Cambridge North West Transport Study

Final Report

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1. Introduction

INTRODUCTION

1.1 Atkins has been commissioned by Cambridgeshire County Council (CCC) to undertake a Transport Study for a development site to the north west of Cambridge City Centre, known as Cambridge North West (CNW). The study has been managed by CCC and steered by representatives from the relevant local planning authorities, namely Cambridge City Council (CCiC) and South Cambridgeshire District Council (SCDC).

1.2 This report presents the analysis undertaken as part of the Transport Study for CNW. It also details the transport schemes, measures and proposals associated with the Preferred Transport Option for the CNW site. The Preferred Transport Option has been developed in consultation with the following parties:

- Strategic Steering Group: composed of Officers from CCC, CCiC and SCDC;
- CNW Joint Member Reference Group: composed of Officers and Council Members from the same three parties;
- A Technical Group: composed of developers with interests in the area and their transport consultants along with representatives from Cambridgeshire Horizons (CH); and
- The Highways Agency (HA).

BACKGROUND

1.3 The Cambridgeshire and Peterborough Structure Plan (2003) identified the need for 47,500 new dwellings in the Cambridge sub-region during the period 1999-2016.

1.4 A key policy aim of the Structure Plan (Policy P1/1 – Approach to Development and Policy P8/1 – Sustainable Development: Links between Land Use and Transport) is to locate as much new housing as possible either within or on the edge of Cambridge, close to existing services, facilities and established public transport networks.

1.5 To this end, a major area for new development has been identified in CNW on land between Madingley Road and Histon Road. Part of this land is within the Cambridge City boundary and has been allocated for development within the Cambridge City Local Plan, whilst the remainder of the site is within the District of South Cambridgeshire and is currently being considered as part of the SCDC Local Development Framework.

1.6 CCC and the local planning authorities recognise that development of the CNW site will generate significant travel demands in an area of Cambridge where radial routes, particularly Huntingdon Road, already experience congestion in peak periods. In addition planning policy guidance dictates that all new development in Cambridgeshire (including CNW) must promote sustainable travel, providing travel choices by walking, cycling and public transport, whilst discouraging travel by the private car. This study has therefore been commissioned to inform development at the site, ensuring that an appropriate level of highway capacity is available whilst promoting travel within the site and to surrounding areas by modes of travel other than the private car.

PROPOSED DEVELOPMENT

Site Location

1.7 CNW consists of two distinct land parcels as follows:

- **Parcel A (also known as the University site):** Land between Madingley Road and Huntingdon Road which has been identified for University related uses, meeting the long term housing needs of the University up to 2016. This land includes land within Cambridge City and South Cambridgeshire District. The land will be the subject of a Joint Area Action Plan as described in Section 2.14 of this report; and
- **Parcel B (also known as the NIAB Site):** Land between Huntingdon Road and Histon Road (B1049) which has been identified for housing on land within Cambridge City and other uses on South Cambridge District land. A masterplan will be prepared for the site to take forward City Local Plan and South Cambridgeshire Local Development Framework proposals for the area.

1.8 The location of CNW and its two constituent land parcels is shown in Figure 1.1.

1.9 Land within Parcel B is defined as land between Huntingdon Road and Histon Road (B1049). When 'Histon Road' is used in this report it refers to the B1049 between its junctions with the A14 and Victoria Road. It is recognised that this section of road actually has two names: Histon Road towards its junction with Victoria Road and Cambridge Road towards its junction with the A14.

Development Land Use Options

1.10 In order to provide a robust assessment of the transport impacts of the development of CNW, two development options have been considered for the site.

1.11 The first development scenario (Scenario 1) is the 'allocated development level'. This includes the development allocations outlined in policies P9/7 and P9/8 of the City Local Plan (for development within the City boundary).

1.12 The second development scenario (Scenario 2) is the 'sensitivity development level'. This includes the allocated development level plus all extra development that developers would like to provide on the site. For the land between Madingley Road and Huntingdon Road these levels have been agreed with Cambridge University. For the land between Huntingdon Road and Histon Road the levels have been agreed with David Wilson Estates who recently submitted (December 2006) a planning application for the land within Cambridge City. It should be noted that these development levels will be used to provide a 'worst case' assessment of the transport implications of maximum development at the site.

1.13 The Scenario 1 and Scenario 2 development levels have been agreed with the CNW Transport Study Steering Group. The agreed development levels are shown in Table 1.1.

Table 1.1 - Cambridge North West Development Levels

Scenario 1: Allocated Development NIAB Land			Scenario 2: Sensitivity Development NIAB Land		
Land Use	**Quantity**	**Unit**	**Land Use**	**Quantity**	**Unit**
Residential	1780	Dwellings	**Residential**	2800	Dwellings
Primary School	2.3	Hectares	**Primary School**	4.6	Hectares
Local centre	1	Hectare	**Local centre**	1.6	Hectares
Secondary school	8	Hectares	**Secondary school**	8	Hectares
Scenario 1: Allocated Development University Land			**Scenario 2: Sensitivity Development University Land**		
Land Use	**Quantity**	**Unit**	**Land Use**	**Quantity**	**Unit**
Primary School	2.3	Hectares	**Primary School**	3.8	Hectares
Residential **(Key worker – 50%)** **(Private/Market – 50%)**	1150 575 575	Dwellings	**Residential** **(Key worker – 50%)** **(Private/Market – 50%)**	2500 1250 1250	Dwellings
Higher Education	14	Hectares	**Earth Science Faculty**	17.75	Hectares
University Related Research	6	Hectares	**University Related Research Total** **(Academic Faculty)** **(Commercial)**	100,000 (50,000) (50,000)	sq.m
Local Centre	1	Hectare	**Local Centre**	2.2	Hectares
			Student Housing	2,000	Units

1.14 The agreed development levels are based upon the following:

- The exact location of the secondary school has not yet been agreed. It has been placed on land between Huntingdon Road and Histon Road to provide a worst case assessment in terms of planning/educational impact;
- The eight hectare secondary school will accommodate eight forms of entry;
- It has been assumed that each site must provide for its own needs for primary education;

- A primary school of 2.3 hectares will accommodate two forms of entry, a primary school of 3.8 hectares will accommodate three forms of entry and a primary school of 4.6 hectares will accommodate four forms of entry;
- Local centres are comprised of retail (A1, A2 and A3) uses;
- Local centre size increases in proportion to the number of houses; and
- The University's aspirations for research development are 100,000 sq.m. Half of this is assumed to be academic and the remaining half commercial space.

1.15 The agreed development levels have provided the basis for the assessment of the transport impact of the proposed development as part of this study.

AIMS AND OBJECTIVES OF THIS STUDY

1.16 The primary aim of the study is to prepare a Preferred Transport Option for the CNW site which promotes sustainable development and integrates this major growth area into Cambridge City and its surrounding areas.

1.17 The study and its findings will provide support to SCDC and CCiC in the Local Development Process. The Transport Study will also provide the Steering Group with information to review forthcoming planning applications.

1.18 The objectives of the study include:

- To promote sustainable travel within the site and to surrounding areas (Structure Plan P8/1, P8/3);
- To cover all modes of travel and include the full range of transport schemes, measures and improvements required to facilitate implementation of the Joint Area Action Plan including those for public transport, cycling, walking and highways;
- To have regard to local planning policy guidance and the Long Term Transport Strategy (see Section 2.24);
- To integrate the site into the surrounding transport networks whilst minimising the impact on these networks;
- To provide a comprehensive network of safe and convenient walk and cycle routes (Structure Plan P8/8, P8,9);
- To provide a network of High Quality Public Transport services (Structure Plan P8/6);
- Ensure an appropriate level of highway capacity;
- Link to local and national highways networks;
- Be consistent with CCC's objectives of promoting alternative travel modes to the car, minimising the need to travel and minimising the traffic impact on the wider highway networks (Structure Plan P8/1, P8/2); and
- Establish key principles for access linking the two development areas.

What the CNW Transport Study is…and isn't

1.19 The CNW Transport Study is a strategic study which aims to assess the impacts of potential growth in CNW upon the existing transport infrastructure in the vicinity of the development and across the wider Cambridgeshire area. From this assessment the study will outline what new infrastructure and services would need to be put into place to address any adverse transport impacts arising from the development.

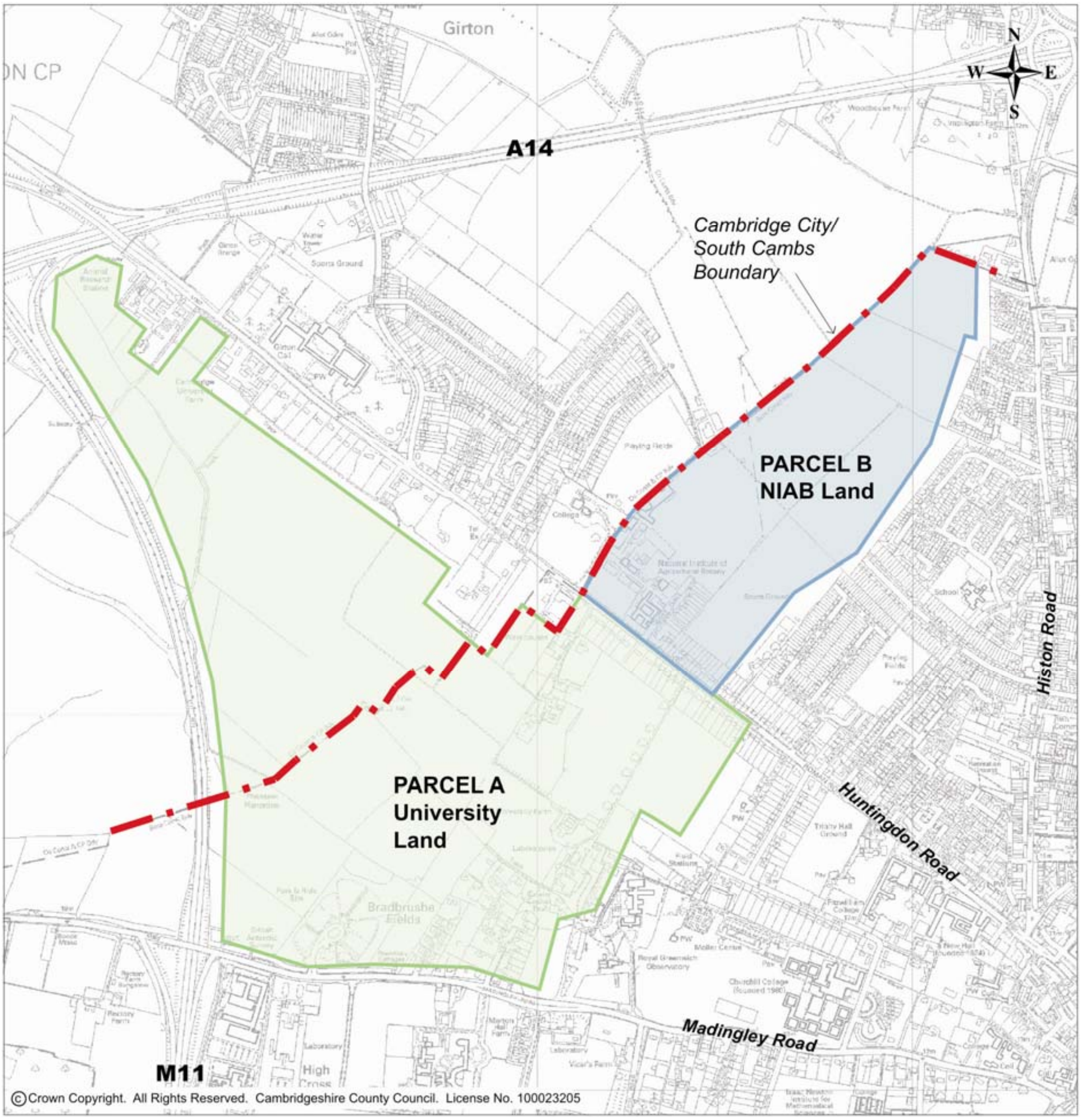
1.20 The CNW Transport Study is a local study and proposes new infrastructure and services to meet the immediate needs of development of the site only. It does not provide a full scale review for the Cambridgeshire area as a whole as this is covered by the Long Term Transport Strategy (LTTS) which considers the impact of a number of developments taking place across Cambridgeshire.

1.21 As stated in Section 1.16, the CNW Transport Study will inform Members of CCiC and SCDC as the planning process for the site progresses. In particular the study will enable Members to consider the transport impact of development of the whole of the CNW site despite the fact that planning applications for different parts of the site may come forward separately and at different times. In a similar manner the study will allow developers to consider the cumulative impact of the development of the whole of the CNW site of which their development may only form a part.

STRUCTURE OF THIS REPORT

1.22 This report contains seven further sections. Section 2 summarises the planning policy context. Section 3 describes the existing transport situation for the site and its surrounding area and identifies the issues and opportunities associated with the site. Section 4 describes the methodology followed during the CNW Transport Study. Section 5 describes the 'strategic options' developed in consultation with stakeholders and the CNW Transport Study Steering Group which have been analysed as part of this study. Section 6 summarises the results of this analysis. Section 7 presents the Preferred Transport Option for the CNW site and finally Section 8 presents our conclusions.

Figure 1.1 - Site Location



2. Setting the Scene

2.1 The Transport Study for CNW has been undertaken with regard to regional and local planning policy guidance (see Section 1.18). It also considers the results of previous studies carried out in the area, including the Long Term Transport Strategy (LTTS). A detailed review of the relevant planning policy guidance and other relevant studies is provided in Appendix A of this report and summarised below.

REGIONAL PLANNING POLICY

Regional Planning Guidance Note 6 (RPG6): Regional Planning Guidance for East Anglia to 2016 (November 2000)

2.2 Adopted Regional Planning Policy Guidance in East Anglia is currently described in Regional Planning Guidance (RPG) Note 6 (November 2000). The sustainable strategy for development presented in RPG6 informs local development plans including the Cambridge and Peterborough Structure Plan, Cambridge City Local Plan, SCDC Local Plan and emerging Local Development Frameworks.

2.3 RPG6 makes clear the preferred locations for development in the Cambridge sub-region, including the City itself (subject to capacity reviews) and on the periphery of the built up area (subject to Green Belt review). The CNW development site is located on the periphery of the built up area.

East of England Plan

2.4 The East of England Plan is a draft spatial strategy to guide development in the East of England for the next 20 years. The Plan has been developed as a revision to RPG6 and is expected to be published as an adopted document in 2007.

2.5 Policy H1 of the Plan outlines the number of new houses local development documents should provide for, including 14,700 new homes to be located in Cambridge between 2001 and 2021. This will include new homes built on the CNW site.

2.6 Following a process of review by the Secretary of State, a number of amendments to the draft East of England Plan have been proposed (Secretary of State's Proposed Changes to the Draft Revision to the Regional Spatial Strategy for the East of England and Statement of Reasons, December 2006). The proposed changes to Policy H1 state that 19,000 new homes should be provided in Cambridge between 2001 and 2021. This is a potential increase of 4,300 homes compared to the draft East of England Plan figure (detailed in Section 2.5).

LOCAL PLANNING POLICY

Cambridge and Peterborough Structure Plan 2003

2.7 The Cambridge and Peterborough Structure Plan was adopted by CCC and Peterborough District Council in October 2003 and provides the strategic policy framework for planning and development that will take place locally during the period 2003-2016. The Plan informs the development of local plans for neighbouring areas, including the Cambridge Redeposit Local Plan, SCDC Local Plan and emerging Local Development Documents.

2.8 The Structure Plan indicates that 47,500 new homes should be provided in the Cambridge sub-region between 1999 and 2016 (Policy P9/1), including 8,000 located on the edge of Cambridge subject to a review of the Green Belt boundary. These should be located in areas which are or can be made to be highly accessible by public transport and will also provide opportunities for travel choice (Policy P8/1).

2.9 The Structure Plan also outlines the schemes which will be sought to be implemented over the Plan period, including Chesterton Interchange and the Guided Busway between Huntingdon and Cambridge.

Cambridge Redeposit Local Plan

2.10 The Cambridge Redeposit Local Plan was formally adopted in July 2006. The Local Plan sets out the policies and proposals for future development and land use up to 2016.

2.11 The Local Plan sets out housing provision within the City, including for CNW within policies P9/7 (University site) and P8/7 (NIAB site). The policies include statements on land use and accessibility which will inform the Transport Study for CNW.

South Cambridgeshire Local Plan (2004)

2.12 The South Cambridgeshire Local Plan sets out the detailed policies and proposals for the control of development in the District up to 2016.

2.13 The Local Plan does not include land use allocations for the South Cambridgeshire District land within the CNW development site, which is classified as Green Belt.

Local Development Framework for South Cambridgeshire

2.14 SCDC are currently preparing a Local Development Framework (LDF) to replace the existing Local Plan under new government legislation for development plans. The LDF will set out the policies and proposals for the use of land in the District for the period to 2016.

2.15 The LDF is comprised of Local Development Documents, Area Action Plans (AAP) and Supplementary Planning Guidance. A Joint AAP is currently being prepared for CNW by SCDC and CCiC. The AAP ‘Issues and Options’ report will draw upon the findings of this Transport Study and will be published in April/May 2007. The final LDF document is proposed to be adopted in 2009.

SUPPLEMENTARY PLANNING GUIDANCE

Northern Corridor Area Transport Plan (NCATP) 2003 and Western Corridor Area Transport Plan (WCATP) 2003

2.16 The NCATP and WCATP form Supplementary Planning Guidance to the Cambridge Local Plan and South Cambridgeshire Local Plan.

2.17 The NCAPT covers an area including north Cambridge and bordering parishes in South Cambridgeshire District whose transport issues are intrinsically linked to those of the City. The NCATP includes the northern half of the NIAB site.

2.18 The WCAPT covers an area including west Cambridge and bordering parishes in South Cambridgeshire District (SCD) whose transport issues are intrinsically linked to those of the City. The WCATP includes the southern half of the NIAB site and all of the University Site.

2.19 A number of schemes are to be secured for these areas through developer contributions. These include:

- Contributions to real time passenger information;
- Extensions/amended frequency on Citi 2, 4 and 6 bus routes;
- Cycle improvements/routes: Kings Hedges riverside; Histon Interchange; Histon Road – Trumpington Road; Huntingdon Road – Barton Road; Madingley Road; and
- Bus priority measures at A1303/Madingley Road.

2.20 Many of these improvements will be associated with development outside the CNW site; however they will improve facilities for residents of the CNW site.

OTHER RELEVANT STUDIES

Cambridge to Huntingdon Multi- Modal Study 2001 (CHUMMS)

2.21 CHUMMS was undertaken on behalf of the Department of Transport, Local Government and the Regions (DTLR) by a consortium of consultants. The findings of the study have informed development of regional and local planning policy.

2.22 The study recommends the following infrastructure schemes to support development:

- Cambridgeshire Guided Busway;
- A14 widening (Ellington – Fen Ditton) with parallel local roads;
- Full consideration of non-motorised travellers in the design of new schemes; and
- Demand management to stabilise traffic entering Cambridge and promote public transport.

2.23 These recommendations have been further considered by the LTTS.

Long Term Transport Strategy (LTTS)

2.24 Alongside the Cambridge Re-deposit Local Plan, CCC in partnership with the District Councils commissioned consultants to prepare a Long Term Transport Strategy (LTTS) for Cambridgeshire covering the period 2006-2021. The LTTS will examine the implications of development growth planned across the whole of Cambridgeshire, including the CNW development, at a strategic level.

2.25 The aim of the LTTS is to ensure that the scale of development in Cambridge can be accommodated in a sustainable manner. The LTTS will also inform the development of regional strategies, Local Plans and Local Development Frameworks and will provide CCC with a solid base from which to bid for Government funding for transport schemes related to development.

2.26 A high-level summary of the LTTS has been published by CCC. This contains measures proposed for: rural areas; strategic corridors; market towns and their hinterland; and Cambridge City.

2.27 The LTTS recognises that growth in Cambridge City will need to be accompanied by a substantial increase in walking, cycling and public transport use. Measures suggested include:

- Smarter Choices: Workplace travel plans and personal journey planning;
- Walking and Cycling: Reallocation of roadspace and provision of a walk/cycle infrastructure integrated with the public realm;
- Public Transport: Town centre shuttle buses, new/enhanced bus interchange facilities, bus priority measures and links to development areas;
- Demand Management: Parking policy controls, physical roadspace controls; and
- Highway Improvements: Traffic management schemes to reduce impacts, integrated safety improvements, improved/new access to development.

2.28 The main recommendation of the study is that a package of measures is required to ensure that the scale of development proposed in Cambridge can be accommodated in a sustainable manner. This package of measures will include improvements to public transport and walking and cycling facilities along with demand management measures to control growth in travel by car in Cambridge.

2.29 Work is continuing through further studies such as the Cambridge Area Transport Strategy, to determine the exact package of public transport, walking and cycling measures and most appropriate form of demand management for Cambridge. The Transport Study for the CNW site will employ the principles of the LTTS in terms of promoting sustainable travel and using a demand management approach to the private car. Additional public transport, walking, cycling and demand management measures implemented as part of the LTTS should serve to enhance those implemented as part of the CNW development.

SUMMARY

2.30 Regional and Local Planning Policy Guidance suggests that 8,000 new homes will be built on the edge of Cambridge between 1999 and 2016. These will include homes built in CNW.

2.31 Policy Guidance also dictates that all new development must promote sustainable travel by walking, cycling and public transport whilst managing demand for travel by the private car. These will form the main principles for development of transport options for the CNW site as part of this study.

2.32 In addition planning policy and other studies carried out in Cambridgeshire suggest that the following major infrastructure improvements will be required during the period 2001-2016 to support ongoing development:

- Huntingdon to Cambridge Guided Busway;
- A14 widening (Ellington to Fen Ditton); and
- Chesterton Station Interchange.

2.33 The impact of these infrastructure improvements on the CNW site will be considered as part of the CNW Transport Study.

3. North West Cambridge Today

3.1 This section of the report describes the existing transport situation in the vicinity of CNW.

ACCESSIBILITY

3.2 In order to predict the potential travel demand patterns generated by the CNW site it is useful to consider the likely main trip attractors for residents of the development.

3.3 Figure 3.1 shows the proximity of CNW in relation to key trip attractors in Cambridge including:

- Employment:
  - Cambridge Science Park;
  - University West site;
  - Cambridge City Centre;
  - Newmarket Road Retail Park; and
  - Addenbrooke's Hospital.
- Education:
  - Primary and secondary schools;
  - Further education colleges; and
  - University colleges.
- Retail:
  - Cambridge City Centre; and
  - Newmarket Road Retail Park.
- Leisure:
  - Open spaces; and
  - Cambridge City Centre.

3.4 Figure 3.1 shows isochrones for 15 minute walking distance (1.2 kilometres) and 15 minutes cycling distance (5 kilometres) from the centre of the CNW site. These isochrones identify the key trip attractors within walking and cycling distance of the site:

- Walking:
  - University West; and
  - Primary schools.
- Cycling:
  - City Centre;
  - Primary and secondary schools and further education college;
  - Open spaces; and
  - Cambridge Science Park.

3.5 All remaining trip attractors, including Addenbrooke's Hospital and Cambridge Railway Station are considered to be beyond reasonable walking or cycling distance from the site and are therefore only accessible by public transport or the private car. This analysis is based upon the assumption that the majority of residents of the new development would not travel beyond the nationally recognised standards for maximum walking and cycling distances (as outlined in Planning Policy Guidance Note 13). It is noted that there is a strong cycling culture in Cambridge and the surrounding area which means that some residents of the city are likely to be willing to cycle distances beyond these nationally recognised standards. In particular, our public consultation during the latter stages of this project identified that residents of Girton and Histon cycle to Cambridge Railway Station. Although this pattern is likely to be replicated by some residents of the proposed development it is likely that the majority of residents would not be prepared to travel further than the nationally recognised standards used in this study.

TRANSPORT NETWORKS

Public Transport Network

3.6 The existing public transport networks in the vicinity of the site are described in the public transport note presented in Appendix B of this report and summarised below.

Rail

3.7 Cambridge Railway Station is located approximately four kilometres to the south west of the development site on the opposite side of Cambridge City Centre, beyond reasonable walking or cycling distance from the CNW site.

3.8 Vehicular access between the development site and the station is not possible across the City Centre which is pedestrianised. Vehicular traffic is required to route along Huntingdon Road to join the ring road. Traffic must then route either clockwise or anticlockwise around the City Centre to reach the station. The shortest distance between the development site and the station via the ring road is approximately 5.5 kilometres.

3.9 The approximate frequency of services operating from Cambridge Railway Station are shown in Table 3.1.

Table 3.1 - Cambridge Railway Station Services

Service	First Train from Cambridge (hours)	Peak Frequency (Trains per hour)	Off Peak Frequency (Trains per hour)	Last Train to Cambridge (hours)
Cambridge, Bishops Stortford and Harlow Town to Liverpool Street	0439	4-5	1	2015
Peterborough, Cambridge and Stowmarket to Ipswich and London Liverpool Street	0641	3-4	0.5	2243
Norwich to Cambridge and Peterborough	0649	2	2	2327
Cambridge to London Liverpool Street	0448	3-4	2	0019
Cambridge to Ely	0513	3-4	3	0027
Peterborough and Cambridge to London Kings Cross	0545	2	2	0139

Future Improvements to the Rail Network

3.10 CCC propose to redevelop Chesterton Sidings to provide a new interchange including a rail station. This could serve as an alternative to Cambridge Station for residents north of Cambridge City Centre, particularly if routes to Chesterton Interchange are less congested then those to Cambridge Station. However it is important to note that Chesterton Interchange would be a similar distance from the site as the existing Cambridge Rail Station and would not be considered accessible by foot. However the potential to encourage cycling trips between the CNW development site and Chesterton Interchange should be considered as part of the Transport Study.

3.11 The inspectors report for the Guided Busway (see Section 3.17) suggested that the busway should not be built without other improvements to transport infrastructure, including Chesterton Station Interchange. However plans for Chesterton Station Interchange are still being developed.

Bus

3.12 Existing bus services operate on Histon Road, Huntingdon Road and Madingley Road in the vicinity of the CNW site.

3.13 The bus services can be subdivided into three broad categories:

- 'Citi' services – operated by Stagecoach primarily to serve the City of Cambridge, typically operating at a frequency of 3 buses per hour in the peak hour;
- Local and rural services – provided by one of a number of bus operators connecting Cambridge with surrounding towns and villages at a variety of frequencies; and
- Park and Ride (P&R) services – a service operates to the Madingley Road P&R site, to the southwest of the University Land development site.

3.14 Detail on the routing and frequencies of existing bus services is provided in Appendix B of this report. The total number of buses per hour along roads in the vicinity of the site are as follows:

- Madingley Road: approximately 12 buses per hour (including the Park & Ride service);
- Huntingdon Road: approximately 12 buses per hour; and
- Histon Road: approximately 5 buses per hour.

3.15 Routes to the City Centre from the CNW site are generally good. However bus links to areas to the south and east of Cambridge from the CNW site are generally poor. In particular, there are no bus links between the site and Queens Road which is a major destination for Cambridge University students due to the high number of faculties and colleges in the area. There are also no direct bus links to Addenbrooke's Hospital or Cambridge Railway Station from Huntingdon Road - bus passengers must interchange in Cambridge City Centre. Some bus passengers may walk between the City Centre and Cambridge Railway Station rather than interchanging.

3.16 Although existing interchange facilities for bus passengers travelling between the site and Cambridge Railway Station are available at Cambridge Bus Station, the bus station is at capacity and new services may be required to interchange at an alternative location.

Future Improvements to Bus Services

3.17 The government has agreed to fund a Guided Busway service running from Huntingdon to Cambridge. This will provide a high quality, reliable and frequent public transport service.

3.18 Buses using the Guided Busway will travel along the disused railway line stretching from St. Ives to the Cambridge Science Park. They will then travel on existing roads through Cambridge City Centre to Cambridge Railway Station. At the railway station buses will rejoin the railway line and travel onto Addenbrooke's Hospital and Trumpington Park & Ride.

3.19 The Guided Busway route links the following destinations:

- Hinchingbrooke Hospital;
- Huntingdon town centre;

- St Ives - including a new Park & Ride site;
- Swavesey;
- A new Park & Ride site in Longstanton;
- Northstowe - Cambridgeshire's new town;
- Oakington;
- Histon & Impington;
- Cambridge Regional College;
- Arbury Park;
- Cambridge Science Park;
- Cambridge city centre;
- Cambridge Railway Station;
- Addenbrooke's Hospital; and
- Trumpington Park & Ride.

3.20 Within Cambridge the Guided Busway buses will run along Histon Road and Milton Road to the east of the CNW site.

3.21 Early proposals for the Guided Busway included a link to Chesterton Interchange. This is not included in the approved alignment for the Guided Busway, although there is potential that this link could be added in the future.

3.22 CCC have begun construction of the Guided Busway route. It is expected that the first buses will be running on the Busway in late 2008.

Public Transport Accessibility

3.23 In order to quantify the level of public transport accessibility for the CNW site 'Public Transport Accessibility Levels' (PTALs) have been calculated. PTALs are commonly expressed in terms of a numbered band between 1 and 6 (1 indicates very poor accessibility, 6 indicates excellent accessibility) and provide a simple means to compare public transport accessibility between different locations.

3.24 Peak and inter-peak accessibility levels have been calculated at 100 metres and 640[1] metres from two nominal points on each of the bus corridors proximate to the development sites (Madingley Road, Huntingdon Road and Histon Road). The areas covered by this analysis are shown in Figure 3.2.

3.25 The results of the PTAL analysis are detailed in Appendix B. The analysis indicates the following:

- Existing developments parallel to Madingley Road, Huntingdon Road and Histon Road achieve 'low' PTALs between 1a-2; and
- Existing developments within maximum walking distance (640 metres) from Madingley Road, Huntingdon Road and Histon Road achieve 'very low' PTALs between 1a and 1b.

[1] The PTAL calculation uses a maximum walk distance to a bus stop of 640 metres.

Walking Network

3.26 There is an existing network of footways and crossing facilities in the vicinity of the CNW site. Footpaths are provided on both sides of Histon Road, Huntingdon Road and Madingley Road which are of adequate width and condition. In addition signalised crossings are available at key pedestrian desire lines crossing all three roads.

3.27 Travelling toward Cambridge City Centre, Huntingdon Road, Histon Road and Madingley Road provide access to a comprehensive network of footpaths serving Cambridge, including pedestrianised areas in the City Centre. Nearing the City Centre itself some of these routes are particularly busy and footway capacity can be a problem. This is difficult to overcome given the historic nature of the buildings and road layout in the City Centre. In particular, capacity problems were observed on Northampton Street and Bridge Street during the baseline site visit. Upon reaching the pedestrianised City Centre, pedestrian priority is increased and capacity problems are reduced.

3.28 A number of side streets on Histon Road, Huntingdon Road and Madingley Road link to the development site offering the potential to increase the permeability of the site. In particular Storey's Way offers a route between the University site and Cambridge City Centre whilst Windsor Road, Blackhall Road and Brownlow Road offer routes between the NIAB site and Histon Road and Howes Place offers a route between the NIAB site and Huntingdon Road. A footpath links Whitehouse Lane with Histon Road along the CCiC/SCDC boundary.

3.29 Travelling away from Cambridge and toward the strategic road network (M11 and A14) footways become discontinuous, with no footways provided on the strategic road network. Continuous footways are available to Histon although this is considered beyond reasonable walking distance of the site.

3.30 Due to the fact that the land within the CNW site is largely undeveloped there are no existing walking routes across the site except the route linking Whitehouse Lane with Histon Road along the CCiC/SCDC boundary.

Future Improvements

3.31 No significant future improvements are planned for the walking network in the vicinity of the site.

Cycling Network

3.32 There is an extensive existing network of cycle routes in the vicinity of CNW. These are shown in Figure 3.3. Cycling routes in the area of CNW are generally radial, not orbital – this is not surprising because the land is undeveloped.

3.33 Many cyclists, such as commuters, prefer to use main roads for convenience and speed. Advisory and mandatory cycle lanes are already provided on Madingley Road, Huntingdon Road and Histon Road, although the latter does not go all the way into the city.

3.34 Mandatory cycle lanes on Huntingdon Road are fairly narrow given the nature of the road. In addition cyclists wishing to access Girton from the City Centre are required to negotiate a hazardous junction at Huntingdon Road/Girton Road. This is composed of two right turn facilities (one for right turning traffic from Huntingdon Road to Girton Road and another for right turning traffic from Girton Road to Huntingdon Road) which cross one another.

3.35 Cycle connections to the City Centre from Histon Road, Huntingdon Road and Madingley Road are generally good and include advanced cycle stop reservoirs at key junctions. However connections for cyclists from the CNW development using the inner ring road to access University buildings along Queens Road, the station or other areas to the south of Cambridge are less adequate in some areas including:

- The one way section between Huntingdon Road and Madingley Road (via Lady Margaret Road) which has sharp bends;
- The right turn from Castle Street into Northampton Street. This junction has traffic lights however right turning traffic (including cyclists) must give way to oncoming traffic); and
- At the Northampton Street/Queens Road/Madingley Road roundabout which has no facilities for cyclists despite being an important link between cycle routes on Huntingdon Road and Queens Road.

Future Improvements to the Cycle Network

3.36 CCiC have published guidelines for the future development of the cycle network in 'Protection and Funding for the Future Expansion of the City Cycle Network' (2004). This document highlights the potential for new cycle routes through the site in the following locations:

- NIAB Site:
  - An orbital route running along the eastern edge of the NIAB site;
  - An orbital route running along the western edge of the NIAB site;
  - A radial route joining the two orbital routes and running towards the City Centre along Windsor Road;
- University Site:
  - An orbital route running through the eastern part of the development site;
  - An orbital route running through the western part of the development site linking Huntingdon Road to the Madingley Road Park & Ride; and
  - A radial link through the site to Storey's Way.

3.37 For the University site the orbital routes should be linked to those servicing the University West site and subsequently the existing footpath to Coton. It is proposed that many of the new routes will be funded by developers of the CNW site.

3.38 The indicative routes are shown on Figure 3.3.

Highway Network

3.39 CNW is ideally placed for access to the strategic road network, with the A14 and M11 adjacent to it, as shown on Figure 3.4. However, at present there are capacity problems on the A14. These are being addressed by the HA (see Section 3.48).

Local Highway Network

3.40 There are three main radial routes serving the site; Madingley Road, Huntingdon Road and Histon Road. There is a Park and Ride site with approximately 500 spaces serving the former. All three roads are single carriageway. Figure 3.4 shows that junctions on all three roads are generally signalised or priority: the only roundabout is Histon Interchange at Junction 32 of the A14.

3.41 Existing traffic flows in the vicinity of the site during the AM Peak Hour (0800-0900 hours) have been taken from the HA/CCC 2003 Ellington to Fen Ditton SATURN model and are illustrated in Figure 3.5. Flows on radial routes into Cambridge City Centre are high and congestion is an issue.

3.42 Huntingdon Road and Histon Road carry approximately 1,800 vehicles per hour (two-way flow), comprising around 1,000 eastbound vehicles and 800 westbound vehicles during the AM Peak Hour. In comparison the maximum capacity of an Urban All-Purpose 2 road (such as Histon Road or Huntingdon Road) suggested in the Design Manual for Roads and Bridges is 1550 vehicles per hour per direction[2]. This suggests that both roads are approaching capacity. Histon Road has even higher flows between Junction 32 and Kings Hedges Road (almost 4000 vehicles per hour in the morning peak) although additional lanes are provided in this location. Madingley Road has the lowest flows of the three routes, although congestion has been reported in the A428 corridor study west of the CNW site, particularly on the approach to M11 Junction 13. In particular congestion was noted in the following areas during the baseline site visit:

- Along Huntingdon Road during peak hours, particularly at its junctions with Girton Road, Victoria Road and Castle Hill. This queuing appears to be a result of the capacity of the junctions (particularly Huntingdon Road/Victoria Road) and high traffic volumes accessing the City Centre;
- Along Northampton Street during peak hours on the approach to the Northampton Street/Queens Road/Madingley Road and Northampton Street/Chesterton Road junctions;
- Along The Fen Causeway which provides access from Queens Road to Trumpington Road;
- Along Victoria Road which connects Huntingdon Road and Histon Road to Mitchams Corner and east of the City Centre; and
- At Mitchams Corner itself which is a circulatory between Chesterton Road, Victoria Road, the A1303 and Victoria Avenue.

[2] Design Manual for Roads and Bridges, TA 79/99 Traffic Capacity of Urban Roads. Table 1 Types of Urban Roads and the features that distinguish them and Table 2 Capacities of Urban Roads One-way hourly flows in each direction.

3.43 The areas of congestion are concentrated along the Inner Ring Road. Traffic entering the City Centre from Histon Road, Huntingdon Road and Madingley Road with destinations to the south and west of the City Centre is likely to route via Queens Road and The Fen Causeway. This may include access to the station (accessed from The Fen Causeway via Trumpington Road, Brooklands Avenue and Hills Road or via Lensfield Road and Hills Road) and Addenbrooke's Hospital. Traffic entering the City Centre from Histon Road, Huntingdon Road and Madingley Road and requiring destinations to the south and east of the city centre is likely to route via Victoria Road and Mitchams Corner to access Victoria Avenue, Elizabeth Way and subsequently Newmarket Road and East Road. The station can also be accessed via this route from East Road/Gonville Place and Hills Road.

Wider Highway Network

3.44 The local highway network in the vicinity of the site provides access to the strategic highway network including the A14 and M11. The A14 is accessed from either Histon Interchange for traffic with destinations to the east of Cambridge or Girton Interchange for traffic with destinations to the west of Cambridge. Traffic exiting the site along Huntingdon Road and using Girton Interchange cannot route south onto the A14/M11 towards London.

3.45 Junction 12 of the M11 is accessed from Madingley Road. Traffic using this junction from Madingley Road is able to turn south onto the M11 towards London. However traffic cannot turn northwards towards the A14 to access areas to the northwest of Cambridge.

3.46 The M11 provides a motorway link between Cambridge and London. At the M25 junction traffic is able to route east to access the southeast of England or west to access the southwest.

3.47 The A14 provides a link to Huntingdon to the northwest of Cambridge and the East Anglian coast to the east. At Huntingdon, the A14 links to the A1 trunk road providing access to the east midlands and the north. From the A1 the A14 at Kettering can be used to access the M1 which provides access to the West Midlands and the north.

Future Improvements

3.48 During the consultation carried out as part of this study concern was raised about congestion on the A14, particularly as a result of the cumulative impact of developments outside the City such as Cambourne.

3.49 Capacity improvements to the A14 between Ellington and Fen Ditton are planned by the HA and are scheduled to start by 2010, subject to Public Inquiry. These improvements will include a new dual carriageway to the south of Huntingdon between Ellington and Fen Drayton and widening of the A14 to three lanes in either direction between Fen Drayton and Fen Ditton. Local access roads will also be provided alongside the A14 to separate local and strategic traffic.

3.50 Capacity improvements to the A14 will accommodate future increases in traffic in Cambridgeshire associated with new development.

3.51 As stated in Section 3.17, further highway infrastructure improvements associated with the proposed Cambridge Guided Busway between Huntingdon and Cambridge will also be provided in the vicinity of the CNW development site.

EXISTING TRAVEL PATTERNS

3.52 The existing 2001 census data for the Castle Ward has been investigated as part of this study. Approximately 40 percent of the population of Castle Ward are full time students. This makes this data particularly relevant to the University sector.

3.53 In order to gain an understanding of the existing travel patterns in the vicinity of CNW, data from the 2001 census has been analysed. The census provides statistics on the origins and destinations of workplace travel trips. The destinations of workplace trips originating from the Castle Ward (the ward covering the CNW site) is shown in Figure 3.6.

3.54 As Figure 3.6 shows, approximately 50 percent of the workplace trips originating from the Castle Ward have destinations within Cambridge. A further 35 percent have destinations within Cambridgeshire, particularly to the north of the City. The remaining 15 percent of trips have destinations outside Cambridgeshire to regions across the UK. Only 3 percent of workplace trips originating from the Castle Ward have destinations within Greater London.

3.55 Table 3.2 shows the modal share of existing workplace trips originating from the Castle Ward.

Table 3.2 - Mode Share: Castle Ward

Mode of Travel	% of Trips
Private Car	35%
Cycle	27%
Walk	16%
Home	11%
Car Passenger	3%
Bus	3%
Train	3%
Motorcycle	1%
Other	1%

3.56 The modal share for the Castle ward displayed in Table 3.2 above is compared with the average situation in Cambridge as a whole in Figure 3.7.

3.57 The data shown in Figure 3.7 suggests that the main mode of travel for workplace trips from the Castle Ward and Cambridge as a whole is the private car. The modal share for the Castle ward is slightly lower than that across Cambridge as a whole and this is likely to be due to the high percentage of students in the Castle Ward.

3.58 Modal shares for walking and cycling are slightly higher for the Castle Ward than across Cambridge as a whole which may also be a result of the high number of students (40 percent) in the ward.

3.59 The modal share for bus trips from the Castle Ward is relatively low compared to Cambridge as a whole. This is partly as result of higher percentages of trips made by walking and cycling. However it is likely that potential exists to improve the number of trips made by this mode of travel.

3.60 Figure 3.7 also shows the modal share for workplace trips from Barhill. These figures are taken from the 2001 'CCC Housing Trip Rates Report' which suggests that all new housing developments in Cambridge should use Barhill trip rates as a basis. As Figure 3.7 shows, the modal share for car trips within the Castle Ward is around half that of Barhill, whilst the modal share for walking and cycling trips are considerably higher than that for Barhill. This suggests that the Barhill trip rates should not be used to predict the number of trips generated by the CNW site without further consideration of the particular characteristics of the site. This is further discussed in Section 5 of this report.

KEY ISSUES AND OPPORTUNITIES

3.61 The reviews of the relevant planning policy and guidance, the existing transport situation in the vicinity of the site and initial stakeholder consultation has highlighted a number of key issues and opportunities associated with the proposed development of the CNW site. These are summarised in Tables 3.3 (key issues) and 3.4 (key opportunities).

3.62 The main issue for development in CNW is existing highway congestion in the vicinity of the site. Peak hour congestion on radial routes such as Huntingdon Road and at key junctions is likely to be exacerbated by further development in the area. The Transport Study must consider the traffic impact of development at CNW on these routes and include measures to mitigate this where appropriate.

3.63 Another issue for development in CNW is the location of Cambridge Railway Station some 4km from the site. This reduces the opportunities for trips to be made by public transport, particularly for long distance travel to destinations such as London. However there is potential to encourage more cycling and public transport trips to the station. This will be considered as part of the Transport Study and measures to promote sustainable travel to the station will be suggested.

Table 3.3 - Cambridge North West Development: Key Issues

Issue	Description	Cause	Impact on Transport Study
Congestion on radial routes	Peak hour congestion particularly on Huntingdon Road, Histon Road and Madingley Road.	Only routes available to traffic accessing Cambridge City Centre during peak hours from areas in northwest Cambridgeshire.	Vehicular accesses to the development site is only available from these roads. Transport options for CNW must ensure that development trips can be managed to avoid undue impact on traffic conditions on these routes.
Capacity of junctions	Signalised junctions including Huntingdon Road/Victoria Road and Histon Roundabout are operating close to/at capacity.	High traffic flows from radial routes.	Vehicular access to the development sites will impact further on the capacity of these junctions. Transport options for CNW must ensure that development trips can be managed to avoid undue impact.
Public transport	Few bus priority on radial routes into Cambridge. Buses are caught in peak hour congestion. Leads to unreliable bus journey times.	Lack of roadspace for bus priority.	Public transport improvements will be necessary to promote sustainable development at the site. Bus priority measures and new routes will be considered.
Cycle network	Some facilities for cyclists on all radial routes. Facilities and safety could be improved.	Lack of roadspace.	Cycle improvements will be necessary to promote sustainable travel to the development site and capitalise on existing cycling culture. New facilities and safety improvements will need to be considered.
Pedestrian network	Some instances where pedestrian routes do not serve desire lines.	Historical road layout.	Pedestrian improvements will be necessary to promote sustainable travel to the development site. New facilities and safety improvements will be considered. These should be incorporated into masterplans for the development site.
Accessibility of Cambridge Railway Station	Station is located on the opposite side of town some 4km from the development site, beyond reasonable walking distance.	Historical layout of the town.	Direct bus links between the development site and the station will be considered. Better cycle links between the site and station will also be considered.

Table 3.4 - Cambridge North West Development: Key Opportunities

Issue	Description	Timescale	Impact on Transport Study
Guided Busway	Guided Busway between Huntingdon and Cambridge will provide travel choice for residents of areas to the northwest of Cambridge. On road proposals for the Guided Busway on Histon Road.	2008	On road proposals on Histon Road may offer opportunities to improve bus priority which could be beneficial to public transport accessibility to the development site.
Chesterton Interchange	New railway station proposed for Chesterton to the east of the development site. Offers a potential alternative to Cambridge station.	2011?	Opportunities to access this proposed rail station will be considered. Orbital movement is required to access the station.
Park and Cycle	Opportunities for Park and Cycle facilities at the existing Madingley Road Park & Ride site or at other locations within the development.	n/a	Opportunities for Park & Cycle will be considered as part of the Transport Study.
Orbital Movements	Location of development site on both sides of Huntingdon Road offers the potential to develop an orbital movement between Madingley Road and Histon Road.	n/a	Orbital movement will be considered as part of the transport Study.
M11 northbound slips	Northbound slips on the M11 will increase accessibility to the development site by the private car.	n/a	M11 northbound slips may reduce the traffic impact of the proposed development by offering alternative routes but may conversely open up a new radial movement into Cambridge and increase congestion. The impact of slips will be considered as part of the Transport Study.

3.64 Although a number of issues are associated with development of the CNW site a number of opportunities also exist that could serve to facilitate development. In particular, proposals for the Cambridgeshire Guided Busway which will run along Histon Road will improve public transport accessibility for some residents of CNW.

3.65 The location of the CNW site on both sides of Huntingdon Road also creates the opportunity to develop an orbital route between Madingley Road and Histon Road. Cambridge City has a general lack of orbital routes and stakeholder consultation suggests that such a route would be particularly welcome. This will be further considered as part of the Transport Study.

3.66 The issues and opportunities for development in CNW have formed the basis of development of strategic options for the Transport Study, as outlined in Section 5 of this report.

Figure 3.1 - CNW Site Accessibility

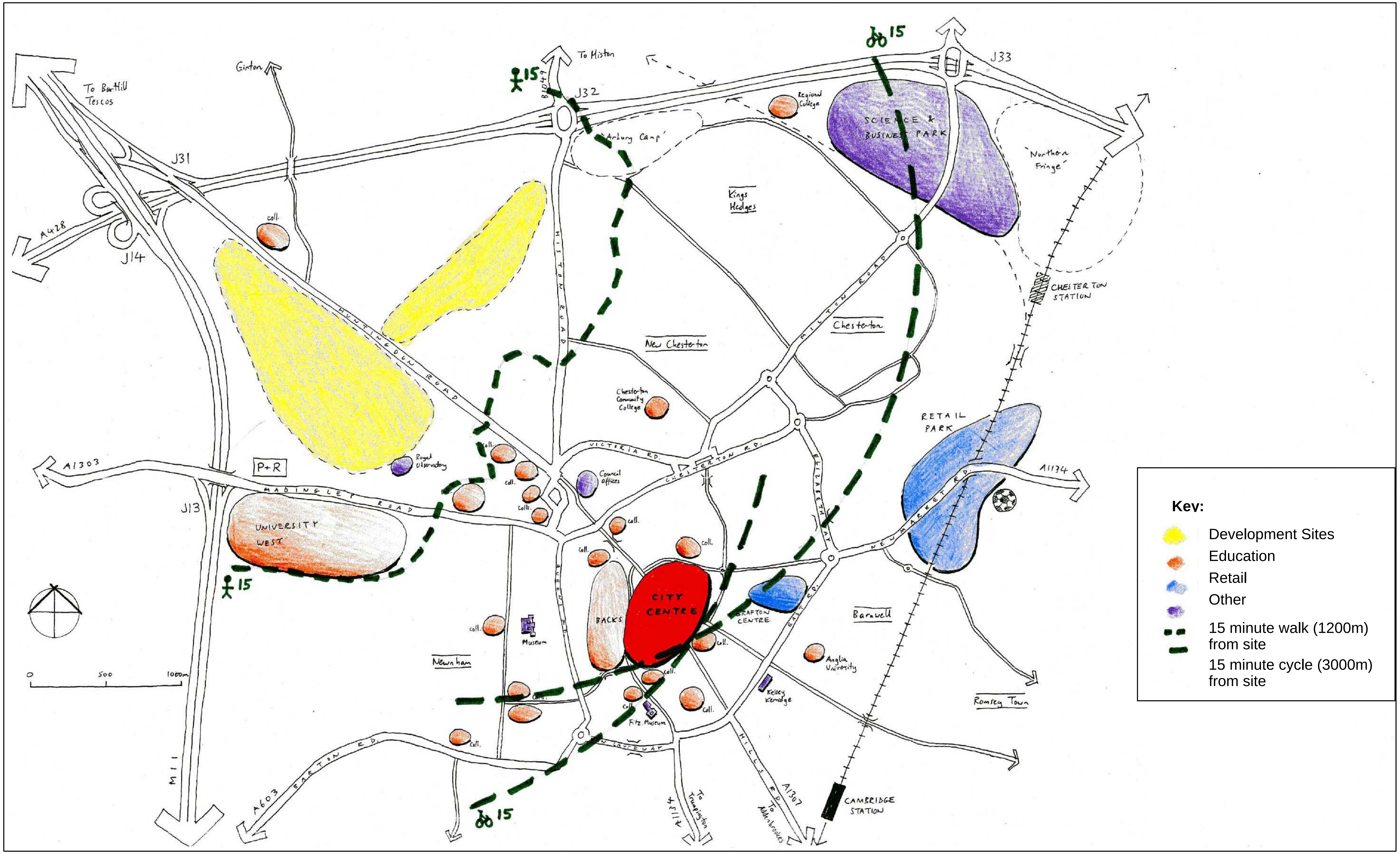


Figure 3.2 - Public transport access isochrones: 640 Metres Distance

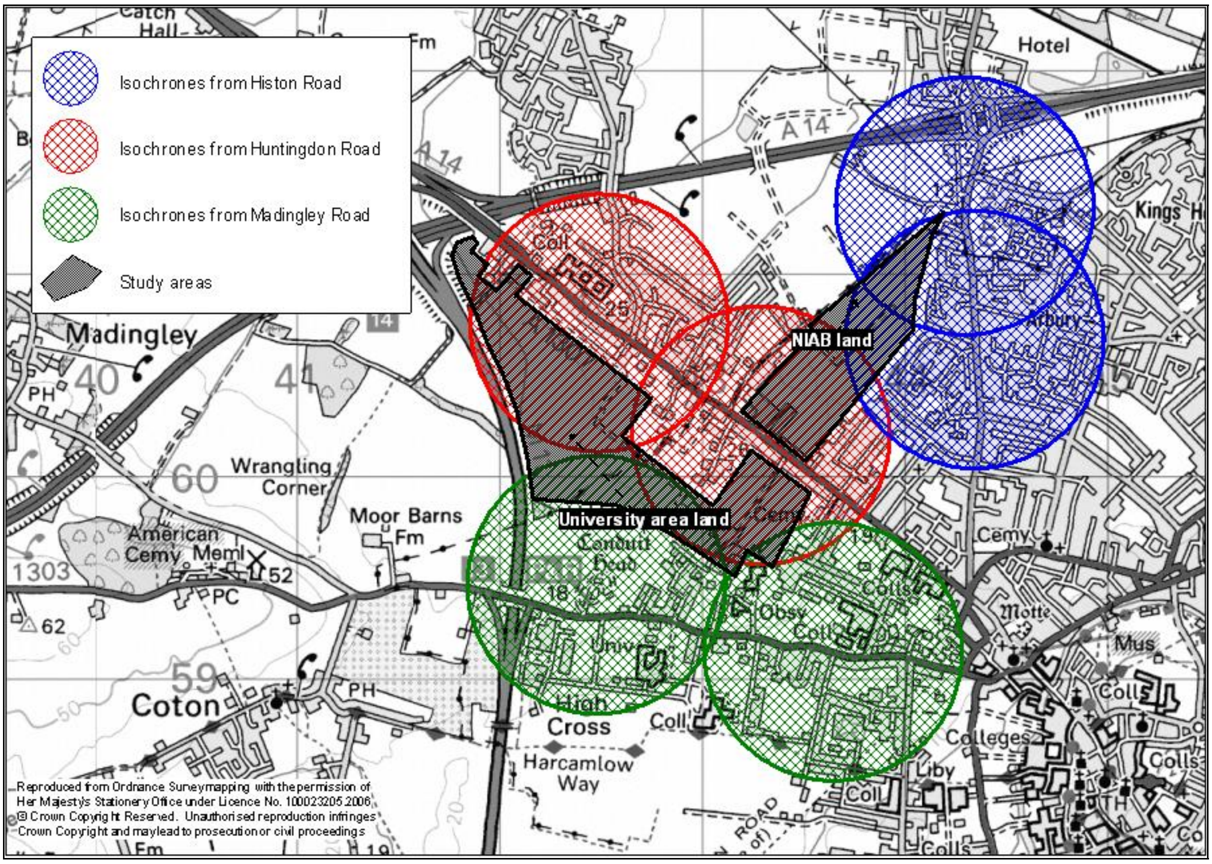


Figure 3.3 - Existing Cycle Network

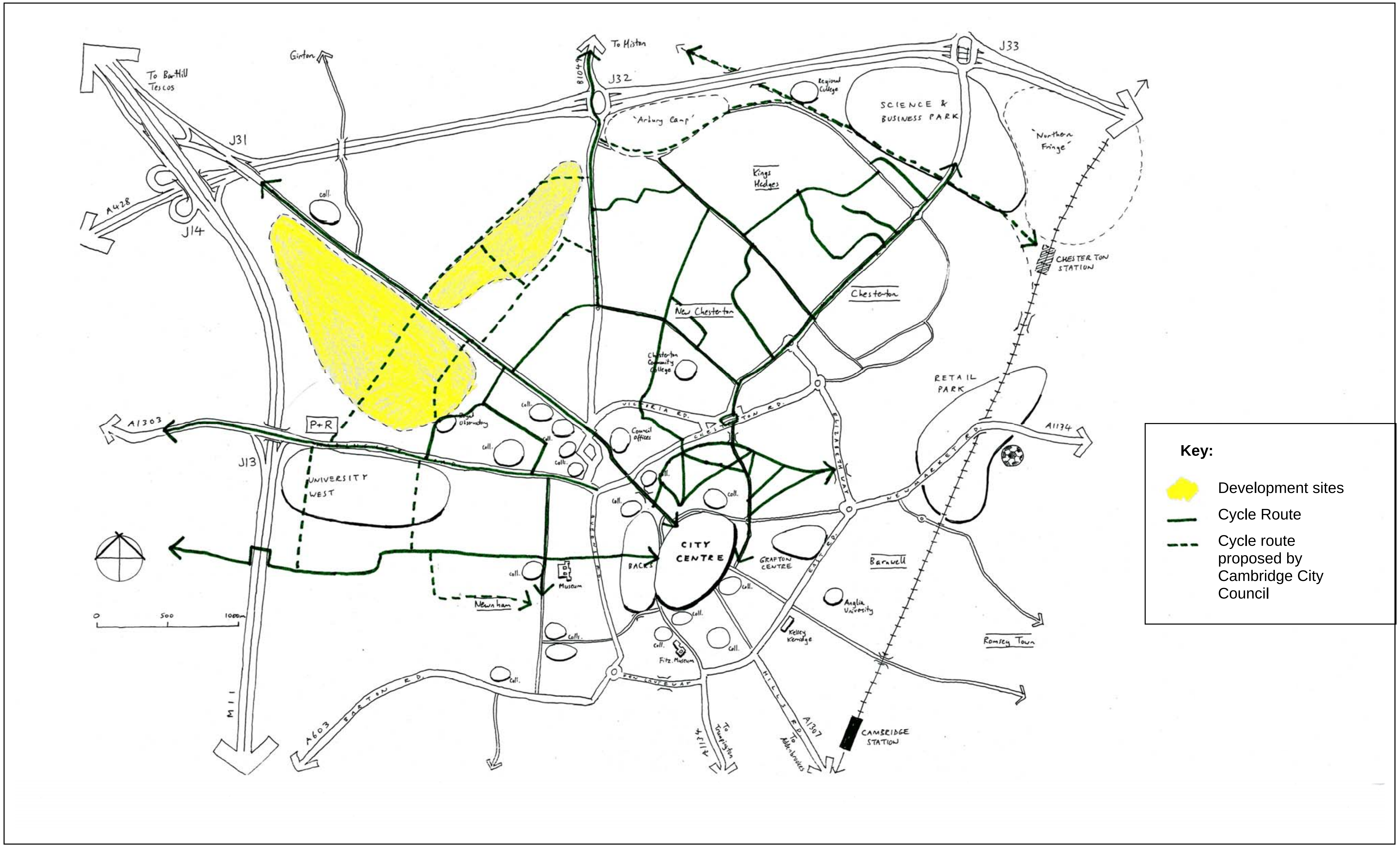


Figure 3.4 - Existing Highway Network

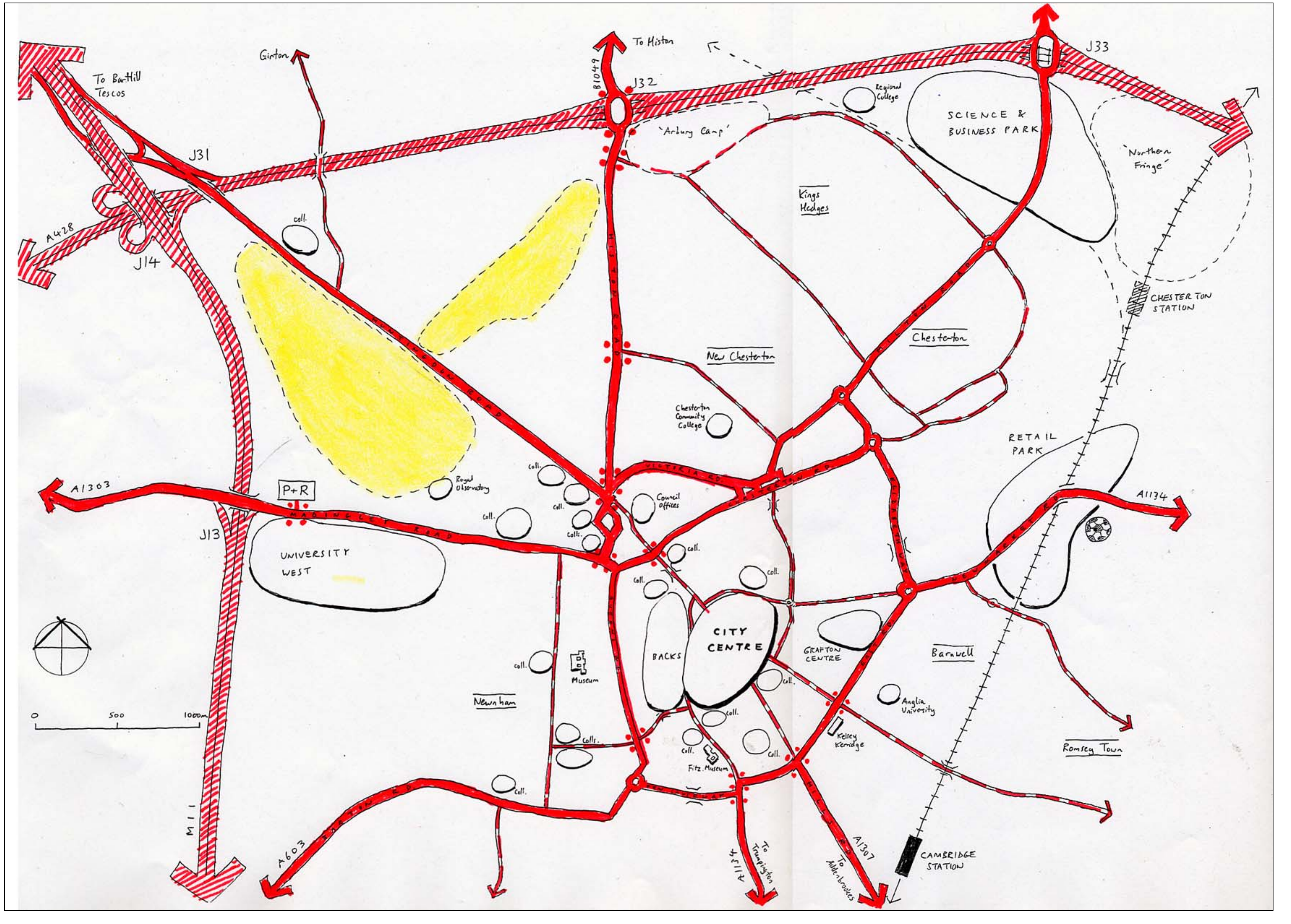


Figure 3.5 - Existing Traffic Flows Vehicles (2003): AM Peak Hour 0800-0900 Hours

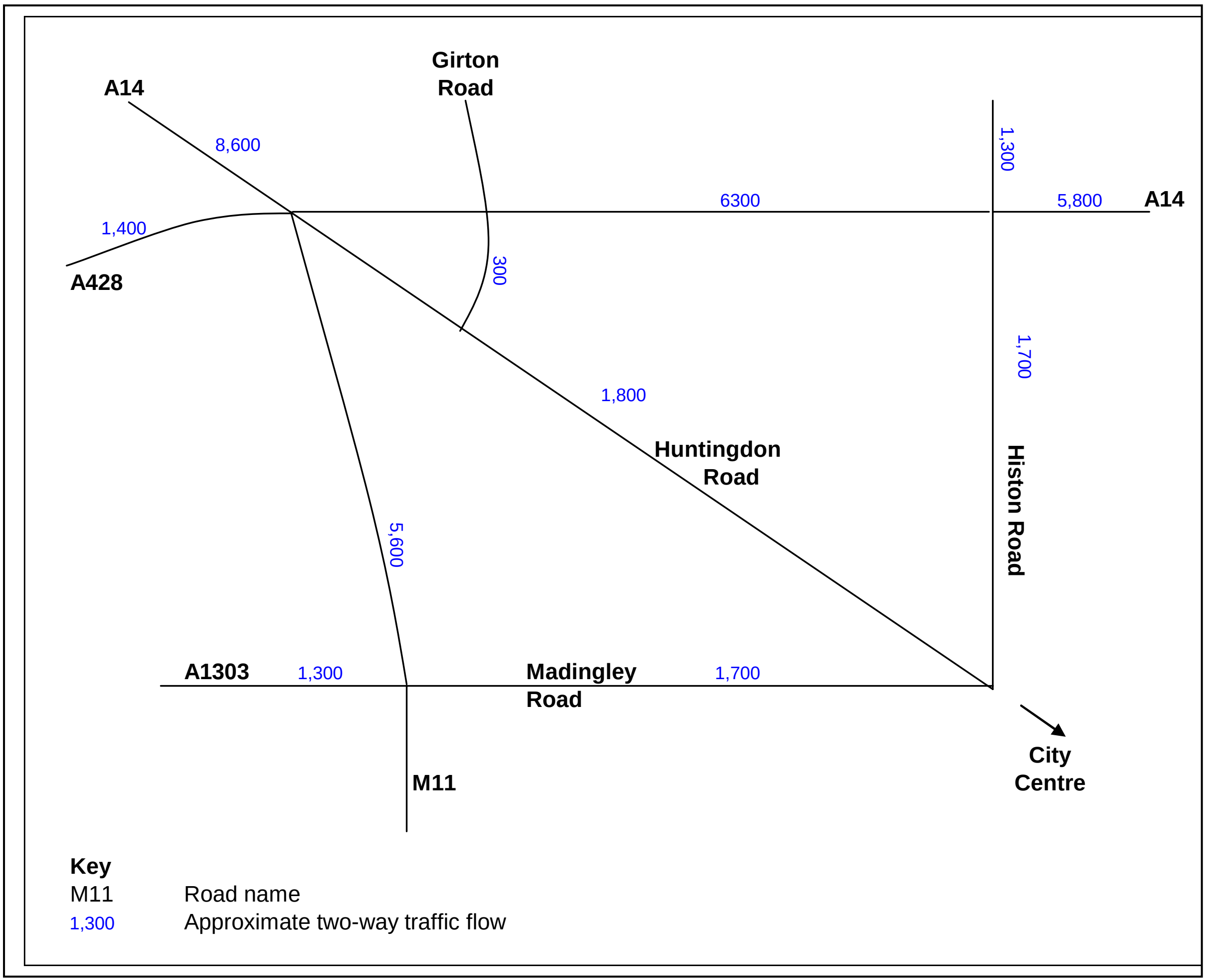


Figure 3.6 - Origin of Workplace Trips: Castle Ward

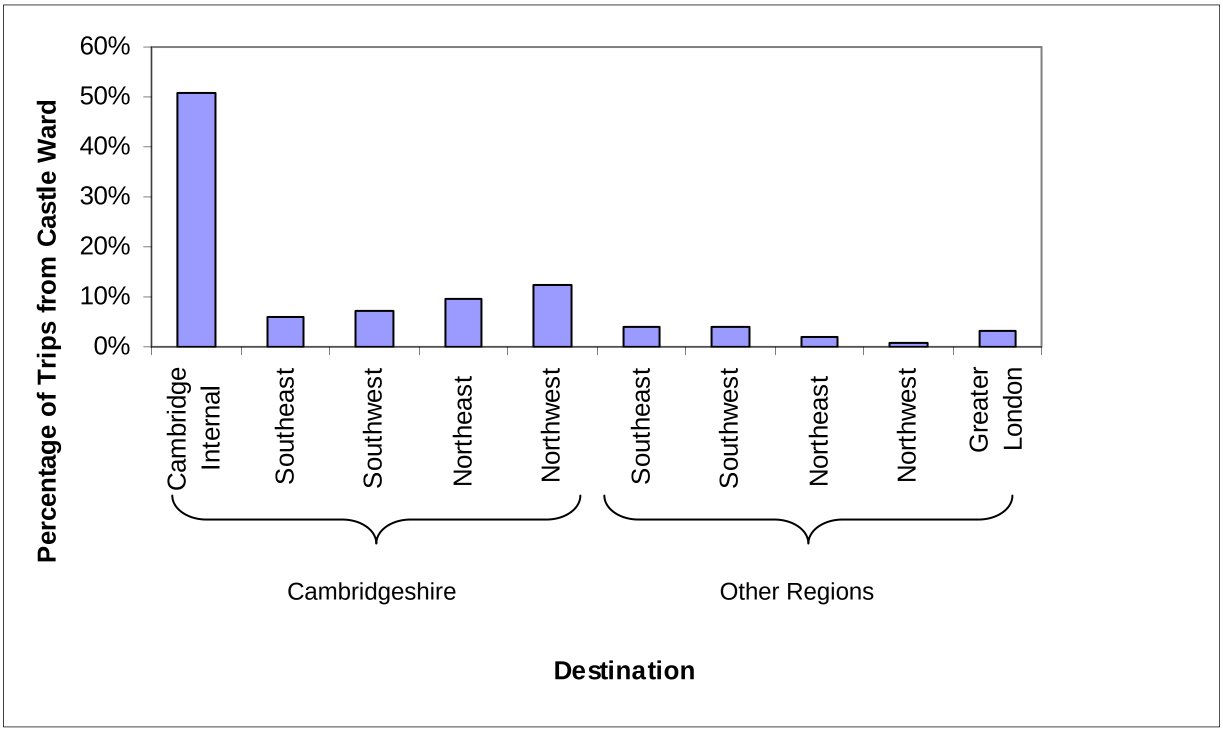
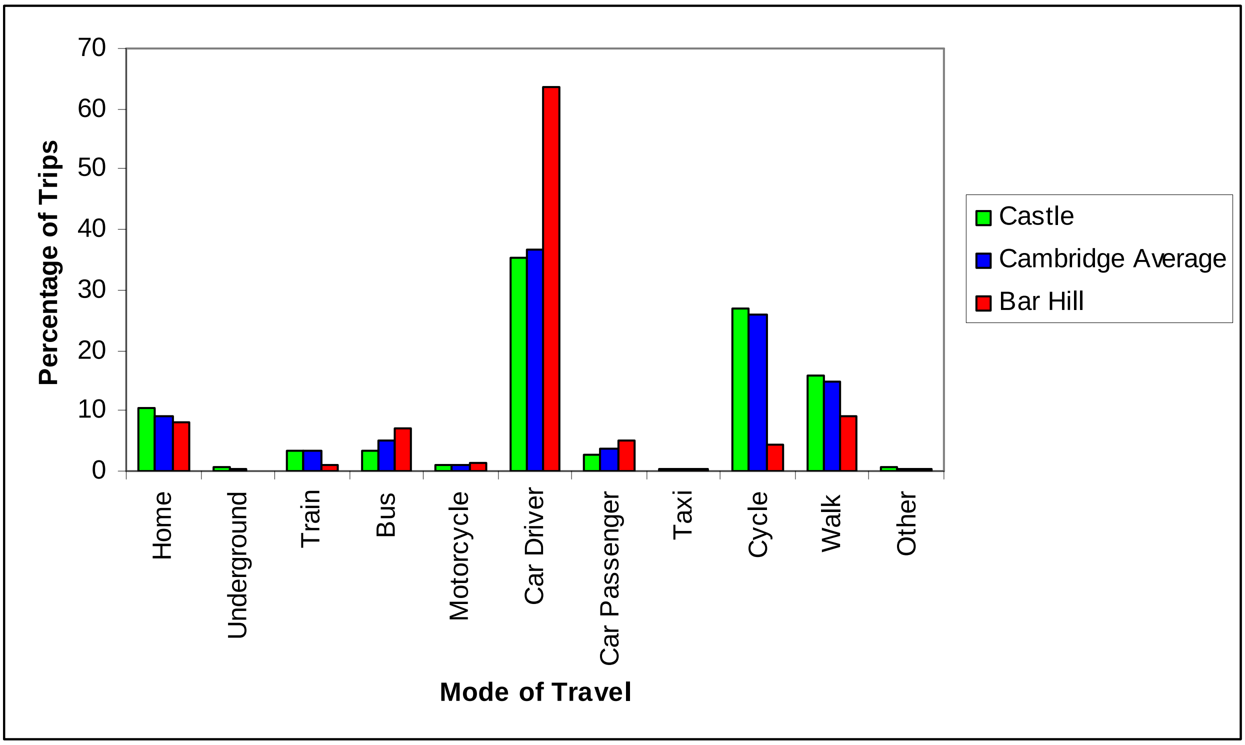


Figure 3.7 - Modal Share: Cambridge, Barhill and Castle Ward



4. Methodology

PHILOSOPHY

4.1 Planning policy from the Cambridge and Peterborough Structure Plan and Cambridge Re-Deposit Local Plan (see Section 2) sets various transport objectives that are themes of this study. The need for direct walking and cycling routes (Policy P1/3), good access by public transport (P1/3) and managed access for private cars that reduces the need to travel (P1/3; P8/1) are particularly relevant.

4.2 The Transport Study is therefore based on a ‘predict, provide and promote’ approach to walking, cycling and public transport infrastructure; but a demand management approach to travel by private car.

4.3 Clearly some additional car trips will result from development in Cambridge North West even when travel is minimised and other modes of travel are available. The approach is to manage these trips by providing only infrastructure to mitigate these trips; rather than to provide additional infrastructure to stimulate car travel.

PROCESS

4.4 Figure 4.1 illustrates the process followed during the study. The work was split into three stages:

- Stage 1: Baseline review of information;
- Stage 2: Option generation and evaluation; and
- Stage 3: Development of the Preferred Transport Option.

Stage 1: Baseline Review

4.5 During the baseline review information was collected on the background to the study and existing situation in the vicinity of the site as follows:

- Planning policy guidance review (see Section 2);
- Review of other relevant studies (e.g. CHUMMS and LTTS);
- Review of the HA/CCC Ellington to Fen Ditton SATURN model; and
- Site visits to determine the existing situation in the vicinity of the site.

4.6 Initial consultation was also undertaken at this stage of the study in order to understand the main aims and objectives for future development of the site from key partners and facilitators. Consultees included:

- Officers from CCC, CCiC and SCDC;
- Members from CCC, CCiC and SCDC;
- Cambridgeshire Horizons;
- The HA;

- Transport consultants for NIAB; and
- Transport consultants for Cambridge University.

