction 2 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077 Phoenix Parkway	A	0.19	0	0.13	0
Ferry Road West	B	0.22	0	0.45	
A1077	C	0.52	1	0.66	2
B1216 Ferry Road West	D	0.24	0	0.16	

Junction 3: A18 Doncaster Road/ Retail Park

6.1.4 This junction is operating well within capacity with no effective queuing.

Table 33: Junction 3 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.23	0	0.47	1
A18 Doncaster Road (E)	B	0.35	1	0.62	2
Retail Park (S)	C	0.07	0	0.26	0
A18 Doncaster Road (W)	D	0.44	1	0.45	1

Junction 4: Scotter Road/ Ferry Road West

6.1.5 In 2017 Junction 4 is operating well within capacity with no effective queuing.

Table 34: Junction 4 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Luneburg Way	A	0.27	0	0.37	1
B1216 Ferry Road	B	0.17	0	0.32	0
Scotter Road	C	0.31	0	0.38	1
Ferry Road West	D	0.21	0	0.25	0

Junction 5: Scotter Road/ A18/ Doncaster Road

6.1.6 The additional traffic at Junction 5 means that in the AM peak it is operating slightly over capacity on the Scotter Road (N), causing slight queueing. In the PM peak the same approach is significantly over capacity resulting in long queues. All other approaches operate well within capacity.

Table 35: Junction 5 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.85	5	1.20	58
Doncaster Road	B	0.25	0	0.44	1
A18 Kingsway	C	0.48	1	0.61	2
Scotter Road (S)	D	0.63	2	0.77	3
A18 Doncaster Road	E	0.68	2	0.74	3

Junction 6: Scoter Road/ Brumby Common Lane

6.1.7 Junction 6 is operating well within capacity in 2017.

Table 36: Junction 6 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.01	0	0.1	0
West Common Lane	B	0.18	0	0.50	1
Scotter Road (S)	C	0.17	0	0.33	0
Brumby Common Lane	D	0.06	0	0.06	0

Junction 7: Scotter Road/ B1450 Burringham Road

6.1.8 This junction operates within capacity at all times with minimal queuing on some approaches.

Table 37: Junction 7 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road	A	0.33	0	0.73	3
B1450 Burringham Road (E)	B	0.31	0	0.50	1
Scotter Road (S)	C	0.75	3	0.71	2
B1450 Burringham Road (W)	D	0.20	0	0.44	1

Junction 8: Scotter Road/ Moorwell Road

6.1.9 Junction 8 operates within capacity although in the AM peak it is approaching capacity on Moorwell Road leading to minimal queuing.

Table 38: Junction 8 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.01	0	0.01	0
Moorwell Road	B	0.83	4	0.74	2
Scotter Road (S)	C	0.12	0	0.12	0
Moor Road	D	0.02	0	0.01	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

6.1.10 This junction operates within capacity at all times with minimal queuing on some approaches, particularly in the PM peak.

Table 39: Junction 9 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
B1430 Normanby Road (N)	A	0.33	0	0.42	1
A1077 Mannaberg Way	B	0.25	0	0.27	0
B1430 Normanby Road (S)	C	0.25	0	0.44	1
A1077 Phoenix Parkway	D	0.58	1	0.59	1

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

6.1.11 This junction operates well within capacity at all times.

Table 40: Junction 10 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077 Winterton Road	A	0.50	1	0.26	0
A1029 Winterton Road	B	0.09	0	0.38	1
A1077 Mannaberg Way	C	0.16	0	0.34	1
Dragonby Vale	D	0.00	0	0.02	0

Junction 11: A18 Station Road/ B1450 Burringham Road

6.1.12 Junction 11 operates well within capacity at all times in 2017.

Table 41: Junction 11 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.21	0	0.36	1
A18 Station Road (S)	C	0.24	0	0.35	1

Junction 12: A18 Station Road/ B1392 Station Road

6.1.13 In the AM peak this junction is significantly over capacity on the approach from B1392 Station Road because of passing traffic on the through route. The junction operates within capacity on

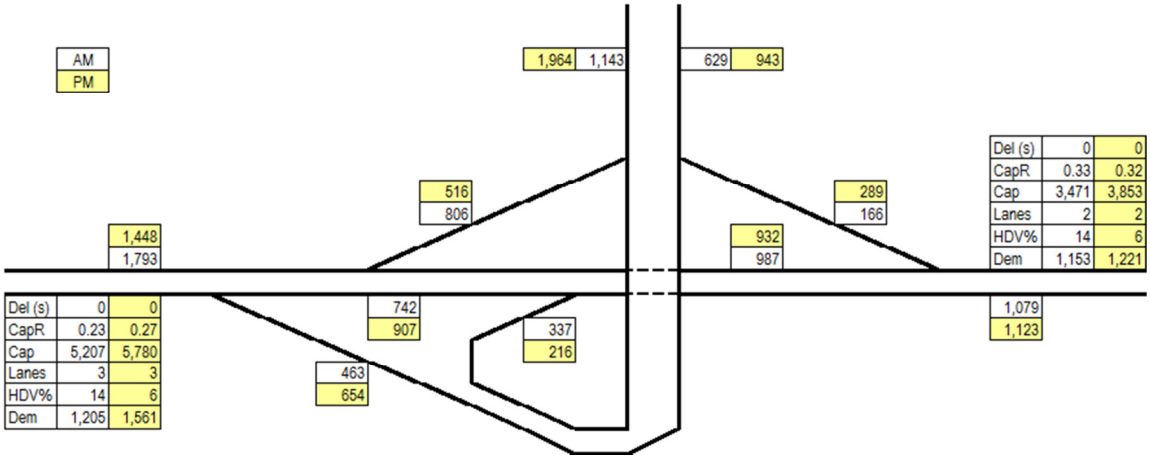
all other approaches in the AM peak and well within capacity in the PM peak on all approaches.

Table 42: Junction 12 Opening Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.21	17	0.20	0
A18 Station Road	B	0.58	1	0.33	0
A18 Trunk Road	C	0.00	0	0.00	0

Junction 13: M180 Jct 3

6.1.14 The merges of Junction 13 operate well within capacity in 2017, with a maximum Capacity to Flow Ration of 0.33 in the AM peak.



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

6.1.15 A summary of the 2017 Reference Case compared with the 2012 Baseline junction assessments in Table 43 shows that where existing junctions are currently within capacity they continue to be so. However Junction 5 and Junction 12 deteriorate operationally, with Junction 5 in particular coming under stress in the AM peak in 2017.

Table 43: Summary Comparison of 2017 Reference Case and 2012 Baseline Junction Assessment (Worst Approach)

	2012 Baseline		2017 Reference Case	
Location	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Jct 1 M181/ A18 Doncaster Road/ A1077	0.72	0.59	0.75	0.62
Jct 2 A1077/ Ferry Road West	0.30	0.63	0.52	0.66
Jct 3 A18 Doncaster Road/ Retail Park	0.32	0.60	0.44	0.62
Jct 4 Ferry Road West/ Scotter Road	0.30	0.37	0.31	0.38
Jct 5 A18/ Scotter Road/ Doncaster Road	0.80	1.11	0.85	1.20
Jct 6 Scotter Road/ Brumby Common Lane	0.17	0.47	0.18	0.50
Jct 7 Scotter Road/ B1450 Burringham Road	0.72	0.69	0.75	0.73
Jct 8 Scotter Road/ Moorwell Road	0.80	0.71	0.83	0.74
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.56	0.56	0.58	0.59
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.48	0.37	0.50	0.38
Jct 11 A18 Station Road/ B1450 Burringham Road	0.24	0.34	0.24	0.36
Jct 12 A18 Station Road/ B1392 Station Road	1.13	0.40	1.21	0.33
Jct 13 M180 Junction 3	0.32	0.31	0.33	0.32
Jct 14 New M181 Junction	-	-	-	-

7. FUTURE YEAR REFERENCE CASE ASSESSMENT

7.1.1 Reference Case traffic flows were calculated based upon the Baseline flows in Section 4 and the traffic growth factor in Table 6. The traffic flows are presented in Appendix B and the results of the junction assessments are presented below.

Junction 1: M181/ A18 Doncaster Road

7.1.2 This junction exceeds effective capacity on the M181 approach in the AM peak, causing short queues, but operates within capacity on the remaining approaches. In the PM peak it is operating within capacity.

Table 44: Junction 1 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077	A	0.35	1	0.77	3
A180 Doncaster Rd (E)	B	0.35	1	0.62	2
M181	C	0.92	9	0.79	4
A180 Doncaster Rd (W)	D	0.56	1	0.42	1

Junction 2: A1077/ Ferry Road West

7.1.3 Junction 2 operates well within capacity in the AM peak and within capacity in the PM peak.

Table 45: Junction 2 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077 Phoenix Parkway	A	0.27	0	0.16	0
Ferry Road West	B	0.27	0	0.57	1
A1077	C	0.63	2	0.84	4
B1216 Ferry Road West	D	0.32	0	0.26	0

Junction 3: A18 Doncaster Road/ Retail Park

7.1.4 In 2033 Junction 3 operates within capacity.

Table 46: Junction 3 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.29	0	0.59	1
A18 Doncaster Road (E)	B	0.42	1	0.77	3
Retail Park (S)	C	0.09	0	0.34	1
A18 Doncaster Road (W)	D	0.51	1	0.54	1

Junction 4: Scotter Road/ Ferry Road West

7.1.5 This junction operates well within capacity on all approaches in both the AM and PM peaks.

Table 47: Junction 4 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Luneburg Way	A	0.33	0	0.45	1
B1216 Ferry Road	B	0.20	0	0.39	1
Scotter Road	C	0.38	1	0.47	1
Ferry Road West	D	0.25	0	0.31	0

Junction 5: Scotter Road/ A18/ Doncaster Road

7.1.6 At Junction 5 Scotter Road (N) significantly exceeds capacity in both the AM and PM peaks. In particular the PM peak period RFC is 1.81, almost double the theoretical capacity for a roundabout approach (1.00).

7.1.7 In the AM peak A18 Doncaster Road is marginally over capacity, with a queue of six vehicles. In the PM peak Scotter Road (S) and A18 Doncaster Road are above capacity, resulting in queuing on both approaches.

Table 48: Junction 5 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	1.22	55	1.81	197
Doncaster Road	B	0.31	0	0.53	1
A18 Kingsway	C	0.59	1	0.74	3
Scotter Road (S)	D	0.78	3	0.96	14
A18 Doncaster Road	E	0.86	6	0.94	11

Junction 6: Scoter Road/ Brumby Common Lane

7.1.8 Junction 6 operates well within capacity on all approaches and in all periods with the exception of West Common Lane in the PM peak. Here the junction significantly exceeds capacity causing considerable queuing.

Table 49: Junction 6 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	0.01	0	0.01	0
West Common Lane	B	0.23	0	1.16	19
Scotter Road (S)	C	0.20	0	0.43	0
Brumby Common Lane	D	0.09	0	0.10	0

Junction 7: Scotter Road/ B1450 Burringham Road

7.1.9 In the AM peak Junction 7 is over capacity on Scotter Road (S). In the PM peak queues on the northern approach (Scotter Road) and southern approach (Scotter Road (S)) are caused by these approaches being over capacity.

Table 50: Junction 7 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road	A	0.41	1	0.93	10
B1450 Burringham Road (E)	B	0.39	1	0.68	2
Scotter Road (S)	C	0.92	9	0.92	9
B1450 Burringham Road (W)	D	0.25	0	0.55	1

Junction 8: Scotter Road/ Moorwell Road

7.1.10 Junction 8 operates well within capacity with the exception of Moorwell Road in both the AM and PM peaks, where it is well in excess of effective capacity.

Table 51: Junction 8 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.01	0	0.02	0
Moorwell Road	B	1.03	16	0.97	10
Scotter Road (S)	C	0.16	0	0.15	0
Moor Road	D	0.03	0	0.01	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

7.1.11 Junction 9 operates within capacity on all approaches.

Table 52: Junction 9 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1430 Normanby Road (N)	A	0.42	1	0.53	1
A1077 Mannaberg Way	B	0.31	0	0.33	0
B1430 Normanby Road (S)	C	0.36	1	0.54	1
A1077 Phoenix Parkway	D	0.74	2	0.75	3

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

7.1.12 Junction 10 operates well within capacity on all approaches in both the AM and PM peaks.

Table 53: Junction 10 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Winterton Road	A	0.58	1	0.31	0
A1029 Winterton Road	B	0.11	0	0.46	1
A1077 Mannaberg Way	C	0.20	0	0.41	1
Dragonby Vale	D	0.00	0	0.03	0

Junction 11: A18 Station Road/ B1450 Burringham Road

7.1.13 Junction 11 operates well within capacity on all approaches in both the AM and PM peaks.

Table 54: Junction 11 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.28	0	0.46	1
A18 Station Road (S)	C	0.29	0	0.44	1

Junction 12: A18 Station Road/ B1392 Station Road

7.1.14 In 2033 Junction 12 experiences severe queuing in the AM peak on B1392 Station Road because of vehicles crossing the face of this side road. All other approaches operate within capacity at all times.

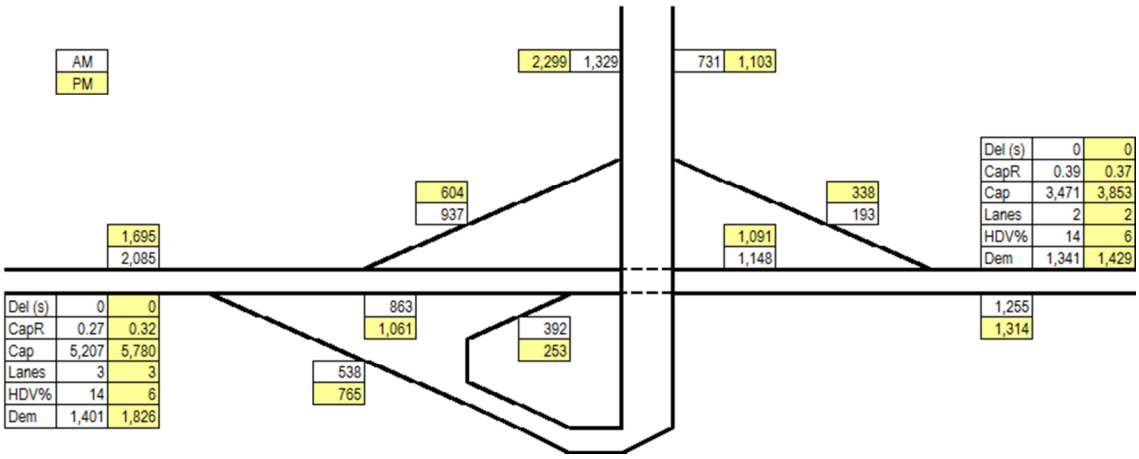
Table 55: Junction 12 Future Year Reference Case Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.67	70	0.40	1
A18 Station Road	B	0.67	2	0.51	1
A18 Trunk Road	C	0.00	0	0.00	0

7.1.15 A spreadsheet assessment using the principles of signalised junctions from the Traffic Advisory Leaflet series on Traffic Signals (TAL 1/06) indicates that this junction may work effectively if signalised, although adopting this approach will cause delays for through traffic on the A18.

Junction 13: M180 Jct 3

7.1.16 The merges of Junction 13 operate well within capacity in 2033, with a maximum Capacity to Flow Ratio of 0.39 in the AM peak.



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

7.1.17 The summary of the 2033 Reference Case compared with the 2012 Baseline junction and 2017 Reference Case assessments is shown in Table 60. It indicates that in addition to worsening conditions at junctions already exceeding effective capacity (Junctions 5 and 12), Junctions 1, 6, 7 and 8 also exceed capacity. Junction 2 in the PM peak is approaching effective capacity. In some instances North Lincs Council may consider that stress at some junctions is desirable, where queues are relatively short, as it may encourage the use of sustainable modes. However at Junction 12 (A18 west of the River Trent) and Junction 6 (West Common Lane) mitigation is likely to be desirable because of the level to which they exceed capacity. Junction 5 (Berkeley Circle) mitigation should be considered essential because of the qualitative evidence indicating that it is already over capacity and because of anticipated demand for local development even without Lincolnshire Lakes.

Table 56: Summary Comparison of 2033 Reference Case and 2012 Baseline Junction Assessment (Worst Approach)

	2012 Baseline		2017 Reference Case		2033 Reference Case	
Location	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Jct 1 M181/ A18 Doncaster Road/ A1077	0.72	0.59	0.75	0.62	0.92	0.79
Jct 2 A1077/ Ferry Road West	0.30	0.63	0.52	0.66	0.63	0.84
Jct 3 A18 Doncaster Road/ Retail Park	0.32	0.60	0.44	0.62	0.51	0.77
Jct 4 Ferry Road West/ Scotter Road	0.30	0.37	0.31	0.38	0.38	0.47
Jct 5 A18/ Scotter Road/ Doncaster Road	0.80	1.11	0.85	1.20	1.22	1.81
Jct 6 Scotter Road/ Brumby Common Lane	0.17	0.47	0.18	0.50	0.23	1.16
Jct 7 Scotter Road/ B1450 Burringham Road	0.72	0.69	0.75	0.73	0.92	0.93
Jct 8 Scotter Road/ Moorwell Road	0.80	0.71	0.83	0.74	1.03	0.97
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.56	0.56	0.58	0.59	0.74	0.75
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.48	0.37	0.50	0.38	0.58	0.46
Jct 11 A18 Station Road/ B1450 Burringham Road	0.24	0.34	0.24	0.36	0.29	0.46
Jct 12 A18 Station Road/ B1392 Station Road	1.13	0.40	1.21	0.33	1.67	0.51
Jct 13 M180 Junction 3	0.32	0.31	0.33	0.32	0.39	0.37
Jct 14 New M181 Junction	-	-	-	-	-	-

8. OPTION A ASSESSMENT

8.1 Option A Opening Year

8.1.1 The development scenario for Option A 2017 is shown in Table 57 with the trip generation, using trip rates from Table 11, presented in Table 58. A diagram of traffic flows for this scenario is shown in Appendix C . This traffic was added to 2017 Reference Case traffic, with the sum of both shown diagrammatically in Appendix D .

Table 57: Option A 2017 Development Scenario

Village		1	2	3	4	5	6	Grove Wharf	Total
Residential	Dwelling	512	997	171	-	-	-	-	**1,680**
B1	sqm	-	-	-	7,125	-	-	-	**7,125**
B2	sqm	-	-	-	-	-	-	-	**0**
Food Store	sqm	-	-	-	-	-	-	-	**0**
Hotel&Pub	rooms	-	-	-	-	-	-	-	**0**
Gym	sqm	-	-	-	-	-	-	-	**0**

Table 58: Option A 2017 Vehicle Trips by Village

	AM			PM		
	In	Out	Total	In	Out	Total
Village 1	67	283	350	181	108	289
Village 2	130	550	680	353	211	564
Village 3	22	94	116	61	36	97
Village 4	114	8	122	17	99	116
Village 5	-	-	-	-	-	-
Village 6	-	-	-	-	-	-
Grove Wharf	-	-	-	-	-	-
Total	**333**	**935**	**1,268**	**612**	**454**	**1,066**

Junction 1: M181/ A18 Doncaster Road

8.1.2 Junction 1 operates within capacity on all approaches in both peak periods.There is a significant improvement in capacity on the southbound approach because of a reduction in traffic approaching the M181 entry to the roundabout from Doncaster Road (E).

Table 59: Junction 1 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077	A	0.36	1	0.69	2
A180 Doncaster Rd (E)	B	0.41	1	0.45	1
M181	C	0.25	0	0.64	2
A180 Doncaster Rd (W)	D	0.83	5	0.63	0

Junction 2: A1077/ Ferry Road West

8.1.3 Junction 2 operates within capacity.

Table 60: Junction 2 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Phoenix Parkway	A	0.22	0	0.14	0
Ferry Road West	B	0.23	0	0.48	1
A1077	C	0.54	1	0.71	0
B1216 Ferry Road West	D	0.27	0	0.20	0

Junction 3: A18 Doncaster Road/ Retail Park

8.1.4 Junction 3 operates well within capacity.

Table 61: Junction 3 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.22	0	0.44	1
A18 Doncaster Road (E)	B	0.31	0	0.55	1
Retail Park (S)	C	0.07	0	0.24	0
A18 Doncaster Road (W)	D	0.39	1	0.39	1

Junction 4: Scotter Road/ Ferry Road West

8.1.5 In 2017 with Option A Junction 4 operates well within capacity.

Table 62: Junction 4 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Luneburg Way	A	0.27	0	0.37	1
B1216 Ferry Road	B	0.17	0	0.32	0
Scotter Road	C	0.31	0	0.38	1
Ferry Road West	D	0.21	0	0.25	0

Junction 5: Scotter Road/ A18/ Doncaster Road

8.1.6 In the PM peak Scotter Road (N) significantly exceeds effective capacity resulting in queues. All other approaches operate within capacity in both the AM and PM peak periods.

8.1.7 Notably Scotter Road (S) shows an improvement compared with the 2017 reference case because of re-routing enabled by the new strategic link.

Table 63: Junction 5 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.75	3	1.02	20
Doncaster Road	B	0.24	0	0.42	1
A18 Kingsway	C	0.49	1	0.62	2
Scotter Road (S)	D	0.49	1	0.60	1
A18 Doncaster Road	E	0.59	1	0.60	1

Junction 6: Scotter Road/ Brumby Common Lane

8.1.8 Junction 6 operates within capacity with the exception of Scotter Road (S), which exceeds effective capacity in the AM peak and is approaching effective capacity in the PM peak.

Table 64: Junction 6 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.23	0	0.54	1
West Common Lane	B	0.12	0	0.29	0
Scotter Road (S)	C	0.92	9	0.80	4
Brumby Common Lane	D	0.15	0	0.17	0

Junction 7: Scotter Road/ B1450 Burringham Road

8.1.9 Traffic generated by Village 2 means that at Junction 7 Scotter Road (S) exceeds capacity in both the AM and PM peak period leading to queues, particularly in the AM peak. Also Scotter Road exceeds effective capacity in the PM peak.

Table 65: Junction 7 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road	A	0.40	1	0.86	6
B1450 Burringham Road (E)	B	0.33	0	0.55	1
Scotter Road (S)	C	0.98	18	0.86	6
B1450 Burringham Road (W)	D	0.22	0	0.46	1

Junction 8: Scotter Road/ Moorwell Road

8.1.10 Junction 8 operates within capacity during both peak periods.

Table 66: Junction 8 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	0.26	0	0.56	1
Moorwell Road	B	0.26	0	0.31	0
Scotter Road (S)	C	0.49	1	0.42	1
Moor Road	D	0.31	0	0.12	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

8.1.11 Junction 9 operates within capacity

Table 67: Junction 9 Option A Assessment

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
B1430 Normanby Road (N)	A	0.34	1	0.42	1
A1077 Mannaberg Way	B	0.27	0	0.28	0
B1430 Normanby Road (S)	C	0.30	0	0.44	1
A1077 Phoenix Parkway	D	0.61	2	0.61	2

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

8.1.12 In 2017 with Option A Junction 10 operates within capacity.

Table 68: Junction 10 Option A Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Winterton Road	A	0.50	1	0.27	0
A1029 Winterton Road	B	0.10	0	0.40	1
A1077 Mannaberg Way	C	0.19	0	0.36	1
Dragonby Vale	D	0.00	0	0.02	0

Junction 11: A18 Station Road/ B1450 Burringham Road

8.1.13 Junction 11 operates well within capacity.

Table 69: Junction 11 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.19	0	0.36	1
A18 Station Road (S)	C	0.24	0	0.35	1

Junction 12: A18 Station Road/ B1392 Station Road

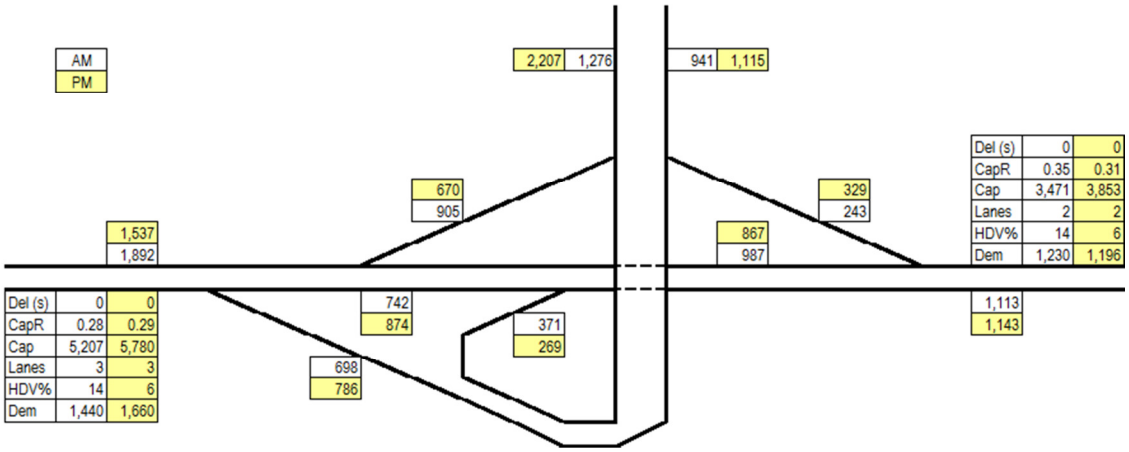
8.1.14 During the AM peak B1392 Station Road significantly exceeds capacity due to background traffic. All other approaches operate within capacity at all times.

