Department for Regional Development - TransportNI

YORK STREET INTERCHANGE

Public Inquiry

November 2015

Proof of Evidence Summary:

Traffic and Economic Assessment

by

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1. INTRODUCTION

My name is Russell Bissland. I am a Chartered Civil Engineer with a Bachelor of Science degree in Civil Engineering. I have been a member of the Institution of Civil Engineers since 1988 and a member of the Institution of Highways and Transportation since 1991.

I have more than 38 years' experience in civil engineering projects.

I am presently employed by Aecom (formerly URS) as a Technical Director based in the Glasgow office.

I am responsible for the traffic and economic assessment of major road improvement schemes throughout Scotland, Northern Ireland and the north of England. In Northern Ireland I have been responsible for the appraisal of road improvement schemes in Armagh, Enniskillen and Omagh. I have also been responsible for the traffic and economic assessment of major road improvement schemes including the A8 Belfast to Larne Improvement, the M2 Motorway Widening, the A1 Beech Hill to Cloghogue Dualling, the A6 Castledawson to Randalstown Dualling, the A6 Londonderry to Claudy Dualling and the A24 Ballynahinch Bypass.

The scope of my evidence concerns the Stage 3 Traffic and Economic Assessment Report for the Proposed Scheme.

The primary objective of the Stage 3 Traffic and Economic Assessment Report is to describe existing traffic conditions in the York Street area, to outline the indicative costs, risks and optimism bias associated with the Proposed Scheme and to describe the work undertaken to develop the various computer models. The report also considers future traffic conditions over the economic life of the Proposed Scheme and presents the results of an operational and economic assessment of the Proposed Scheme. Given the uncertainty in predicting future traffic conditions, the results from a series of sensitivity tests have also been reported.

2. BACKGROUND AND REPORTING

The Proposed Scheme was identified in the Roads Service Consultation Document 'Expanding the Strategic Road Improvement Programme 2015', dated July 2006, as an additional scheme to be added to the programme subject to consultation.

2.1 Scheme Development and Reporting

The Stage 1 Scheme Assessment completed in March 2009 identified that the introduction of grade separation at the existing signalised junction would deliver positive benefit to cost ratios.

The options were subject to separate Stage 2 engineering, environmental, traffic and economic assessments in accordance with the requirements of the Design Manual for Roads and Bridges (DMRB). The findings from these assessments were reported in the Preferred Options Report of October 2012.

Following the announcement of the Preferred Option, the layout of the scheme was further refined ahead of a Stage 3 Assessment in accordance with the requirements of the DMRB.

3. EXISTING CONDITIONS

The existing York Street junction in the centre of Belfast is one of the most heavily trafficked junction arrangements in Northern Ireland.

Existing conditions in the York Street area are subject to significant congestion during periods of peak traffic demand due to the convergence of traffic from the Westlink, the M2 and M3 motorways and the local surface streets. This demand is controlled by a series of signalised junctions.

The general location of the existing York Street junction and the surrounding road network is shown in Figure 3.1. A more detailed location plan is shown in Figure 3.2.

4. TRAFFIC SURVEYS AND DATA COLLECTION

A programme of data collection surveys was undertaken in 2012 to assist in establishing traffic volumes, turning flows and vehicle proportions at key junctions in the York Street area.

A programme of Manual Classified Counts (MCCs) was carried out at twenty nine locations within the study area to define current traffic volumes and turning movements. Analysis of the observed counts indicates that more than 100,000 vehicles approach the junction in a typical 12-hour weekday.

The locations of the MCCs are shown in Figure 4.1.

A programme of Queue Surveys was undertaken at four locations within the study area to assist in assessing operating conditions around the York Street gyratory.

The locations of the Queue Surveys are shown in Figure 4.2.

Six temporary Automatic Traffic Counters (ATCs) were installed at key locations within the study area to define directional, hourly and daily variations in traffic flows over a 14 day period.

The locations of the temporary ATC Sites are shown in Figure 4.3.

A survey of current journey times was also undertaken in the York Street area, including the Westlink and the M2 and the M3 motorways, to assist in defining current operating conditions within the corridor. The surveys were carried out using two survey vehicles over two routes, namely the Red Route and the Blue Route, between 7am and 7pm to record variations in journey times throughout the day.

A total of 112 runs were carried out over the two days for the two routes.

The Journey Time Survey routes are shown in Figure 4.4.

5. THE PROPOSED SCHEME

The Proposed Scheme would provide uninterrupted links between the Westlink and the M2 and M3 motorways. The existing link between the M2 and M3 motorways via the Lagan Bridge would be retained.

York Street would be realigned to provide a two-way running arrangement, with a single southbound bus lane in operation between the York Street / M2 motorway junction and Great Patrick Street.

Nelson Street between Dock Street and Great George's Street would be closed to traffic to accommodate the new links to and from the M3 motorway.

The Proposed Scheme would also provide a new link between Duncrue Street and the Westlink.

A detailed plan showing the Proposed Scheme and the associated junction arrangements is shown in Figure 5.1.

5.1 Costs, Risks and Optimism Bias

Cost estimates were prepared for the Proposed Scheme. These costs were used to define both the total construction cost and total land cost for the Proposed Scheme.

Consultations with both NI Water and Translink identified an opportunity to introduce stormwater separation and to undertake strengthening works to several foundations of the Dargan Bridge as part of the Proposed Scheme.

As these works would be funded separately and there are no corresponding transport user benefits, the construction costs and benefits associated with these works have been excluded from the assessment.

The estimated cost of the Proposed Scheme in Q2 2013 prices, including an allowance of 16.5% for optimism bias, is £120.3m.

For the purpose of the economic appraisal, the cost profile is based on a three year construction period commencing in 2018 with the Proposed Scheme opening in 2021.

6. DEVELOPMENT OF COMPUTER MODELS

The assessment of the transport economic efficiency and road safety aspects of a proposed road improvement scheme requires the development and application of various computer models. In the case of the Proposed Scheme, this has involved the development of a COBA (Cost Benefit Analysis) model and a QUADRO (Queues and Delays at Roadworks) model. In addition to these models, various detailed traffic models were created to assist in the development of the Proposed Scheme.

6.1 The COBA Model

COBA is the standard computer model introduced in the 1970s to examine proposed investments in the trunk road network by comparing the costs of the road scheme with the associated road user benefits.

The Do-Minimum network is the base road network against which the Do-Something network is assessed.

The locations of the links and nodes which define the COBA Do-Minimum network are shown in Figure 6.1.

The Do-Minimum COBA model was calibrated to reflect local conditions. To demonstrate that the model provides a reasonable representation of existing transport conditions in the area, the observed journey times and modelled times on the network derived from the COBA model were compared. The modelled Red Route time is within -4.5% of the observed time and the modelled Blue Route time is within +2.9% of the observed time, both of which are well within the 15% target defined in the DMRB.

The correlation between the observed times and the modelled times derived from the calibrated model confirms that the model provides a reasonable representation of actual operating conditions on the network.

The locations of the links and nodes which define the COBA Do-Something network are shown in Figure 6.2.

6.2 The QUADRO Model

An assessment of the economic effects of the road user delays associated with the construction of the Proposed Scheme has been undertaken using the computer program QUADRO.