Stage 2: Option Generation and Evaluation

4.7 Options for different land uses and supporting transport infrastructure were analysed in Stage Two. The main steps were:

- **Generate options:** Two land use scenarios were created based on the planning policy review and consultation: 'allocated development' levels and 'sensitivity test development' levels (as described in Table 1.1). For transport, three traffic infrastructure options were generated. Walking, cycling and public transport strategies were found to be interchangeable between traffic options.
- **Initial assessments:** A review of the three traffic options was carried out using the 'Webtag' impact checklist. Impacts were assigned to each option using engineering judgement on a seven point scale. A broad prediction of public transport demand was also calculated. From this work, two traffic infrastructure options were selected for detailed evaluation. Further details of this process are included in Appendix C.
- **Evaluate options:** The two traffic infrastructure scenarios were permutated with the two land use scenarios and modelled using various traffic modelling packages as described below.

4.8 Further consultation with the key partners and stakeholders outlined in Section 4.6 was carried out at this stage of the study to ascertain their views on the strategic options developed as part of the Transport Study. The findings of the consultation informed the choice of the Preferred Transport Option.

Stage 3: Development of the Preferred Transport Option

4.9 In Stage Three, the Preferred Transport Option was elaborated upon to provide more details on delivery, such as costs, phasing and timescales.

Consultation

4.10 The approach to consultation was to work with key stakeholders to achieve consensus during the process. Public exhibitions on the draft Transport Study took place as part of the Area Action Plan process on Friday 6, Tuesday 10 and Monday 23 October 2006, offering the opportunity for comments.

TRAFFIC MODELLING

4.11 There are three strategic multi-modal models which have recently been used to forecast transport conditions in the Cambridge / Huntingdon area. These are:

- County Model maintained by CCC;
- CHUMMS Model developed for the CHUMMS study; and
- The HA's A14 Ellington to Fen Ditton Model.

4.12 The three models are similar in that they operate on the basis of conventional four-stage transport models and use the same land-use model for trip generation and distribution (MENTOR).

4.13 The HA model was selected for three main reasons. Firstly, it has a separate local highway model which has been adjusted to reflect observed trips, unlike the other models – so it should be the most accurate. Secondly, it was accepted by the HA as appropriate for modelling the A14. Finally it is also being used for the nearby Cambridge East study.

4.14 There was very little modelling information available to use for assessing individual junctions and several new junctions are proposed as part of the transport options for the CNW site that could not have been modelled previously. For these reasons, new LINSIG models were built to model the signalised junctions. This was considered reasonable as the junctions were sufficiently far apart that independent signal timings be appropriate. The only exception was at the Histon Road interchange where a TRANSYT model was supplied by WSP (on behalf of Gallaghers) to model the interaction of the proposed site access, Kings Hedges Road and the roundabout above Junction 32 of the A14. This TRANSYT model has been reviewed and 'signed off' by the HA.

4.15 It was agreed with CCC that the method for determining traffic flows from the development should be the same as that used for Cambridge East. The model includes some development within the CNW area between 2003 and 2025. As the trip rates for this development cannot be ascertained these trips have been left in the model. Trips generated by the additional development required to bring the CNW area up to the two land use scenarios detailed in Table 1.1 (i.e. land use within the model subtracted from allocated/sensitivity land use) have been predicted using the TRICS database. These additional trips have been added to the relevant zones of the model.

4.16 The trip rates used for additional development are detailed in Appendix D of this report. Residential trips were predicted using the Barhill trip rates outlined in 'CCC Housing Trip Rates, Comparison of Surveys' (October 2001) which were determined from survey data. These trip rates are to be used as a starting point for all new developments in Cambridge. New trips for other land uses were calculated using selected sites from the TRICS database as a first estimate.

4.17 Initial modelling carried out using the Barhill vehicular trip rate for the CNW site suggested that this trip rate was not suitable for accurately assessing the impact of the development (see Section 3.60). As a result the original trip rates used were reviewed. The full review is included in Appendix D of this report. The results indeed suggest that the Barhill trip rates are not suitable for assessing the trips generated by the residential elements of the CNW development as a higher proportion of trips are made by car than within Cambridge. A new trip rate was therefore derived using a range of data, as shown in Table 4.1.

4.18 This trip rate was further reviewed to account for the package of measures to encourage use of sustainable modes of travel associated with the Preferred Transport Option for CNW (see Section 7). The methodology for generating this reduced vehicular trip rate is outlined in Appendix D of this report. The reduced trip rate is also shown in Table 4.1.

Table 4.1 - CNW Car Driver Trip Rates

Source	In	Out	Total
Barhill Survey	0.07	0.41	0.48
Suggested CNW	0.05	0.32	0.37
Reduced CNW	0.04	0.26	0.31

4.19 The nodes and links in the A14 Ellington to Fen Ditton model were revised locally to reflect the two traffic infrastructure strategies (Options A and B).

4.20 The A14 Ellington to Fen Ditton model was run for the following scenarios (all AM Peak Hour):

- 2003 Base;
- 2025 Base;
- 2025 Approved Land Use;
- 2025 Sensitivity Land Use;
- 2025 Approved Land Use, Highway Option A;
- 2025 Sensitivity Land Use, Highway Option A;
- 2025 Approved Land Use, Highway Option B;
- 2025 Sensitivity Land Use, Highway Option B; and
- 2025 Preferred Highway Option (Approved Land Use, Highway Option A).

4.21 The base and land use/infrastructure models were run using the Barhill trip rate as a worst case scenario. The Preferred Highway Option was run using the reduced CNW trip rates to reflect the range of measures included within the Preferred Transport Option to promote sustainable development (see Section 7).

4.22 Initial estimates of likely junction layouts, staging patterns and intergreen times were made to feed into the A14 Ellington to Fen Ditton model. These were manually adjusted a number of times once the model had been run to generate the most realistic results. This was undertaken as the SATURN model does not have the ability to optimise signal timings.

4.23 Road characteristics were adjusted using speed restrictions to simulate the effect of more torturous alignments: for example, development access roads designed not to represent through traffic routes.

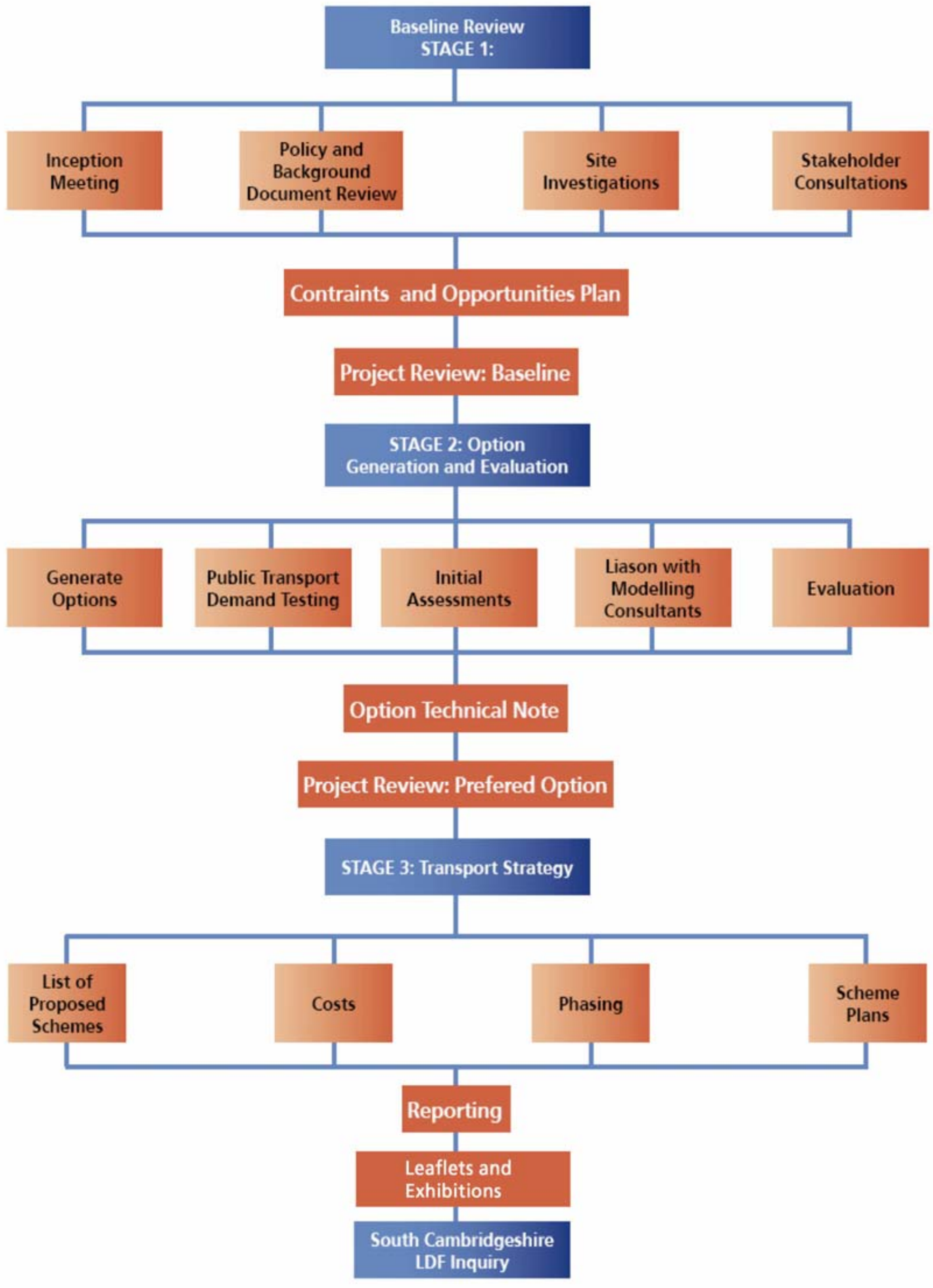
4.24 In order to carry out local junction assessments the output traffic flows and junction designs (where applicable) from the A14 Ellington to Fen Ditton Model were then input into the LINSIG models. For the TRANSYT model the base flows within the model were growthed up according to the percentage change between base and future scenarios as predicted by the SATURN model for each development option. This process was agreed with CCC and the HA.

Key Assumptions

4.25 A number of key assumptions are inherent in the modelling work. These include:

- That the A14 Ellington to Fen Ditton SATURN model network is representative of the highway network in Cambridgeshire (this is the view of the HA);
- That the development included in the A14 model used suitable trip rates and distribution (the model was validated against observed flows);
- That trip distribution for CNW will be the same as for existing zones in the model (i.e. the pattern of origins and destinations will be the same);
- That Bar Hill and TRICS trip rates are a suitable proxy for new development at CNW (as agreed with CCC);
- That the sustainable trip rates proposed are suitable for the site and can be achieved through a package of sustainable measures included in the Preferred Transport Option;
- Modal share will be the same for all options, and will not change with time (all options have similar objectives, and this simplification helps to make relative comparisons of performance);
- Future land use patterns will reflect CCC's structure plan review; and
- Traffic growth in Cambridge between 2003 and 2016 is included in the model.

Figure 4.1 - Method of Approach



5. Strategic Options

5.1 This section of the report outlines the strategic options which have been developed as part of the Transport Study. These are based on the issues and opportunities identified during the baseline analysis. This section of the report first describes the options explored for promoting sustainable travel for the site and then the two strategic highway options. These highway options have been developed to reduce the impact of vehicular access to the site on the surrounding highway network, whilst ensuring a demand management approach to travel by the private car.

5.2 As stated in Section 4, the strategic options have been developed with consideration to the following:

- Issues and opportunities identified during the baseline review;
- Aims and objectives of this study;
- Planning policy guidance; and
- Land use assumptions.

PROMOTING SUSTAINABLE TRAVEL

5.3 A number of strategies have been developed to promote sustainable travel for the CNW development. These are based upon:

- 'Predicting' both the demand for trips and the likely destinations for trips by each mode of travel;
- 'Promoting' the use of sustainable travel by meeting or exceeding the predicted requirements; and
- 'Providing' ensuring that all the measures identified are provided within the Preferred Transport Option.

Public Transport

5.4 The PTAL analysis described in Section 3.23 indicated that existing public transport accessibility near to and within the proposed CNW development site is low. The Public Transport Strategy for the development aims to improve this situation and achieve higher levels of accessibility than generally exist in Cambridge.

5.5 The Public Transport Strategy achieves this by bringing higher public transport service levels to the greatest possible site area. Routes through the sites have been developed in conjunction with the highway and walking/cycling strategies while the bus service options proposed, aim to maximise accessibility of the sites.

University Land

5.6 It is proposed that the Public Transport Strategy for the University land site should make use of an east-west road through the heart of the development. The main features of this are:

- ♦ Connection to Madingley Road in the southeast of the site – to allow a new bus service to operate through the whole development and then continue in to the City Centre with possible onward connection to the Cambridge Railway Station and Addenbrooke's Hospital;
- ♦ Connection to Huntingdon Road in the northwest of the site. This provides the facility for existing bus service on Huntingdon Road to divert into the site, thereby taking advantage of bus priority facilities that could be provided; and
- ♦ Direct connection is also provided to a possible future P&R site in the northwest corner of the development.

5.7 In addition a north-south spine road is envisaged, connecting Madingley Road with Huntingdon Road and the NIAB site. An additional connection could be provided to the northeast corner of the Madingley Road P&R site to allow bus services to operate into the University West area and/or onwards to the NIAB site.

5.8 The proposed new/amended routings are shown in Figure 5.1.

NIAB Land

5.9 Within the NIAB land site it is proposed that a north-south road is provided, connecting with the same from the University land site at Huntingdon Road and also with Histon Road in the northeast corner of the site, forming an orbital public transport route through the sites. The road will enable:

- ♦ A new bus service to operate though the NIAB site, continuing on to the City Centre and potentially beyond via either Huntingdon Road or through the University land site and Madingley Road; and
- ♦ An orbital route to continue from the University land site through the NIAB land site (via a direct link between the two sites to minimise delay and maximise journey time reliability and legibility of route) and then north-eastwards along King's Hedges Road to the Science Park.

5.10 Unlike the University land site the new spine road is unlikely to offer a journey time saving to existing services in the area (for example, those on Histon Road to the east of the NIAB site). Furthermore, diverting services away from Histon Road would reduce the public transport accessibility of the already developed Arbury area of the City.

5.11 The public transport link between the two sites should be direct to minimise delay and maximise journey time reliability and legibility of the route. This is best achieved through a crossroads arrangement with public transport priority measures as necessary.

5.12 The proposed new/amended routings are shown in Figure 5.1.

Walking Strategy

5.13 The proposed Walking Strategy is shown in Figure 5.2.

5.14 It is recognised that the majority of walking trips generated by the development will be internal to the development site. Nevertheless opportunities also exist for walking trips to be made to existing schools and colleges in the vicinity of the site, the University West site and Cambridge City Centre. Many of these destinations are considered beyond reasonable walking distance; however it is likely that some people will find the distance acceptable especially given the level and nature of routes.

5.15 The Walking Strategy is based around a grid system of walking routes within the development sites, providing maximum permeability to destinations within the development. In particular these will provide access to the local centres. As for the Public Transport Strategy, pedestrian links between the development sites should be direct.

5.16 The grid system will connect to existing walking routes on Histon Road, Huntingdon Road and Madingley Road. It is recommended that as many connections as possible are provided between the development sites and these routes. Existing opportunities for connections are available at the following locations:

- Histon Road:
  - Development access;
  - Brownlow Road;
  - Windsor Road;
  - Blackhall Road;
- Huntingdon Road:
  - Development access;
  - Whitehouse Lane;
  - Oxford Road (served from Windsor Road);
  - Howes Place;
  - Hoadly Road/Eachard Road/Sherlock Road/Sherlock Court;
  - Accesses to University buildings;
- Madingley Road:
  - Park and Ride access;
  - Development access;
  - Storey's Way; and
  - Accesses to University buildings.

5.17 Where feasible these links should be in the form of separate cycle and footpath links.

5.18 It is also important that the Walking Strategy complements the Public Transport Strategy detailed above.

Cycling Strategy

5.19 The proposed Cycling Strategy is shown in Figure 5.3.

5.20 The main destinations for trips made by cycle are likely to be Cambridge City Centre, Cambridge Science Park and Cambridge Railway Station. This suggests that the Cycling Strategy must provide for radial movements toward the City Centre and orbital movements around the edge of the City.

5.21 The Cycling Strategy includes a new orbital route that would link eastwards to Histon Road (connecting to an existing route serving the Science Park) and southwards to Coton path. This will form part of a wider orbital route around the outside of the City as outlined in 'Protection and Funding for the Future Expansion of the City Cycle Network' (2004). This route has the potential to reach Chesterton Interchange, providing a direct and convenient cycle route between the sites and the new station. From Coton Path, the University buildings located on Queens Road can be accessed.

5.22 The orbital route will be connected at the new junction on Huntingdon Road which will provide access to both development parcels. Dedicated cycle facilities should be provided at this junction in the form of cycle lanes and cycle stop reservoirs. Wherever possible it is recommended that the cycle lane is segregated from the carriageway. The new junction should provide direct connections for public transport, cyclists and pedestrians.

5.23 Links will also be provided to Park and Ride interchange sites and into existing networks via Windsor Road and Storey's Way. The overall aim is to link to existing cycle paths where available.

5.24 Radial cycle routes will also be provided between the orbital cycle route and Histon Road and the orbital cycle route and Storey's Way. These will provide alternatives to the existing mandatory cycle route on Huntingdon Road which should be widened where possible. For the University site, the opportunity exists to provide an alternative cycle route to Huntingdon Road stretching from the northeastern part of Huntingdon Road right through the site and emerging at Storey's Way. This would improve accessibility to Cambridge Rail Station for residents of the University site and surrounding areas.

5.25 Within the development itself, it is recommended that excellent facilities are provided for cyclists including:

- A network of segregated cycle lanes within the development providing maximum permeability for cyclists to the surrounding cycle network and to the local centre;
- Cycle parking spaces at the local centres of both parts of the development;
- Cycle storage for all dwellings located in both parts of the development; and
- Cycling schemes and information published through community schemes and schools.

5.26 It is also recommended that the developers of the CNW site should consider including improvements to cycle parking and other facilities in Cambridge City Centre and at Cambridge Station. In addition suitable provision should be made for future cycle parking at Chesterton Interchange, which may be secured by investment from the developers as appropriate. The needs of local cyclists should also be considered through appropriate negotiation with local cycle groups.

STRATEGIC HIGHWAY OPTIONS

5.27 Strategic alternatives for the highway network in the vicinity of the site aim to provide some traffic capacity to serve the new development whilst assuming for nil detriment to the overall highway network in the vicinity of the site. The approach is one of demand management which will complement the walking, cycling and public transport strategies.

5.28 Two strategic highway options have been developed as detailed below. Both highway options encompass the public transport, walking and cycling strategies described above and have been the subject of testing using the SATURN model.

Option A: Orbital Link

5.29 Highway Option A is shown in Figure 5.4. It includes an orbital link road between Madingley Road and Histon Road running through each of the development sites. This road will provide access to the development but will also create additional highway capacity. This additional capacity presents the opportunity to divert trips from existing radial routes (such as Huntingdon Road, Histon Road and Madingley Road). The capacity created on radial routes from diverted trips could subsequently be used for bus priority or pedestrian/cycle measures.

5.30 It is not intended that this option should encourage additional vehicular trips on the network. As such the additional capacity created will be equal to the additional demand created by development and the capacity removed from radial routes and given over to bus priority or pedestrian/cycle measures.

Option B: M11 Slip Roads and Extended Park & Ride

5.31 Highway Option B is shown in Figure 5.5 and is based around providing northern slip roads at M11 Junction 11. As for Option A, these would provide additional highway capacity to accommodate development; however they would also open up a new route into the development site and the City Centre. It is likely that this proposal would relieve traffic pressure on Huntingdon Road and possibly alleviate congestion at Histon Interchange by opening up an alternative route into the City Centre. Any spare capacity generated here could be used for bus priority or pedestrian/cycle measures.

5.32 In addition to the M11 slips an orbital link would be provided between Madingley Road and Histon Road running through each of the development sites. However this route will be tortuous with a high number of bends and/or associated traffic management discouraging through traffic from using this route. This would enable development traffic to reach the existing highway network in the vicinity of the site whilst preventing non-development traffic from “rat-running”.

5.33 Highway Option B would also include an extension to the Madingley Road Park & Ride to accommodate the additional demand created by opening up a new route into the City Centre. An additional capacity restraint may also be required downstream of the P&R to achieve this aim.

5.34 As for Option A, it is not intended that this option should encourage additional trips on the network. As such the additional capacity created will be equal to the development traffic plus the capacity removed from radial routes.

WEBTAG Assessment

5.35 A strategic transport appraisal of the two highway options had been carried out based on the 'Webtag' framework (http://www.webtag.org.uk). This is fully detailed in Appendix C of this report and summarised below.

5.36 In order to carry out the assessment a reference case is required. This was taken as the new development with a tortuous orbital route to prevent rat-running of non-development related traffic, as outlined for highway Option B. No other highway measures are included in the reference case.

5.37 A standard seven point rating system has been used with the potential range of scores for the total of 22 sub-objectives being +/- 66.

5.38 The results of the assessment are as follows:

- Option A: The overall score is -3, which means that Highway Option A scores slightly lower than the reference case;
- Option B: The overall score is -5, which means that Highway Option B scores slightly lower than the base case and also slightly lower than Highway Option A.

5.39 The Webtag assessment suggests that there is little difference in the impact of the two highway options. However the assessment does not allow for weighting of the criteria, nor for considering deliverability.

5.40 The results of the assessment will be quantified with further testing, as described in Section 6 of this report.

Figure 5.1 - Public Transport Strategy

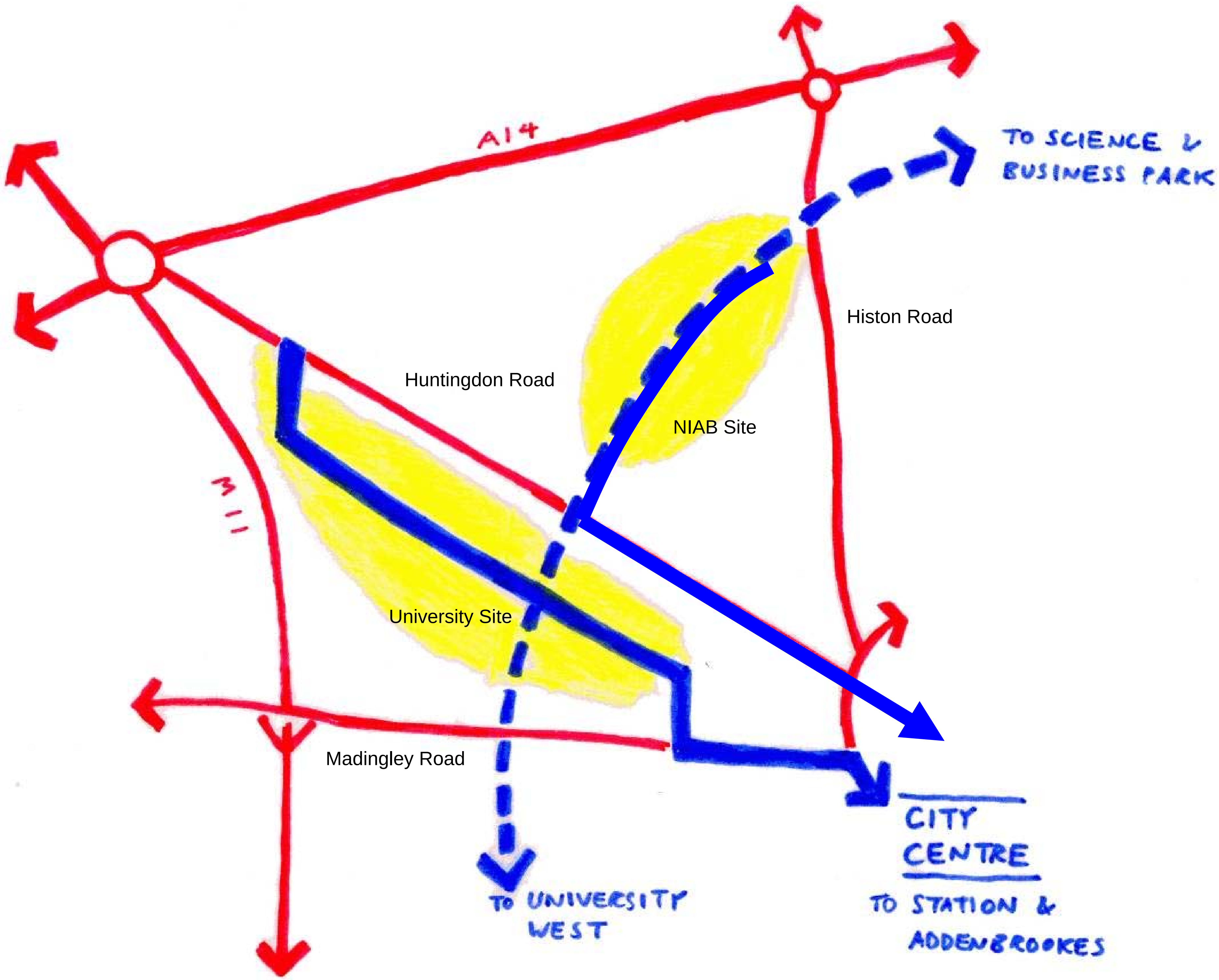


Figure 5.2 - Walking Strategy

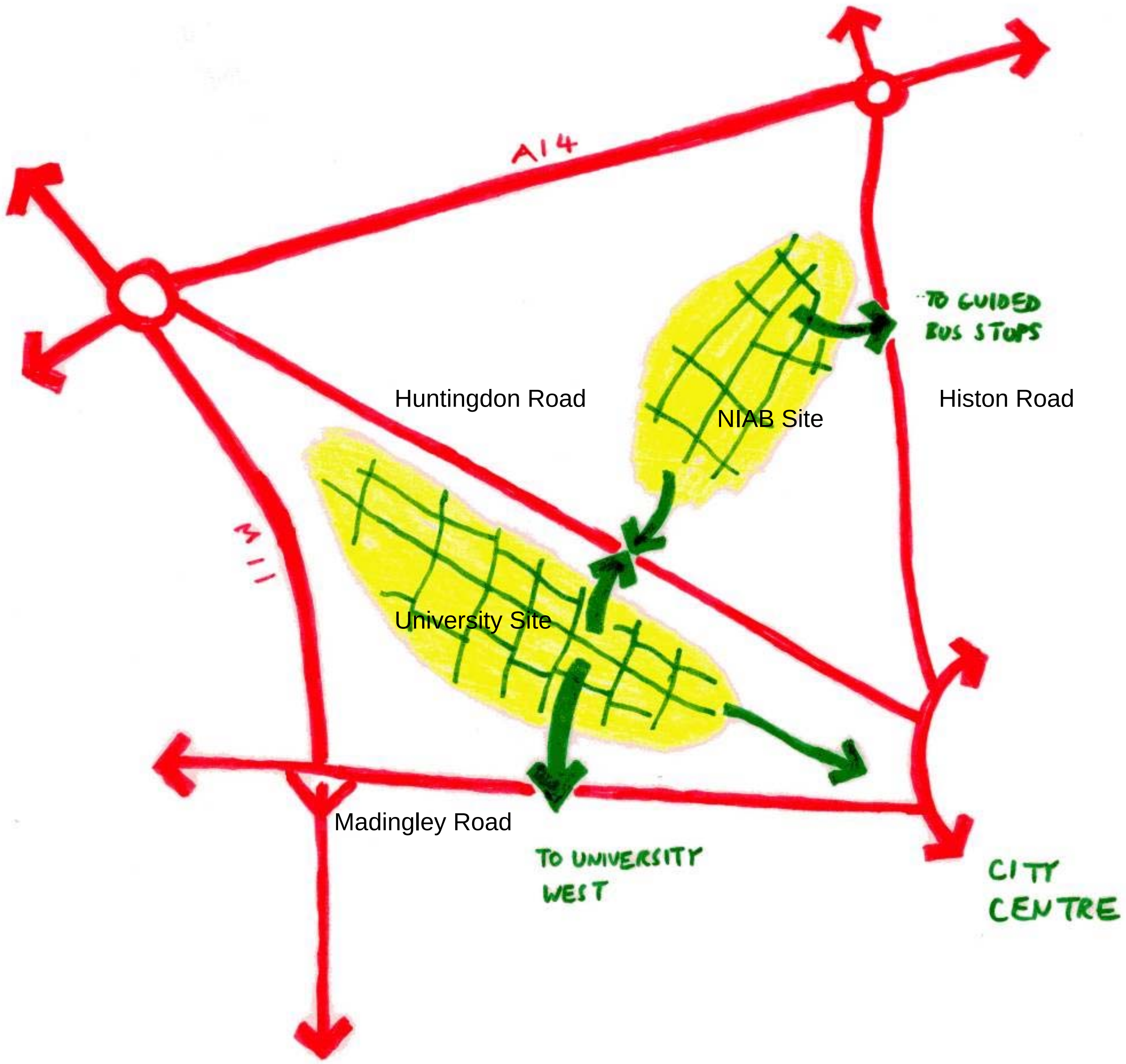


Figure 5.3 - Cycling Strategy

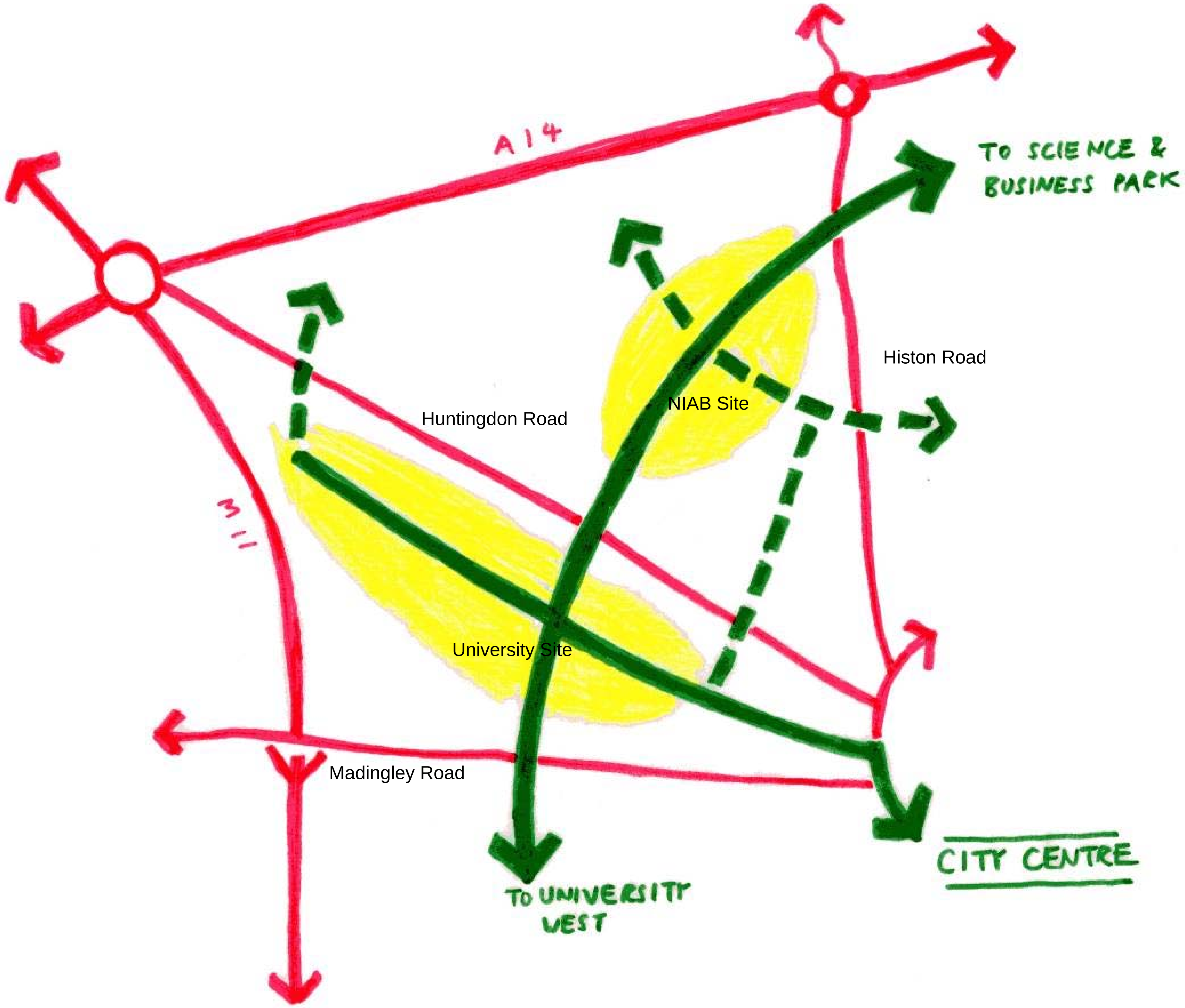
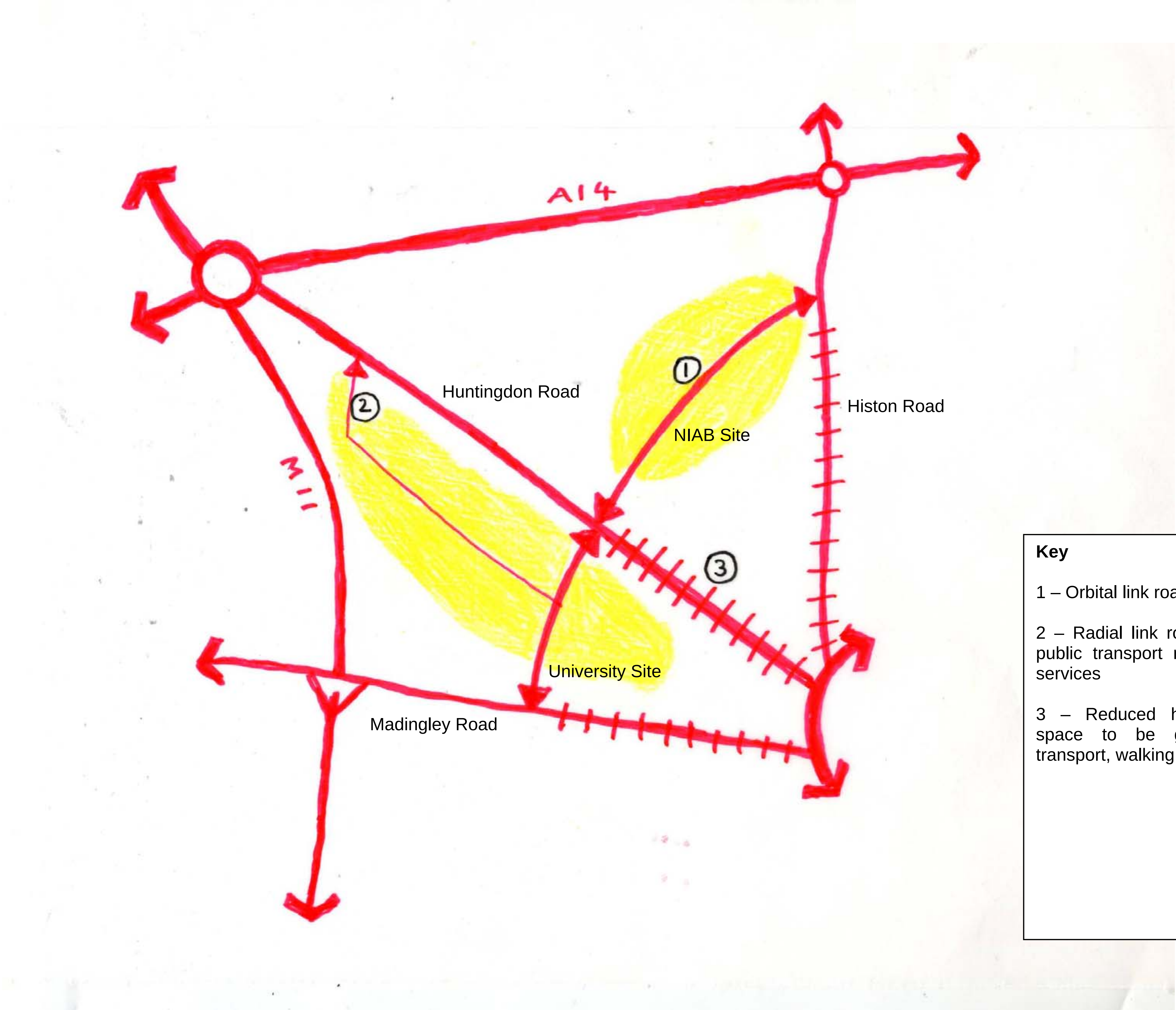


Figure 5.4 - Strategic Highway Option A



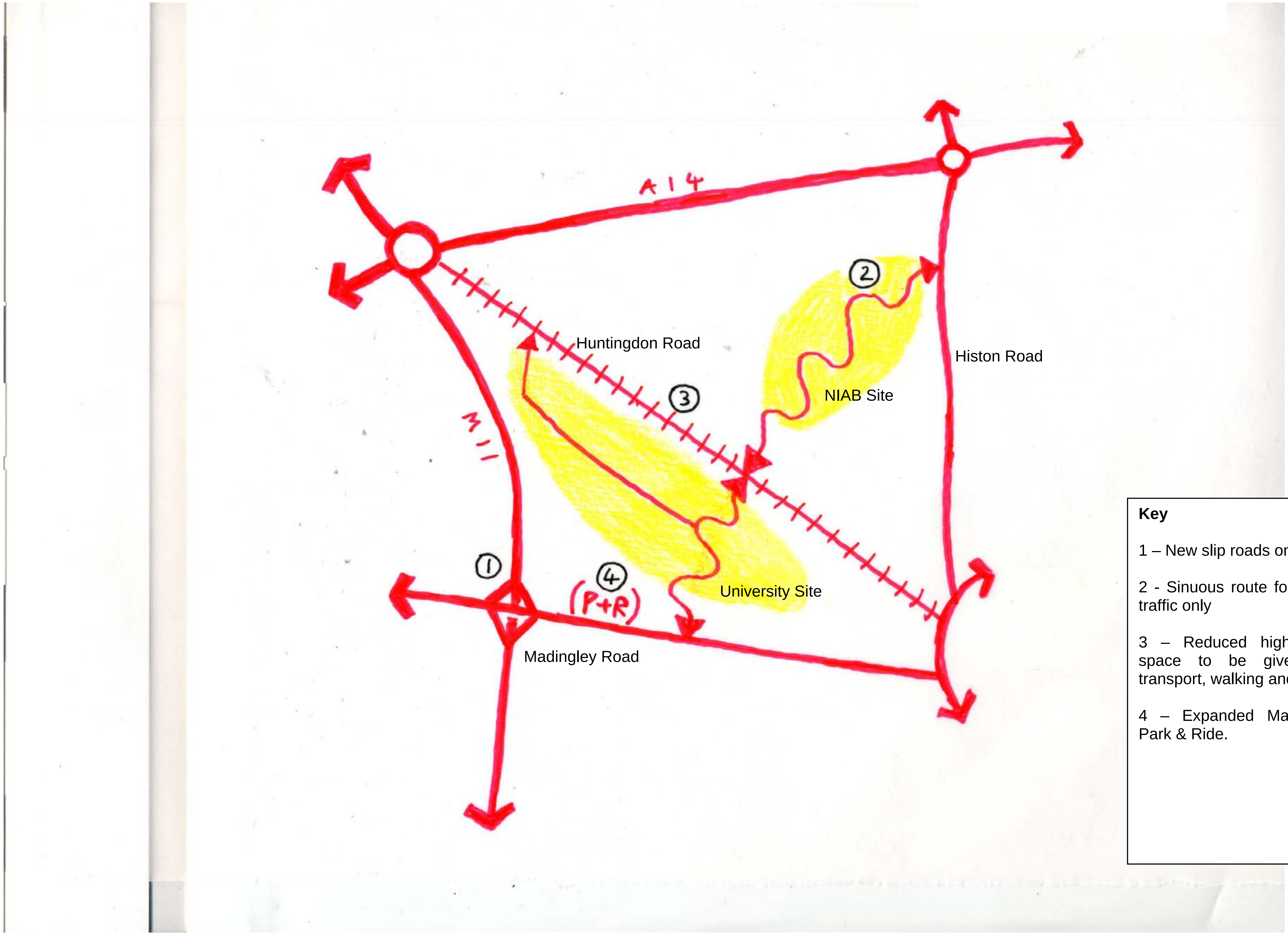
Key

1 – Orbital link road

2 – Radial link road and potential public transport route for existing services

3 – Reduced highway capacity space to be given to public transport, walking and cycling.

Figure 5.5 - Strategic Highway Option B



Key

1 – New slip roads on M11

2 - Sinuous route for development traffic only

3 – Reduced highway capacity space to be given to public transport, walking and cycling

4 – Expanded Madingley Road Park & Ride.

6. Highway Option Testing

6.1 This section of the report summarises the results of our traffic impact assessments of the 'strategic highway options' developed as part of the Transport Study. The modelling work has been undertaken using the methodology outlined in Section 4 of this report. The full modelling results are included in Appendix E of this report.

STRATEGIC TRAFFIC MODELLING ASSESSMENT

6.2 As described in Section 4.20, the A14 Ellington to Fen Ditton SATURN model was used to assess the following scenarios (all for the AM Peak Hour 0800-0900 hours):

- 2003 Base;
- 2025 Base;
- 2025 Approved Land Use;
- 2025 Sensitivity Land Use;
- 2025 Approved Land Use, Highway Option A;
- 2025 Sensitivity Land Use, Highway Option A;
- 2025 Approved Land Use, Highway Option B;
- 2025 Sensitivity Land Use, Highway Option B; and
- 2025 Preferred Option (Approved Land Use, Highway Option A).

2003 Base

6.3 The 2003 Base model represents the highway network in the vicinity of the site three years ago. This model has been used as a base against which to assess the impact of traffic growth within Cambridge between the present day and 2025 (the development design year).

6.4 The 2003 Base model results are presented in the form of Queue/Saturation (or Q/S) plots in Figures 6.1 and 6.2. Q/S plots provide a visual representation of the queues that are predicted under a given modelling scenario with the queues shown as a bar alongside the link. Figure 6.1 shows the 2003 base model Q/S plot for the highway network in the immediate vicinity of the CNW development site, whilst Figure 6.2 shows the 2003 base model Q/S plot for the wider area.

6.5 As Figure 6.1 shows there is not a significant amount of queuing in the vicinity of the development site under the existing situation. Queuing is focused upon the main junctions on Huntingdon Road, Histon Road and Madingley Road. No significant queuing is predicted on the radial routes, which is in slight contrast to the findings of the baseline study, although SATURN results are based upon predicting average or typical conditions. Further investigation of the SATURN delay plots (see Appendix E) suggests that vehicles are delayed when travelling toward the City Centre on radial routes, particularly on Huntingdon Road.

6.6 As Figure 6.2 shows there are no lengthy queues in the wider area (covering Cambridge City, South Cambridgeshire District, Huntingdonshire, East Cambridgeshire District and Fenland District) under the existing situation. Any queuing which does exist appears to be concentrated at the main junctions along the strategic road network, particularly Histon Interchange and Milton Interchange.

Base 2025

6.7 The 2025 Base model represents the forecast highway network in the vicinity of the site under year 2025 traffic conditions but without any development or related infrastructure at CNW. This model has been used as the base against which to assess the impact of the proposed development of CNW and the effectiveness of the strategic highway options. The 2003 Base model has also been compared with the 2025 Base model to assess the impact of traffic growth over this time period.

6.8 The A14 Ellington to Fen Ditton SATURN model includes the following infrastructure and land use assumptions:

- 2016 Structure Plan land use assumptions;
- Guided Busway Scheme;
- A14 Ellington to Fen Ditton Infrastructure Improvements;
- A428 Dualling to Caxton Gibbet; and
- Papworth Bypass.

6.9 These assumptions, along with the assumed traffic growth between 2003 and 2025, account for the increase in congestion in the vicinity of the development.

6.10 The 2025 base model results are presented in the form of Q/S plots in Figures 6.3 and 6.4.

6.11 In order to quantify the impact of background traffic growth and committed development in Cambridgeshire between 2003 and 2025 the total number of vehicles in the 2003 Base and 2025 Base models has been compared, as shown in Table 6.1.

Table 6.1 - Total Vehicles Base 2003 and Base 2025

Vehicle Type	2003 Base	2025 Base	% Increase 2003-2025
LGV*	72,565	91,689	26%
HGV	3,741	5,249	40%
Total	73,306	96,938	32%

* Includes cars

6.12 As Table 6.1 shows, there is a 32 percent increase in traffic levels in the SATURN model between 2003 and 2025. This is a significant increase in traffic levels which will have a significant impact on the patterns of congestion and delay in the County. Development of the CNW site is likely to have a localised impact which is relatively minor in comparison with this overall background traffic growth.

6.13 As Figure 6.3 shows, traffic growth and committed development occurring in Cambridgeshire between 2003 and 2025 will result in significant queuing on radial routes into Cambridge City Centre. In particular traffic queues are predicted to form in the following locations:

- Huntingdon Road;
- Histon Interchange; and
- A1303 on approach to Junction 11 of the M11.

6.14 Increased congestion would have environmental impacts on these locations, particularly in terms of increased noise pollution and poorer air quality. This could include increased noise levels in the immediate vicinity of the queue and local increases in pollution levels (such as carbon dioxide, nitrogen oxide, particulates, carbon monoxide and hydrocarbons). Detailed assessment of the impact of increased congestion on noise levels and air quality is beyond the scope of this Transport Study.

6.15 These results suggest that background traffic growth between 2003 and 2025 will significantly increase pressure on radial routes, particularly the main routes into the City, for a large proportion of development within Cambridgeshire. This includes Huntingdon Road, which serves trips between the City Centre and villages between Cambridge and St. Ives including the planned Northstowe development and the A1303 Madingley Road which serves trips between the City Centre and the new development at Cambourne.

6.16 As Figure 6.4 shows, background traffic growth between 2003 and 2025 will increase the number of locations experiencing queuing on the wider road network (covering Cambridge City, South Cambridgeshire District, Huntingdonshire, East Cambridgeshire District and Fenland District). In particular, increased queuing is predicted at interchanges with the strategic road network, including Milton and Histon Interchange and Junctions 11 and 12 on the M11. Queuing is also predicted to occur at a greater number of junctions within the City Centre by 2025 and at junctions where queues currently occur these are predicted to become longer.

2025 with Development: Option Testing

6.17 The 2025 with development models represent the forecast highway network in the vicinity of the site in 2025 with development traffic added assuming typical trip rates without the benefit of a package of measures to encourage use of more sustainable modes of travel. These development models have been run for the following scenarios:

- 2025 Approved Land Use, Highway Option A (Figures 6.5 and 6.6);
- 2025 Sensitivity Land Use, Highway Option A (Figures 6.7 and 6.8);
- 2025 Approved Land Use, Highway Option B (Figures 6.9 and 6.10); and
- 2025 Sensitivity Land Use, Highway Option B (Figure 6.11 and 6.12).

6.18 The 2025 with development model results are presented in the form of Q/S plots in Figures 6.5 to 6.12 as listed above.

6.19 In order to quantify the impact of the development at CNW in comparison to the predicted 2025 background traffic flows the total number of vehicles in the 2025 Base and 2025 with development models has been compared for both land use scenarios, as shown in Table 6.2.

Table 6.2 - Total Vehicles Base 2025 and 2025 with Development

Vehicle Type	2025 Base	2025 with Approved Land Use	% Increase	2025 with Sensitivity Land Use	% Increase
LGV*	91,700	93,700	2%	95,100	4%
HGV	5,200	5,300	1%	5,300	1%
Total	96,900	99,000	2%	100,400	4%

* Includes cars

6.20 As Table 6.2 shows, development of the CNW site under the Approved Land Use Scenario will result in a 2 percent increase in traffic levels in the County, whilst development of the site under the Sensitivity Land Use Scenario will result in a 4 percent increase in traffic levels.

Comparison of Options

6.21 The results of the modelling of all four 2025 with development options are remarkably similar to the 2025 Base results. This can be accounted for by the fact that the development only results in a small increase in trips compared with the 2025 Base Scenario (a 2 percent increase for the Approved Land Use Scenario across the County and 4 percent increase for the Sensitivity Land Use Scenario). Similarities across all four models include:

- A small increase in queuing on Huntingdon Road in comparison to the 2025 Base. This is concentrated at accesses to the development and also extends onto the A14 at the A14/Huntingdon Road junction;
- A similar pattern of queuing at Histon Interchange as in the 2025 Base;
- A similar pattern of queuing on Madingley Road at the development access junction and Storey's Way. This is not in the 2025 Base; and
- Queuing at Milton Interchange, Junction 12 of the M11 and in the City Centre as displayed in the 2025 Base.

6.22 There are some subtle differences in the queuing patterns for each of the development options:

- Increased queuing across Huntingdon Road, Histon Road and Madingley Road under the Approved Land Use Scenario compared to the Sensitivity Land Use Scenario for both Highway Options A and B;
- Slight reduction in queuing on Huntingdon Road under Highway Option B compared to Highway Option A under both land use scenarios;
- Slight reduction in queuing on the development orbital road under Highway Option B compared to Highway Option A under both land use scenarios; and

- Slight reduction in queuing on Histon Road and at Histon Interchange under Highway Option B compared to Highway Option A under both land use scenarios.

6.23 The SATURN model summary statistics for each of the option tests are shown in Table 6.3.

Table 6.3 - 2025 Option Transport Modelling Summary

Statistic	2025 Base	2025 Approved Option A	2025 Sensitivity Option A	2025 Approved Option B	2025 Sensitivity Option B
Total Vehicles (pcu)	96,900	99,000	100,400	99,000	100,400
Transient Queued Time (pcu hrs)	4,000	4,300	4,500	4,300	4,500
Overcapacity Queued Time (pcu hrs)	6,000	7,300	7,900	7,800	8,000
Total Travel Time (pcu hrs)	66,000	68,100	69,000	68,700	69,200
Average speed (km/hr)	60.9	59.5	58.9	58.9	58.8

6.24 The results shown in Table 6.3 are consistent with the Q/S plots for each option. The general stress on the highway network as a result of traffic growth and committed development between 2003 and 2025 causes the Approved Land Use Scenario development option to perform better than the Sensitivity Land Use Scenario development option under both Highway Options.

6.25 In general, Highway Option B performs better than Highway Option A under both land use development scenarios, however the results for these two options are very similar, with the Highway Option B offering very little improvement compared to the Highway A option. It appears that the choice of an orbital road rather than a sinuous route through the sites also has very little impact on network performance.

6.26 The decision on the preferred highway option cannot focus purely on success of each development option in terms of the impact on existing highway capacity. The environmental impact and cost impact of each of the options must also be considered. Comparison of the likely costs of the Option A and Option B highway options suggests that the slight improvement in congestion gained by highway option B would not outweigh the negative cost impact of building slip roads onto the M11.

6.27 As a result the preferred option chosen for further assessment (Preferred Highway Option) is Option A with the Approved Land Use Scenario development level but with a sinuous route through the NIAB site. Given that the choice of an orbital road rather than a sinuous route through the sites has very little impact on the performance of the highway option, a sinuous route has been chosen through this part of the development in line with Planning Policy Guidance to avoid encouraging through traffic and generating entirely new trips.

2025 Preferred Highway Option

6.28 The highway network for the Preferred Option can be summarised as follows:

- New access junction on Huntingdon Road close to the A14 slip road to serve as an access to University land;
- New radial route through the University site between the Huntingdon Road access and orbital road;
- Sinuous orbital road through the NIAB development site to discourage through traffic;
- Direct orbital road through the University development site to discourage existing rat-running on Storey's way and offer an alternative access to the strategic road network;
- New crossroads on Huntingdon Road serving the orbital road and providing access to University and NIAB land;
- New access junction to the University land on Madingley Road: and
- New access junction on Histon Road close to Histon Interchange serving as an access to the NIAB land.

6.29 As stated in Section 4.17, the vehicular trip rates used during the option modelling process were felt to be significantly higher than those which would be generated by the development, particularly as a package of measures to promote sustainable travel will be included in the Preferred Transport Option. As a result the trip rates were reviewed and an alternative reduced mode share and vehicular trip rate estimated for the site.

6.30 The Preferred Highway Option was modelled using these modified trip rates. The results are shown in the form of Q/S plots in Figures 6.13 and 6.14 for Land Use Scenario 1 and Figure 6.15 and 6.16 for Land Use Scenario 2.

6.31 The Preferred Highway Option is shown in Figure 6.17.

Land Use Scenario 1

6.32 As Figure 6.13 shows under the Preferred Highway Option with Land Use Scenario 1 queuing is predicted in the local area at the following locations:

- Huntingdon Road, principally at access points to the developments and on the A14 slip road;
- Madingley Road at the development access; and
- Histon Interchange.

6.33 When compared with the 2025 Base situation presented in Figure 6.3 it is clear that there are only two changes in queuing patterns associated with the CNW Preferred Highway Option development proposals. Firstly, within South Cambridgeshire the queue on the A1303 to the west of Junction 11 of the M11 in the 2025 Base scenario is reduced and increased queuing is predicted on Madingley Road to the west of the Junction 11 instead. Secondly, the single section of queuing predicted on Huntingdon Road in the 2025 Base scenario is split into a number of locations along Huntingdon Road in the Preferred Highway Option scenario (largely as a result of the new access junction).

6.34 In summary, development of the CNW site under the Preferred Highway Option will not have a significant impact on the local road network in the vicinity of the site. Increased queuing is however predicted for Huntingdon Road, Madingley Road and Histon Interchange which is a result of traffic growth and development in the area. The impact upon these junctions has been assessed using local junction capacity assessments as described in Section 6.39.

6.35 As Figure 6.14 shows, under the Preferred Highway Option with land use Scenario 1 queuing is predicted in the wider area at the following locations:

- Milton Interchange (South Cambridgeshire);
- Junction 12 of the M11 (South Cambridgeshire); and
- A number of locations across the City Centre (Cambridge City).

6.36 When compared with the 2025 Base situation presented in Figure 6.4 it is clear that the queuing patterns predicted in the Preferred Highway Option are remarkably similar to those predicted in the 2025 Base scenario. The CNW development will therefore not have an undue impact on the wider strategic highway network in the vicinity of the site.

Land Use Scenario 2

6.37 As Figure 6.15 shows under the Preferred Highway Option with Land Use Scenario 2, queuing is predicted in the local area in the same locations as for Land Use Scenario 1 (see Section 6.32). However the length in queuing is predicted to increase in some areas in response in to the higher level of car trips associated with increased development levels on the CNW site.

6.38 As Figure 6.16 shows under the Preferred Highway Option with Land Use Scenario 2 queuing is predicted in the wider area in similar locations as for Land Use Scenario 1 (see Section 6.35). However the length of queuing is predicted to increase in response to the higher level of car trips associated with increased development levels on the CNW site.

LOCAL JUNCTION CAPACITY ASSESSMENTS

6.39 As outlined in Section 6.25 above, the Preferred Highway Option compares well with the Base 2025 situation in terms of queuing on the highway network in the local and wider area. However the SATURN assessment does not undertake a detailed assessment of the performance of key junctions in the vicinity of the CNW site.

6.40 This section of the report describes the results of local junction capacity assessments undertaken using TRANSYT and LINSIG. The four new junctions serving as access points to the development sites have been assessed, together with Histon Interchange which is located adjacent to the northernmost site access point and SATURN modelling has shown to be sensitive to traffic growth and development traffic.

6.41 The assessments have been carried out for Land Use Scenario 1 only.

Huntingdon Road/University Site Access

6.42 The Huntingdon Road/University Site Access junction has been assessed using the LINSIG program based on a cycle time of 96 seconds. The assessment has been carried out for the future year 2025 with development, under Land Use Scenario 1. The assumed configuration of the junction, suggested signal staging and modelling assumptions are presented in Appendix F of this report.

6.43 The LINSIG results for the Preferred Highway Option are shown in Table 6.4. The results are expressed in terms of Degree of Saturation (DoS) in percent and Mean Maximum Queue (Q) in passenger car units (pcu). A junction with a DoS higher than 85 percent is predicted to be approaching its capacity, whilst a junction with a DoS over 100 percent is predicted to exceed its capacity.

Table 6.4 - Huntingdon Road/University Site Access Preferred Highway Option

Link no.	Link name	DoS (%)	Q (pcu)
1/1	Huntingdon Road N Right	84	10
1/2	Huntingdon Road N Ahead	73	8
2/1	Huntingdon Road S Ahead Left	84	12
3/1	University Access Left	22	1
3/2	University Access Right	2	1

6.44 As Table 6.4 shows, the Huntingdon Road/University Site Access operates within but approaching capacity under the Preferred Highway Option. The maximum queuing predicted is on Huntingdon Road with a DoS of 84 percent and associated queue of 12 pcus.

Orbital Road/Huntingdon Road Crossroads

6.45 The Orbital Road/Huntingdon Road Crossroads junction has been modelled using LINSIG with a cycle time of 88 seconds. The assessment has been carried out for the future year 2025 with development, under Land Use Scenario 1. The assumed configuration of the junction, suggested signal staging and modelling assumptions are presented in Appendix F of this report.

6.46 The LINSIG modelling results for the Preferred Highway Option are shown in Table 6.5.

Table 6.5 - Orbital Road/Huntingdon Road Preferred Highway Option

Link no.	Link name	DoS (%)	Q (pcu)
1/1	NIAB Access Left Ahead	67	3
1/2	NIAB Access Ahead Right	59	3
2/1	Huntingdon Road SE Right Ahead Left	38	9
2/2	Huntingdon Road SE Right	66	1
3/1	University Access Ahead Left	41	2
3/2	University Access Ahead Right	45	2
4/1	Huntingdon Road NW Right Ahead Left	68	17
4/2	Huntingdon Road NW Right	0	0

6.47 As Table 6.5 shows, the Orbital Road/Huntingdon Road Crossroads operates within capacity under the Preferred Highway Option. The maximum queuing predicted is on Huntingdon Road north with a DoS of 68 percent and associated queue of 17 pcus.

Madingley Road/University Site Access

6.48 The Madingley Road/University Site Access junction has been modelled using LINSIG using a cycle time of 60 seconds. The assessment has been carried out for the future year 2025 with development, under Land Use Scenario 1. The assumed configuration of the junction, suggested signal staging and modelling assumptions are presented in Appendix F of this report.

6.49 The LINSIG modelling results for the Preferred Option are shown in Table 6.6.

Table 6.6 - Madingley Road/University Site Access Preferred Highway Option

Link no.	Link name	DoS (%)	Q (pcu)
1/1	Madingley Road E Left Ahead	84	8
2/1	University Access Right Left	86	12
3/1	Madingley Road W Ahead	20	2
3/2	Madingley Road W Right	18	0

6.50 As Table 6.6 shows, the Madingley Road/University Access Road junction operates within but approaching capacity under the Preferred Highway Option. The maximum queuing predicted is on the University Access Road with a DoS of 86 percent and associated queue of 12 pcus.

Histon Road/ NIAB Site Access

6.51 The Histon Road/NIAB Site Access junction has been modelled using LINSIG using a cycle time of 100 seconds. The assessment has been carried out for the future year 2025 with development, under Land Use Scenario 1. The assumed configuration of the junction, suggested signal staging and modelling assumptions are presented in Appendix F of this report.

6.52 The LINSIG modelling results for the Preferred Highway Option are shown in Table 6.7.

Table 6.7 - Histon Road/NIAB Site Access Preferred Highway Option

Link no.	Link name	DoS (%)	Q (pcu)
1/1	Histon Road S Left Ahead	69	14
2/1	NIAB Access Right	36	4
2/2	NIAB Access Left	67	7
3/1	Histon Road N Right	69	6
3/2	Histon Road N Ahead	57	14

6.53 As Table 6.7 shows, the Histon Road/NIAB Site Access Road junction operates within capacity under the Preferred Highway Option. The maximum queuing predicted is on NIAB Access Road with a DoS of 69 percent and associated queue of 14 pcus.

Histon Interchange

6.54 Due to budgetary constraints we have not undertaken new counts at Histon Interchange; instead we have relied on a previous TRANSYT model.

6.55 A TRANSYT model of Histon Interchange has been obtained from WSP. This model represents the future situation at the junction when Arbury Camp, a development of 900 homes located adjacent to the junction, has been completed. The TRANSYT does not account for any single future year, as traffic flows for separate roads have been increased to represent different capacities and years. The TRANSYT model has been 'signed-off' by the HA and relevant local authorities.

Base TRANSYT

6.56 The Base TRANSYT has been taken to be the model provided by WSP Consultants. This includes the committed development at Arbury Camp. The Base model results are included in Appendix G and summarised in Table 6.8 for links with DoS over 85 percent. The results are expressed in terms of Degree of Saturation (DoS) in percent and Mean Maximum Queue (Q) in passenger car units (pcus). As for the LINSIG assessments a link with a DoS higher than 85 percent is approaching its capacity, whist a link with a DoS over 100 percent has exceeded its capacity.

Table 6.8 - Histon Road Base TRANSYT

Link no.	Link name	DoS (%)	Q (pcu)
11	Histon Rd S from Histon	175	377
21	A14 off-slip Westbound nearside	107	37
22	A14 off-slip Westbound offside	113	31
41	A14 off-slip Eastbound nearside	105	41
42	A14 off-slip Eastbound offside	98	24
52	Histon Rd S at Kings Hedges	92	32
58	Histon Rd N at Kings Hedges	123	21
61	Histon Rd N from A14 to Histon	92	28
62	Bridge Rd Histon	116	61
521	Histon Rd S to Kings Hedges	92	32

6.57 As Table 6.8 shows a number of links within Histon Interchange are predicted to exceed their capacity under the Base scenario. These include:

- Histon Road southbound from Histon;
- A14 westbound off-slips;
- Histon Road northbound at Kings Hedges; and
- Bridge Road Histon.

6.58 These overcapacity links have been agreed with the HA on the basis that they are of ‘nil detriment’ to the strategic highway network. Long queues at the junction are pushed onto local roads, particularly those towards Histon. The Preferred Highway Option must also seek ‘nil detriment’ for the strategic road network.

6.59 The needs of the local highway authority will be dealt with by more detailed work carried out as part of transport assessments that accompany the relevant planning applications.

Preferred Highway Option TRANSYT

6.60 In order to model the Preferred Highway Option at Histon Interchange the Base TRANSYT flows have been factored up according to the percentage increase in flows predicted by the SATURN model between 2025 Base and 2025 Preferred Highway Option scenarios. This process is described in Appendix G and has been agreed with then HA.

6.61 In addition a new junction has been added into the Preferred Highway Option TRANSYT to represent the NIAB site access located on Histon Road immediately south of the junction with Kings Hedges Road.

6.62 The Preferred Highway Option TRANSYT results are included in Appendix G of this report and summarised in Table 6.9.

Table 6.9 - Histon Road Preferred Highway Option TRANSYT

Link no.	Link name	DoS (%)	Q (pcu)
11	Histon Rd S from Histon	145	209
21	A14 off-slip Westbound nearside	109	45
22	A14 off-slip Westbound offside	116	36
41	A14 off-slip Eastbound nearside	105	41
42	A14 off-slip Eastbound offside	98	23
43	Circulatory W nearside	99	30
44	Circulatory W nearside	99	30
52	Histon Rd S at Kings Hedges	95	36
58	Histon Rd N at Kings Hedges	137	29
61	Histon Rd N from A14 to Histon	104	83
62	Bridge Rd Histon	137	91
521	Histon Rd S to Kings Hedges	95	36

6.63 As Table 6.9 shows a number of links within Histon Interchange continue to exceed their capacity under the Preferred Highway Option scenario. These include:

- Histon Road southbound from Histon;
- A14 westbound off-slips;
- Histon Road northbound at Kings Hedges;
- Histon Road northbound from A14 to Histon; and
- Bridge Road Histon.

6.64 These overcapacity links continue to cause ‘nil detriment’ to the strategic highway network. Long queues at the junction are pushed onto local roads, particularly those towards Histon. Queing at the Histon Interchange junction is not significantly increased under the Preferred Highway Option in comparison to the 2025 Base scenario.

SUMMARY

6.65 This section of the report describes the highway options which have been tested as part of the Transport Study. The impact assessments have led to the generation of a Preferred Highway Option for development which includes a sinuous route for development traffic through the NIAB site, direct route for development traffic through the University site and new access junctions at a number of locations. Impact assessments undertaken for the Preferred Highway

Option suggest that this option could accommodate the vehicular traffic generated by the CNW site. It should be noted that the SATURN model predicts significant areas of congestion for the 2025 Preferred Highway Option although these are similar in nature to the 2025 Base. This option has therefore been adopted as the highway element of the Preferred Transport Option.

Specific Impact on South Cambridgeshire

6.66 The SATURN modelling described in this section of the report has considered the impact of the development proposals upon the local highway network in the vicinity of the site (Huntingdon Road, Histon Road, Madingley Road and their junctions) and the wider highway network (including South Cambridgeshire District, Huntingdonshire, East Cambridgeshire District and Fenland District).

6.67 As outlined in Section 6.6, under the Base 2003 Model Scenario there are no lengthy queues in the South Cambridgeshire area. Queues which are predicted are concentrated around Histon and Girton Interchanges on the A14. In 2025, the Base 2025 Model Scenario predicts increased queuing at Milton and Histon Interchange and at Junctions 11 and 12 on the M11 (see Section 6.15) when compared to 2003. This is in response to committed development within Cambridgeshire and general traffic growth between 2003 and 2025.

6.68 Under the Preferred Highway Option (Section 6.28-6.38), the pattern and location of queuing in South Cambridgeshire is similar to the 2025 Base. This suggests that the impact of the development proposals on the highway network in the wider South Cambridgeshire area is small compared to the impact of traffic growth between 2003 and 2025.