Table 70: Junction 12 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.21	31	0.26	0
A18 Station Road	B	0.58	1	0.42	1
A18 Trunk Road	C	0.00	0	0.00	0

Junction 13: M180 Jct 3 Assessment Opening Year

8.1.15 The merges of Junction 13 operate well within capacity in 2017 with Option A, with a maximum Capacity to Flow Ratio of 0.35 in the AM peak at the eastbound onslip.



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

Junction 14: New M181 Junction

8.1.16 In 2017 with Option A Junction 14 operates within capacity on all approaches in both peak periods.

Table 71: Junction 14 Option A Assessment Opening Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
De-trunked M181	A	0.36	1	0.65	2
New Strategic Link	B	0.25	0	0.16	0
M181 South	C	0.76	3	0.57	1
Western Villages Access	D	0.00	0	0.04	0

8.1.17 A comparison of the 2017 Reference Case and 2017 with Option A is presented in Table 72. It shows that at Junctions 1, 2, 3, 4, 5, 9, 10, 11, 12 and 13 there is little or no impact and in some cases there is an increase in capacity in response to of traffic re-routing to use the new strategic link. In particular there is an improvement at Junction 5 (Berkley Circle roundabout) and at Junction 8, where there is a significant improvement in the RFC because of the assumed new junction layout.

8.1.18 At Junctions 6 and 7 junction performance becomes considerably worse due to traffic re-routing (vehicles avoiding Berkeley Circle would get onto Scotter Road at Junction 6 instead) and because in 2017 development will be focused in particular at Villages 1 and 2 adjacent to Scotter Road.

Table 72: Summary Comparison of 2017 Reference Case with 2017 Option A Assessment (Worst Approach)

	2017 Reference Case		2017 Option A	
Location	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Jct 1 M181/ A18 Doncaster Road/ A1077	0.75	0.62	0.83	0.69
Jct 2 A1077/ Ferry Road West	0.52	0.66	0.54	0.71
Jct 3 A18 Doncaster Road/ Retail Park	0.44	0.62	0.39	0.55
Jct 4 Ferry Road West/ Scotter Road	0.31	0.38	0.31	0.38
Jct 5 A18/ Scotter Road/ Doncaster Road	0.85	1.20	0.75	1.02
Jct 6 Scotter Road/ Brumby Common Lane	0.18	0.50	0.92	0.80
Jct 7 Scotter Road/ B1450 Burringham Road	0.75	0.73	0.98	0.86
Jct 8 Scotter Road/ Moorwell Road	0.83	0.74	0.49	0.56
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.58	0.59	0.61	0.61
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.50	0.38	0.50	0.40
Jct 11 A18 Station Road/ B1450 Burringham Road	0.24	0.36	0.24	0.36
Jct 12 A18 Station Road/ B1392 Station Road	1.21	0.33	1.21	0.26
Jct 13 M180 Junction 3	0.33	0.32	0.35	0.31
Jct 14 New M181 Junction	-	-	0.76	0.65

8.2 Option A Future Year

The development scenario for Option A 2033 is shown in Table 73 with the trip generation, using trip rates from Table 11, presented in Table 74. A diagram of traffic flows for this scenario is shown in Appendix C . This traffic was added to 2033 Reference Case traffic, with the sum of both is shown diagrammatically in Appendix D .

Table 73: Option A 2033 Development Scenario[4]

Village		1	2	3	4	5	6	Grove Wharf	Total
Residential	Dwelling	512	997	875	1,548	1,225	843	-	**6,000**
B1	sqm	-	-	-	21,000	-	-	-	**21,000**
B2	sqm	-	-	-	-	-	-	17,625	**0**
Food Store	sqm	-	-	3,450	-	-	-	-	**3,450**
Hotel&Pub	rooms	-	-	-	60	-	-	-	**60**
Gym	sqm	-	-	-	1,300	-	-	-	**1,300**

Table 74: Option A 2033 Vehicle Trips by Village

	AM			PM		
Location	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Village 1	67	283	350	181	108	289
Village 2	130	550	680	353	211	564
Village 3	271	596	867	618	506	1,124
Village 4	553	901	1,454	650	651	1,301
Village 5	159	676	835	434	259	693
Village 6	110	465	575	299	178	477
Grove Wharf	121	57	178	44	111	155
Total	**1,411**	**3,528**	**4,939**	**2,579**	**2,024**	**4,603**

Junction 1: M181/ A18 Doncaster Road

8.2.1 In the AM peak at Junction 1 the M181 approach significantly exceeds effective capacity, resulting in severe queuing due to an increase in traffic of over 1,100 vehicles. In the PM peak the M181 suffers from severe queuing because of an increase of over 800 vehicles on this approach, compared with the reference case. Also in the PM peak the A1077 is significantly above effective capacity because of an increase in traffic on this approach of almost 700 vehicles.

[4] The location for the supermarket that has been tested for this assessment is Village 3 not Village 4 as shown on the plan.

Table 75: Junction 1 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077	A	0.74	3	1.38	336
A180 Doncaster Rd (E)	B	0.43	1	0.72	3
M181	C	1.82	928	1.62	472
A180 Doncaster Rd (W)	D	0.97	17	0.62	2

8.2.2 If severe queuing persists at this junction in the preferred option for Lincolnshire Lakes (although it should be resolved with outline design) then an additional junction between the M181 junction and the current junction with the A18 may need to be reconsidered.

Junction 2: A1077/ Ferry Road West

8.2.3 Junction 2 is approaching effective capacity on the Phoenix Parkway approach (due to vehicles turning into B1216 Ferry Road West) in the AM peak and significantly exceeds effective capacity on Ferry Road West in the same period.

8.2.4 The PICADY junction assessment indicates that during the AM peak period B1216 Ferry Road West will have an effective entry capacity of no vehicles at some time within the peak period. This results in severe queuing and indicates that a new junction design is likely to be required at this location to accommodate traffic generated by Lincolnshire Lakes. This could take the form of a roundabout to minimise delays to through traffic during inter peak and off peak periods compared with a signalised junction, NLC has indicated that this would be the preferred junction type.

Table 76: Junction 2 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
A1077 Phoenix Parkway	A	1.24	5	0.25	0
Ferry Road West	B	-	39	1.33	39
A1077	C	0.51	1	0.86	5
B1216 Ferry Road West	D	-	51	-	93

Junction 3: A18 Doncaster Road/ Retail Park

8.2.5 Junction 3 continues to operate within capacity on all approaches and in all periods with the exception of A18 Doncaster Road (E) in the PM peak, which leads to small queues. This is because of an increase in east/ west traffic generated by Lincolnshire Lakes

Table 77: Junction 3 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.32	0	0.62	2
A18 Doncaster Road (E)	B	0.47	1	0.86	6
Retail Park (S)	C	0.09	0	0.37	1
A18 Doncaster Road (W)	D	0.62	2	0.59	1

Junction 4: Scotter Road/ Ferry Road West

8.2.6 Traffic flows are forecast to remain largely unchanged in 2033 with Option A compared with the reference case. The junction therefore continues to operate well within capacity.

Table 78: Junction 4 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Luneburg Way	A	0.33	0	0.45	1
B1216 Ferry Road	B	0.20	0	0.39	1
Scotter Road	C	0.38	1	0.47	1
Ferry Road West	D	0.25	0	0.37	0

Junction 5: Scotter Road/ A18/ Doncaster Road

8.2.7 At Junction 5 Scotter Road (N) and A18 Doncaster Road demand significantly exceeds capacity in both the AM and PM peak periods. This is a worsening of existing conditions as a result of traffic heading to and from Scunthope town centre from Lincolnshire Lakes, which increases traffic across the face of the Scotter Road (N) entry.

8.2.8 In both peak periods Scotter Road (S) has a lower RFC than in the 2033 Reference Case. This is because of the redistribution effect of the strategic link provided as part of Lincolnshire Lakes.

Table 79: Junction 5 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	1.41	95	1.89	241
Doncaster Road	B	0.32	0	0.53	1
A18 Kingsway	C	0.80	4	1.05	42
Scotter Road (S)	D	0.67	2	0.85	5
A18 Doncaster Road	E	1.10	73	1.06	45

Junction 6: Scotter Road/ Brumby Common Lane

8.2.9 At Junction 6 the assumption of an upgraded junction means that there are no longer capacity constraints on the West Common Lane approach. However with Lincolnshire lakes Scotter Road (S) significantly exceeds capacity in both the AM and PM peak periods. It is likely that this is due to an increase in traffic on this approach, compared with the 2033 Reference Case, and a large increase (200 vehicles) from West Common Lane to Brumby Common Lane.

Table 80: Junction 6 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	0.29	0	0.69	2
West Common Lane	B	0.21	0	0.53	1
Scotter Road (S)	C	1.13	99	1.12	68
Brumby Common Lane	D	0.33	0	0.29	0

Junction 7: Scotter Road/ B1450 Burringham Road

8.2.10 Scotter Road significantly exceeds capacity in the PM peak with Scotter Road South significantly exceeding capacity in both peak periods. The worsening at this junction is a result of north south traffic, approximately two thirds of which has its origin or destination in Village 2. This equates to between 100 and 200 vehicles per hour varying by direction and time of day.

Table 81: Junction 7 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road	A	0.51	1	1.09	70
B1450 Burringham Road (E)	B	0.41	1	0.72	2
Scotter Road (S)	C	1.20	127	1.14	67
B1450 Burringham Road (W)	D	0.26	0	0.56	1

Junction 8: Scotter Road/ Moorwell Road

8.2.11 Junction 8 operates within capacity in spite of traffic generated by Option A, which is because the assumed junction upgrade to a roundabout provides an increase in the available capacity. This is an improvement on the 2033 Reference Case where the junction is over capacity on Moorwell Road.

Table 82: Junction 8 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.35	1	0.67	2
Moorwell Road	B	0.33	0	0.41	1
Scotter Road (S)	C	0.60	1	0.52	1
Moor Road	D	0.32	0	0.13	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

8.2.12 With the exception of the eastern approach (A1077 Phoenix Parkway) this junction operates within capacity. The A1077 eastern approach is approaching the threshold at which it would significantly exceed effective capacity. This suggests that, although the junction performance may be acceptable (on the grounds of encouraging sustainable travel), further background traffic growth in future years is likely to make this unsustainable much beyond 2033.

Table 83: Junction 9 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1430 Normanby Road (N)	A	0.47	1	0.58	1
A1077 Mannaberg Way	B	0.41	1	0.49	1
B1430 Normanby Road (S)	C	0.38	1	0.58	1
A1077 Phoenix Parkway	D	0.98	17	0.96	14

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

8.2.13 Junction 10 operates within capacity.

Table 84: Junction 10 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Winterton Road	A	0.62	2	0.35	1
A1029 Winterton Road	B	0.19	0	0.58	1
A1077 Mannaberg Way	C	0.41	1	0.56	1
Dragonby Vale	D	0.00	0	0.03	0

Junction 11: A18 Station Road/ B1450 Burringham Road

8.2.14 Junction 11 operates within capacity.

Table 85: Junction 11 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.21	0	0.47	1
A18 Station Road (S)	C	0.30	0	0.44	1

Junction 12: A18 Station Road/ B1392 Station Road

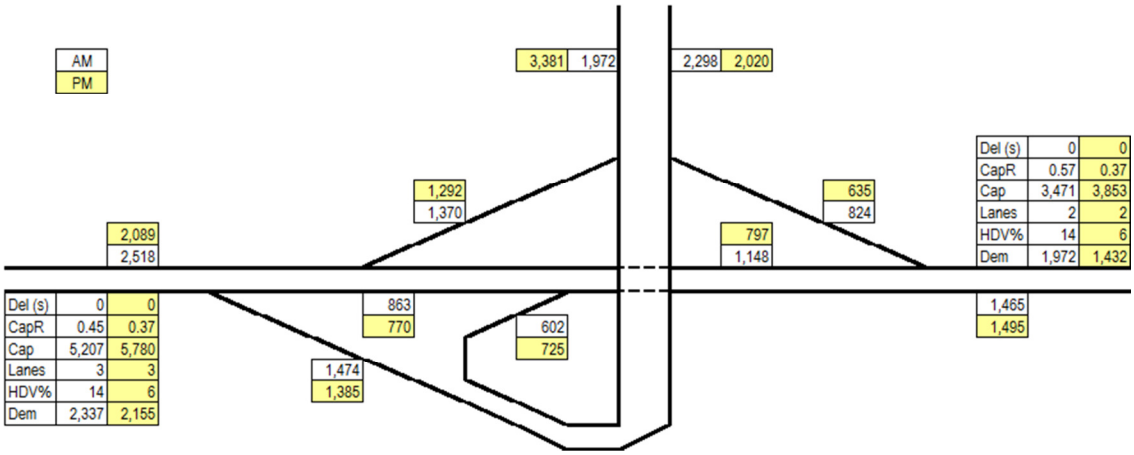
8.2.15 Traffic flows at Junction 12 change little compared to the reference case (approximately 10 vehicles). As a result the junction continues to be significantly over capacity on the B1392 approach in the AM peak but otherwise operates within capacity.

Table 86: Junction 12 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.71	39	0.41	1
A18 Station Road	B	0.69	2	0.51	1
A18 Trunk Road	C	0.00	0	0.00	0

Junction 13: M180 Jct 3

8.2.16 The merges of Junction 13 operate well within capacity in 2033 with Option A, with a maximum Capacity to Flow Ratio of 0.57 in the AM peak at the eastbound onslip.



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

Junction 14: New M181 Junction

8.2.17 In 2033 Junction 14 provides for the relatively light background traffic but also for the significant additional traffic associated with Lincolnshire Lakes. This includes north/ south traffic, vehicles entering and exiting to the east and west, and east/ west through traffic. In all this amounts to approximately 3,200 additional vehicles in both the AM and PM peak period, the current throughput of Junction 1 in the PM peak (upon which the geometry for Junction 14 is based).

8.2.18 As a result of the traffic generated by Lincolnshire Lakes the junction exceeds capacity on both the northern approach in the AM peak and significantly exceeds capacity in the PM peak while the southern approach significantly exceeds capacity at all times. This is as a result of traffic entering from the east and west circulating around the roundabout.

Table 87: Junction 14 Option A Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
De-trunked M181	A	0.98	18	1.36	320
New Strategic Link	B	0.56	1	0.44	1
M181 South	C	1.66	580	1.57	562
Western Villages Access	D	1.04	43	0.55	1

8.2.19 Nine out of 14 junctions exceed or significantly exceed capacity in 2033 with Option A. This is an increase compared with the 2033 Reference Case but it must be noted that provision of an

assumed junction upgrade at Junction 8 has resulted in this junction no longer being over capacity.

8.2.20 A policy maintaining some degree of network stress to encourage use of sustainable modes could be adopted, although NLC has indicated that this would not be preferable. Where junctions significantly exceed effective capacity, causing excessive or unacceptable queues, this approach is likely to be impractical

Table 88: Summary Comparison of 2033 Reference Case and 2033 With Development Assessment (Worst Approach)

	2033 Reference Case		2033 Option A	
Location	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Jct 1 M181/ A18 Doncaster Road/ A1077	0.92	0.79	1.82	1.62
Jct 2 A1077/ Ferry Road West	0.63	0.84	-	-
Jct 3 A18 Doncaster Road/ Retail Park	0.51	0.77	0.62	0.86
Jct 4 Ferry Road West/ Scotter Road	0.38	0.47	0.38	0.47
Jct 5 A18/ Scotter Road/ Doncaster Road	1.22	1.81	1.10	1.89
Jct 6 Scotter Road/ Brumby Common Lane	0.23	1.16	1.13	1.12
Jct 7 Scotter Road/ B1450 Burringham Road	0.92	0.93	1.20	1.14
Jct 8 Scotter Road/ Moorwell Road	1.03	0.97	0.60	0.67
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.74	0.75	0.98	0.96
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.58	0.46	0.62	0.58
Jct 11 A18 Station Road/ B1450 Burringham Road	0.29	0.46	0.30	0.47
Jct 12 A18 Station Road/ B1392 Station Road	1.67	0.51	1.71	0.51
Jct 13 M180 Junction 3	0.39	0.37	0.57	0.37
Jct 14 New M181 Junction	-	-	1.66	1.57

9. OPTION C ASSESSMENT

9.1 Option C Opening Year

9.1.1 The development scenario for Option C 2017 is shown in Table 73 with the trip generation, using the trip rates in Table 11 presented in Table 74. A diagram of traffic flows for this scenario is shown in Appendix C . This traffic was added to 2017 Reference Case traffic, the sum of these is shown diagrammatically in Appendix D

Table 89: Option C 2033 Development Scenario

Village		1	2	3	4	5	6	Grove Wharf	Total
Residential	Dwelling	770	910	-	-	-	-	-	**1,680**
B1	sqm	-	-	-	8,625	-	-	-	**8,625**
B2	sqm	-	-	-	-	-	-	-	**0**
Food Store	sqm	-	-	-	-	-	-	-	**0**
Hotel&Pub	rooms	-	-	-	-	-	-	-	**0**
Gym	sqm	-	-	-	-	-	-	-	**0**

Table 90: Option C 2017 Vehicle Trips by Village

	AM			PM		
Location	In	Out	Total	In	Out	Total
Village 1	100	425	525	273	163	436
Village 2	118	502	620	323	192	515
Village 3	-	-	-	-	-	-
Village 4	138	9	147	20	120	140
Village 5	-	-	-	-	-	-
Village 6	-	-	-	-	-	-
Grove Wharf	-	-	-	-	-	-
Total	**356**	**936**	**1,292**	**616**	**475**	**1,091**

Junction 1: M181/ A18 Doncaster Road

9.1.2 Junction 1 exceeds capacity in both the AM and PM peak at the M181 approach, causing queuing.

Table 91: Junction 1 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077	A	0.44	1	0.77	3
A180 Doncaster Rd (E)	B	0.30	0	0.48	1
M181	C	0.94	12	0.79	4
A180 Doncaster Rd (W)	D	0.49	1	0.34	1

Junction 2: A1077/ Ferry Road West

9.1.3 Junction 2 operates within capacity

Table 92: Junction 2 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Phoenix Parkway	A	0.24	0	0.14	0
Ferry Road West	B	0.25	0	0.50	1
A1077	C	0.58	1	0.74	0
B1216 Ferry Road West	D	0.36	1	0.26	3

Junction 3: A18 Doncaster Road/ Retail Park

9.1.4 Junction 3 operates within capacity

Table 93: Junction 3 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.22	0	0.45	1
A18 Doncaster Road (E)	B	0.34	1	0.56	1
Retail Park (S)	C	0.07	0	0.24	0
A18 Doncaster Road (W)	D	0.40	1	0.41	1

Junction 4: Scotter Road/ Ferry Road West

9.1.5 Junction 4 operates within capacity

Table 94: Junction 4 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Luneburg Way	A	0.27	0	0.37	1
B1216 Ferry Road	B	0.17	0	0.32	0
Scotter Road	C	0.31	0	0.38	1
Ferry Road West	D	0.21	0	0.25	0

Junction 5: Scotter Road/ A18/ Doncaster Road

9.1.6 Scotter Road (N) significantly exceeds capacity causing large queues in the PM peak.

Table 95: Junction 5 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.78	3	1.06	28
Doncaster Road	B	0.24	0	0.43	1
A18 Kingsway	C	0.56	1	0.64	2
Scotter Road (S)	D	0.50	1	0.61	2
A18 Doncaster Road	E	0.61	2	0.64	2

Junction 6: Scotter Road/ Brumby Common Lane

9.1.7 Junction 6 operates within capacity.

Table 96: Junction 6 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.20	0	0.49	1
West Common Lane	B	0.15	0	0.31	0
Scotter Road (S)	C	0.71	2	0.65	2
Brumby Common Lane	D	0.06	0	0.04	0

Junction 7: Scotter Road/ B1450 Burringham Road

9.1.8 Junction 7 operates within capacity.

Table 97: Junction 7 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road	A	0.28	0	0.68	2
B1450 Burringham Road (E)	B	0.31	0	0.50	1
Scotter Road (S)	C	0.76	3	0.72	2
B1450 Burringham Road (W)	D	0.27	0	0.50	1

Junction 8: Scotter Road/ Moorwell Road

9.1.9 Junction 8 operates within capacity.

Table 98: Junction 8 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.24	0	0.46	1
Moorwell Road	B	0.24	0	0.26	0
Scotter Road (S)	C	0.45	1	0.32	0
Moor Road	D	0.03	0	0.02	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

9.1.10 Junction 9 operates within capacity with the exception of A1077 Phoenix Parkway, which slightly exceeds effective capacity in the AM peak resulting in minimal queuing.

Table 99: Junction 9 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1430 Normanby Road (N)	A	0.38	1	0.46	1
A1077 Mannaberg Way	B	0.37	1	0.42	1
B1430 Normanby Road (S)	C	0.32	0	0.48	1
A1077 Phoenix Parkway	D	0.85	5	0.79	3

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

9.1.11 Junction 10 operates within capacity

Table 100: Junction 10 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Winterton Road	A	0.54	1	0.30	0
A1029 Winterton Road	B	0.21	0	0.54	1
A1077 Mannaberg Way	C	0.39	1	0.50	1
Dragonby Vale	D	0.00	0	0.02	0

Junction 11: A18 Station Road/ B1450 Burringham Road

9.1.12 Junction 11 operates well within capacity in 2017 with Option A.

Table 101: Junction 11 Option C Assessment

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.19	0	0.36	1
A18 Station Road (S)	C	0.24	0	0.35	1

Junction 12: A18 Station Road/ B1392 Station Road

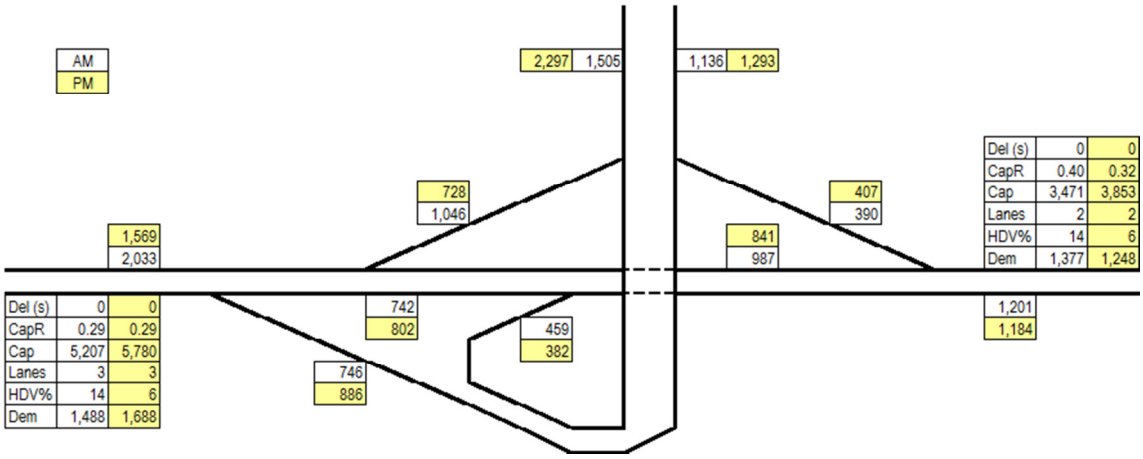
9.1.13 Because of background traffic growth Junction 12 significantly exceeds capacity on the B1392 approach in the AM peak.