For the purpose of the QUADRO assessment, it has been assumed that traffic management would be in place for 24 hours per day, 7 days a week for the estimated 3 years construction programme between 2018 and 2021.

Within urban road networks in general and the York Street area in particular, multiple diversion routes are available within the local road network for road users affected by the Temporary Traffic Management arrangements. A maximum queue delay of 5 minutes has therefore been defined in the QUADRO models to reflect the time that road users are willing to be delayed due to the roadworks before selecting an alternative route.

7. FUTURE CONDITIONS

In accordance with standard procedures, it is necessary to establish changes in traffic demand over the full economic life of the scheme, which in the case of the Proposed Scheme extends to 60 years from the year of opening.

It is therefore considered that the most likely forecast of long term traffic growth within the study area for the assessment of the Proposed Scheme can best be defined by the application of national forecasts of traffic growth. The National Road Traffic Forecasts (NRTF) central growth projection has therefore been adopted to provide a reasonable estimate of long-term future traffic flows within the area over the 60-year economic assessment period.

Given the degree of uncertainty in predicting future traffic flows, the Proposed Scheme has also been tested considering NRTF low and high traffic growth projections.

A further test has been undertaken to consider the potential effects of releasing any suppressed demand when the Proposed Scheme opens. This high demand test is based on a high growth scenario with an additional 5% increase in traffic travelling on the strategic routes between the Westlink and the M2 and M3 motorways.

8. OPERATIONAL ASSESSMENT

8.1 Traffic Flows

The principal operational effect of the Proposed Scheme is to provide improved transport links for strategic traffic movements by providing a grade-separated interchange that avoids the existing signalised junctions.

The estimated 24-hour traffic flows for the Do-Minimum and Do-Something networks in the 2021 year of opening are shown in Figures 8.1 and 8.2 respectively.

Examination of the traffic flows on the Do-Something network indicates that 83,400 vehicles per day would transfer on to the new strategic links between the Westlink and the M2 and M3 motorways in the 2021 year of opening.

8.2 Journey Times

Savings in journey times are generally one of the most significant benefits resulting from the provision of a new transport improvement scheme.

The reductions in journey times for the strategic routes based on COBA Flow Group 4, which represents the peak period, in the 2021 year of opening are as follows:

- Westlink to M2 Motorway – 0.61 mins (19%) Saving;
- M2 Motorway to Westlink – 4.47 mins (56%) Saving;
- Westlink to M3 Motorway – 1.84 mins (53%) Saving; and
- M3 Motorway to Westlink – 2.50 mins (56%) Saving.

8.3 Network Capacity

Based on the information obtained from the COBA models, the over-capacity links and junctions in the Do-Minimum network under NRTF central traffic growth were identified.

By the 2021 year of opening, peak demand would exceed capacity on 13 links and 6 junctions, increasing to 18 links and 7 junctions in 2035.

Examination of the results for the Do-Something network indicates that peak traffic demand in 2021 would exceed capacity on 12 links and 3 junctions, increasing to 18 links and 4 junctions in 2035.

8.4 Road Safety

Given the inherent uncertainties in predicting future accident rates and casualty severities over the 60-year economic assessment period, the COBA assessment has been based on the application of default accident rates and costs. These have been applied to both the Do-Minimum and Do-Something networks to provide a reasonable measure of the relative change in road traffic accident characteristics associated with the two networks.

It should be noted that due to the characteristics of some of the new links relative to the existing links, the COBA model indicates that the various improvement options would lead to road safety disbenefits. For example, whereas the northbound approach to York Street on the existing Westlink currently has a 50 mph speed limit with a default accident rate of 0.174 Personal Injury Accidents / Million Vehicle Kilometres, the Do-Something option reduces the speed limit on this section of the road network to 40 mph with a default accident rate of 1.004 Personal Injury Accidents / Million Vehicle Kilometres. This results in a corresponding increase in accident numbers and associated disbenefits. This characteristic of the model should be taken into account when considering the road safety effects of the Proposed Scheme.

Based on the application of default accident rates and costs, the Proposed Scheme would lead to an additional 955 personal injury accidents over the 60-year period, which equates to an economic disbenefit of -£49.4m.

However, it is recognised that this increase in road safety costs is a characteristic of the default accident rates in the COBA model and it is expected that the Proposed Scheme would contribute positively to road safety.

9. ECONOMIC APPRAISAL

The economic results based on the combined COBA and QUADRO appraisals are summarised below, expressed in 2010 prices.

- Present Value of Benefits £174.57m
- Present Value of Costs £74.79m
- Net Present Value £99.78m
- Benefit to Cost Ratio 2.334

The principal benefits of the Proposed Scheme result from savings in transit time, which equate to £263.98m.

The results include road user delay costs of £38.26m derived from the QUADRO model.

The results from the combined COBA and QUADRO appraisal indicate that the Proposed Scheme would deliver a Benefit to Cost Ratio of 2.334 and therefore represents good value for money.

10. SENSITIVITY TESTS

A series of sensitivity tests has been undertaken to examine the extent to which the combined results from the COBA and QUADRO economic appraisals vary under various scenarios. The results of the sensitivity tests to examine the effects of different traffic growth forecasts are summarised below.

- NRTF Low Traffic Growth BCR 1.563
- NRTF Central Traffic Growth BCR 2.334
- NRTF High Traffic Growth BCR 3.544
- NRTF High Traffic Demand BCR 2.289

The results from the combined COBA and QUADRO traffic forecast sensitivity tests indicate that the Proposed Scheme would deliver a Benefit to Cost Ratio range of 1.563 to 3.544.

To test the sensitivity of the QUADRO assessment to changes in maximum queue delay, the Proposed Scheme has been tested by increasing the maximum queue delay from 5 minutes to 10 minutes.

The results of this test indicate that the BCR would reduce from 2.334 to 2.170.

11. CONCLUSIONS

My evidence has described the extensive data collection surveys undertaken over a period of many years throughout the progressive DMRB Stage 1, Stage 2 and Stage 3 Scheme Assessments to define baseline conditions and the level of congestion at the existing signalised junctions at the intersection of the Westlink, M2 and M3 motorways.