Figure 6.1 - 2003 Base Model Q/S: Local Area

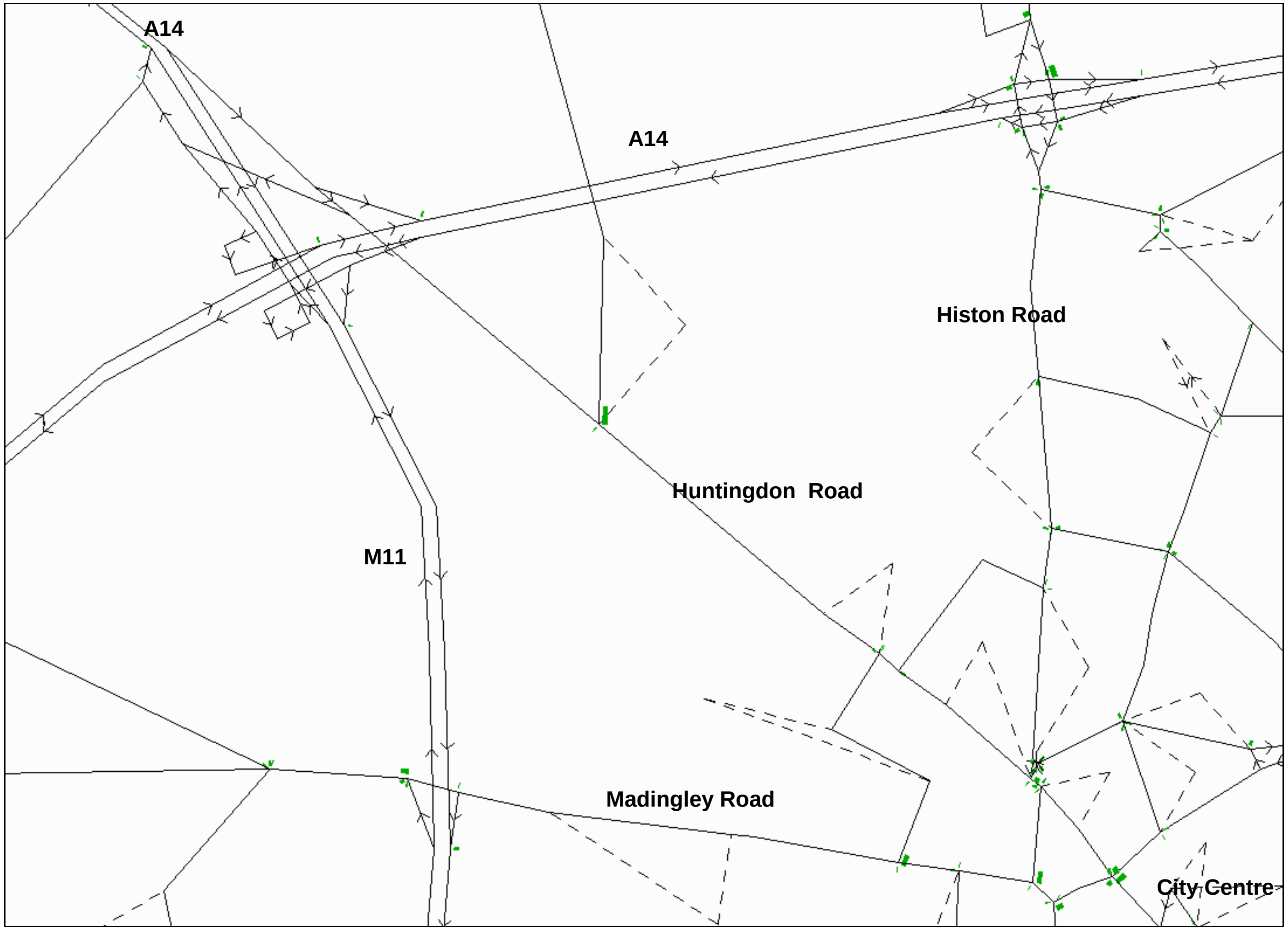


Figure 6.2 - 2003 Base Model Q/S: Wider Area

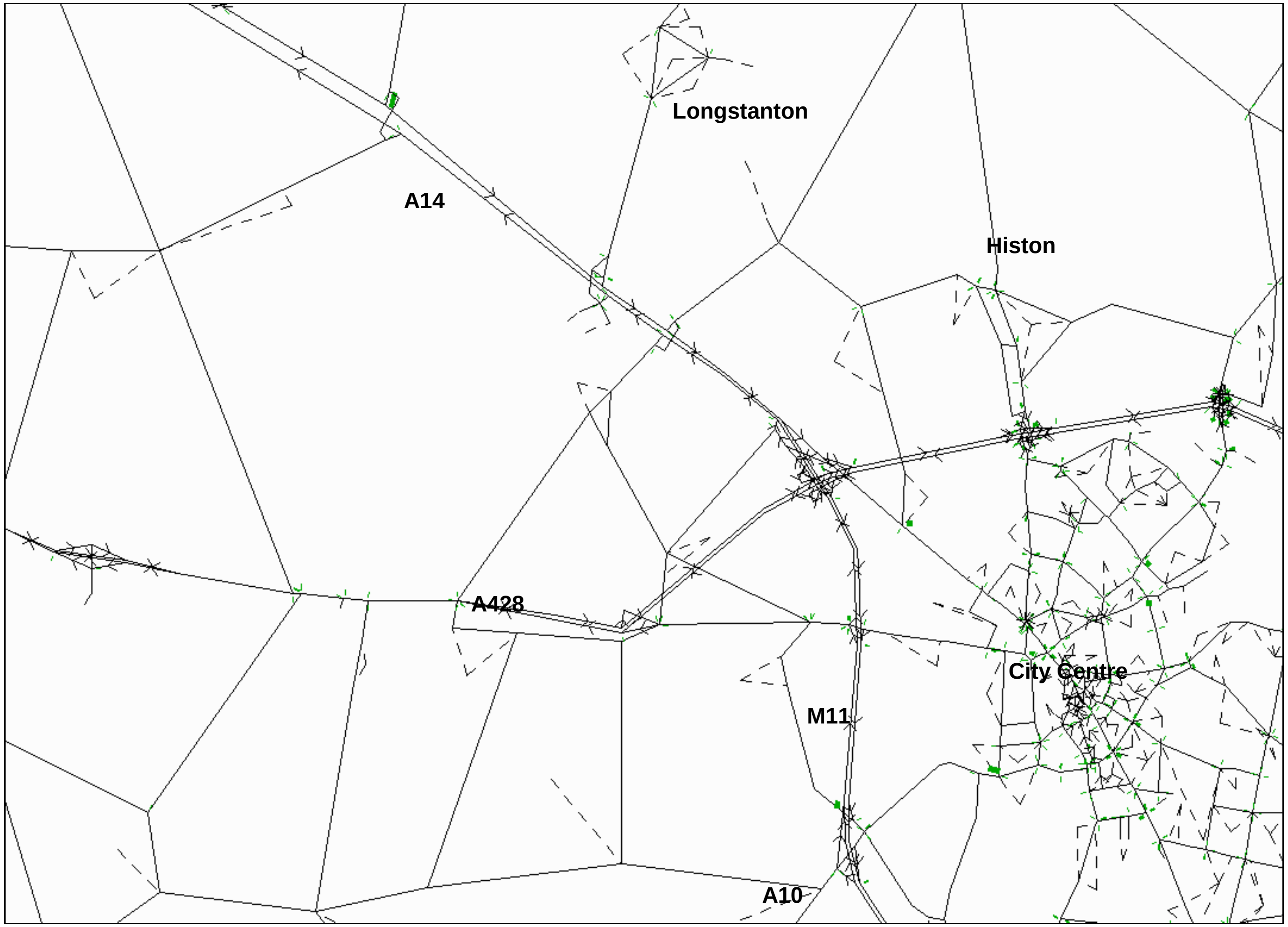


Figure 6.3 - 2025 Base Model Q/S: Local Area

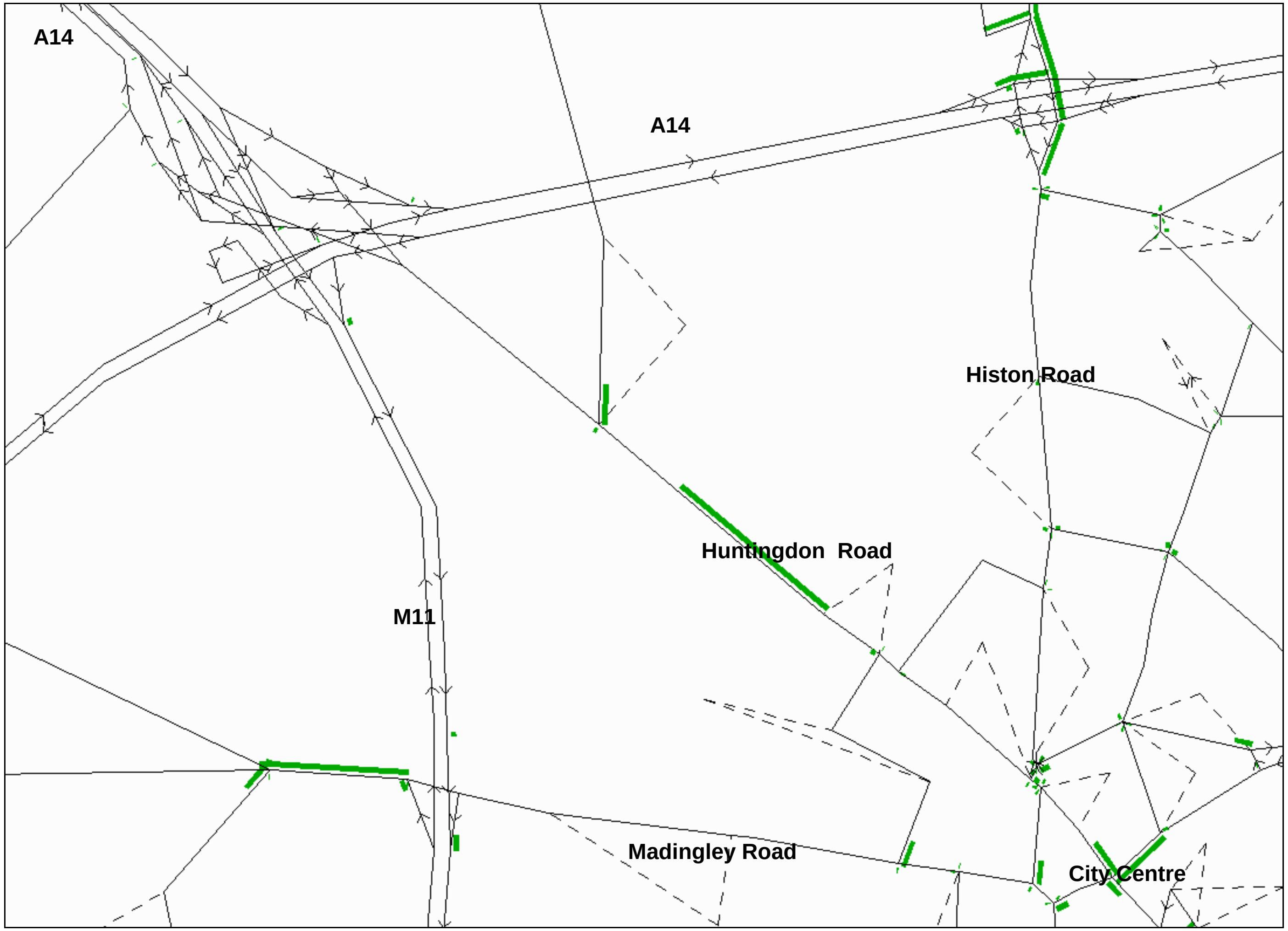


Figure 6.4 - 2025 Base Model Q/S: Wider Area

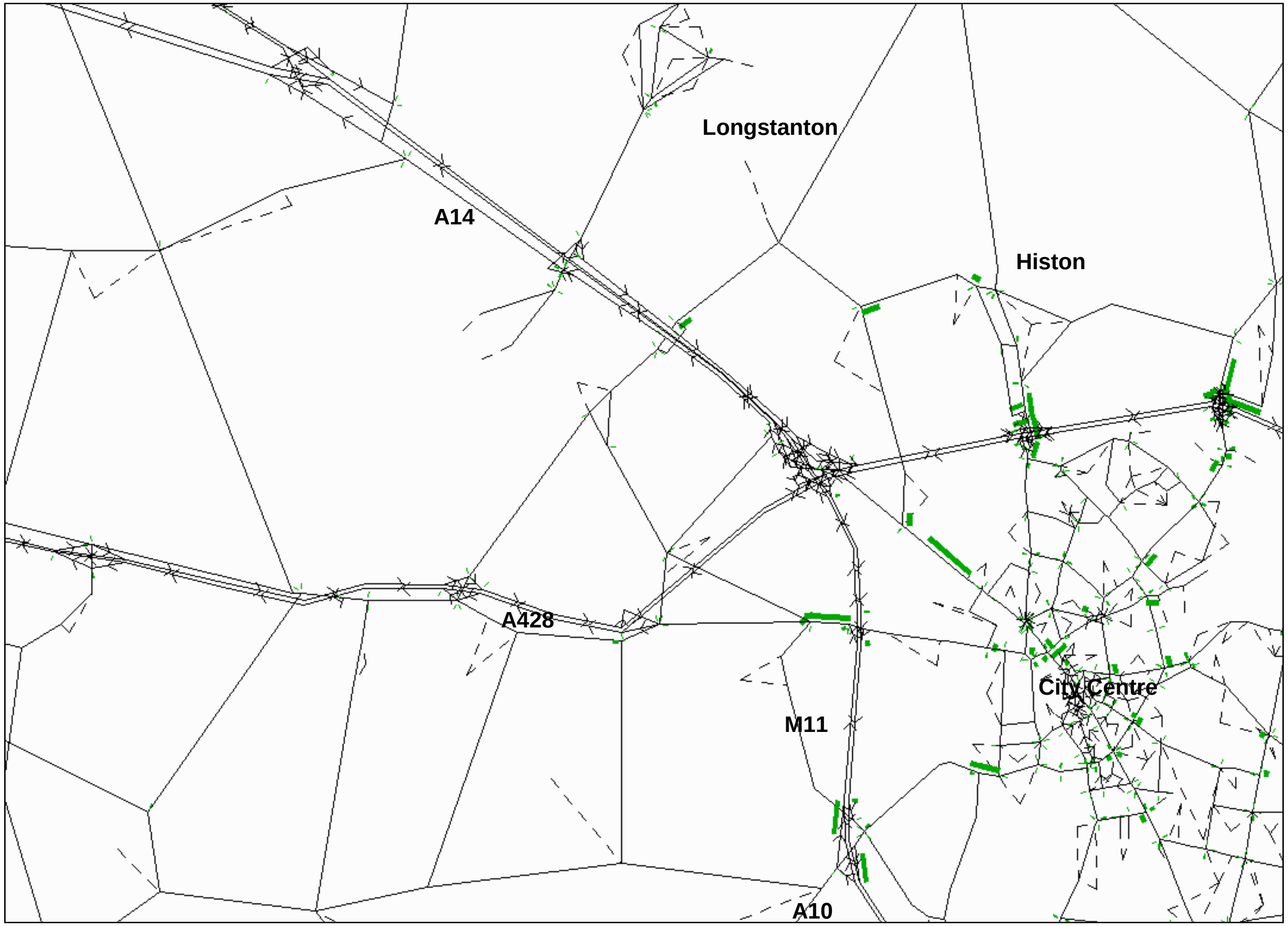


Figure 6.5 - 2025 with Development: Highway Option A Approved Land Use: Local Area

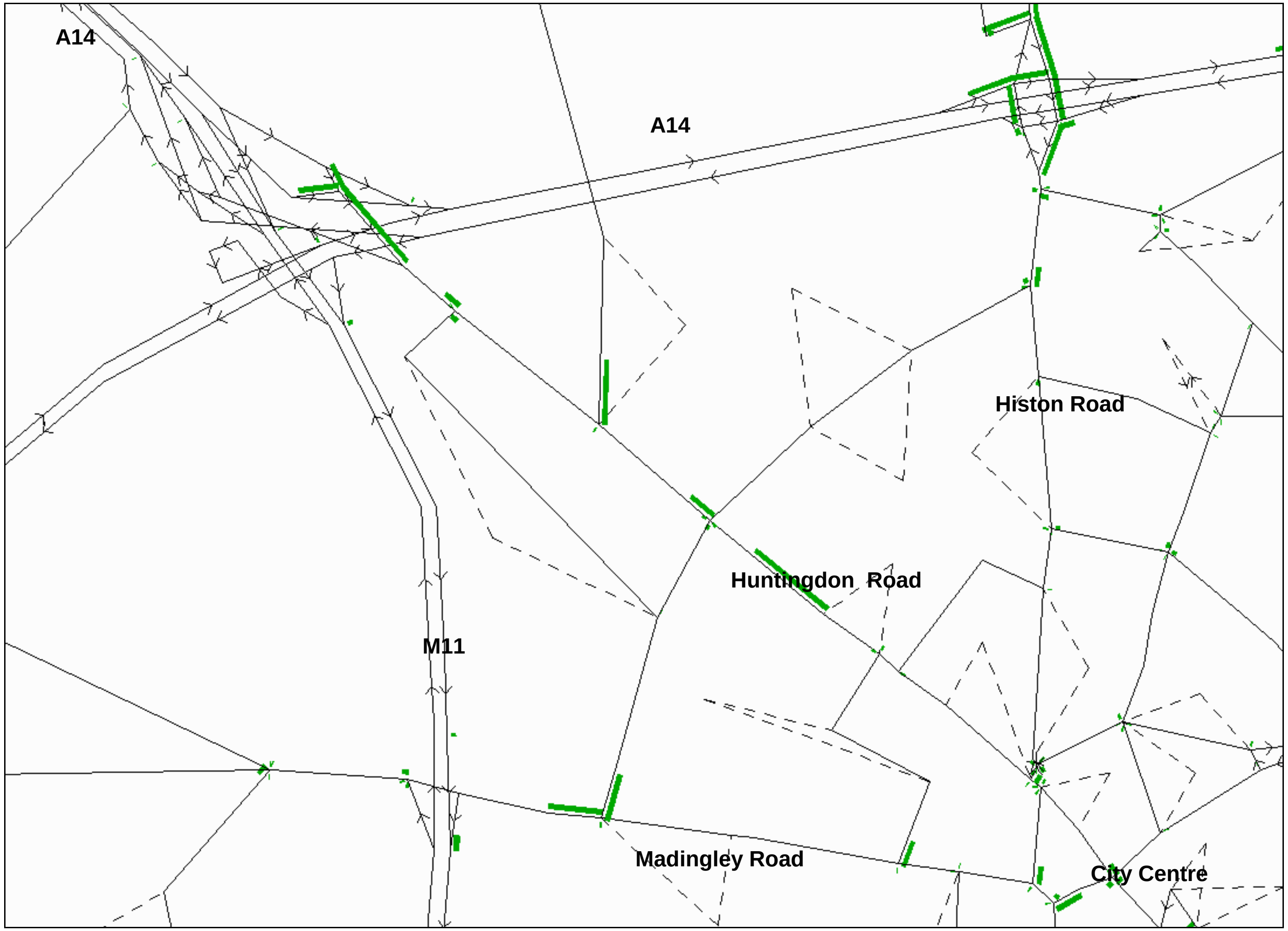


Figure 6.6 - 2025 with Development: Highway Option A Approved Land Use: Wider Area

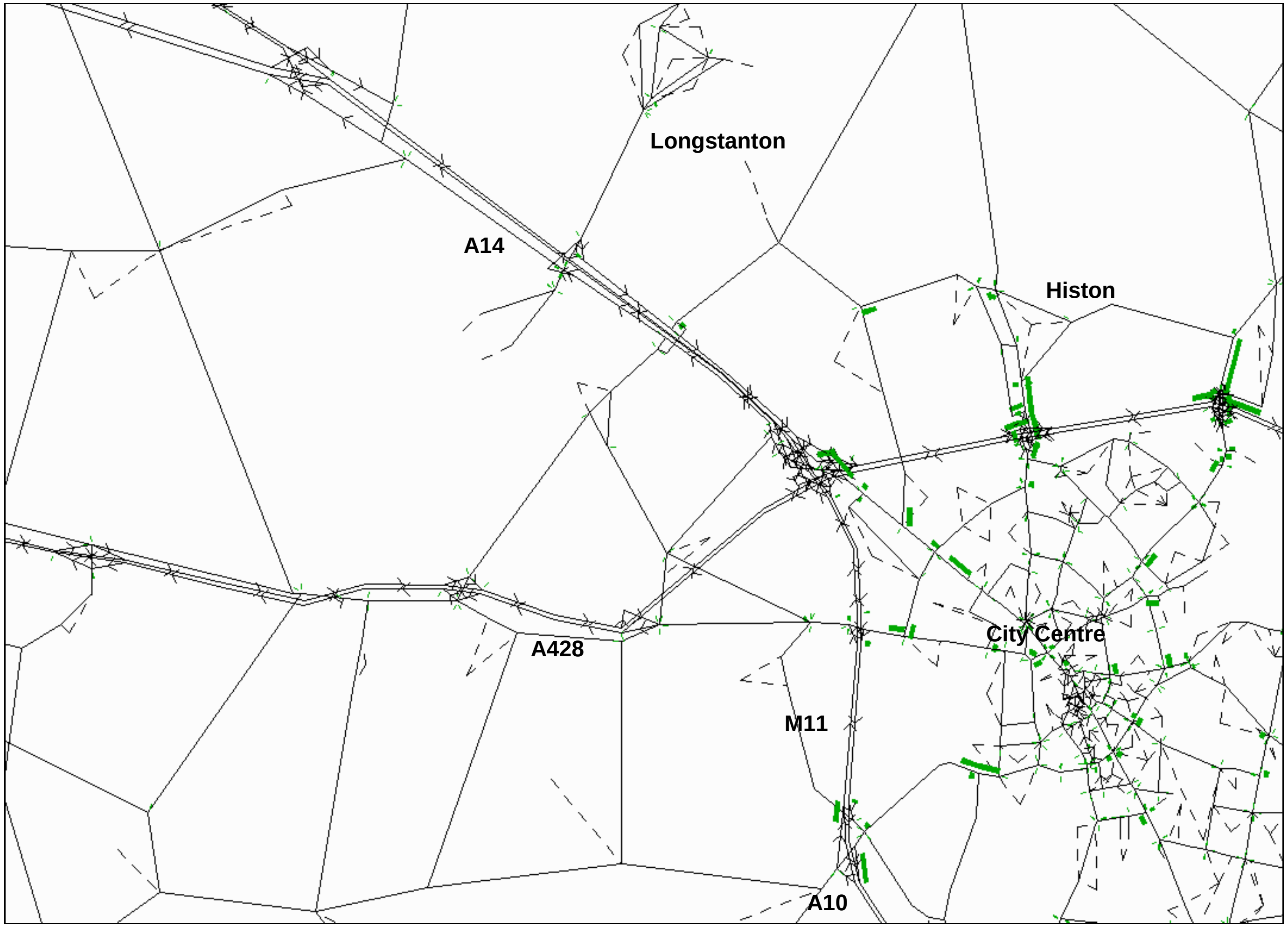


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Figure 6.7 - 2025 with Development: Highway Option A Sensitivity Test Land Use: Local Area

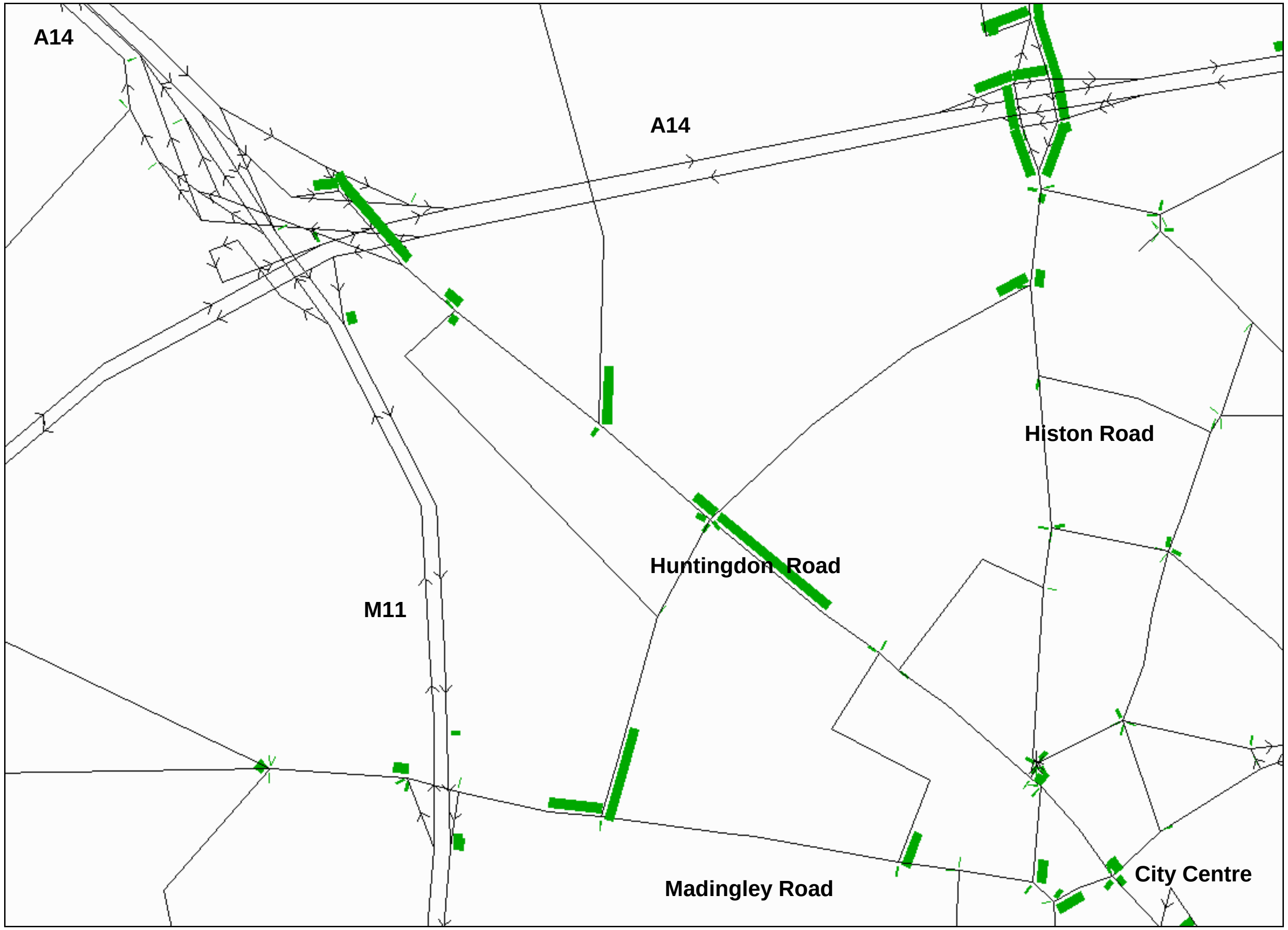


Figure 6.8 - 2025 with Development: Highway Option A Sensitivity Test Land Use: Wider Area

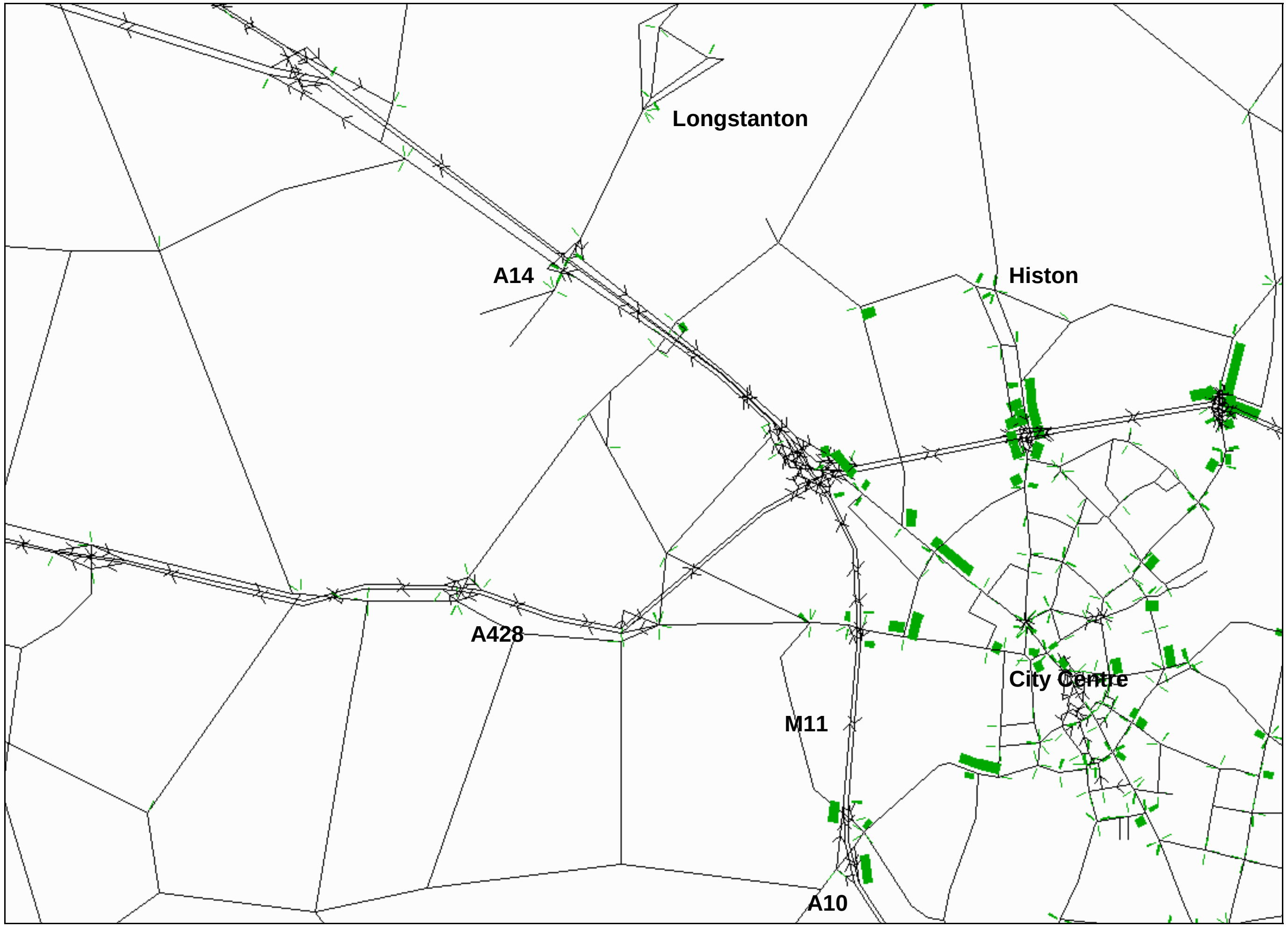


Figure 6.9 - 2025 with Development: Highway Option B Approved Land Use: Local Area

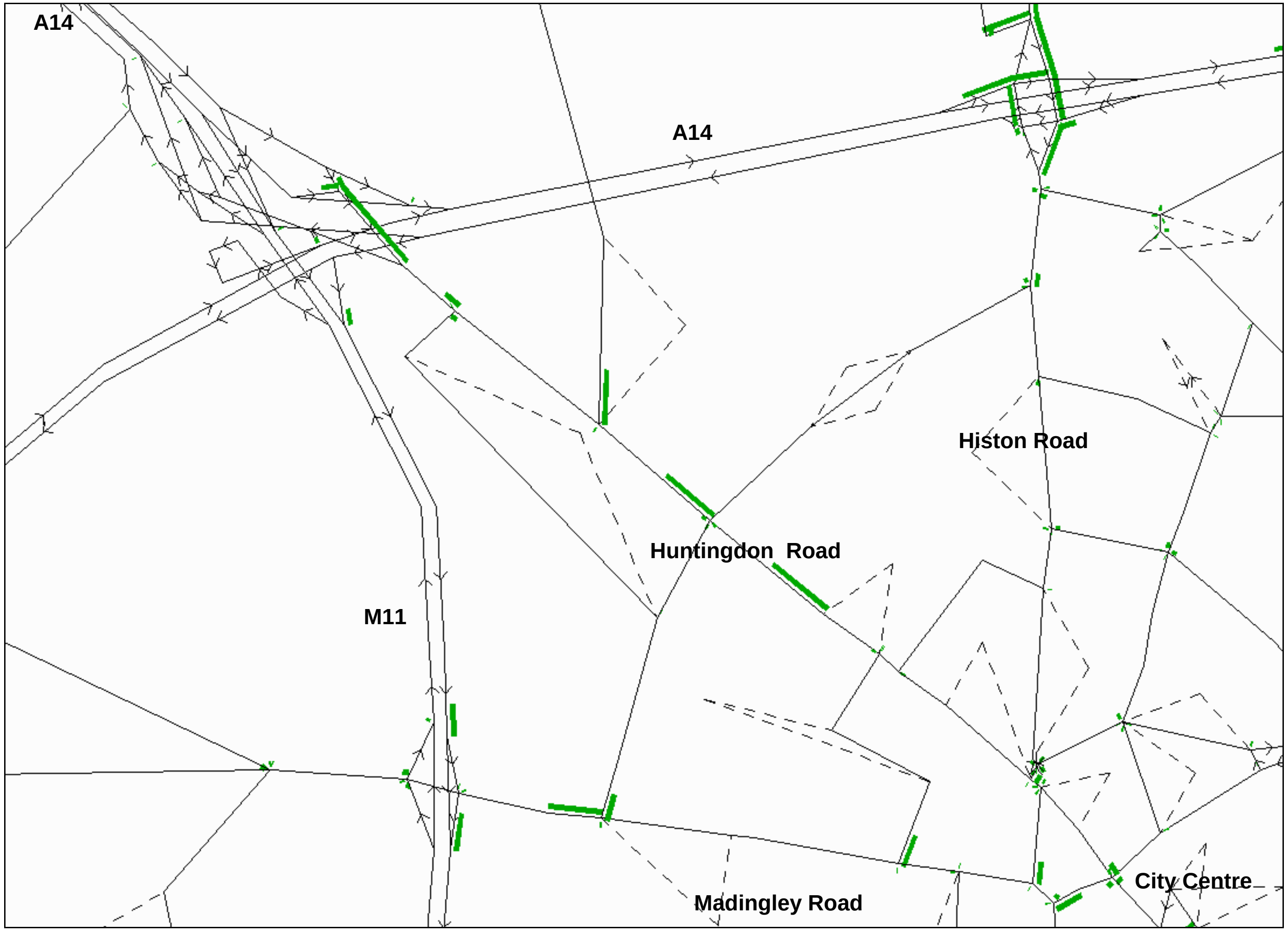


Figure 6.10 - 2025 with Development: Highway Option B Approved Land Use: Wider Area

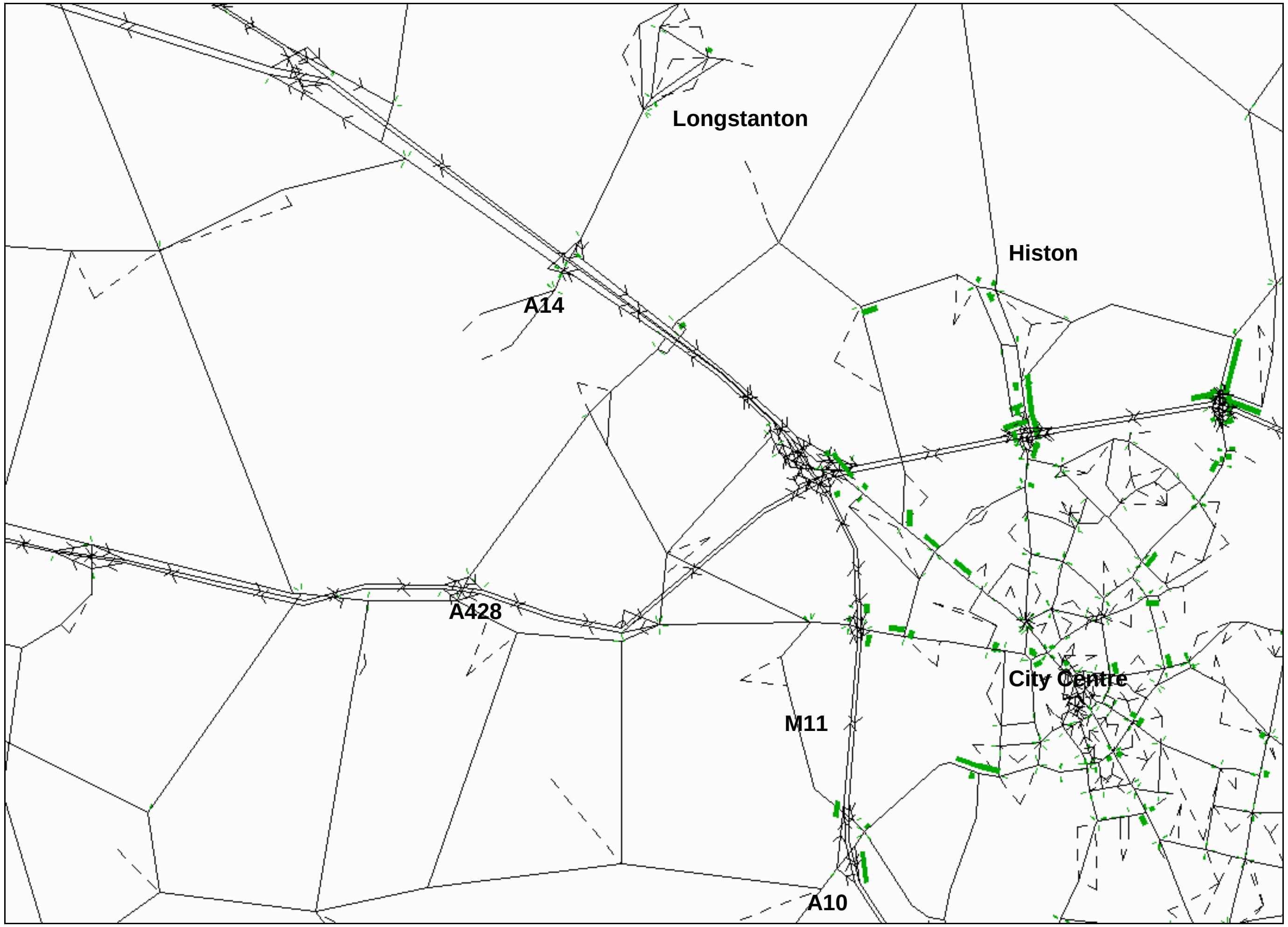


Figure 6.11 - 2025 with Development: Highway Option B Sensitivity Test Land Use: Local Area

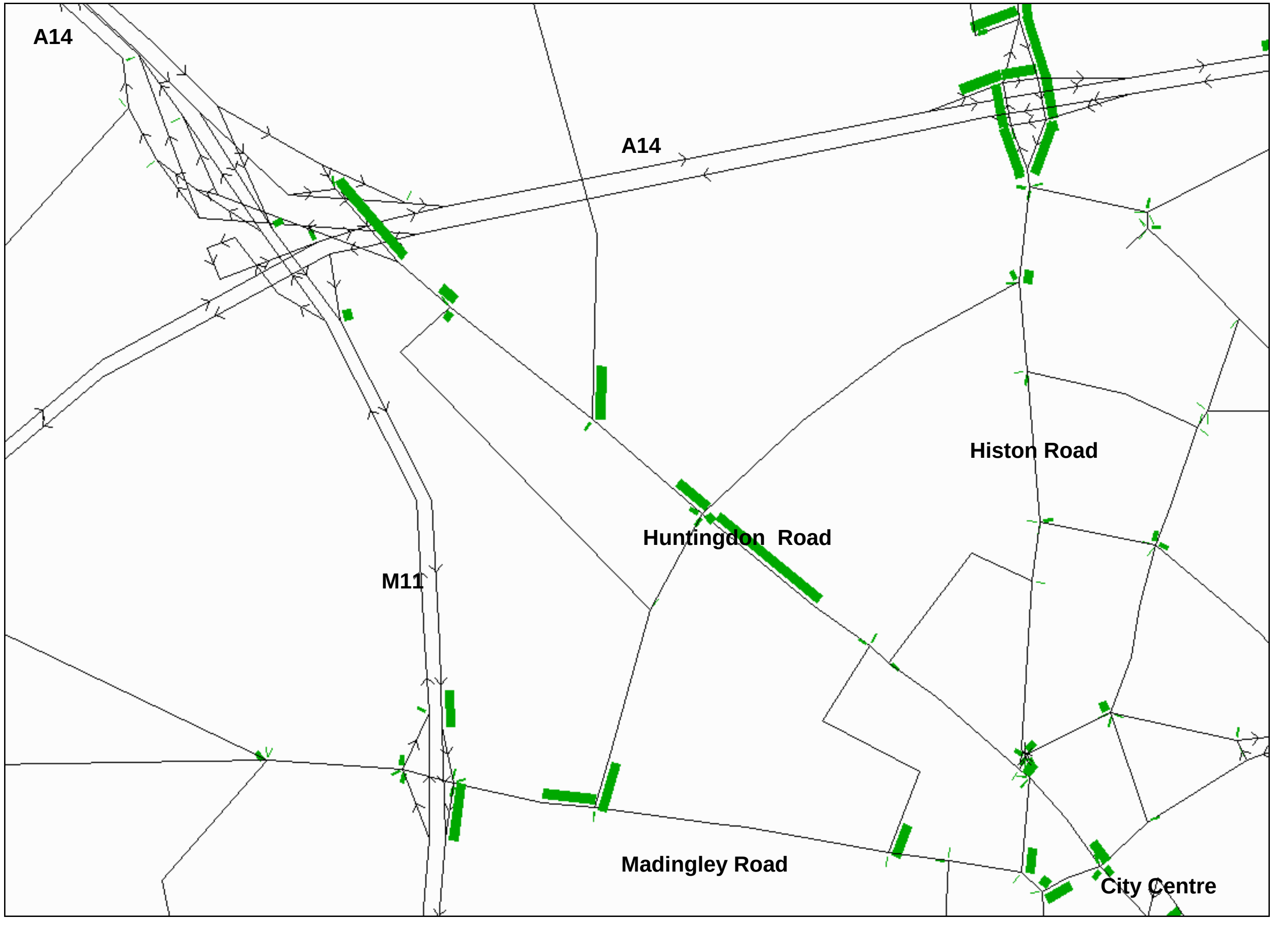


Figure 6.12 - 2025 with Development: Highway Option B Sensitivity Test Land Use: Wider Area

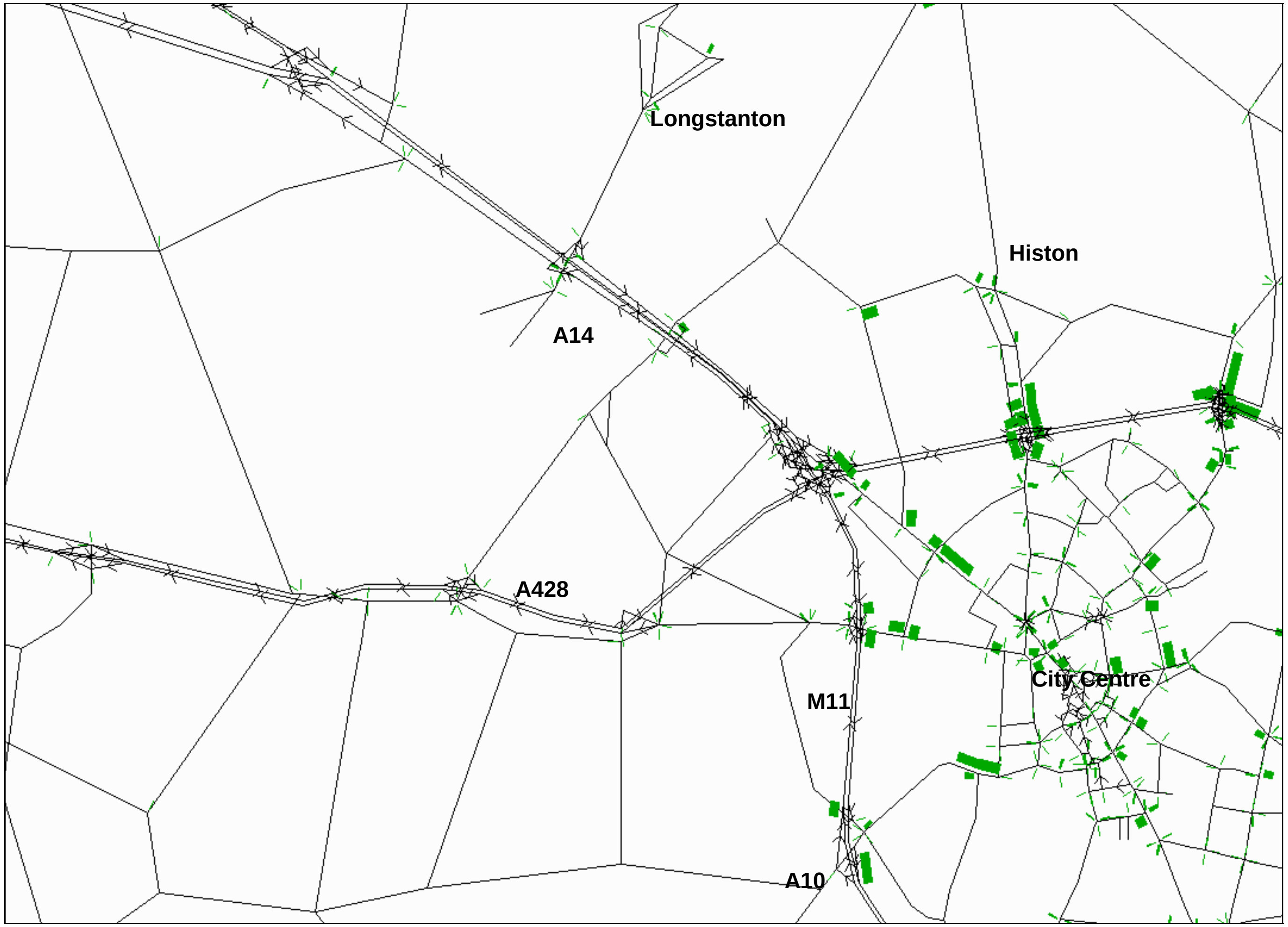


Figure 6.13 - Preferred Highway Option Land Use Scenario 1: Local Area

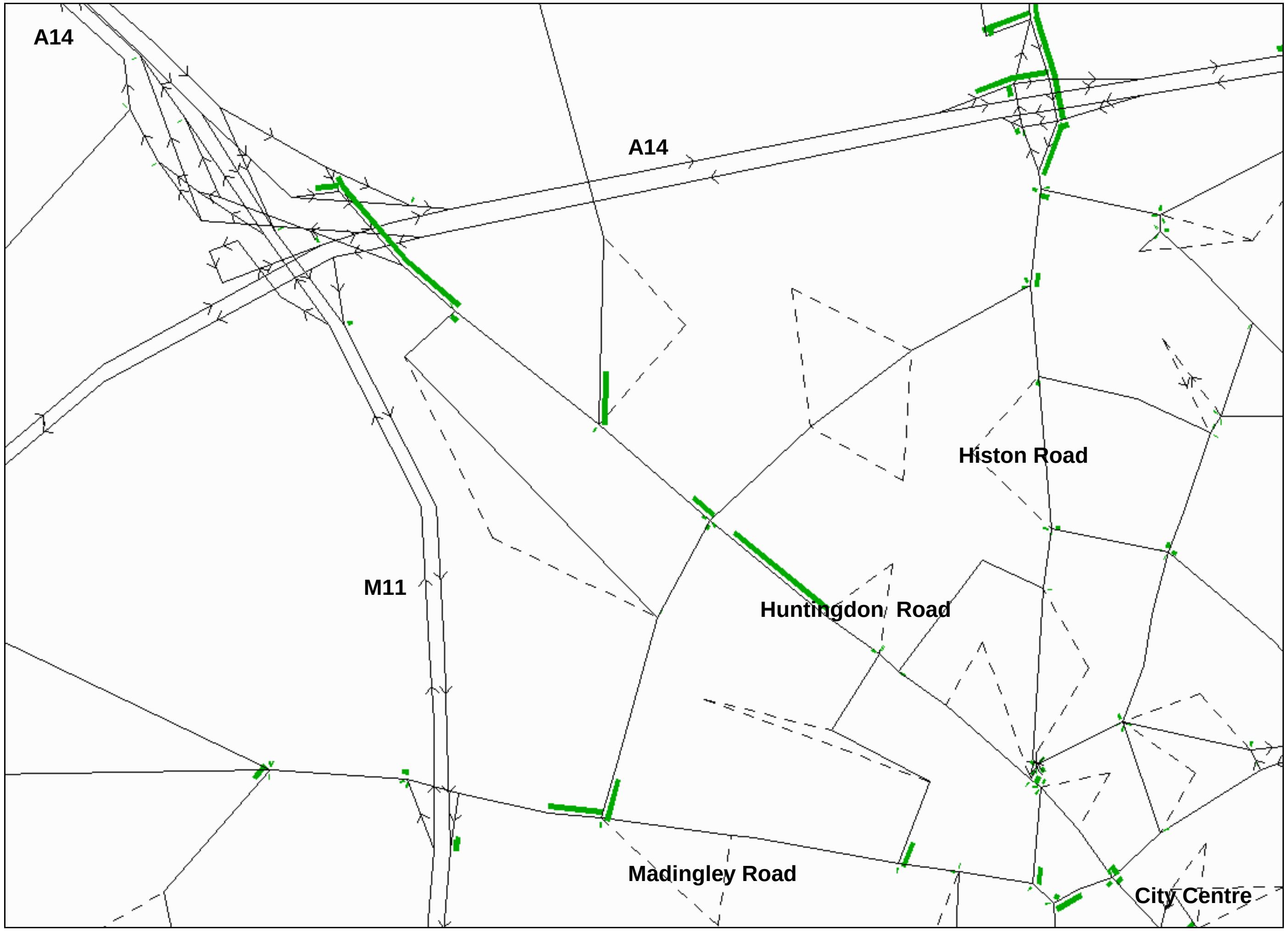


Figure 6.14 – Preferred Highway Option Land Use Scenario 1: Wider Area

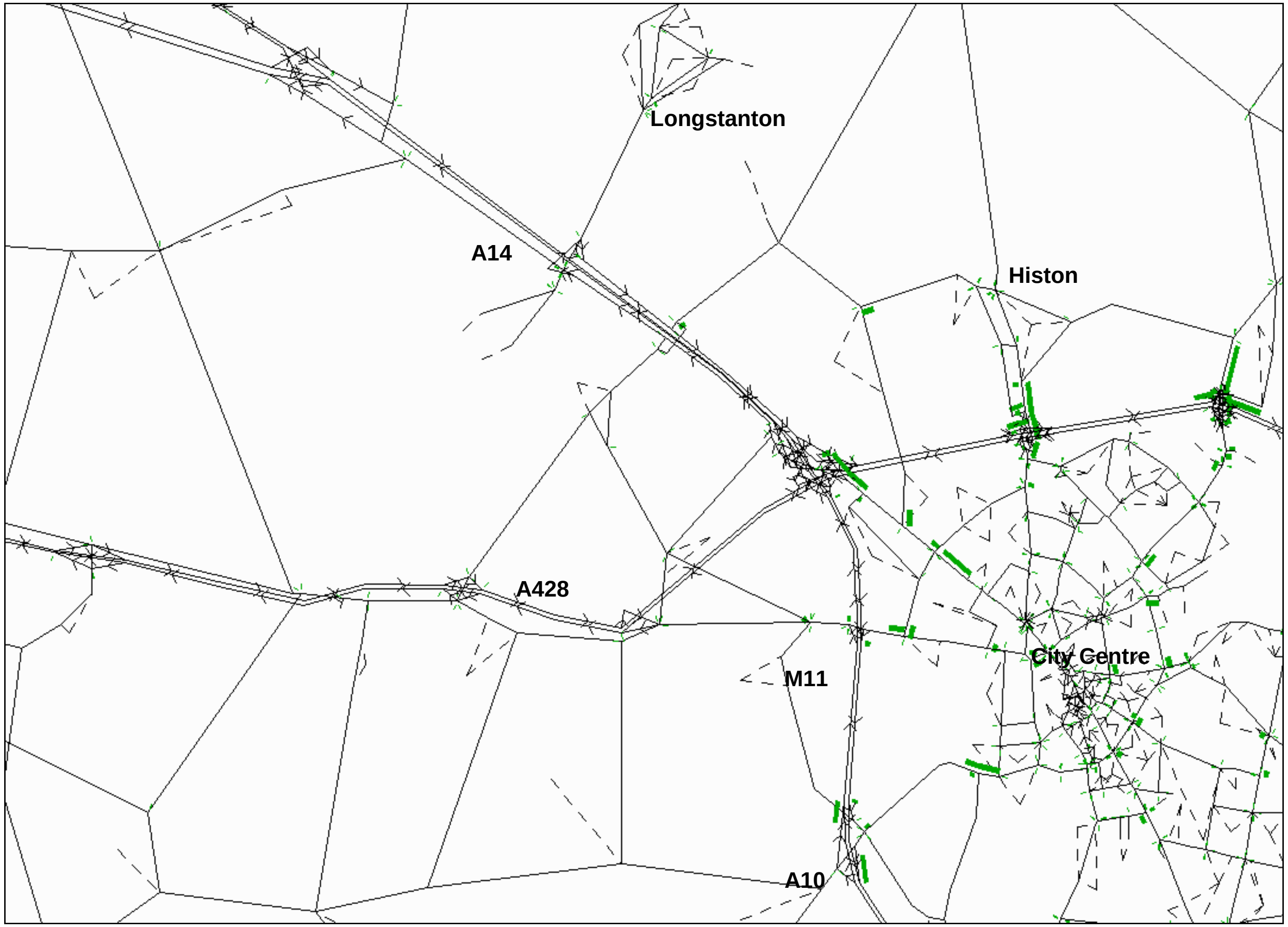


Figure 6.15 - Preferred Highway Option Land Use Scenario 2: Local Area

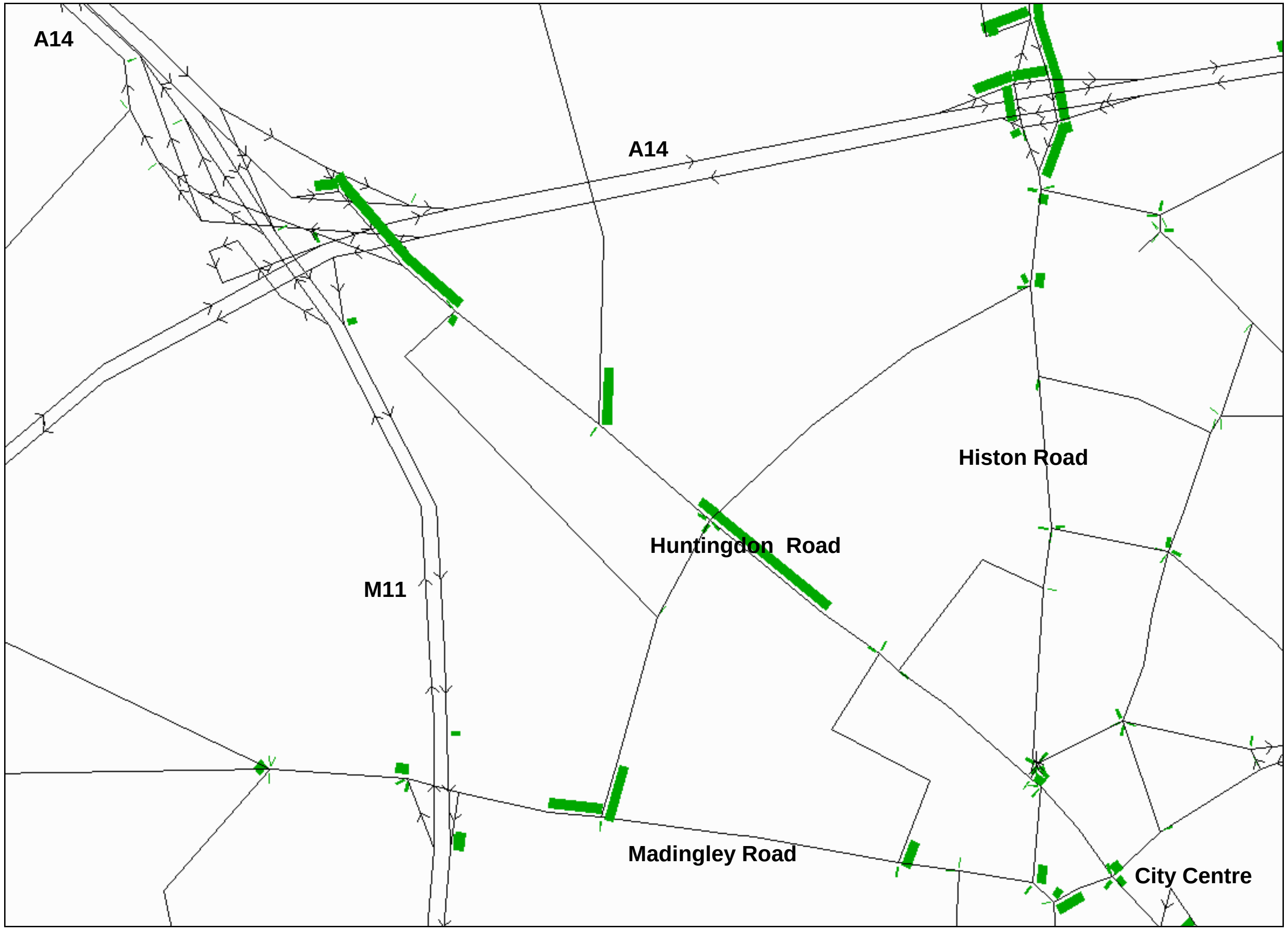


Figure 6.16 - Preferred Highway Option Land Use Scenario 2: Wider Area

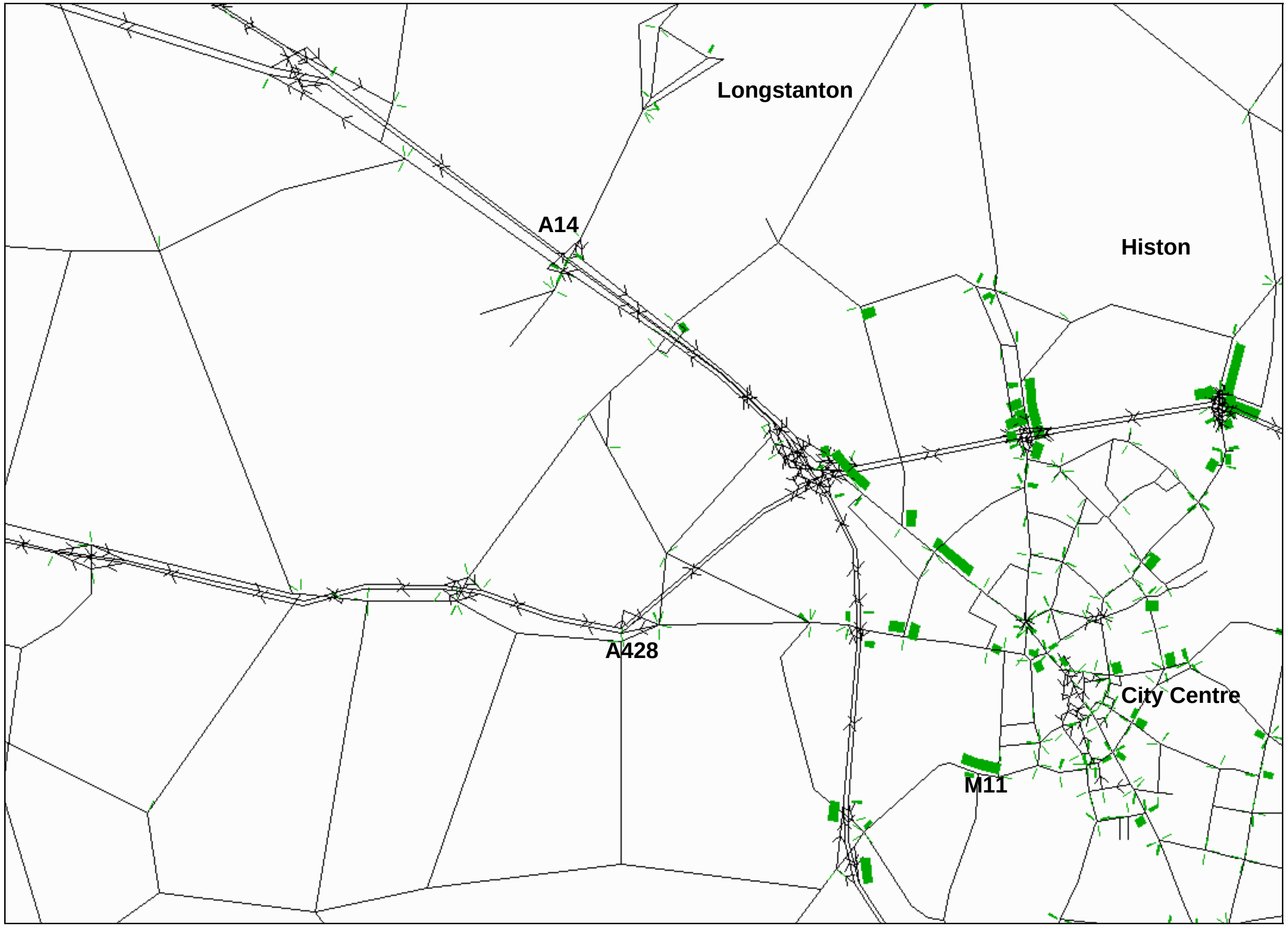
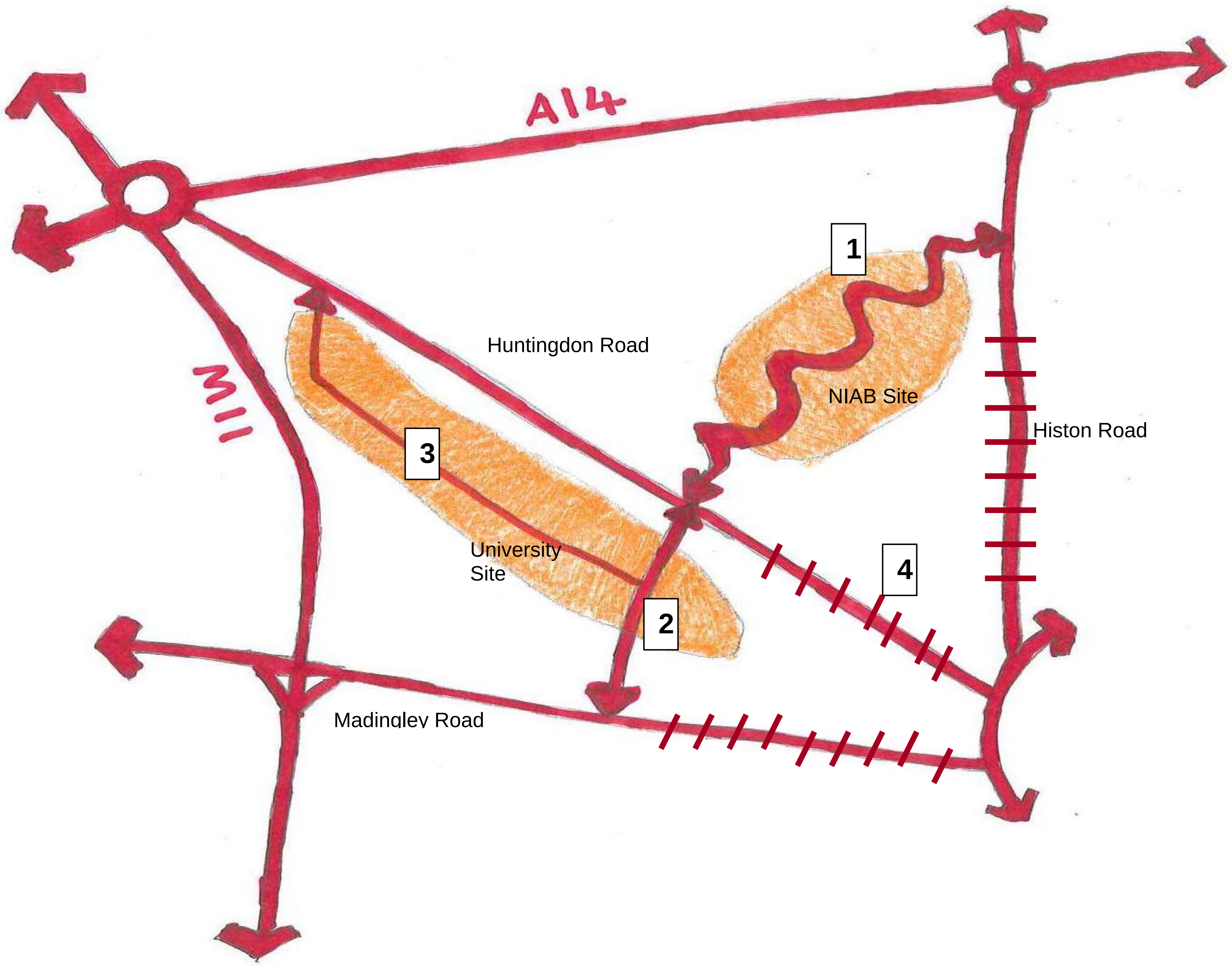


Figure 6.17 - Preferred Highway Option



Key

1 - Sinuous route designed to accommodate development traffic only

2 - Orbital Link Road

3 - Radial link road and potential public transport route for existing services

4 - Reduced highway capacity space to be given to public transport, walking and cycling.

7. The Preferred Transport Option

Introduction

7.1 This Section of the report summarises the Preferred Transport Option to accompany development of the CNW site. This is based upon the public transport, walking and cycling strategies set out in Section 5 of this report and the Preferred Highway Option described in Section 6.

7.2 The proposed land use for the Preferred Transport Option is the Approved Land Use as identified in Section 1 of this report and summarised in Table 7.1.

Table 7.1 - Transport Study Land Use

NIAB Land			University Land		
Land Use	**Quantity**	**Unit**	**Land Use**	**Quantity**	**Unit**
Residential	1780	Dwellings	**Primary School**	2.3	Hectares
Primary School	2.3	Hectares	**Residential** **(Key worker – 50%)** **(Private/Market – 50%)**	1150 575 575	Dwellings
Local centre	1	Hectare	**Higher Education**	14	Hectares
Secondary school	8	Hectares	**Research**	6	Hectares
			Local Centre	1	Hectare

THE PREFERRED TRANSPORT OPTION

Public Transport Strategy

7.3 The proposed Public Transport Strategy is described in Section 5 of this report. The strategy includes diverted and new bus routes passing through the CNW development site. Measures to be provided as part of this strategy include:

- Diversion of existing bus services along Huntingdon Road from Bar Hill (the 15/15A, 1A/5, 151 and City 5) through the University land, continuing in to the City along Madingley Road;
- Bus priority measures within the NIAB and University land, including dedicated bus lanes;
- A new bus service from the northwest corner of the site, exiting on to the wider highway network at the junction with Madingley Road in the southwest corner of the site, continuing to the City Centre with a possible extension to the rail station and/or Addenbrooke's Hospital;

- A new bus route to broaden the destinations served directly by bus and thereby enhance the public transport mode share of trips to/from the development site. This route would be orbital in nature starting in either the Madingley Road P&R site or at the potential new Huntingdon Road P&R site in the northwest of the development and continuing northeast through the site, crossing directly across Huntingdon Road and travelling on to the NIAB land site and continuing to the Science Park via King's Hedges Road; and
- A new bus service to the City Centre and beyond to Cambridge Railway Station and Addenbrooke's Hospital starting from the north of the development site and exits on to Huntingdon Road at the new signalised junction, continuing via the University land site if this offers a journey time advantage.

7.4 The new routes have been assessed for two different levels of service frequency. A Lower Public Transport Enhancement giving a PTAL of 2-3 across the development site and a Higher Public Transport Enhancement giving a PTAL of at least 3 across much of the development site. The frequency of service for each enhancement option is presented in Table 7.2.

Table 7.2 - New bus route service frequencies (Buses per hour peak and off peak)

	Low PT enhancements	High PT enhancements
University area land to City Centre	2	6
NIAB land to City Centre	4	6
Orbital route	2	4
Guided Busway	10	10

7.5 The proposed Public Transport Strategy is shown in Figure 5.1. A detailed cross section of the bus corridor is shown in Figure 7.1.

7.6 In order to achieve the reduced trip rates for car drivers suggested in Section 7.11 below, the higher level of Public Transport Enhancement should be achieved as part of the Transport Strategy.

Walking Strategy

7.7 The proposed Walking Strategy is described in Section 5 and shown in Figure 5.2. Measures to be provided as part of this Strategy include:

- A grid system of walking routes within the development sites, providing maximum permeability to destinations within the development;
- Connections to existing walking routes on Histon Road, Huntingdon Road and Madingley Road. It is recommended that as many connections as possible are provided between the development sites and these routes. Opportunities for connections are available at the following locations:
  - Histon Road: Development access, Bronlow Road and Windsor Road;
  - Huntingdon Road: Development access, Whitehouse Lane, Oxford Road (served from Windsor Road) and Accesses to University buildings;

- Madingley Road: Park and Ride access, Development access, Storey's Way and Accesses to University buildings; and
- New pedestrian crossings at all new highway access points and several new pedestrian access points.

7.8 Where feasible these links should be in the form of segregated footpath/cycle links.

Cycling Strategy

7.9 The proposed Cycling Strategy is described in Section 5 and shown in Figure 5.3. Measures to be provided as part of this strategy include:

- ♦ A new orbital route that would link eastwards to Histon Road (connecting to an existing route serving the Science Park) and southwards to Coton path forming part of a wider orbital route around the outside of the City as outlined in 'Protection and Funding for the Future Expansion of the City Cycle Network' (2004). From Coton Path, University buildings located on Queens Road can be accessed. This route also has the potential to reach Chesterton Interchange, providing a direct and convenient cycle route between the sites and the new station;
- ♦ Widened cycle lanes on Huntingdon Road to improve safety;
- ♦ Links to Madingley Road Park and Ride, Windsor Road and Storey's Way;
- ♦ A radial route between the orbital cycle route and Histon Road;
- ♦ A radial route between the orbital cycle route and Storey's Way, providing a link between the development site and Cambridge Station;
- ♦ A network of segregated cycle/footway lanes within the development providing maximum permeability for cyclists to the surrounding cycle network and to the local centre;
- ♦ Cycle parking spaces at the local centres of both parts of the development;
- ♦ Cycle storage in all dwellings on both developments either as extended garages or in a separate covered location; and
- ♦ Cycling schemes and information published through community schemes and schools.

7.10 It is also recommended that the developers of the CNW site should consider including improvements to cycle parking and other facilities in Cambridge City Centre and at Cambridge bus and rail stations. In addition suitable provision should be made for future cycle parking at Chesterton Interchange, which may be secured by investment from the developers as appropriate.

Highway Strategy

7.11 The Preferred Highway Option is described in Section 6 and shown in Figure 6.17. This Preferred Highway Option is based upon a 'reduced' trip rate for car trips, as outlined in Section 4.18 of this report and further detailed in Appendix D. The reduced trip rate is based upon the following modal shift being achieved by the Preferred Transport Option:

- Modal share for trips made on foot to be increased by 2 percent from 24 percent to 26 percent;
- Modal share for trips made by cycle to be increased by 2 percent from 16 percent to 18 percent;
- Modal share for rail made by train to be increased by 1 percent from 2 percent to 3 percent; and
- Modal share for trips made by bus to be increased by 3 percent from 4 percent to 7 percent.

7.12 These changes in mode share allow an 8 percent reduction to be made in the mode share for journey by car (reducing the mode share from 45 percent to 37 percent). This corresponds to a reduction in the AM two-way trip rate from 0.37 trips per household to 0.31 trips per household.

7.13 The modal shift suggested in Section 7.10 above is based upon the measures inherent within the Preferred Transport Option to increase the number of trips made by public transport, walking and cycling. However, the modal shift is also based upon the following being achieved within the development sites:

- A high level of public transport accessibility, giving an average PTAL level of 3 across the CNW development site;
- A direct bus service being provided between the CNW development and Cambridge Railway Station;
- Continued growth in cycling mode share in the ward. This should be encouraged by providing good levels of safe, secure and well lit cycle parking within the development site for residents and visitors;
- Parking management being enforced within the CNW development site, with levels of parking provision which are below those outlined in the Cambridgeshire and Peterborough Structure Plan;
- Car sharing facilities being available within the development, through the use of car clubs or other similar measures;
- Residential travel planning, including personal journey to work travel planning for residents of the development;
- Good levels of service provision within local centres on the CNW site, to encourage trips to be internalised within the site;
- Implementation of the Huntingdon to Cambridge Guided Busway;
- Implementation of A14 widening (Ellington to Fen Ditton) scheme; and
- Implementation of Chesterton Station Interchange.

7.14 Measures to be provided as part of the CNW Preferred Transport Option include:

- New access junction on Huntingdon Road close to the A14 slip road to serve as an access to University land;
- New radial route through the University site between the Huntingdon Road access and orbital road; and
- Sinuous orbital road through the NIAB development site to discourage through traffic;

- Direct orbital road through the University development site to discourage existing rat-running on Storey's Way and offer an alternative access to the strategic road network;
- New crossroads on Huntingdon Road serving the orbital road and providing access to University and NIAB land;
- New access junction to the University land on Madingley Road;
- New access junction on Histon Road close to Histon Interchange serving as an access to the NIAB land; and
- Car parking within the development to be restricted to a level below the maximum parking standards set out by CCC to deter car usage, with appropriate car park management measures.

7.15 This highway network will provide for the necessary vehicular trips associated with the development and provide a structure to accommodate the public transport, walking and cycling strategies.

COST OF DELIVERY OF THE PREFERRED TRANSPORT OPTION

Public Transport

Service Costs

7.16 For costing purposes it is assumed that the proposed new bus services operate with the following service characteristics:

- Operating hours:
  - Morning peak period: 0700-1000 hours;
  - Inter peak period: 1000-1600 hours;
  - Evening peak period: 1600-1900 hours;
- Operating days:
  - Weekdays: 252 days;
  - Saturday service (75% of weekday service): 55 days; and
  - Sunday service (50% of weekday service): 55 days.

7.17 The route length for the University service is 6.4km (based on a route through the site to the City Centre and rail station); for the NIAB service 6.1km (based on a route through the site to the City Centre and rail station) and for the orbital service 6.9km (based on a route starting in the University site and continuing to the Science Park). During peak periods an operating speed of 18kmh is assumed; this provides journey times comparable with existing timetables along the corridors in question.

7.18 Using the service parameters described above, and industry standard unit cost rates, an estimate has been made of the cost of providing these new services. This exercise provides a guideline operating cost for a local bus company to operate the service. The combined cost of the lower level of public transport service enhancements is £729,000 (Table 7.3), while the higher level of enhancements costs £1,426,000 (Table 7.4).

Table 7.3 - New Route costs per annum (Low Public Transport Enhancements)

Cost element	University Route	NIAB Route	Orbital Route
Drivers	£84,000	£159,000	£111,000
Other direct	£25,000	£41,000	£30,000
Depreciation	£23,000	£34,000	£23,000
Engineering	£22,000	£38,000	£29,000
Total direct	*£153,000*	*£273,000*	*£193,000*
Indirect	£16,000	£25,000	£16,000
Depot overhead	£10,000	£15,000	£10,000
Head office overhead	£5,000	£8,000	£5,000
Total indirect & overheads	*£32,000*	*£47,000*	*£32,000*
Total	**£185,000**	**£320,000**	**£225,000**

Table 7.4 - New Route Costs (High Public Transport Enhancements)

Cost element	University Route	NIAB Route	Orbital Route
Drivers	£323,000	£310,000	£223,000
Other direct	£87,000	£85,000	£60,000
Depreciation	£68,000	£68,000	£46,000
Engineering	£82,000	£79.000	£58,000
Total direct	*£560,000*	*£543,000*	*£386,000*
Indirect	£49,000	£49,000	£33,000
Depot overhead	£31,000	£31,000	£20,000
Head office overhead	£15,000	£15,000	£10,000
Total indirect & overheads	*£95,000*	*£95,000*	*£63,000*
Total	**£654,000**	**£638,000**	**£449,000**

7.19 The lower frequency of the orbital route results in the lower operating cost – around £450,000 – while the two routes to the City Centre each cost around £650,000 per year. The combined operating cost of the services described is thus around £1,750,000.

Operating Revenues

7.20 Based on the forecast public transport trip generation rates provided in Table 2.4 of Appendix B, additional operating revenues have been estimated for the services proposed as shown in Table 7.5 and 7.6. Daily demands have been estimated by analysing the relationships between all day demand and morning peak hour demand on the existing bus route 553/4/5, and then annualised using the same estimates as detailed for the costing exercise above. Revenue per trip has been calculated from an assumed charge of £0.28 per kilometre. This charging level is in line with the current Stagecoach ticket price between Girton Corner and the City Centre.

7.21 It should be noted that the forecast revenues relate only to trips with an origin or destination in at least one of the development sites. As the proposed bus services extend beyond these sites – to the City Centre, rail station and Science Park, it would be expected that additional bus trips would be generated. In addition, as the existing bus routes on Histon Road, Huntingdon Road and Madingley Road all serve parts of the sites, some of the additional revenue forecast would be captured by these services.

Table 7.5 - Estimation of Extra Bus Revenue (Low Land Use Scenario)

Route	Trips				Revenue	
	Peak hour	Weekday	Weekend	Year	Per trip	Per year
University	113	636	955	212,876	£1.29	£274,000
NIAB	140	791	1,186	264,512	£1.20	£318,000
Orbital	42	237	356	79,428	£1.93	£153,000
Combined						£746,000

Table 7.6 - Estimation of Extra Bus Revenue (High Land Use Scenario)

Route	Trips				Revenue	
	Peak hour	Weekday	Weekend	Year	Per trip	Per year
University	171	965	1,447	322,641	£1.29	£416,000
NIAB	197	1,108	1,663	370,777	£1.20	£446,000
Orbital	61	345	517	115,372	£1.93	£223,000
Combined						£1,085,000

Net Operating Costs

7.22 A comparison of the costs and revenues for the two development scenarios and the two public transport options reveals that only the Lower Public Transport Enhancements are able to operate without subsidy in the long term (Table 7.7). With the Higher Public Transport Enhancements (Table 7.8) an ongoing operating subsidy would be required, even with the higher development intensity scenario (Land Use Scenario 2).