Table 102: Junction 12 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.21	17	0.26	0
A18 Station Road	B	0.58	1	0.42	1
A18 Trunk Road	C	0.00	0	0.00	0

Junction 13: M180 Junction 3 Opening Year

9.1.14 The merges of Junction 13 operate well within capacity in 2017 with Option C, with a maximum Capacity to Flow Ratio of 0.40 in the AM peak at the eastbound onslip.



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

Junction 14: New M181 Junction

9.1.15 In the AM peak period the M181 south approach is significantly over capacity, causing long queues. The northern, eastern and western approaches operate within capacity in both the AM and PM peak period.

Table 103: Junction 14 Option C Assessment Opening Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
De-trunked M181	A	0.52	1	0.76	3
New Strategic Link	B	0.39	1	0.30	0
M181 South	C	1.02	35	0.76	3
Western Villages Access	D	0.01	0	0.05	0

9.1.16 A comparison of the 2017 Reference Case is made with the With Option C scenario in Table 104. It shows that junctions already over capacity in 2017 will generally become more congested. There are exceptions such as Junction 8, where the route to the Strategic Link reduces traffic on Scotter Road, and the southern approach to Junction 5, which is also mitigated by the strategic link in the AM peak. In addition Junctions 1 and 9 become over capacity with Option C in 2017 and the new junction on the M181 (Junction 14) is severely over capacity.

Table 104: Summary Comparison of 2017 Reference Case and 2017 with Option C Junction Assessment (Worst Approach)

	2017 Reference Case		2017 Option C	
Location	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Jct 1 M181/ A18 Doncaster Road/ A1077	0.75	0.62	0.94	0.79
Jct 2 A1077/ Ferry Road West	0.52	0.66	0.58	0.74
Jct 3 A18 Doncaster Road/ Retail Park	0.44	0.62	0.40	0.56
Jct 4 Ferry Road West/ Scotter Road	0.31	0.38	0.31	0.38
Jct 5 A18/ Scotter Road/ Doncaster Road	0.85	1.20	0.78	1.06
Jct 6 Scotter Road/ Brumby Common Lane	0.18	0.50	0.71	0.65
Jct 7 Scotter Road/ B1450 Burringham Road	0.75	0.73	0.76	0.72
Jct 8 Scotter Road/ Moorwell Road	0.83	0.74	0.45	0.46
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.58	0.59	0.85	0.79
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.50	0.38	0.54	0.54
Jct 11 A18 Station Road/ B1450 Burringham Road	0.24	0.36	0.24	0.36
Jct 12 A18 Station Road/ B1392 Station Road	1.21	0.33	1.21	0.42
Jct 13 M180 Junction 3	0.33	0.32	0.40	0.32
Jct 14 New M181 Junction	-	-	1.02	0.76

9.2 Option C Future Year

9.2.1 The development scenario for Option C 2013 is shown in Table 105 with the trip generation, using the trip rates in Table 11 presented in Table 106. A diagram of traffic flows for this scenario is shown in Appendix C . This traffic was added to 2017 Reference Case traffic, the sum of these is shown diagrammatically in Appendix D

Table 105: Option C 2033 Development Scenario

Village		1	2	3	4	5	6	Grove Wharf	Total
Residential	Dwelling	770	1,631	843	651	925	1,180	-	**6,000**
B1	sqm	-	-	-	25,500	-	-	-	**25,500**
B2	sqm	-	-	-	-	-	-	-	**0**
Food Store	sqm	-	-	-	-	-	-	-	**0**
Hotel&Pub	rooms	-	-	-	60	-	-	-	**60**
Gym	sqm	-	-	-	1,300	-	-	-	**1,300**

Table 106: Option C 2033 Vehicle Trips by Village

	AM			PM		
Location	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Village 1	100	425	525	273	163	436
Village 2	212	900	1,112	578	344	922
Village 3	110	465	575	299	178	477
Village 4	509	411	920	343	524	867
Village 5	120	510	630	328	195	523
Village 6	153	651	804	418	249	667
Grove Wharf	-	-	-	-	-	-
Total	**1,204**	**3,362**	**4,566**	**2,239**	**1,653**	**3,892**

Junction 1: M181/ A18 Doncaster Road

9.2.2 Junction 1 significantly exceeds effective capacity on the M181 approach in the AM peak causing severe queuing. In the PM peak both the northern (A1077) and southern (M181) approaches exceed capacity, again causing severe queuing.

Table 107: Junction 1 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077	A	0.68	2	1.24	188
A180 Doncaster Rd (E)	B	0.42	1	0.70	2
M181	C	1.87	1053	1.55	408
A180 Doncaster Rd (W)	D	0.60	1	0.46	1

Junction 2: A1077/ Ferry Road West

9.2.3 In 2033 B1216 Ferry Road West suffers from periods of no effective capacity due to through traffic and vehicles turning off the A1077. In the PM peak Ferry Road West exceeds capacity causing queuing on this approach. As with Option A this indicates that junction mitigation is required.

Table 108: Junction 2 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Phoenix Parkway	A	0.83	1	0.202	0
Ferry Road West	B	2.00	37	1.25	19
A1077	C	0.60	1	0.90	4
B1216 Ferry Road West	D	-	41	-	36

Junction 3: A18 Doncaster Road/ Retail Park

9.2.4 Junction 3 operates within capacity.

Table 109: Junction 3 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Retail Park (N)	A	0.31	0	0.60	2
A18 Doncaster Road (E)	B	0.47	1	0.81	4
Retail Park (S)	C	0.10	0	0.35	1
A18 Doncaster Road (W)	D	0.58	1	0.57	1

Junction 4: Scotter Road/ Ferry Road West

9.2.5 In 2033 with Option C Junction 4 operates well within capacity.

Table 110: Junction 4 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Luneburg Way	A	0.33	0	0.45	1
B1216 Ferry Road	B	0.20	0	0.39	1
Scotter Road	C	0.38	1	0.47	1
Ferry Road West	D	0.25	0	0.31	0

Junction 5: Scotter Road/ A18/ Doncaster Road

9.2.6 At Junction 5 both Scotter Road (N) and A18 Doncaster Road are significantly over capacity in both peak periods, at times causing severe queuing on these approaches. In the PM peak A18 Kingsway is over capacity, causing delays to traffic queuing on this approach.

Table 111: Junction 5 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	1.39	82	1.85	210
Doncaster Road	B	0.32	0	0.53	1
A18 Kingsway	C	0.80		0.98	17
Scotter Road (S)	D	0.67	2	0.84	5
A18 Doncaster Road	E	1.02	33	1.00	22

Junction 6: Scotter Road/ Brumby Common Lane

9.2.7 Junction 6 operates within capacity with the exception of Scotter Road (S), which experiences queues in both peak periods. This is caused by a high traffic demand on this southern approach when combined with other vehicle movements at the junction.

Table 112: Junction 6 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		RFC	Max Queue	RFC	Max Queue
Scotter Road (N)	A	0.26	0	0.61	2
West Common Lane	B	0.22	0	0.50	1
Scotter Road (S)	C	0.90	8	0.86	6
Brumby Common Lane	D	0.16	0	0.09	0

Junction 7: Scotter Road/ B1450 Burringham Road

9.2.8 Junction 7 exceeds capacity on Scotter Road (S) in both peak periods in 2033 with Option C, leading to significant queuing, and exceeds capacity on Scotter Road (northern approach) in the PM peak. This is due to the large north/ south travel demand.

Table 113: Junction 7 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road	A	0.35	1	0.89	7
B1450 Burringham Road (E)	B	0.39	1	0.67	2
Scotter Road (S)	C	0.93	11	0.96	13
B1450 Burringham Road (W)	D	0.35	1	0.64	2

Junction 8: Scotter Road/ Moorwell Road

9.2.9 Junction 8 operates within capacity as the assumed roundabout relieves reference case congestion and the link road from Village 2 to the new Strategic Link via Burringham Road provides a route away from Scunthorpe that does not require travel via Scotter Road.

Table 114: Junction 8 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
Scotter Road (N)	A	0.28	0	0.55	1
Moorwell Road	B	0.28	0	0.31	0
Scotter Road (S)	C	0.54	1	0.39	1
Moor Road	D	0.03	0	0.02	0

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

9.2.10 A1077 Phoenix Parkway is significantly above effective capacity in both peak periods causing queuing. All other approaches operate within capacity at all times.

Table 115: Junction 9 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1430 Normanby Road (N)	A	0.47	1	0.58	1
A1077 Mannaberg Way	B	0.44	1	0.50	1
B1430 Normanby Road (S)	C	0.39	1	0.58	1
A1077 Phoenix Parkway	D	1.01	24	0.98	16

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

9.2.11 Junction 10 operates within capacity.

Table 116: Junction 10 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A1077 Winterton Road	A	0.63	2	0.35	1
A1029 Winterton Road	B	0.23	0	0.62	2
A1077 Mannaberg Way	C	0.44	1	0.58	1
Dragonby Vale	D	0.00	0	0.03	0

Junction 11: A18 Station Road/ B1450 Burringham Road

9.2.12 Junction 11 operates within capacity.

Table 117: Junction 11 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
A18 Station Road (N)	A	0.00	0	0.00	0
B1450 Burringham Road	B	0.23	0	0.47	1
A18 Station Road (S)	C	0.29	0	0.44	1

Junction 12: A18 Station Road/ B1392 Station Road

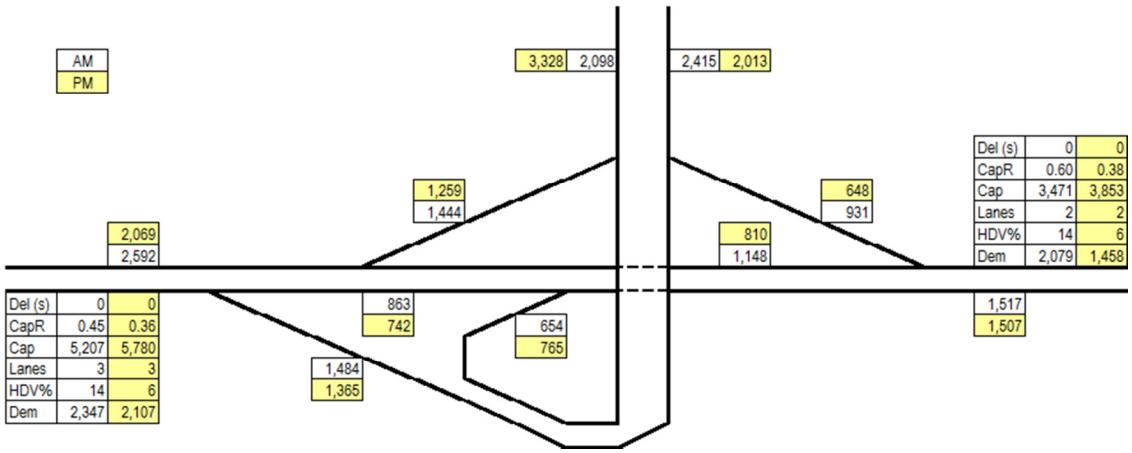
9.2.13 At Junction 12 B1392 Station Road is significantly above capacity in the AM peak. There is no increase in traffic associated with Lincolnshire Lakes on this approach. Consequently there is no change from the 2033 Reference Case.

Table 118: Junction 12 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
B1392 Station Road	A	1.67	37	0.33	0
A18 Station Road	B	0.67	2	0.51	1
A18 Trunk Road	C	0.00	0	0.00	0

Junction 13: M180 Junction 3 Future Year

9.2.14 The merges of Junction 13 operate well within capacity in 2033 with Option C, with a maximum Capacity to Flow Ratio of 0.60 in the AM peak at the eastbound onslip.



Key

Table	Description
Del (s)	Delay in seconds
CapR	Capacity Ratio
Cap	Link Capacity
Lanes	Number of Lanes
HDV%	Percentage of Heavy Duty Vehicles
Dem	Upstream demand

Junction 14: New M181 Junction

9.2.15 In both peak periods Junction 14 is significantly over capacity on both the northern and southern approaches, causing severe queuing. The eastern and western approaches operate within capacity in both the AM and PM peak period.

Table 119: Junction 14 Option C Assessment Future Year

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
De-trunked M181	A	1.06	49	1.37	339
New Strategic Link	B	0.82	4	0.51	1
M181 South	C	2.21	979	1.65	628
Western Villages Access	D	0.79	4	0.47	1

9.2.16 A comparison of the 2033 Reference Case is made with the With Option C scenario in Table 120. It shows that, at those junctions already over capacity in 2017 will generally become more congested. The exceptions to this are Junction 8, where the route to the Strategic Link reduces traffic on Scotter Road, and at Junction 12 where the traffic varies littleresulting in no change in the RFC. In addition there is an improvement in operation at Junction 6 in the PM peak because through a reduction in traffic travelling to and from Junction 7 to follow the relief provided by the route between Brumby Common Lane and Burringham Road in Option C. Junctions 2 and 9 become over capacity with Option C in 2033 and the new junction on the M181 (Junction 14) is severely over capacity.

Table 120: Summary Comparison of 2033 Reference Case and 2033 With Development Assessment (Worst Approach)

	2033 Reference Case		2033 Option C	
Location	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Jct 1 M181/ A18 Doncaster Road/ A1077	0.92	0.79	1.87	1.55
Jct 2 A1077/ Ferry Road West	0.63	0.84	-	-
Jct 3 A18 Doncaster Road/ Retail Park	0.51	0.77	0.58	0.81
Jct 4 Ferry Road West/ Scotter Road	0.38	0.47	0.38	0.45
Jct 5 A18/ Scotter Road/ Doncaster Road	1.22	1.81	1.39	1.85
Jct 6 Scotter Road/ Brumby Common Lane	0.23	1.16	0.90	0.86
Jct 7 Scotter Road/ B1450 Burringham Road	0.92	0.93	0.93	0.96
Jct 8 Scotter Road/ Moorwell Road	1.03	0.97	0.51	0.55
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.74	0.75	1.01	0.98
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.58	0.46	0.63	0.62
Jct 11 A18 Station Road/ B1450 Burringham Road	0.29	0.46	0.29	0.47
Jct 12 A18 Station Road/ B1392 Station Road	1.67	0.51	1.67	0.51
Jct 13 M180 Junction 3	0.39	0.37	0.45	0.60
Jct 14 New M181 Junction	-	-	2.21	1.65

10. COMPARISON OF IMPACTS

10.1 Junction Impacts

10.1.1 This section compares the impacts of each option in both the Opening Year (OY) and Future Years (FY) with the reference cases. To assist with this the worst RFC for each junction is presented in Table 121 for the AM peak and Table 122 for the PM peak. In Table 121 and Table 122 orange cells denote a junction forecast to operate at or above effective capacity (0.85 - 0.99), with red cells indicating a junction predicted to be operating well in excess of effective capacity (+1.0).

Table 121: Summary of AM Peak Junction Assessment (Worst Approach)

Location	OY Ref	OY Opt A	OY Opt C	FY Ref	FY Opt A	FY Opt C
Jct 1 M181/ A18 Doncaster Road/ A1077	0.75	0.83	0.94	0.92	1.82	1.87
Jct 2 A1077/ Ferry Road West	0.52	0.54	0.58	0.63	-	-
Jct 3 A18 Doncaster Road/ Retail Park	0.44	0.39	0.40	0.51	0.62	0.58
Jct 4 Ferry Road West/ Scotter Road	0.31	0.31	0.31	0.38	0.38	0.38
Jct 5 A18/ Scotter Road/ Doncaster Road	0.85	0.75	0.78	1.22	1.10	1.39
Jct 6 Scotter Road/ Brumby Common Lane	0.18	0.92	0.71	0.23	1.13	0.90
Jct 7 Scotter Road/ B1450 Burringham Road	0.75	0.98	0.76	0.92	1.20	0.93
Jct 8 Scotter Road/ Moorwell Road	0.83	0.49	0.45	1.03	0.60	0.51
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.58	0.61	0.85	0.74	0.98	1.01
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.50	0.50	0.54	0.58	0.62	0.63
Jct 11 A18 Station Road/ B1450 Burringham Road	0.24	0.24	0.24	0.29	0.30	0.29
Jct 12 A18 Station Road/ B1392 Station Road	1.21	1.21	1.21	1.67	1.71	1.67
Jct 13 M180 Junction 3	0.33	0.35	0.40	0.39	0.57	0.45
Jct 14 New M181 Junction	-	0.76	1.02	-	1.66	2.21

Table 122: Summary of PM Peak Junction Assessment (Worst Approach)

Location	OY Ref	OY Opt A	OY Opt C	FY Ref	FY Opt A	FY Opt C
Jct 1 M181/ A18 Doncaster Road/ A1077	0.62	0.69	0.79	0.79	1.62	1.55
Jct 2 A1077/ Ferry Road West	0.66	0.71	0.74	0.84	-	-
Jct 3 A18 Doncaster Road/ Retail Park	0.62	0.55	0.56	0.77	0.86	0.81
Jct 4 Ferry Road West/ Scotter Road	0.38	0.38	0.38	0.47	0.47	0.45
Jct 5 A18/ Scotter Road/ Doncaster Road	1.20	1.02	1.06	1.81	1.89	1.85
Jct 6 Scotter Road/ Brumby Common Lane	0.50	0.80	0.65	1.16	1.12	0.86
Jct 7 Scotter Road/ B1450 Burringham Road	0.73	0.86	0.72	0.93	1.14	0.96
Jct 8 Scotter Road/ Moorwell Road	0.74	0.56	0.46	0.97	0.67	0.55
Jct 9 A1077 Phoenix Parkway/ Normanby Road	0.59	0.61	0.79	0.75	0.96	0.98
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	0.38	0.40	0.54	0.46	0.58	0.62
Jct 11 A18 Station Road/ B1450 Burringham Road	0.36	0.36	0.36	0.46	0.47	0.47
Jct 12 A18 Station Road/ B1392 Station Road	0.33	0.26	0.42	0.51	0.51	0.51
Jct 13 M180 Junction 3	0.32	0.31	0.32	0.37	0.37	0.60
Jct 14 New M181 Junction	-	0.65	0.76	-	1.57	1.65

Junction 1: M181/ A18 Doncaster Road

10.1.2 In Option A Junction 1 operates comparably to the 2017 reference case in the AM peak while Option C experiences a significant reduction in capacity. This is also the case in the PM peak 2017 Opening Year. However in the 2033 Future Year both scenarios significantly exceed effective capacity by a similar order of magnitude in both peak periods.

10.1.3 The assessment of junction 1 indicates that while mitigation for Option C may be required earlier, both options are likely to require a comparable level of mitigation in response to the PM peak demand. On the northern A1077 approach this may mean developing the flare to provide a two lane approach. Congestion on the M181 approach is likely to require an

additional entry lane, which would then require the circulatory carriageway to be expanded to accommodate three lanes joining the roundabout from this approach.

10.1.4 Option C may require mitigation sooner than Option A but the overall scale of mitigation at Junction 1 is likely to be comparable.

Junction 2: A1077/ Ferry Road West

10.1.5 Junction C operates effectively in both reference cases and in 2017 with the Options but is significantly above capacity with both options during 2033. The constraint is on traffic trying to leavethe B1216 Ferry Road West in the face of a busy A1077 queue of vehicles attempting to turn right into this side road and entering Ferry Road. The impact is slightly greater in Option C, which may be the result of a slight increase in traffic travelling north to south on the A1077.

10.1.6 It is likely that this could be resolved through construction of a roundabout, although it should be noted that this would require the realignment of one or both of Ferry Road West and B1216 Ferry Road West.

10.1.7 Because of the impact in the AM peak the scale of mitigation is likely to be comparable for both options.

Junction 3: A18 Doncaster Road/ Retail Park

10.1.8 At Junction 3 in 2017 both options provide an improvement to junction operation because of re-routing encouraged by the new strategic link. In 2033 the increased background and development traffic means that both options have a comparable impact, with no net benefit and a slightly worse impact from Option A compared with Option C.

10.1.9 In all scenarios this junction continues to operate within or only slightly above effective capacity. As a result it is unlikely that mitigation will be required.

Junction 4: Scotter Road/ Ferry Road West

10.1.10 Based upon the distribution presented in Section 3.3 no traffic from Lincolnshire Lakes uses Junction 4. In reality this is unlikely to be the case but the distribution does indicate that vehicle trips are quicker by alternative routes. As a result only local traffic is expected to be attracted through Junction 4. Consequently the impact of Lincolnshire Lakes at this junction is minimal and it is not anticipated that mitigation will be required.

Junction 5: Scotter Road/ A18/ Doncaster Road

10.1.11 In the Reference Case Junction 5 exceeds or significantly surpasses effective capacity and with both Options this is exacerbated in the PM peak. In the AM peak both options experience a slight improvement in both years due to relief on the Scotter Road approach from the south.

10.1.12 Junction mitigation was proposed for this location for existing submitted development proposals, consisting of a signalised solution. This assessment indicates that the junction will be significantly over capacity in both Reference Case years, therefore it may be beneficial to consider the potential impact of Lincolnshire Lakes and, if feasible, incorporate further mitigation into the existing proposed design. Funding for this would ultimately need to be sourced through Lincolnshire Lakes through contributions from developers but may require pump-priming from NLC. The benefit of this would be less traffic disruption to accommodate further junction improvements in future years.

10.1.13 Because both Options aggravate the operational effectiveness at the junction in the PM peak there is no strategic difference in choosing one Option over the other for Junction 5.

Junction 6: Scotter Road/ Brumby Common Lane

10.1.14 In the AM and PM peak the junction operates within capacity in both the Opening Year (2017) and Future Year (2033) reference cases. In the AM peak both Option A exceeds effective capacity in 2017 and significantly exceed effective capacity in 2033 while Option C exceeds effective capacity in the Opening and Future Years in the PM peak only.

10.1.15 The Opening Year and Future Year impact of Option C is less than Option A. This is predominantly due to the link road between Brumby Common Lane and B1450 Burringham Road to the new strategic link that provides relief to the Scotter Road corridor from increased traffic volumes due to the Lakes.

10.1.16 For the purposes of this study a roundabout was assumed at this location. A signalised junction may be more preferable because it will provide opportunities to integrate Non-Motorised User (NMU) crossings. Any new junction here will require land take in all directions and may necessitate the stopping up of Bristol Road onto West Common Lane to comply with highway design standards and/ or for effective junction operation. The building on the corner of Brumby Common Lane and Scotter Road towards Berkeley Circle will be a constraint to effective junction design.

Junction 7: Scotter Road/ B1450 Burringham Road

10.1.17 Junction 7 exceeds effective capacity in the 2033 Reference Case in both peak periods. The impact of the Options is comparable to Junction 6 in that bothOption A causes the junction to become significantly over capacity while Option C causes it to exceed effective capacity. This is again because of the link road between Brumby Common Lane and B1450 Burringham Road to the new strategic link providing relief to the Scotter Road corridor from increased traffic volumes due to the Lakes.

10.1.18 The relief provided by the link road will reduce the scale and potentially cost of mitigation along Scotter Road. However this must be considered alongside the cost of constructing a link from Village 2 to the new strategic link. The route from Village 2 would however provide increased permeability between Lincolnshire Lakes villages in addition to congestion relief on Scotter Road.

10.1.19 For the purposes of this study a roundabout was assumed at this location. In common with Junction 6 a signalised junction may be more preferable to provide enhanced opportunities to cater for NMUs. Any new junction here will again require land take, which may prove to be a constraint due to the proximity of existing buildings.