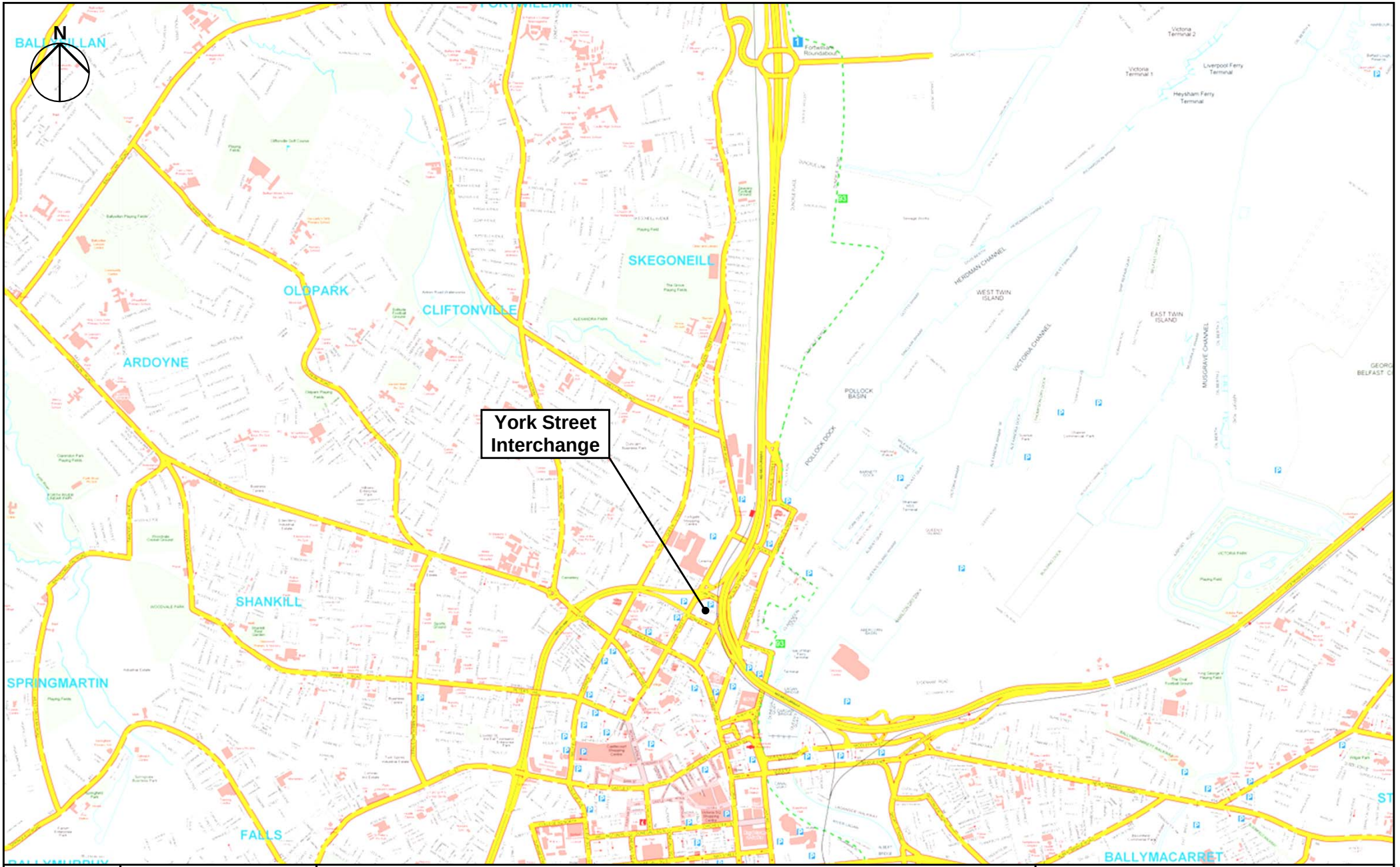
In addition to describing the development, validation and application of the various industry standard computer models, my evidence has presented the results of the operational and economic assessments of the Proposed Scheme and the results of the various sensitivity tests.

The results of the operational assessments indicate that the Proposed Scheme would reduce journey times in the York Street area.

The results of the economic assessments indicate that the Proposed Scheme represents good value for money with an overall Net Present Value of £99.78m and a Benefit to Cost Ratio of 2.334 under the NRTF central traffic growth forecast scenario.

The results of the various sensitivity tests indicate that the Proposed Scheme would generate a positive Net Present Value over a range of test scenarios where the overall benefits exceed the cost of the scheme.

Based on the above results, it is concluded that the Proposed Scheme would improve operating conditions in the York Street area and represents good value for money.



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Notes

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Figure 3.1
General Location Plan