Table 7.7 - Summary of Operating Costs and Revenues

Development scenario	PT enhancement	Cost	Revenue	Subsidy required	Surplus produced
Low	Low	£729,000	£746,000	-	£17,000
	High	£1,426,000	£746,000	£680,000	-
High	Low	£729,000	£1,085,000	-	£355,000
	High	£1,426,000	£1,085,000	£341,000	-

7.23 An investigation of the estimated costs and revenues for individual routes (Table 7.8) reveals that the orbital route requires the greatest subsidy – it is only under Land Use Scenario 2 and Low Public Transport Enhancement option that it comes close to being a self supporting route.

Table 7.8 - Operating Subsidy Required (negative indicates surplus produced)

Development scenario	PT enhancement	Route		
		University	NIAB	Orbital
Low	Low	-£89,000	£1,000	£71,000
	High	£242,000	£142,000	£296,000
High	Low	-£231,000	-£127,000	£2,000
	High	£100,000	£14,000	£227,000

7.24 As noted earlier, additional revenue can be expected from bus trips not related to the development sites. However, some trips will be made on the existing bus routes past the sites and thus revenue will be lost to these services.

7.25 As stated in Section 7.6, in order to achieve the reduced trip rates for car drivers suggested in Section 7.11, the higher level of Public Transport Enhancement should be achieved as part of the Preferred Transport Option.

Walking

7.26 Walking facilities within the development site and connections to the existing walking network should be wholly funded by the developer. It is predicted that the walking elements of the Preferred Transport Option would cost approximately £750,000 to deliver.

Cycling

7.27 Cycling facilities within the development site and connections to the cycling walking network should be wholly funded by the developer. It is predicted that the cycling elements of the Preferred Transport Option would cost approximately £500,000 to deliver.

Highway

7.28 A basic estimate of the cost of the proposed highway improvements and other improvements associated with the Preferred Transport Option is shown in Table 7.9.

Table 7.9 - Preferred Transport Option Cost Estimate

Proposed Measure	Estimated Cost
Off site highway improvements to Histon Interchange	£1,500,000
Extension to Madingley Road Park and Ride	£750,000
New Huntingdon Road Park & Ride	£1,250,000
Ten year operating subsidy for Bus Routes	£20,000 - £2,960,000
Bus priority Measures	£500,000
Pedestrian measures	£750,000
Cycle Measures	£500,000
TOTAL*	**£5,270,000 – £8,210,000**

* the approximate cost estimate does not include statutory diversions or compulsory purchase of land or design fees.

7.29 As Table 7.9 shows the Preferred Transport Option highway network would cost approximately £5,270,000 - £8,210,000 to deliver. It is recommended that this is sought through developer funding.

PHASING OF THE TRANSPORT PREFERRED TRANSPORT OPTION

7.30 Development of the CNW site is likely to take place in a phased manner. This will partly be determined by the method of construction and individual needs of developers of the site, as well as restrictions placed on development by local authorities. However a suggested method of phasing delivery of the development and associated Preferred Transport Option is shown in Figure 7.2 and summarised below.

- Phase 1 (2006-2011): development of section of NIAB land accessed from Huntingdon Road. Once a set level of development has been reached (to be agreed with the local authority) construction of the entire link road between Huntingdon Road and Histon Road should be completed before further development can proceed. Once the entire link road has been developed all new bus services should be provided at a reduced frequency as agreed with the local authority.;
- Phase 2 (2011-2016): development of the remainder of the NIAB land. Once the development is complete all new bus services should be provided at full frequency. Development of a section of University land accessed from Huntingdon Road and Madingley Road. Once a set level of development has been reached (to be agreed with the local authority) construction of the entire link road between Huntingdon Road and Madingley Road should be completed

before further development can proceed Once the entire link road has been developed all new bus services should be provided at a reduced frequency as agreed with the local authority;;

- Phase 3 (2016-2020): development of the remainder of the University land. Part of the land may be accessed from the link road between Huntingdon Road and Madingley Road, however once a set level of development has been reached (to be agreed with the local authority) construction of the entire link road between Huntingdon Road the link road should be completed before further development can proceed Once the development is complete all new bus services should be provided at full frequency; and
- Phase 4 (2020-2026): Development of remainder of University Site and Huntingdon Road Park & Ride.

7.31 It should be noted that this phasing has been developed for the purposes of delivering the Preferred Transport Option only and is subject to change as a result of negotiations between the development and local authorities regarding the construction of the development.

SUMMARY

7.32 The Preferred Transport Option for the CNW site includes the following elements:

- A Public Transport Strategy;
- A Walking Strategy;
- A Cycling Strategy; and
- A Highway Strategy.

7.33 These elements all need to be delivered in order for the Preferred Transport Option to operate effectively.

7.34 Approximate cost estimates for the measures included in the Preferred Transport Option suggest that it will cost £5.27 - £8.21 million to deliver. It is recommended that this is sought through developer funding.

Figure 7.1 - Typical Cross Section of Orbital Road

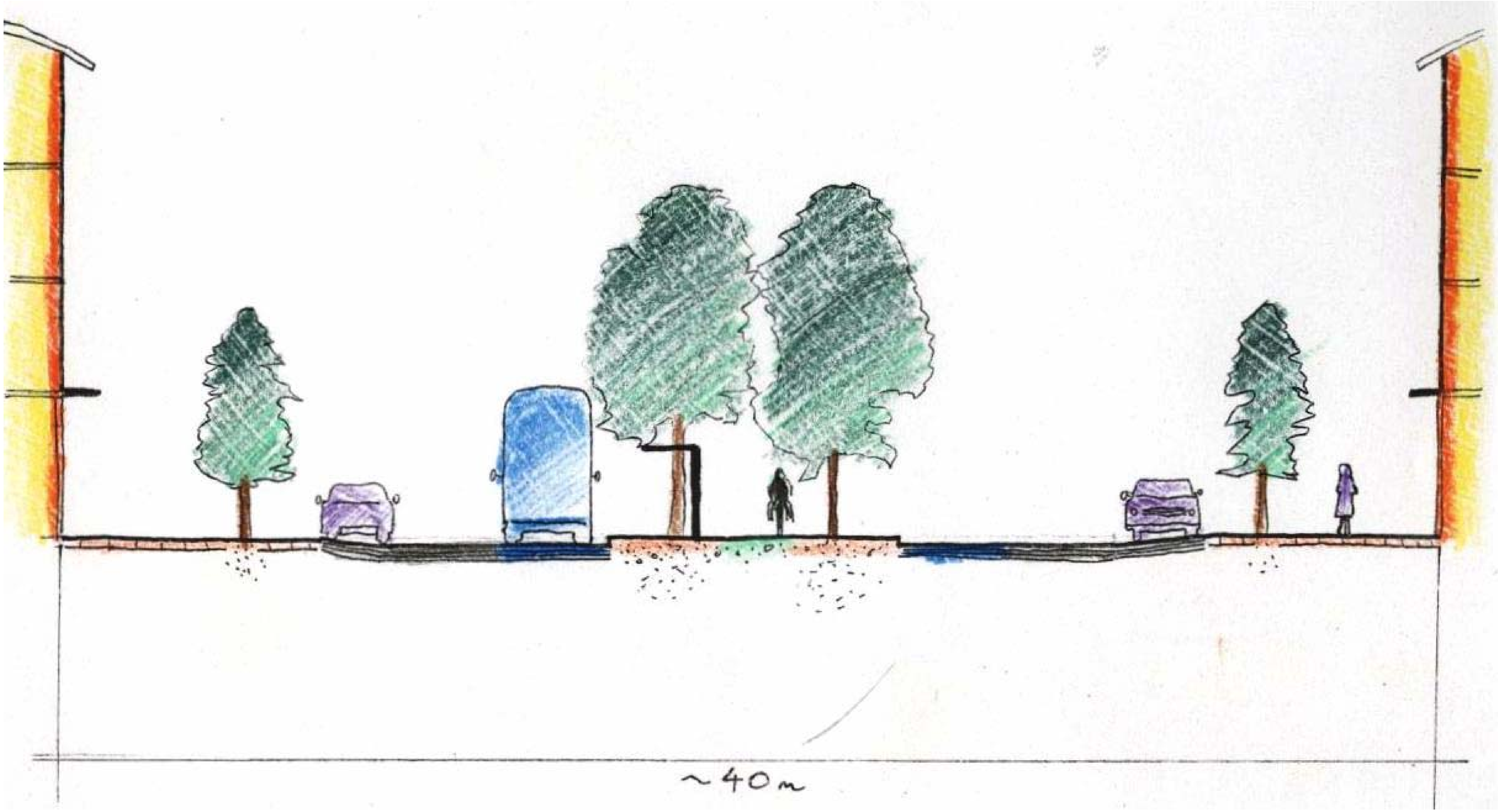
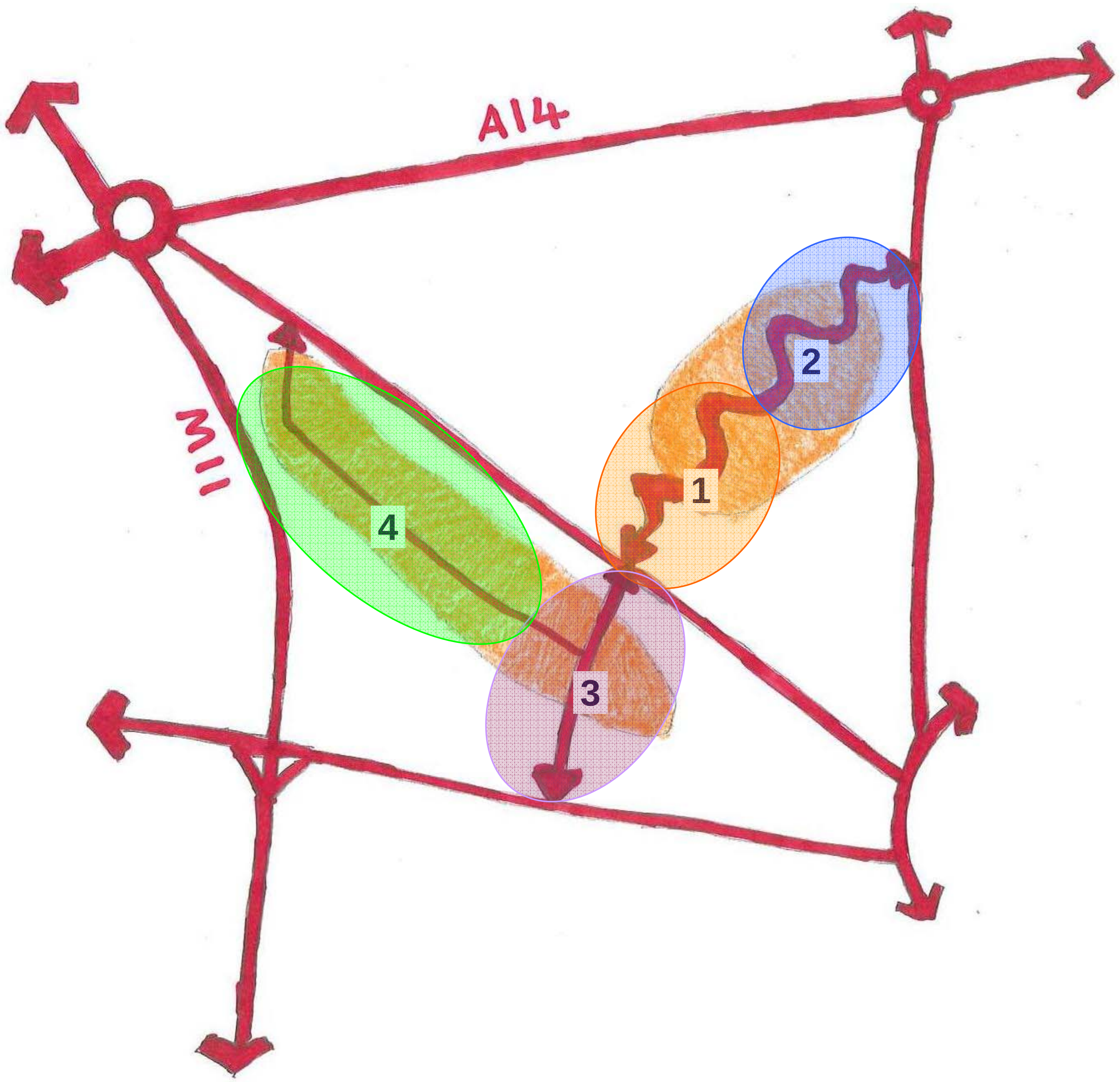


Figure 7.2 - Proposed Phasing of the Preferred Transport Option



Key

1 – Phase 1 (2006-2011)

2 – Phase 2 (2011-2016)

3 – Phase 3 (2016-2020)

4 – Phase 4 (2020-2026)

8. Summary

8.1 This report presents the findings of a study undertaken to develop a Preferred Transport Option for a proposed development site in north-west Cambridge named Cambridge North West.

8.2 The proposed development site includes two parcels of land as follows:

- NIAB Land: located between Huntingdon Road and Histon Road; and
- University Land: located between Huntingdon Road and Madingley Road.

8.3 Two land use scenarios have been included in the study. The first includes allocated development on both land parcels, whilst the second is a sensitivity test reflecting higher development levels on both sites.

8.4 This study has been steered by Officers from CCC, CCiC and SCDC. Consultation has taken place with Members of CCC, CCiC and SCDC, developers of the land parcels, the HA and Cambridge Horizons.

FUNDAMENTAL PRINCIPLES OF THE TRANSPORT STUDY

8.5 This Transport Study is guided by two main principles, which have been identified to fulfil the overall aims and objectives of the study. These principles include:

- A 'predict, provide and promote' Study for trips by public transport, cycling and foot; and
- A 'demand management' approach for trips by the private car.

8.6 These principles will allow for sustainable development of the site.

ELEMENTS OF THE PREFERRED TRANSPORT OPTION

8.7 A number of strategic alternatives were developed during the study based on the fundamental principles outlined above. These strategic alternatives were subject to a series of revisions based on the findings of traffic impact modelling using SATURN, LINSIG and TRANSYT. The refined strategic alternatives form four strategies which make up the overall Preferred Transport Option:

- A Public Transport Strategy designed to promote the use of buses for trips to key destinations in the vicinity of the site, including Cambridge Rail Station;
- A Walking Strategy designed to maximise the permeability of the site and encourage short distance trips to be made by this mode of travel;
- A Cycling Strategy designed to provide direct cycle routes to the Science Park, Station and future Chesterton Interchange; and
- A Highway Strategy designed to provide for the necessary vehicular trips associated with the development whilst managing the need to travel using the private car and promoting the use of other modes of travel as outlined above.

8.8 The Preferred Transport Option depends on all four of these strategies being implemented within the development site. The Public Transport, Walking and Cycling strategies are based upon a direct link (crossroads) being achieved across Huntingdon Road between the development sites.

8.9 The Preferred Transport Option is based upon an 8 percent reduction in the mode share for journey by car being achieved at the site. This mode shift is based upon the measures inherent in the Preferred Transport Option to increase the number of trips made by public transport, walking and cycling. However, the modal shift is also based upon the following being achieved within the development sites:

- A high level of Public Transport enhancement, giving an average PTAL level of 3 across the CNW development site;
- A direct bus service being provided between the CNW development and Cambridge Railway Station;
- Continued growth in cycling mode share in the ward;
- Parking management being enforced within the CNW development site, with levels of parking provision which are below those outlined in the Cambridgeshire and Peterborough Structure Plan;
- Car sharing facilities being available within the development, through the use of car clubs or other similar measures;
- Residential travel planning, including personal journey to work travel planning for residents of the development;
- Good levels of service provision within local centres on the CNW site, to encourage trips to be internalised within the site;
- Implementation of the Huntingdon to Cambridge Guided Busway;
- Implementation of A14 widening (Ellington to Fen Ditton) scheme; and
- Implementation of Chesterton Station Interchange.

DELIVERING THE PREFERRED TRANSPORT OPTION

8.10 Development of the CNW site is likely to take place in a phased manner. This will partly be determined by the method of construction and individual needs of developers of the site, however it is suggested that the Preferred Transport Option is delivered in the following stages:

- Phase 1 (2006-2011): development of the Huntingdon Road to Histon Road link and new bus services serving the site at reduced frequency ;
- Phase 2 (2011-2016): new bus services serving the site at full frequency;
- Phase 3 (2016-2020): development of the Huntingdon Road to Madingley Road link and new bus services serving the site at reduced frequency; and
- Phase 4 (2020-2026); new bus services serving the site at full frequency.

8.11 It should be noted that this phasing has been developed for the purposes of delivering the Preferred Transport Option only and is subject to change as a result of negotiations between the development and local authorities regarding the construction of the development.

8.12 It is estimated that the cost of implementing the Preferred Transport Option is approximately £5.27 - £8.21 million. It is recommended that this is sought through developer funding.

RECOMMENDATIONS FOR FURTHER STUDY

8.13 This Transport Study is strategic in nature and the analysis carried out as part of the study does not provide a detailed assessment of the impact of development of the CNW site. Developers of the site will need to undertake further assessment in the form of Transport Assessment Reports to meet the needs of the planning application process. These Transport Assessments will need to include analysis of the transport impact of development of the site all day and for all modes of travel in line with CCC guidance. Travel plans will also be required.

APPENDIX A

Planning Policy Note

Planning Policy Review

1. INTRODUCTION

1.1 This technical note outlines the planning policy and guidance relevant to the Cambridge North West Transport Study.

1.2 The note deals first with planning policy and guidance at a regional scale, including the draft East of England Plan and Regional Planning Guidance 6. The note then deals with more local guidance including:

- The Cambridge and Peterborough Structure Plan (2003)
- Cambridge Redeposit Local Plan

1.3 For each policy document the overall aims and objectives of the guidance are summarised and the main policies relevant to Transport Study for Cambridge North West are described. The aim of the note is to ensure that the Transport Study is consistent with planning policy guidance.

2. REGIONAL PLANNING

2.1 Adopted Regional Planning Guidance in East Anglia is currently described in Regional Planning Guidance (RPG) note 6 (November 2000). This sets out the longer term future in East Anglia up to 2016 covering the counties of Cambridgeshire, Norfolk and Suffolk.

2.2 In April 2001 the area covered by RPG 6 was combined with part of the south eastern region covered by RPG 9 to form a new region: East of England. Planning guidance for the East of England has been published in draft format and will eventually replace RPG 6 and part of RPG 9.

2.3 Both documents are relevant to the Cambridge North West Transport Study and are considered in more detail below.

East of England Plan

2.4 The East of England Plan is a draft spatial strategy to guide development in the East of England in the next 20 years. The plan is designed as a revision to the existing Regional Spatial Strategy for the East of England. The Plan will cover: Bedfordshire; Luton; Cambridgeshire; Peterborough; Hertfordshire; Essex; Southend-on-sea; Thurrock; Norfolk; and Suffolk (currently covered by RPG6 and RPG9).

2.5 The draft East of England Plan has been produced by the East of England Regional Assembly (EERA), a voluntary organisation comprising all 54 county, unitary and district/borough councils in the region, along with a wide cross-section of stakeholders.

2.6 The East of England Plan is currently not a statutory document. The draft Plan was the subject of an Examination in Public from September 2005 to early 2006. The Panel Report from this Examination in Public has been published and the Secretary of State has recently proposed changes. It is expected that the final East of England Plan will be published in Spring 2007.

Aims and Objectives

2.7 The spatial planning vision for the East of Anglia is to ‘sustain and improve the quality of life for all people who live in, work in, or visit the region, by developing a more sustainable, prosperous and outward-looking region, while respecting its diversity and enhancing its assets.’

Policies Relevant to the Cambridge North West Transport Study

2.8 Chapter 8 of the draft plan presents the Regional Transport Strategy for the East of England. Many of the policies within this chapter are also included in more local planning policy including the Cambridge and Peterborough Structure Plan and are therefore explored in more detail in the relevant sections of this note.

Policy CSR2: scale of housing provision and its distribution

2.9 *“Local development documents should provide for 46,800 homes in the (Cambridge) sub-region between 2001 and 1016, 15,000 new homes will be required between 2016 and 2021.*

	2001-2016	*2016-2021*
Cambridge built up area	*8,000*	*1,200*

Edge of Cambridge	*8,000*	*5,500…"*

Regional Planning Guidance Note 6 (RPG6): Regional Planning Guidance for East Anglia to 2016 (November 2000)

2.10 The existing Regional Planning Guidance note for East Anglia had been provided by the Secretary of State for the Environment, Transport and the Regions and covers the period up to 2016, setting out the framework for the longer term future. The purpose of the guidance is to set out the regional framework for development plans in East Anglia and the RPG is a material consideration which must be taken into account, where relevant, in decisions on planning applications.

Aims and Objectives

2.11 The vision for East Anglia is one of 'development set within a sustainable development framework'. The RPG includes a number of objectives to achieve this vision, including 'to locate new development to maximise access to facilities in town and city centres'.

Policies Relevant to the Cambridge North West Transport Study

2.12 The RPG provides a sustainable strategy for the location and scale of development across the whole region. This strategy follows through to more local development plans, including the Cambridgeshire and Peterborough Structure Plan, Local Transport Plans and Local Development Frameworks and is explored in more detail in the relevant sections of this note.

Policy 22: Location of Housing and Related Development

"Development Plans should identify locations for housing and related development for services, schools, community facilities etc. in the following order of preference:

i. within the built up area of Cambridge, subject to capacity and environmental considerations;

ii. on the periphery of the built up area of Cambridge, subject to a review of the Green Belt…"

Policy 8: Housing Provision

"Provision should be made in development plans for the following net increases in dwellings (annual averages):

- *Cambridgeshire 4,000 (2,800 in the part of Cambridgeshire within the Cambridge sub-region 1,200 in the rest of the county)."*

3. CAMBRIDGESHIRE & PETERBOROUGH STRUCTURE PLAN 2003: PLANNING FOR SUCCESS

3.1 The Cambridgeshire and Peterborough Structure Plan (2003) was adopted by Cambridgeshire County Council and Peterborough District Council in October 2003 and provides the strategic policy framework for planning and development that will take place locally. The plan covers the period 2003 – 2016.

3.2 The Structure Plan ensures that provision for development is consistent with national and regional planning policy and informs the development of local plans for neighbouring areas, thereby ensuring that they are consistent.

3.3 New planning legislation which came into operation in 2004 will result in the gradual replacement of structure plans and local plans by regional spatial strategies (East of England Plan) and Local Development Documents. Until these documents have been approved (and in some cases for three years after for 'saved' policies) the Structure Plan remains in force.

Aims and Objectives

3.4 The Structure Plan is intended to 'improve the quality of life for everyone who lives, works and spends time in Cambridgeshire and Peterborough.' The Structure Plan does not set out specific objectives for realising this aim, however it is implicit within the document that the main objectives relate to providing for new development in a sustainable manner.

Policies Relevant to the Cambridge North West Transport Study

3.5 The policies within the Structure Plan which are directly relevant to the Transport Study for Cambridge North West are explored in detail below.

Sustainable Development

Policy P1/3 – Sustainable Design in Built Environment

"A high standard of design and sustainability for new development will be required which:

- *Minimises the need to travel and reduces car dependence providing;*
- *An appropriate mix of land uses and accessible services and facilities…;*
- *A safe and people-friendly environment;*
- *Direct walking and cycling routes;*
- *Good access by public transport;*
- *Managed access for private car and other motor vehicles;*
- *Infrastructure for modern telecommunication and information technology…"*

The Cambridge North West Transport Study must be developed with regard to this policy. The study will propose include strategic measures to minimise the need to travel and reduce car dependence and will also provide walking and cycling strategies designed to 'predict, provide and promote' for these modes of travel.

Places for Work

Policy P2/3 – Strategic Employment Locations

"Strategic employment sites in Cambridgeshire and Peterborough will be provided where there are good transport links, a locally available labour supply and the potential for business and industrial expansion. Locations are as follows:…

On land to be released from the Green Belt on the edge of Cambridge in accordance with Policy P9/2c, at locations …between Madingley Road and Huntingdon Road… for mixed use development including the expansion of educations and research facilities."

3.6 The Cambridge North West development includes the potential for employment on the University land between Madingley Road and Huntingdon Road. Further negotiations between Cambridge City Council and South Cambridgeshire District Council (as part of the Area Action Plan for the site) are required to determine the exact nature of this employment. In order to provide a robust review of the strategic impact of development of the North West site, the Transport Study will consider development at both allocated and aspirational development levels.

Where we Live

Policy P5/3 – Density

"Densities of 40 dwellings per hectare should be sought in locations close to a good range of existing or potential services and facilities and where there is, or there is the potential for, good public transport accessibility."

3.7 The Cambridge North West Transport Study will include strategic measures to reduce the need to travel and reliance on the private car. This will include measures to link the site to key destinations in Cambridge and the surrounding area by public transport, walking and cycling.

3.8 The study will inform masterplanning for the sites and will promote higher density development close to local centres and public transport routes.

Supporting Development

Policy P6/1 – Development Related Provision

"Development will only be permitted where the additional infrastructure and community requirements generated by the proposals can be secured, which may be conditional or legal agreement or undertaking."

Transport

Policy P8/1 – Sustainable Development – Links between Land use and Transport

"Local Planning Authorities should include policies in their Local Plans to ensure that new development:

- *Is located in areas that are, or can be made, highly accessible to public transport, cycle and foot;*

- *Is designed to reduce the need to travel, particularly by car;*
- *Provides opportunities for travel choice;*
- *Provides for the needs of pedestrians, cyclists and public transport users;*
- *Provides appropriate access from the highway network that does not compromise safety."*

3.9 This policy builds upon Policy P1/3. The principle aim of the Cambridge North West Transport Study is to integrate the development with existing transport networks and promote sustainable development which is designed to promote travel choice and reduce the need to travel by the private car.

Policy P8/2 – Implementing Sustainable Transport for New Development

"New development will be required to make provision for integrated and improved transport infrastructure to increase the ability to move by cycle, public transport and on foot.

Travel Plans will be required to accompany new non residential developments and expansion of existing non residential developments as a means of reducing car dependency and promoting alternative modes of travel."

3.10 These policies build upon Policy P1/3. The principle aim of the Transport Study is to integrate the development with existing transport networks and promote sustainable development which is designed to promote travel choice and reduce the need to travel by the private car.

Policy P8/5 – Provision of Parking

"Parking standards for all new development will be expressed as maximum standards and will be set in Local Plans. Lower levels of parking provision may be required:

- *Where means of travel other than the private car are available or can be provided;*

- *Where the need for high density development associated with central facilitates limits the potential for car parking.*

Parking standards for non-residential development should not exceed the standards specified in PPG13. In Cambridge, Peterborough and the Market

Towns parking standards for non-residential development below PPG13 standards should be achieved where shared parking is possible."

3.11 The Cambridge North West Transport Study is strategic in nature and will not include parking standards for the development. However improved public transport, walking and cycling facilities proposed as part of the Preferred Transport Option should enable the development to achieve lower levels of parking provision than those set in PPG13.

Policy P8/10 – Transport Investment Priorities

"Implementation of the following transport schemes will be sought over the Structure Plan period to meet strategic requirements and the needs of major developments:

- *A rapid transit network to serve key centres in the Cambridge Sub-region, initially between Cambridge and Huntingdon utilising the former St. Ives railway line between Trumpington and Cambridge City centre.*
- *Provision of improved travel information across the Structure Plan area including real time information;*
- *Bus priorities on key radial routes into Cambridge, Peterborough and the Market Towns;*
- *Bus routes which cater for an orbital movement around Cambridge;*
- *East West Rail route through Cambridge.*
- *Major improvement to Cambridge station including additional platforms and passenger facilities;*
- *Chesterton rail station and interchange including link to the rapid transit system utilising the former St. Ives railway line;*
- *Addenbrooke's rail station;*
- *Completion of 'Sustrans' long distance cycle network."*

3.12 The schemes detailed above will influence existing travel patterns in Cambridge and are likely to impact upon the Cambridge North West site. The

Transport Study will consider each of the proposals and the constraints and opportunities created by them. In particular the study will investigate whether orbital bus movement through the site should be promoted.

4. CAMBRIDGE REDEPOSIT LOCAL PLAN

4.1 Following a process of review which began in 2001, Cambridge City Council anticipates that the Cambridge Redeposit Local Plan will be adopted during 2006. Until such time it remains a 'material consideration' when planning decisions are made. The Local Plan sets out the policies and proposals for future development and land use up to 2016.

Aims and Objectives

4.2 The 'Vision' for Cambridge presented in the plan is of a compact, dynamic City with a thriving historic core surrounded by attractive and accessible green spaces. The Local Plan seeks to guide and facilitate growth in a sensitive and sustainable manner.

Policies Relevant to the Cambridge North West Transport Study

4.3 The policies within the Local Pan which are directly relevant to the Cambridge North West Transport Study are explored in detail below.

Policy 5/1 – Housing Provision

"Provision is made for an increase of 12,500 dwellings (net) over the period 1999-2016. This will comprise approximately 6,500 dwellings within the urban area and 6,000 in the urban extensions."

4.4 The provision of dwellings detailed in this policy includes the dwellings proposed for the Cambridge North West site.

Policy 9/8 – Land between Huntingdon Road and Histon Road

"The principal land uses will be:

(a) around 40 hectares of housing, indicative capacity 1,280 dwellings;

(b) complementary mixed uses including 1.5 hectares for a primary school;

(c) open space (the existing Christ's & Sidney Sussex Sports Ground should be retained unless adequate provision can be made elsewhere).

4.5 The ‘allocated’ development level tested as part of the Cambridge North West Transport Study includes the level of development included in this policy.

Proposals should:

(d) provide and open space buffer in order to respect the setting of Girton and avoid development which causes coalescence with the City. This development should link with the strategic gap which straddles Huntingdon Road between Girton College and Cambridge…”

Accessibility

(e) main vehicular access will be from Huntingdon Road, but some limited vehicle access may be possible form Histon Road providing it does not adversely affect the proposed Cambridgeshire Guided Bus route running on Histon Road;

(f) no vehicular access from Windsor Road;

(g) give priority to public transport, cycling and walking links between Histon Road and Huntingdon Road;

(h) give priority to walking and cycling within the development and link the development with the surrounding walking and cycling network and orbital routes;

(i) build part of the link identified in the western cycle network (this is an orbital route linking Huntingdon Road to Histon Road and extending to Girton and Impington);

(j) strengthen and expand public transport along Huntingdon Road and Histon Road with potential opportunity for bus stops within the development. Create an orbital bus route across the site;

(k)provide easy access to the Cambridgeshire Guided bus station stop on Histon Road.

4.6 The proposals for accessibility included in the Preferred Transport Option developed as part of the Cambridge North West Transport Study will be in accordance with the above policy.

Policy 9/7 Land between Madingley Road and Huntingdon Road

“Land between Madingely Road and Huntingdon Road is reserved for predominately Cambridge University related uses. In considering what is appropriate development, regard will be had to the Structure Plan and other Local Plan policies and to wheteher Cambridge University can show a clear need for the land to be released. In respect of collegiate development for staff

Proposals should:

(g) *provide an open space buffer in order to respect the setting of Girton and avoid development which causes coalescence with the City. This should link with the strategic gap (part of which is designated Green Belt) which straddles Huntingdon Road betweenGirton and Cambridge;*

(h) *Provide a radial green corridor into Cambridge;*

(i) *Provide an open space buffer adjacent to the M11 to protect Cambridge's setting, reinforce the new Green Belt edge and for public amenity;*

(j) *Undertake on-site strategic landscaping to an agreed framework early in the development of the site so that this will become established as development proceeds;*

(k) *Provide open space within the development for amenity, recreation and landscaping purposes, linking to the existing network of open space in the City and linking the urban area to the open countryside;*

(l) *Include a landscape framework which protects the SSSI at the Travellers' Rest Pit.*

Accessibility

(m) *vehicular access from Huntingdon Road and Madingley Road;*

(n) *the number of vehicular access points to the site should be minimised, especially from Huntingdon Road, and there should be no vehicular access from Storey's Way;*

(o) *give priority to walking and cycling within the development and link the development with the surrounding walking and cycling network and orbital routes;*

(p) *Facilitate the strengthening and expansion of public transport services along Madingley Road and Huntingdon Road;*

(q) *provide stops and create an orbital public transport route across the site."*

4.8 The proposals for accessibility included in the Preferred Transport Option developed as part of the Cambridge North West Transport Study will be in accordance with the above policy.

5. SOUTH CAMBRIDGESHIRE LOCAL PLAN (2004)

5.1 The South Cambridgeshire Local Plan sets out the detailed policies and proposals for the control of development in the District up to 2016.

Aims and Objectives

5.2 The strategy for the South Cambridgeshire Local Plan is based upon meeting the needs of the people of South Cambridgeshire up to the year 2006. The strategy includes locating new development in areas which provide the opportunity for more people to satisfy their day-to-day needs locally or in locations from which modes of transport in addition to the private motor car can be realistically provided. The strategy also includes maintaining and enhancing the character and diversity of the built and natural environment.

Policies Relevant to the Cambridge North West Transport Study

5.3 The policies within the Local Pan which are directly relevant to the Cambridge North West Transport Study are explored in detail below.

Policy TP1

The Council will seek, through its decisions on planning applications, to promote more sustainable transport choices, to improve access to major trip generators by non-car modes, and to reduce the need to travel, especially by car."

5.4 The location of the Cambridge North West development close to Cambridge City Centre allows the principles set out in Policy TP1 to be met.

6. LOCAL DEVELOPMENT FRAMEWORK FOR SOUTH CAMBRIDGESHIRE

6.1 South Cambridgeshire District Council are currently preparing a Local Development Framework (LDF) to replace the existing Local Plan under new government legislation for development plans. The LDF will set out the policies and proposals for the use of land in the District for the period to 2016.

6.2 The LDF is comprised of Local Development Documents, Area Action Plans (AAP) and Supplementary Planning Guidance. A Joint AAP is currently being prepared for Cambridge North West by South Cambridgeshire District Council and Cambridge City Council. The AAP 'Issues and Options' report will draw upon the findings of this Transport Study and will be published in April/May 2007. The final LDF document is proposed to be adopted in 2009.

and student accommodation and University academic faculty development, such evidence will also need to show that there is no available alternative land allocated for these uses elsewhere in Cambridge.

Land not required for development until after 2016 will be safeguarded fir the uses set out in this policy.

Development will take place over an extended period of time and phasing will be established through the Area Action Plan and a site-wide Masterplan. Sites 9.12, 9.15 and 9.16 can be bought forward at an early stage for development consistent with the emerging masterplan. Development of sites 9.07 and 9.08 should only take place when the University can show a clear need on a project by project basis for the land to be released (as defined above).

The principal land uses will be:

(a) up to 26 hectares of housing, of which 70% must be key worker housing for University or College staff, indicative capacity 1,150 dwellings. This housing mix will be required in each phase of development. The provision of key worker housing for University or College staff will satisfy the affordable housing requirement of Policy 5/5. Where it is not possible to develop enough key worker housing to satisfy the key worker target percentage, the affordable housing shortfall should be made up to the affordable housing target set by Policy 5/5 through the provision of other types of affordable housing;

(b) up to 14 hectares for higher education, including new collegiate provision, academic faculty development, student accommodation,University conference centre;

(c) all or part of a site for education including up to 1.5 hectares for a primary school;

(d) up to 6 hectares for University related sui generic research institutes and commercial research uses within Use Class B1(b);

(e) all or part of a site for a local centre to include a mix of uses within Classes A1, A2 and A3, of an appropriate scale to its location taking into account other local and district centres;

(f) public open space.

4.7 The ‘allocated’ development level tested as part of the Cambridge North West Transport Study includes the level of development included in this policy.

APPENDIX B

Public Transport Assessment

Cambridge North West Transport Study

Public Transport

JOB NUMBER: 5043251			DOCUMENT REF: PT Note3			
2	Revised and expanded draft	PWH	RJ	CPG	CPG	Aug 06
1	Draft PT Note	PWH				May 06
		Originated	Checked	Reviewed	Authorised	Date
Revision	Purpose Description	ATKINS				

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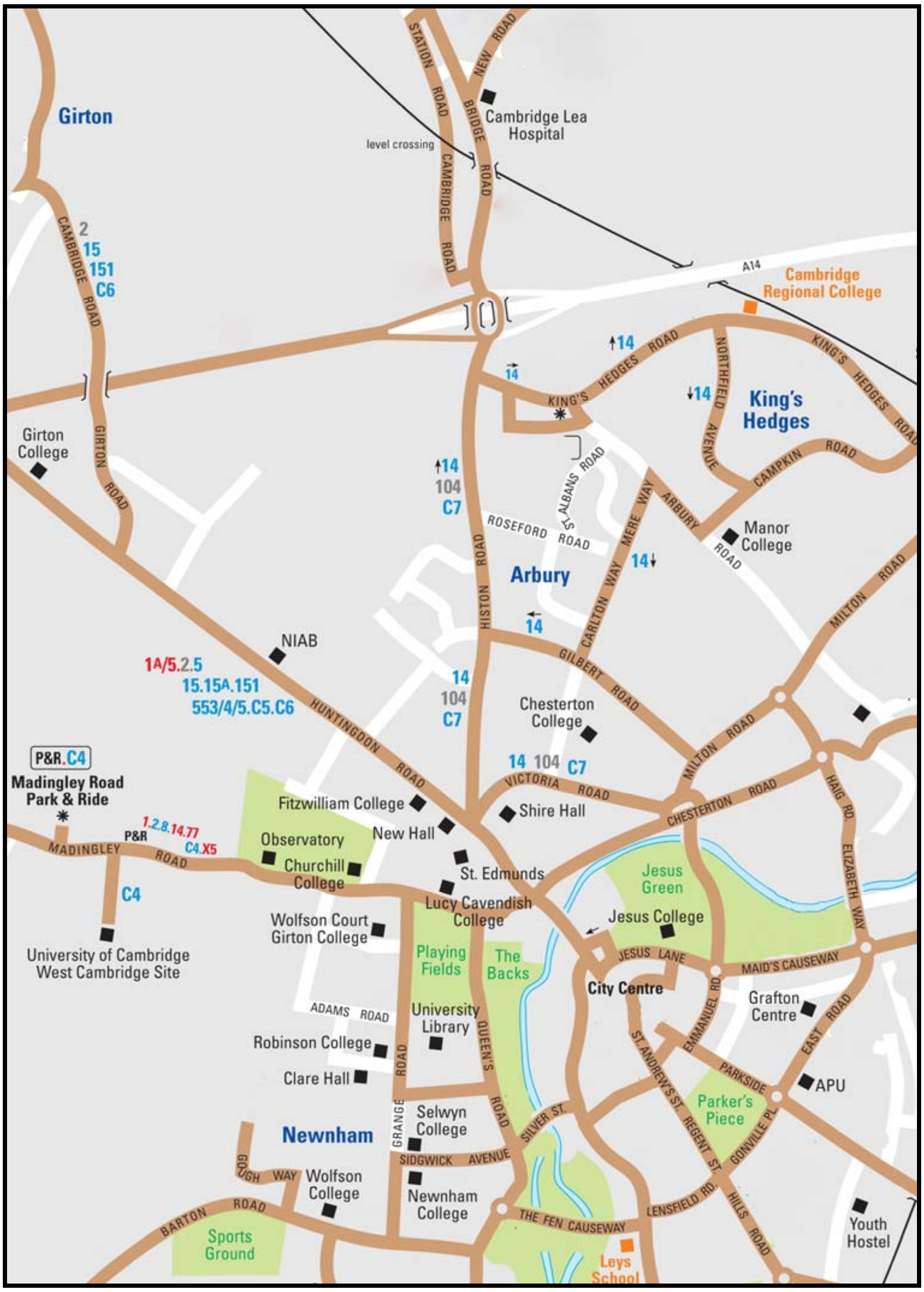
1. Existing situation

BUS ROUTES

1.1 A number of existing bus services operate close to the two development sites along Histon Road, Huntingdon Road and Madingley Road as indicated in Figure 1.1.

Figure 1.1 – Histon, Huntingdon & Madingley Road bus services



Source: Cambridgeshire County Council

1.2 These bus services can be subdivided into three broad categories:

- 'Citi' services – operated by Stagecoach these exist primarily to serve the City of Cambridge, typically operating at a frequency of 3 buses per hour in the peak hour.
- Local services – provided by one of a number of bus operators these connect Cambridge with surrounding towns and villages at a variety of frequencies.
- Park and Ride services – a service operates to the Madingley Road P&R site, to the southwest of the University Land development site.

1.3 Detail on the frequencies and hours of operation of the existing bus services are provided in Table 1.1, Table 1.2 and Table 1.3 below.

Table 1.1 – Bus Services Along Madingley Road

Route number	Operator	Route description	Operating hours	Hourly bus frequency			Days of operation
				Morning peak	Inter peak	Evening peak	
P&R	Stagecoach	Mad. Rd P&R-Cambridge-New. Rd P&R	0700-2000	6	6	6	Mon-Sun
Citi 4	Stagecoach	Mad. Rd P&R-Cambridge	0700-1940	3	4	3	Mon-Fri
14	Stagecoach	Cambourne-Coton-Cambridge	0705-2205	2	2	2	Mon-Sun
1	Whippet	St. Ives-Coton-Cambridge	0715-1805	1	1	2	Mon-Sat
1	Whippet	St. Ives-Coton-Cambridge	1035-1500	2 return services per day			Sun
2	Whippet	Caldecote-Coton-Cambridge	0755-1735	3 return services per day			Mon-Fri
8	Whippet	Papworth Everard-Coton-Cambridge	1000-1620	3 return services per day			Mon-Sat
77	Stagecoach	Dry Drayton-Coton-Cambridge	0800-1800	1 (inbound only)	-	1 (outbound only)	Mon-Fri
X5	Stagecoach	Oxford-Mad. Rd P&R-Cambridge	0540-2310	2	2	2	Mon-Sun

Table 1.2 – Bus Services Along Huntingdon Road

Route number	Operator	Route description	Operating hours	Hourly bus frequency Morning peak	Inter peak	Evening peak	Days of operation
553/4/5	Huntingdon & District	Huntingdon-Girton Cnr.-Cambridge	0710-2300	4	3	4	Mon-Sat
15/15A	Stagecoach	St. Ives-Bar Hill-Cambridge	0725-1815	4	1	2	Mon-Sat
15	Huntingdon & District	St. Ives-Bar Hill-Cambridge	1950-2315	3 evening services			Mon-Sat
1A/5	Whippet	Huntingdon-Bar Hill-Cambridge	0725-1815	3	2	2	Mon-Sun
151	Huntingdon & District	Huntingdon-Bar Hill-Cambridge	1915-2120	2 evening services			Mon-Sat
Citi 5	Stagecoach	Bar Hill-Cambridge	0700-1820	3	3	3	Mon-Sat
Citi 6	Stagecoach	Oakington-Girton-Cambridge	0715-1830	3	3	3	Mon-Sat
2	Huntingdon & District	Oakington-Girton-Cambridge-Rail Stn.	0915-2255	-	1	1	Sun

Table 1.3 – Bus Services Along Histon Road

Route number	Operator	Route description	Operating hours	Hourly bus frequency Morning peak	Inter peak	Evening peak	Days of operation
Citi 7	Stagecoach	Cottenham-Cambridge-Duxford	0650-2250	3	3	3	Mon-Sat
14	Whippet	Kings Hedges-Arbury-Cambridge	0935-1545	-	2	-	Mon-Sat
104	Myalls	Cottenham-Histon-Cambridge	0950-2305	-	1	1	Sun

BUS PATRONAGE

1.4 Existing bus patronage data has been obtained for all non-Stagecoach services – data for Stagecoach services is collected independently of other operators and it has not been possible to obtain this data. The data presented below is taken from surveys conducted during October and November 2005. The surveys have been conducted over 3 or 4 days, though in many cases the sample in any particular period and direction can be very small as indicated by the tables of services surveyed.

Madingley Road Services

1.5 Table 1.4 indicates that bus occupancy on non-stagecoach services is generally low with average peak period bus occupancies of less than 20 passengers per bus. Maximum bus occupancies (Table 1.5) are also low indicating that spare capacity for development generated trips may be available on these services. As noted above, when disaggregating results in to individual routes and time periods the sample sizes become very low – for clarity Table 1.6 shows the number of services surveyed in each category.

Table 1.4 – Average Occupancy per Bus – Madingley Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak	Total
Towards Cambridge	1	12	4	1	3
	2	7	1	-	4
	8	-	4	-	4
	All	*10*	*3*	*1*	*4*
From Cambridge	1	18	5	19	10
	2	-	2	11	5
	8	-	2	9	4
	All	*18*	*5*	*17*	*9*
Both	**All**	**12**	**4**	**12**	**7**

Table 1.5 – Maximum Bus Occupancy – Madingley Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak	Total
Towards Cambridge	1	12	8	4	12
	2	7	1	-	7
	8	-	6	-	6
	All	*12*	*8*	*4*	*12*
From Cambridge	1	18	20	25	25
	2	-	4	11	11
	8	-	3	9	9
	All	*18*	*20*	*25*	*25*
Both	**All**	**18**	**20**	**25**	**25**

Table 1.6 – Number of Services Surveyed – Madingley Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak	Total
Towards Cambridge	1	1	9	4	14
	2	1	1	0	2
	8	0	4	0	4
	All	*2*	*14*	*4*	*20*
From Cambridge	1	1	14	7	22
	2	0	2	1	3
	8	0	2	1	3
	All	*1*	*18*	*9*	*28*
Both	**All**	**3**	**32**	**13**	**48**

Huntingdon Road Services

1.6 Peak period occupancies on Huntingdon Road bus services are higher than on Madingley Road services – inbound (towards Cambridge) average morning peak occupancies on the route 1A/5 are 27 while on the 553/4/5 they are 29 (Table 1.7). Both of these numbers are derived from larger sample size (Table 1.9). Maximum bus occupancies (Table 1.8) indicate that some buses on routes 1A/5 and 553/4/5 are likely to be loaded to capacity, and thereby offer little spare capacity for additional development generated trips.

Table 1.7 – Average Occupancy per Bus – Huntingdon Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak	Total
Towards Cambridge	15A	-	-	9	9
	1A/5	27	6	4	10
	553/4/5	29	9	6	13
	All	*29*	*8*	*6*	*12*
From Cambridge	15A	-	-	-	-
	1A/5	1	6	16	8
	553/4/5	6	9	21	12
	All	*5*	*8*	*19*	*10*
Both	**All**	**18**	**8**	**13**	**11**

Table 1.8 – Maximum Bus Occupancy – Huntingdon Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak	Total
Towards Cambridge	15A	-	-	9	9
	1A/5	69	13	9	69
	553/4/5	72	27	15	72
	All	*72*	*27*	*15*	*72*
From Cambridge	15A	-	-	-	-
	1A/5	2	16	48	48
	553/4/5	16	33	46	46
	All	*16*	*33*	*48*	*48*
Both	**All**	**72**	**33**	**48**	**72**

Table 1.9 – Number of Services Surveyed – Huntingdon Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak	Total
Towards Cambridge	15A	0	0	1	1
	1A/5	8	24	6	38
	553/4/5	22	44	24	90
	All	*30*	*68*	*31*	*129*
From Cambridge	15A	0	0	0	0
	1A/5	7	28	15	50
	553/4/5	17	45	27	89
	All	*24*	*73*	*42*	*139*
Both	**All**	**54**	**141**	**73**	**268**

Histon Road Services

1.7 Data on bus occupancies along Histon Road is very sparse – the only figures available concern the X14 (see Table 1.10 to Table 1.12). As the X14 is an express service it does not stop close to the development sites.

Table 1.10 – Average Occupancy per Bus – Histon Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak
Towards Cambridge	X14	18	-	-
From Cambridge	X14	-	-	5

Table 1.11 – Maximum Bus Occupancy – Histon Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak
Towards Cambridge	X14	18	-	-
From Cambridge	X14	-	-	6

Table 1.12 – Number of Services Surveyed – Histon Road

Direction	Service Number	AM Peak	Inter Peak	PM Peak
Towards Cambridge	X14	3	-	-
From Cambridge	X14	-	-	3

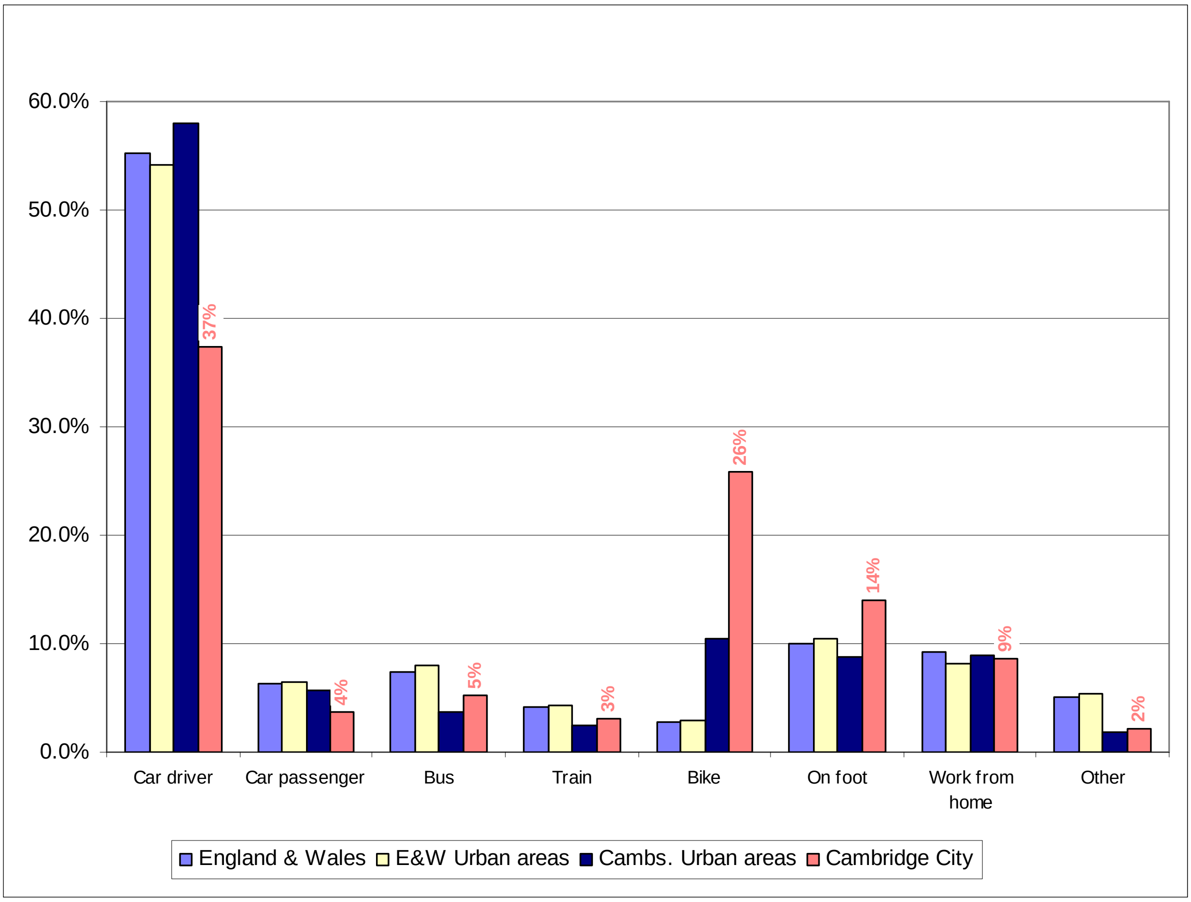
MODAL SHARE

1.8 Census 2001 travel to work mode shares have been obtained to place public transport modes within the context of existing travel patterns in Cambridge. While at 5 percent bus mode shares for travel to work in Cambridge are higher than in other urban areas in Cambridgeshire, they are lower than the averages for England and Wales as a whole (Figure 1.2). However, car mode shares (37 percent for 'car driver') are substantially lower than those displayed within other Cambridgeshire urban areas and England and Wales averages, with walking and, in particular, cycling mode shares correspondingly high at 14 percent and 26 percent respectively.

1.9 This modal split analysis indicates that the sustainable travel priorities for the development sites should be focused on cycling and walking. However, there are reasons why a public transport strategy will also be important to the developments, namely:

- The 2 development sites are on the edge of the existing Cambridge urban area and thus the journey distance to the City Centre is likely to be greater than the existing City wide average. This may result in less walking and cycling trips and thus a greater need for public transport.
- The congested nature of much of the highway network around the development sites indicates that there will be a need for a large proportion of new trips to travel by modes other than private car.
- The census data only indicates mode shares for travel to work while there will be a need to ensure good levels of accessibility to the sites by all modes throughout the day.

Figure 1.2 – Travel to Work Mode Shares



PUBLIC TRANSPORT ACCESSIBILITY

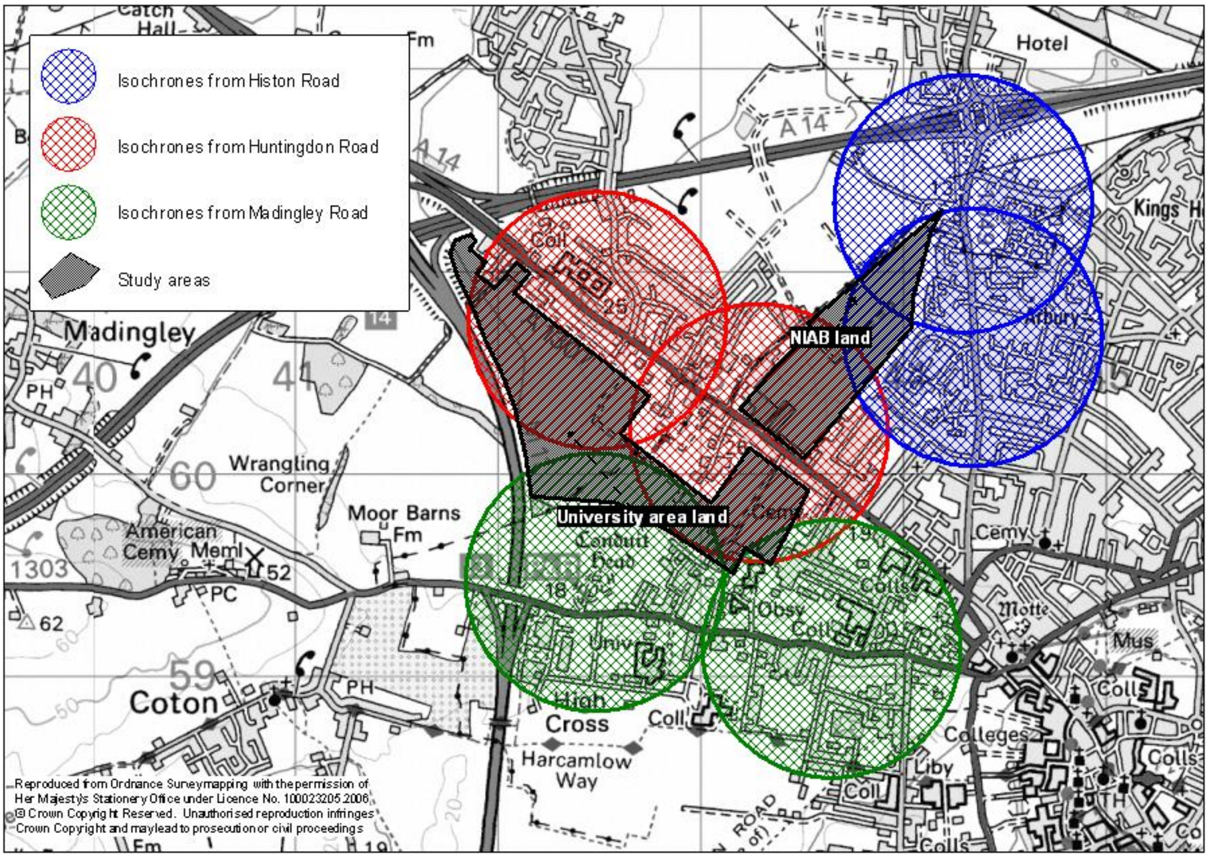
1.10 In order to quantify the level of accessibility within the development sites 'Public Transport Accessibility Levels' (PTALs) have been calculated. Accessibility indices are calculated for individual sites using public transport service frequencies and walk times to the points of access (rail stations and bus stops). The accessibility indices are converted to PTALs using the ranges shown in Table 1.13.

Table 1.13 – PTAL Bands

PTAL	Range of index	Description
1a (Low)	0.01 – 2.50	Very poor
1b	2.51 – 5.00	Very poor
2	5.01 – 10.00	Poor
3	10.01 – 15.00	Moderate
4	15.01 – 20.00	Good
5	20.01 – 25.00	Very good
6a	25.01 – 40.00	Excellent
6b (High)	40.01 +	Excellent

1.11 Peak and inter-peak accessibility levels have been calculated at 100 metres and 640[1] metres from two nominal points on each of the bus corridors proximate to the development sites (Madingley Road, Huntingdon Road and Histon Road). The areas covered by this analysis are shown in Figure 1.3.

Figure 1.3 – Public Transport Access Isochrones



1 The PTAL calculation uses a maximum walk distance to a bus stop of 640 metres.

1.12 The results of this analysis (shown in Table 1.14) indicate that existing developments parallel to these bus corridors (within 100 metres) only achieve PTALs of between 1a and 2. Further from the bus corridors – at 640 metres – PTALs are very low at 1a (Histon Road corridor, peak hours) or 1b (Huntingdon Road and Madingley Road corridors). These accessibility levels are described as 'Poor' and 'Very poor'. The current bus mode share in this area – 5 percent – is thus achieved with only low levels of public transport provision.

Table 1.14 – Existing Public Transport Accessibility Levels (PTALs)

Corridor	Metres from corridor	Morning peak		Inter peak	
		Accessibility index	PTAL	Accessibility index	PTAL
Madingley Road	100	6.86	2	7.13	2
	640	4.33	1b	4.43	1b
Huntingdon Road	100	7.58	2	5.80	2
	640	4.82	1b	3.98	1b
Histon Road	100	2.26	1a	3.09	1b
	640	1.50	1a	2.10	1a

2. Future situation

TRIP GENERATION & DISTRIBUTION

2.1 Two sets of site trip generation figures have been produced for public transport modes. These represent the two development density scenarios proposed for the NIAB and University land sites. These are known as the 'allocated' and 'sensitivity test' development levels.

Table 2.1 – Public Transport Morning Peak Hour Trip Generation – Allocated Development Level

Route	Rail		Bus		Total		
	In	Out	In	Out	In	Out	Combined
NIAB land	7	56	17	131	24	187	211
University land	8	43	19	100	27	143	170
Total	15	99	35	231	50	330	380

Table 2.2 – Public Transport Morning Peak Hour Trip Generation – Sensitivity Test Development Level

Route	Rail		Bus		Total		
	In	Out	In	Out	In	Out	Combined
NIAB land	11	78	25	182	36	259	295
University land	19	58	44	136	62	195	257
Total	29	136	69	318	98	454	552

2.2 As neither development site is served directly by a rail station, all rail trips will require another mode of site access. For the purposes of this assessment it is nominally assumed that 25 percent of the 'rail' trips actually travel to and from the sites by bus, with the remainder travelling by other modes.

2.3 The distribution of trips has been based on existing travel patterns from Castle ward, as shown in the table below. Trips to zones external to Cambridgeshire have been included in the City Centre zone – it is assumed that passengers would interchange on to longer distance coach services or change mode to rail. Similarly trips to destinations within Cambridge that are likely to be made via the City Centre are shown as to the City Centre zone.

Table 2.3 – Distribution of Trips

Zone	Proportion of trips
City Centre	78%
Northeast (e.g. Science Park)	10%
Local trips	13%

2.4 Applying the trip distribution proportions to the trip rates provides a matrix of trips to and from the development sites.

Table 2.4 – Morning Peak Hour Public Transport Trips by Destination

Destination	Allocated development		Sensitivity development	
	NIAB land	University land	NIAB land	University land
City Centre	131	105	184	160
Northeast (e.g. Science Park)	14	11	20	17
Local trips	19	15	26	23

OTHER LOCAL ISSUES

Guided Bus

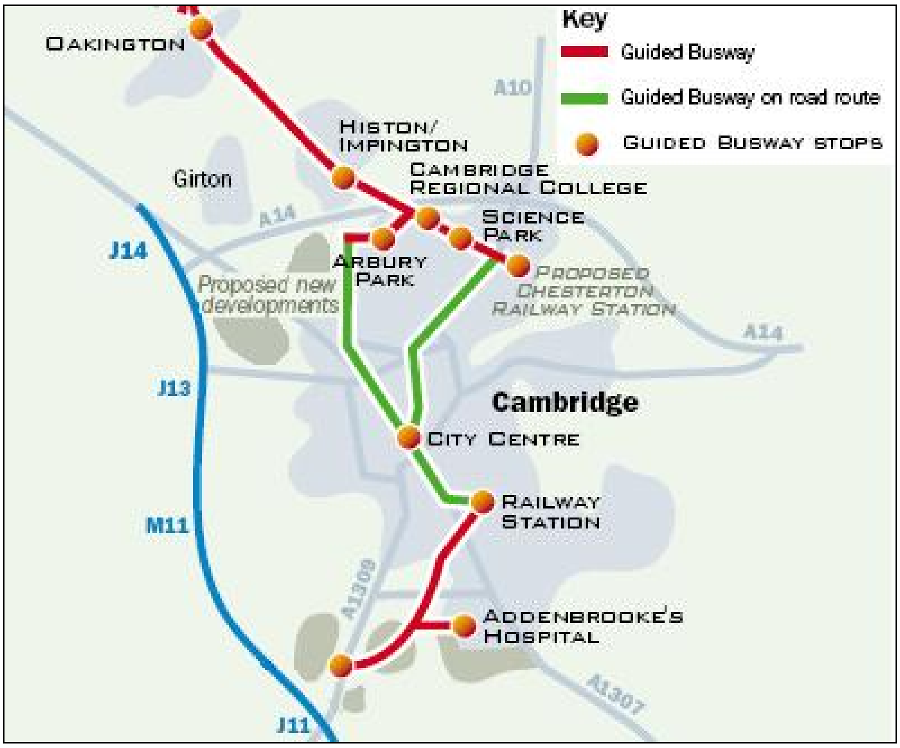
2.5 The Cambridgeshire Guided Busway is planned to be an express public transport corridor between Cambridge and St. Ives. When completed buses will be able to travel on a guideway along the disused railway line from St Ives to Cambridge. They will continue through Cambridge on normal roads and rejoin the guideway at Cambridge Railway Station to travel through to Addenbrooke's Hospital and Trumpington Park & Ride. On the Cambridge City roads the buses will stop at normal bus stops.

2.6 The scheme has been approved following a public enquiry and the government has agreed to provide £92.5 million funding necessary for construction. The remainder of the £115.2 million funding required will be provided by developers of sites along the route. The Council plans to start construction of the busway in January 2007 and open the busway at the end of 2008.

One of the two City Centre on-road routes passes close to the NIAB land development site – on Histon Road (see

2.7 Figure 2.1). Although this section of the route is not shown as including 'Guideway stops', it is expected that Guided Bus route services will call at the normal bus stops while running on City Centre roads, and thus parts of the NIAB site will be served by the new service.

Figure 2.1 – Cambridge Guided Busway



Source; Cambridgeshire County Council

2.8 The Guided Bus 'Statement of Case' provided for the Public Enquiry indicates a range of potential service frequencies over the City Centre sections of the route. For the purposes of the new development site PTAL assessment in the sections below the mid point assessment of 20 buses in each direction during the peak hour has been assumed. However, as two City Centre routes exist it is assumed that only half this service frequency will occur on Histon Road.

3. Public transport strategy

3.1 The PTAL analysis reported above indicated that existing public transport accessibility within the two development sites is very low. New and modified bus routes will be required to achieve public transport accessibility levels similar to those in existing developed areas surrounding the sites. Furthermore, highway modelling of the possible trip generation of the sites has indicated severe congestion problems on parts of the network, and therefore a public transport strategy that aims to achieve higher levels of accessibility than generally exist in Cambridge is required.

3.2 The strategy described below aims to bring higher public transport service levels to the greatest possible site area. Routes through the sites have been developed in conjunction with the highway and walking/cycling strategies while the bus service options proposed aim to maximise accessibility of the sites.

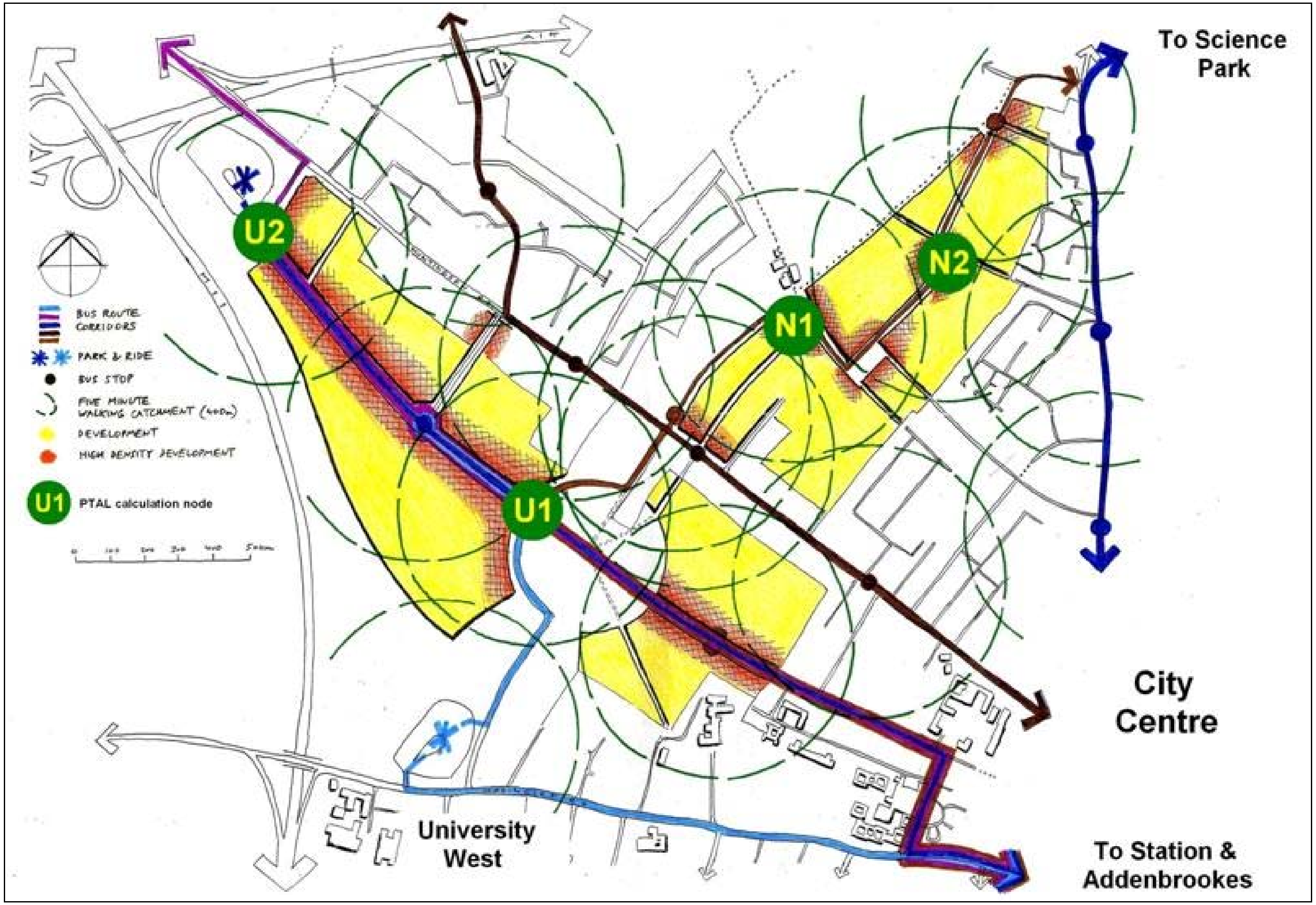
UNIVERSITY LAND PUBLIC TRANSPORT CORRIDORS

3.3 It is proposed that the public transport strategy for the University land site should make use of an east-west spine road through the heart of the development (see Figure 3.1). The main features of this are:

- Connection to Madingley Road in the southeast of the site – to allow a new bus service to operate through the whole development, and then continue in to the City Centre with possible onward connection to the rail station and Addenbrooke's hospital.
- Connection to Huntingdon Road in the northwest of the site. This provides the facility for existing bus service on Huntingdon Road to divert in to the site, thereby taking advantage of bus priority facilities that could be provided.
- Connection is also provided to a possible future (e.g. 2016 +) P&R site in the northwest corner of the development.

3.4 In addition a north-south spine road is envisaged, connecting Madingley Road with Huntingdon Road and the NIAB site. An additional connection could be provided in to the northeast corner of the Madingley Road P&R site to allow bus services to operate into the University West area and/or onwards to the NIAB site.

Figure 3.1 – Public Transport Corridors



NIAB LAND PUBLIC TRANSPORT CORRIDORS

3.5 Within the NIAB land site it is proposed that a north-south spine road is provided, connecting with the same from the University land site at Huntingdon Road and also with Histon Road in the northeast corner of the site. The road will enable:

- A new bus service to operate though the NIAB site, continuing on to the City Centre and potentially beyond via either Huntingdon Road or through the University land site and Madingley Road.
- An orbital route to continue from the University land site through the NIAB land site and then north-eastwards along King's Hedges Road to the Science Park.

3.6 Unlike the University land site the new spine road is unlikely to offer a journey time saving to existing services in the area (for example, those on Histon Road to the east of the NIAB site). Furthermore, diverting services away from Histon Road would reduce the public transport accessibility of the already developed Albury area of the City.

SERVICE PROPOSALS

3.7 For the purposes of this study a possible public transport service pattern has been proposed. It is accepted that as urban bus services in Great Britain operate predominantly on a commercial basis the actual service pattern that operates may differ. However, the proposals contained within this section indicate a recommended strategic level approach for the development sites that can be tested in terms of the PTAL analysis method described earlier.

University Land Site

3.8 It is proposed that the existing bus services along Huntingdon Road from Bar Hill (the 15/15A, 1A/5, 151 and City 5) divert via the east-west spine road, continuing in to the City along Madingley Road.

- Greater opportunities exist to provide bus priority within the University land site than on the existing Huntingdon Road. This route diversion could improve journey times and reliability for existing bus passengers as well as improving public transport accessibility within the site.
- The higher density of development proposed within the University land site, compared with that which currently exists along Huntingdon Road, justifies the switch in routes in terms of best meeting passengers' needs. As the bus services to Girton (553/4/5, City 6 and 2) remain on Huntingdon Road, existing bus boarders along this corridor are still served by 7 buses per hour through the day.

3.9 A new bus service from the northwest corner of the site, exiting on to the wider highway network at the junction with Madingley Road in the southwest corner of the site, is proposed:

- This would pass through the whole of the development site ensuring the greatest possible area is brought within walking distance of the bus service.

- The service would continue to the City Centre with a possible extension to the rail station and/or Addenbrooke's hospital.
- The new route would be able to serve the possible future P&R site in the northwest corner of the site.

3.10 A second new bus route is recommended in order to broaden the destinations served directly by bus and thereby enhance the public transport mode share of trips to/from the development site. This route would be orbital in nature:

- There is an option for the orbital route to start in either the Madingley Road P&R site or at the potential new Huntingdon Road P&R site in the northwest of the development.
- The route would continue northeast through the site, crossing Huntingdon Road and travelling on to the NIAB land site.

3.11 For the purposes of this analysis it is assumed that the route starts at a new Huntingdon Road P&R site.

NIAB Land Site

3.12 As noted earlier it is not recommended that any of the existing bus routes are diverted through the NIAB land site – there is unlikely to be any journey time advantage on offer and the reduction in public transport accessibility in the Arbury area is unlikely to be acceptable.

3.13 It is proposed that the orbital route described in the University land section continues through the NIAB site and continues to the Science Park via King's Hedges Road. This route would be accessible to the whole of the development site, while its route through a new development would enable the introduction of bus priority measures to ensure attractive journey times and high levels of reliability are provided.

3.14 As the bus service frequencies on Histon Road are relatively low, and walk distances to this corridor are at the limit of accessibility guidelines for much of the development site, a new bus service to the City Centre and potentially beyond to the rail station and Addenbrooke's Hospital is proposed. It is suggested that the route starts from the north of the development site and exits on to Huntingdon Road at the new signalised junction. From this point the route could continue via the University land site if this offers a journey time advantage, though for the purposes of this assessment it is shown as continuing in to the City along Huntingdon Road (Figure 3.1).