Junction 8: Scotter Road/ Moorwell Road

10.1.20 In 2017 Junction 8 operates within capacity in both periods and for all scenarios. Both Options provide an improvement as the assessment in this case has replaced the existing priority crossroads with a roundabout. In the 2033 Reference Case the junction exceeds effective capacity in both the AM and PM peak although the Options again provide relief through the assumed junction upgrade. Because of the link from Village 2 to the new strategic link the impact of Option C is less than the impact of Option A.

Junction 9: B1430 Normanby Road/ A1077 Mannaberg Way

10.1.21 In 2017 Junction 9 operates within capacity during all scenarios with the exception of the Option C AM peak, which slightly exceeds effective capacity. In 2033 the junction is within capacity in the reference case but exceeds capacity with both Options A and C, significantly exceeding capacity in the AM peak with Option C; the actual difference in impact between the options however, is minimal.

10.1.22 The A1077 Phoenix Way is the approach over capacity, although it does benefit from the opportunity to take advantage of spare land that could be used to provide relief in the form of widening to provide a flare on this western approach. This mitigation would be required earlier with Option C than with Option A.

Junction 10 A1077 Mannaberg Way/ A1029 Winterton Road

10.1.23 At Junction 10 the maximum throughput from Option A is approximately 310 vehicles and from Option C approximately 375 vehicles. As the junction operates well in the reference case in both years this has a small impact and as a result mitigation is unlikely to be required.

Junction 11: A18 Station Road/ B1450 Burringham Road

10.1.24 Minimal traffic uses Junction 11 in both Options A and C. Consequently the impact of Lincolnshire Lakes is negligible and no mitigation is likely to be required.

Junction 12: A18 Station Road/ B1392 Station Road

10.1.25 Junction 12 significantly exceeds capacity in both reference cases in the AM peak period but operates well in the PM peak period. Option A is anticipated to generate a smaller number of additional vehicle trips through this junction than Option C, causing deteriorating operating conditions on the B1392 Station Road side road, but this impact is minimal.

10.1.26 Building on the spreadsheet assessment in paragraph 7.1.15, which uses the principles of signalised junctions from the Department for Transport's Traffic Advisory Leaflet series on Traffic Signals (TAL 1/06), the exercise was repeated for the 2033 Option A scenario. This indicates that signalisation can still be considered a worthwhile option for further investigation should mitigation be desirable. The main issue at this junction is background traffic growth and as such there is no benefit in choosing one option over the other.

Junction 13: M180 Jct 3

10.1.27 In the Future Year Option A has a greater impact in the AM peak but Option C has a greater impact in the PM peak. However Junction 13 operates well within capacity in all scenarios, therefore no mitigation is required.

Junction 14: New M181 Junction

10.1.28 Junction 14 is not applicable to the reference cases as it would only be constructed as part of the Lincolnshire Lakes development. Due to the alternative distribution of residential and business land use the impact of Option A is significantly less when compared with Option C in both the AM and PM peak periods. With Option A the junction operates within capacity in the 2017 AM peak period while Option C significantly exceeds capacity with severe queuing. In 2033 both options significantly exceed capacity on the northern and southern approaches, although Option C is more severe.

10.1.29 To some degree the adoption of the geometry from M181/ A18 Doncaster Road will provide a distorted result as a new junction would be designed to current standards and to the dimensions necessary to accommodate forecast traffic. In response to this issue WSP, working on behalf of a developer with interests at Lincolnshire Lakes (Lucent), has identified a potential junction design (see Appendix E). Notably the junction has a segregated left turn from the new strategic link (the eastern approach) and a two lane approach from the north, flared to three lanes at the roundabout entry. This layout was tested in ARCADY by amending the geometry of Junction 1, using standard lane widths on the northern approach to provide 3 approach lanes at 50 metres and removing the left turning traffic from the strategic link to emulate a Segregated Left Turn Lane.

10.1.30 The revised layout was tested with Option C in 2033 because this scenario demonstrates the worst junction performance in Table 121 and Table 122; the results are presented in Table 123. It indicates that congestion on the northern approach is largely resolved; although there are large queues in the PM peak they are significantly reduced and may be resolved through a junction design that is more specific to this location. On the M181 South approach in spite of a reduction in the RFC, particularly in the AM peak, there are still severe queues. A 3-lane approach has been assumed on this approach, which would require a 3-lane circulatory. These unresolved issues would be addressed through detailed design. Junction 14 will provide a new termination location for the M181, where it meets with the new strategic link. The junction design must therefore be approved by the Highways Agency.

Table 123: Junction 14 Option C Assessment With WSP Junction Design

		AM Peak		PM Peak	
Approach		**RFC**	**Max Queue**	**RFC**	**Max Queue**
De-trunked M181	A	0.87	6	1.13	118
New Strategic Link	B	0.36	1	0.26	0
M181 South	C	1.11	120	1.05	68
Western Villages Access	D	0.87	6	0.54	1

10.1.31 The junction will be constructed for Lincolnshire Lakes. Therefore the time of delivery is likely to be similar. However because the RFC is worse with Option C than Option A, junction design may demonstrate that Option A is less costly than Option C. To confirm this, a formal study will be required.

10.1.32 A summary of potential mitigation and phasing depending on each option is presented in Table 124. It identifies that Junction 1 would be required later with Option A, which would allow for increased contributions to be collected by NLC from developers before committing to works. Mitigation at Junction 6 would be required when the link road to the M181 is constructed while mitigation at Junction 7 could be delivered when it is forecast to be required (this is earlier with Option A) or at the same time as a link road between Brumby Common Lane and B1450 Burringham Road. Junction 9 would require mitigation later in Option A than Option C.

10.1.33 A development distribution at Lincolnshire Lakes that reflects Option A is likely to be least onerous in terms of mitigation requirements. This is because of the later impact of Option A at some junctions, including Junction 1 where mitigation will be costly, and for the reason that mitigation at Junction 14 may be slightly less onerous with Option A.

Table 124: Summary of Potential Mitigation

Location	Mitigation	Required	
		Opt A	Opt C
Jct 1 M181/ A18 Doncaster Road/ A1077	Increased capacity from south and on circulatory	2033	2017
Jct 2 A1077/ Ferry Road West	Roundabout	2033	2033
Jct 3 A18 Doncaster Road/ Retail Park	None	-	-
Jct 4 Ferry Road West/ Scotter Road	None	-	-
Jct 5 A18/ Scotter Road/ Doncaster Road	Existing proposed mitigation amended for Lincs Lakes	2017	2017
Jct 6 Scotter Road/ Brumby Common Lane	Roundabout of signals	2017	2017
Jct 7 Scotter Road/ B1450 Burringham Road	Roundabout or signals	2017	2033
Jct 8 Scotter Road/ Moorwell Road	Roundabout or signals	2017	2017
Jct 9 A1077 Phoenix Parkway/ Normanby Road	Flare on EB approach	2033	2017
Jct 10 A1077 Mannaberg Way/ A1029 Winterton Road	None	-	-
Jct 11 A18 Station Road/ B1450 Burringham Road	None	-	-
Jct 12 A18 Station Road/ B1392 Station Road	Signals for B1392 Station Road	2017	2017
Jct 13 M180 Junction 3	None	-	-
Jct 14 New M181 Junction	Roundabout	2017	2017

10.2 Link Impacts

10.2.1 To provide a guide on the impact of Lincolnshire Lakes on link capacity an assessment of the 2033 future year was completed using *TA79/99 Traffic Capacity of Urban Roads* (Highways Agency, May 1999). In particular Tables 1 and 2 from TA79/99 informed the capacity assessment, which is presented in Table 125.

10.2.2 The assessment shows that a single carriageway is unlikely to be suitable for the forecast volume of traffic to and from the existing M181/ A18 junction, suggesting that a 6.75m dual carriageway is likely to be more appropriate for the de-trunked section of the M181.

10.2.3 The assessment also indicates that with Option A in place the A1077 will exceed link capacity in the AM peak and will marginally exceed link capacity in the AM peak with Option C. To address this the single carriageway at this location could be widened to 10.0m or could be upgraded to dual carriageway. This will need to be reviewed in more detail once a preferred option for Lincolnshire Lakes is developed.

10.2.4 In terms of link capacity both options are likely to require the same level of mitigation at approximately the same time. This means that there is no strategic benefit for preferring one option above the other.

Table 125: 2033 Link Capacity Assessment[5]

Location	Type	One-way Capacity	Reference Case		Option A		Option C	
			AM	PM	AM	PM	AM	PM
M181 north of Jct 14 – current layout	UM 7.3m	4,000	1,394	1,227				
M181 north of Jct 14 – with development	UAP1 9.0m	1,860			2,456	2,036	2,591	2,010
A1077 south of Jct 2	UAP1 9.0m	1,860	1,023	1,057	1,941	1,748	1,870	1,645
A18 Doncaster Road east of Jct 3	UAP1 10.0m	2,010	1,313	1,173	1,370	1,527	1, 278	1,453
A18 Kingsway	UAP2 9.3m	1,550	776	700	1,187	1,003	1,095	929
Scotter Road north of Jct 6	UAP3 7.3m	1,300	976	1,063	840	938	840	938
Scotter Road south of Jct 6	UAP3 7.3m	1,300	1,148	1,023	1,386	1,381	1,036	1,143
Scotter Road south of Jct 7	UAP2 7.3m	1,470	590	1,200	1,177	1,383	956	1,227

[5] Based upon Tables 1 and 2 of *TA79/99 Traffic Capacity of Urban Roads* (Highways Agency, May 1999). Forecast flows are highest one-way on each link.

11. CONCLUSIONS & RECOMMENDATIONS

11.1 Conclusions

11.1.1 By 2033 Scunthorpe, as with many other towns across the UK, is forecast to experience increased congestion at key junctions on the highway network. The baseline assessment of 2012 existing conditions demonstrates that with the exception of Berkeley Circle and A18 Station Road/ B1392 Station Road the highway network around Lincolnshire Lakes operates within capacity.

11.1.2 In addition to the 2012 Baseline this study has assessed a 2017 and 2033 Reference Case, i.e. without Lincolnshire Lakes Development. 2017 is the assumed Opening Year for the development, when there will be approximately 1,500 dwellings constructed, while 2033 is the Future Year with full completion of Lincolnshire Lakes. Option A and Option C development distribution were assessed in both Reference Case years.

11.1.3 In the 2017 Reference Case the situation on the highway network is unchanged. By the 2033 Reference Case this will continue to be the case at a large number of locations although those on the Scotter Road corridor, to the south of Berkeley Circle, begin to exceed capacity.

11.1.4 Both Option A and Option C significantly increase junction stress at a number of locations and cause other junctions to exceed capacity where they do not in the reference case. This is to be expected with large scale development consisting of 6,000 dwellings in association with supporting business and leisure.

11.1.5 The traffic distribution and demand associated with the two options creates a greater impact at different locations, Because of this variation in the option with least impact across the local highway network there is no immediate option emerging as preferred.

11.1.6 The summary in Table 126 shows the Option with least impact at each junction, or identifies where this judgement was not applicable as no mitigation is required. Table 126 shows that Option A has the lowest impact at a greater number of junctions than Option C. In addition at those junctions where Option C has the lowest impact it is because of the relief provided by the north-south link road from Village 2 to the new strategic link rather than because of the pattern of development in each option.

Table 126: Junction Impact Summary

ID	Junction	Lowest Impact Option	Comments
1	M181/ A18 Doncaster Road/ A1077	A	Mitigation required later
2	A1077/ Ferry Road West	A	
3	A18 Doncaster Road/ Retail Park	n/a	No mitigation required
4	Ferry Road West/ Scotter Road	n/a	No mitigation required
5	A18/ Scotter Road/ Doncaster Road	A	
6	Scotter Road/ Brumby Common Lane	C	Due to Village 2 link
7	Scotter Road/ B1450 Burringham Road	C	Due to Village 2 link
8	Scotter Road/ Moorwell Road	C	Due to Village 2 link
9	A1077 Phoenix Parkway/ Normanby Road	A	Slightly smaller impact although mitigation likely to be similar. Mitigation required later
10	A1077 Mannaberg Way/ A1029 Winterton Road	n/a	No mitigation required
11	A18 Station Road/ B1450 Burringham Road	n/a	No mitigation required
12	A18 Station Road/ B1392 Station Road	n/a	Mitigation is required because of background growth, not Lincolnshire Lakes
13	M180 J3	n/a	No mitigation required
14	New M181 Junction	A	May require slightly less onerous mitigation, further assessment required

11.1.7 Based upon the assessments in this report and analysis of Table 126 the preferred pattern of build out would respond to Option A but include the link road from Village 2. It should be noted that Option A does not necessarily reduce the need for mitigation at key junctions when compared with Option C but it does delay when mitigation becomes necessary. Such delay could assist by making the mitigation more financially viable as more units will be built from which developers could then support planning obligations or for NLC to fund transport schemes through any combined financial contributions that may be collected.

11.1.8 While the operational effectiveness of the local highway network is very important this assessment has raised the issue of sustainability in relation to Lincolnshire Lakes. In particular whether some degree of junction stress above effective capacity is desirable to promote sustainable transport and reduce reliance on the private motor vehicle for some trips. This approach could also reduce the financial burden of providing extensive infrastructure to cater for background growth. NLC highways department has indicated that this approach is not desirable because of the need to ensure that the highway network operates efficiently. It should be noted that this may risk the sustainable objectives of Lincolnshire Lakes because it limits the tools available to the Council for tackling use of private vehicles. If this approach was

adopted sustainable modes such as buses would need to be provided for to ensure that they were not hampered by such a strategy. A strategy of managed stress could not leave junctions significantly over capacity but may be appropriate where junctions only slightly exceed effective capacity.

11.1.9 To further support sustainable travel signalised junctions may be preferred over priority junctions. This could particularly be the case on the Scotter Road corridor where this road will cause severance between Lincolnshire Lakes and the existing town. Signalised junctions would allow for NMU crossings (i.e. for pedestrians and cyclists) to be integrated on desire lines from the Lakes to Scunthorpe. A further benefit of signalisation would be to group the junctions under an Urban Traffic Control (UTC) system to maximise the efficiency of the local highway network as a whole rather than on an individual junction basis. It should be noted that signalised junctions will cause greater delays to through traffic compared with priority junctions.

11.2 Recommendations

11.2.1 This report has assessed in detail the local highway network around Lincolnshire Lakes. The resulting recommendations can be implemented over the coming years with some requiring more urgent attention than others. In particular consideration of large junction design at Junction 1 and Junction 14 should be reviewed in outline in the near future to confirm viability. Also a policy of acceptable network stress could be addressed in the near future and offers benefits for general network management in the form of reduced or delayed costs. Consideration of recommendations at remaining junctions can be considered in detail at a later date, as the detailed planning for Lincolnshire Lakes takes place.

11.2.2 Recommendations arising from this report are:

1. Of the two Options considered in this study, adopt a development pattern reflective of Option A;
2. Assess the suitability of signalised over priority junctions on an individual basis and as a linked UTC system, particularly on the Scotter Road corridor;
3. Review the need for additional capacity at Junction 1 M181/ A18 Doncaster Road/ A1077 alongside the treatment of the de-trunked M181 to an urban environment;
4. Consider outline design options for a roundabout at Junction 2 A1077/ Ferry Road West;
5. Review opportunities for increasing capacity at Berkeley Circle, based upon existing proposals, to accommodate traffic from background growth and Lincolnshire Lakes. Note that this will need to consider a method of recouping costs from both existing and future development including Lincolnshire Lakes but also other relevant development;
6. Assess alternative priority and signalised junction options for junctions Scotter Road/ Brumby Common Lane, 7 Scotter Road/ B1450 Burringham Road and 8 Scotter Road/ Moorwell Road;;
7. Add a flare to the western approach of Junction 9 A1077 Phoenix Parkway/ Normanby Road;
8. Assess options for signalisation of Junction 12 A18 Station Road/ B1392 Station Road;
9. Undertake optioneering for roundabout design on the M181 at Junction 14 New M181 Junction, including one refined version of the potential WSP design;
10. Promote the development of the strategic link along Brumby Common Lane in tandem with the link from Village 2 via Burringham Road; and

11. Review link capacity and desirable link standards for the de-trunked M181 and for the A1077 between the A18 and Ferry Road West.