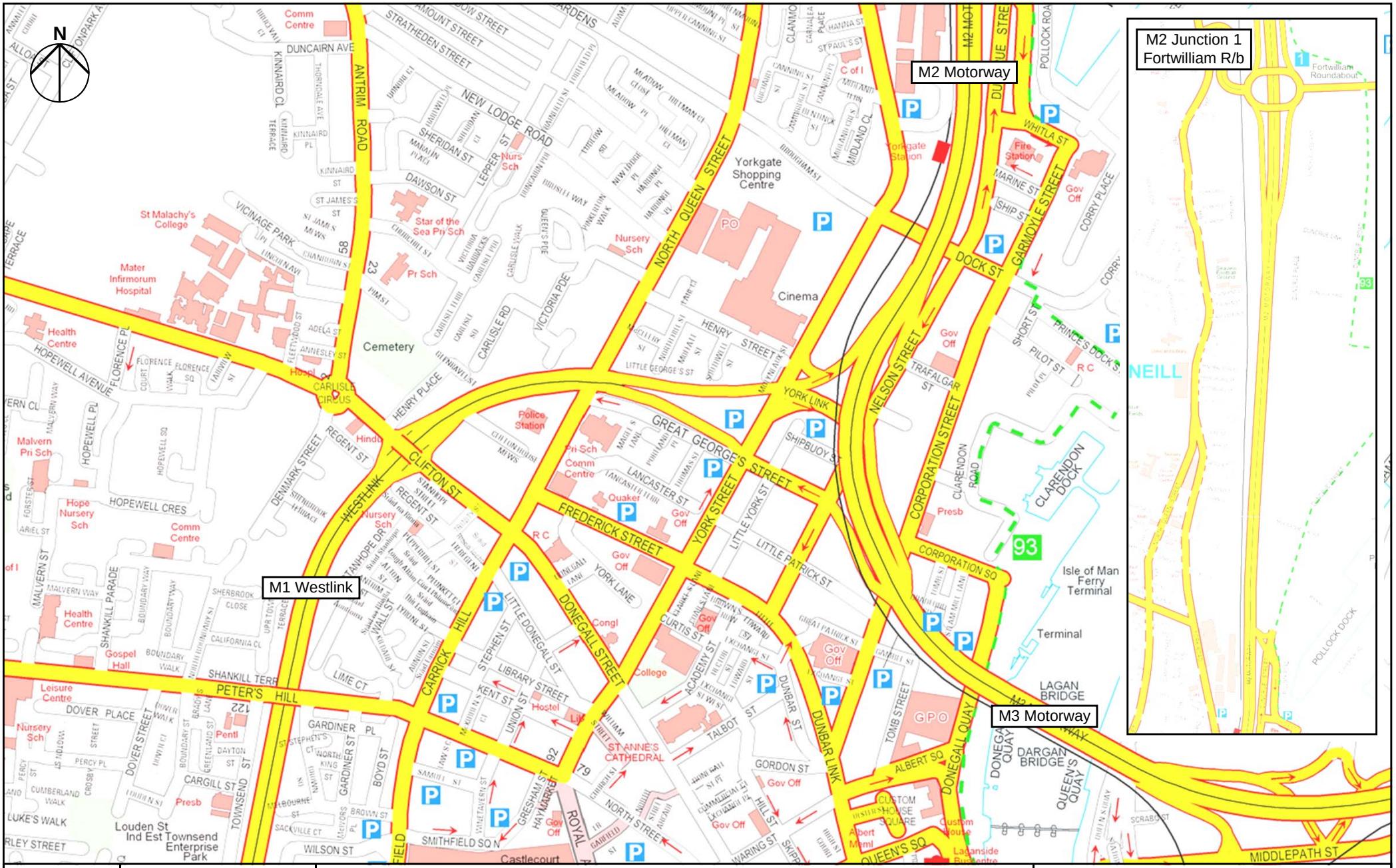

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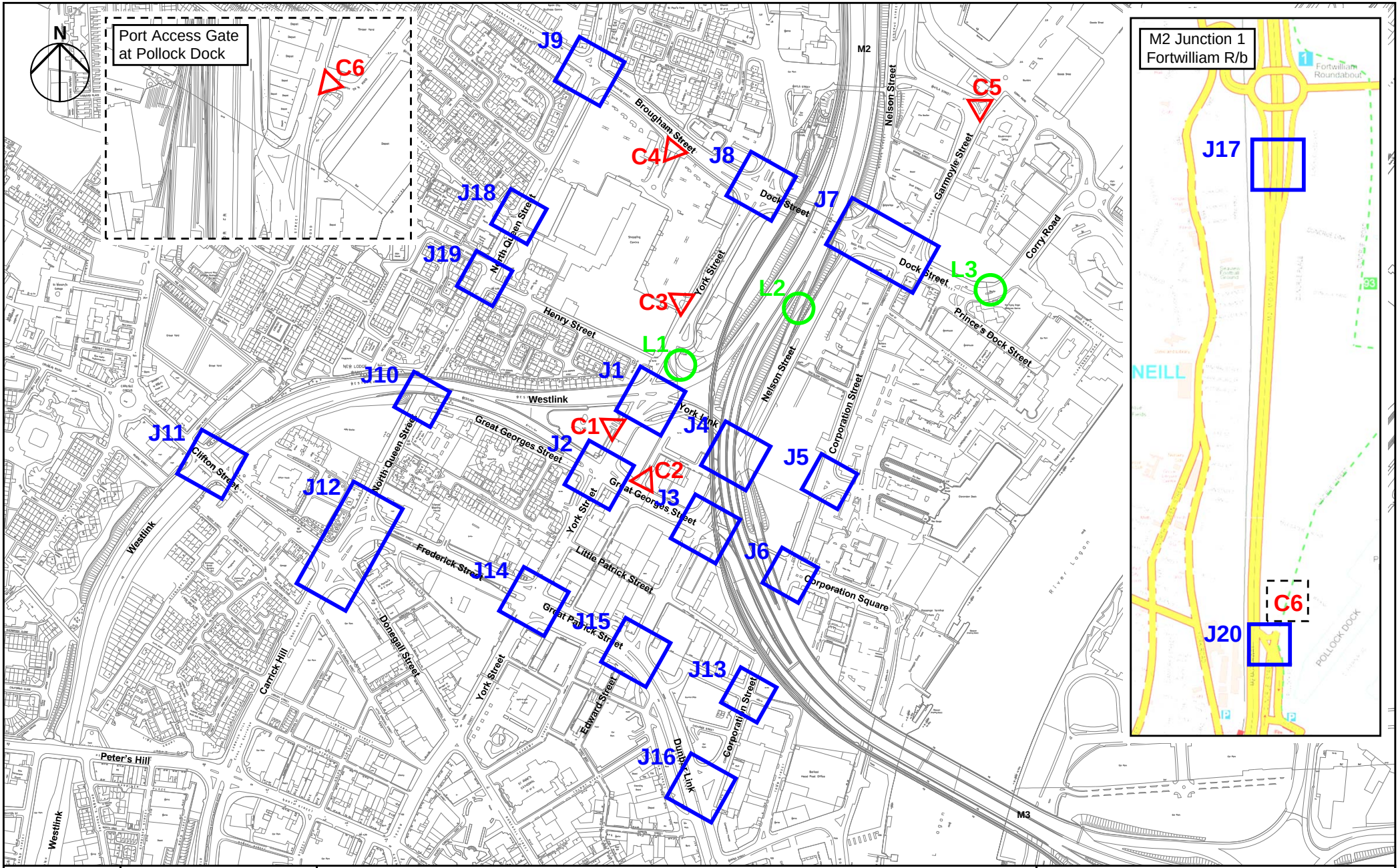
Figure 3.2
Key Location Plan



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Notes
- Junction Turning Count
- Link Count
- In/Out Turning Count

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Figure 4.1
Manual Classified Counts Locations – May 2012