PUBLIC TRANSPORT ACCESSIBILITY

3.15 Service frequencies (described as 'Low PT enhancements' in Table 3.1) for the new routes have been proposed that ensure a PTAL of at least 2, with the higher accessibility PTAL 3 at the central 'hub' area of the University land site. The impact of a higher level of service provision (described as 'High PT enhancements' in Table 3.1) has also been tested in order to ascertain whether it is possible to achieve a PTAL of 3 across a wider area of the development sites. The PTAL analysis also includes the impact of the Guided bus along Histon Road, which is assumed to be operating at a frequency of 10 buses per hour.

Table 3.1 – New Bus Route Service Frequencies (peak and off peak)

	Low PT enhancements	High PT enhancements
University area land to City Centre	2	6
NIAB land to City Centre	4	6
Orbital route	2	4
Guided bus	10	10

3.16 The impact on public transport accessibility levels of the proposed changes in bus services has been tested for two locations within each development site. The tables below indicate the improvements in PTALs within the sites as a result of the service enhancements for peak and off peak periods.

3.17 The tables compare the predicted PTALs with service enhancements against a 'do minimum' scenario which is based on the existing pattern of services with the addition of the Guided Bus along Histon Road. PTALs are calculated for the lowest accessible point within a 100 metre radius of the point shown in Figure 3.1.

Table 3.2 – Do Minimum and New Development Site PTALs (Peak Periods)

Site	Location	Do minimum		Low PT enhancements		High PT enhancements	
		Accessibility index	PTAL	Accessibility index	PTAL	Accessibility index	PTAL
University land	Central (U1)	7.47	2	12.15	3	13.87	3
	NW (U2)	4.17	1b	6.70	2	8.69	2
NIAB	South (N1)	5.75	2	5.53	2	6.95	2
	North (N2)	3.88	1b	6.10	2	7.10	2

Table 3.3 – Do Minimum and New Development Site PTALs (Inter Peak Period)

Site	Location	Do minimum		Low PT enhancements		High PT enhancements	
		Accessibility index	PTAL	Accessibility index	PTAL	Accessibility index	PTAL
University land	Central (U1)	6.48	2	10.79	3	12.51	3
	NW (U2)	3.05	1b	5.18	2	7.44	2
NIAB	South (N1)	4.62	1b	5.38	2	6.80	2
	North (N2)	3.38	1b	5.60	2	7.16	2

3.18 It can be seen that the new bus services have resulted in accessibility indices higher than those that exist at present both within the sites (Table 3.2 and Table 3.3) and on the surrounding roads (compare with Table 1.14). While the higher level of public transport enhancements result in higher accessibility levels, at the locations tested (100 metre radius around the locations shown in Figure 3.1), the PTALs remain unchanged. The higher accessibility levels will, however, result in a greater area of the development sites being covered by PTALs of 2 and 3.

3.19 The higher accessibility indices in the University land site, particularly in the central area around the intersection of the 2 proposed new routes, suggests that this site and area should receive the highest density of development. Areas remote from the public transport corridors proposed within the sites should be developed to lower densities.

FINANCIAL ASSESSMENT

Service Costs

3.20 For costing purposes it is assumed that the proposed new bus services operate with the following service characteristics:

- Operating hours
  - Morning peak: 0700-1000 hours;
  - Inter peak: 1000-1600 hours;
  - Evening peak: 1600-1900 hours;
- Operating days
  - Weekdays: 252 days
  - Saturday service (75% of weekday): 55 days
  - Sunday service (50% of weekday): 55 days

3.21 The route length for the University service is 4.6 km (based on a route through the site to the City Centre); for the NIAB service 4.3 km (based on a route through the site to the City Centre) and for the orbital service 6.9 km (based on a route starting in the University site and continuing to the Science Park). During peak periods an operating speed of 18 kmh is assumed; this provides journey times comparable with existing timetables along the corridors in question.

3.22 Using the service parameters described above, and industry standard unit cost rates, estimates have been made of the costs of providing these new services (Table 3.4 and Table 3.5). This exercise provides a guideline operating cost for a local bus company to operate the service. The combined cost of the allocated level of public transport service enhancements is £729,000, while the sensitivity test level of enhancements costs £1,426,000.

Table 3.4 – New route costs per annum (Allocated PT enhancements)

Cost element	University Route	NIAB Route	Orbital Route
Drivers	£84,000	£159,000	£111,000
Other direct	£25,000	£41,000	£30,000
Depreciation	£23,000	£34,000	£23,000
Engineering	£22,000	£38,000	£29,000
Total direct	*£153,000*	*£273,000*	*£193,000*
Indirect	£16,000	£25,000	£16,000
Depot overhead	£10,000	£15,000	£10,000
Head office overhead	£5,000	£8,000	£5,000
Total indirect & overheads	*£32,000*	*£47,000*	*£32,000*
Total	**£185,000**	**£320,000**	**£225,000**

Table 3.5 – New route costs per annum (Sensitivity Test PT enhancements)

Cost element	University Route	NIAB Route	Orbital Route
Drivers	£251,000	£239,000	£223,000
Other direct	£68,000	£58,000	£60,000
Depreciation	£57,000	£46,000	£46,000
Engineering	£61,000	£55,000	£58,000
Total direct	*£437,000*	*£397,000*	*£386,000*
Indirect	£41,000	£33,000	£33,000
Depot overhead	£25,000	£20,000	£20,000
Head office overhead	£13,000	£10,000	£10,000
Total indirect & overheads	*£79,000*	*£63,000*	*£63,000*
Total	**£516,000**	**£461,000**	**£449,000**

Operating Revenues

3.23 Based on the forecast public transport trip generation rates provided in Table 2.4, additional operating revenues have been estimated (Table 3.6 and Table 3.7). Daily demands have been estimated by analysing the relationships between all day demand and morning peak hour demand on the existing bus route 553/4/5, and then annualised using the same estimates as detailed for the costing exercise above. Revenue per trip has been calculated from an assumed charge of £0.28 per kilometre. This charging level is in line with the current Stagecoach ticket price between Girton Corner and the City Centre.

3.24 It should be noted that the revenues forecast relate only to trips with an origin or destination in at least one of the development sites. As the proposed bus services extend beyond these sites – to the City Centre, rail station and Science Park, it would be expected that additional bus trips would be generated. In addition, as the existing routes on Histon Road, Huntingdon Road and Madingley Road all serve parts of the sites, some of the additional revenue forecast would be captured by these services.

Table 3.6 – Estimation of Extra Bus Revenue (Allocated development scenario)

Route	Trips				Revenue	
	Peak hour	Weekday	Weekend	Year	Per trip	Per year
University	113	636	955	212,876	£1.29	£274,000
NIAB	140	791	1,186	264,512	£1.20	£318,000
Orbital	42	237	356	79,428	£1.93	£153,000
Combined						£746,000

Table 3.7 – Estimation of Extra Bus Revenue (Sensitivity Test development scenario)

Route	Trips				Revenue	
	Peak hour	Weekday	Weekend	Year	Per trip	Per year
University	171	965	1,447	322,641	£1.29	£416,000
NIAB	197	1,108	1,663	370,777	£1.20	£446,000
Orbital	61	345	517	115,372	£1.93	£223,000
Combined						£1,085,000

Net Operating Costs

3.25 A comparison of the costs and revenues for the two development scenarios and the two public transport options reveals that only the lower level of bus enhancements is able to operate without subsidy in the long term (Table 3.8). With the higher level of bus enhancement proposed an ongoing operating subsidy would be required, even with the sensitivity test development intensity scenario.

Table 3.8 – Summary of Operating Costs and Revenues

Development scenario	PT enhancement	Cost	Revenue	Subsidy required	Surplus produced
Allocated	Low	£729,000	£746,000	-	£17,000
	High	£1,426,000	£746,000	£680,000	-
Sensitivity	Low	£729,000	£1,085,000	-	£355,000
	High	£1,426,000	£1,085,000	£341,000	-

3.26 An investigation of the estimated costs and revenues for individual routes (Table 3.9) reveals that the orbital route requires the greatest subsidy – it is only under the sensitivity development scenario and low public transport cost option that it comes close to being a self supporting route.

Table 3.9 – Operating Subsidy Required (negative indicates surplus produced)

Development scenario	PT enhancement	Route University	NIAB	Orbital
Allocated	Low	-£89,000	£1,000	£71,000
	High	£242,000	£142,000	£296,000
Sensitivity	Low	-£231,000	-£127,000	£2,000
	High	£100,000	£14,000	£227,000

3.27 As noted earlier, additional revenue can be expected from bus trips not related to the development sites. However, some trips will be made on the existing bus routes past the sites and thus revenue will be lost to these services.

4. Summary of Analysis

4.1 An investigation of existing public transport services in the vicinity of the two development sites revealed bus services to the south and east of the development area, as well as along Huntingdon Road between the two sites. The existing routes operate at frequencies up to 6 buses per hour but the PTALs along the route corridors and within the development sites are all low (between 1a and 2). These low PTALs are reflected in the low bus mode shares recorded in Cambridge.

4.2 Demand forecasts for the sites were produced using two development scenarios and based on assumed household trip rates and mode shares. These forecasts were used to indicate the number and direction of trips made from the development sites by bus.

4.3 A public transport strategy was developed that sees the diversion of some bus routes away from their existing corridor and into the University land development. Three new routes are also proposed:

- A radial bus route from the University land site in to the City Centre;
- A radial bus route from the NIAB site in to the City Centre; and
- An orbital route from the University land site to the Science Park via the NIAB site.

4.4 Using proposed service frequencies a PTAL analysis of the sites was undertaken; this showed the core areas of both development sites achieved a PTAL of 2 or 3. These PTALs are higher than those typically achieved within existing developments in this part of Cambridge.

4.5 A comparison of estimated costs and revenues shows that the overall strategy can operate without an on-going subsidy. However, this conclusion does rely on cross subsidies between the radial routes and the orbital route taking place. An enhanced level of bus service provision was tested – while this increased accessibility indices it was not sufficient to increase PTALs and could not be provided without on-going operating subsidies.

APPENDIX C

Initial Option Evaluation

Transport Study Alternatives

1. INTRODUCTION

1.1 Transport opportunities and constraints have been reviewed for the Cambridge North West Transport Study and a joint working group meeting has been held to create an agreed understanding of the issues. This concludes consultation for the baseline review.

1.2 Stage Two of the project is to generate and evaluate transport alternatives. The first stage of this process is to identify alternatives that could meet the aims of stakeholders and objectives of the Re-Deposit Local Plan. A ‘Webtag’ evaluation process is presented to narrow down the options to two preferred alternative strategies. Details of the necessary transport modelling to test these are discussed. Finally, a ‘bottom up’ vision of how some elements of different transport strategies might be combined and integrated with site masterplans is presented to provoke further debate and questioning.

2. TRANSPORT OBJECTIVES

2.1 Objectives of the Transport Study follow planning policy from the Cambridge and Peterborough Structure Plan and Cambridge Re-Deposit Local Plan. Full details are in a separate Technical Note.

2.2 The most relevant overarching objectives are to facilitate:

- Direct walking and cycling routes (Policy P1/3).
- Good access by public transport (P1/3).
- Managed access for private car and other motor vehicles that reduces the need to travel, particularly by car, and provides opportunities for travel choice (P1/3; P8/1).

2.3 The Transport Study is therefore based on a predict and provide approach to walking, cycling and public transport infrastructure; but a demand management approach to travel by private car.

2.4 Clearly some additional car trips will result from development in North West Cambridge even when travel is minimised and other modes of travel are available. The Transport Study will aim to manage these trips by providing only infrastructure to mitigate these trips; rather than to provide additional infrastructure to stimulate car travel.

3. POSSIBLE TRANSPORT SOLUTIONS

General planning requirements

3.1 The general investment priorities for Cambridge that are sought in planning policy are:

- Bus priority on key radial routes.
- Bus routes which cater for an orbital movement.
- Reallocation of roadspace to be used by public transport, pedestrians and cyclists.
- Restrictions on access by the private car.

3.2 These are described in more detail for the North West Cambridge sites, as below:

Land between Huntingdon Road and Histon Road

- Vehicular access; from Huntingdon Road, and possibly from Histon Road; none from Windsor Road.
- An orbital cycle link.
- Strengthened and expanded public transport along Huntingdon Road and Histon Road and an orbital bus route across the site.
- Walking and cycling access, particularly to guided bus stops on Histon Road.

Land between Madingley Road and Huntingdon Road

- Vehicular access; from Huntingdon Road and Madingley Road (but with limited vehicle access points, particularly from the former); none from Storey's Way.
- Strengthened and expanded public transport along Huntingdon Road and Madingley Road and an orbital bus route across the site.

- Walking and cycling access.

Key Constraints

3.3 The planning recommendations have been reviewed in the light of opportunities and constraints. The most important constraints seem to be:

- Congestion on the local highway network severely constraining space for development traffic.

- Insufficient demand for public transport to generate the desired quality and frequency of routes.

3.4 A cause and effect analysis has been undertaken to try and establish the range of transport measures that could unlock these constraints. Each constraint has been traced back to a potential solution that could accord with planning policy. Solutions that result in an increase in traffic capacity need to be limited to that needed by the development, which may involve reducing traffic capacity elsewhere. Table 3.1 summarises all the solutions.

3.5 Some potential solutions have been discarded at this stage, because they do not meet planning policy, have severe impacts or are outside the scope of the study:

- Additional road space for traffic, such as extra lanes at junctions – only justified where necessary to mitigate the development, not for existing traffic.

- Road tolls – outside the scope of the study.

- Limiting access points for traffic – environmental and land ownership constraints already limit the number of access points lower than would normally be sought, and to further limit these would cause congestion at access points. Also, a minimum level of accessibility is necessary for some through trips into the site to support local facilities that will in turn encourage walking and cycling trips.

- A major access road parallel to the M11 (and possibly A14) – the environmental impact would be too severe.

Table 3.1 – Constraints and solutions analysis

Constraints	Solutions
Congestion on the local highway network severely constraining space for development traffic	Bus priority lanes
	Bus detection at signals
	Direct connected walking network
Insufficient demand for public transport to enerate the desired quality and frequency of routes	New orbital and improved radial cycle routes
	New outer orbital road, with reallocation of road space from traffic to buses on radial routes on the city side of the road link
	New J13 slip roads, with reallocation of road space from traffic to buses on Huntingdon Road
	‘Gate’ traffic inside development using signal control (manages demand closer to the source)
	Park & Ride with reallocation of road space from traffic to buses on radial routes downstream
	New radial bus routes flanked by high density development to increase patronage (University site)
	Integrated land use and transport planning to maximise internalised trips

Discussion of Potential Solutions

3.6 Many of the solutions are common to different transport strategies and simply represent best practice, particularly walking, cycling and public transport improvements and an integrated approach to transport and masterplanning to reduce the need to travel. An early view on a possible integrated strategy is set out in Section 7.

3.7 Initial work by Atkins on public transport demand suggests that there may be problems with the viability of orbital bus services, and it is presumed that improvements to radial services will remain the focus. However, the radial routes in the Study Area are characterised by low density development and congestion, whereas the ideal conditions for public transport are high density development and low congestion. There is a particular opportunity on the University land to create a new fast high density corridor parallel to Huntingdon Road to support buses; and this could link into a park and ride strategy.

3.8 It is in the approaches to traffic management that the main differences in the solutions emerge. Effectively there are three different proposal packages, based on park and ride or orbital movement, which form the strategic alternatives. These are identified and evaluated in Section 4.

4. STRATEGIC ALTERNATIVES

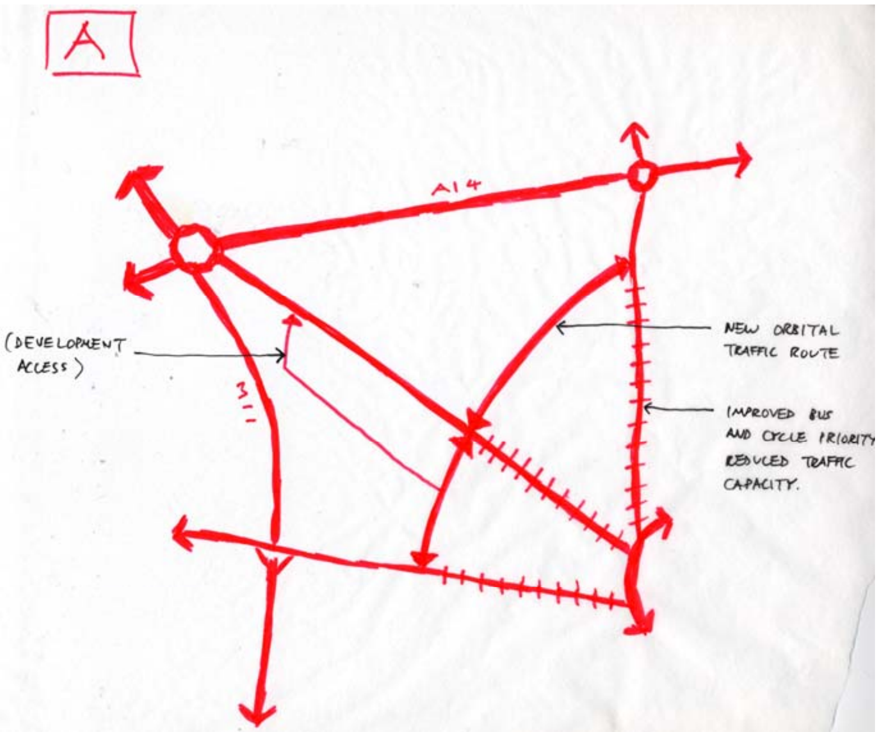
4.1 All the strategic alternatives aim to provide some traffic capacity for the development to achieve nil detriment impact overall.

Option A – Orbital Road Link

4.2 Highway Option A (Figure 4.1) is based around a new orbital road link between Madingley Road and Histon Road. This would:

- Provide additional highway capacity.
- Provide access for the development.
- Provide the opportunity for reducing traffic capacity on radial routes on the city side of the road link (for example with increased bus priority).

Figure 4.1 – Highway Option A



4.3 The aim would be to refine the design so that no additional road trips are induced, i.e.

Capacity needed for development trips = Additional capacity from orbital road – Capacity removed from radial roads

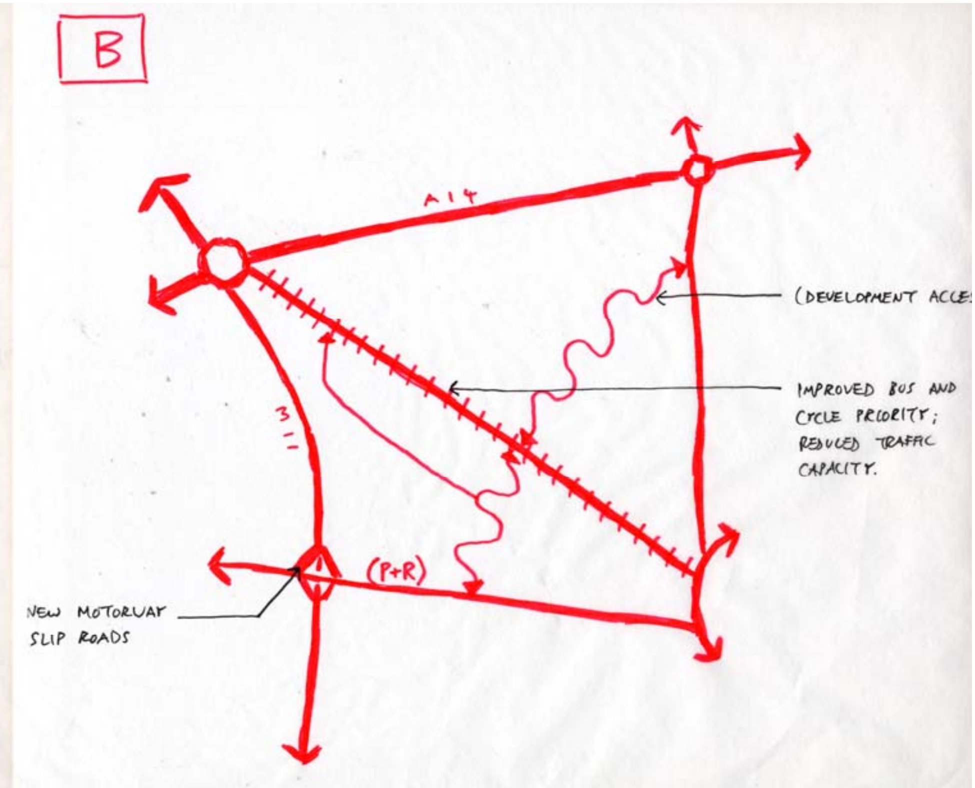
4.4 A number of public transport strategies would be consistent with this option, including orbital and radial services.

Highway Option B – Motorway Slip Roads and Park and Ride extension at Madingley Road

4.5 Highway Option B (Figure 4.2) is based around new motorway slip roads off the M11 at Junction 13. This would:

- Provide additional highway capacity.
- Reduce traffic on Huntingdon Road.
- Provide improved access to the Park & Ride site at Madingley Road for trips from the north.
- Provide the opportunity for reducing traffic capacity on Huntingdon Road (for example with increased bus priority).

Figure 4.2 – Highway Option B



4.6 The Park & Ride site at Madingley Road is assumed to be extended to cater for the additional demand.

4.7 The aim would be to refine the design so that no additional road trips are induced, i.e.

Capacity needed for development trips = Additional capacity from motorway slip roads + Capacity generated by removing traffic from Huntingdon Road – Capacity removed from Huntingdon Road

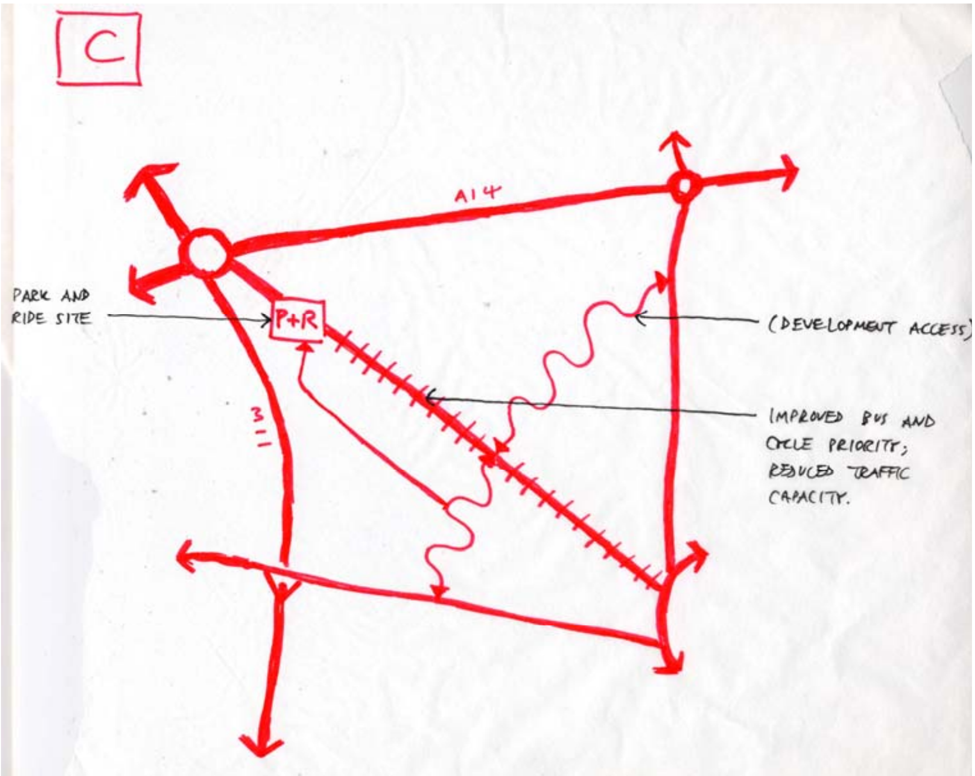
4.8 A number of public transport strategies would be consistent with this option, including orbital and radial services.

Highway Option C – Park and Ride on Huntingdon Road

4.9 Highway Option C (Figure 4.3) is based around a new Park & Ride site at Huntingdon Road. This would:

- Reduce traffic on Huntingdon Road.
- Provide the opportunity for reducing traffic capacity on Huntingdon Road (for example with increased bus priority).

Figure 4.3 – Highway Option C



4.10 The aim would be to refine the design so that no additional road trips are induced, i.e.

		other areas.	
	Transport Economic Efficiency: Business Users & Transport Providers	Likely to be more attractive in perception of improved infrastructure and faster journey times, and encouragement of commerce within the development.	+2
	Transport Economic Efficiency: Consumers	Likely to be more attractive in perception of improved infrastructure and faster journey times.	+2
	Reliability	Potential for slight improvements.	+1
	Wider Economic Impacts	Likely to be more attractive in perception of improved infrastructure and faster journey times.	+2
Accessibility	Option values	Park and ride option lost.	-2
	Severance	Increased severance for the development likely – e.g. staggered crossings.	-3
	Access to the Transport System	Accessibility better by car, but potentially worse by public transport due to lack of park and ride.	+1
Integration	Transport Interchange	Park and ride option lost.	-2
	Land-Use Policy	Local policy is uncertain about the need for an orbital road, but there is also uncertainty about the delivery of a new park and ride.	0
	Other Government Policies	Highways Agency likely to support improved local orbital links.	+2

Option B

5.5 The results are presented in Table 5.2. The overall score is -5, which means that Option B scores slightly lower than Option C; and also lower than Option A.

Table 5.2 – Webtag Appraisal of Option B in comparison to Option C

Objective	Sub-objective	Qualitative impacts	Rating
Environment	Noise and air quality	Increase around new motorway junction and on Madingley Road could be partly balanced by reductions for existing residents on Huntingdon Road.	-1
	Greenhouse gases	Some additional trips could be offset by reductions in traffic on radial routes, but will	-1

Capacity needed for development trips = Capacity generated by removing traffic from Huntingdon Road – Capacity removed from Huntingdon Road

4.11 A number of public transport strategies would be consistent with this option, including orbital and radial services.

5. ASSESSMENT OF STRATEGIC ALTERNATIVES

5.1 A strategic transport appraisal of the alternatives is presented, based on the 'Webtag' framework (http://www.webtag.org.uk).

5.2 As recommended, a reference case is selected so that impacts can be compared. Option C is used as the reference case, because it represents the lowest level of intervention in the highway network. The impacts of Option A and B are highlighted in comparison to Optioin C.

5.3 A standard seven point rating system is used (-3 to +3). The potential range of scores for the total of 22 sub-objectives is therefore +/- 66.

Option A

5.4 The results are presented in Table 5.1. The overall score is -3, which means that Option A scores slightly lower than Option C.

Table 5.1 - Webtag Appraisal of Option A in Comparison to Option C

Objective	Sub-objective	Qualitative impacts	Rating
Environment	Noise and air quality	Increase on new orbital links could be balanced by greater reductions for existing residents on radial routes.	0
	Greenhouse gases	Some additional trips could be offset by reductions in traffic on radial routes.	-1
	Landscape	New road has greater impact due to design standards for 30mph road.	-2
	Townscape	New road has greater impact due to design standards for 30mph road.	-2
	Heritage	No significant difference.	0
	Biodiversity	No significant difference.	0
	Water	No significant difference.	0
	Physical fitness	Potentially more encouragement to drive and therefore slight impact.	-1
	Journey ambience	Potentially smoother ride due to design standards for 30mph road.	+1
Safety	Accidents	Likely to be similar as distance travelled may be slightly less, but this may be offset by the potential for greater severity of accidents at higher speeds.	0
	Security	No significant difference.	0
Economy	Public accounts	Probably more expensive, which may slightly reduce development contributions in	-1

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		be difficult to avoid increases in trips.	
	Landscape	Significant localised impacts.	-2
	Townscape	No significant difference.	0
	Heritage	No significant difference.	0
	Biodiversity	No significant difference.	0
	Water	No significant difference.	0
	Physical fitness	Potentially more encouragement to drive and therefore slight impact.	-1
	Journey ambience	Potentially smoother ride.	+1
Safety	Accidents	Potential for greater severity of accidents at higher speeds, and encouragement of local trips on strategic roads.	-1
	Security	No significant difference.	0
Economy	Public accounts	Likely to be very expensive, with public subsidies almost certain to be necessary, and less money available for other improvements.	-4
	Transport Economic Efficiency: Business Users & Transport Providers	Likely to be more attractive in perception of improved infrastructure and faster journey times, and encouragement of commerce within the development.	+2
	Transport Economic Efficiency: Consumers	Likely to be more attractive in perception of improved infrastructure and faster journey times.	+2
	Reliability	No significant difference.	0
	Wider Economic Impacts	Likely to be more attractive in perception of improved infrastructure and faster journey times.	+2
Accessibility	Option values	No significant difference.	0
	Severance	No significant difference.	0
	Access to the Transport System	Accessibility better by car.	+2
Integration	Transport Interchange	No significant difference.	0
	Land-Use Policy	Local policy uncertain about the potential to extend the park and ride and implement slip roads.	-2
	Other Government Policies	Highways Agency opposed to inducing more local trips on strategic network.	-2

Discussion

5.6 The results of this assessment suggest that the order of preference is:

- Option C
- Option A
- Option B

5.7 However, the results are very close, suggesting that there is little to choose between the strategies.

5.8 The assessment does not allow for weighting of the criteria, nor for considering deliverability. Implementation of Option B would be problematic due to the high construction costs and difficulties extending Madingley Road Park & Ride.

5.9 The results of the assessment also need to be quantified with further testing, as, for example, the traffic intercepted by a Park & Ride site may be insufficient to support some of the development scenarios or downgrading of radial routes.

5.10 The brief is for two strategies to be considered for testing. Option C is based on the same highway network as Option B but with the inclusion of a Park and Ride. As a result Atkins has been directed not to pursue modelling this option. It is therefore recommended that Options B and A are taken forward for more detailed modelling as set out in Section 6.

6. SCOPE OF DETAILED TESTING

SATURN modelling parameters

Time Periods

6.1 The 2025 AM peak model will be used as the reference case, using trips and accesses currently within the model. The 2025 AM peak model will be used as the future opening year case, with revised trips and access points.

Accesses

6.2 Option A will be modelled in 2025 with a new 30mph orbital road and an additional major access onto Huntingdon Road from the University land, all with signalised junctions (all movements). The orbital road will be modelled as a wide single carriageway link, similar in nature and capacity to Madingley Road, Huntingdon Road and Histon Road.

6.3 Option B will be modelled in 2025 with a new restricted access orbital road and an additional major access onto Huntingdon Road from the University land, all with signalised junctions (all movements). The orbital road will be modelled as a traffic managed link by including a penalty on the route in the SATURN model. Option B will also include northbound slip roads onto the M11 at Junction 11.

Origins and Destinations

6.4 Both options will be modelled with the same origins and destinations in the current SATURN model.

Development Size and Traffic Generation

6.5 Both options will be modelled in 2025 with the ‘allocated’ and ‘sensitivity test’ development scenarios.

Changes to Highway Conditions on Existing Roads

6.6 Both options will introduce new signalised junctions in accordance with the access strategies discussed.

6.7 Broad calculations for options A and B suggest that the scope for reallocation of highway to public transport space on radial routes will be limited due to high numbers of trips from the development. Therefore, capacity reductions of about 20% for traffic will be modelled on these routes.

APPENDIX D

Trip Rate Assessment

Trip Rate Analysis

1. INTRODUCTION

1.1 This technical note describes the methodology used to determine trip rates for use in the Cambridge North West Transport Study (CNW) and associated modelling work.

2. MODAL SHARE DATA

2.1 The first stage in determining trip rates suitable for use in the CNW Transport Study commenced with a review of mode share information for the Cambridge area from a number of sources including:

- Atkins 2001 Housing Trip Rate Comparison Report;
- 2001 Census; and
- TRICS Database, (Chesterton site).

Atkins 2001 Housing Trip Rate Comparison Report

2.2 The Atkins 2001 Housing Trip Rate Comparison Report presented the results of surveys undertaken in Barhill, Trumptington and Cherryhinton. The report was commissioned by Cambridgeshire County Council to determine trip rates to be used for new housing developments in Cambridgeshire. The report presented the mode share at each of these sites and compared the results to determine the most suitable mode share to apply to new development in Cambridge such as CNW. The report concluded that the most suitable results were those for Barhill.

2.3 The mode share results for the three sites are summarised in Appendix A shown in Table 2.1.

Table 2.1 – 12hr Mode Share (%): 2001 Trip Rate Report

Location	Ped	Cycle	Mcycle	Car	LGV	HGV	Total
Barhill	27	2	1	63	6	1	100
Cherryhinton	15	12	1	66	6	0	100
Trumptington	26	16	1	50	5	2	100

2.4 The results shown in Table 2.1 suggest that there is a significant difference between the mode share for Barhill and for the two sites within Cambridge (Cherryhinton and Trumpington). In particular, the modal share for cycling in Barhill is just 2 percent, compared to 12 percent at Cherryhinton and 16 percent at Trumpington. This is as expected since Barhill is a village accessed from the A14, a major trunk road with high speed traffic, which cyclists are unlikely to use. This reduces accessibility to areas outside Barhill by cycling. In contrast, Cherryhinton and Trumpington are both located within Cambridge which benefits from a cycle network offering good accessibility to a large number of destinations including shopping and leisure.

2.5 The Barhill mode share data has therefore been discounted from further analysis. The Cherryhinton and Trumptington mode share data has been included in the overall comparison of mode share detailed in Section 3.

2001 Census

2.6 Workplace travel data from the 2001 Census has been analysed for the Castel Ward (in which CNW is situated) and Cambridge as a whole.

2.7 The data has been reviewed to produce a suggested mode share for CNW based upon the following:

- Rail usage is similar to Cherryhinton and Trumpington wards, based upon the fact that these wards are a similar distance from the station;

- Bus usage is similar to Cherryhinton and West Chesterton, based upon the fact that these areas have similar provision of bus services;

- Car usage is similar to Trumpington, based upon the fact that this ward has similar access to the strategic road network albeit via the M11 rather than the A14;

- Car passenger, taxi, cycle and motorcycle mode shares are similar to the average for Cambridge, based upon the fact that these modes vary little across the wards of outer Cambridge; and

- Walk usage is similar to Chesterton based on a similar walk distance to the City Centre as the CNW site.

2.8 The suggested CNW mode share has been further modified to account for changes in travel patterns produced as a result of the sustainable transport measures provided in the Preferred Transport Option. Bus usage has been increased to reflect the significant number of bus services included in the Preferred Transport Option. Walking and cycling usage has also been slightly increased to account for the Preferred Transport Option measures to improve accessibility by these modes of travel. Finally the car driver mode share has been reduced to reflect the demand management measures included in the Preferred Transport Options and the sustainable transport measures which have reduced the need to travel by the private car.

2.9 The full analysis for the suggested and reduced mode share is included in Appendix B and summarised below.

Table 2.2 – Suggested and Adjusted Mode Share for CNW based upon 2001 Census

Scenario	Train	Bus	MC	Car	Pass	Cycle	Walk	Other
Suggested	2	4.5	1	41	3.5	25	12	9
Adjusted	3	8	1	38	3	26	13	8

TRICS Database

2.10 The TRICS database was analysed to identify suitable housing sites for inclusion in the modal share analysis for CNW. Only one suitable site was identified located in Chesterton, Cambridge. Multi-modal data is available for this site within the database.

2.11 Trip rates for each journey mode were analysed to produce a mode share for the site. The full analysis is presented in Appendix C of this note and summarised in Table 2.3.

Table 2.3 – TRICS Chesterton Site Mode Share

Period	Car	Ped	PT	Cycle	Pass	OGV
AM	26	37	2	20	14	0
PM	40	29	1	15	11	3
Total	40	30	1	13	15	2

3. MODE SHARE ANALYSIS

3.1 The second stage in determining trip rates suitable for use in the CNW Transport Study commenced with a comparison of the Cambridge mode share data from the sources outlined in Section 2.

3.2 The data was inputted into a single table and comparisons between the different modal shares were used to develop a suitable mode share for the CNW site. This was based upon the following assumptions:

- Pedestrian mode share has been assumed to be similar to mode share in Trumpington and Chesterton due to the fact that there is a similar walk distance between these sites and the City Centre as the CNW site. However a slight reduction has been made to account for the fact that bus and train trips were not assessed for the Chesterton site (and will therefore have been counted as pedestrian trips);

- Cycle mode share has been assumed to be similar to the Trumpington survey used due to similar distance from City Centre. This mode share is also similar to Chesterton/Cherry Hinton surveys;

- Motorcycle mode share was the same across all of the sites and this has therefore been applied to CNW;

- The mode share for car driver has been assumed to be similar to Trumpington and Chesterton due to the similar access to the strategic road network from these sites. A midway figure between the two sites has been applied to CNW;

- There is a lack of data for the car passenger mode share and as a result an average level across the sites has been used;

- It has been assumed that there is little or no HGV/LGV use associated with the site;

- There is a lack of data for bus and train mode share. As a result the suggested percentages from the 2001 Census data have been used; and

- There are no 'other' trips associated with the CNW development.

3.3 As for the 2001 Census analysis, the suggested CNW mode share has been further modified to account for changes in travel patterns produced as a result of the sustainable transport measures provided in the Preferred Transport Option.

3.4 Bus usage has been increased to reflect the significant number of bus services included in the Preferred Transport Option, whilst walking and cycling usage has also been slightly increased to account for the Preferred Transport Option measures to improve accessibility by these modes of travel. Finally the car driver mode share has been reduced to reflect the demand management measures included in the Preferred Transport Option and the sustainable transport measures which have reduced the need to travel by the private car.

3.5 The full analysis is included in Appendix B and summarised in Table 3.1.

Table 3.1 - Suggested and Adjusted Mode Share for CNW

Scenario	Ped	Cycle	MC	Car	Pass	Train	Bus
Suggested	24	16	1	45	8	2	4
Adjusted	26	18	1	37	8	3	7

4. TRIP RATE ANALYSIS

4.1 The final stage in determining trip rates suitable for use in the CNW Transport Study involved converting the suggested and adjusted mode shares into trip rates.

4.2 The total person trip rate for Barhill was used as a basis for calculating trip rates by each mode of travel. This total person trip rate was outlined in the Atkins 2001 Housing Trip Rate Report as the most suitable person trip rate for new development in Cambridge. The total person trip rate for Barhill during the AM peak Hour is 0.83 trips per hour.

4.3 The mode shares outlined in Table 3.1 were applied to the total person trip rate to produce trip rates by mode (in and out) for the suggested and reduced scenarios. The proportion of trips into and out of the site was taken to be as for the Barhill AM person trip rate. The full results are presented in Appendix C of this note and summarised in Table 4.1.

Table 4.1 – CNW Trip Rates

Mode	Suggested CNW			Adjusted CNW		
	In	Out	Total	In	Out	Total
Car	0.05	0.32	0.37	0.04	0.26	0.31
Pedestrian	0.03	0.17	0.20	0.03	0.18	0.22
Cycle	0.02	0.11	0.13	0.02	0.13	0.15
M Cycle	0.00	0.01	0.01	0.00	0.01	0.01
Passenger	0.01	0.06	0.07	0.01	0.06	0.07
Train	0.00	0.01	0.02	0.00	0.02	0.02
Bus	0.00	0.03	0.03	0.01	0.05	0.06

4.4 The adjusted trip rates shown in Table 4.1 have been used for modelling of the Preferred Highway Option of the CNW Transport Study.

Appendix A – 2001 Atkins Housing Trip Rate Report

Client:	**Cambridgeshire County Council**
Project:	**Housing Trip Rates**
Title:	**Comparison of Surveys**
Date:	**October 2001**

Prepared by:

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EXECUTIVE SUMMARY

WS Atkins has been commissioned by Cambridgeshire County Council to develop a set of housing trip rates for use in Travel Impact Assessments of new developments in the Cambridgeshire area.

The following trip rates have been derived from surveys carried out at three separate locations in the Cambridgeshire area and may be used as a base from which to derive housing trip rates for use in assessment of future housing developments.

- **PERSON TRIPS PER HOUSEHOLD**

Time	Total Person Trips per Household	Car Driver Trips per Household		
		Arrivals	Departures	Total
AM Peak Hour	0.83	0.07	0.41	0.48
PM Peak Hour	0.90	0.36	0.18	0.54
7am-7pm	7.47	1.89	2.00	3.89

Note: These figures are based on normal levels of public transport service and assume that no enhanced public transport services are available.

- **MODAL SPLIT**

  Unless it can be demonstrated otherwise, the number of car drivers will be assessed at 53% of the overall person trip rate.

- **EDUCATION TRIPS**

  Surveys have shown a 27% reduction in person trip rates and a 16% reduction in vehicle trip rates during the AM peak hour in the school holidays. However, no reduction has been observed during the evening peak hour and indeed an overall increase in the 12 hour person trip rate was recorded.

- **USE OF NTS DATA**

  The Cambridgeshire Surveys suggest that trip rates derived from National Travel Survey data yield an underestimate of trips in the Cambridgeshire area. Therefore, trip rates derived from local data should be used in preference to those derived from NTS data.

CONTENTS

1 INTRODUCTION

1.1 WS Atkins has been commissioned by Cambridgeshire County Council to look at housing trip rates for new developments in the Cambridgeshire area, with the intention that the trip rates identified be promulgated for use in Travel Assessment studies.

1.2 The trip rates being derived from person and vehicle movements observed at various housing developments at the following locations in Cambridgeshire (see Figures 1-4):

- Bar Hill;
- Cherry Hinton;
- Trumpington.

1.3 The purpose of this report is to compare person trip rates obtained from movements observed at the three survey locations listed above and to derive a set of person trip rates for use in Travel Impact Assessments for new housing developments in Cambridgeshire. The full analyses of the surveys are reported in four earlier reports, 'Study of Bar Hill', 'Study of Bar Hill – May 2000 Surveys', 'Study of Cherry Hinton', and 'Study of Trumpington'.

1.4 Three sets of surveys were undertaken on separate occasions at Bar Hill in November 1999, March 2000 and May 2000. The repeated surveys allowed for the verification of earlier results and the subsequent report ('Study of Bar Hill – May 2000 surveys') recommends the use of the May 2000 survey results in any further work.

1.5 Person and vehicle trip rates for school term time and school holidays are compared using information collected at Cherry Hinton, in order to quantify the difference in travel movements between the two periods.

1.6 Finally, a comparison is made between trip rates derived from National Travel Survey data and those derived from the surveys carried out at Bar Hill, Cherry Hinton and Trumpington.

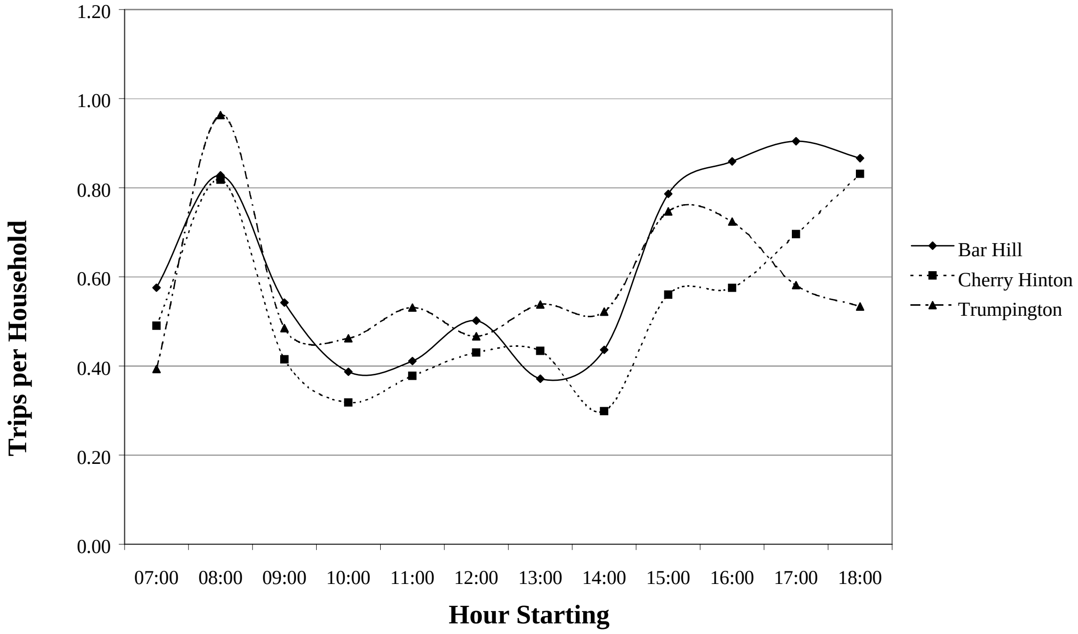
2 COMPARISON OF RESULTS

PERSON TRIP RATES

2.1 Pedestrian flow and vehicle occupancy were recorded over 12-hour periods at each of the survey locations and these have been used to calculate person trip rates per household, by dividing the number of people travelling by each mode by the number of households within the cordon.

2.2 Figure 2.1 below shows PM person trips in Trumpington reach a peak between 3 and 4pm, whilst those in Cherry Hinton reach a peak between 6 and 7pm. The early PM peak in Trumpington is most likely to be due to school trips whilst the later than usual PM peak hour in Cherry Hinton may be due to commuters delaying their trips in order to avoid evening congestion on the roads.

Figure 2.1 12 Hour Person Trip Rates Graph



2.3 The following table summarises person trip rates for each of the housing locations.

Table 2.1 Person Trips per Household

Time	Bar Hill*	Cherry Hinton	Trumpington	Mewburn*	Crabtree	Cherry & Lady Lodge
AM Peak Hour	0.83	0.82	0.96	1.01	0.53	0.87
PM Peak Hour	0.90	0.83	0.75	1.20	0.86	0.90
7am-7pm	7.47	6.24	6.95	7.86	6.22	7.27

** Trip rates derived from May 2000 surveys*
Figures may be subject to some rounding errors

2.4 Table 2.1 above shows a close correlation between the AM peak hour and PM peak hour household trip rates for the three survey areas.

PERSON TRIP RATES BY MODE

2.5 Table 2.2 and 2.3 below show person trip rates by mode over a 12 hour period.

Table 2.2 12-Hour Person Trips per Household by Mode

Location	Pedestrians	Cycle	M/Cycle	Cars & Taxis	LGV	HGV	TOTAL
Bar Hill	2.04	0.16	0.04	4.72	0.45	0.06	7.47
Cherry Hinton	0.93	0.73	0.06	4.09	0.38	0.03	6.24
Trumpington	1.78	1.14	0.09	3.46	0.37	0.11	6.95
Mewburn*	1.23	0.20	0.06	5.65	0.51	0.20	7.86
Crabtree	0.13	0.07	0.03	5.35	0.58	0.06	6.22
Cherry & Lady Lodge	0.34	0.19	0.03	5.93	0.61	0.16	7.27

Figures may be subject to some rounding errors

Table 2.3 12-Hour Modal Split

Location	Pedestrians	Cycle	M/Cycle	Cars & Taxis	LGV	HGV	TOTAL
Bar Hill	27%	2%	<1%	63%	6%	<1%	100%
Cherry Hinton	15%	12%	1%	66%	6%	<1%	100%
Trumpington	26%	16%	1%	50%	5%	2%	100%
Mewburn*	16%	3%	1%	72%	6%	2%	100%
Crabtree	2%	2%	1%	86%	9%	1%	100%
Cherry & Lady Lodge	5%	3%	0%	81%	8%	3%	100%

Figures may be subject to some rounding errors

2.6 Although the 12 hour trip rates obtained for each location are comparable, Table 2.3 shows the overall modal split of traffic to very considerably depending on location. Cycle use in Bar Hill is considerably lower than at the other survey locations and this may be due to its rural location making cycling to anywhere other than local destinations an unattractive option. However, local destinations at Bar Hill are highly accessible by walk mode due to a comprehensive network of internal walkways through the development.

2.7 Pedestrians in Cherry Hinton are a much lower proportion of the modal share than in Bar Hill or Trumpington where pedestrians share of the modal split is significantly higher at around 27 % and 26% compared to 15% in Cherry Hinton. Cars and taxis also make up a greater proportion of the modal split in Bar Hill and Cherry Hinton than in Trumpington, with two thirds of trips made by this mode.

2.8 Trumpington has the lowest proportion of trips made by car and the highest proportion of trips made by cycle, pedestrians also make up a large share of person trips. This may be due to its urban location making it more attractive to cycle into the city centre rather than drive.

2.9 It should be noted that some of the pedestrians recorded may subsequently have caught a bus, whilst others may have been walking with a child to school or simply 'walking the dog'.

2.10 Table 2.4 and 2.5 below show a comparison of the motorised and non-motorised trip rates for each of the locations.

Table 2.4 Person Trips per Household by Motorised and Non-Motorised Modes

Location	Non Motorised Modes		Motorised Modes		TOTAL
	Pedestrians	Pedal Cycles	Passengers	Drivers	
Bar Hill	2.04	0.16	1.37	3.90	7.47
Cherry Hinton	0.93	0.73	1.09	3.49	6.24
Trumpington	1.78	1.14	0.34	3.69	6.95
Mewburn*	1.23	0.20	1.54	4.89	7.86
Crabtree	0.13	0.07	1.77	4.26	6.22
Cherry & Lady Lodge	0.34	0.19	1.57	5.17	7.27

Figures may be subject to some rounding errors

Table 2.5 Person 12 Hour Modal Split by Motorised and Non-Motorised Modes

Location	Non Motorised Modes		Motorised Modes		TOTAL
	Pedestrians	Pedal Cycles	Passengers	Drivers	
Bar Hill	27%	2%	18%	52%	100%
Cherry Hinton	15%	12%	17%	56%	100%
Trumpington	26%	16%	5%	53%	100%
Mewburn*	22%	8%	19%	51%	100%
Crabtree	2%	2%	28%	68%	100%
Cherry & Lady Lodge	5%	2%	23%	70%	100%

Figures may be subject to some rounding errors

2.11 Despite variation in modal split between pedestrian, cycle and motor vehicle passengers by location, the vehicle driver mode share is remarkably consistent irrespective of location.

2.12 It may be expected that the higher pedal cycle and pedestrian mode share (as particularly observed at Trumpington) would be accompanied by a reduction in the use of motorised modes. However, it appears that the increase in pedal cycle and pedestrian mode share is actually accompanied by a commensurate reduction in motorised vehicle passenger trips rather than any material difference in the vehicle driver mode share by location.

VEHICLE ARRIVALS AND DEPARTURES

2.13 The number of arrivals and departures to and from each of the survey areas has been calculated from the data. The following table gives the morning peak hour (8-9am), evening peak hour (5-6pm, 6-7pm and 4-5pm for Bar Hill, Cherry Hinton and Trumpington respectively) and 12-hour (7am-7pm) arrival and departure vehicle trip rates for each of the survey locations.

Table 2.6 Vehicle Arrival and Departure Trip Rates

Location	AM Peak Hour		PM Peak Hour		12 Hour	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Bar Hill	0.07	0.41	0.36	0.18	1.89	2.00
Cherry Hinton	0.04	0.39	0.32	0.15	1.65	1.84
Trumpington	0.06	0.22	0.27	0.13	2.01	1.69
Mewburn*	0.12	0.42	0.45	0.27	2.46	2.43
Crabtree	0.07	0.29	0.34	0.21	2.20	2.06
Cherry & Lady Lodge	0.14	0.45	0.42	0.21	2.57	2.61

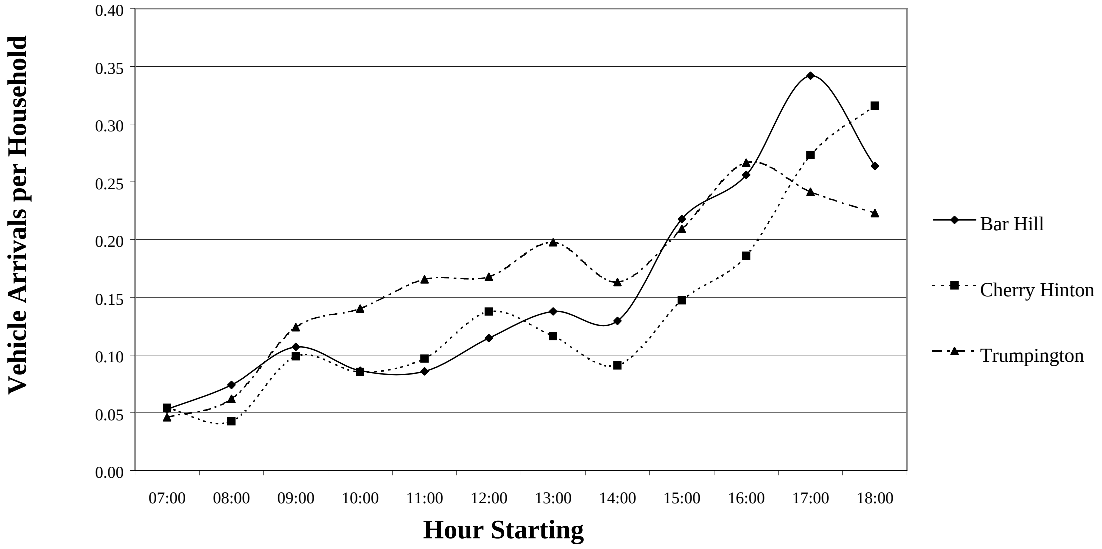
Figures may be subject to some rounding errors

2.14 Overall Bar Hill shows the highest vehicle trip rates of the three survey locations.

2.15 Figures 2.1 and 2.2 below show the arrival and departure profiles for the three locations over a 12 hour period.

Location	Households	12 – hour vehicle rip rates	85%	50%	12 hour person trip rates	85%	50%
Bar Hill	837	4.07	5.44	4.09	7.47	8.36	5.65
Cherry Hinton (Term Time)	516	3.49	-	-	6.24	-	-
(School Holidays)		3.44	-	-	6.53	-	-
Trumpington	435	3.68	-	-	6.95	-	-
Mewburn*	162	4.89	-	-	7.86	-	-
Crabtree	281	4.26	-	-	6.22	-	-
Cherry & Lady Lodge	747	5.17	-	-	7.27	-	-

Figure 2.1 12 Hour Vehicle Arrival Trip Rates



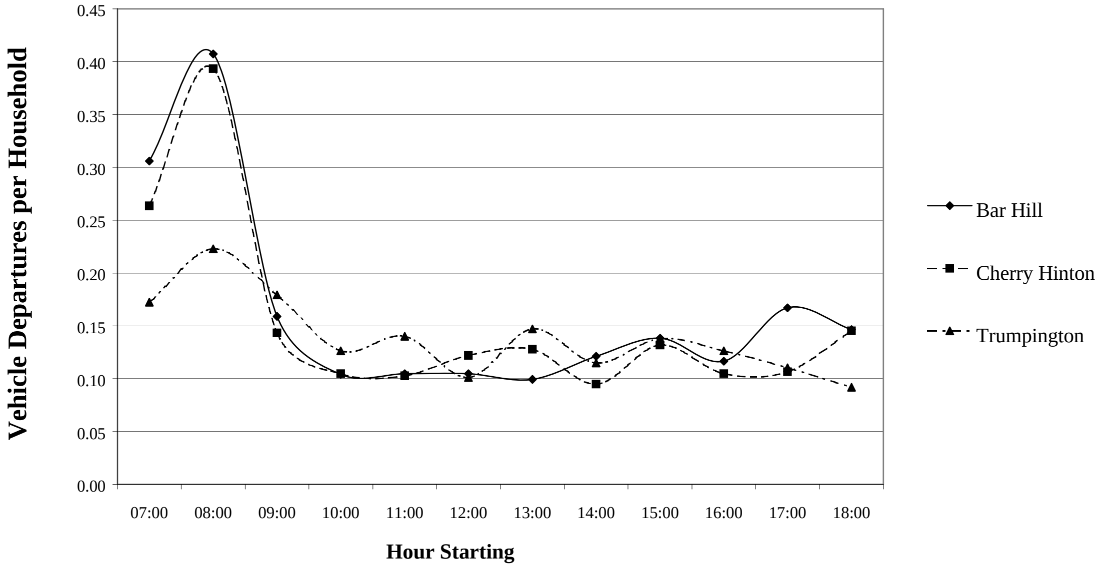


Figure 2.2 12 Hour Vehicle Departure Trip Rates

2.16 Vehicle departure rates from all three locations reach a peak between 8 and 9am. Although total vehicle trips per household are similar for each of the three cordons, departure rates from Trumpington are significantly lower during the AM peak hour than in Bar Hill and Cherry Hinton. This may be due, in part, to differences in socio-economic characteristics between the three areas (see Appendix A).

2.17 Vehicle arrival rates at all three location grow steadily throughout the day although peak arrival times are different for each cordon. Arrival rates at Trumpington reach a peak between 4 and 5pm, those at Bar Hill peak between 5 and 6pm and those at Cherry Hinton reach a peak between 6 and 7pm. As for vehicle departure rates, this may be due, in part, to differences in socio-economic characteristics of the areas.

Hour Starting

CONCLUSION

Person Trip Rates

2.18 The surveys undertaken at Bar Hill were based on the person and vehicle movements of 837 households, whilst those at Cherry Hinton and Trumpington were based on 516 and 435 households respectively (see figures 2-4).

2.19 Given the larger sample size and repeated surveys at Bar Hill there is more confidence in the use of these trip rates as the starting point for the derivation of housing trip rates to be applied elsewhere. Therefore, for housing developments with a mix of housing types it would be reasonable to use the 'total' trip rate as observed at Bar Hill in May 2000.

2.20 The following table therefore summarises the person trip rates on which those for new housing developments should be based.

Table 2.7 Person Trips per Household for use in TIAs of New Housing Developments in Cambridgeshire

Time	Total Person Trips per Household	Vehicle Driver Trips per Household		
		Arrivals	Departures	Total
AM Peak Hour	0.83	0.07	0.41	0.48
PM Peak Hour	0.90	0.36	0.18	0.54
7am-7pm	7.47	1.89	2.00	3.89

Note: These figures are based on normal levels of public transport service and assume that no enhanced public transport services are available.

Modal Split

2.21 Unless it can be demonstrated otherwise, the number of vehicle drivers will be assessed at 52% of the overall person trip rate as for Bar Hill (see Table 2.5).

3 COMPARISON OF TERM TIME AND SCHOOL HOLIDAY TRIP RATES

3.1 An opportunity was taken to expand the scope of the study to investigate the true difference in trip generation between school term time and school holiday periods. Surveys were undertaken at Cherry Hinton during the October 2000 school half term holidays the results of which are compared with the school term time results below.

3.2 The purpose of the surveys was to compare the variation in housing trip rates arising between holiday periods and school term times.

PERSON TRIP RATES

3.3 The resulting person trip rates are given in Table 3.1 below.

Table 3.1 Cherry Hinton Term Time and School Holiday Person Trip Rates

Time	School Term Time	School Holidays
AM Peak Hour	0.82	0.60
PM Peak Hour	0.83	0.81
7am-7pm	6.24	6.53

3.4 There is a significant 27% reduction in person trips per household in the AM peak hour during school holiday periods, despite an increase in the 12-hour trip rate. However, there is little material difference in person trips per household during the 6-7pm evening peak hour. This is as may be expected, as school-related trips add to the overall trip rate during the term time AM peak hour, but not during the evening 6-7pm peak hour.

3.5 An overall increase in leisure journeys during school holidays may contribute to the overall increase in 12 hour person trip rates during those periods.

VEHICLE TRIP RATES

3.6 The resulting vehicle trip rates are given in Table 3.2 below.

Table 3.2 Cherry Hinton Term Time and School Holiday Vehicle Trip Rates

Time	School Term Time	School Holidays
AM Peak Hour	0.44	0.37
PM Peak Hour	0.46	0.46
7am-7pm	3.49	3.44

3.7 There is a 16% reduction in the number of AM peak hour vehicle trips per household during the school holiday period, although there is no reduction in vehicle trips during the PM peak hour. Overall there is a reduction of 1% in the of vehicle trips observed during the whole 12 hour period.

CONCLUSION

3.8 Surveys at Cherry Hinton have shown a 27% reduction in AM peak hour person trips during school holidays and a 16% reduction in AM peak hour vehicle trips. This is consistent with a reduction in the 'school run' and maybe parents themselves taking holidays from work and thus not travelling between 8 and 9am. It may therefore be concluded that school related trips form less than 16 % of vehicle trips during the 8-9am peak hour.

3.9 However, no reduction was observed during the evening peak hour and indeed there was an overall increase in the 12 hour person trip rate associated with the school half term, although it should be noted that there was a concurrent slight decrease in 12 hour vehicle trips.

4 COMPARISON WITH NATIONAL TRAVEL SURVEY DATA

4.1 The National Travel Survey (NTS) is a household survey of travel covering residents of Great Britain and includes most personal trips made over 50 yards. It is possible to derive person trip rates per household from this NTS data for comparison with those trip rates obtained from the Bar Hill, Cherry Hinton and Trumpington surveys.

NTS PERSON TRIP RATES FOR CAMBRIDGESHIRE

4.2 The NTS data states that on average a total of 1,057 trips per year are made by each individual (see Appendix B, Table B.1). This national average can be factored up by a further 1.05 to represent "Rest of England & Wales" (the NTS category into which Cambridgeshire falls, see Appendix B, B.2) to give 1,062 trips per individual per year.

4.3 For each of the settlements surveyed in Cambridgeshire the average number of residents per household can be determined from 1991 census data for South Cambridgeshire and Cambridge City. Bar Hill and Cherry Hinton both lie in South Cambridgeshire and Trumpington lies in Cambridge City. Table 4.1 below shows the number of persons per household for each district.

Table 4.1 Persons per Household by District

District	Total Population	Total Households	Persons per Household
Cambridge City	91,933	39,561	2.32
South Cambridgeshire	118,692	45,934	2.58

Source: 1991 Census Data

4.4 Assuming 365 days per year, the average number of person trips per household per 24 hour day is calculated to be 6.75 in Cambridge City and 7.51 in South Cambridgeshire. NTS data shows that weekday average (Monday-Friday) trips for all modes are 2.7% higher than the daily (Monday-Sunday) average for all modes, which gives person weekday trips per household per day as 6.93 in Cambridge and 7.71 in South Cambridgeshire.

4.5 From NTS data (Appendix B, Table B.3) it can be determined that 85% of weekday trips are made between the hours of 7am and 7pm. This gives a 12 hour person trip rates per household of:

- **Cambridge City** 5.89 trips per household per weekday
- **South Cambridgeshire** 6.55 trips per household per weekday

COMPARISON OF NTS AND SURVEY TRIP RATES

4.6 NTS data shows that in the 8-9am peak hour the number of person trips is 2.43 times greater than the average (24 hour) hourly figure and in the 5-6pm peak hour the number of person trips is 2.06 times greater than the hourly average figure (Appendix B, Table B.3).

4.7 AM and PM peak hour trips per household for Cambridge City and South Cambridgeshire District, as derived from NTS data using the above peak hour factors, are shown in Table 4.2 below.

Table 4.2 AM and PM Peak Hour and 12 Hour Trip Rates as derived from NTS

Time Period	AM Peak Hour	PM Peak Hour	12 Hour
Cambridge City	0.70	0.60	5.89
South Cambridgeshire	0.78	0.66	6.55

4.8 Table 4.3 below compares the person trip rates derived from NTS data with those derived from the Bar Hill, Cherry Hinton and Trumpington surveys.

Table 4.3 Comparison of NTS and Survey Person Trip Rates

Time Period	Cambridge City		South Cambridgeshire		
	NTS Data	Trumpington	NTS Data	Cherry Hinton	Bar Hill
AM Peak Hour	0.70	0.96	0.78	0.82	0.83
PM Peak Hour	0.60	0.58	0.66	0.69	0.90
12 Hour	5.89	6.95	6.55	6.53	7.47

4.9 The NTS Person Trip Rates obtained for South Cambridgeshire and Cambridge City are generally lower than those observed at Bar Hill, Cherry Hinton and Trumpington. This may be due to NTS data being averaged and converted from annual daily trips rates which takes no account of the seasonal variations such as those between school term time and half term holidays.

4.10 Table 4.4 below shows the AM and PM peak hour trips as a proportion of the total 12 hour trips per household.

Table 4.4 Comparison of Peak Hour Person Trips to Daily Trip Proportions

Time Period	Cambridge City		South Cambridgeshire		
	NTS Data	Trumpington	NTS Data	Cherry Hinton	Bar Hill Total
AM Peak Hour	12%	14%	12%	13%	11%
PM Peak Hour	10%	8%	10%	11%	12%
12 Hour	100%	100%	100%	100%	100%

4.11 A comparison of the peak hour person to daily trip proportions shows a close correlation between NTS and the locally observed survey data.

CONCLUSION

4.12 NTS derived trips are generally lower than those observed locally, which may be due to NTS trips being based on average observations. This suggests that the trip rates derived from NTS data are an underestimate for the Cambridgeshire area.

5 CONCLUSION

5.1 Three sets of surveys at housing developments in Bar Hill, Cherry Hinton and Trumpington have been successfully undertaken between December 1999 and December 2000. Cordons were formed at each of the locations with the largest sample cordon formed at Bar Hill capturing the person and vehicle movements made by over 830 households.

PERSON TRIP RATES

5.2 Given the larger sample size and repeated surveys at Bar Hill there is more confidence in the use of person trip rates derived from this data than those derived from the surveys at Cherry Hinton or Trumpington.

5.3 It is recommended that the following person trip rates should be used as a starting point from which trips rates for new housing developments in the Cambridgeshire area may be derived.

Table 5.1 Person Trips per Household for use in TIAs of New Housing Developments in Cambridgeshire

Time	Total Person Trips per Household	Car Driver Trips per Household		
		Arrivals	Departures	Total
AM Peak Hour	0.83	0.07	0.41	0.48
PM Peak Hour	0.90	0.36	0.18	0.54
7am-7pm	7.47	1.89	2.00	3.89

Note: These figures are based on normal levels of public transport service and assume that no enhanced public transport services are available.

5.4 It is suggested that the number of vehicle drivers be initially assessed at the same level as those observed in Bar Hill at 52% of the overall person trip rate.

EDUCATION TRIPS

5.5 Surveys undertaken at Cherry Hinton during both school term time and school holidays have allowed the true difference in trip generation between the two periods to be investigated. It may be concluded from the surveys that school related trips form less than 16% of all vehicle trips during the 8-9am morning peak hour. It is also noted that there is no significant change in 12 hour person or vehicle trips made during the school holidays compared to those made during term time.

USE OF NTS DATA

5.6 Trip rates derived from NTS data are generally lower than those observed in the surveys and are therefore considered to be an underestimate of trips in the Cambridgeshire area. It is therefore recommended that trip rates derived from local data be used as a starting point for the calculation of trips for new housing developments in Cambridgeshire in preference to trip rates derived from NTS data.

APPENDIX A

SOCIO ECONOMIC CHARACTERISITCS

BAR HILL

Socio Economic Characteristics

A.1 Bar Hill may be described as an established new settlement and is located approximately 6km north west of the built up edge of Cambridge and accessed by the A14(T). It has a population of approximately 4,460 and approximately 1,750 households in total.

A.2 Car ownership in Bar Hill is significantly higher than the county average with approximately 90% of the households owning at least one car (source: 1991 census).

A.3 The housing type is a mixture of flats, semi-detached and detached houses built between the late 1960s and late 1980s. It may be expected that those cul-de-sacs consisting of older housing are more likely to contain a higher percentage of retired households whereas the newer cul-de-sacs are likely to contain a higher proportion of economically active households. The housing contained within the survey cordon is a mixture of old and new. More detailed information about household size, type, amenities and tenure are contained in Appendix A to this report.

Community Facilities

A.4 There is a hypermarket shopping centre located on the northern side of Bar Hill that may be accessed from the residential areas via the perimeter road or via a network of footpaths running through the centre of the development. The furthest residential area is approximately ½ mile from the shopping centre which may be considered to be within reasonable walking distance of most housing within Bar Hill.

A.5 Bar Hill Village Hall and the local Church are both located relatively centrally within the village and may be accessed via the internal footpath network or the road network via the perimeter road and then one of the residential cul-de-sacs.

Public Transport Services

A.6 There are several bus services calling at Bar Hill each day, with regular 15-30 minute frequency services to Cambridge and Huntingdon. One such 30-minute frequency service from Cambridge calls into Bar Hill and follows a circuit of the perimeter road before continuing onto Willingham and St Ives.

A.7 The closest train station to Bar Hill is Cambridge.

CHERRY HINTON

Socio Economic Characteristics

A.8 The Cherry Hinton surveys were carried out at a relatively new housing estate built during the1990s. The houses are mainly detached and semi-detached 2-4 bedroom dwellings, some of which may be described as ‘starter’ homes.

A.9 The socio-economic data available for Fulbourn Parish (in which the survey location is situated) is that collected in the 1991 census and is therefore not applicable to the housing development studied.

Community Facilities

A.10 There is a large supermarket situated approximately ¼ mile from the furthest houses in the development and situated on the opposite side of a busy 40mph limit road to the houses. There are primary and junior schools located within a ½ mile radius of the site, however there are no internal footpaths or cycle ways linking them to the site and these must therefore be accessed via the local road network.

Public Transport Services

A.11 There is a half hourly bus service to Sawston, Fulbourn and Cambridge which stops near the site and which also connects to Cambridge Rail Station.

TRUMPINGTON

Socio Economic Characteristics

A.12 Housing at the Anstey Way estate, Trumpington, is predominantly council and ex-council owned property and is around 50 years old. It is situated approximately 1½ miles south of the Cambridge inner ring road.

A.13 Trumpington ward has a lower car ownership compared to the rest of Cambridgeshire with approximately 32% of households having no car.

Community Facilities

A.14 There is a small shopping precinct located at the entrance to the site, within comfortable walking distance of most houses as well as a large supermarket located approximately 500m across the road from the site entrance.

A.15 The local primary school is located just north of the site and may be accessed from via an internal footpath to it from the site.

Public Transport Services

A.16 There is a half hourly bus service running past the site connecting it to Cambridge to the north and Saffron Walden and Whittlesford to the south.

Appendix B – Mode Share Analysis

Cambridge North West Transport Study
Modal Share Analysis

Housing Trip Rates: Comparison of Surveys
WS Atkins October 2001

Person Trips per Household

Time	Barhill*	Cherry Hinton	Trumpington
AM	0.83	0.82	0.96
PM	0.9	0.83	0.75
12 hr	7.47	6.24	6.95

Trips by mode - 12hr

Location	Pedestrian	Cycle	Mcycle	Car	LGV	HGV	Total
Barhill	27	2	1	63	6	1	100
Cherry Hinton	15	12	1	66	6	0	100
Trumpington	26	16	1	50	5	2	100

Vehicle arrivals and departures

Location	AM		PM		12hr	
	IN	OUT	IN	OUT	IN	OUT
Barhill*	0.07	0.41	0.36	0.18	1.89	2
Cherry Hinton	0.04	0.39	0.32	0.15	1.65	1.84
Trumpington	0.06	0.22	0.27	0.13	2.01	1.69

* 2001 report recommends using Barhill trip rates for new developments in Cambridge

Cambridge North West Transport Study
Modal Share Analysis

Housing Trip Rates: Comparison of Surveys
WS Atkins October 2001
Analysis

Assumptions

1. Barhill is not located close to Cambridge City Centre and as a result trip characteristics are likely to be dissimilar to the proposed development.
2. Results for Trumpington and Cherry Hinton are likely to be similar to the proposed development and are discussed below.