APPENDIX A BASELINE TRAFFIC

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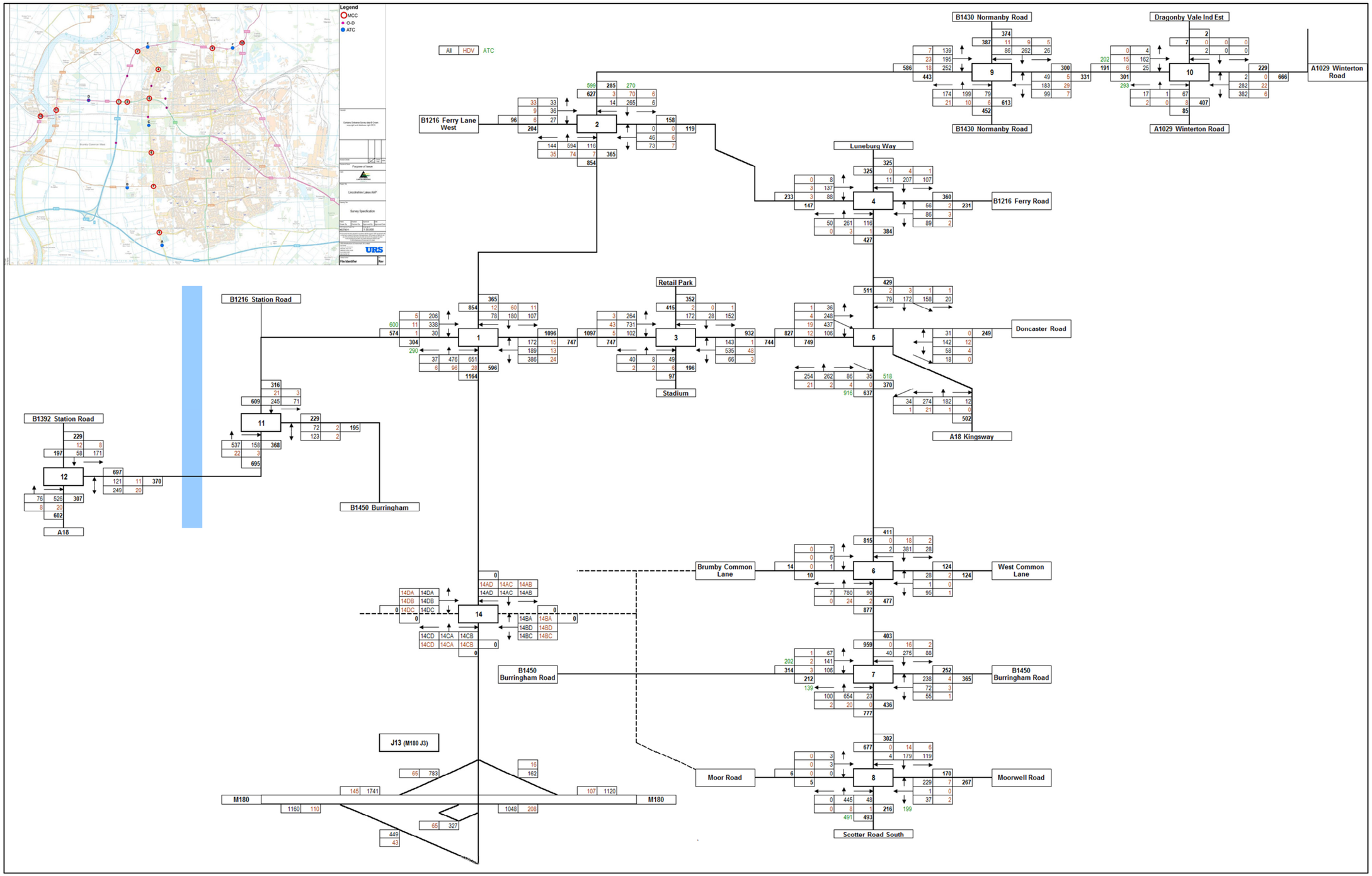
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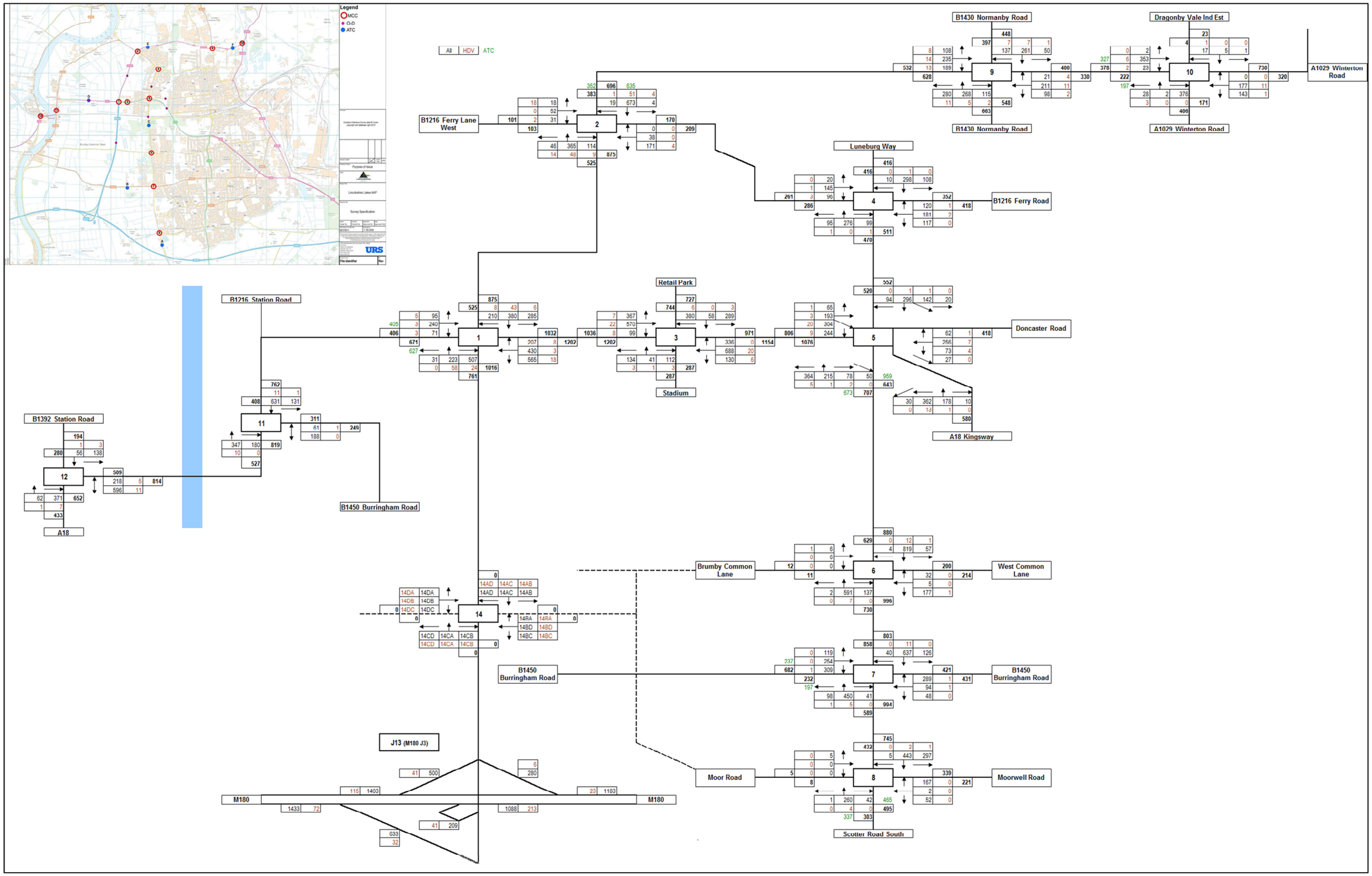
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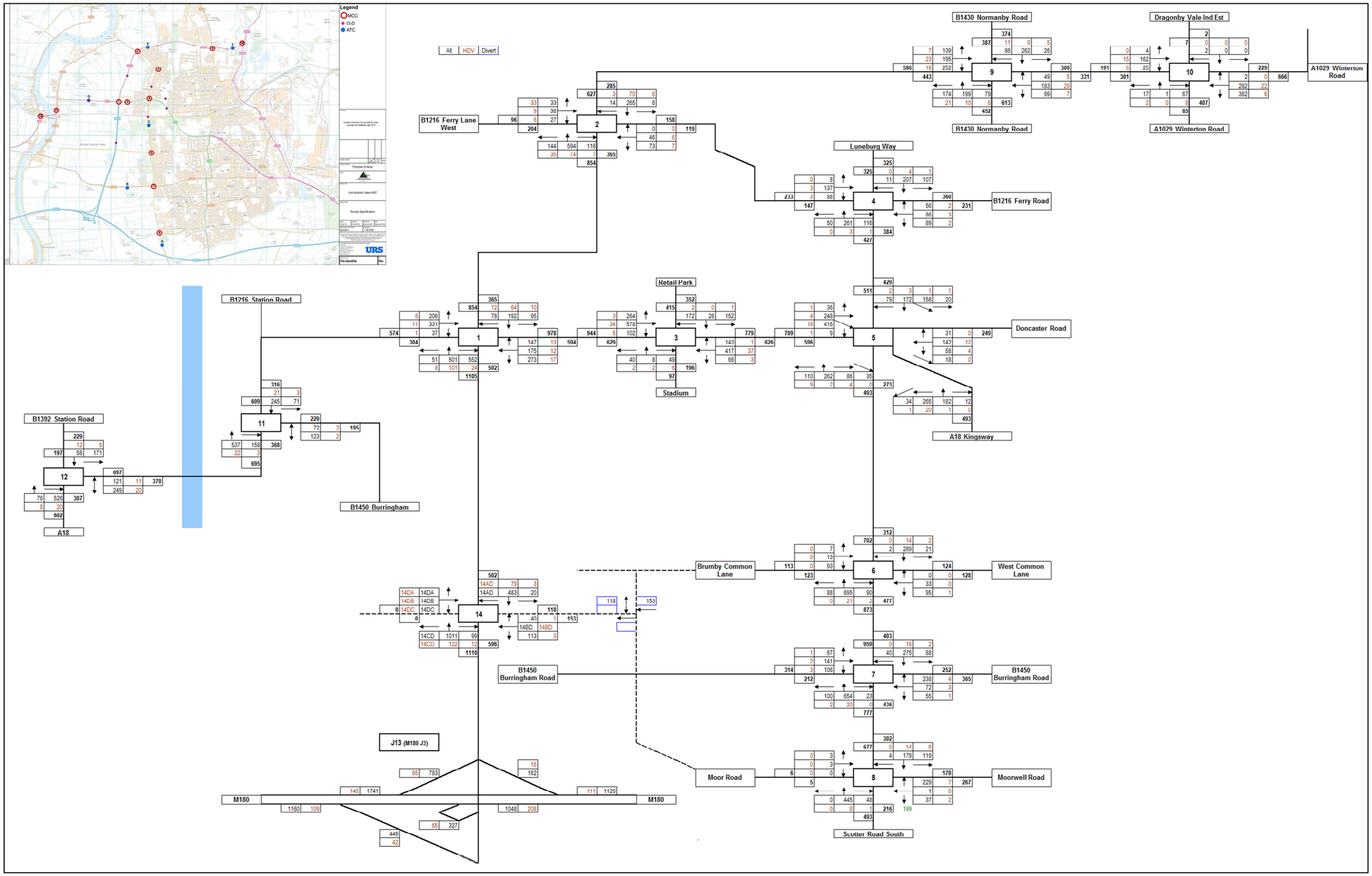
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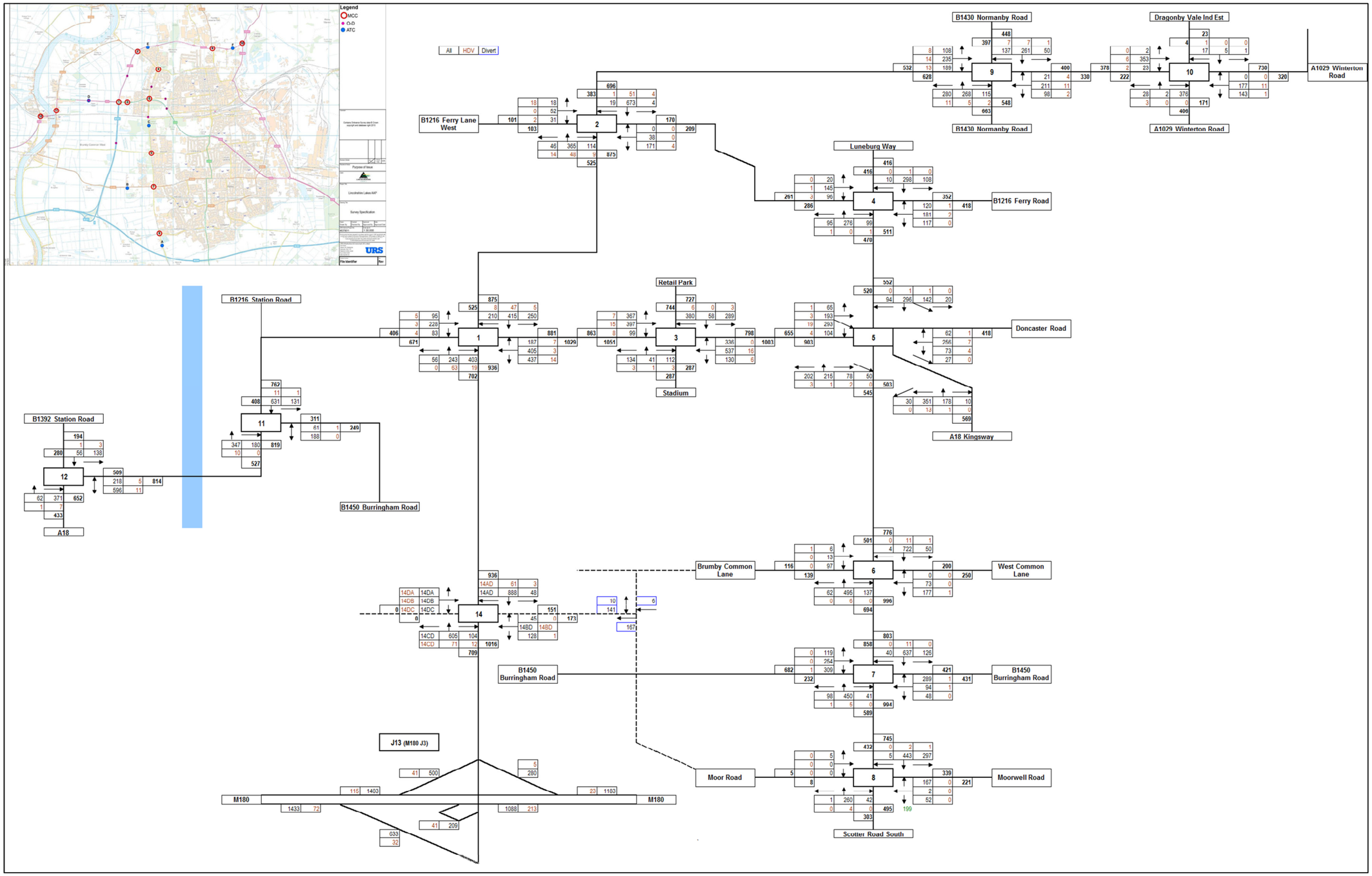
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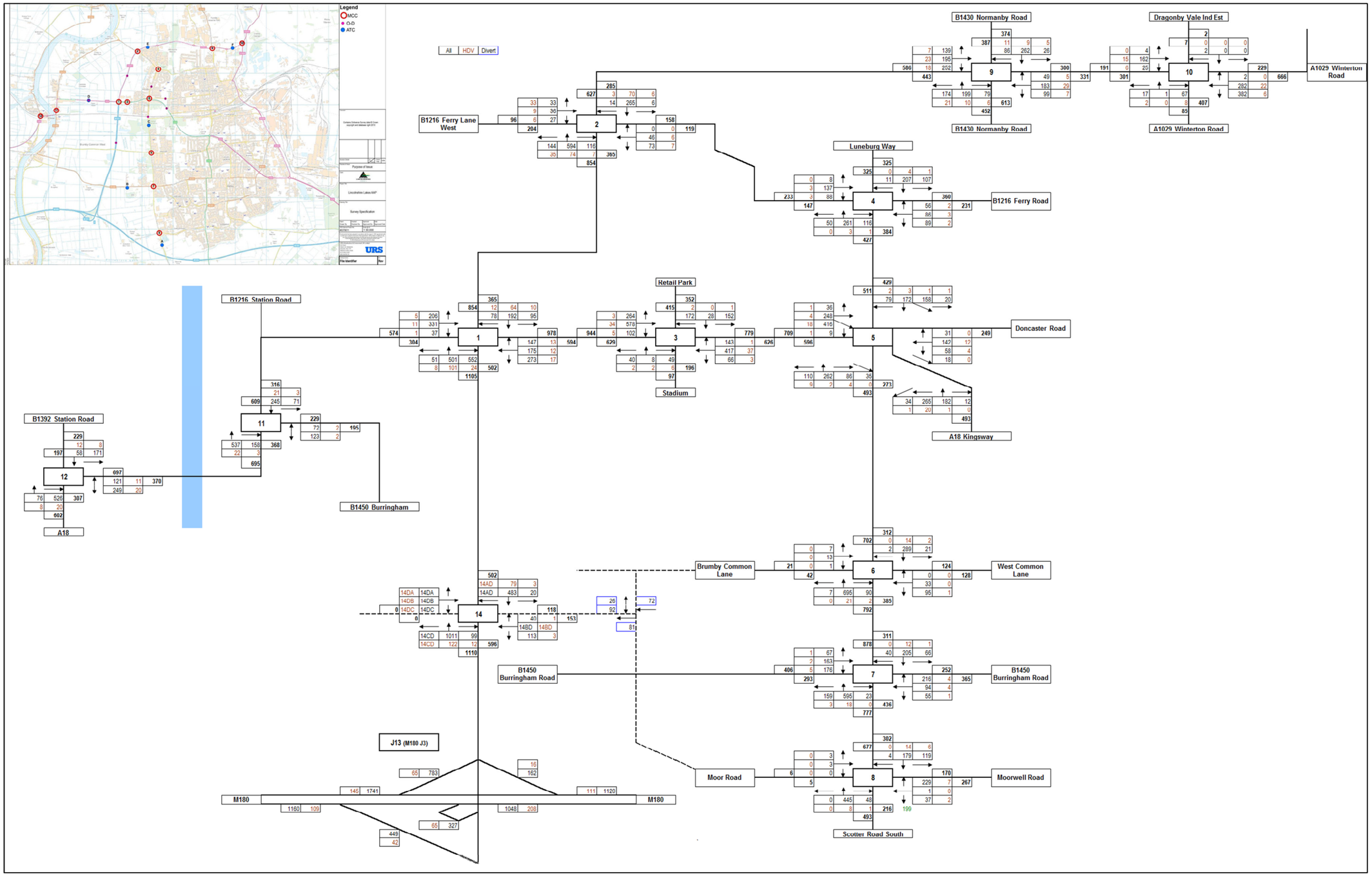
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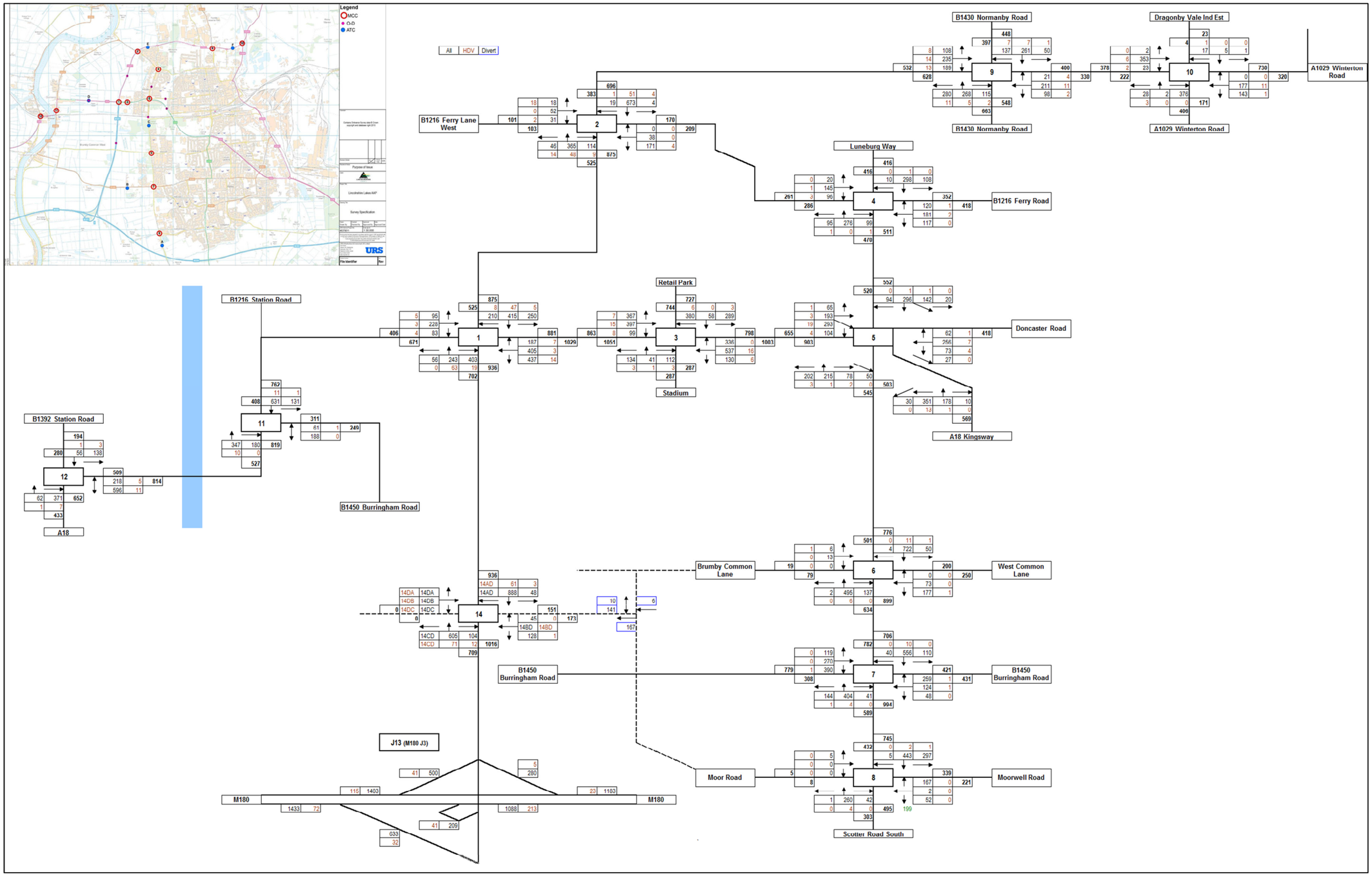
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APPENDIX B REFERENCE CASE TRAFFIC FLOWS