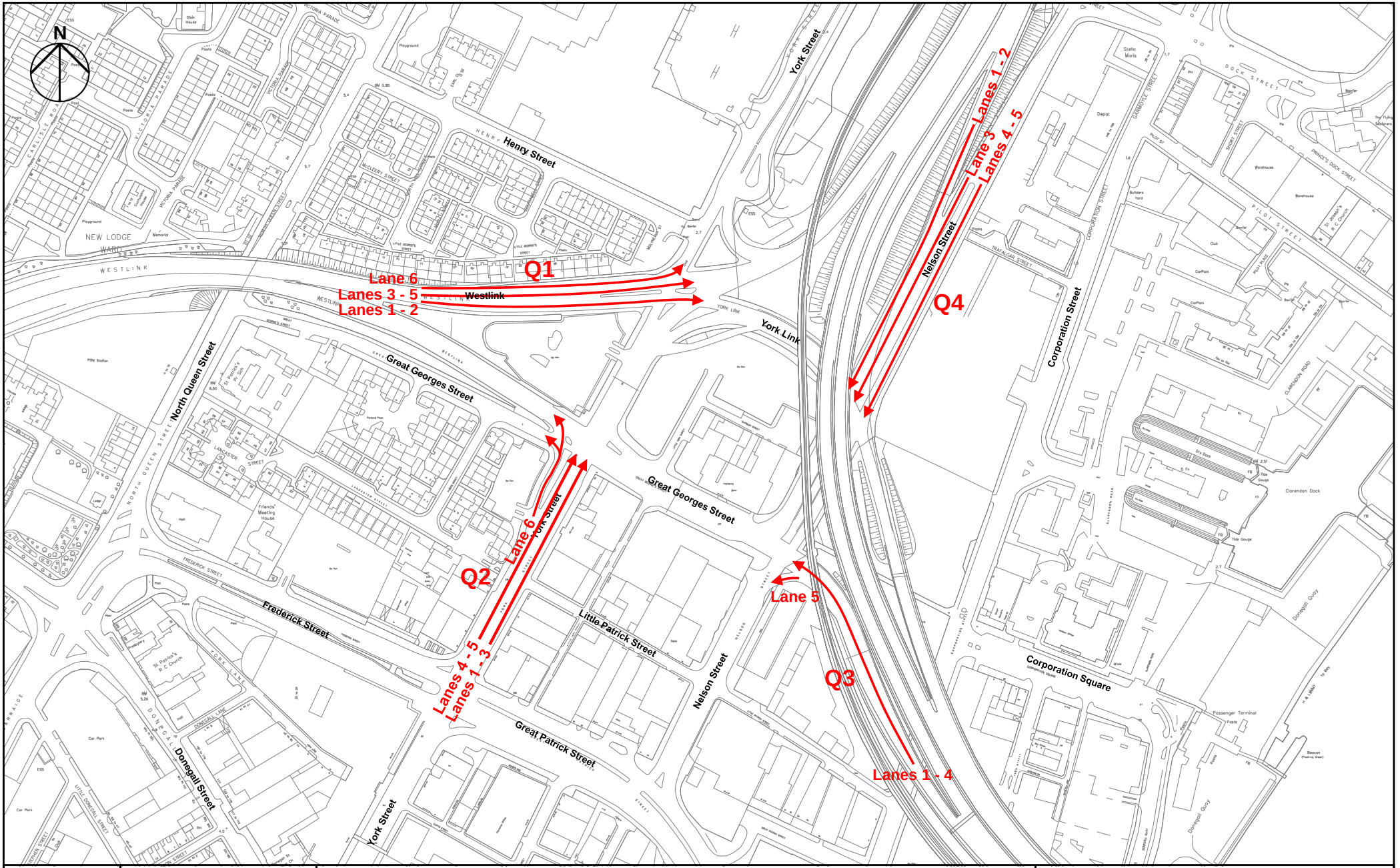

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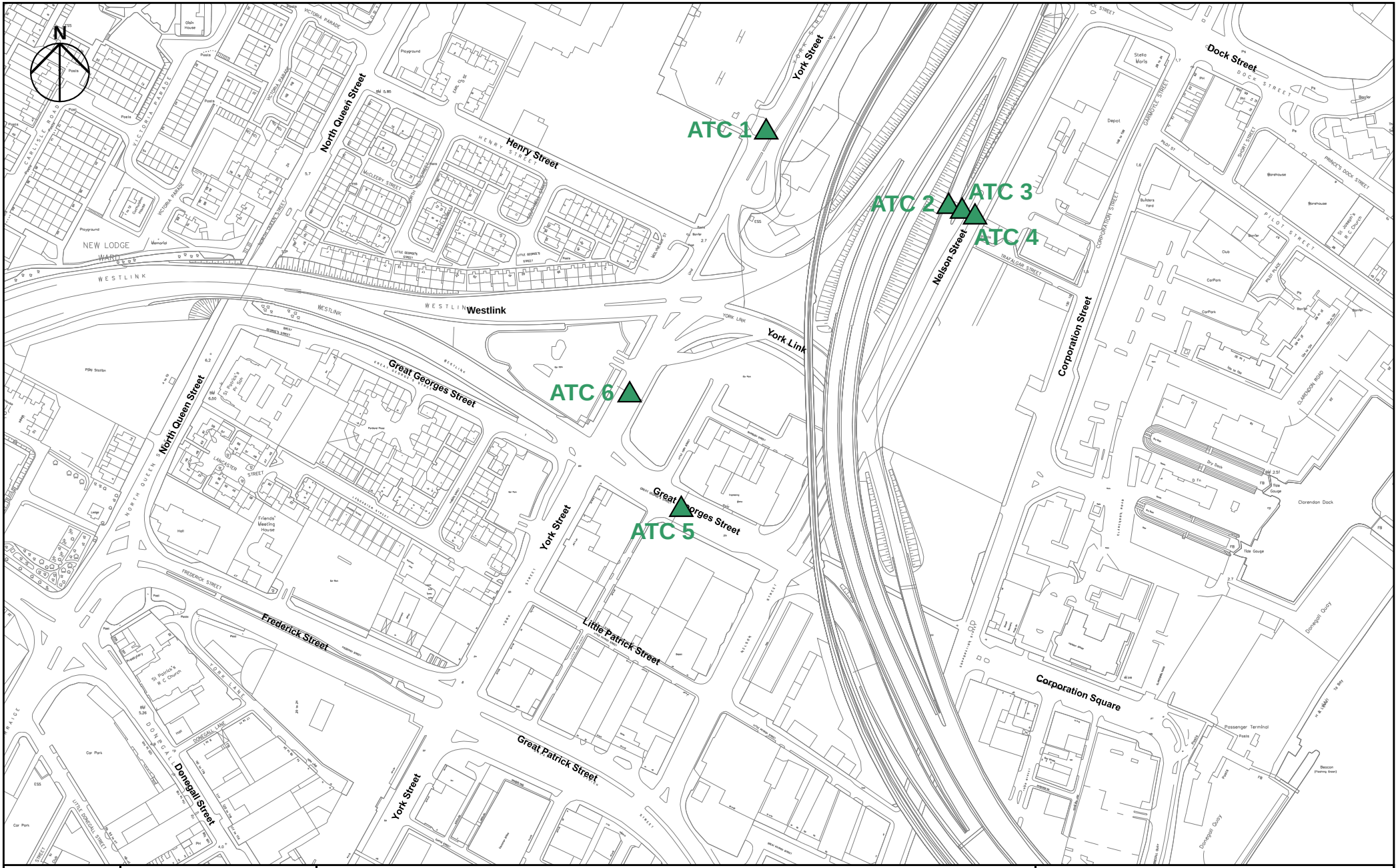
Figure 4.2
Queue Surveys Locations – May 2012



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▲ Temporary Automatic Traffic Count Location

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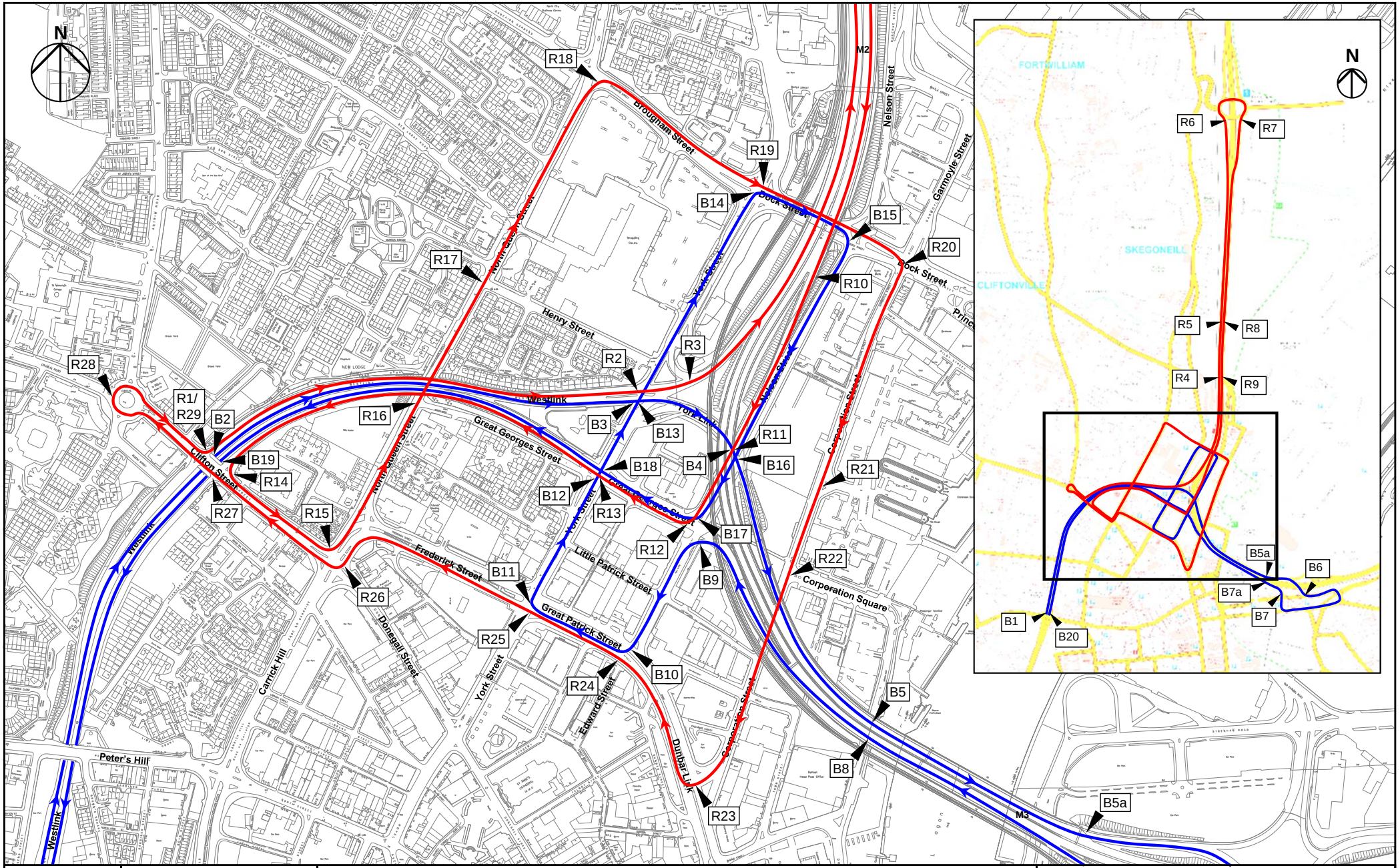
Figure 4.3
Temporary Automatic Traffic Count Locations – May / June 2012