Cherry Hinton Profile

Vehicular Trip Rates

Time	Total trips	Vehicle Trips		
		IN	OUT	TOTAL
AM	0.82	0.04	0.39	0.43
PM	0.83	0.32	0.15	0.47
12hr	6.24	1.65	1.84	3.49

Modal Share

Pedestrian	Cycle	Mcycle	Car	LGV	HGV	Total
15	12	1	66	6	0	100

Trumpington Profile

Vehicular Trip Rates

Time	Total trips	Vehicle Trips		
		IN	OUT	TOTAL
AM	0.96	0.06	0.22	0.28
PM	0.75	0.27	0.13	0.4
12hr	6.95	2.01	1.69	3.7

Modal Share

Pedestrian	Cycle	Mcycle	Car	LGV	HGV	Total
26	16	1	50	5	2	100

Cambridge North West Transport Study
Modal Share Analysis

Summary from 2001 Census by Ward

	Home	**Underground**	**Train**	**Bus**	**Motorcycle**	**Car Driver**	**Car Passenger**	**Taxi**	**Cycle**	**Walk**	**Other**	**TOTAL**
	%	%	%	%	%	%	%	%	%	%	%	%
Abbey	6.81	0.09	1.41	7.42	1.57	42.13	5.14	0.59	24.74	9.86	0.26	100
Arbury	7.5	0.15	1.85	5.82	1.63	38.82	4.11	0.32	26.89	12.53	0.39	100
Ward												0
Castle	10.51	0.57	3.33	3.33	0.9	35.39	2.55	0.37	26.77	15.72	0.57	100
Cherry Hinton	6.96	0.14	1.99	6.93	2.16	50.25	5.41	0.36	20.4	5.3	0.09	100
Coleridge	7.08	0.14	3.06	4.7	1.56	40.02	4.62	0.34	26.9	11.36	0.23	100
East Chesterton	7.54	0.22	1.59	5.06	1.68	40.82	3.6	0.42	29.67	9.08	0.31	100
King's Hedges	6.73	0	1.04	8.38	1.93	45.43	5.19	0.37	24.06	6.68	0.2	100
Market	11.69	0.64	3.37	4.01	0.24	23.23	2.2	0.15	20.98	32.52	0.98	100
Newnham	14.05	0.31	5.25	1.96	0.67	27.48	1.7	0.21	28.82	18.84	0.72	100
Petersfield	8.39	0.24	6.75	4.22	0.51	25.85	2.31	0.19	26.47	24.77	0.3	100
Queen Edith's	10.81	0.11	3.57	4.68	0.9	36.98	3.46	0.21	20.54	18.32	0.42	100
Romsey	6.79	0.22	4.79	3.99	0.95	32.81	3.37	0.29	30.43	15.99	0.35	100
Trumpington	10.48	0.18	3.69	4.3	0.92	40.16	3.52	0.36	22.51	13.49	0.39	100
West Chesterton	10.44	0.07	3.25	4.23	0.68	32.53	2.38	0.21	31.69	14.28	0.24	100
Bar Hill	8.14	0	0.95	7.06	1.41	63.51	4.89	0.46	4.27	9.03	0.26	100

Cambridge North West Transport Study
Modal Share Analysis

Summary from 2001 Census by Ward Analysis

	Home	Tube	Train	Bus	MC	Car Driver	Car Passenger	Taxi	Cycle	Walk	Other	TOTAL
Average Model Share*	8.98	0.22	3.21	4.93	1.16	36.56	3.54	0.31	25.78	14.91	0.39	100
Highest Mode Share*	14.05	0.64	6.75	8.38	2.16	50.25	5.41	0.59	31.69	32.52	0.98	
Lowest Mode Share*	6.73	0.00	1.04	1.96	0.24	23.23	1.70	0.15	20.40	5.30	0.09	
Suggested for CNWTS	9.00	0.00	2.00	4.50	1.00	41.00	3.50	0.00	25.00	12.00	0.00	98
Modified for CNWTS	8.00	0.00	3.00	8.00	1.00	38.00	3.00	0.00	26.00	13.00	0.00	100
Assumptions	Similar to average rate for Cambridge	No service available	Similar to areas such as Cherrry Hinton at present but anhanced service to station will improve	Similar to areas such as Trumpington and West Chesterton at present enhanced service aims to increase mode share	Assumed close to average	Assumed similar to Trumpington enhanced bus service aims to reduce mode share	Assumed close to average	Assumed close to average	Assumed close to average aim to enhance links and improve mode share	Similar to average and areas such as west Chesterton aim to improve mode share	Assumed close to average	

*excludes Barhill

Cambridge North West Transport Study
Modal Share Analysis

Data from TRICS Database
124 houses on Fallowfield, Chesterton. Surveyed 06/02/01

Vehicles

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0.1	1	124	0.21	1	124	0.31
08:00-09:00	1	124	0.15	1	124	0.4	1	124	0.55
09:00-10:00	1	124	0.17	1	124	0.16	1	124	0.33
10:00-11:00	1	124	0.21	1	124	0.15	1	124	0.36
11:00-12:00	1	124	0.28	1	124	0.33	1	124	0.61
12:00-13:00	1	124	0.24	1	124	0.25	1	124	0.49
13:00-14:00	1	124	0.23	1	124	0.24	1	124	0.47
14:00-15:00	1	124	0.27	1	124	0.24	1	124	0.51
15:00-16:00	1	124	0.43	1	124	0.43	1	124	0.86
16:00-17:00	1	124	0.39	1	124	0.31	1	124	0.7
17:00-18:00	1	124	0.31	1	124	0.22	1	124	0.53
18:00-19:00	1	124	0.25	1	124	0.31	1	124	0.56
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			3.04			3.23			6.28

Total People

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0.23	1	124	0.42	1	124	0.65
08:00-09:00	1	124	0.47	1	124	1.63	1	124	2.1
09:00-10:00	1	124	0.51	1	124	0.43	1	124	0.94
10:00-11:00	1	124	0.36	1	124	0.35	1	124	0.71
11:00-12:00	1	124	0.62	1	124	0.63	1	124	1.25
12:00-13:00	1	124	0.52	1	124	0.56	1	124	1.08
13:00-14:00	1	124	0.53	1	124	0.44	1	124	0.97
14:00-15:00	1	124	0.65	1	124	0.61	1	124	1.26
15:00-16:00	1	124	1.79	1	124	0.98	1	124	2.77
16:00-17:00	1	124	1.1	1	124	0.67	1	124	1.77
17:00-18:00	1	124	0.76	1	124	0.55	1	124	1.31
18:00-19:00	1	124	0.51	1	124	0.56	1	124	1.07
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			8.05			7.84			15.88

Pedestrians

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0.04	1	124	0.06	1	124	0.1
08:00-09:00	1	124	0.16	1	124	0.62	1	124	0.78
09:00-10:00	1	124	0.23	1	124	0.16	1	124	0.39
10:00-11:00	1	124	0.05	1	124	0.08	1	124	0.13
11:00-12:00	1	124	0.15	1	124	0.15	1	124	0.3
12:00-13:00	1	124	0.11	1	124	0.13	1	124	0.24
13:00-14:00	1	124	0.13	1	124	0.1	1	124	0.23
14:00-15:00	1	124	0.13	1	124	0.21	1	124	0.34
15:00-16:00	1	124	0.85	1	124	0.3	1	124	1.15
16:00-17:00	1	124	0.35	1	124	0.15	1	124	0.5
17:00-18:00	1	124	0.19	1	124	0.19	1	124	0.38
18:00-19:00	1	124	0.13	1	124	0.1	1	124	0.23
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			2.51			2.24			4.77

Public Transport

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0	1	124	0	1	124	0
08:00-09:00	1	124	0	1	124	0.04	1	124	0.04
09:00-10:00	1	124	0	1	124	0.01	1	124	0.01
10:00-11:00	1	124	0	1	124	0.02	1	124	0.02
11:00-12:00	1	124	0.01	1	124	0.01	1	124	0.02
12:00-13:00	1	124	0	1	124	0	1	124	0
13:00-14:00	1	124	0	1	124	0	1	124	0
14:00-15:00	1	124	0	1	124	0	1	124	0
15:00-16:00	1	124	0.01	1	124	0	1	124	0.01
16:00-17:00	1	124	0.02	1	124	0	1	124	0.02
17:00-18:00	1	124	0.01	1	124	0	1	124	0.01
18:00-19:00	1	124	0	1	124	0	1	124	0
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			0.05			0.07			0.13

Cyclists

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0.07	1	124	0.1	1	124	0.17
08:00-09:00	1	124	0.13	1	124	0.29	1	124	0.42
09:00-10:00	1	124	0.07	1	124	0.06	1	124	0.13
10:00-11:00	1	124	0.05	1	124	0.04	1	124	0.09
11:00-12:00	1	124	0.05	1	124	0.04	1	124	0.09
12:00-13:00	1	124	0.13	1	124	0.07	1	124	0.2
13:00-14:00	1	124	0.03	1	124	0.02	1	124	0.05
14:00-15:00	1	124	0.1	1	124	0.04	1	124	0.14
15:00-16:00	1	124	0.2	1	124	0.09	1	124	0.29
16:00-17:00	1	124	0.16	1	124	0.08	1	124	0.24
17:00-18:00	1	124	0.14	1	124	0.06	1	124	0.2
18:00-19:00	1	124	0.04	1	124	0.04	1	124	0.08
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			1.18			0.94			2.1

Vehicle Occupants

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0.12	1	124	0.25	1	124	0.37
08:00-09:00	1	124	0.17	1	124	0.68	1	124	0.85
09:00-10:00	1	124	0.19	1	124	0.19	1	124	0.38
10:00-11:00	1	124	0.27	1	124	0.21	1	124	0.48
11:00-12:00	1	124	0.42	1	124	0.42	1	124	0.84
12:00-13:00	1	124	0.28	1	124	0.36	1	124	0.64
13:00-14:00	1	124	0.37	1	124	0.31	1	124	0.68
14:00-15:00	1	124	0.4	1	124	0.35	1	124	0.75
15:00-16:00	1	124	0.73	1	124	0.58	1	124	1.31
16:00-17:00	1	124	0.56	1	124	0.43	1	124	0.99
17:00-18:00	1	124	0.4	1	124	0.28	1	124	0.68
18:00-19:00	1	124	0.32	1	124	0.39	1	124	0.71
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			4.22			4.44			8.68

OGV

TRIP RATE for Land Use 03 - RESIDENTIAL/K - MIXED PRIVATE HOUSING
Calculation Factor: 1 HHOLDS

		ARRIVALS			DEPARTURES			TOTALS	
	No.	Ave.	Trip	No.	Ave.	Trip	No.	Ave.	Trip
Time Range	Days	HHOLDS	Rate	Days	HHOLDS	Rate	Days	HHOLDS	Rate
00:00-01:00	0	0	0	0	0	0	0	0	0
01:00-02:00	0	0	0	0	0	0	0	0	0
02:00-03:00	0	0	0	0	0	0	0	0	0
03:00-04:00	0	0	0	0	0	0	0	0	0
04:00-05:00	0	0	0	0	0	0	0	0	0
05:00-06:00	0	0	0	0	0	0	0	0	0
06:00-07:00	0	0	0	0	0	0	0	0	0
07:00-08:00	1	124	0	1	124	0.02	1	124	0.02
08:00-09:00	1	124	0.01	1	124	0	1	124	0.01
09:00-10:00	1	124	0.02	1	124	0.02	1	124	0.04
10:00-11:00	1	124	0	1	124	0.01	1	124	0.01
11:00-12:00	1	124	0	1	124	0.01	1	124	0.01
12:00-13:00	1	124	0	1	124	0	1	124	0
13:00-14:00	1	124	0	1	124	0.01	1	124	0.01
14:00-15:00	1	124	0.02	1	124	0.02	1	124	0.04
15:00-16:00	1	124	0.01	1	124	0.02	1	124	0.03
16:00-17:00	1	124	0.01	1	124	0.01	1	124	0.02
17:00-18:00	1	124	0.02	1	124	0.02	1	124	0.04
18:00-19:00	1	124	0.02	1	124	0.03	1	124	0.05
19:00-20:00	0	0	0	0	0	0	0	0	0
20:00-21:00	0	0	0	0	0	0	0	0	0
21:00-22:00	0	0	0	0	0	0	0	0	0
22:00-23:00	0	0	0	0	0	0	0	0	0
23:00-24:00	0	0	0	0	0	0	0	0	0
Daily Trip Rates:			0.1			0.15			0.28

Cambridge North West Transport Study
Modal Share Analysis

Data from TRICS Database
124 houses on Fallowfield, Chesterton. Surveyed 06/02/01
Analysis

Mode Share by Time

Vehicles			
Time Range	Arrival	Departure	Total
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	43	50	48
08:00-09:00	32	25	26
09:00-10:00	33	37	35
10:00-11:00	58	43	51
11:00-12:00	45	52	49
12:00-13:00	46	45	45
13:00-14:00	43	55	48
14:00-15:00	42	39	40
15:00-16:00	24	44	31
16:00-17:00	35	46	40
17:00-18:00	41	40	40
18:00-19:00	49	55	52
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

Pedestrians

Time Range	Arrival	Departure	Total
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	17	14	15
08:00-09:00	34	38	37
09:00-10:00	45	37	41
10:00-11:00	14	23	18
11:00-12:00	24	24	24
12:00-13:00	21	23	22
13:00-14:00	25	23	24
14:00-15:00	20	34	27
15:00-16:00	47	31	42
16:00-17:00	32	22	28
17:00-18:00	25	35	29
18:00-19:00	25	18	21
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

Public Transport

Time Range	Arrival	Departure	Total
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	0	0	0
08:00-09:00	0	2	2
09:00-10:00	0	2	1
10:00-11:00	0	6	3
11:00-12:00	2	2	2
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	1	0	0
16:00-17:00	2	0	1
17:00-18:00	1	0	1
18:00-19:00	0	0	0
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

Cycle

Time Range	Arrival	Departure	Total
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	30	10	26
08:00-09:00	28	29	20
09:00-10:00	14	6	14
10:00-11:00	14	4	13
11:00-12:00	8	4	7
12:00-13:00	25	7	19
13:00-14:00	6	2	5
14:00-15:00	15	4	11
15:00-16:00	11	9	10
16:00-17:00	15	8	14
17:00-18:00	18	6	15
18:00-19:00	8	4	7
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

Vehicle Occupants

Time Range	**Arrival**	**Departure**	**Total**
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	52	60	57
08:00-09:00	36	42	40
09:00-10:00	37	44	40
10:00-11:00	75	60	68
11:00-12:00	68	67	67
12:00-13:00	54	64	59
13:00-14:00	70	70	70
14:00-15:00	62	57	60
15:00-16:00	41	59	47
16:00-17:00	51	64	56
17:00-18:00	53	51	52
18:00-19:00	63	70	66
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

OGV

Time Range	Arrival	Departure	Total
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	0	5	3
08:00-09:00	2	0	0
09:00-10:00	4	5	4
10:00-11:00	0	3	1
11:00-12:00	0	2	1
12:00-13:00	0	0	0
13:00-14:00	0	2	1
14:00-15:00	3	3	3
15:00-16:00	1	2	1
16:00-17:00	1	1	1
17:00-18:00	3	4	3
18:00-19:00	4	5	5
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

Total

Time Range	**Arrival**	**Departure**	**Total**
00:00-01:00			
01:00-02:00			
02:00-03:00			
03:00-04:00			
04:00-05:00			
05:00-06:00			
06:00-07:00			
07:00-08:00	100	89	102
08:00-09:00	100	111	100
09:00-10:00	100	94	101
10:00-11:00	103	95	103
11:00-12:00	102	98	101
12:00-13:00	100	95	100
13:00-14:00	100	97	100
14:00-15:00	100	99	101
15:00-16:00	101	101	101
16:00-17:00	100	96	100
17:00-18:00	100	95	100
18:00-19:00	100	97	100
19:00-20:00			
20:00-21:00			
21:00-22:00			
22:00-23:00			
23:00-24:00			

Overall Mode Share

	Vehicles	Pedestrians	Public Transport	Cycle	Passenger	OGV	Total
AM	26	37	2	20	14	0	100
PM	40	29	1	15	11	3	100
Daily	40	30	1	13	15	2	101

Cambridge North West Transport Study
Modal Share Analysis

Overall Comparison

Survey

	Home	Pedestrian	Cycle	Mcycle	Car	Passenger	LGV	HGV	Train	Bus	Other	Total
Cherry Hinton: 2001 Report	0	15	12	1	66		6	0				100
Trumpington: 2001 Report	0	26	16	1	50		5	2				100
2001 Census: average	9	15	26	1	37	4			3	5	1	100
2001 Census: suggested	9	13	26	1	41	4			2	5		100
Chesterton TRICS		30	13		40	15		1		1		100

Suggested for CNWTS	0	24	16	1	45	8			2	4		100
Basis note	1	2	3	4	5	6	7	8	9	10	11	

Basis notes

1 - Assumed no home trips

2 - Pedestrian trips assumed to be similar to Trumpington/Chesterton, however slight reduction made to account for bus/train trips which are not assessed for these sites (and will therefore have been counted as pedestrian trips).

3 - Trumpington survey used due to similar distance from City Centre. Also similar to Chesterton/Cherry Hinton surveys.

4 - Assumed the same as all surveys

5 - Assumed similar to Trumpington and Chesterton, midway figure used.

6 - Lack of data for this mode. Average level taken.

7 - Assumed no LGV.

8 - Assumed no HGV.

9 - Train mode share taken from 2001 Census.

10 - Bus mode share taken from 2001 Census, slight reduction on the basis of low bus usage in the Chesterton survey.

11 - Assumed no other trips.

Cambridge North West Transport Study
Modal Share Analysis

Adjusted Rates

	Pedestrian	Cycle	Mcycle	Car	Passenger	Train	Bus	Total
Suggested for CNWTS	24	16	1	45	8	2	4	100
Adjusted Rate	26	18	1	37	8	3	7	100
Basis note	1	2	3	4	5	6	7	

Basis Notes:

1 - Increase in pedestrian modal share due to proposed measures plus internalisation of trips on new sites.
2 - Increase in cycle modal share due to proposed measures plus internalisation of trips on new sites.
3 - Motorcycle remain as present.
4 - Reduction in car trip rate due to increases in trips by pedestrians, cycle and public transport plus demand management.
5 - Remain as present.
6 - Small increase due to increased bus accessibility between site and station.
7 - Increase due to improved public transport services and accessibility.

Appendix C – Trip Rate Analysis

Cambridge North West Transport Study
Trip Rate Analysis

Housing Trip Rates: Comparison of Surveys
WS Atkins October 2001

Person Trips per Household

Time	Barhill	Cherry Hinton	Trumpington
AM	0.83	0.82	0.96
PM	0.9	0.83	0.75
12 hr	7.47	6.24	6.95

Trips by mode - 12hr

Location	Pedestrian	Cycle	Mcycle	Car	LGV	HGV	Total
Barhill	27	2	1	63	6	1	100
Cherry Hinton	15	12	1	66	6	0	100
Trumpington	26	16	1	50	5	2	100

Vehicle arrivals and departures

Location	AM		PM		12hr	
	IN	OUT	IN	OUT	IN	OUT
Barhill	0.07	0.41	0.36	0.18	1.89	2
Cherry Hinton	0.04	0.39	0.32	0.15	1.65	1.84
Trumpington	0.06	0.22	0.27	0.13	2.01	1.69

Report recommends using these trip rates for new developments in Cambridge

Cambridge North West Transport Study
Trip Rate Analysis

Housing Trip Rates: Comparison of Surveys
WS Atkins October 2001

Barhill is not located close to Cambridge City Centre and as a result trip characteristics are likely to be dissimilar to the proposed development.
Results for Trumping ton and Cherry Hinton are discussed below.

Cherry Hinton Profile

Time	Total trips	Vehicle Trips		
		IN	OUT	TOTAL
AM	0.82	0.04	0.39	0.43
PM	0.83	0.32	0.15	0.47
12hr	6.24	1.65	1.84	3.49

Modal Share

Pedestrian	Cycle	Mcycle	Car	LGV	HGV	Total
15	12	1	66	6	0	100

Trumpington Profile

Time	Total trips	Vehicle Trips		
		IN	OUT	TOTAL
AM	0.96	0.06	0.22	0.28
PM	0.75	0.27	0.13	0.4
12hr	6.95	2.01	1.69	3.7

Modal Share

Pedestrian	Cycle	Mcycle	Car	LGV	HGV	Total
26	16	1	50	5	2	100

Cambridge North West Transport Study
Trip Rate Analysis

Summary from 2001 Census by Ward

	Home	Underground	Train	Bus	Motorcycle	Car Driver	Car Passenger	Taxi	Cycle	Walk	Other	TOTAL
	Percentage	*Percentage*	*Percentage*	*Percentage*	*Percentage*	*Percentage*	*Percentage*	*Percentage*	*Percentage*	*Percentage*	*Percentage*	0
Abbey	6.81	0.09	1.41	7.42	1.57	42.13	5.14	0.59	24.74	9.86	0.26	100
Arbury	7.5	0.15	1.85	5.82	1.63	38.82	4.11	0.32	26.89	12.53	0.39	100
Ward												0
Castle	10.51	0.57	3.33	3.33	0.9	35.39	2.55	0.37	26.77	15.72	0.57	100
Cherry Hinton	6.96	0.14	1.99	6.93	2.16	50.25	5.41	0.36	20.4	5.3	0.09	100
Coleridge	7.08	0.14	3.06	4.7	1.56	40.02	4.62	0.34	26.9	11.36	0.23	100
East Chesterton	7.54	0.22	1.59	5.06	1.68	40.82	3.6	0.42	29.67	9.08	0.31	100
King's Hedges	6.73	0	1.04	8.38	1.93	45.43	5.19	0.37	24.06	6.68	0.2	100
Market	11.69	0.64	3.37	4.01	0.24	23.23	2.2	0.15	20.98	32.52	0.98	100
Newnham	14.05	0.31	5.25	1.96	0.67	27.48	1.7	0.21	28.82	18.84	0.72	100
Petersfield	8.39	0.24	6.75	4.22	0.51	25.85	2.31	0.19	26.47	24.77	0.3	100
Queen Edith's	10.81	0.11	3.57	4.68	0.9	36.98	3.46	0.21	20.54	18.32	0.42	100
Romsey	6.79	0.22	4.79	3.99	0.95	32.81	3.37	0.29	30.43	15.99	0.35	100
Trumpington	10.48	0.18	3.69	4.3	0.92	40.16	3.52	0.36	22.51	13.49	0.39	100
West Chesterton	10.44	0.07	3.25	4.23	0.68	32.53	2.38	0.21	31.69	14.28	0.24	100
Bar Hill	8.14	0	0.95	7.06	1.41	63.51	4.89	0.46	4.27	9.03	0.26	100

Cambridge North West Transport Study
Trip Rate Analysis

Summary from 2001 Census by Ward

	Home	Underground	Train	Bus	Motorcycle	Car Driver	Car Passenger	Taxi	Cycle	Walk	Other	TOTAL
Average Model Share*	8.98	0.22	3.21	4.93	1.16	36.56	3.54	0.31	25.78	14.91	0.39	100.00
Highest Mode Share*	14.05	0.64	6.75	8.38	2.16	50.25	5.41	0.59	31.69	32.52	0.98	
Lowest Mode Share*	6.73	0.00	1.04	1.96	0.24	23.23	1.70	0.15	20.40	5.30	0.09	
Suggested for CNWTS	9.00	0.00	2.00	4.50	1.00	41.00	3.50	0.00	25.00	12.00	0.00	98
Modified for CNWTS	8.00	0.00	3.00	8.00	1.00	38.00	3.00	0.00	26.00	13.00	0.00	100
Assumptions	Similar to average rate for Cambridge	No Underground available	Similar to areas such as Cherry Hinton at present but enhanced bus service to station aims to improve	Similar to areas such as Trumpington and West Chesterton at present enhanced service aims to increase mode share	Assumed close to average	Assumed similar to Trumpington enhanced bus service aims to reduce mode share	Assumed close to average	Assumed close to average	Assumed close to average aim to enhance links and improve mode share	Similar to average and areas such as west Chesterton aim to improve mode share	Assumed close to average	

* Excludes Barhill

Cambridge North West Transport Study
Trip Rate Analysis

Overall Comparison

Survey

	Vehicle						Person		
Survey	**AM**		**PM**		**12hr**		**AM**	**PM**	**12hr**
	IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**			
2001 Report: Barhill	0.07	0.41	0.36	0.18	1.89	2	0.83	0.90	7.47
2001 Report: Cherry Hinton	0.04	0.39	0.32	0.15	1.65	1.84	0.82	0.83	6.24
2001 Report: Trumpington	0.06	0.22	0.27	0.13	2.01	1.69	0.96	0.75	6.95
Chesterton TRICS	0.15	0.4	0.39	0.31	3.04	3.23	2.10	1.77	15.88
Average	0.08	0.36	0.34	0.19	2.15	2.19	1.18	1.06	9.14
Average excl. Chesterton	0.06	0.34	0.32	0.15	1.85	1.84	0.87	0.83	6.89

Modal Share

	Ped	**Cycle**	**Mcycle**	**Car**	**Pass**	**Train**	**Bus**	**Total**
Suggested for CNWTS	0.24	0.16	0.01	0.45	0.08	0.02	0.04	1.00
Reduced Rate	0.26	0.18	0.01	0.37	0.08	0.03	0.07	1.00

Trip Rate By Mode: Based on Barhill total person trips: Suggested CNWTS
AM Trips

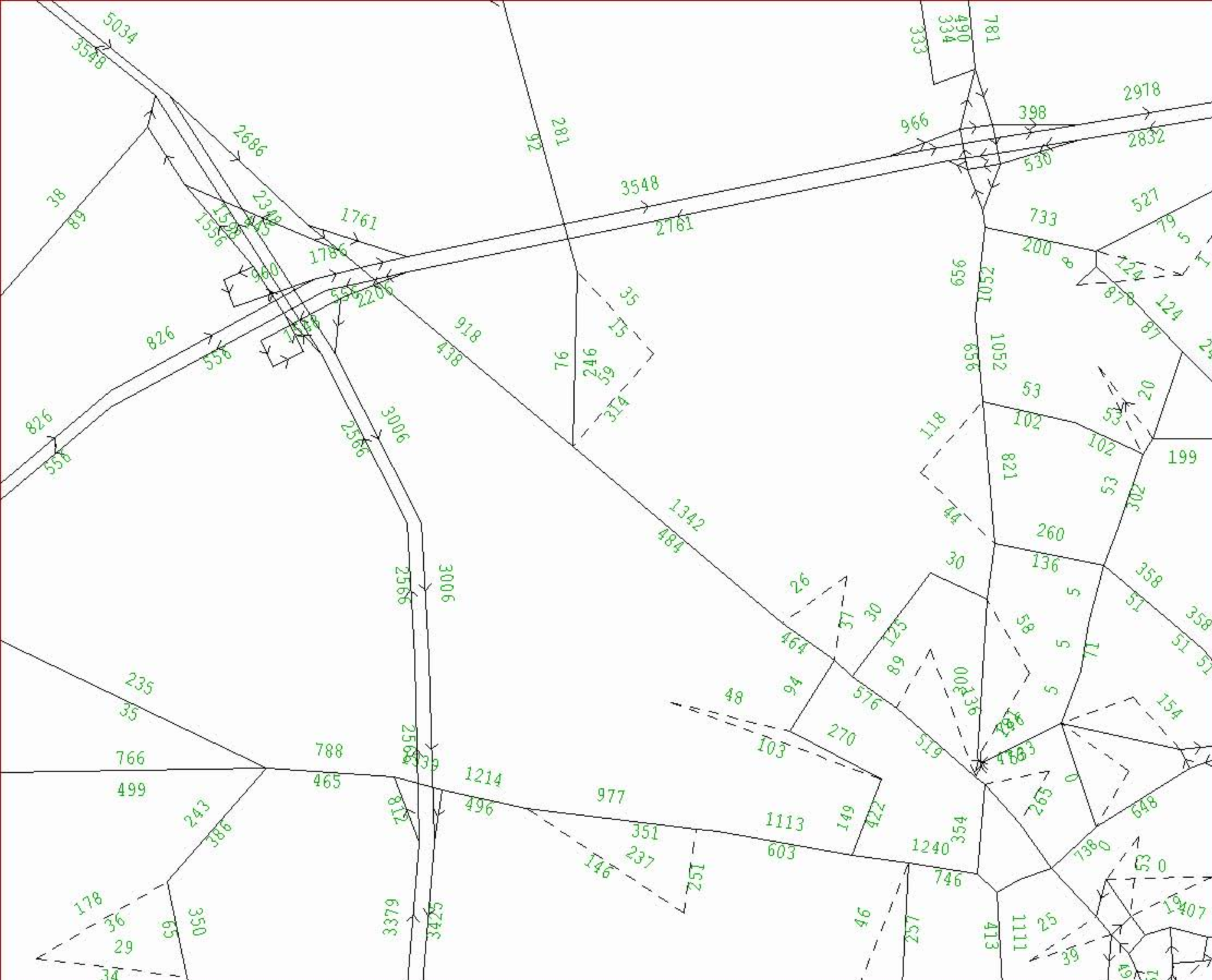
	IN	**OUT**	**TOTAL**
Percentage	15	85	
Vehicle	0.05	0.32	0.37
Pedestrian	0.03	0.17	0.20
Cycle	0.02	0.11	0.13
Mcycle	0.00	0.01	0.01
Passenger	0.01	0.06	0.07
Train	0.00	0.01	0.02
Bus	0.00	0.03	0.03
Total	0.12	0.71	0.83

Trip Rate By Mode: Based on Barhill total person trips: Reduced Rate

	IN	**OUT**	**TOTAL**
Percentage	15	85	
Vehicle	0.04	0.26	0.31
Pedestrian	0.03	0.18	0.22
Cycle	0.02	0.13	0.15
Mcycle	0.00	0.01	0.01
Passenger	0.01	0.06	0.07
Train	0.00	0.02	0.02
Bus	0.01	0.05	0.06
Total	0.12	0.71	0.83

APPENDIX E

SATURN Modelling Results



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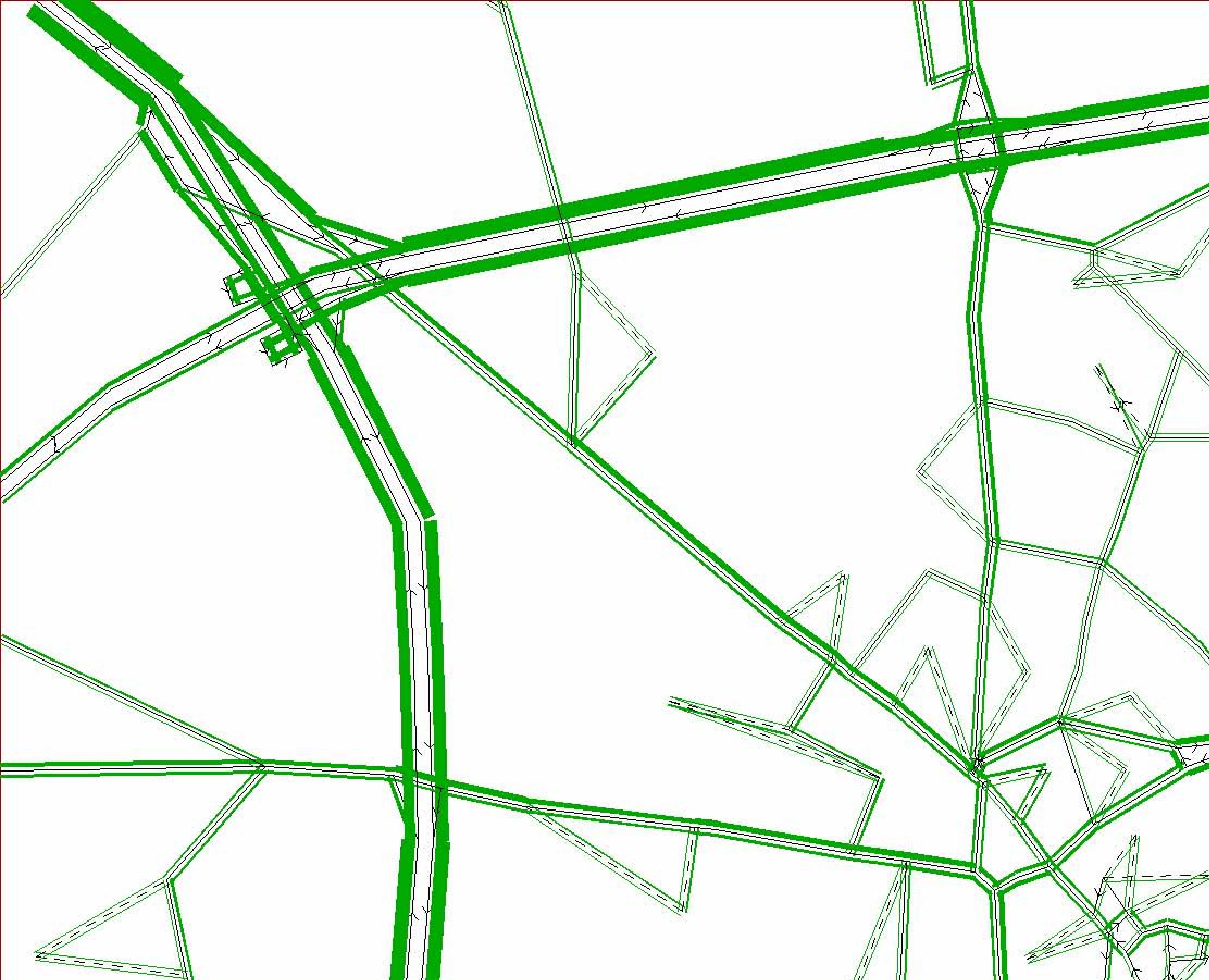

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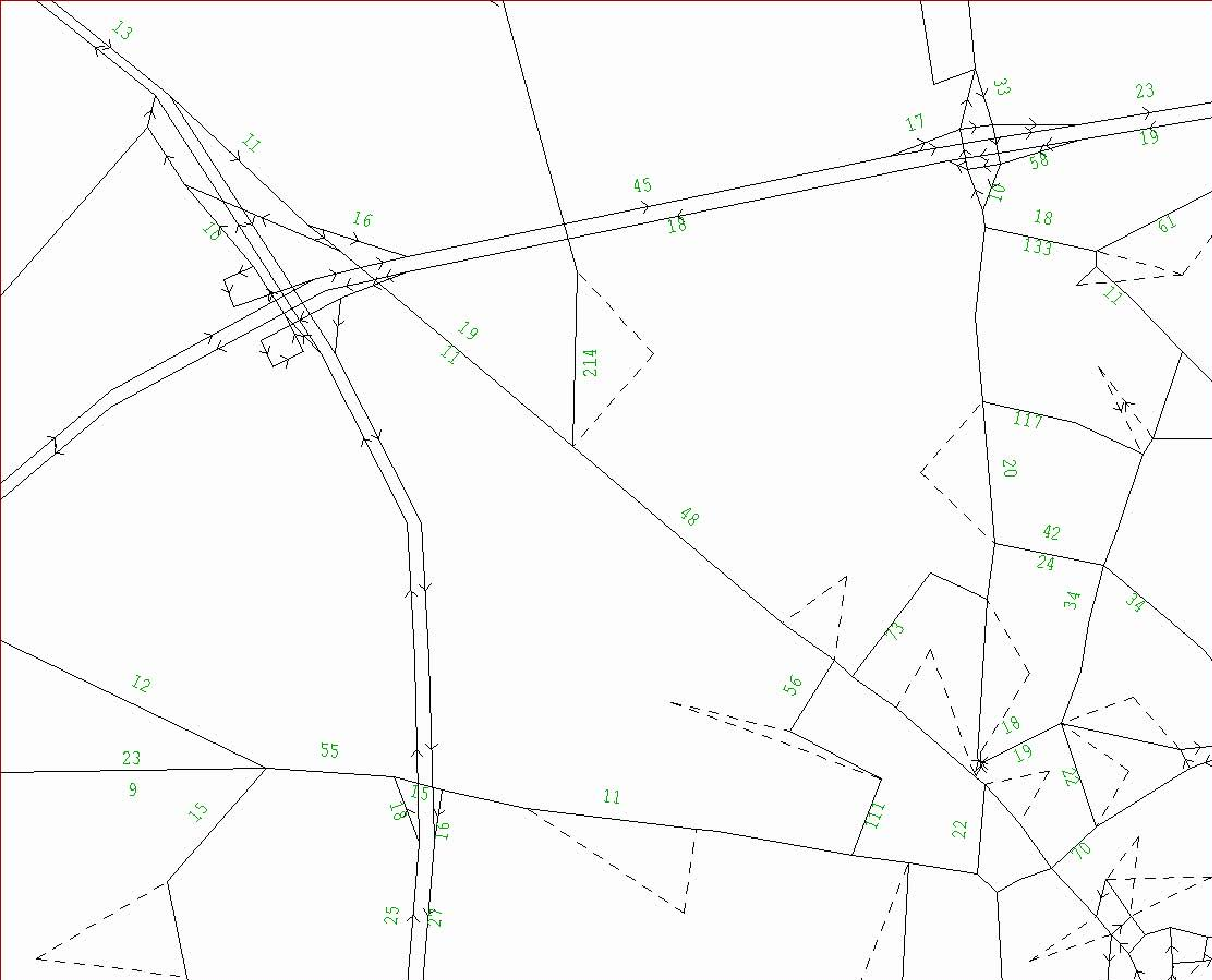

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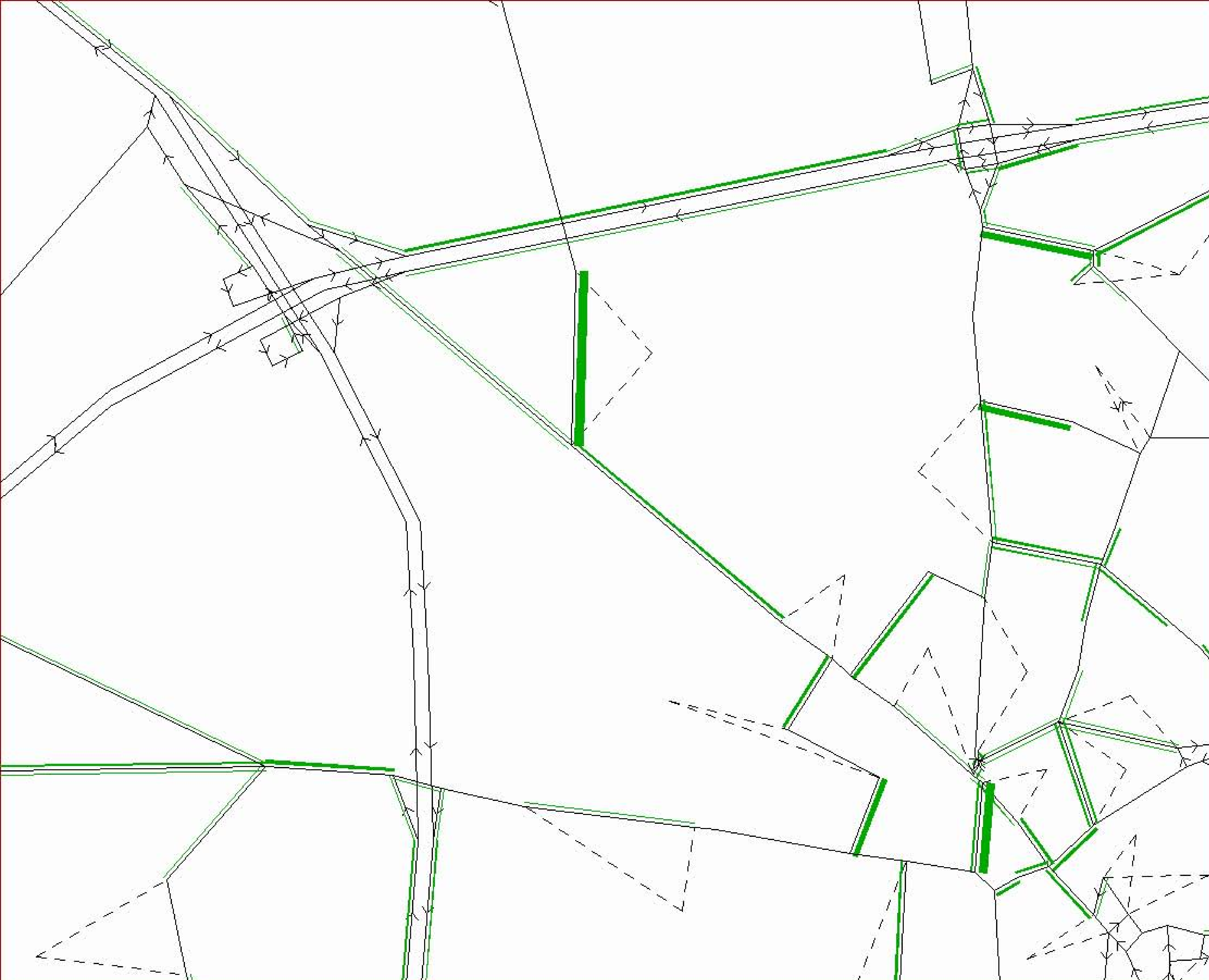
A14 Ellington to Fen Ditton - 2003 Base - AM V52   7- 8-06



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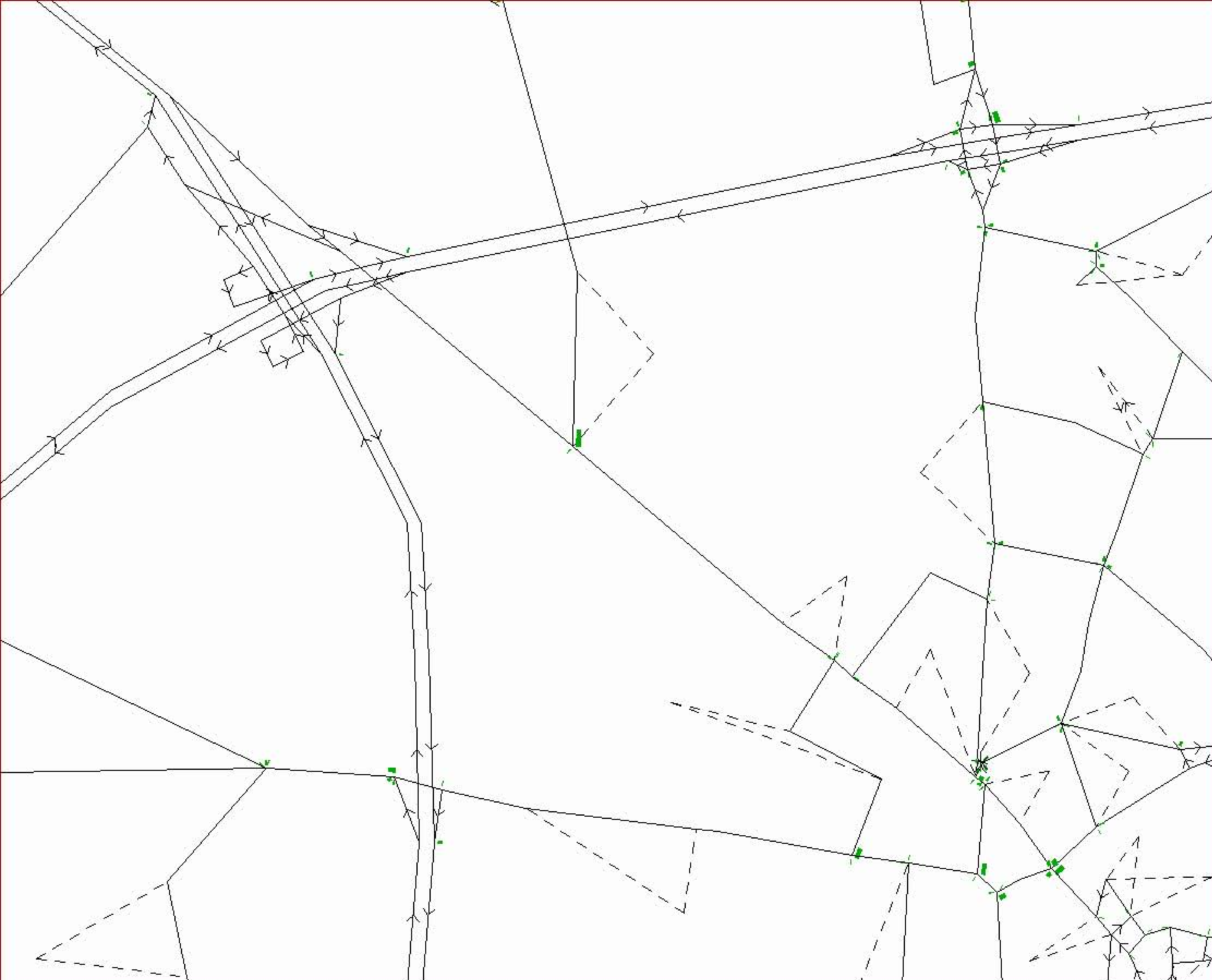

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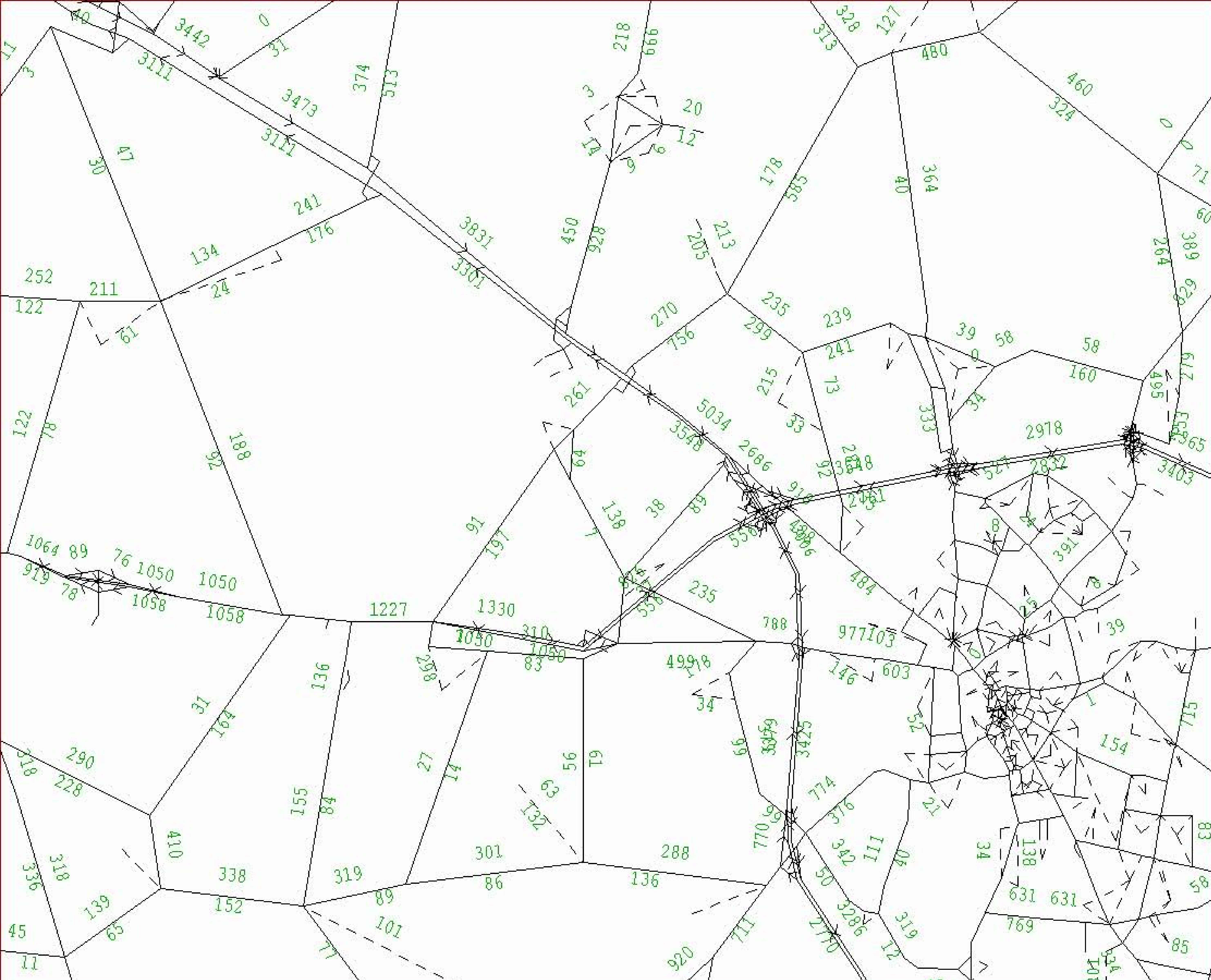

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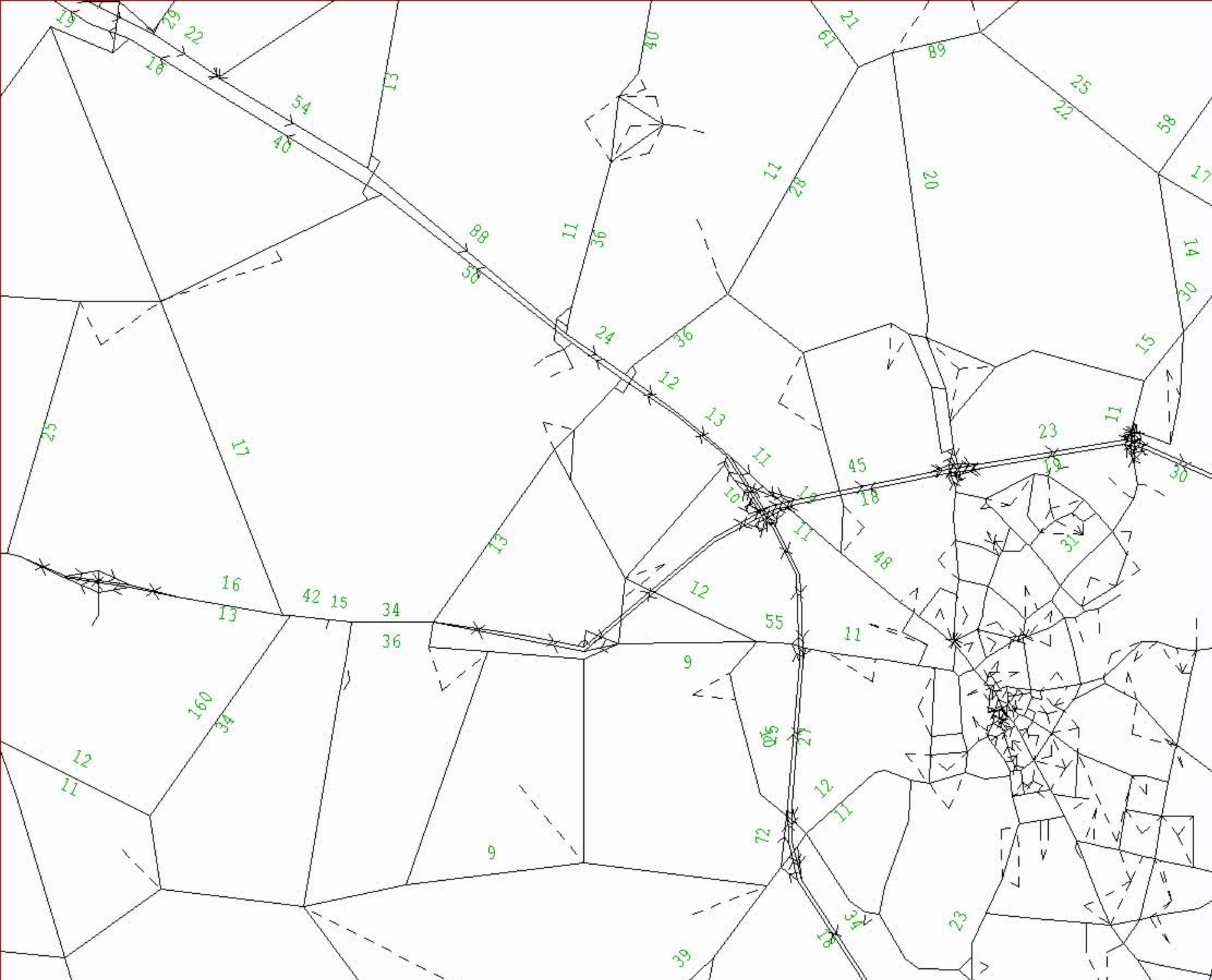

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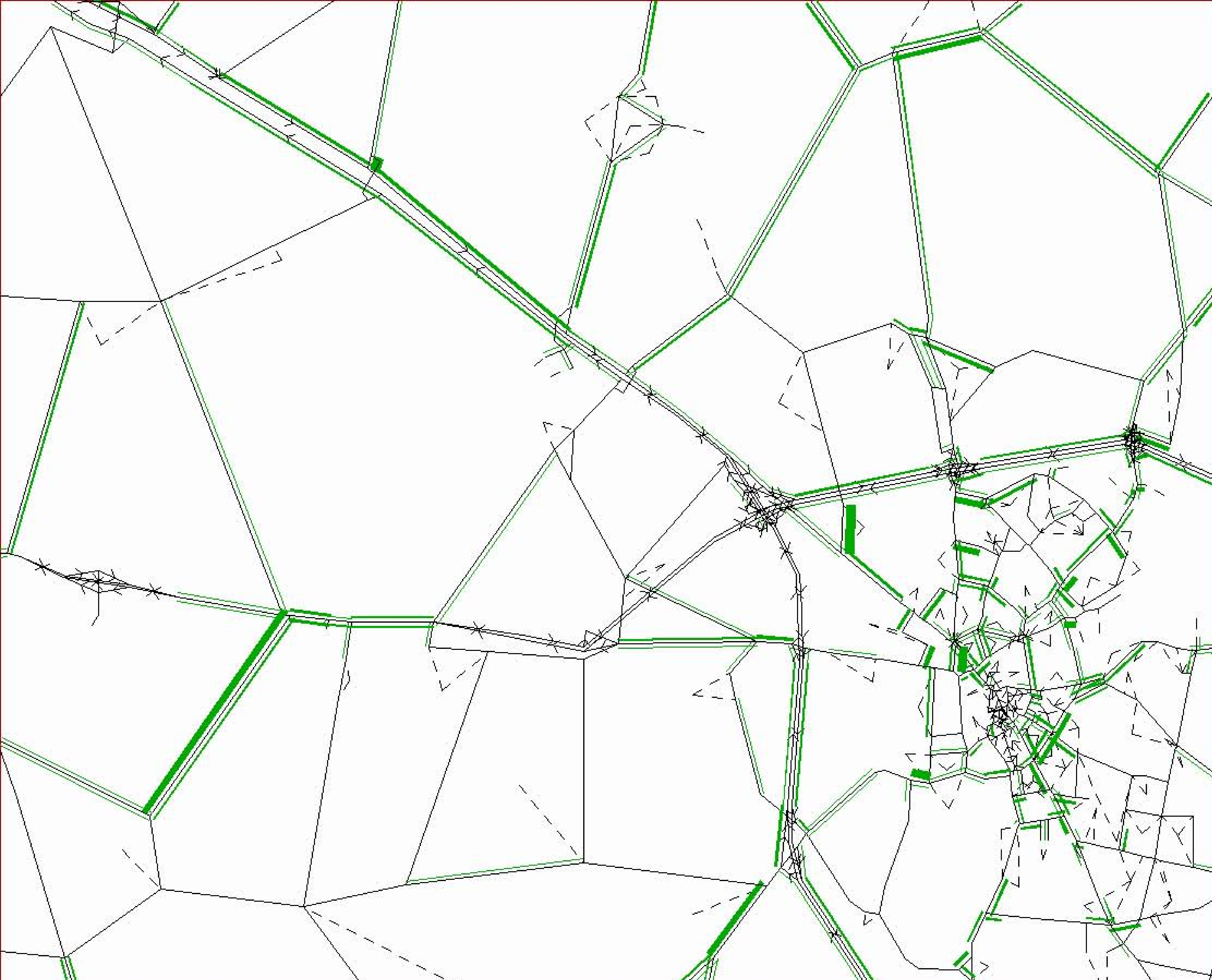
A14 Ellington to Fen Ditton - 2003 Base - AM V52   7- 8-06



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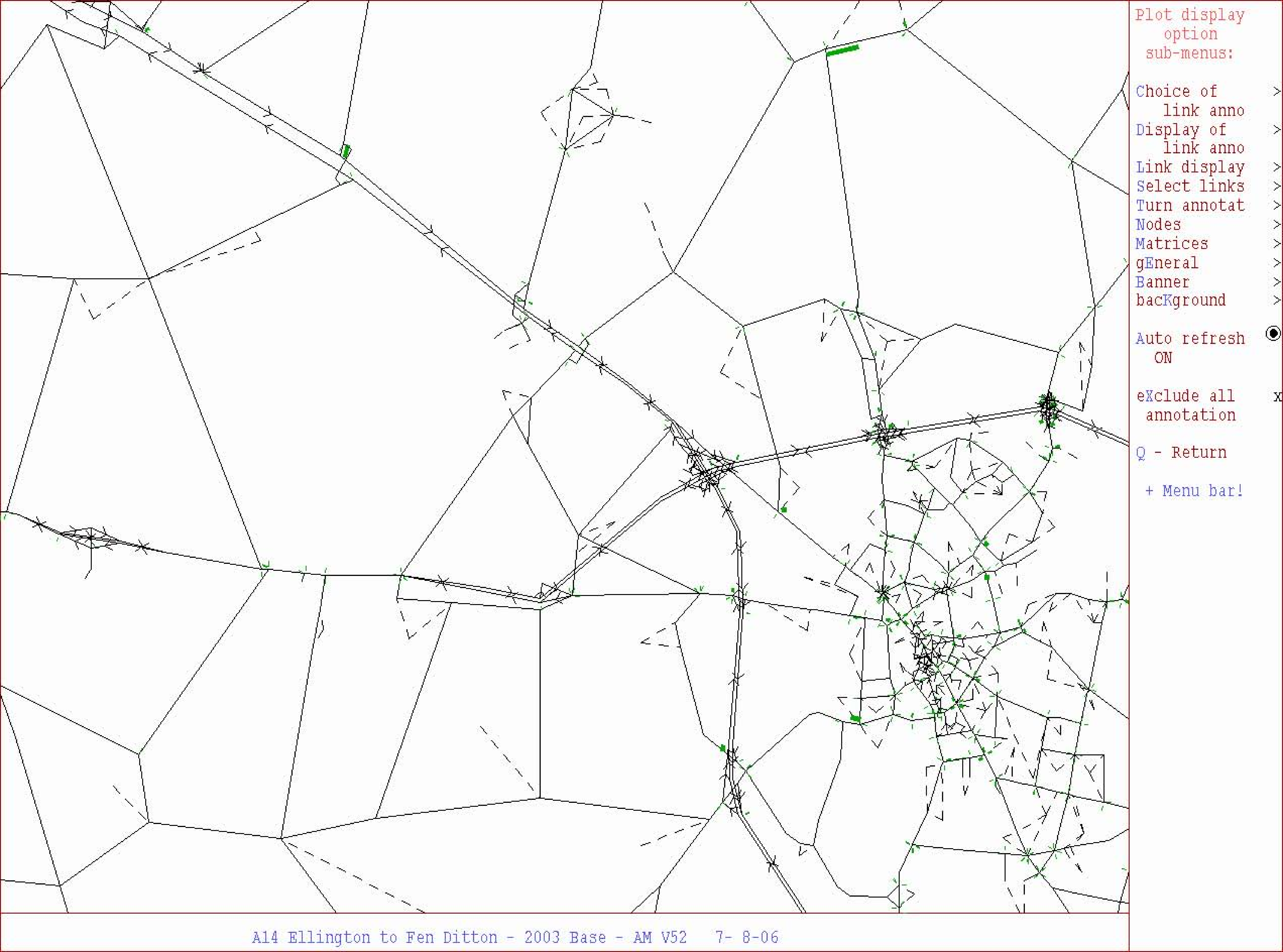
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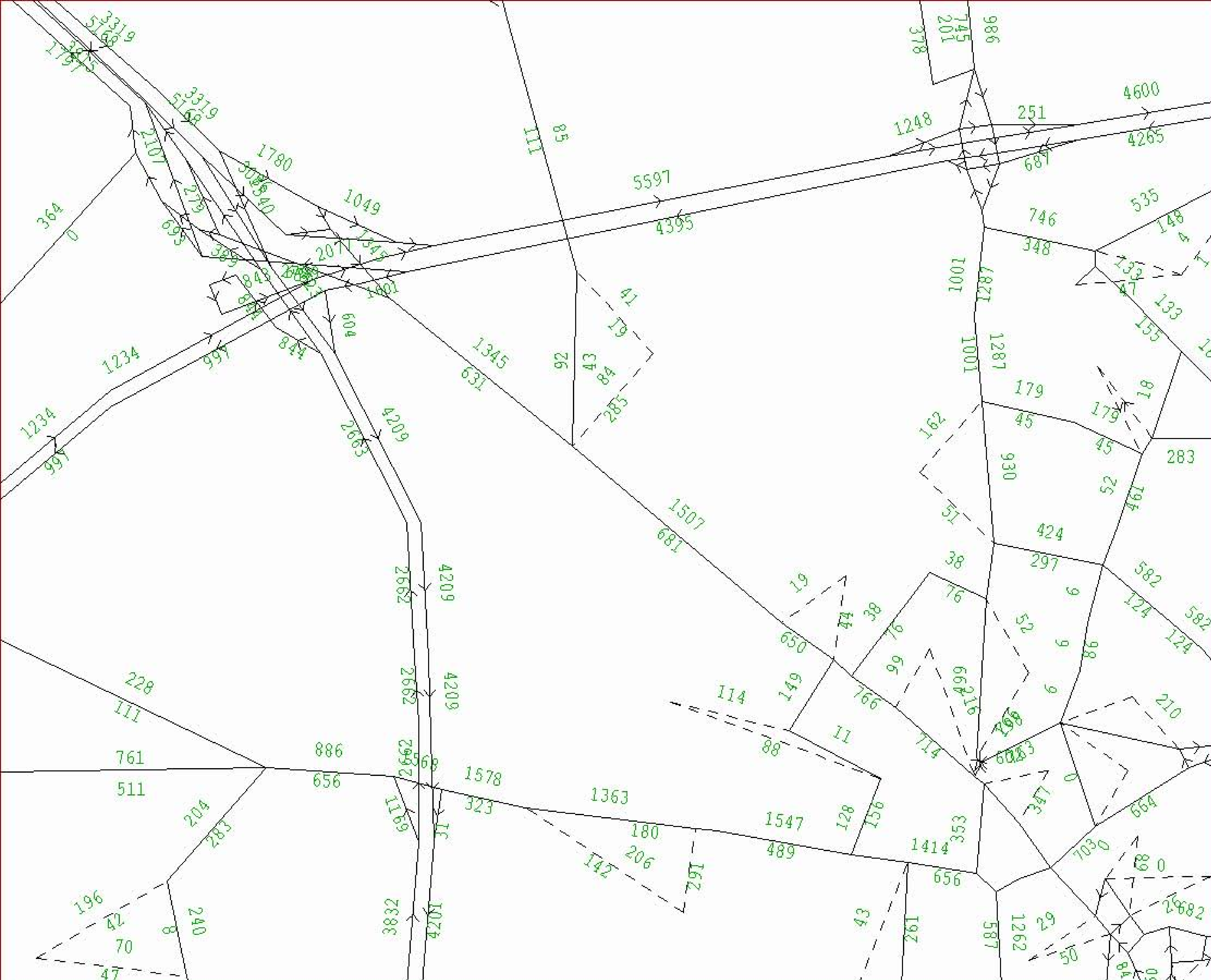

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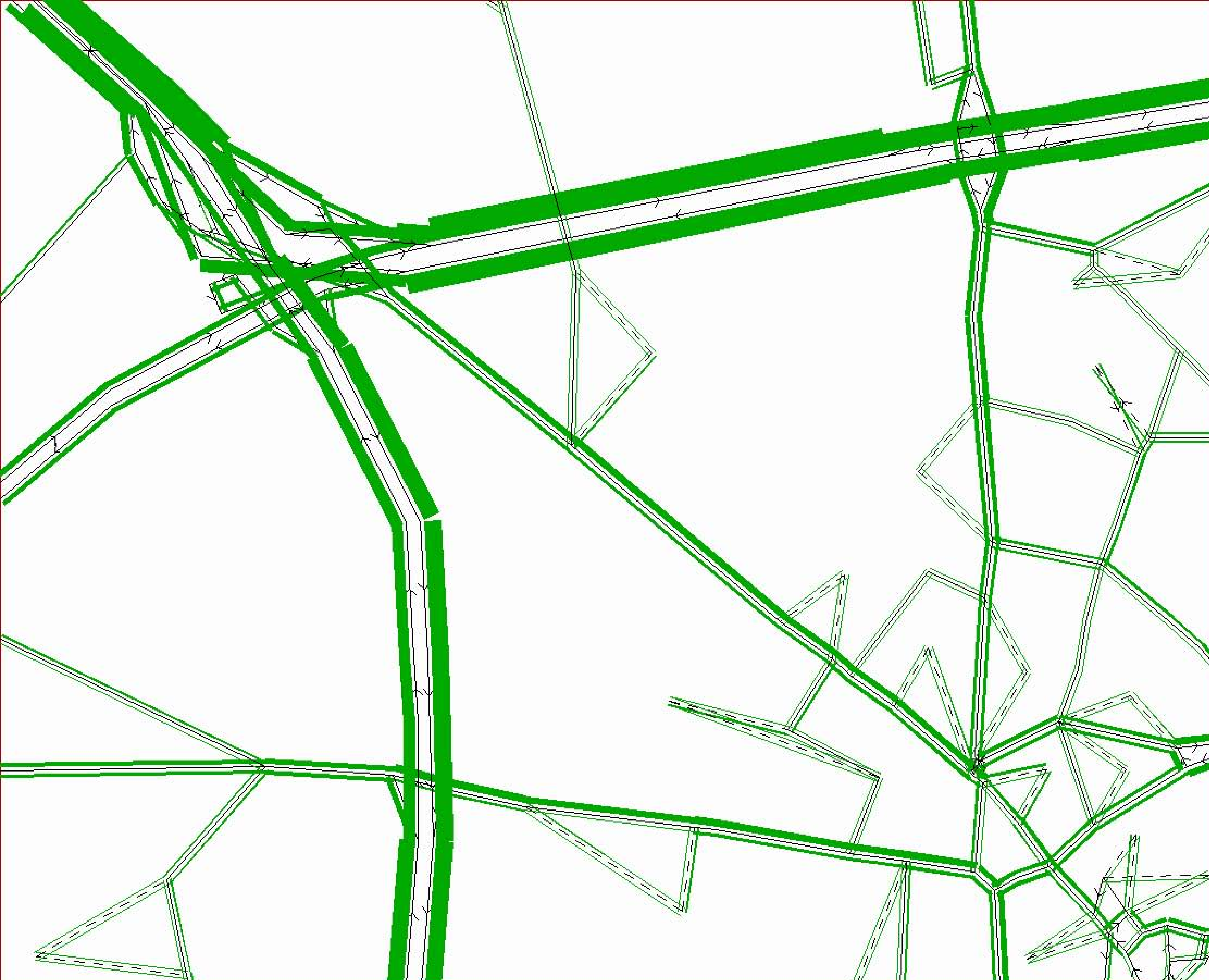

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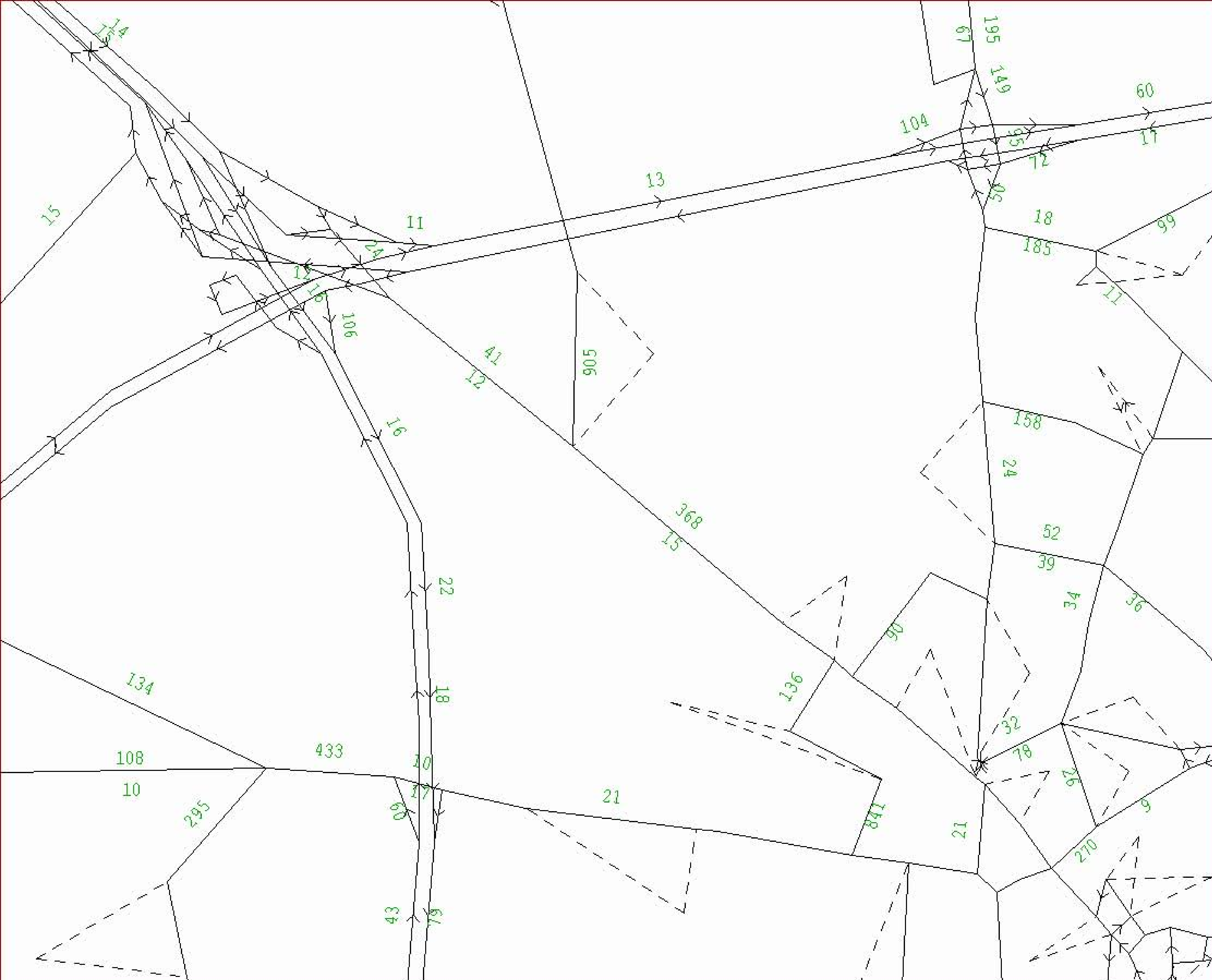

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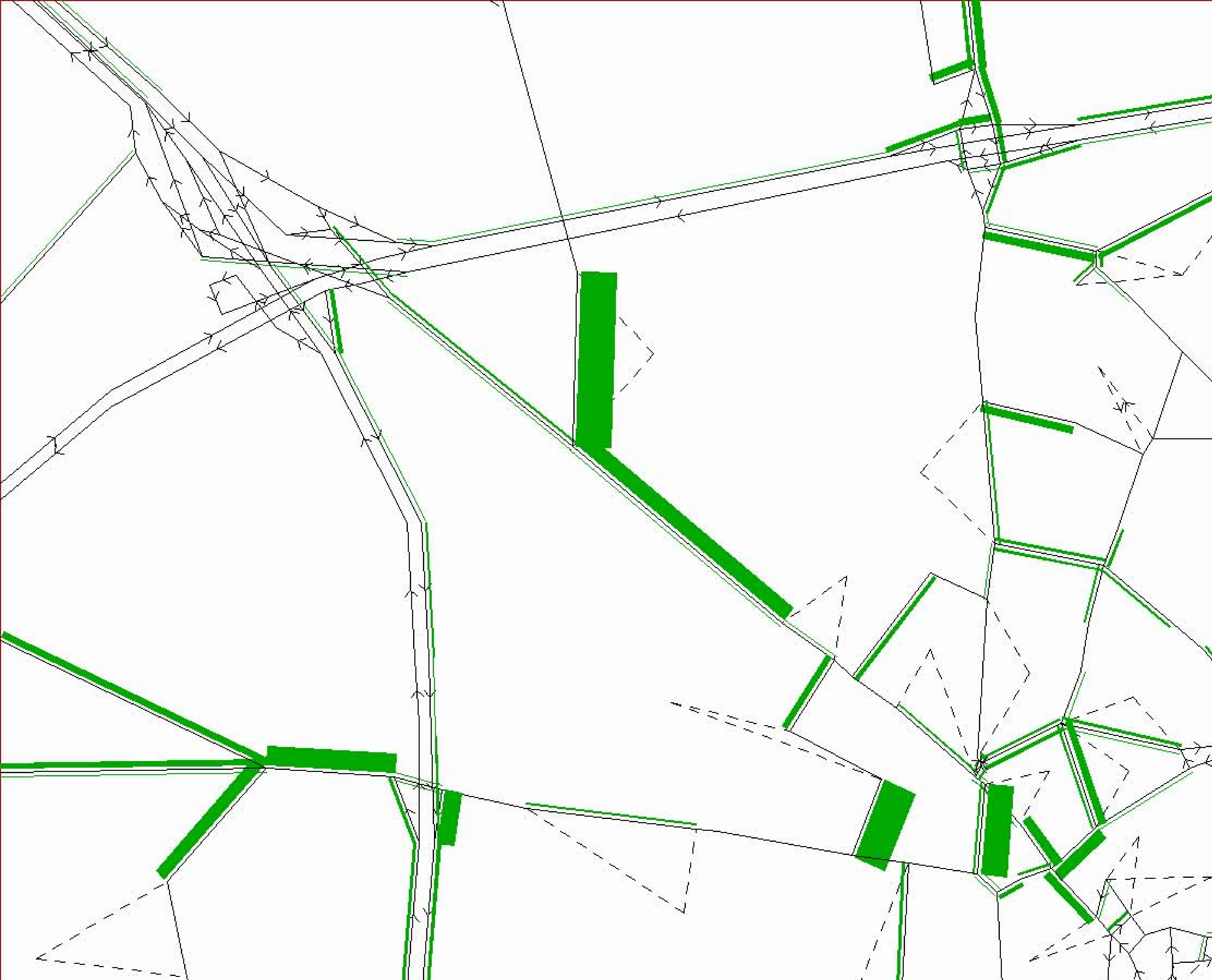