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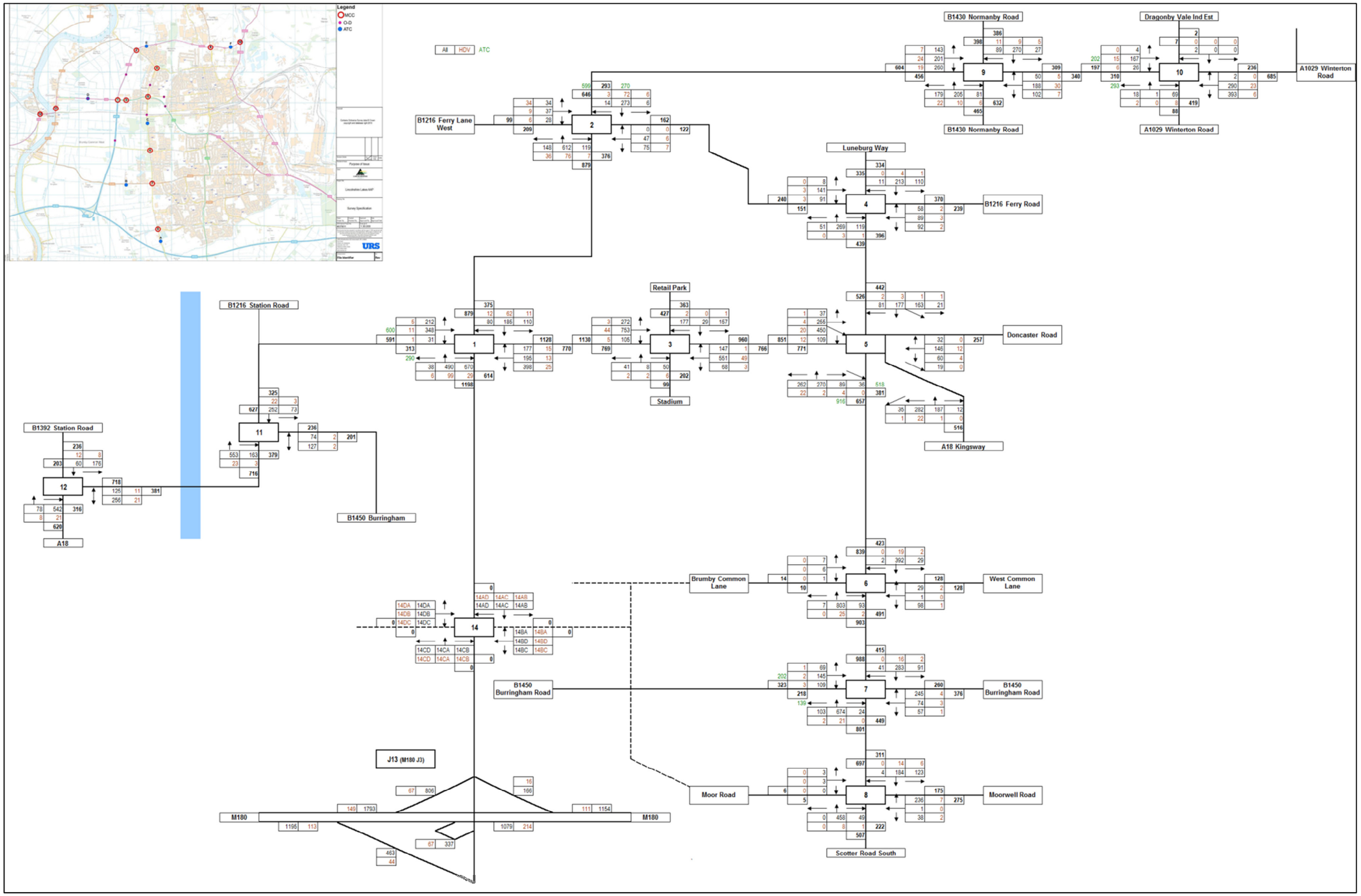
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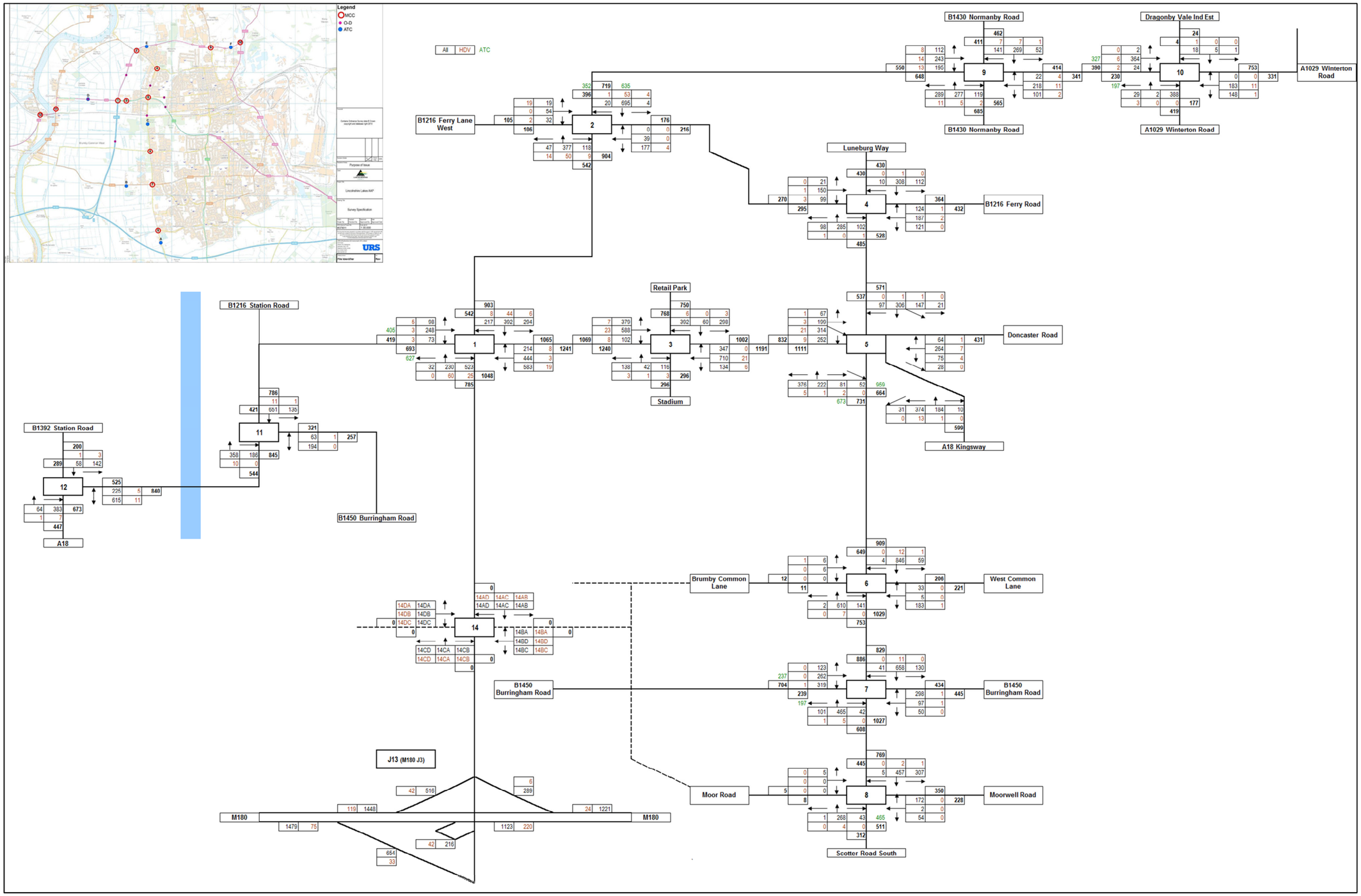
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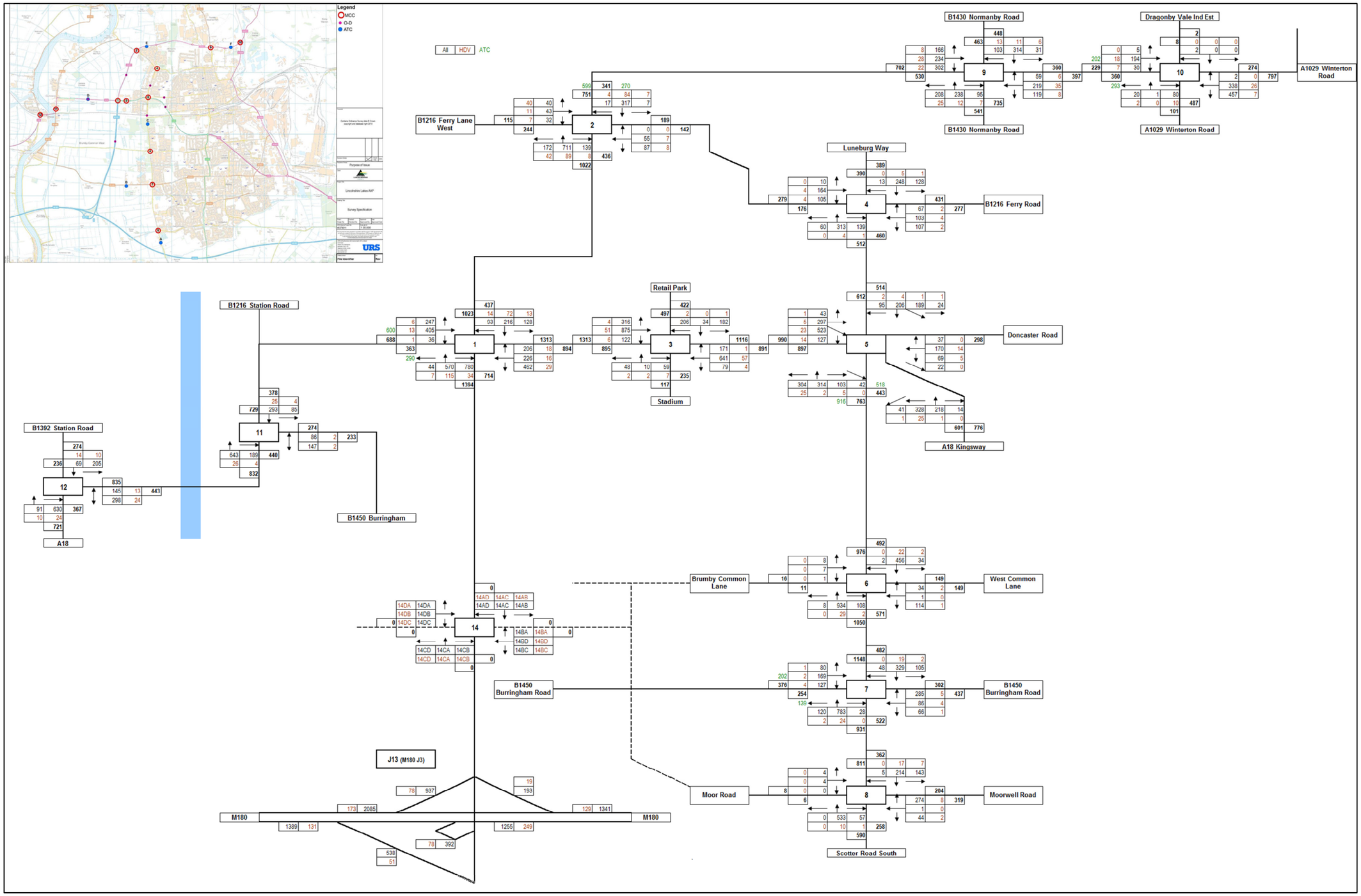
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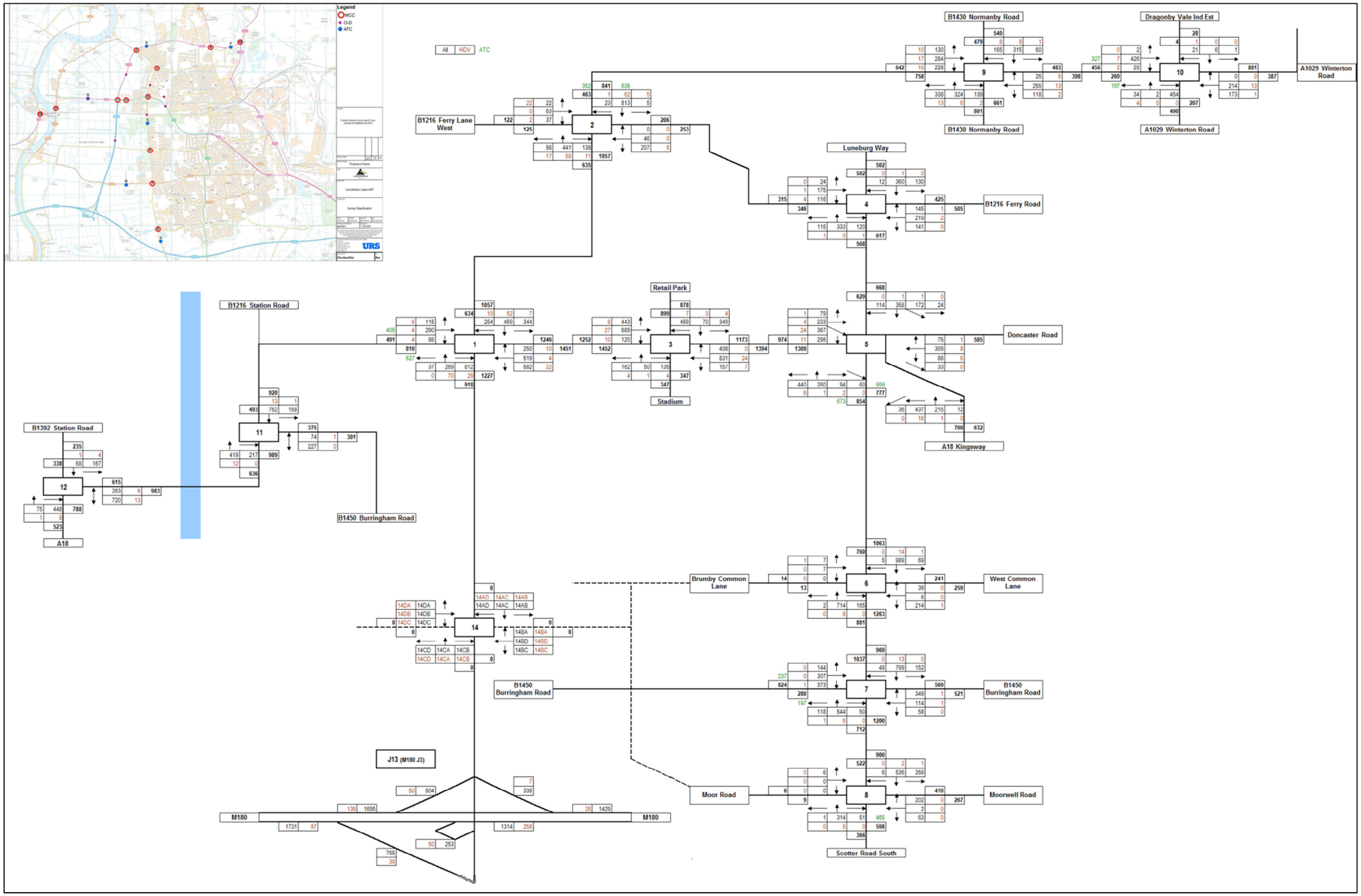
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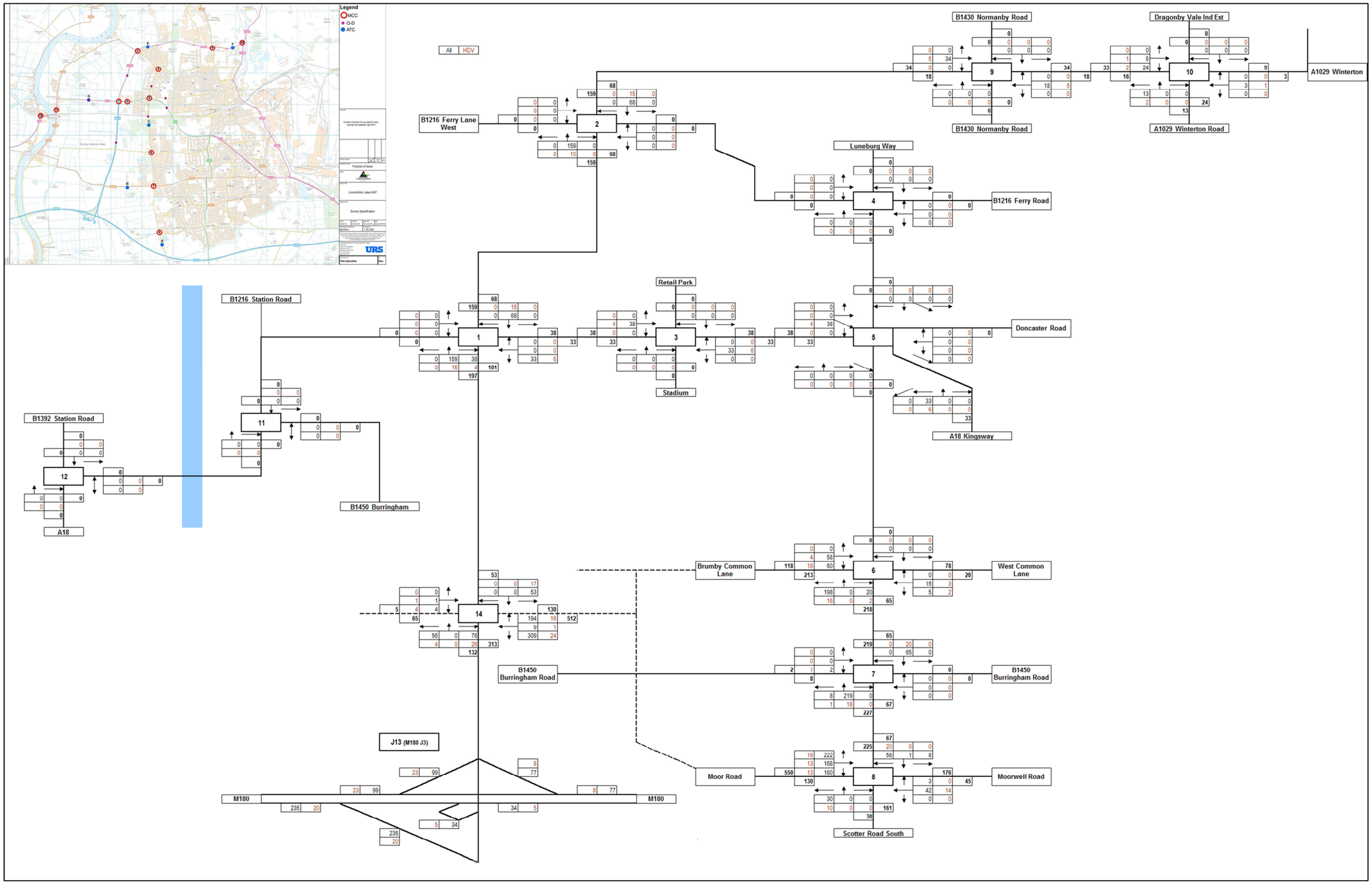
APPENDIX C DEVELOPMENT ONLY TRAFFIC FLOW DIAGRAMS

Option A 2017 AM peak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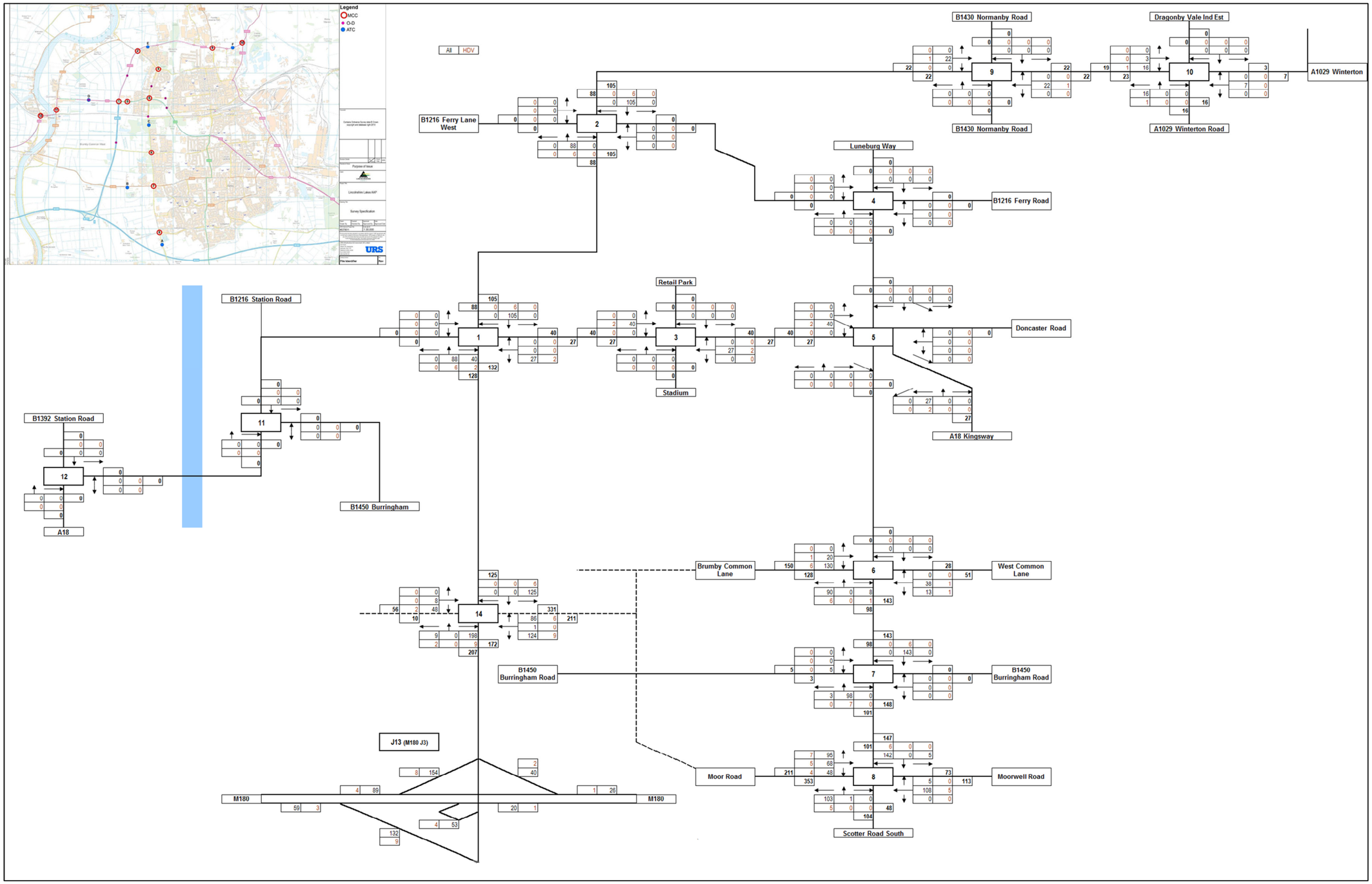
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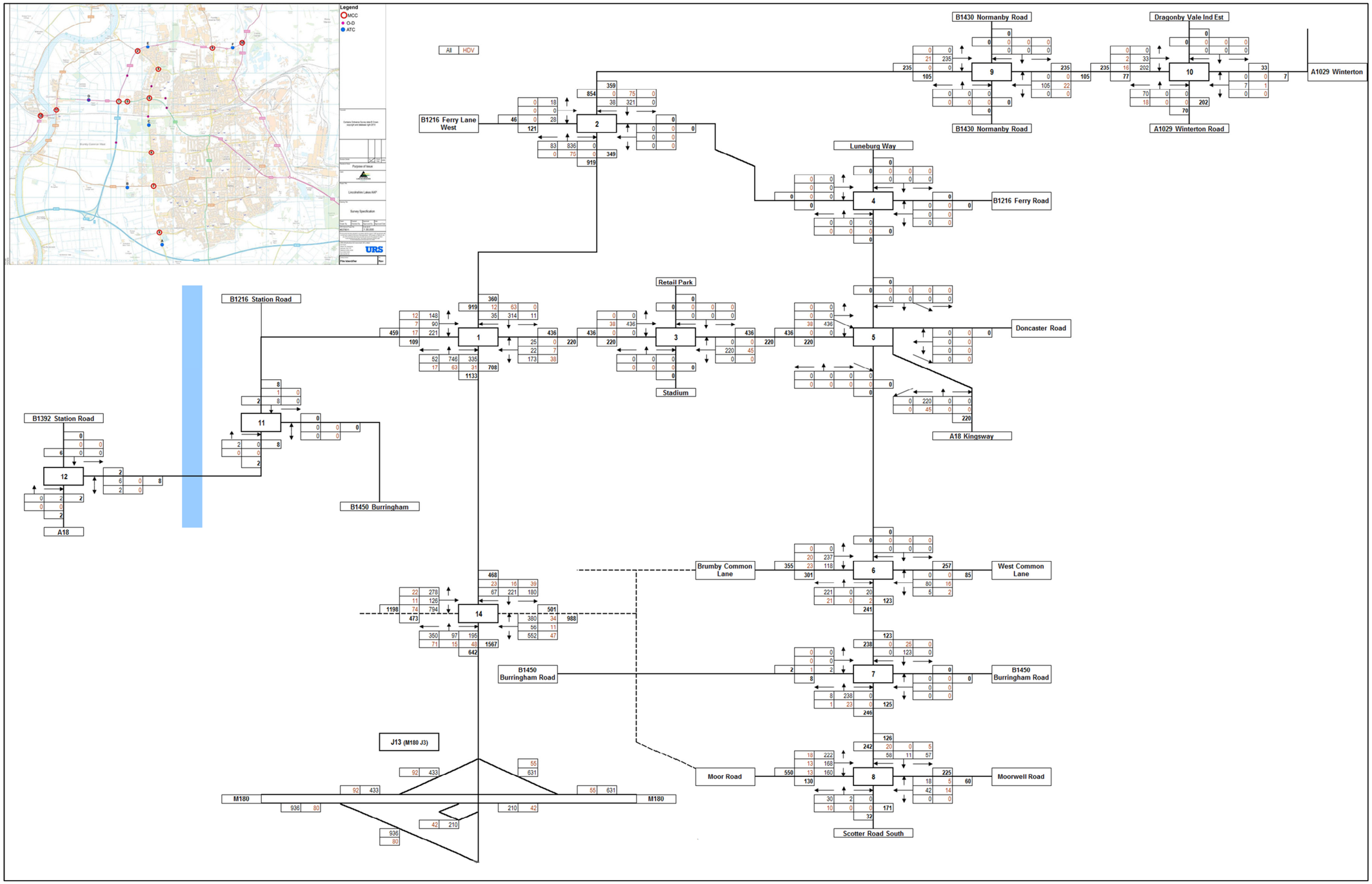
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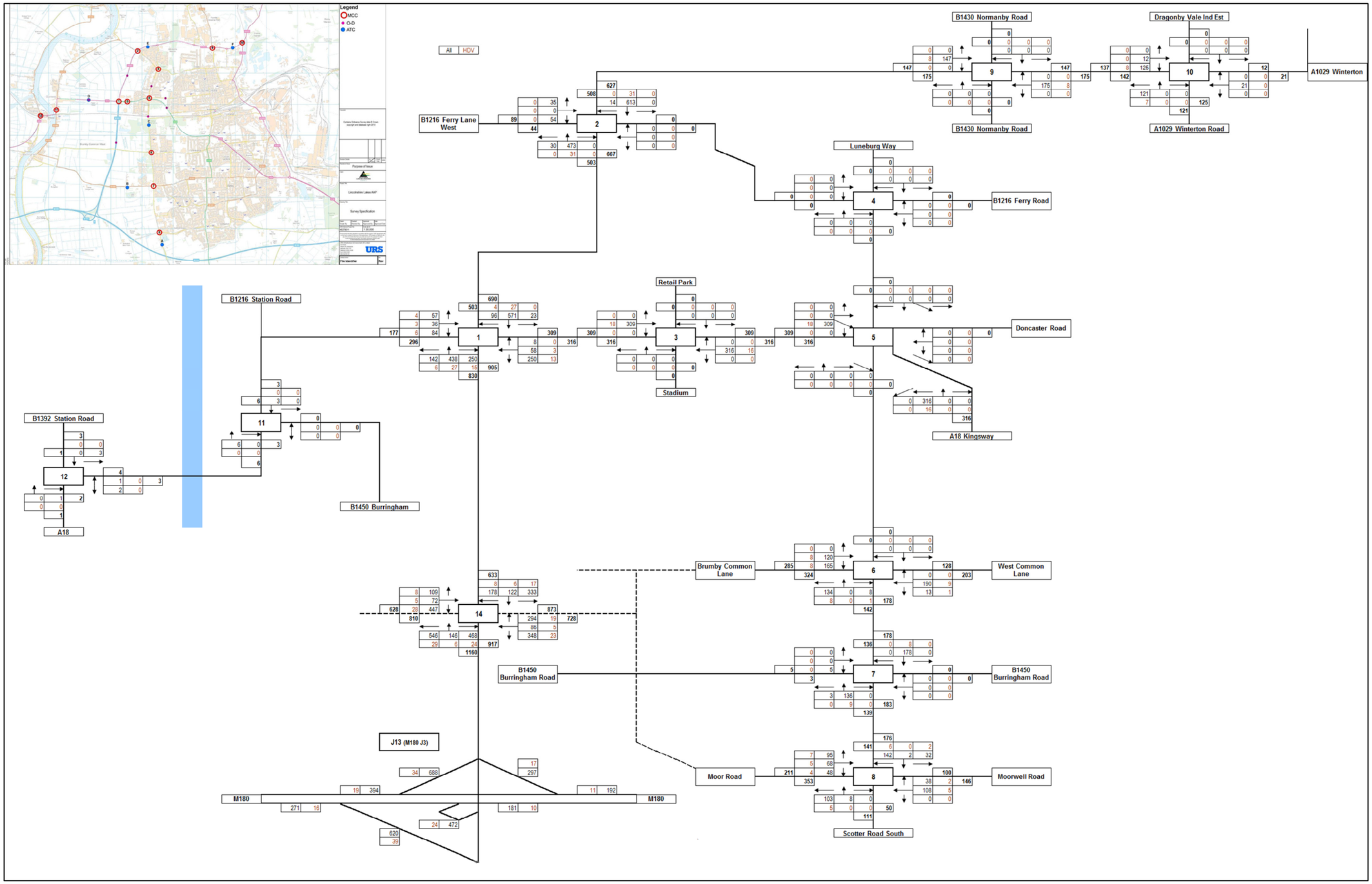
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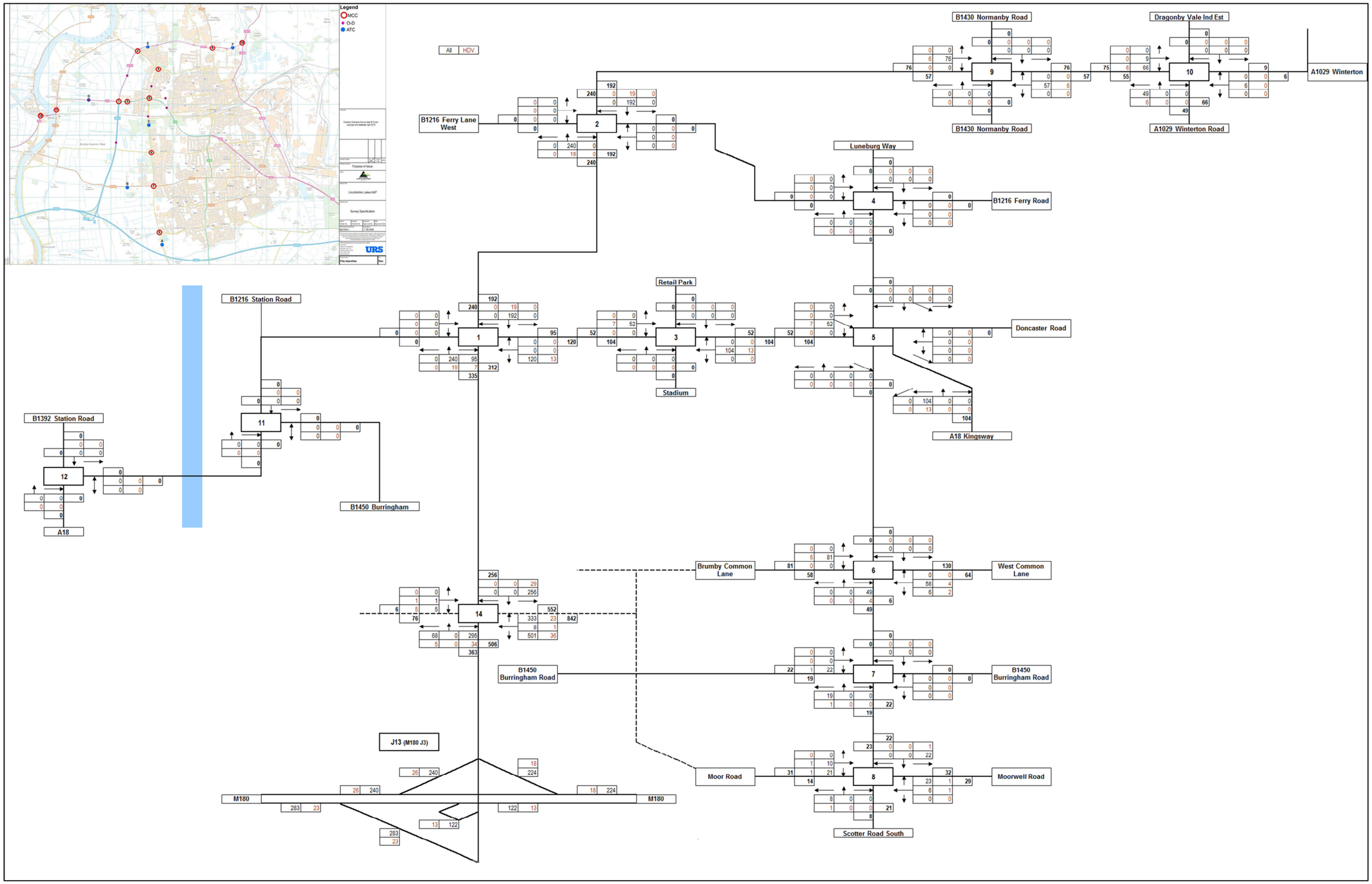
Option C 2017 AM peak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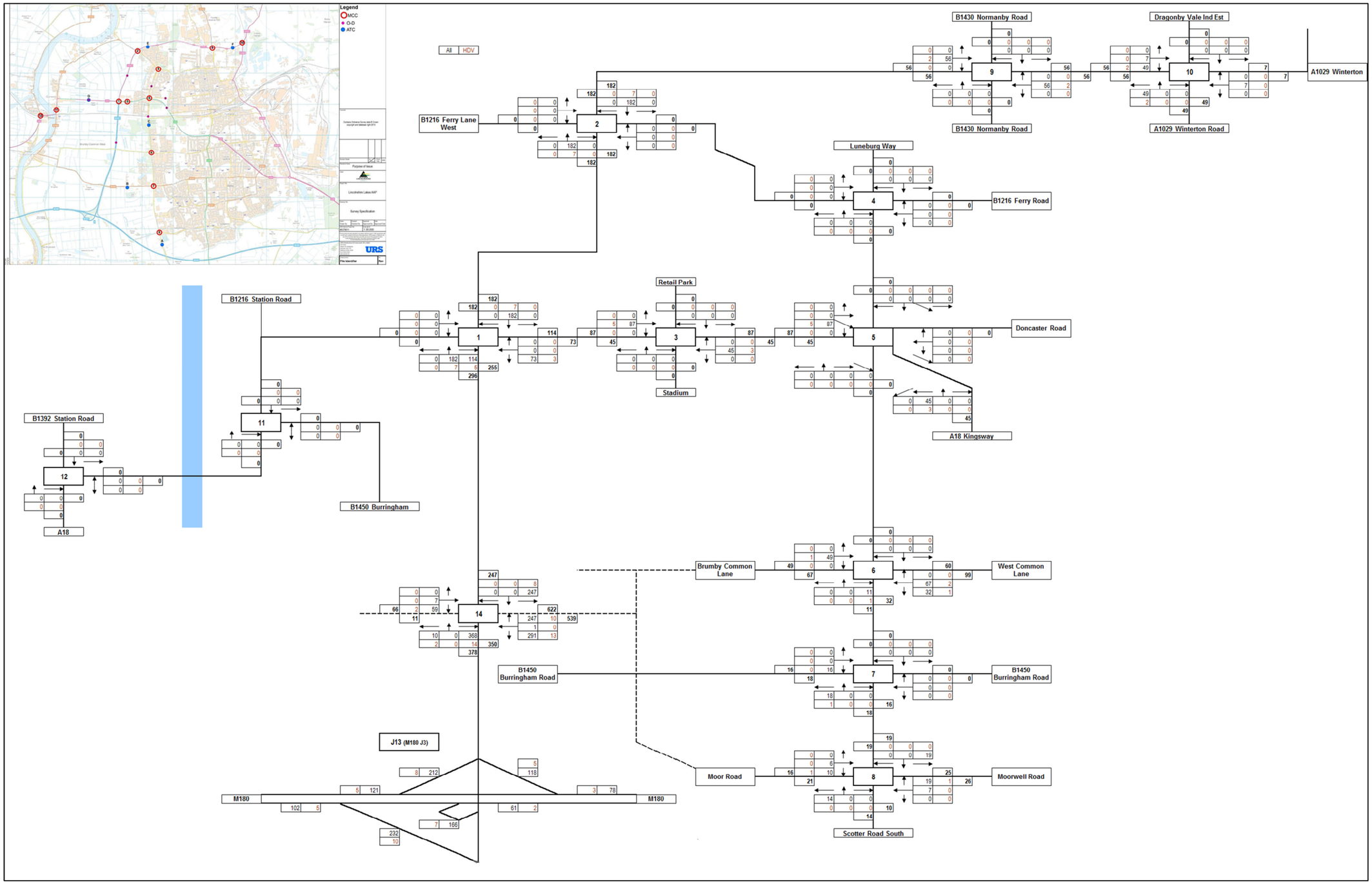
Option C 2017 PM Peak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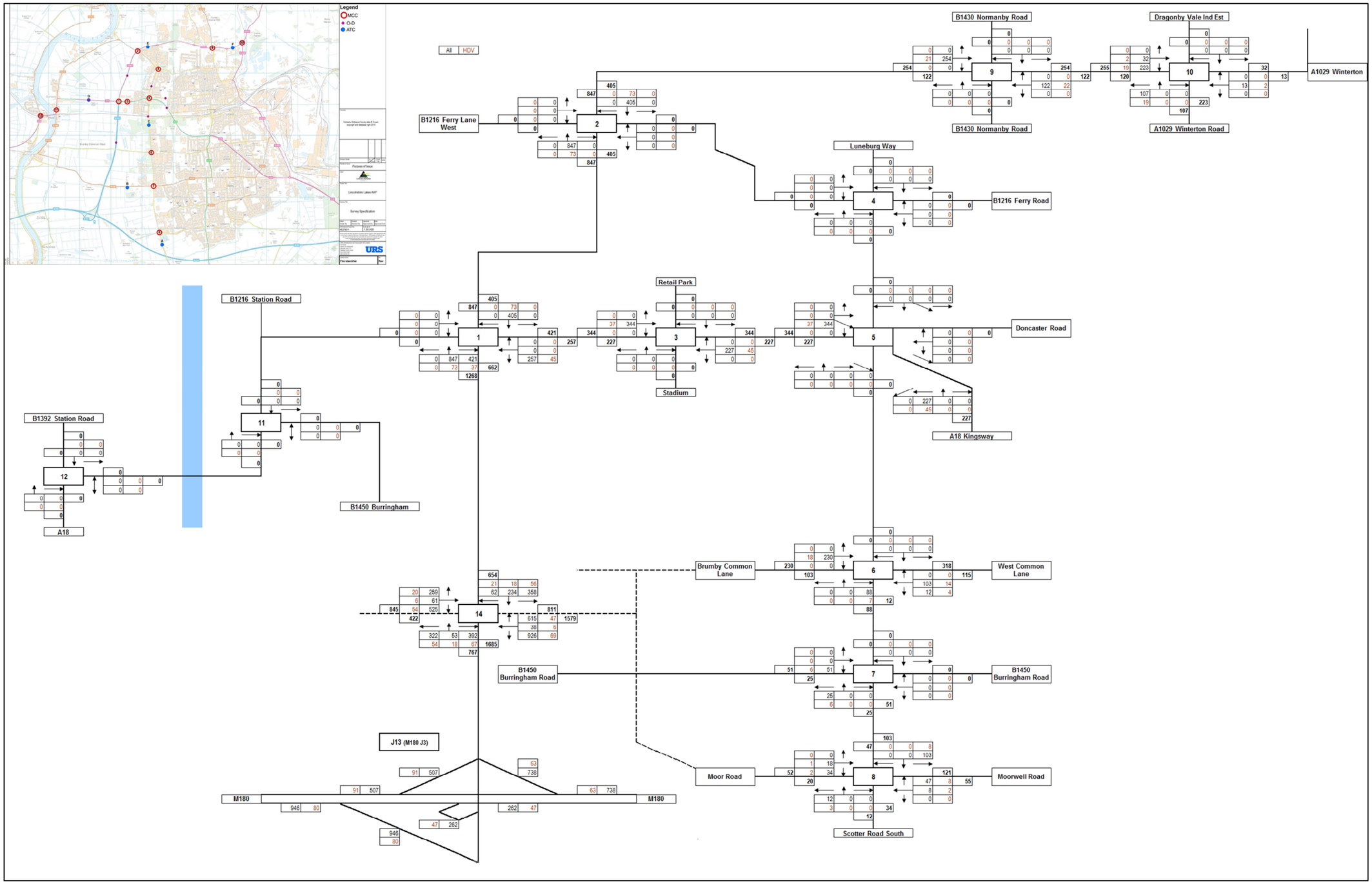
Option C 2033 AM Peak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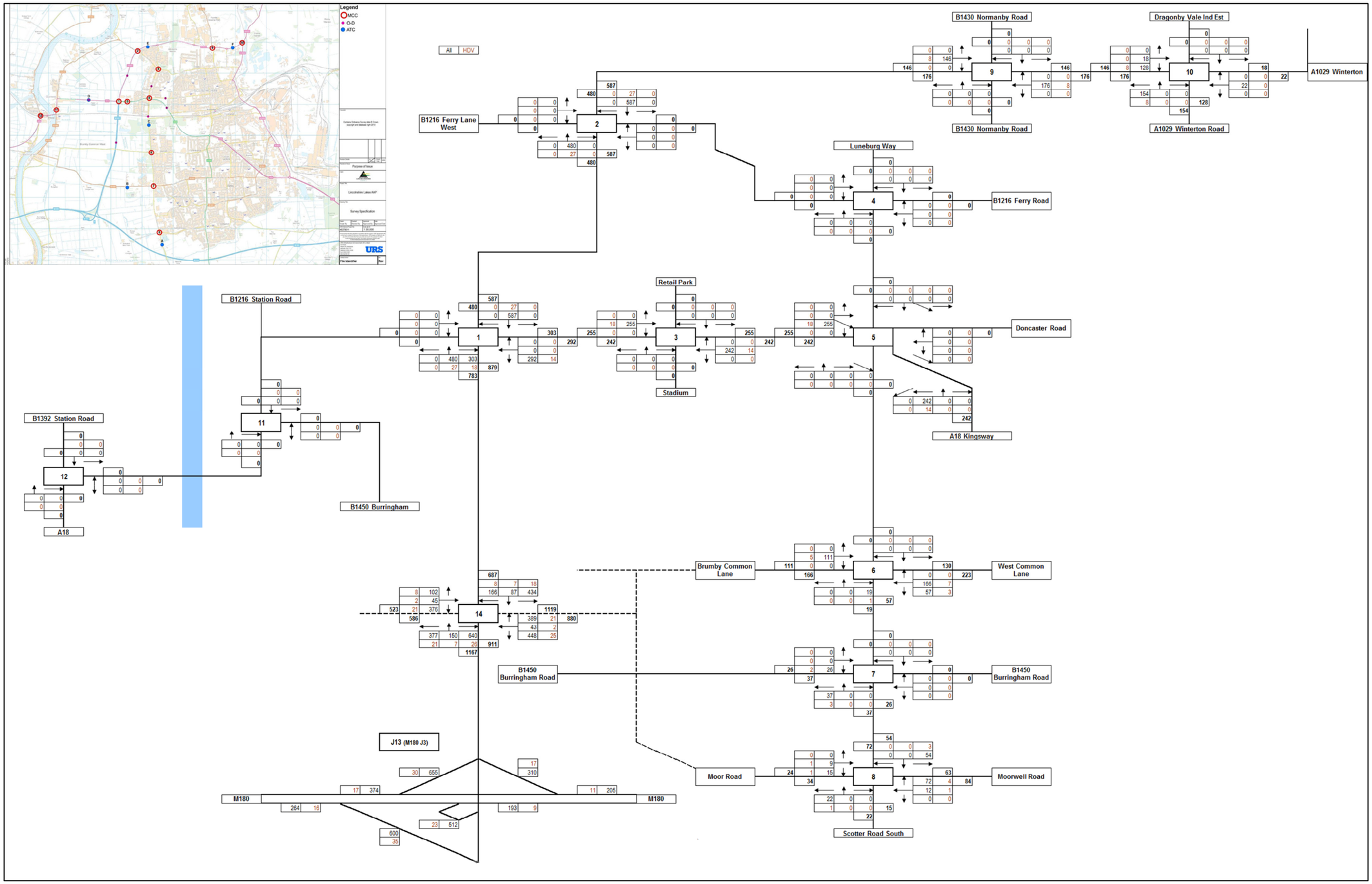
Option C 2033 PM Peak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APPENDIX D DEVELOPMENT + BACKGROUND GROWTH TRAFFIC FLOW DIAGRAMS