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Journey Time Survey Route

Journey Time Survey Measurement Point

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Figure 4.4
Journey Time Survey Locations – May / September 2012

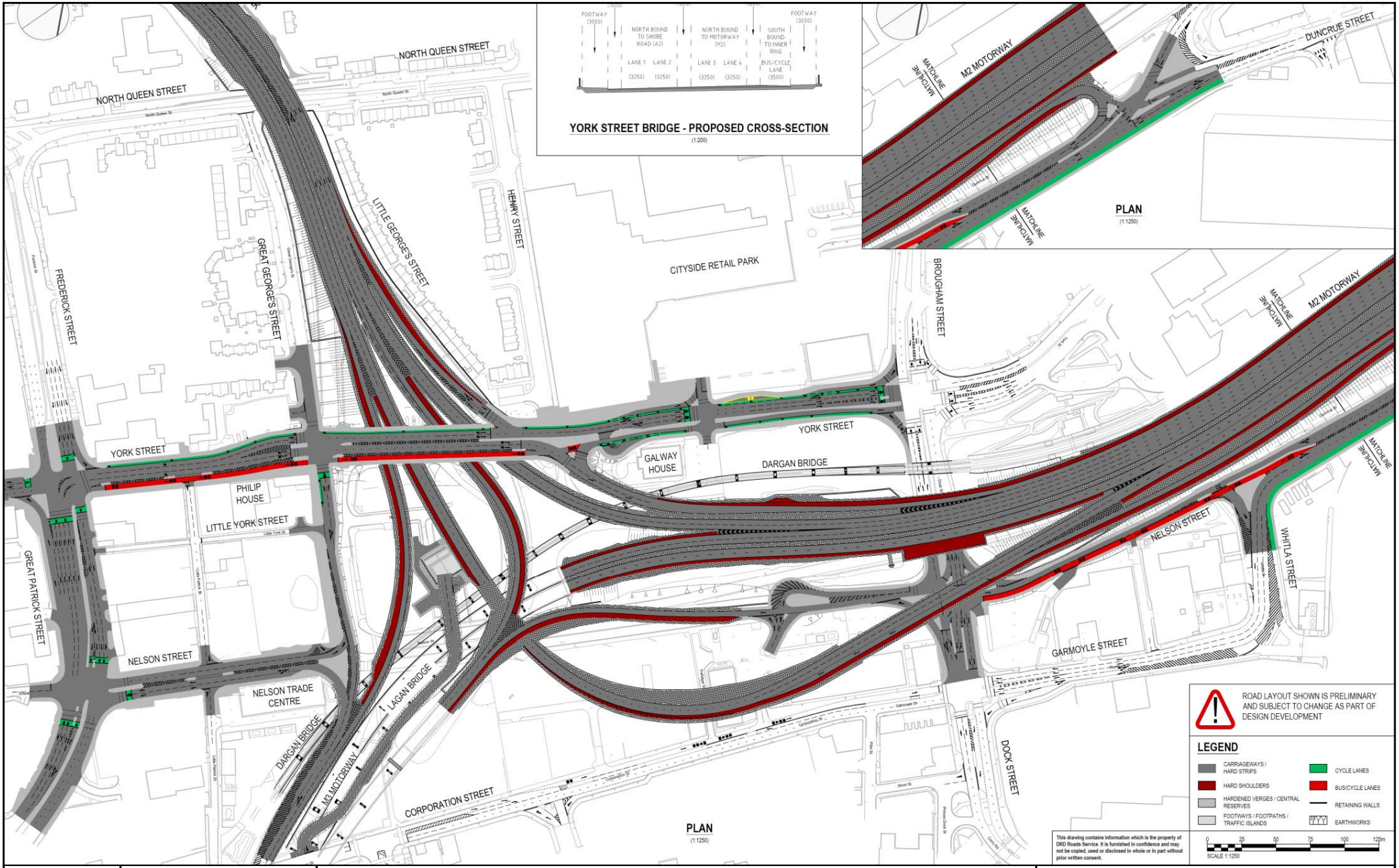

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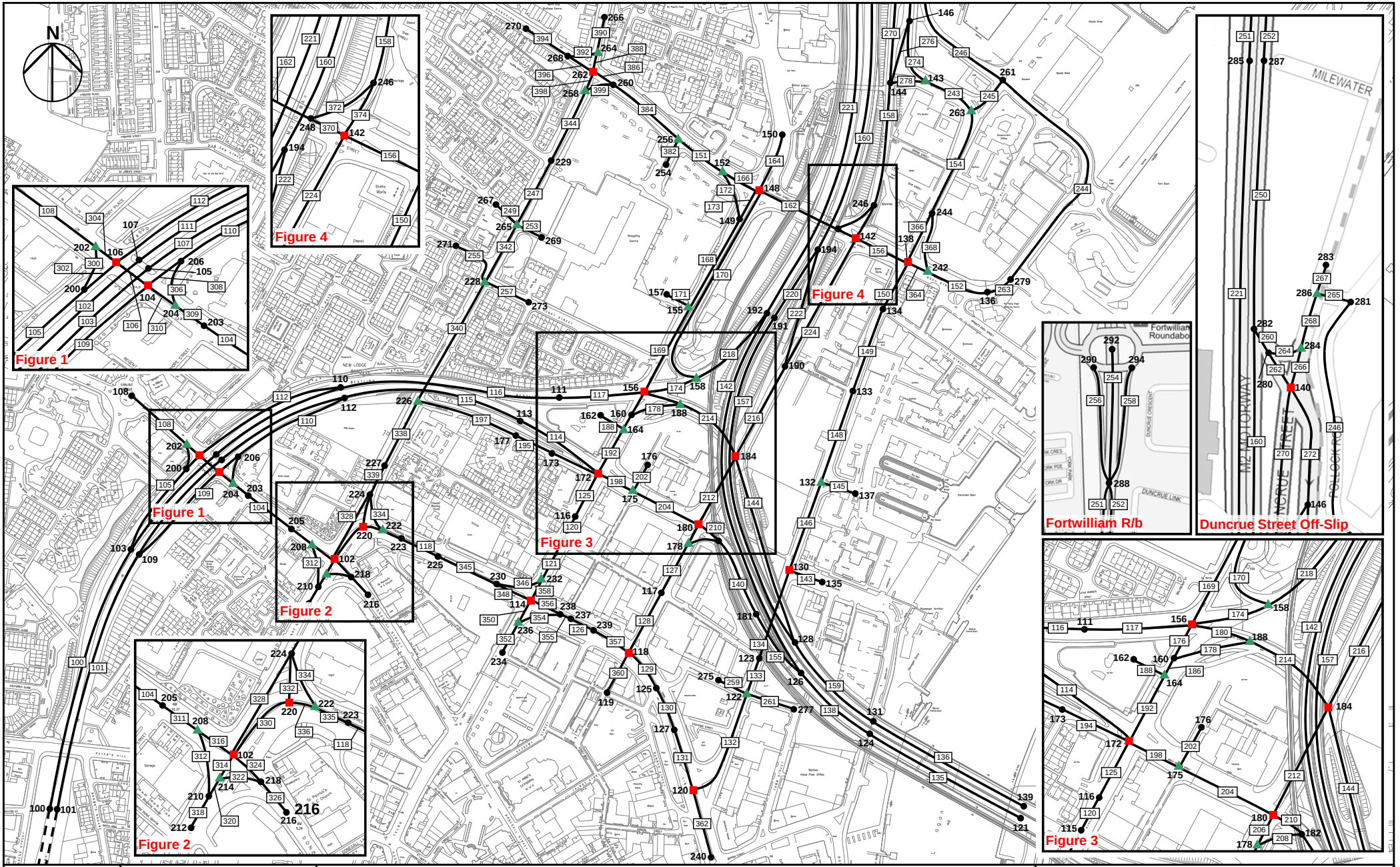