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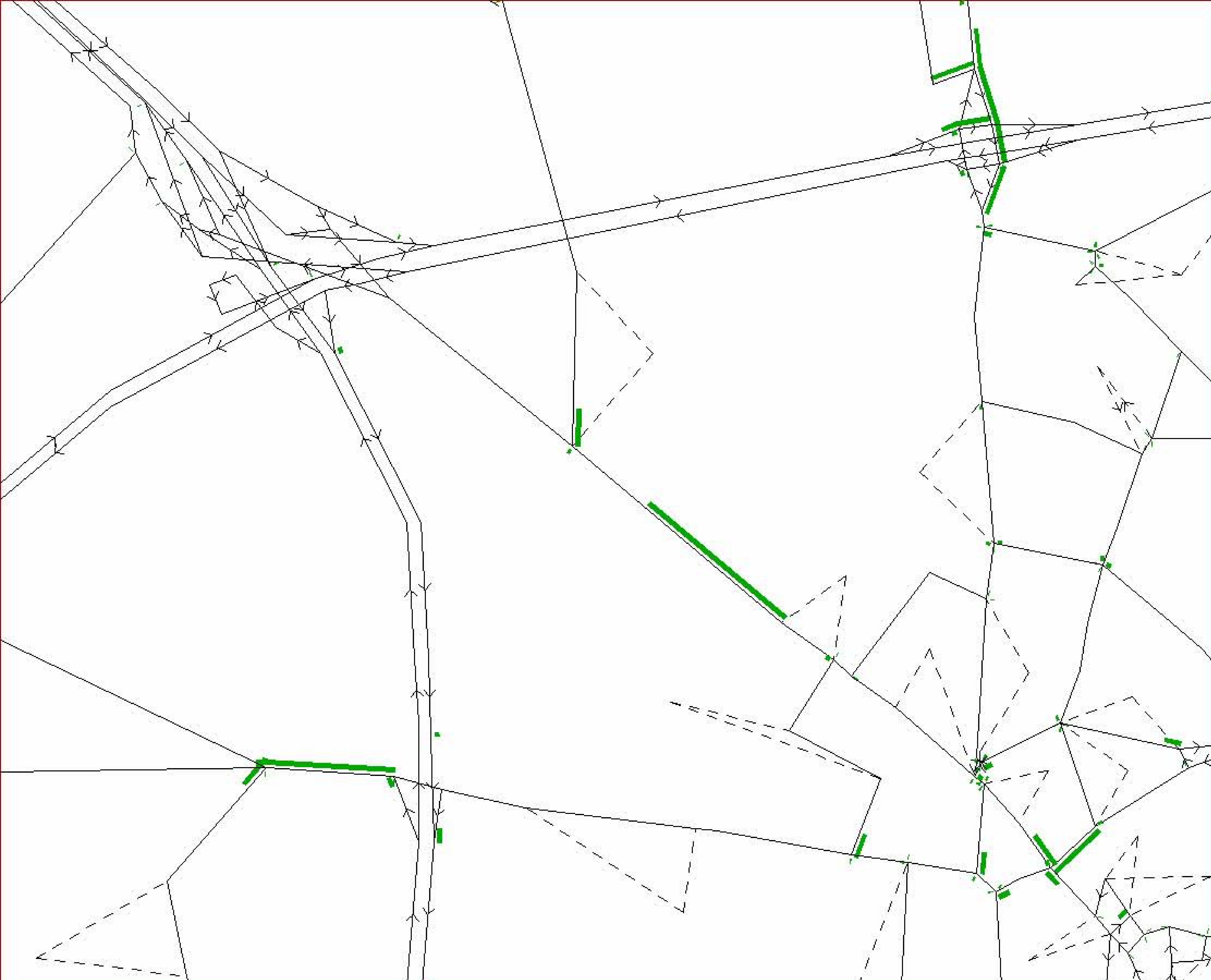

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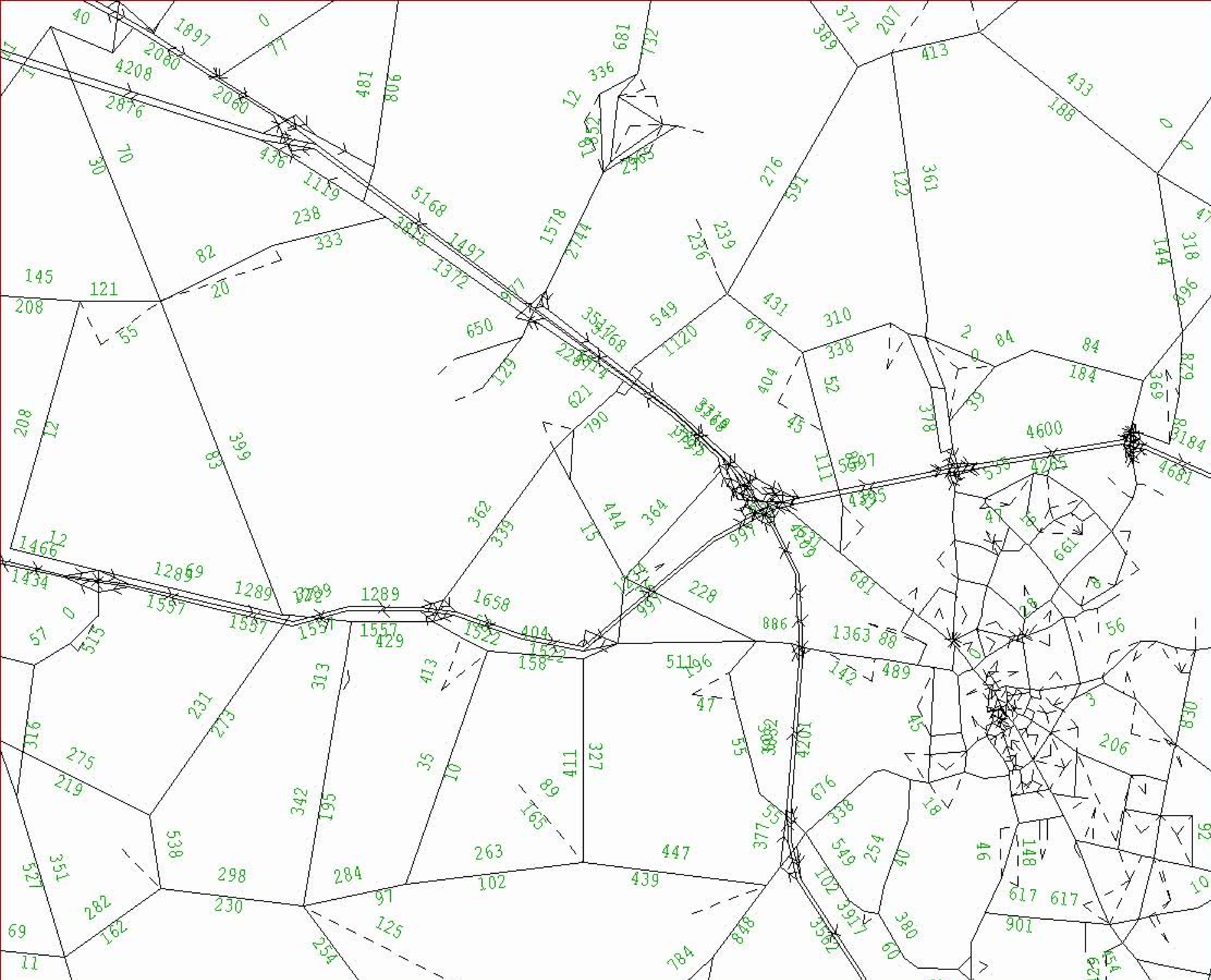
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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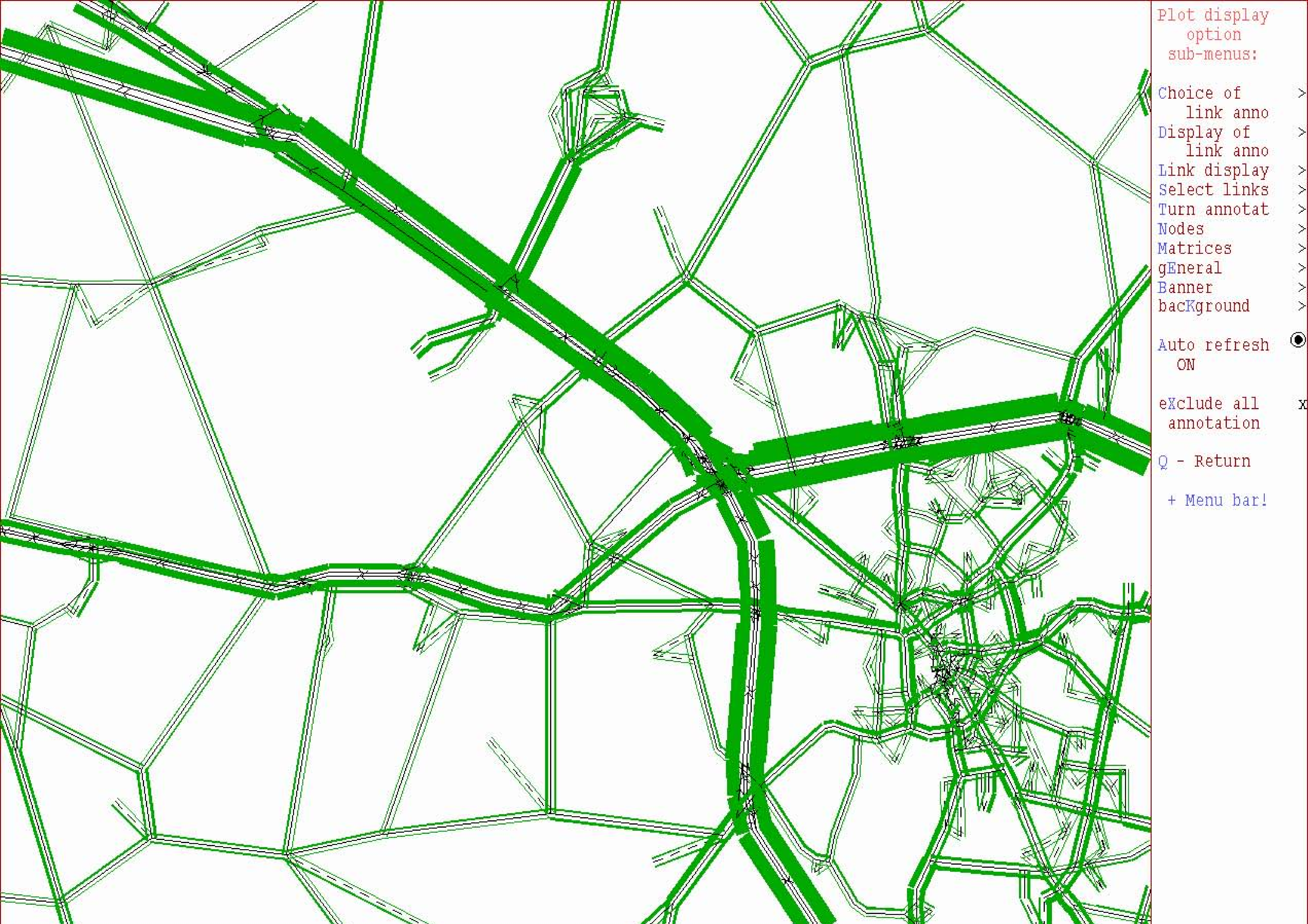
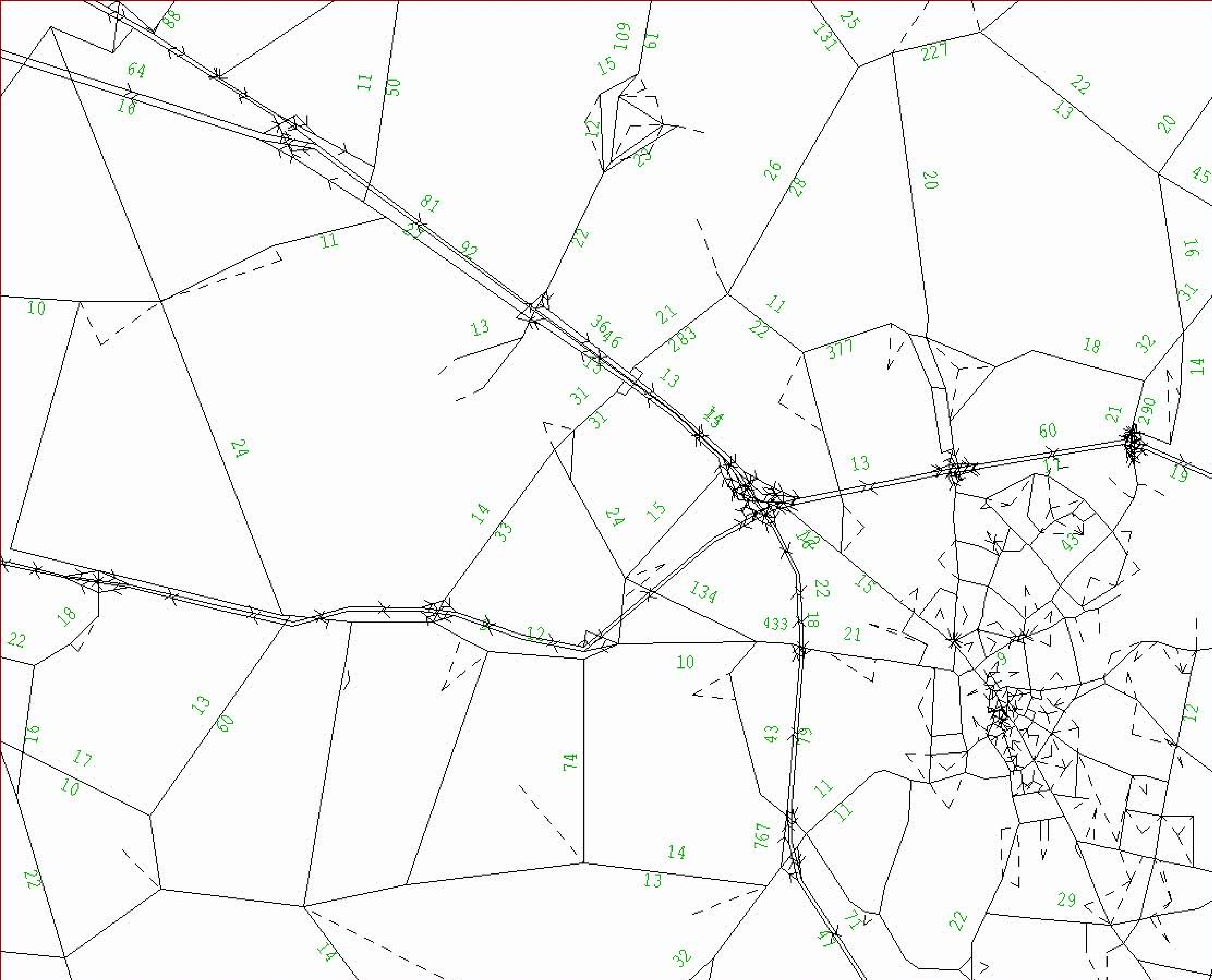
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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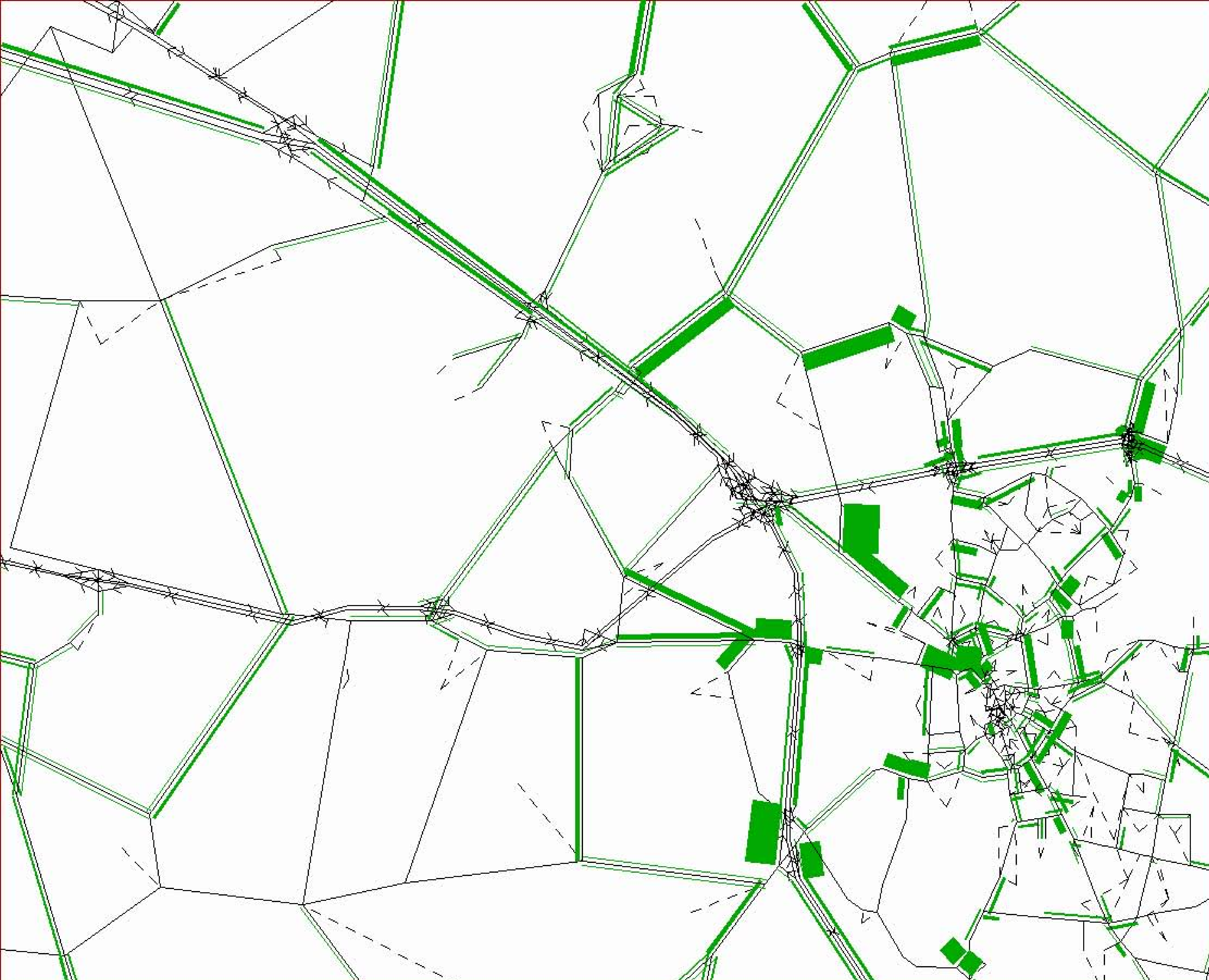
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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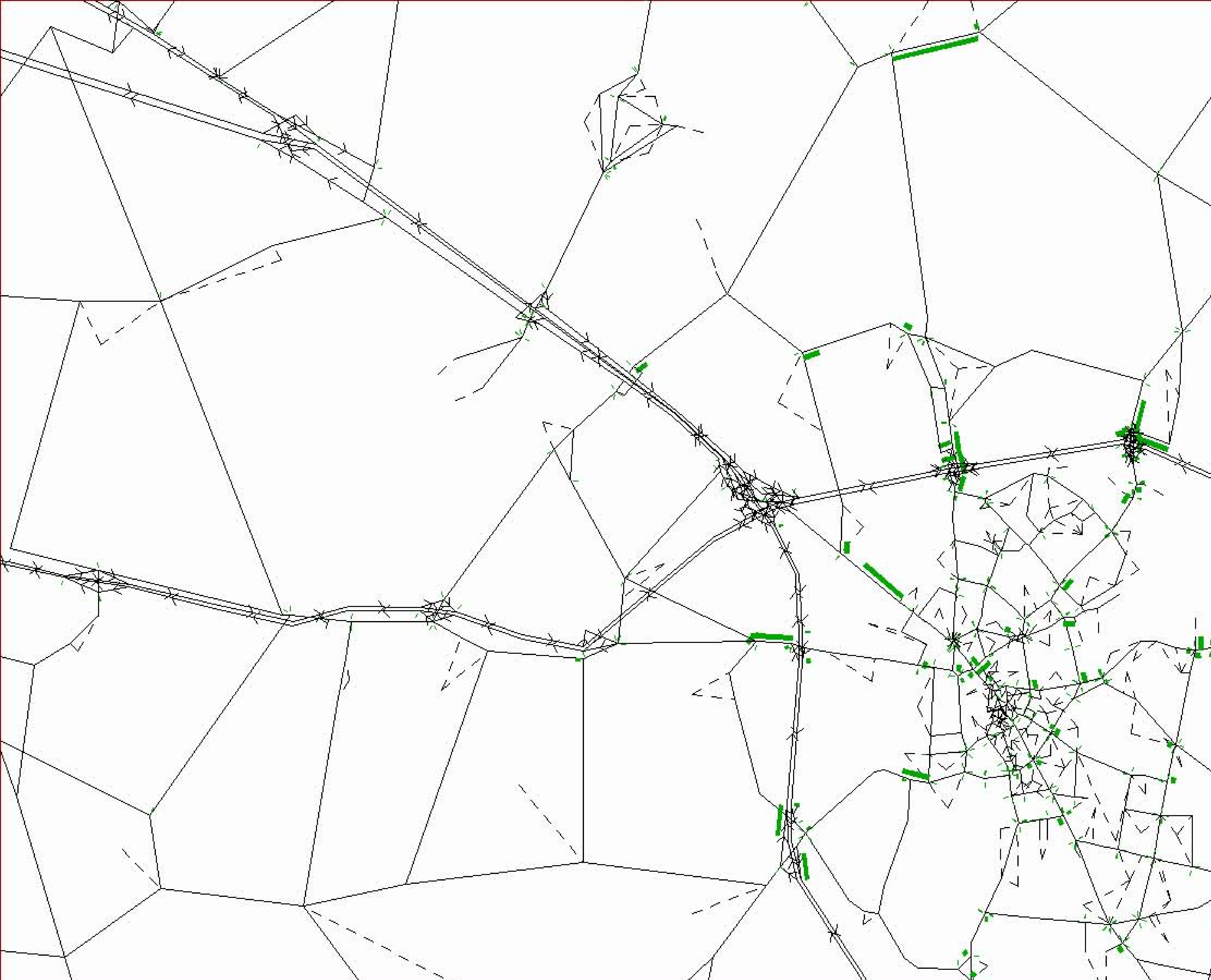
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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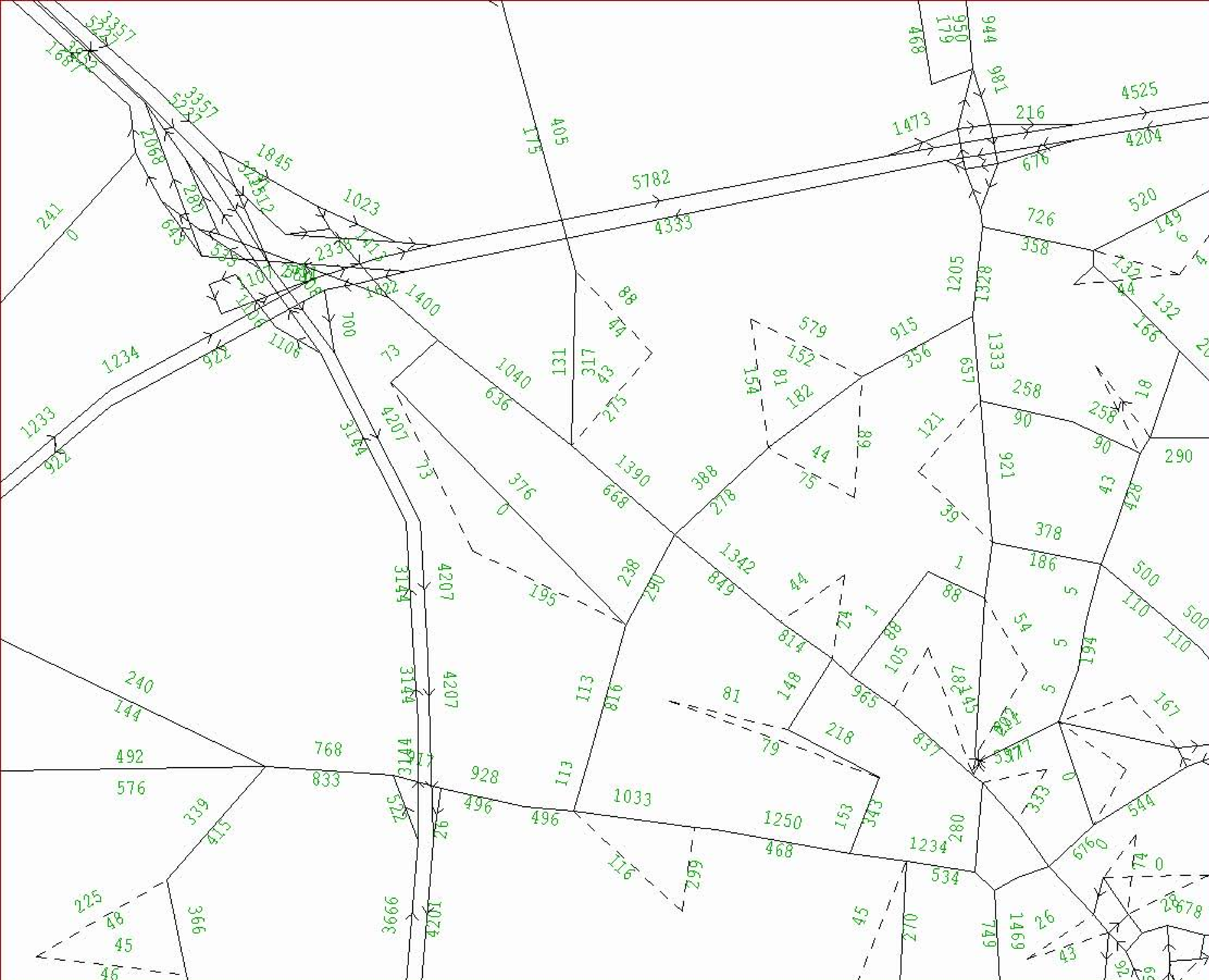
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06

Plot display option sub-menus:

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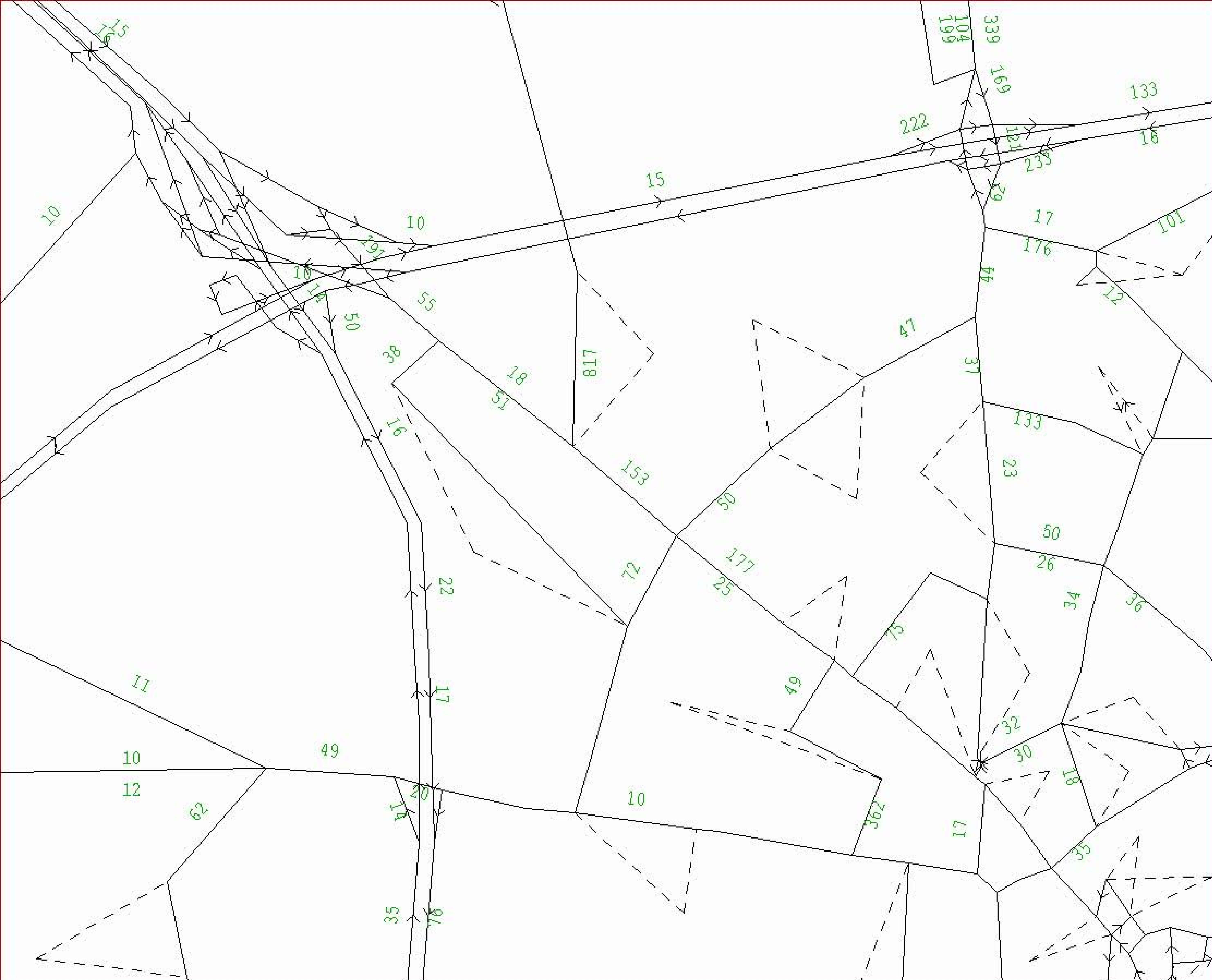
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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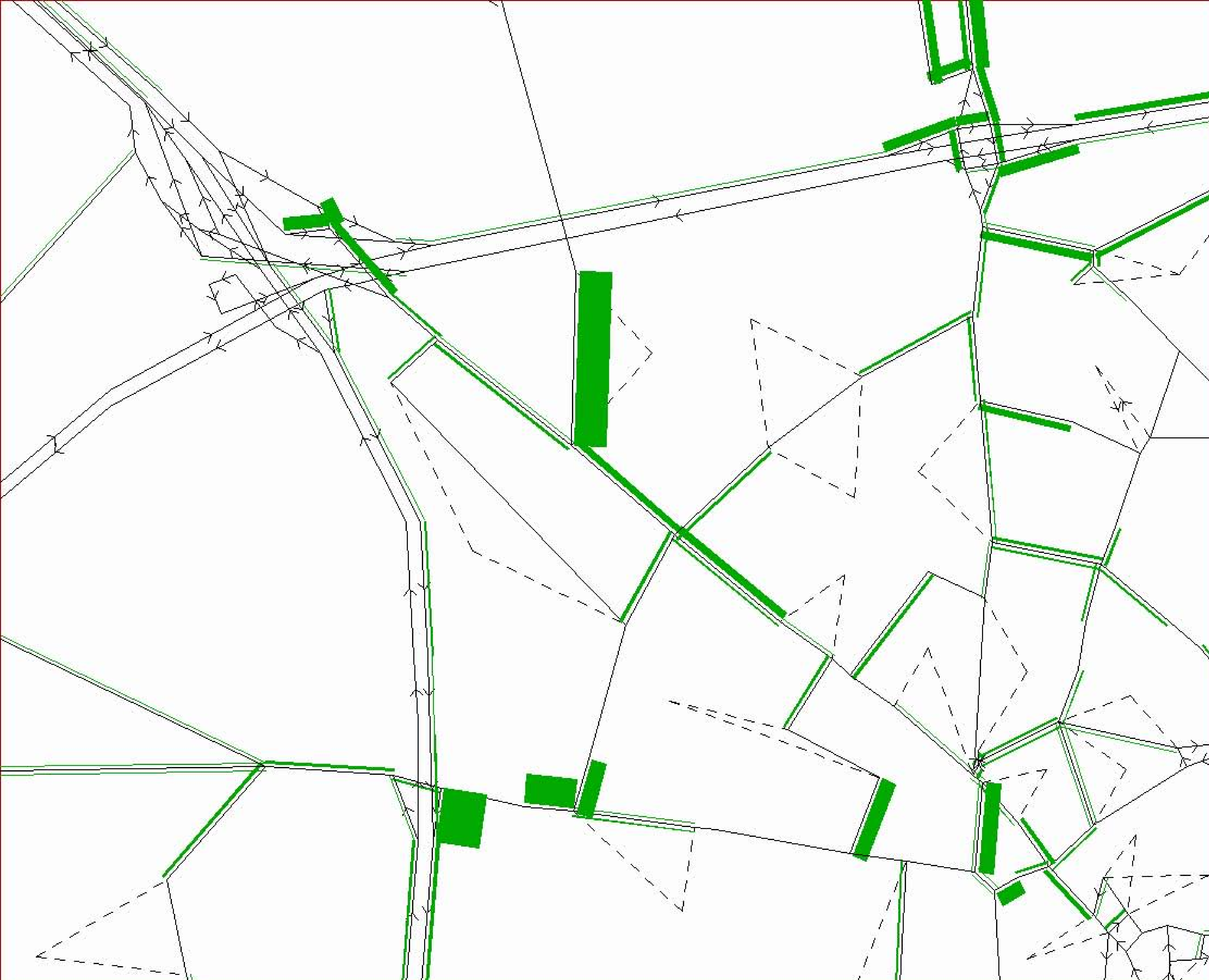
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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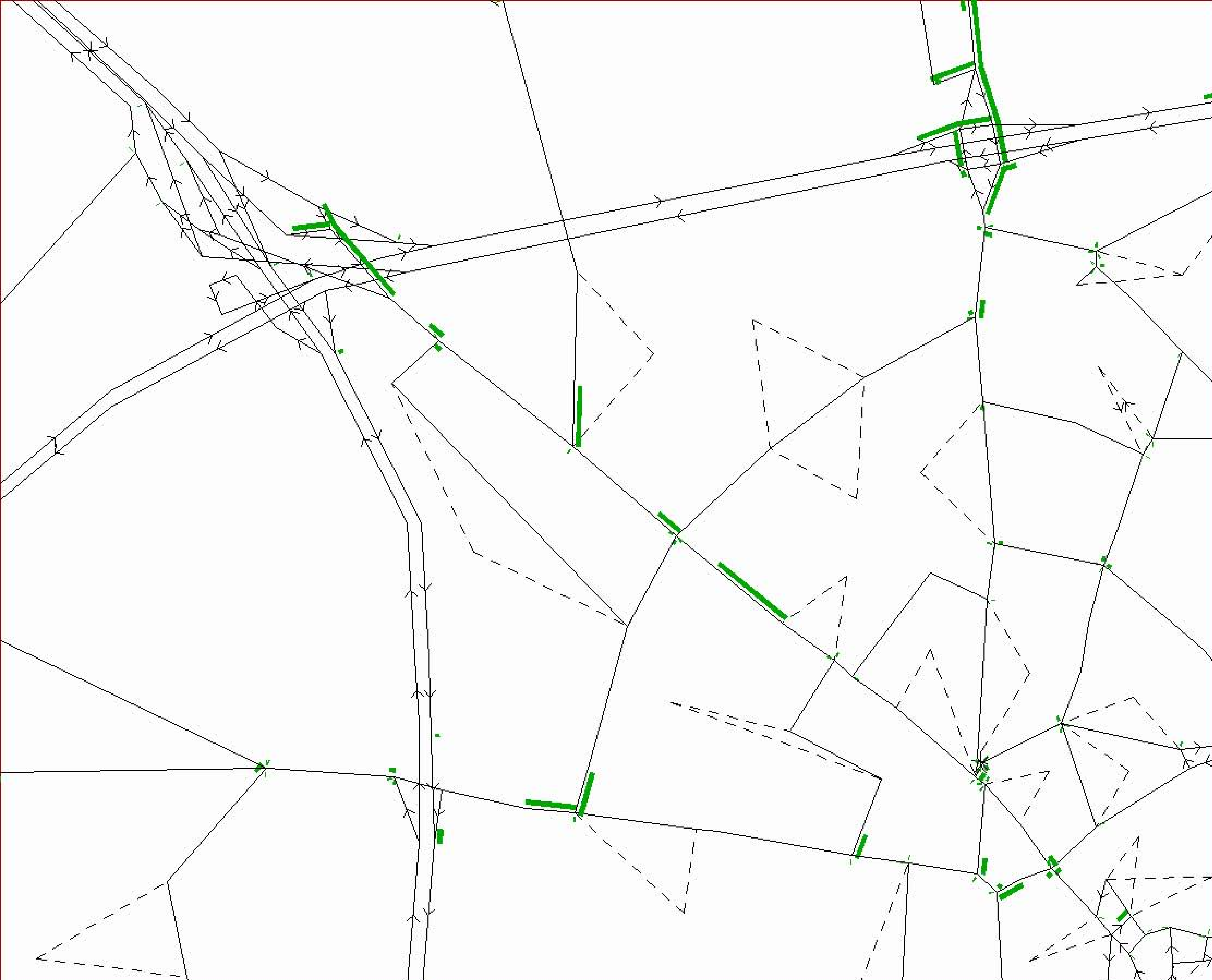
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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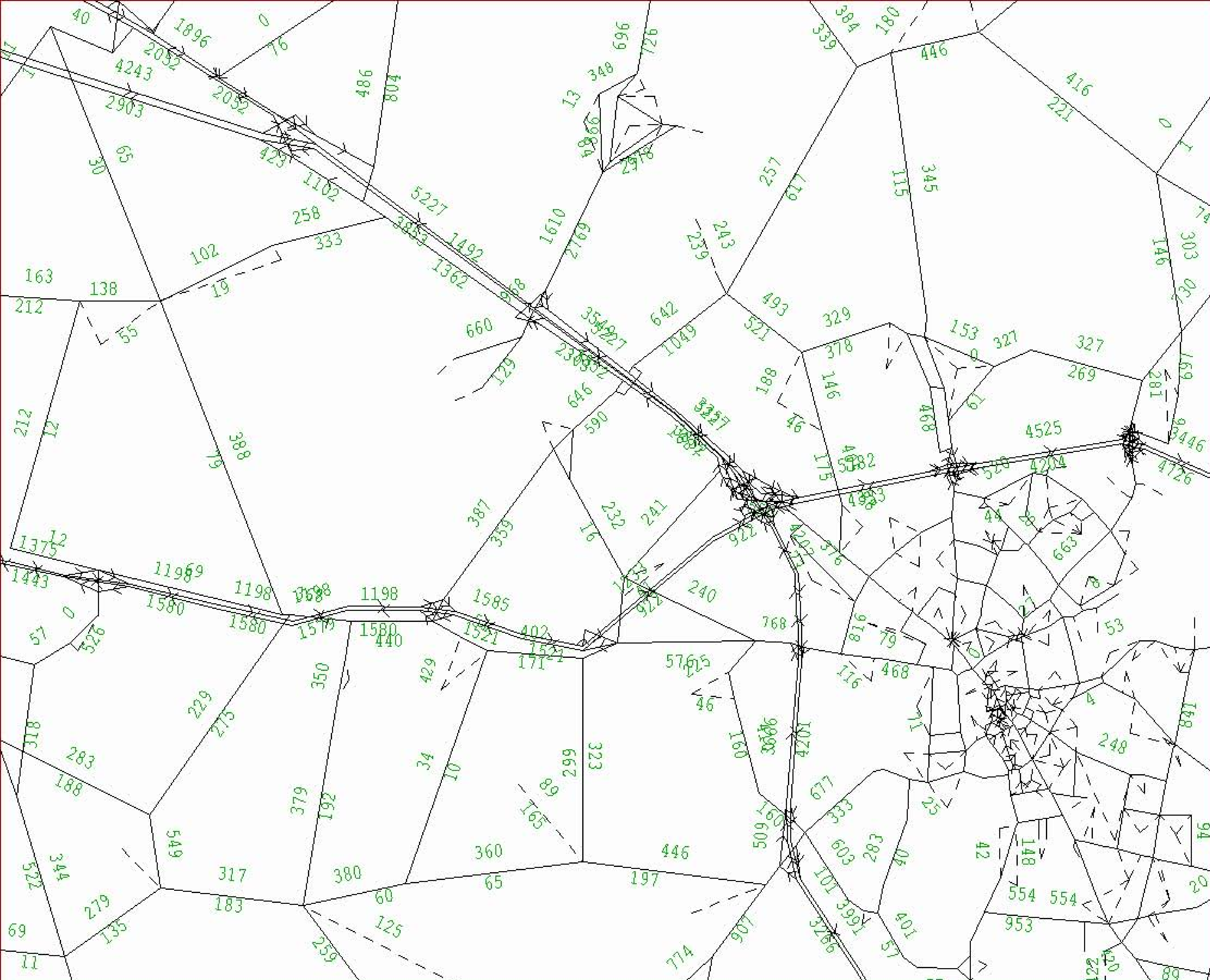
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06

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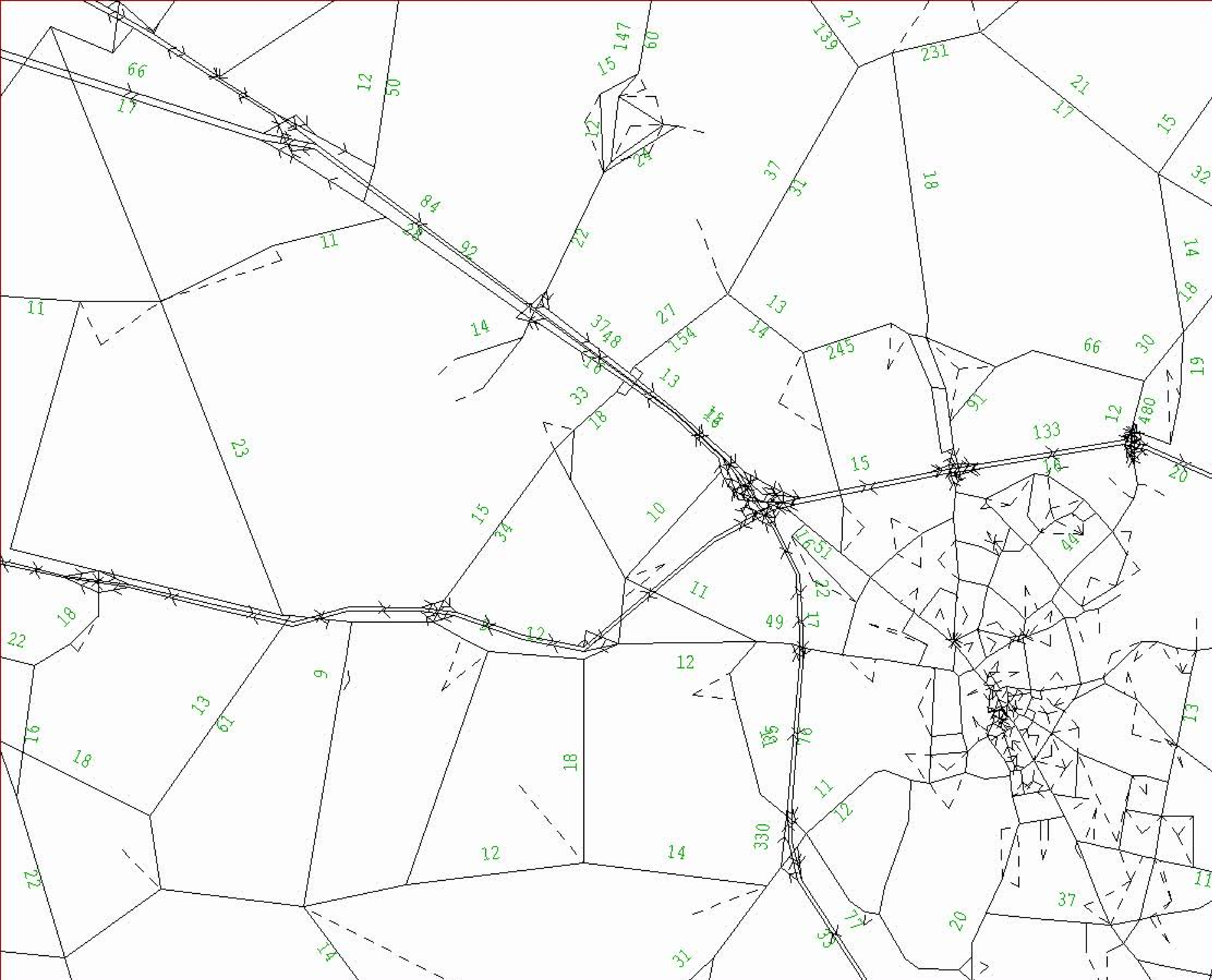
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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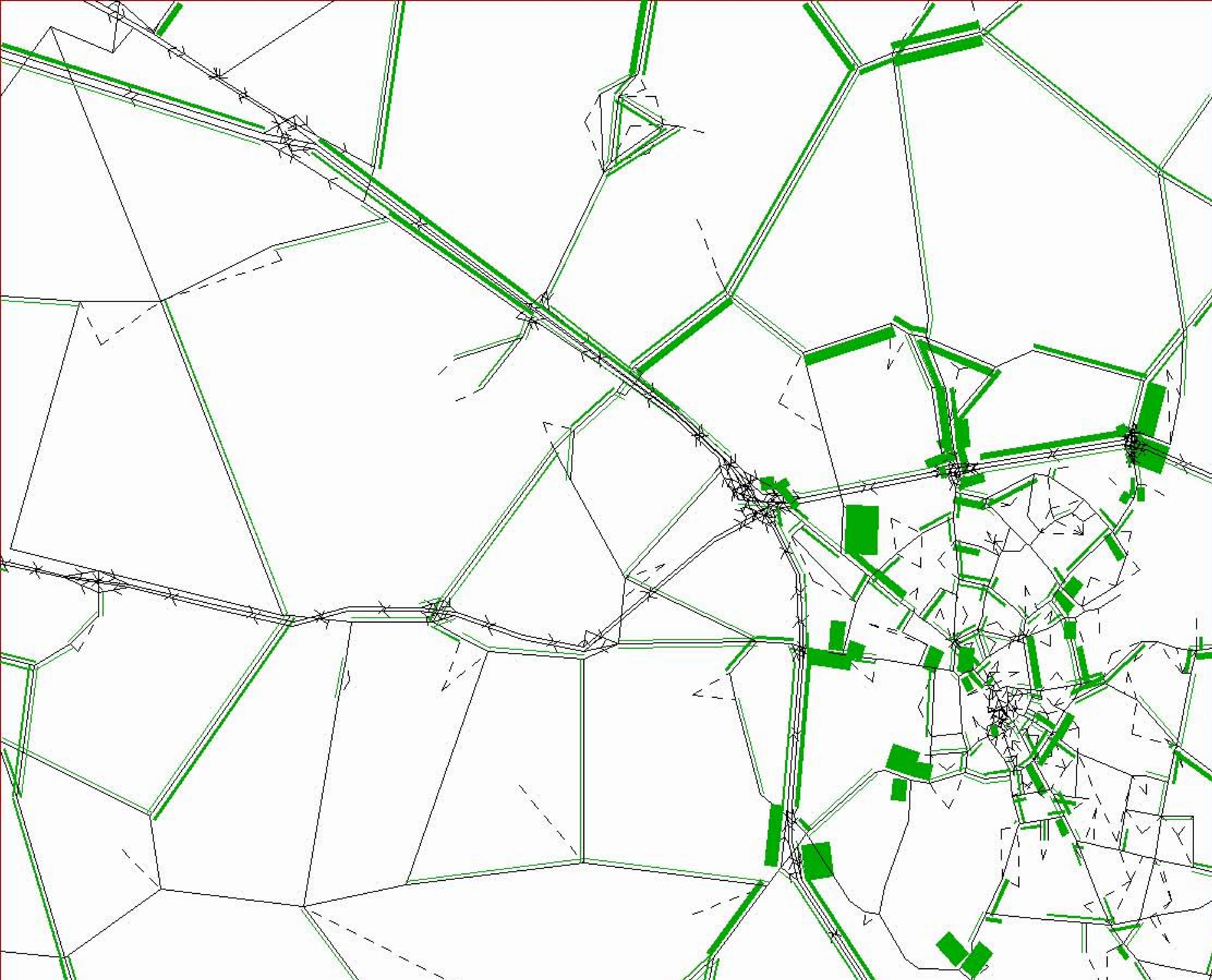
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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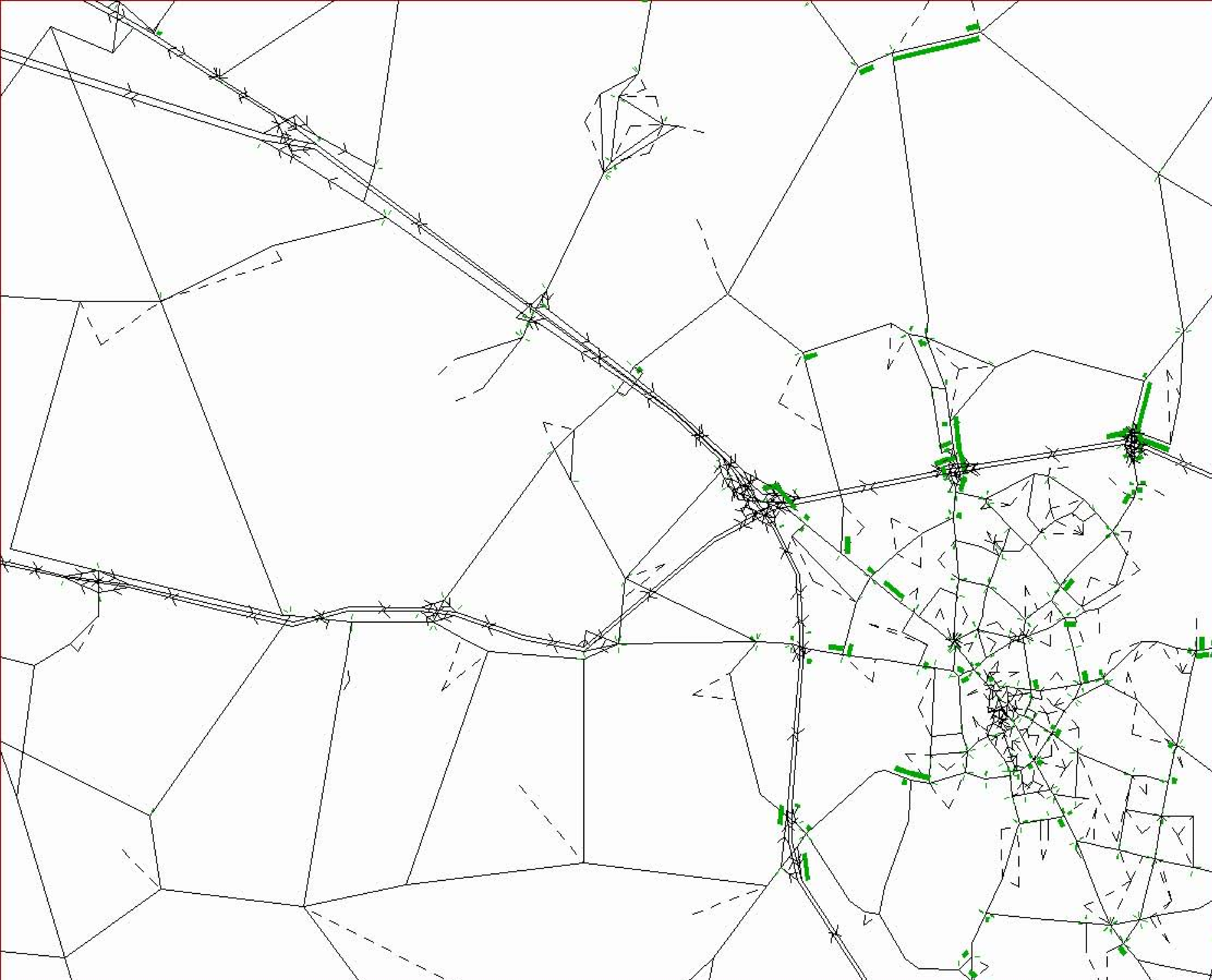
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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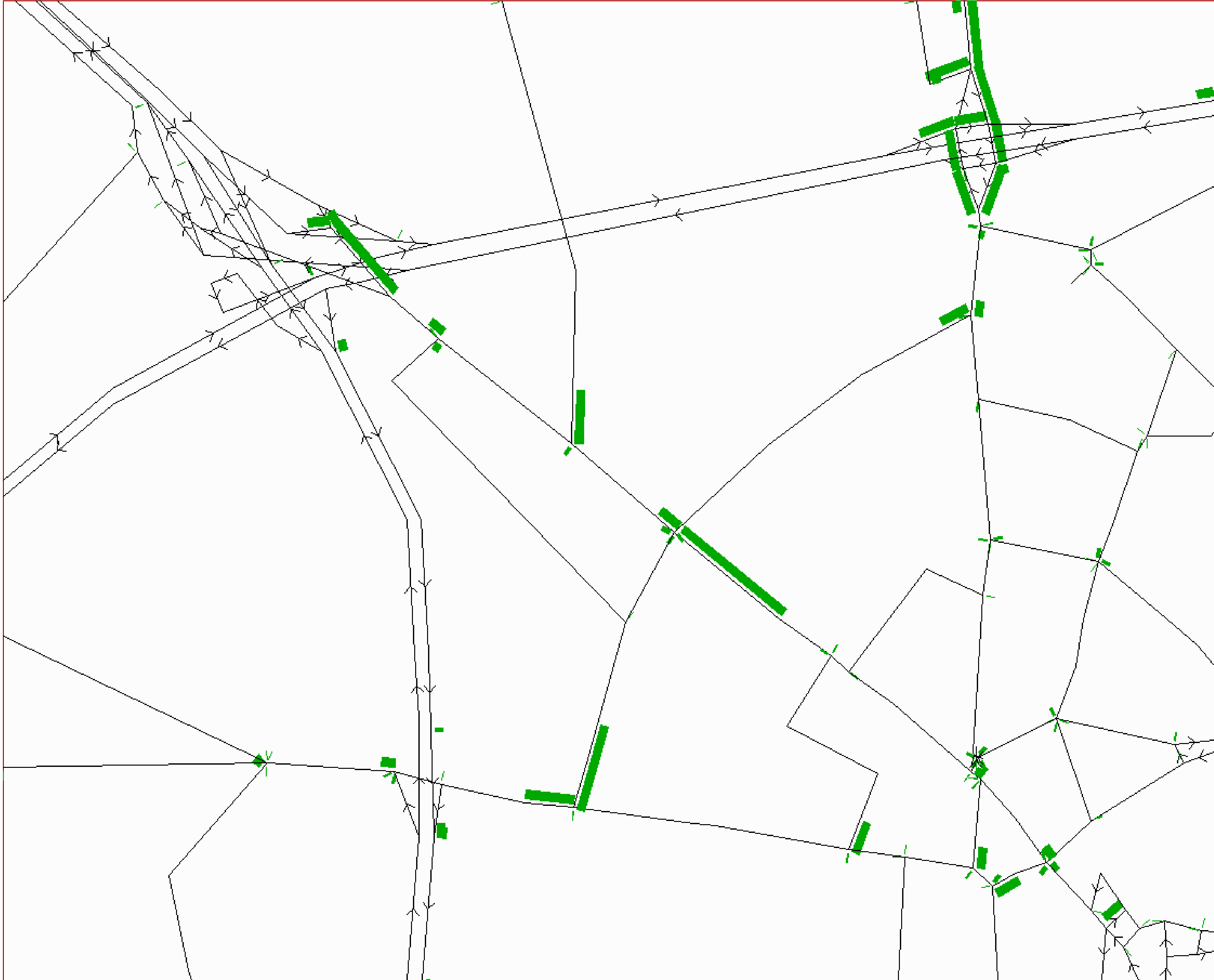
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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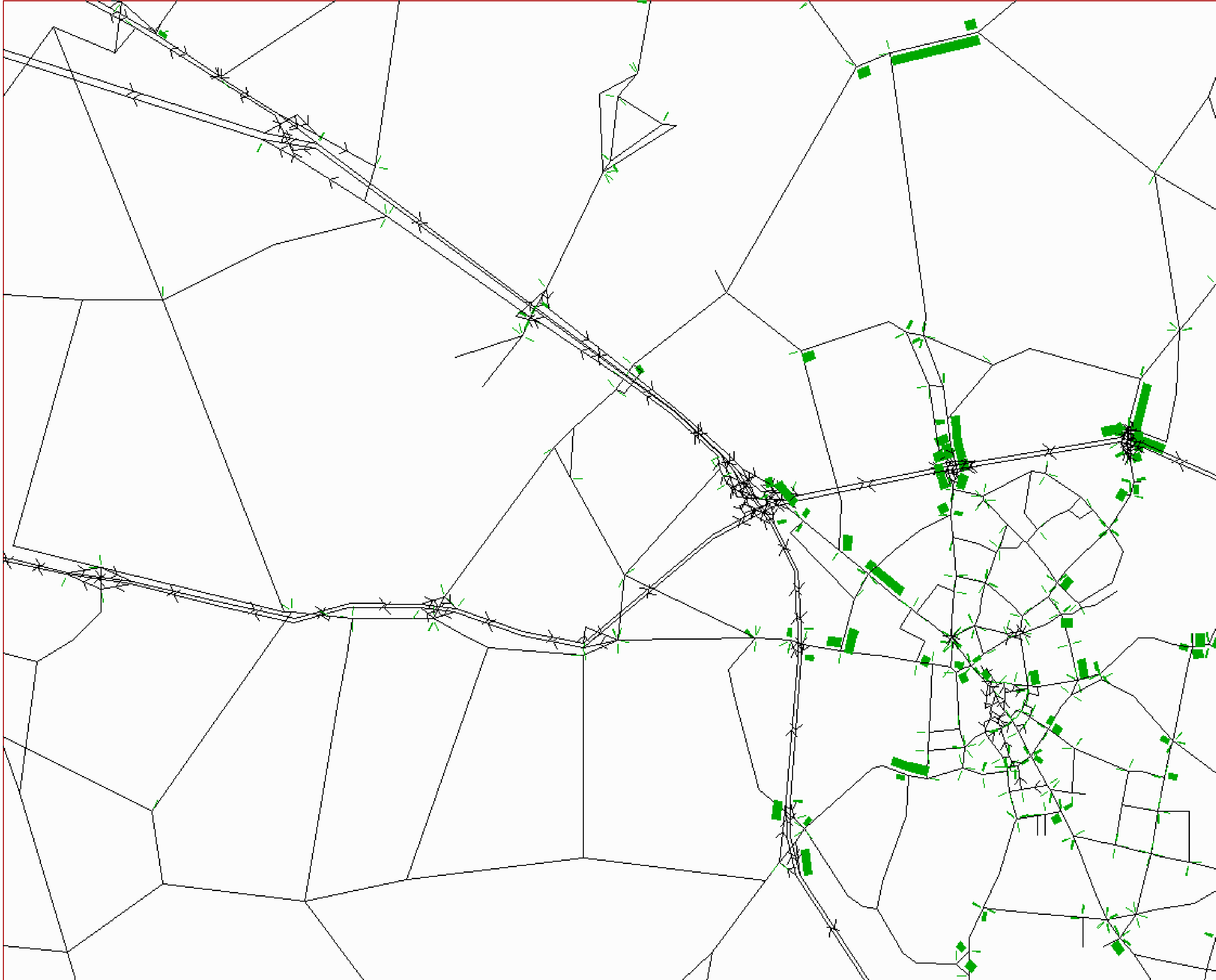
A14 - Limited Junction Option 2025 am EA9 Central Growth 14- 2-07



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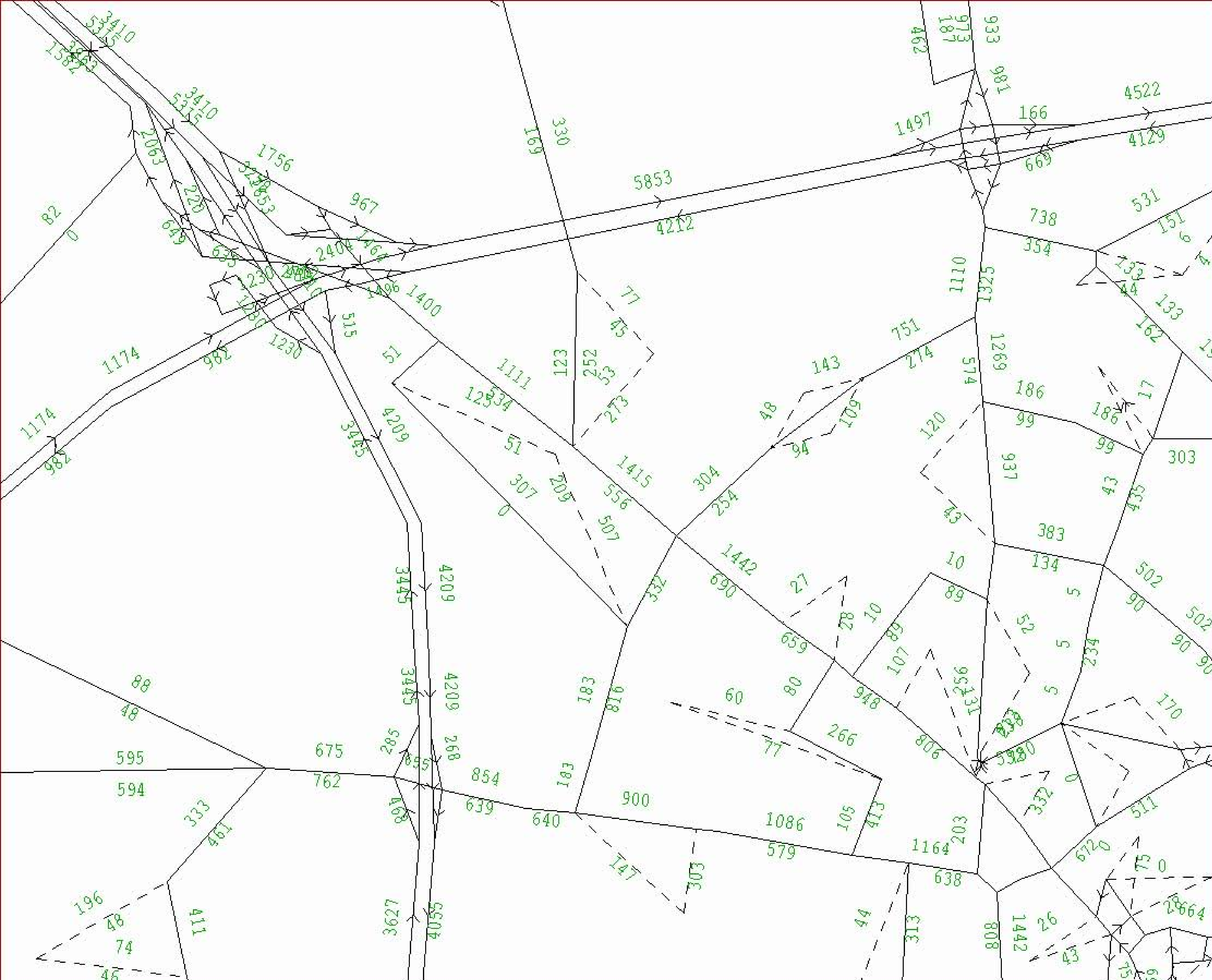
A14 - Limited Junction Option 2025 am EA9 Central Growth 14- 2-07



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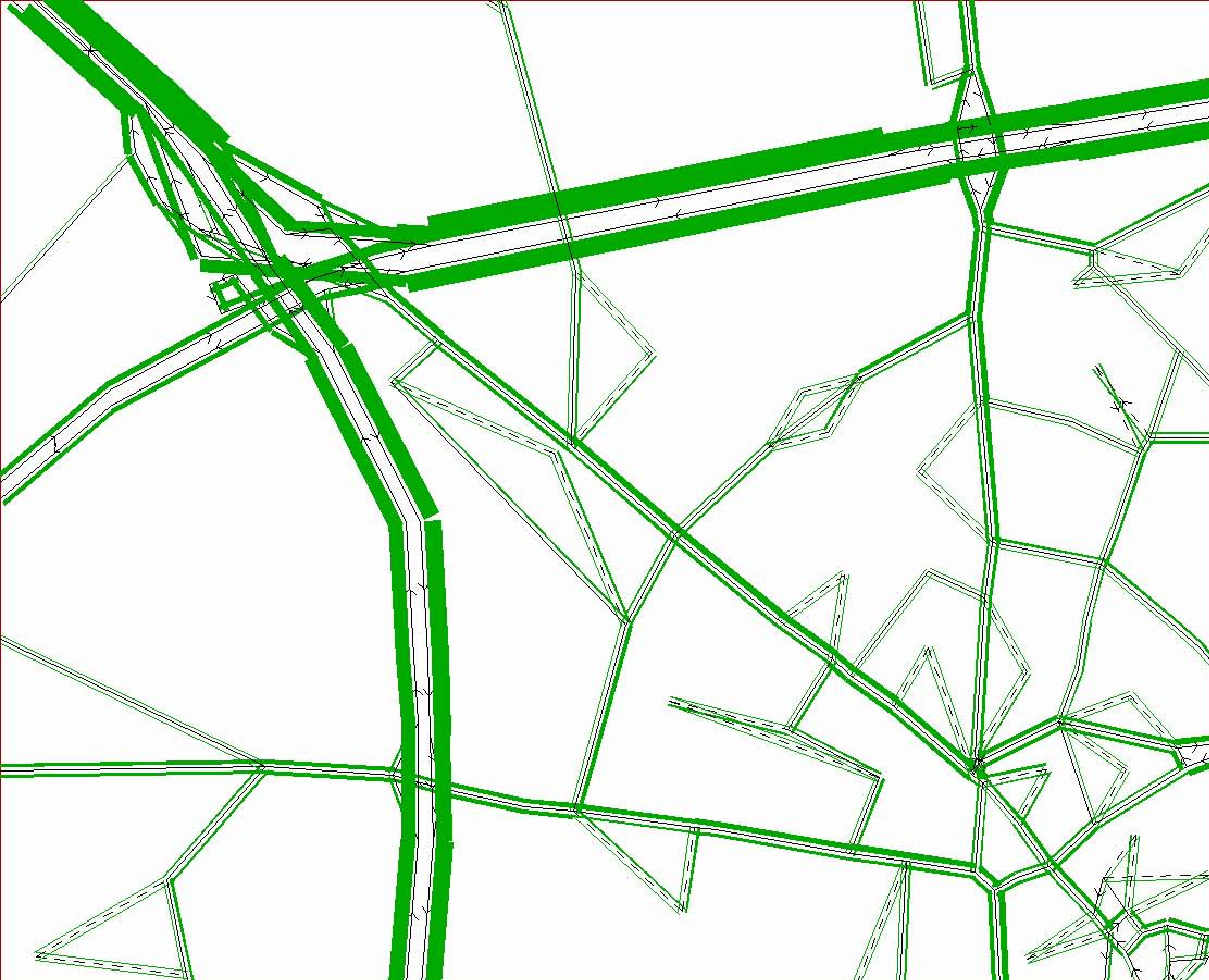
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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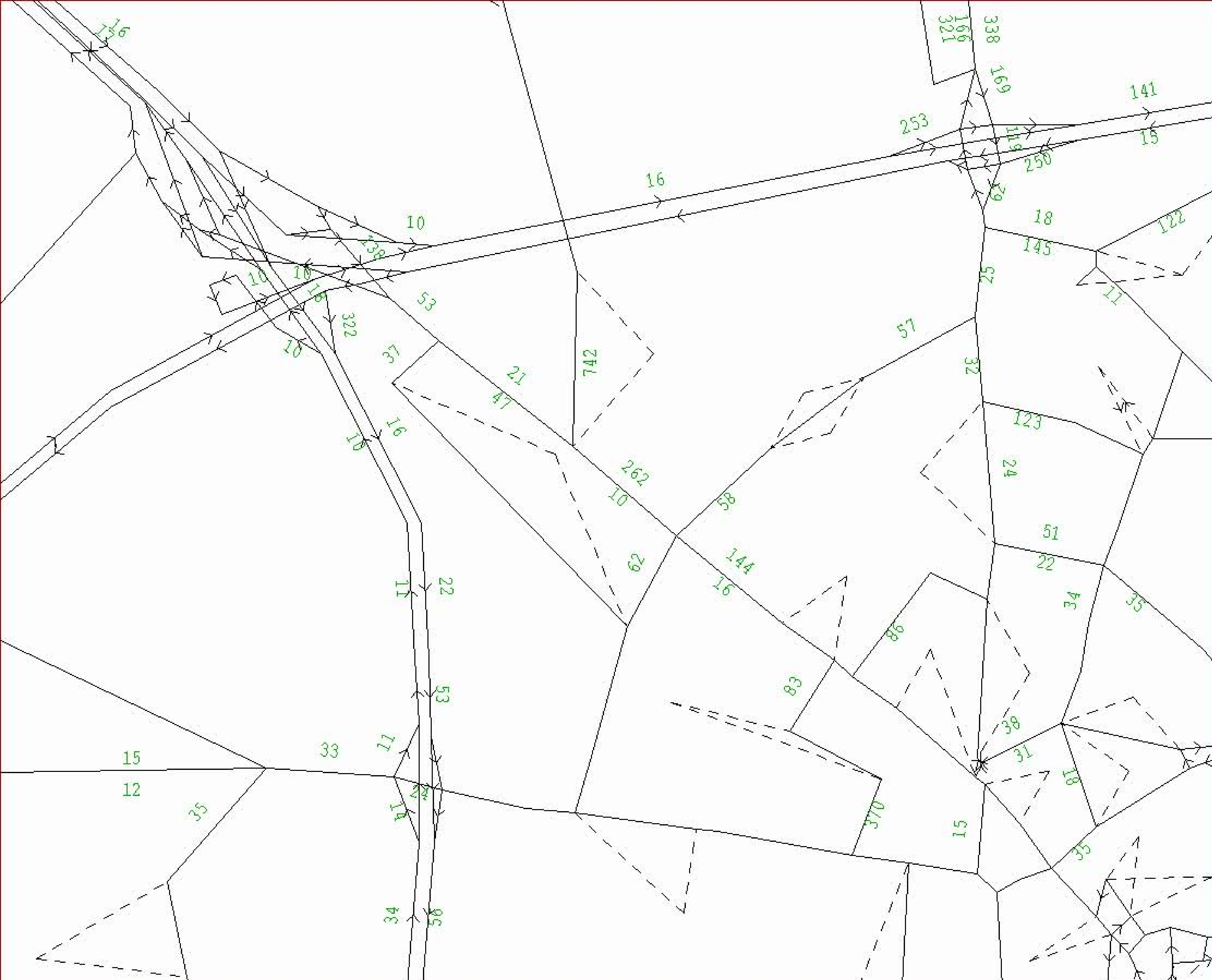
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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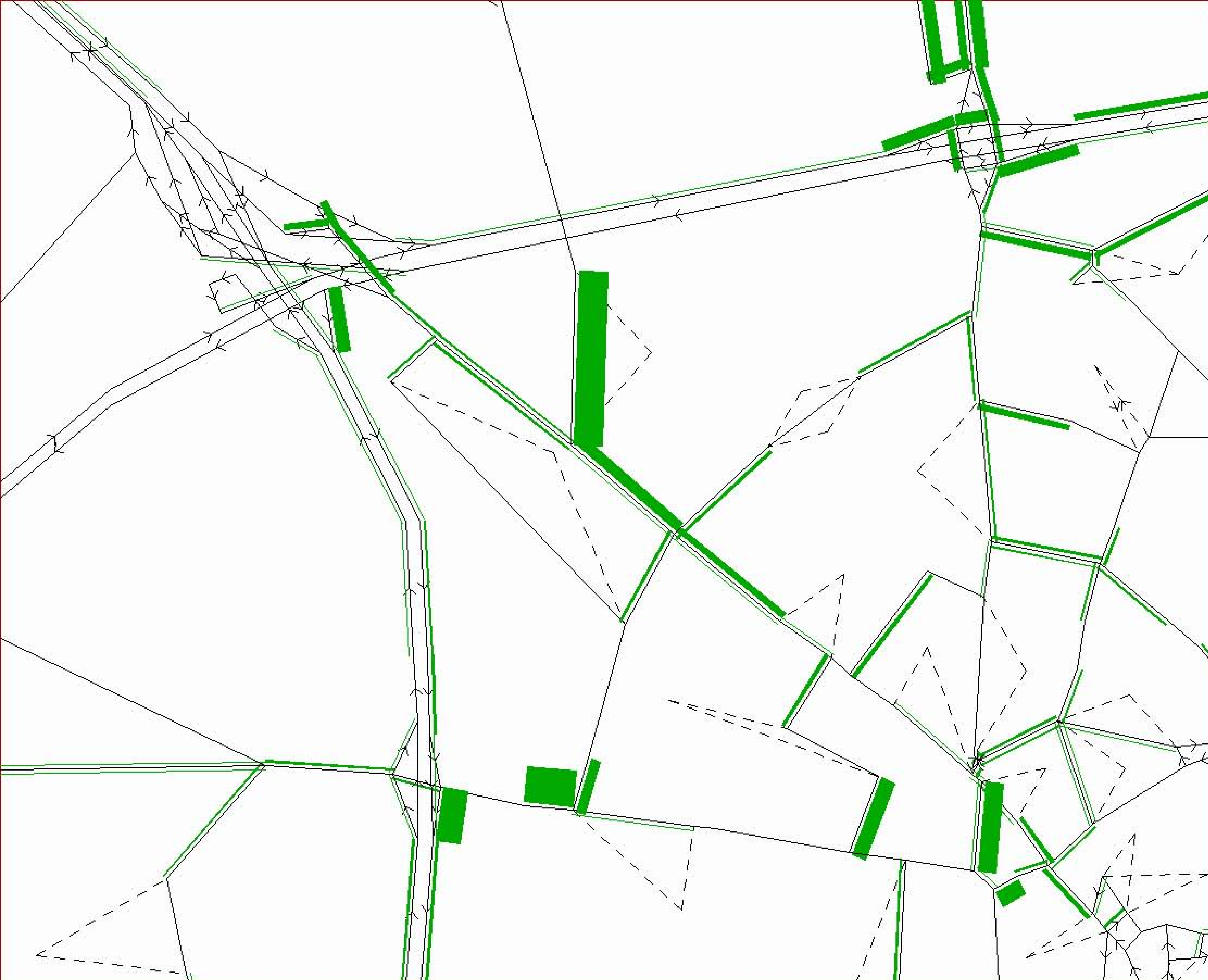