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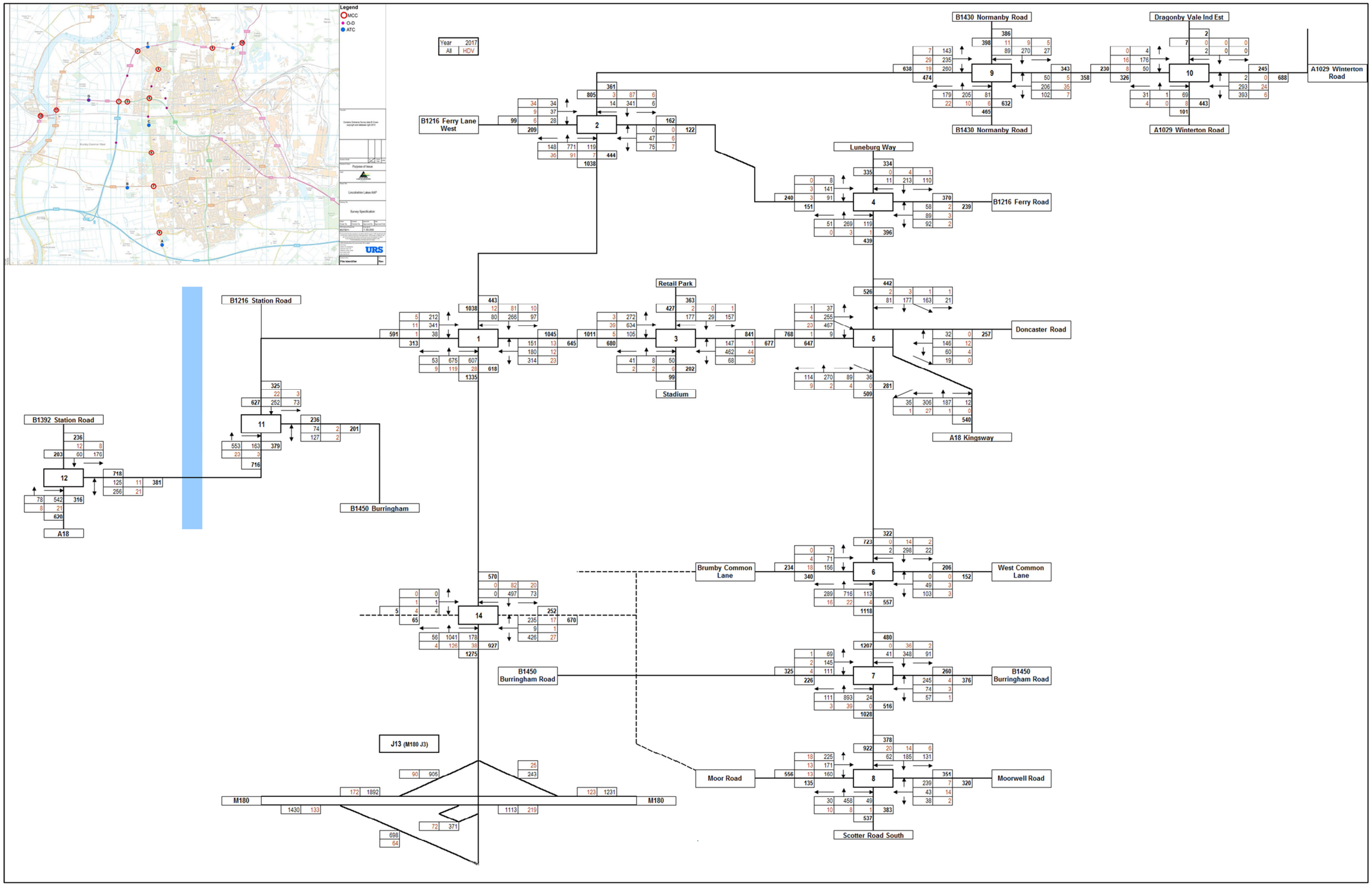
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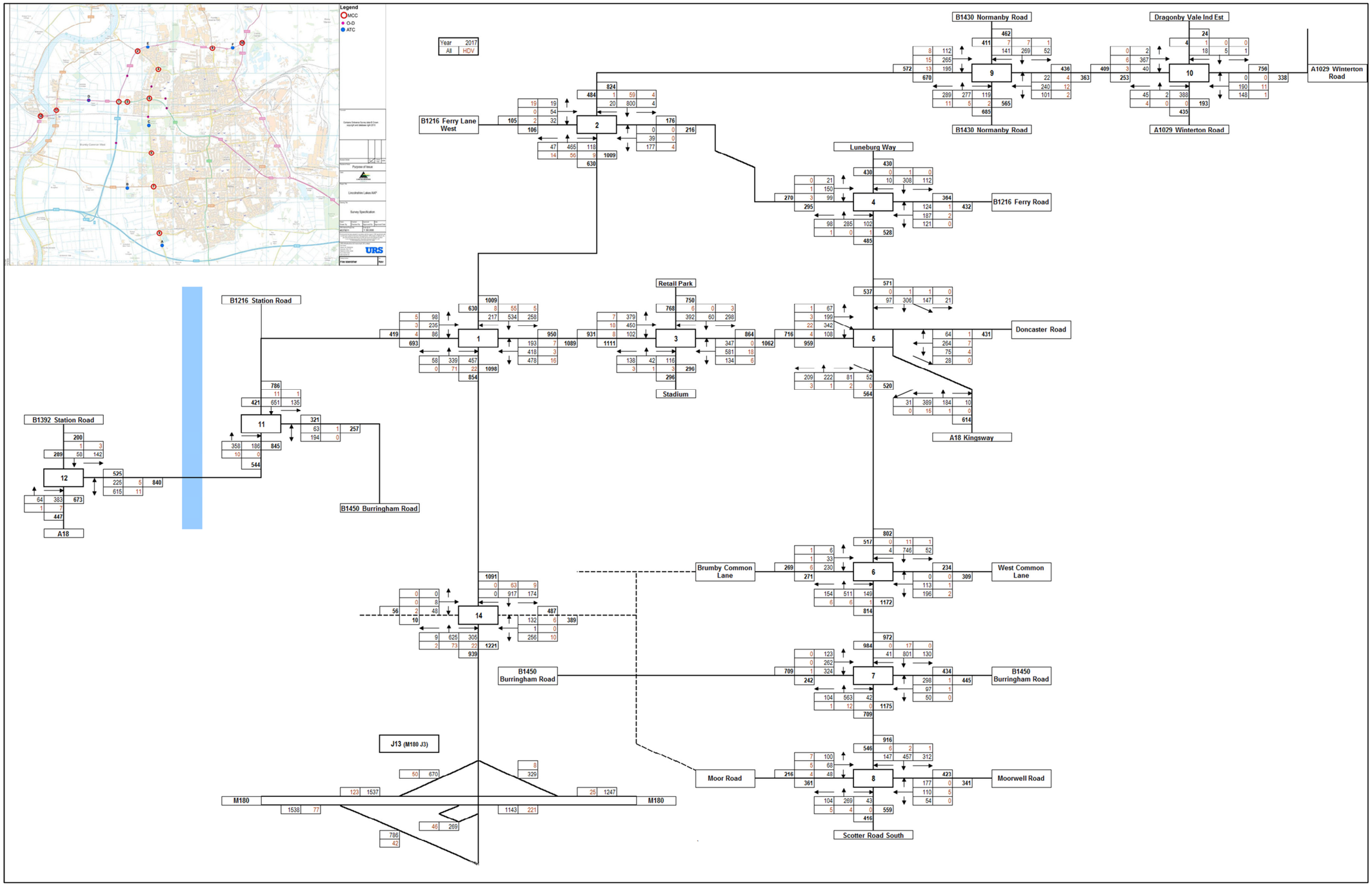
Option A 2017 PM Peak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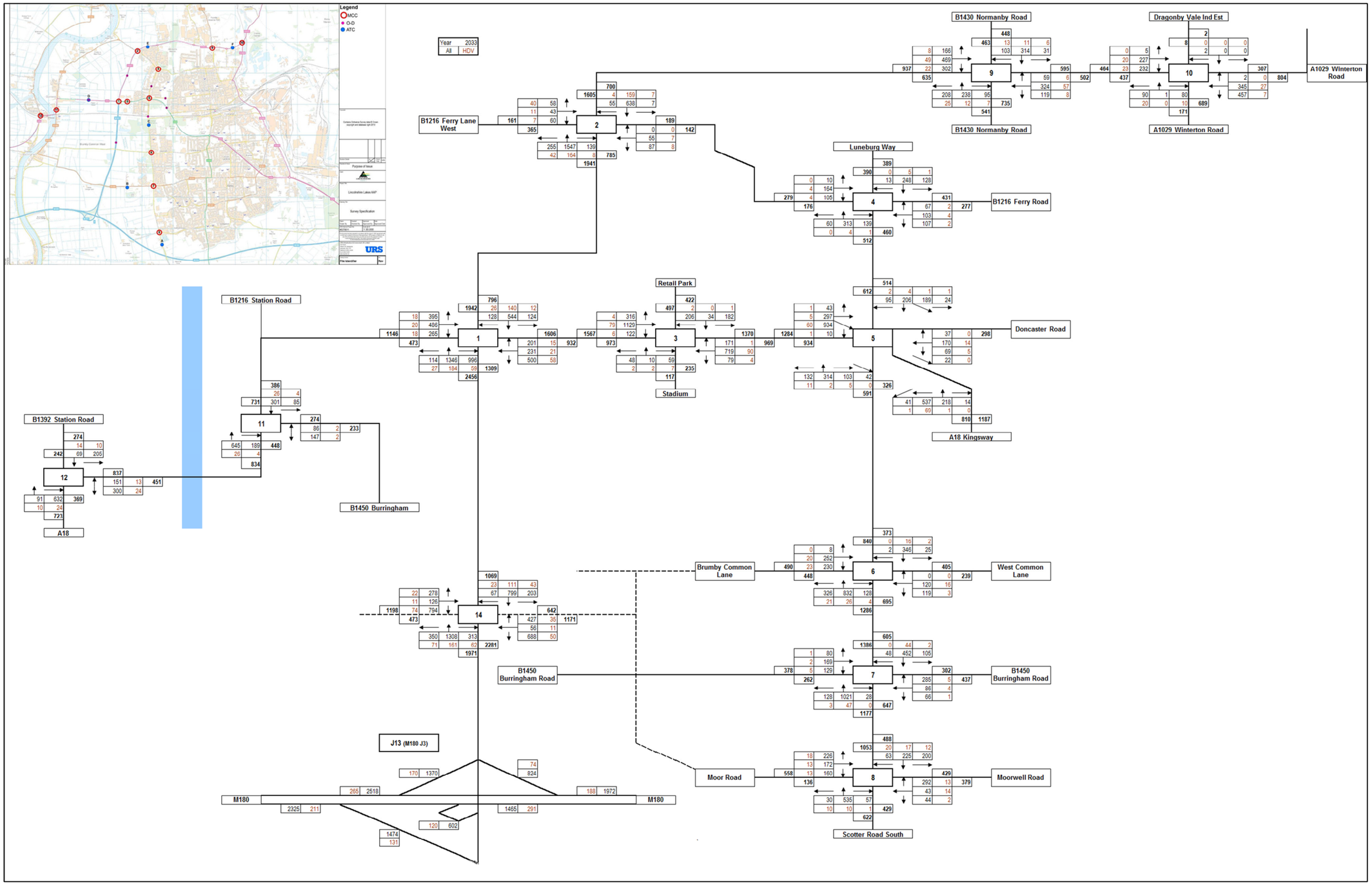
Year 2017
All HDV
B1430 Normanby Road
Dragonby Vale Ind Est
A1029 Winterton Road
B1216 Ferry Lane West
Luneburg Way
B1216 Ferry Road
B1216 Station Road
Retail Park
Doncaster Road
B1392 Station Road
A18 Kingsway
B1450 Burringham Road
Stadium
Brumby Common Lane
West Common Lane
J13 (M180 J3)
M180
Moor Road
Moorwell Road
Scotter Road South
A18