Figure 5.1
Proposed Scheme



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Notes

- Do-Minimum Link
- **100** Node Number
- [100] Link Number
- Node Point
- Signalised Junction
- Priority Junction

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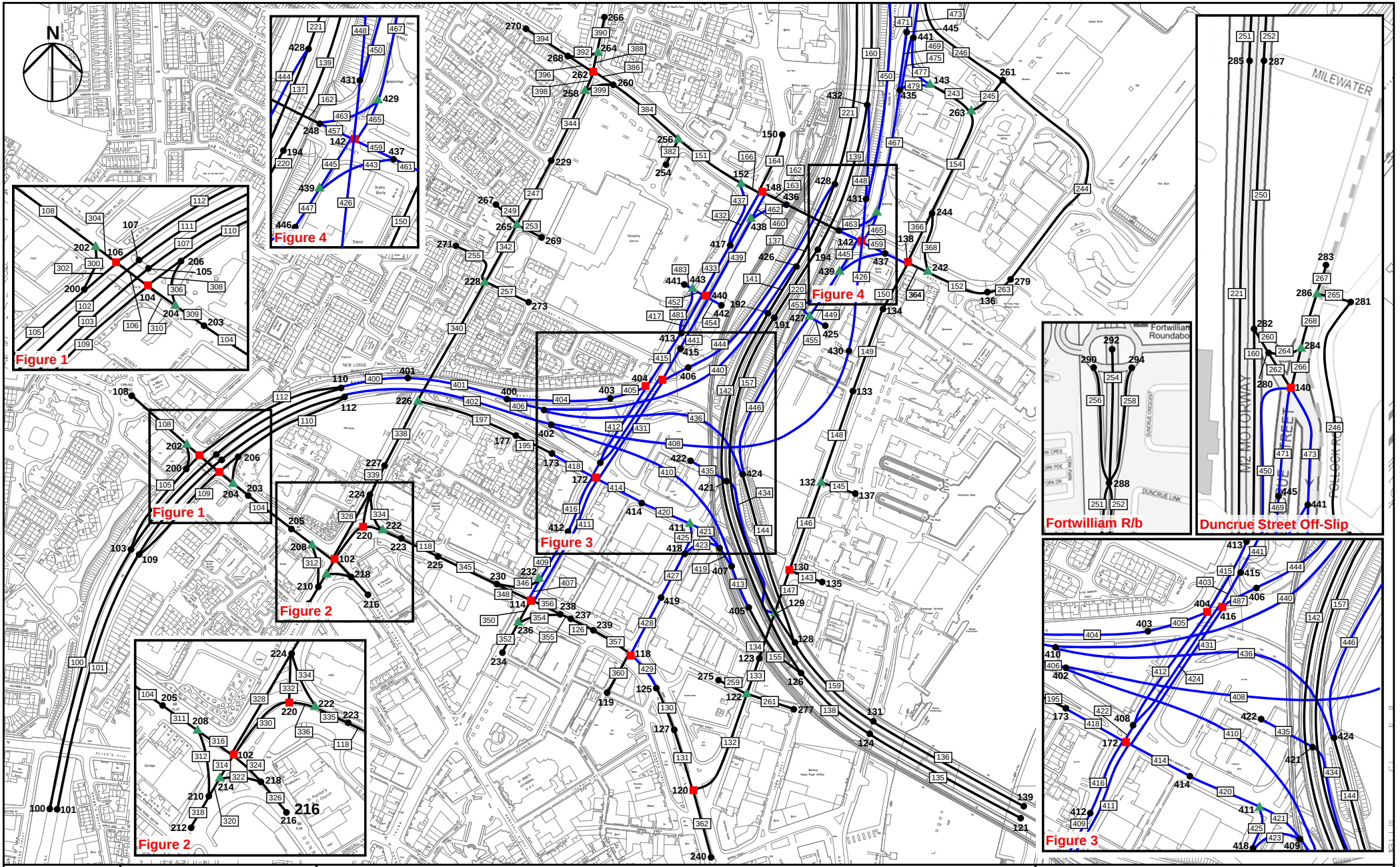
Figure 6.1
Do-Minimum Network
COBA Link and Node Diagram