Option A 2033 AM Peak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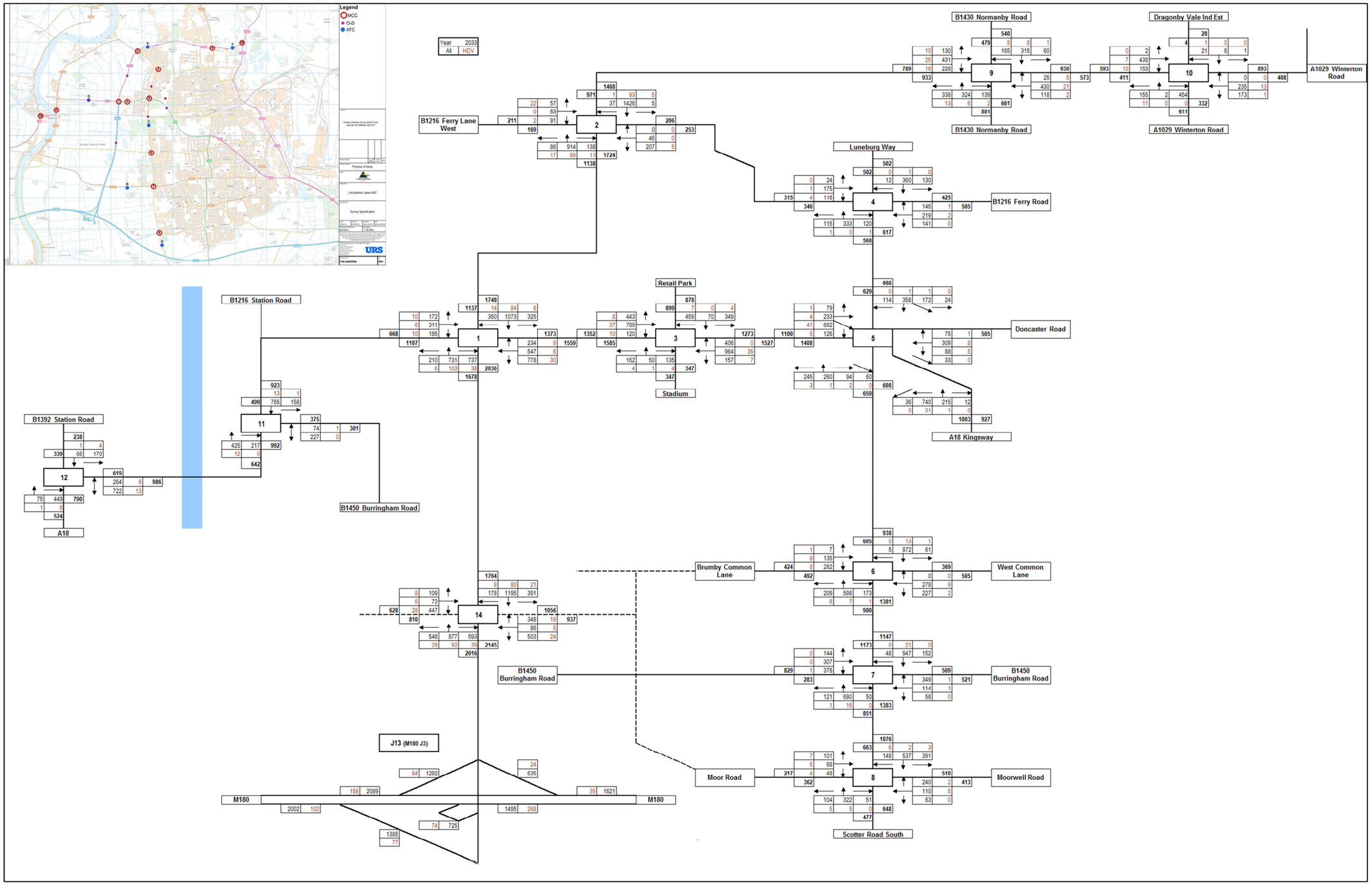
M180
Moor Road
Moorwell Road
Scotter Road South

Option A 2033 PM Peak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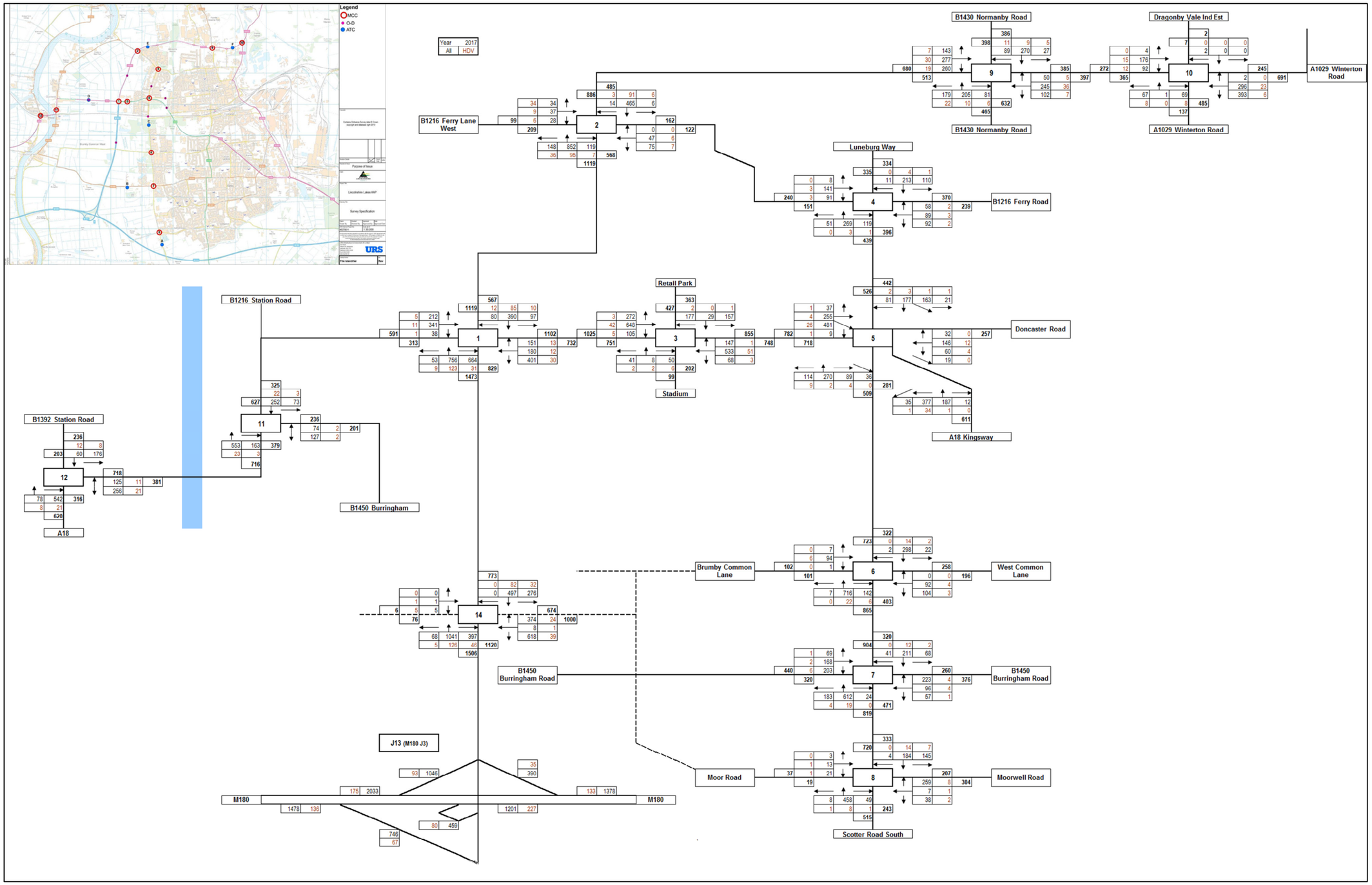
A18

Option C 2017 AM peak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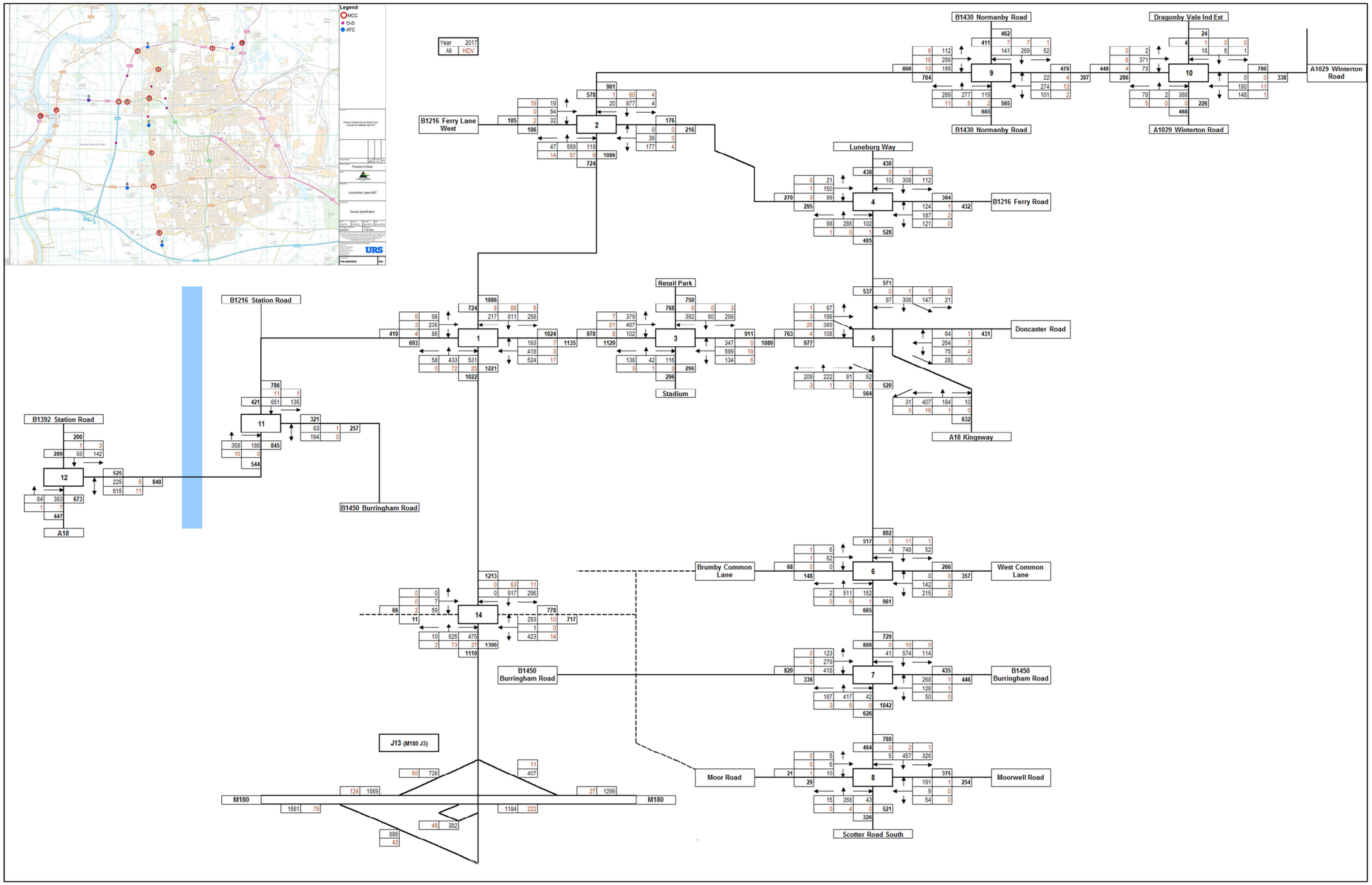
Option C 2017 PM Peak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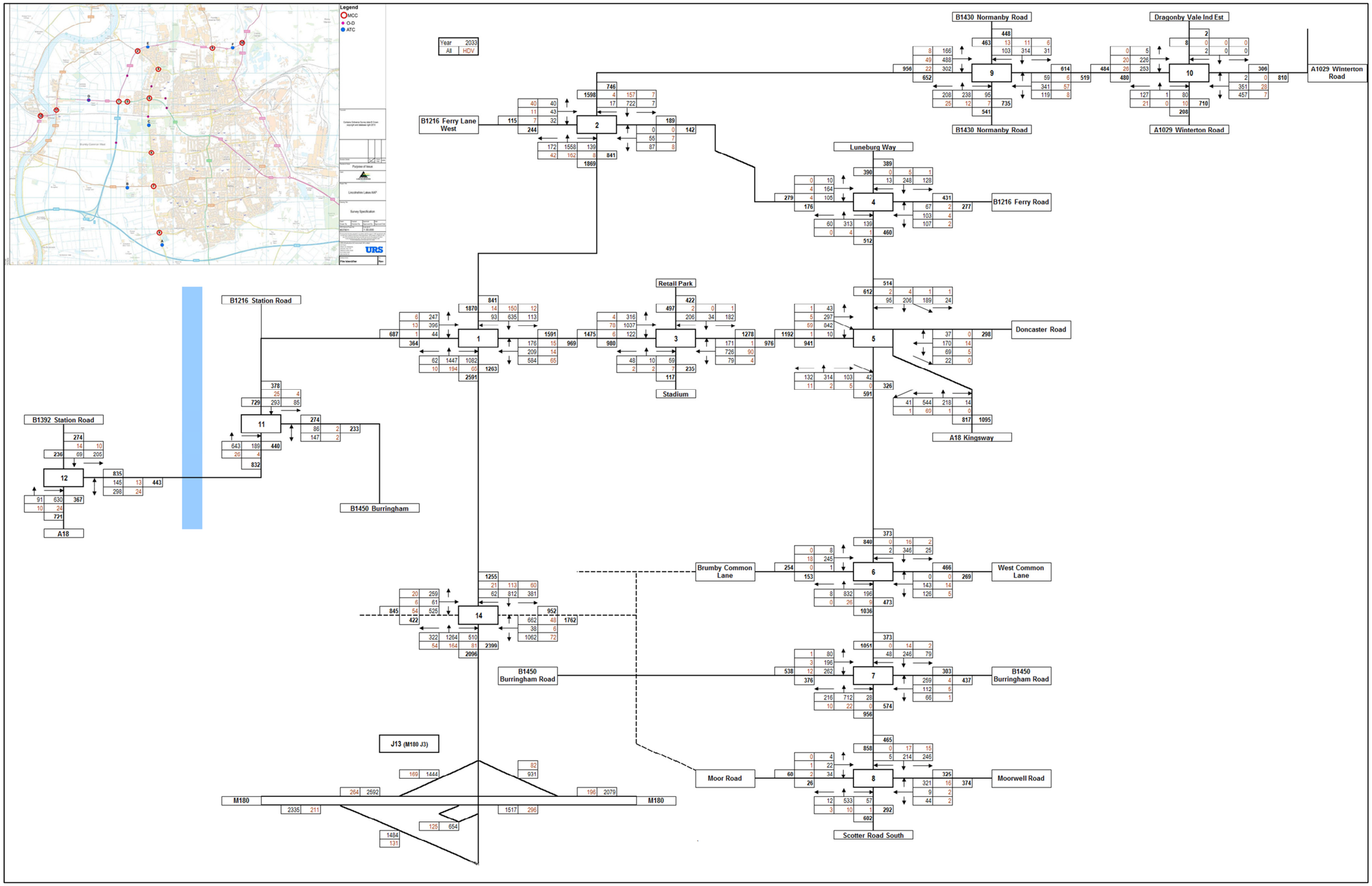
Moor Road
Moorwell Road
Scotter Road South
Stadium

Option C 2033 AM Peak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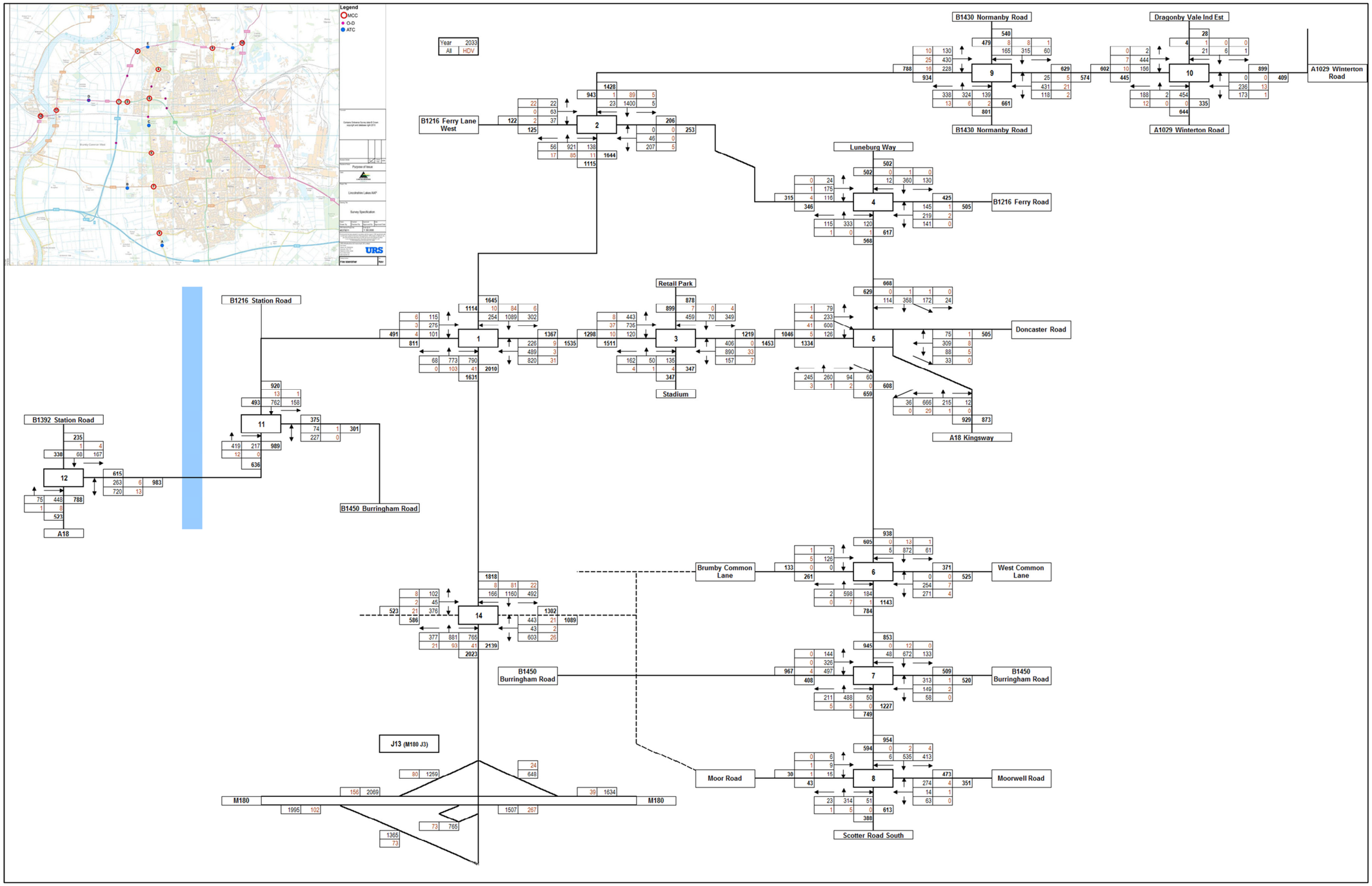
Option C 2033 PM Peak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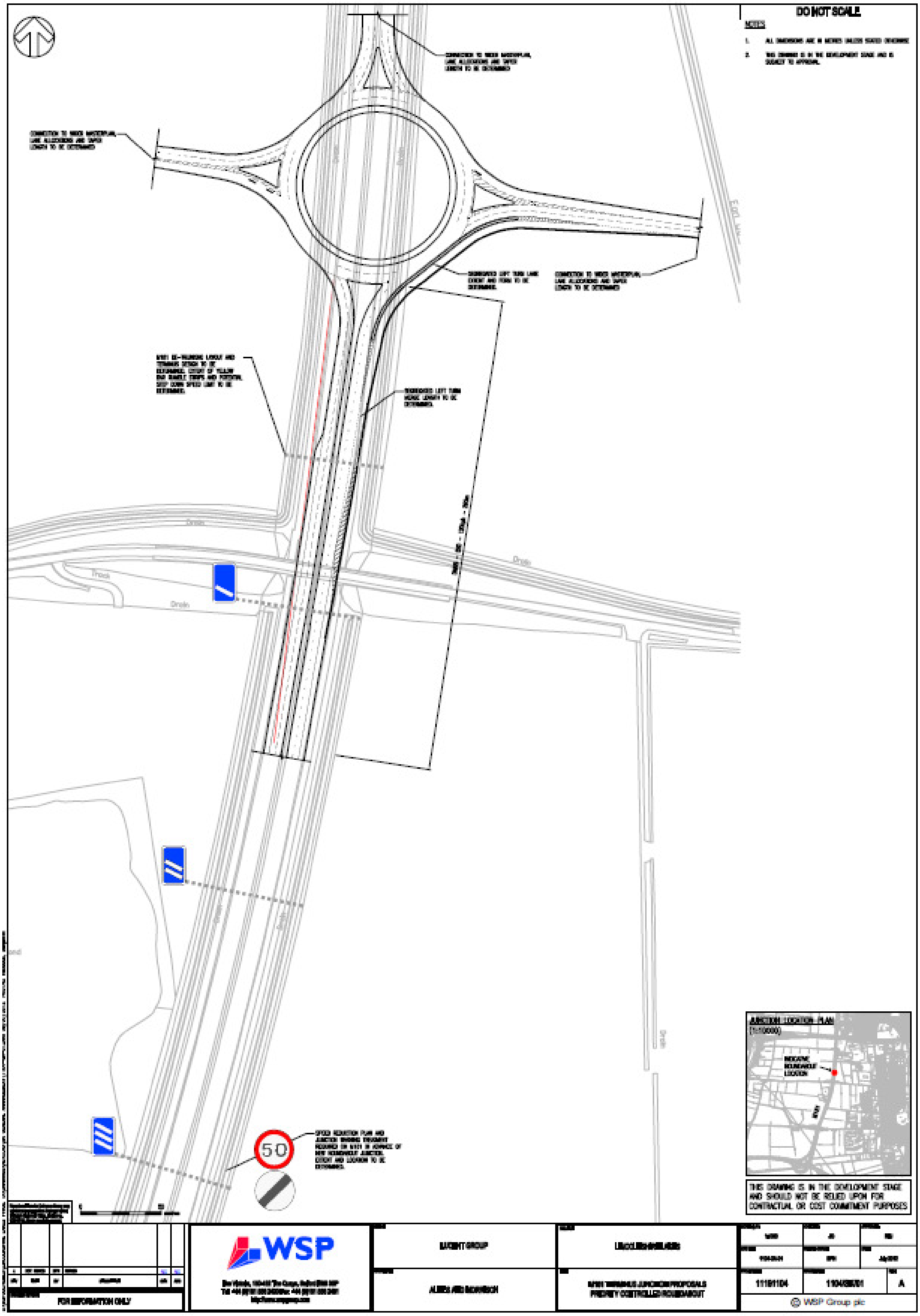
APPENDIX E JUNCTION 14 WSP PROPOSAL


DO NOT SCALE
NOTES
Drain
Track
JUNCTION LOCATION PLAN
THIS DRAWING IS IN THE DEVELOPMENT STAGE AND SHOULD NOT BE RELIED UPON FOR CONTRACTUAL OR COST COMMITMENT PURPOSES
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