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- Do-Something Link
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- [100] Link Number
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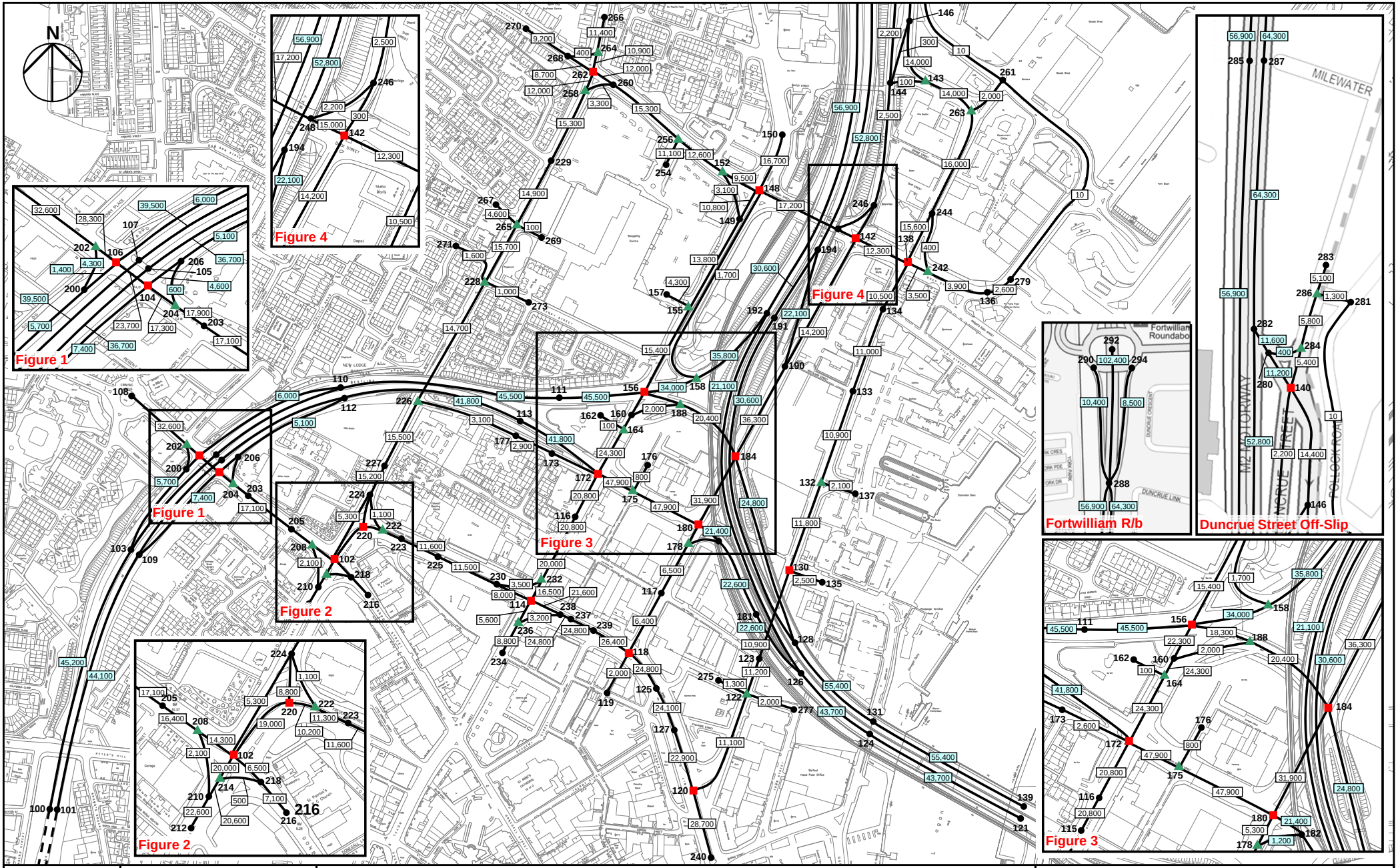
Figure 6.2
Do-Something Network
COBA Link and Node Diagram



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- Do-Minimum Link
- **100** Node Number
- 100 Link Number
- Node Point
- Signalised Junction
- Priority Junction
- 10,000 24-Hour Traffic Flows – Surface Street Flows
- 10,000 24-Hour Traffic Flows – Motorway Flows

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Figure 8.1
COBA Do-Minimum Network
24-Hour Traffic Flows – 2021 Year of Opening

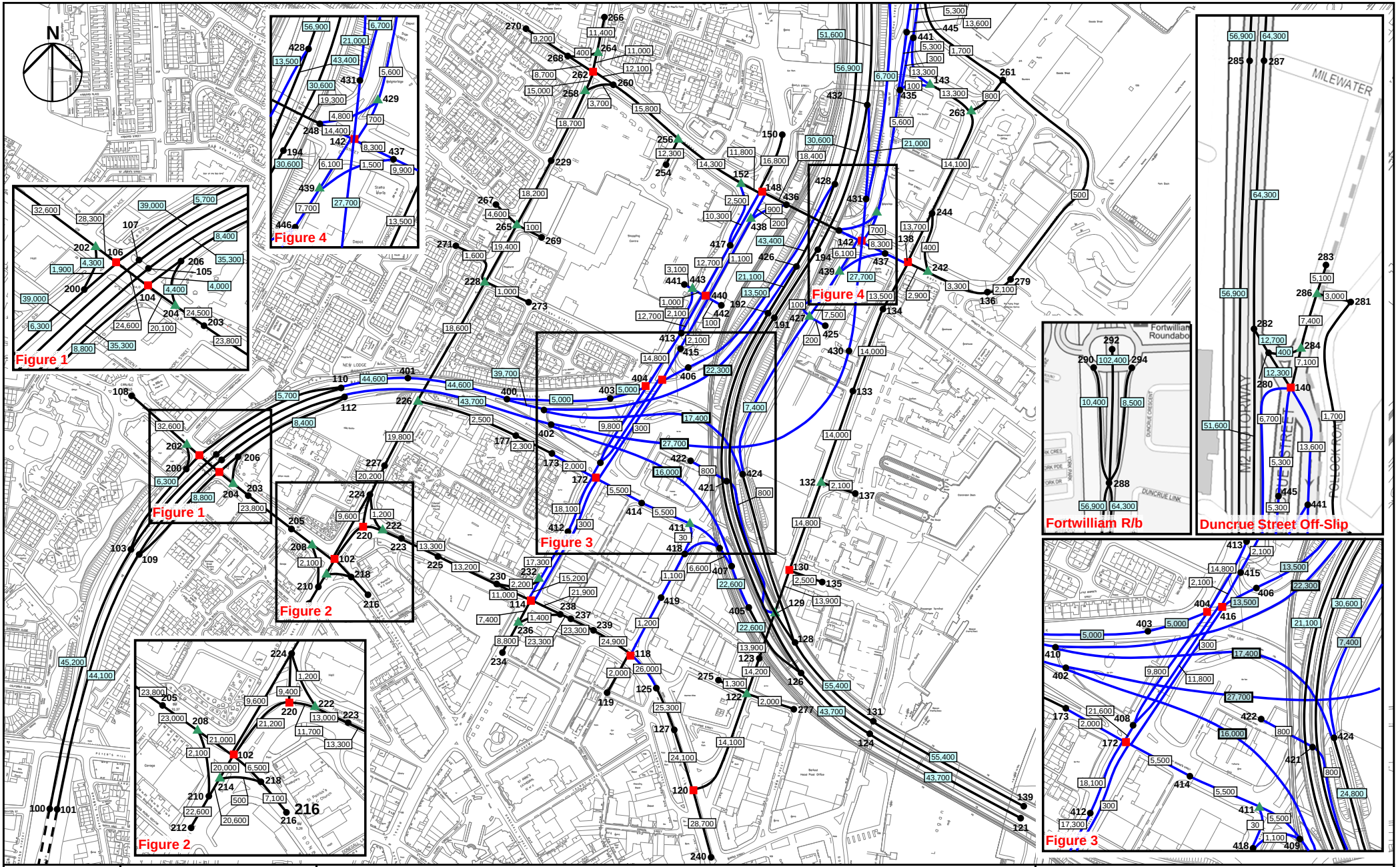

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Figure 8.2
COBA Do-Something Network
24-Hour Traffic Flows – 2021 Year of Opening