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A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06

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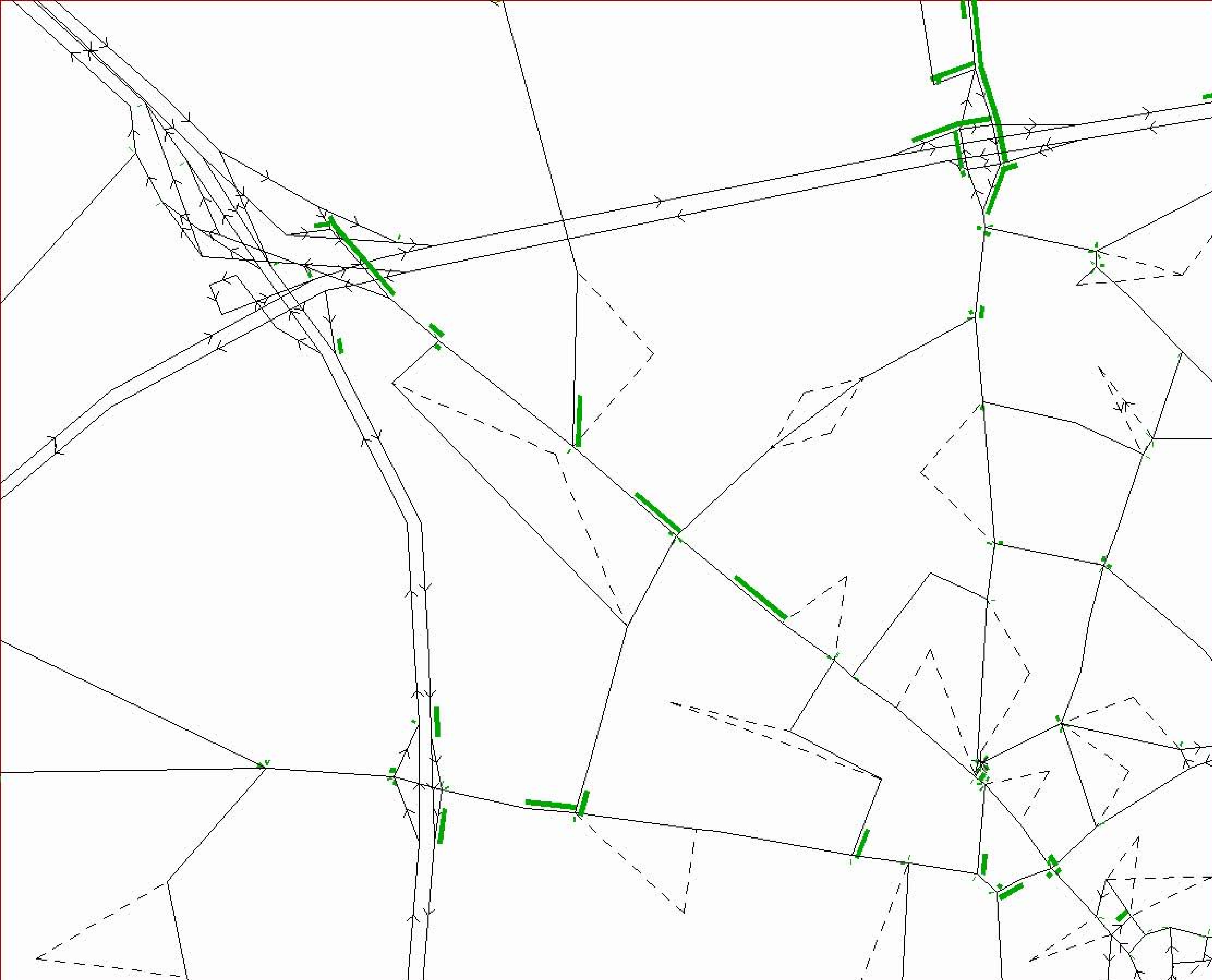
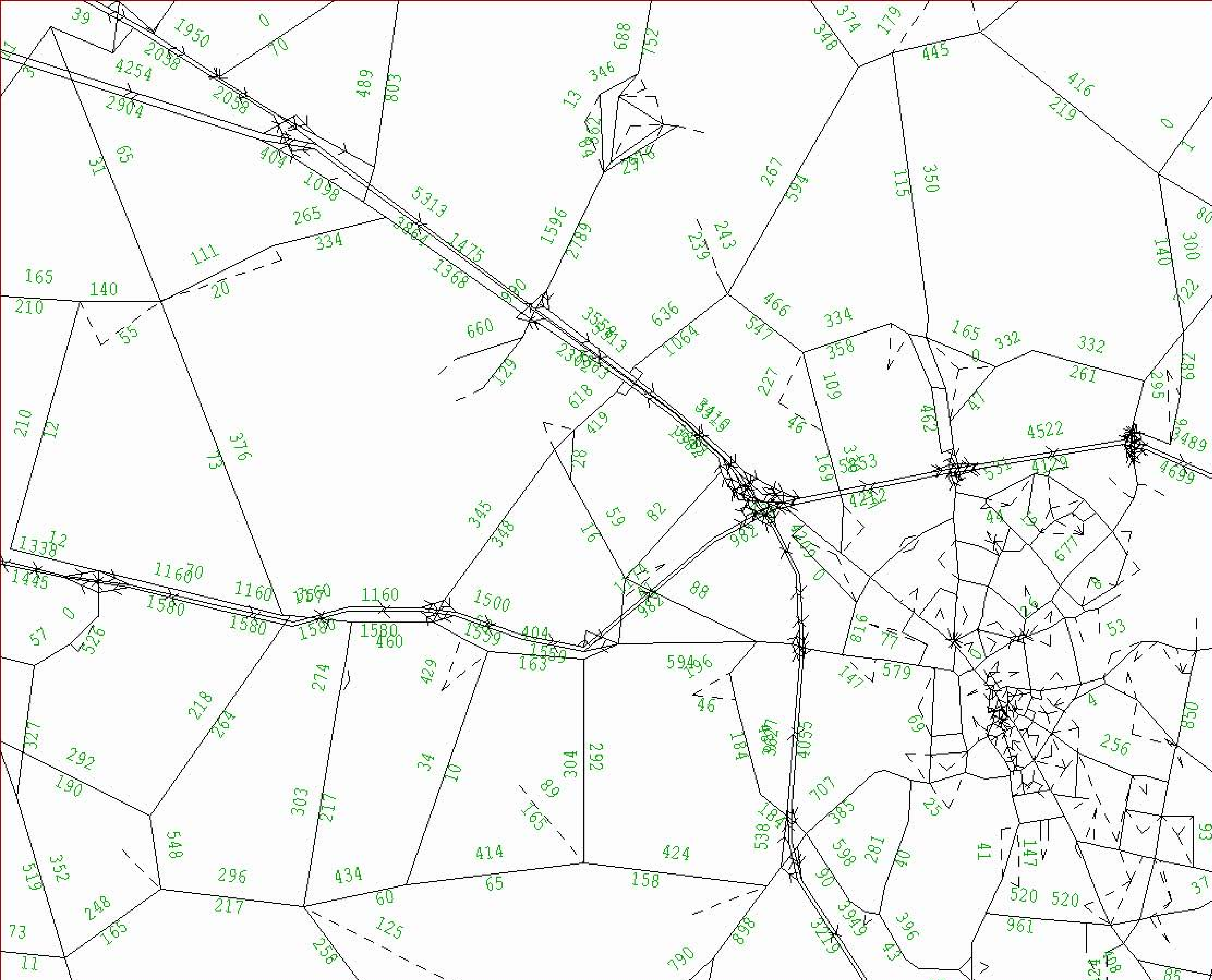


A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06

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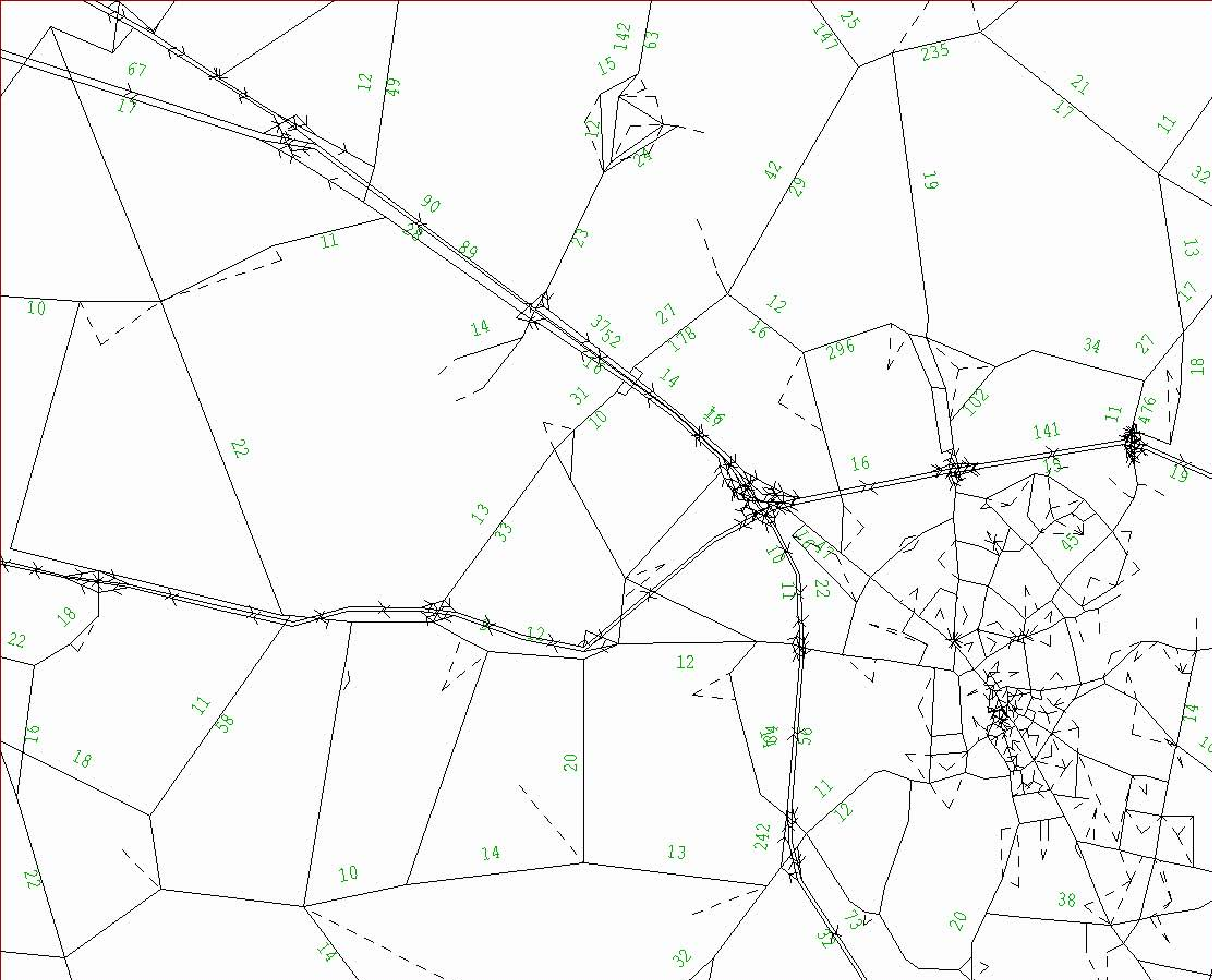
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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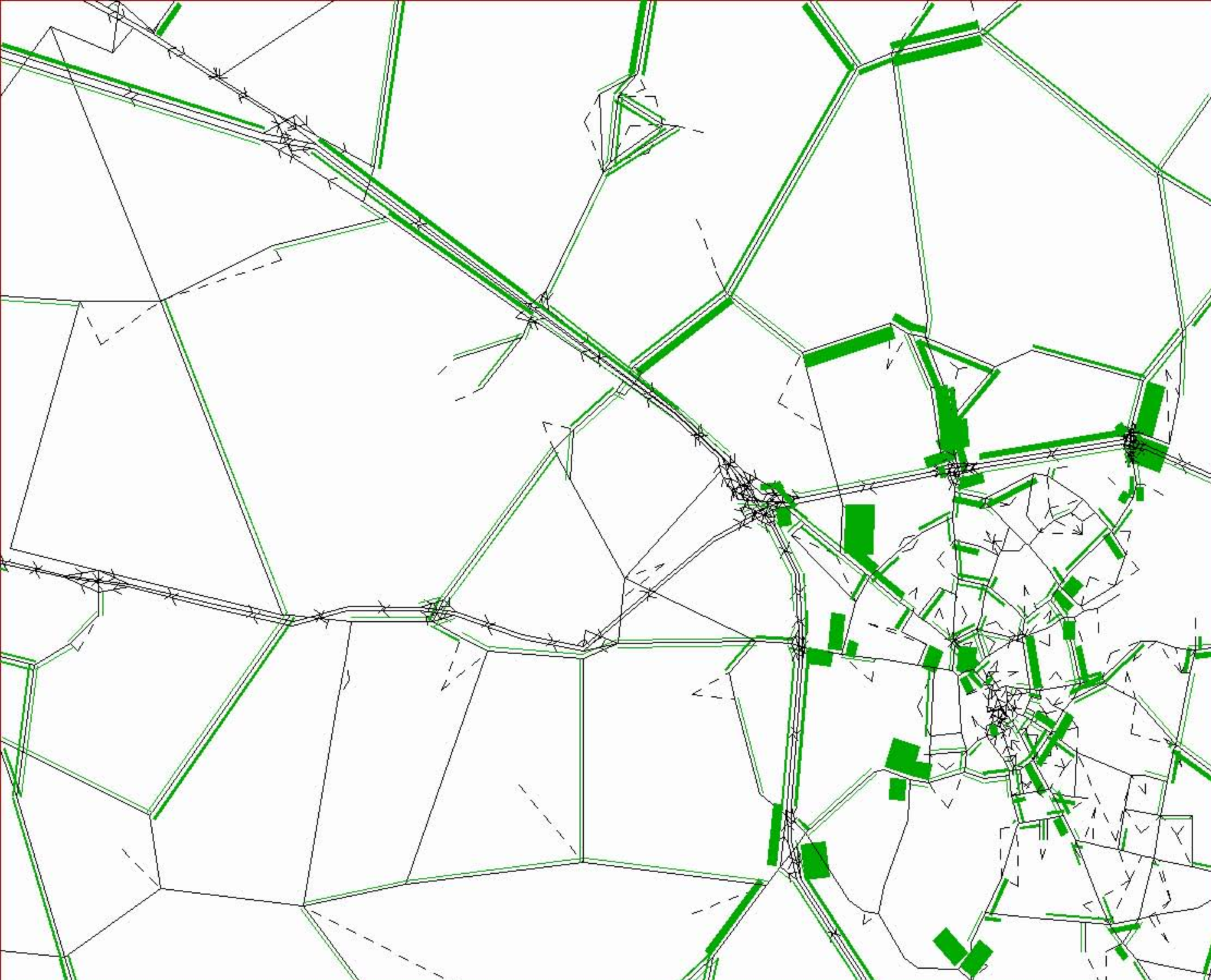
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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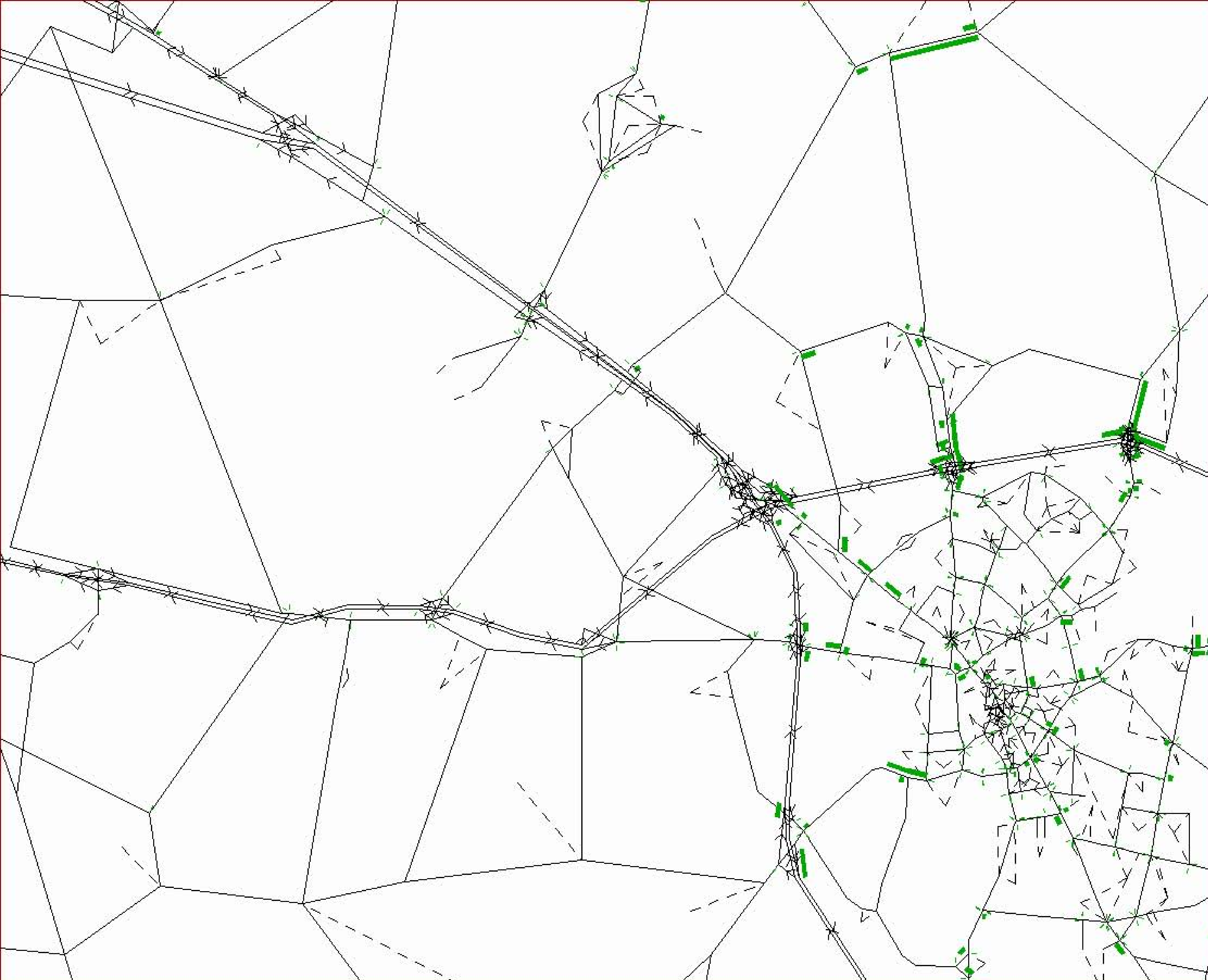
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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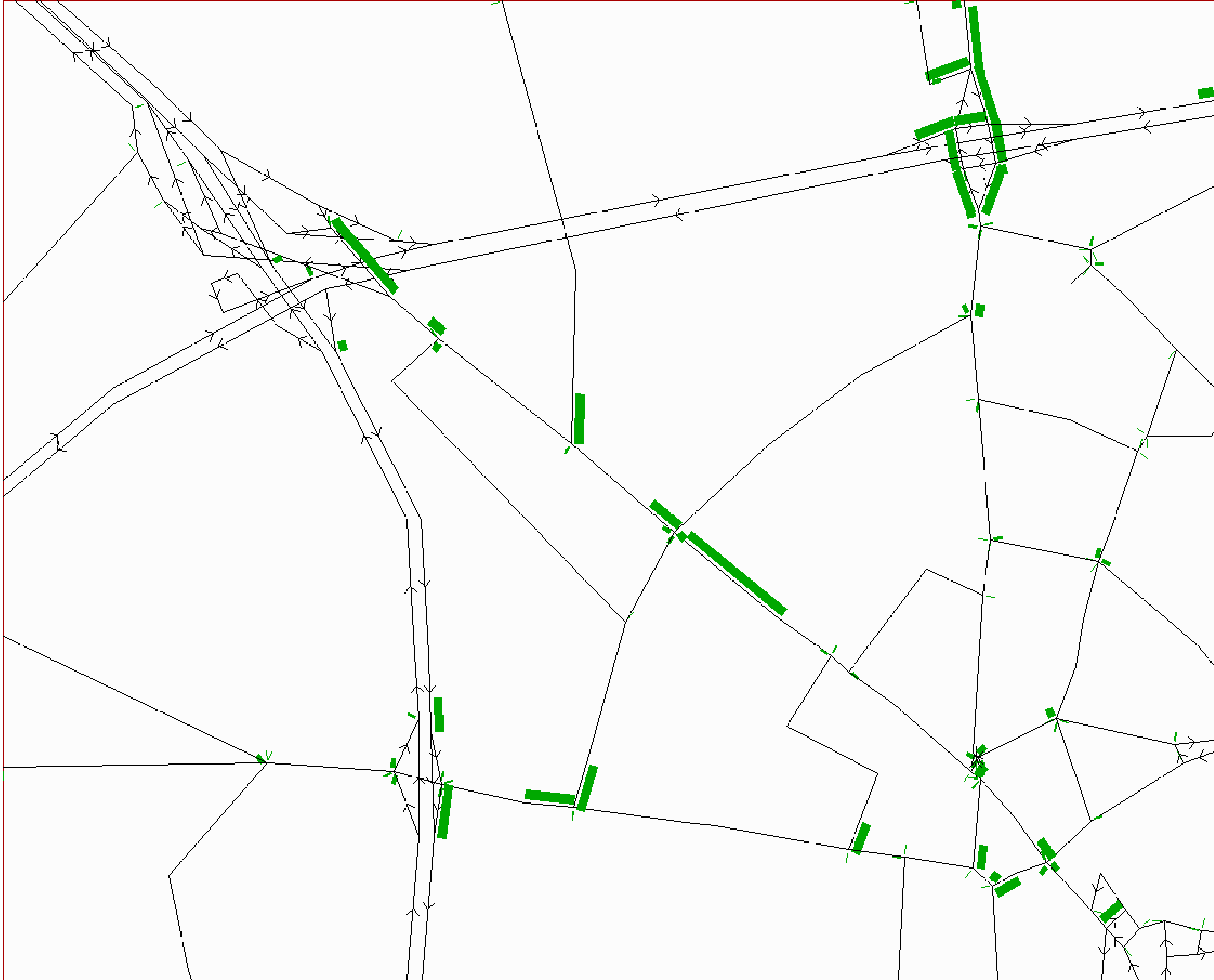
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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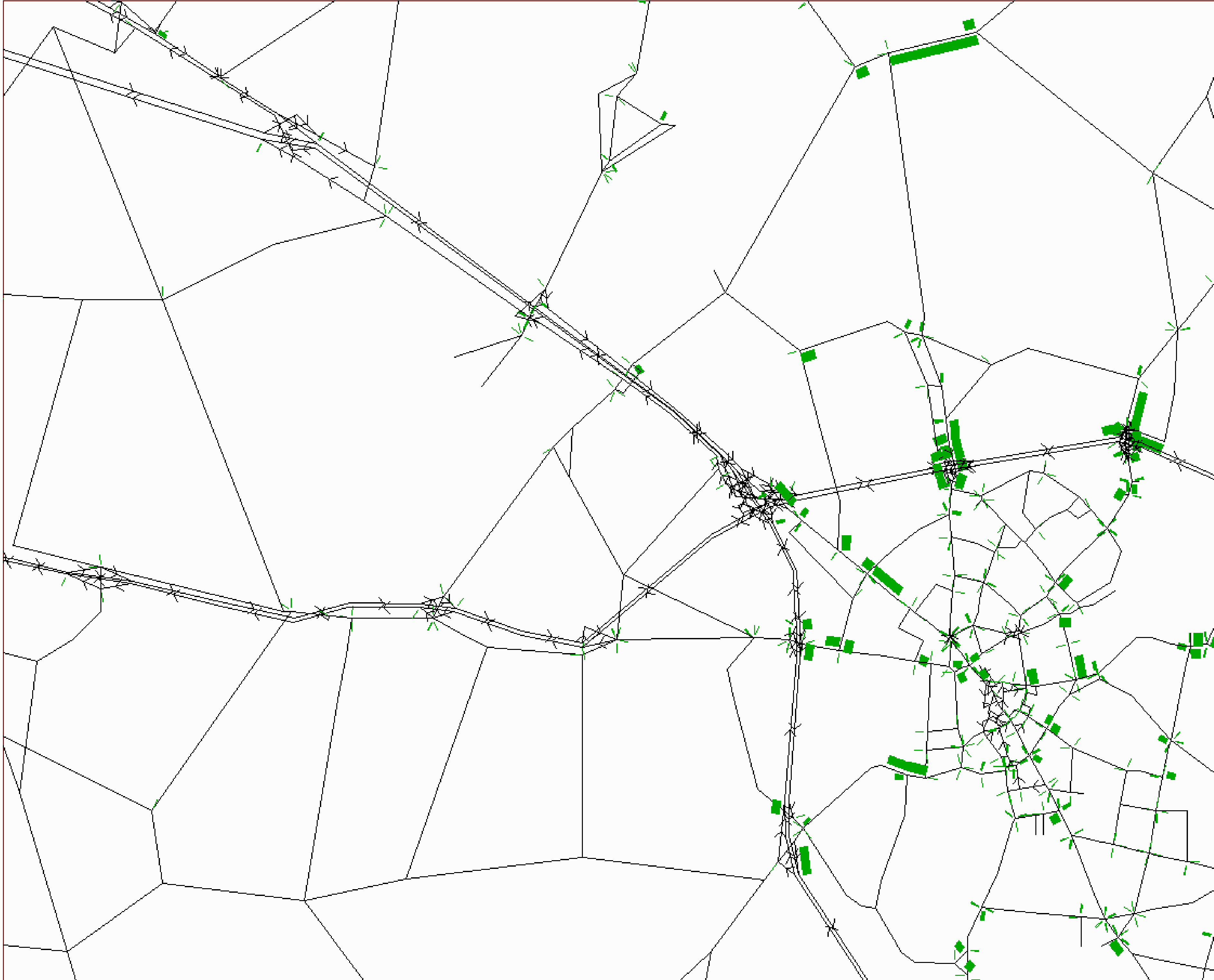
A14 - Limited Junction Option 2025 am EA9 Central Growth 14- 2-07



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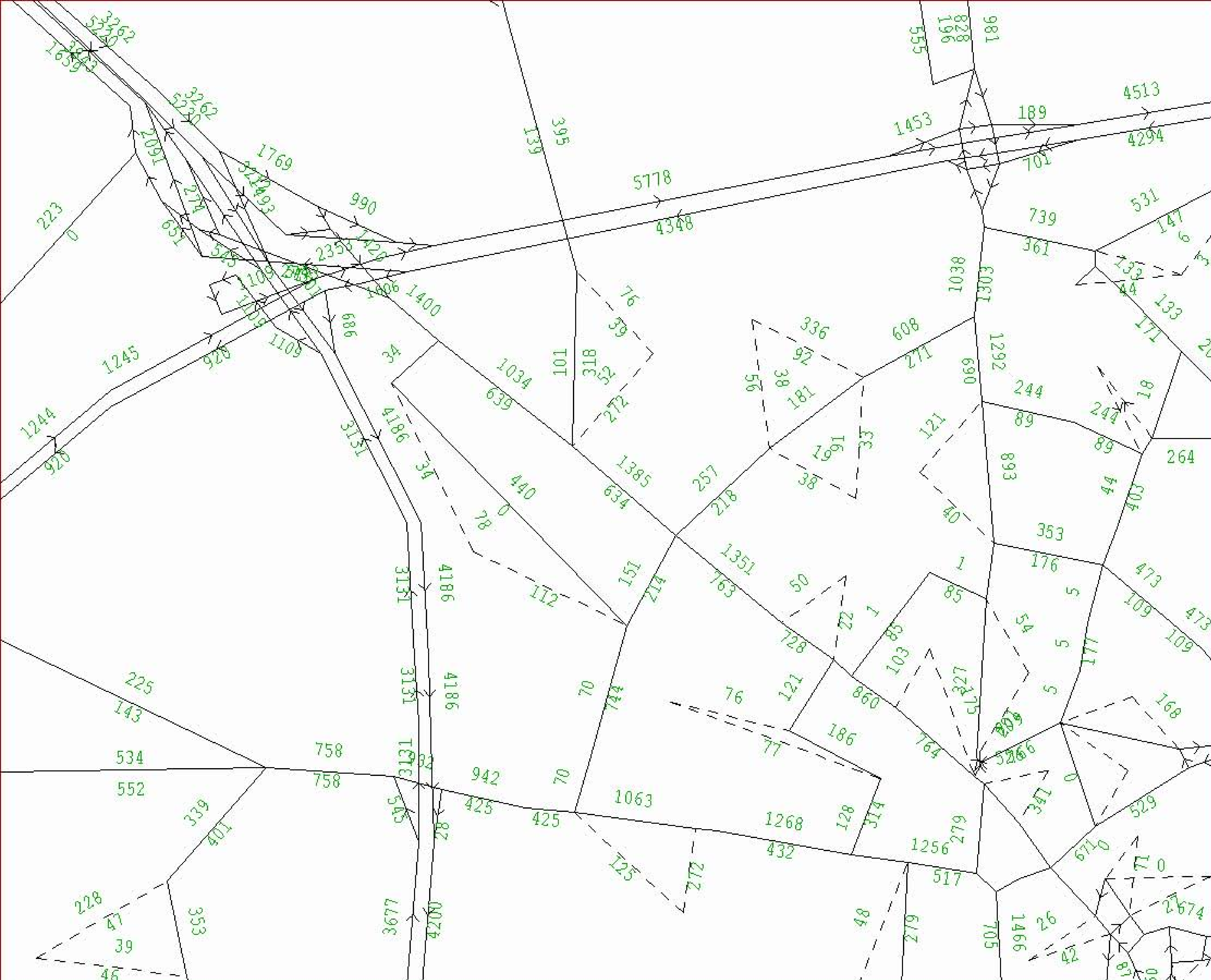
A14 - Limited Junction Option 2025 am EA9 Central Growth 14- 2-07



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A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06

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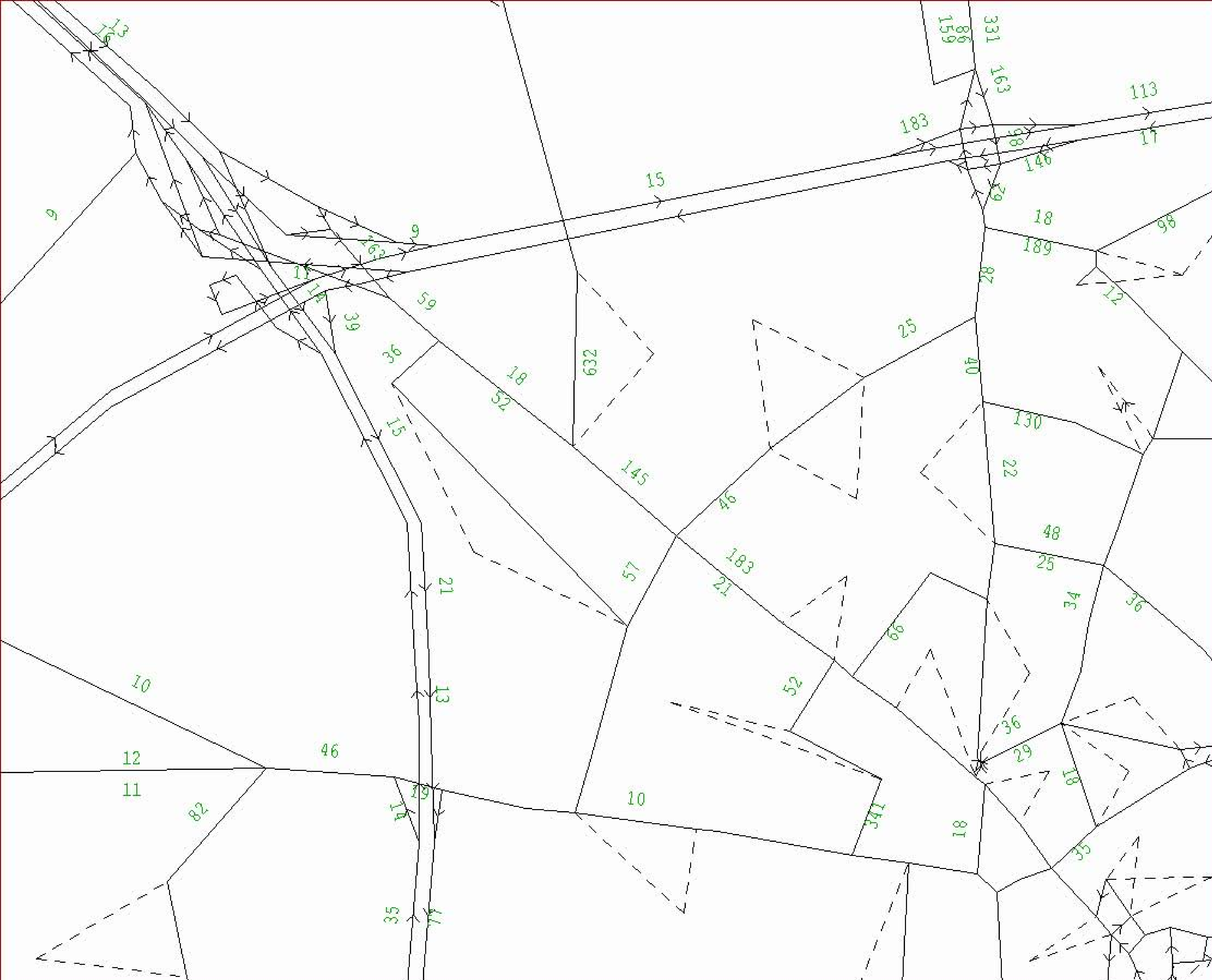
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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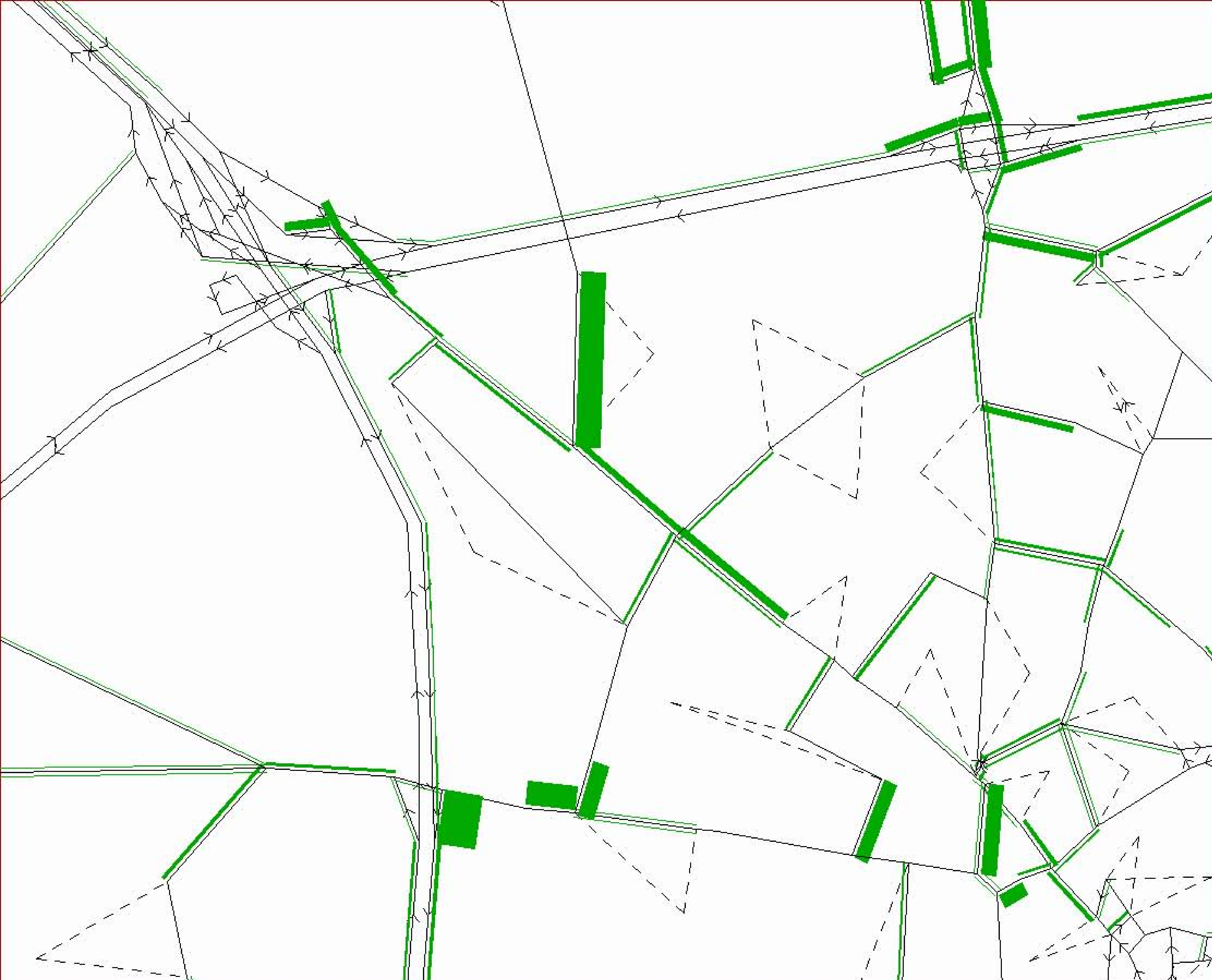
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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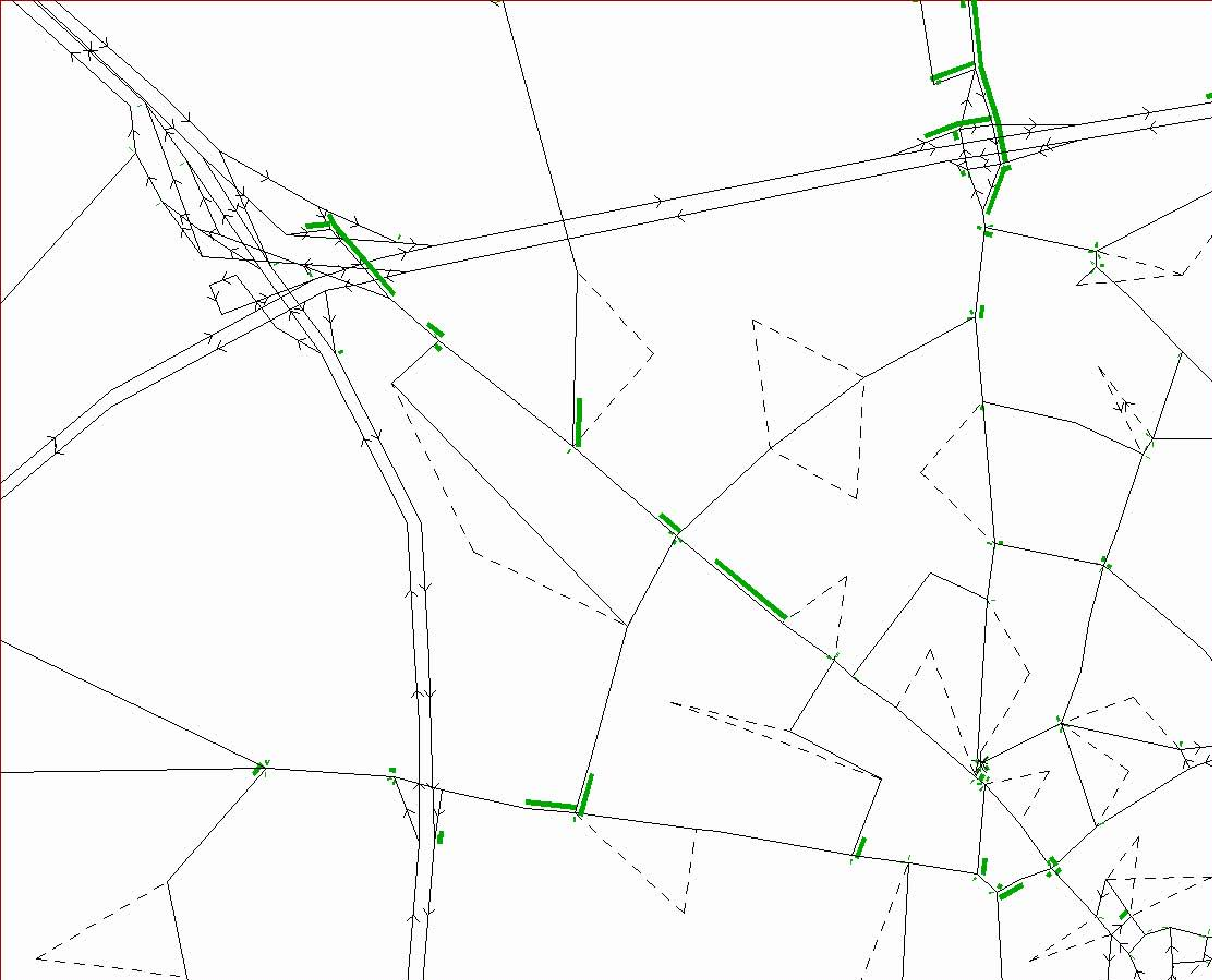

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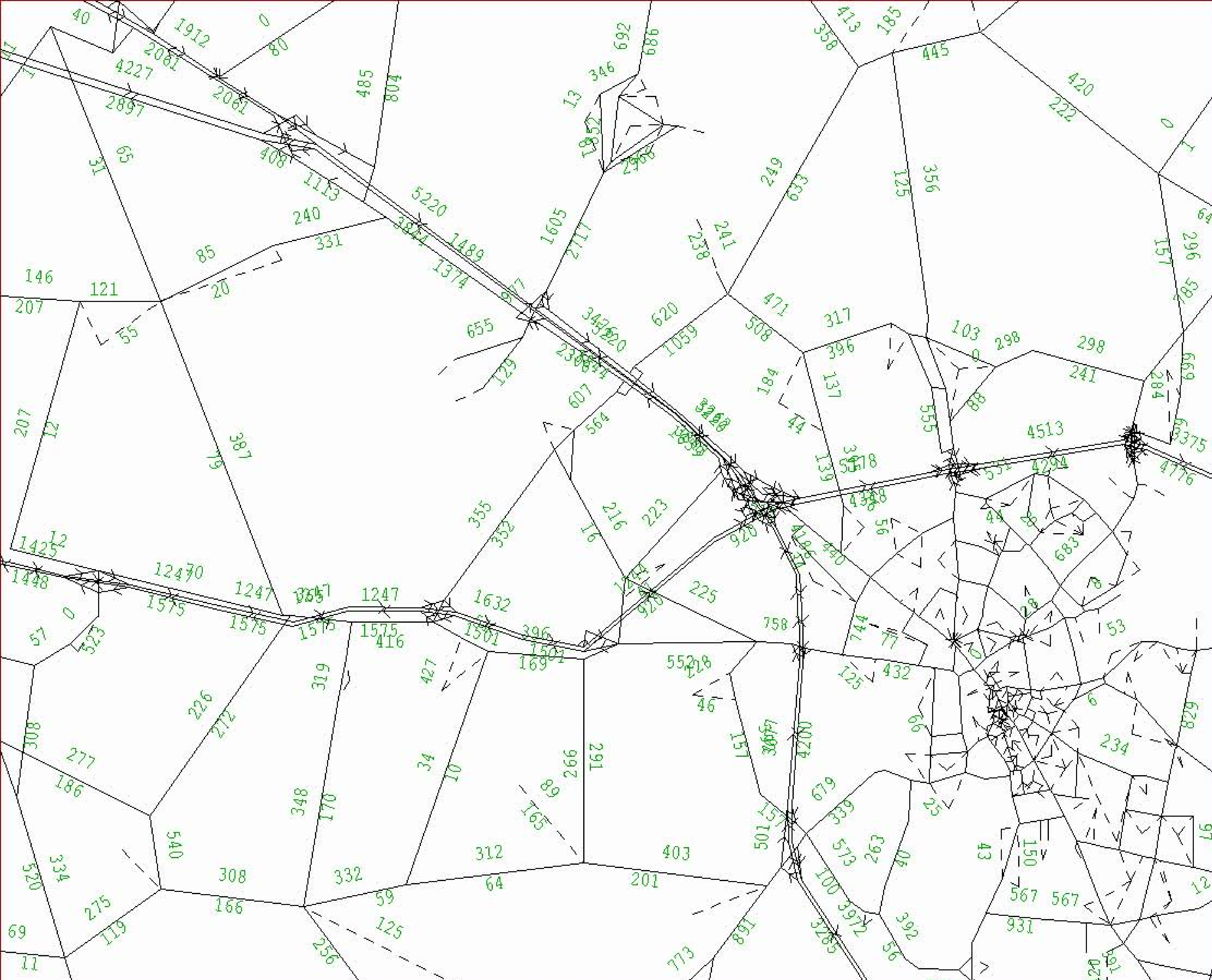

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A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06

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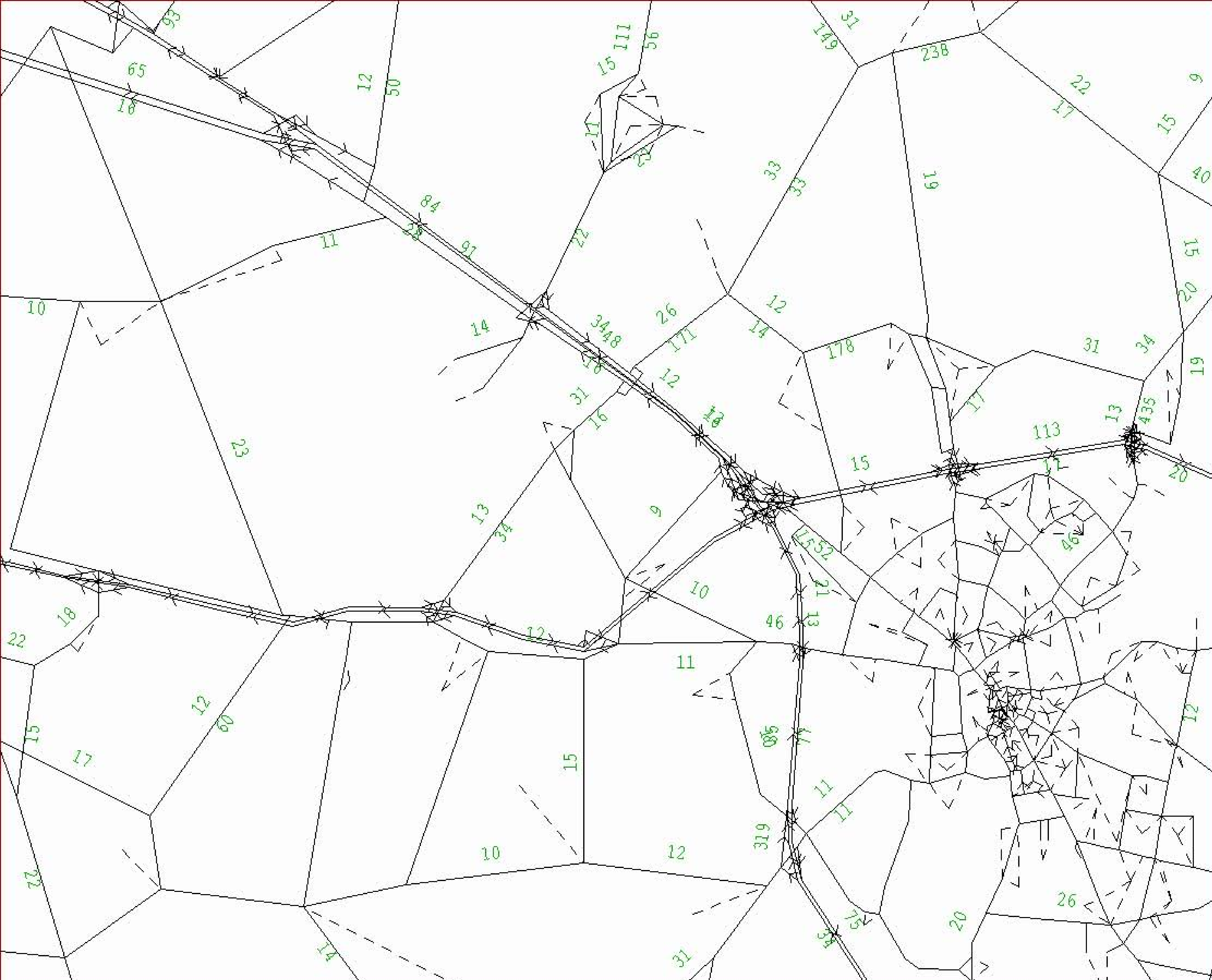

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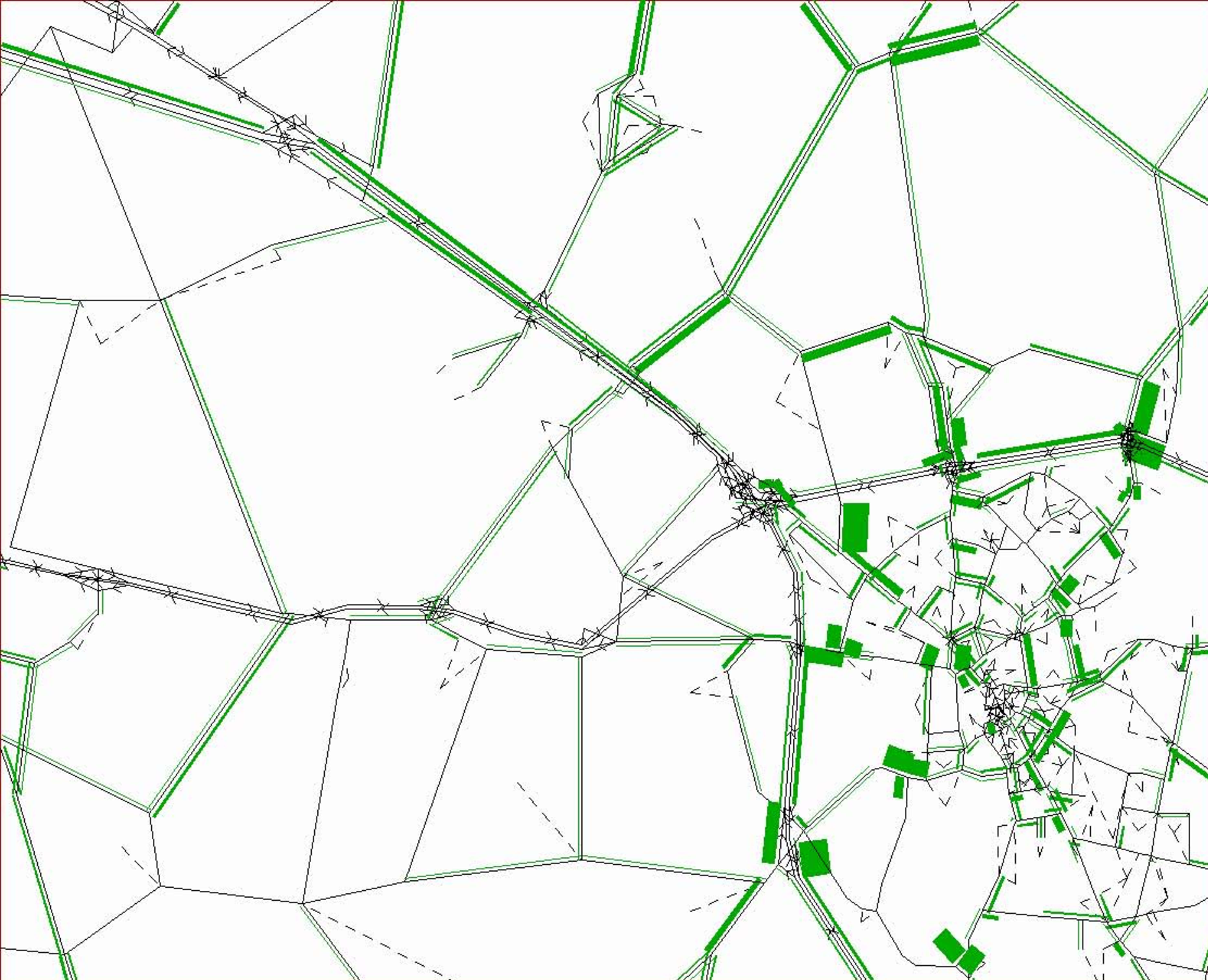

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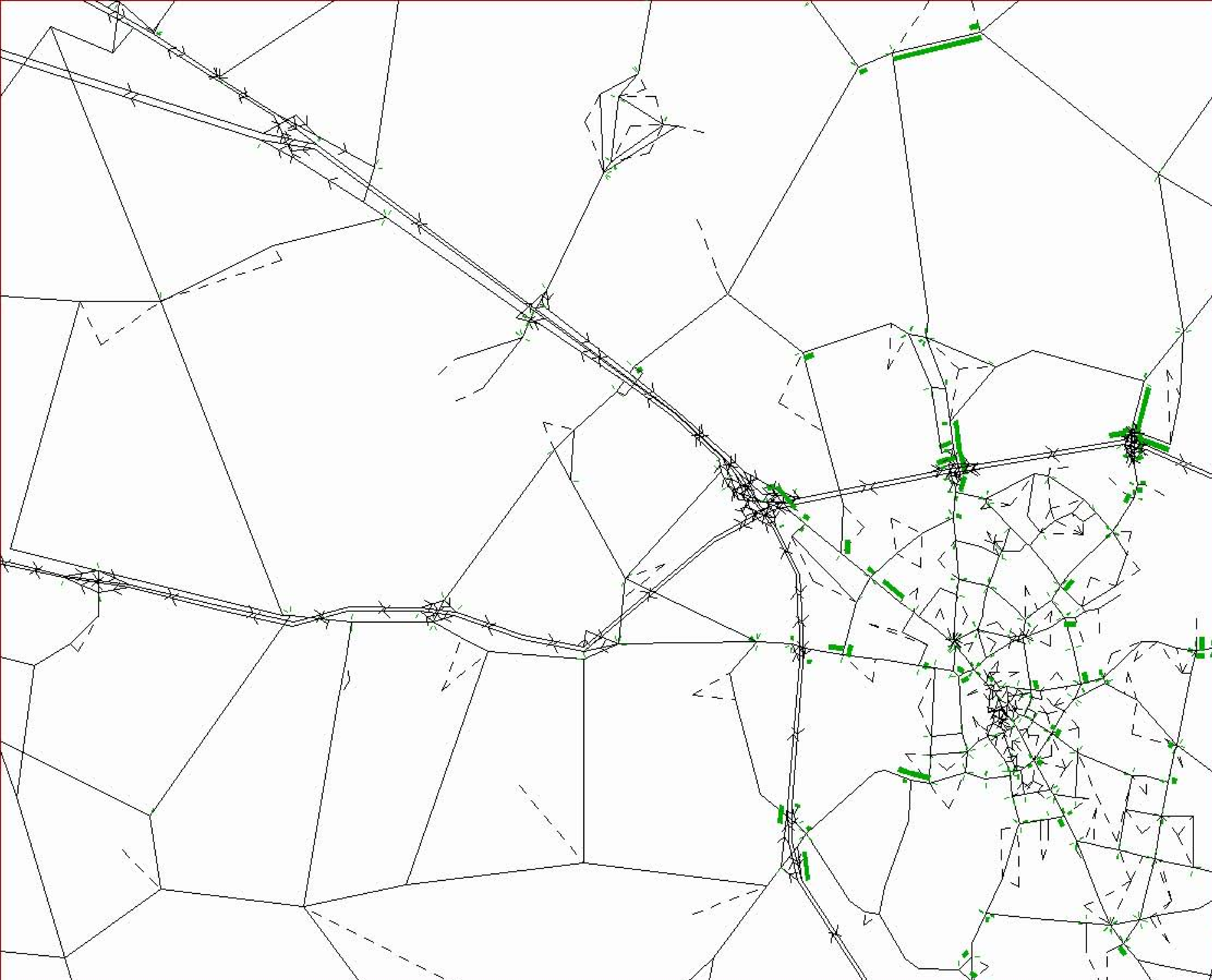

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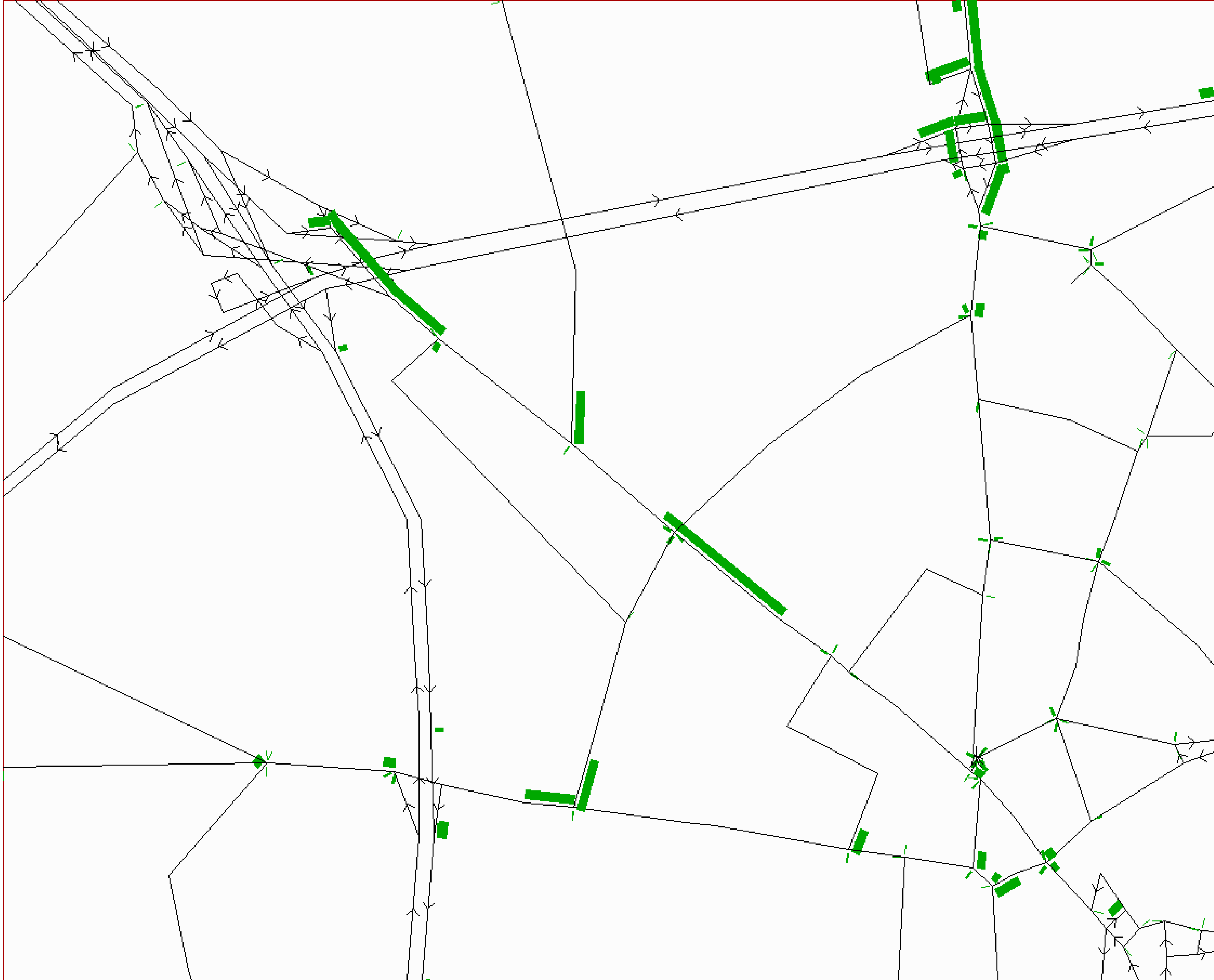
A14 - Limited Junction Option 2025 am EA9 Central Growth 7- 8-06



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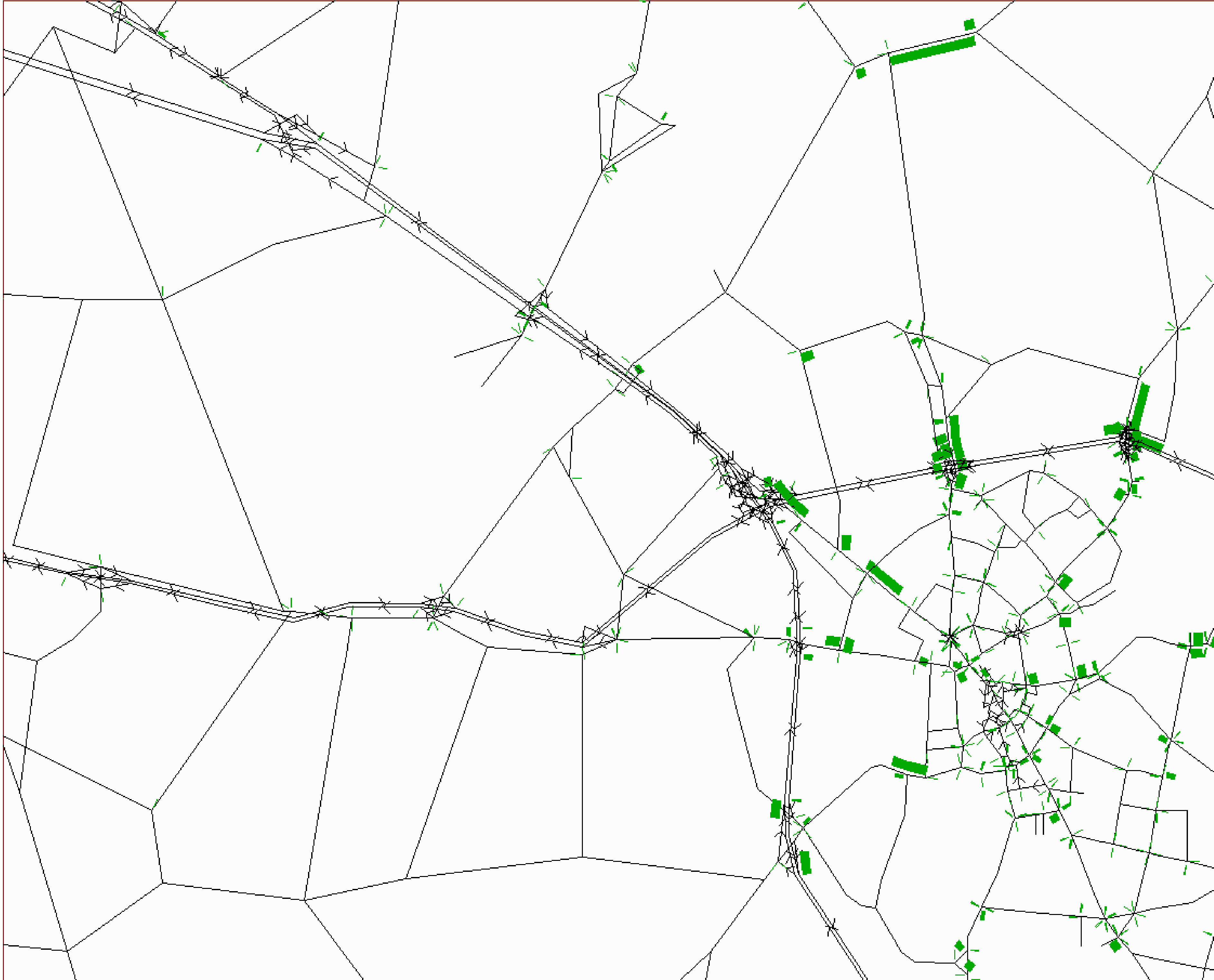
A14 - Limited Junction Option 2025 am EA9 Central Growth 14- 2-07



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A14 - Limited Junction Option 2025 am EA9 Central Growth 14- 2-07

APPENDIX F

LINSIG Printouts

User	Atkins Limited - Epsom	Project				Page 1
Location		File	A_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Phases

Phase Data					
Phase Name		Phase Type	Assoc Phase	Street Min	Cont MIn
A	Huntingdon Road N Right	Traffic		7	7
B	Huntingdon Road N Ahead	Traffic		7	7
C	Huntingdon Rd S	Traffic		7	7
D	Uni Access	Traffic		7	7

User	Atkins Limited - Epsom	Project				Page 2
Location		File	A_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Phase Intergreens

From Phase	Phase Intergreens To Phase			
	A	B	C	D
A			10	10
B				10
C	10			10
D	10	10	10	

User	Atkins Limited - Epsom	Project				Page 3
Location		File	A_s1_o1.LSG	SCN		Chkd
Title			Controller	Generic	Appvd	

Prohibited Moves and Interstage Lengths

From Stage	Prohibited Moves To Stage		
	1	2	3
1	X	10	X
2	X	X	10
3	10	X	X

User	Atkins Limited - Epsom	Project				Page 4
Location		File	A_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Stages

Stage Data	
Stage	Phases In Stage
1	BC
2	AB
3	D

User	Atkins Limited - Epsom	Project				Page 5
Location		File	A_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Links

Link Data							
Ref Num	Link	Type	Full Phase	Arrw Phase	Opposing Arm/Link	R Turn Storage	Max Turn
1/1	Huntingdon Road N Right	U	A				
1/2	Huntingdon Road N Ahead	U	B				
2/1	Huntingdon Rd S Ahead Left	U	C				
3/1	Uni Access Left	U	D				
3/2	Uni Access Right	U	D				

User	Atkins Limited - Epsom	Project				Page 6
Location		File	A_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Lanes

Lane Data								
Ref Num	**Lane**	**Length (pcu)**	**Gradient (%)**	**Width (m)**	**Propn Turn(%)**	**Radius (m)**	**User Satn**	**RR67 Satn**
1/1	Huntingdon Road N Ahead	Inf	0.00	3.25	0	Inf	1800	1940
1/2	Huntingdon Road N Right	Inf	0.00	3.25	100	20.00	1800	1935
2/1	Huntingdon Rd S Ahead Left	Inf	0.00	3.25	24	12.00	1800	1883
3/1	Uni Access Left	Inf	0.00	3.25	100	12.00	1800	1724
3/2	Uni Access Right	Inf	0.00	3.25	100	20.00	1800	1935

User	Atkins Limited - Epsom	Project				Page 7
Location		File	A_s1_o1.LSG	SCN	Chkd	
Title				Controller	Generic	Appvd

Traffic Flows

Traffic Flows								
Grp Num	Time Start	Time End	Title	Link Number				
				1/1	1/2	2/1	3/1	3/2
1	08:00	09:00	Scenario One Option One	344	240	630	186	7
2	08:00	09:00	Scenario One Option Two	359	1041	537	44	7
3	08:00	09:00	Scenario Two Option One	312	1093	668	280	49
4	08:00	09:00	Scenario Two Option Two	257	1143	607	257	41
5	08:00	09:00	Scenario One Preferred Option	370	1030	639	31	3

User	Atkins Limited - Epsom	Project				Page 8
Location		File	A_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Parameters Selected

Parameters Selected	
Flow Group	Scenario One Preferred Option
Flow Group Period	08:00 to 09:00
Phase Minimum Type	Street
CycleTime	96
Flow Factor	1.00
Sat Flows Used	RR67

Stage Results

Stage Timings			
Stage Sequence	1	2	3
Stage Duration	38	21	7
Stage Change Point	0	48	79

User	Atkins Limited - Epsom	Project				Page 9
Location		File	A_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Link Results

Link Results												
Link Ref	Link Name	Link Type	Full Phs	Arw Phs	Tot Grn (s)	Dem Flow pcu	Max Satn pcu/h	Cap pcu	Deg Sat %	Tot Del s/pcu	TDel pcuh	Que' pcu
1/1	Huntingdon Road N Right	U	A		21	370	1935	443	83.4	55.1	5.7	9.5
1/2	Huntingdon Road N Ahead	U	B		69	1030	1940	1415	72.8	11.4	3.2	7.7
2/1	Huntingdon Rd S Ahead Left	U	C		38	639	1883	765	83.5	37.7	6.7	11.8
3/1	Uni Access Left	U	D		7	31	1724	144	21.6	45.4	0.4	0.8
3/2	Uni Access Right	U	D		7	3	1935	161	1.9	41.5	0.0	0.1
Cycle Time 96 s				PRC 7.7 %				Total Delay 16.0 PCUh				

User	Atkins Limited - Epsom	Project				Page 1
Location		File	B_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Phases

Phase Data						
Phase Name		Phase Type	Assoc Phase	Street Min	Cont MIn
A	Madingley Road E	Traffic		7	7
B	Uni Access	Traffic		7	7
C	Madingley Road W	Traffic		7	7

User	Atkins Limited - Epsom	Project				Page 2
Location		File	B_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Phase Intergreens

From Phase	Phase Intergreens To Phase		
	A	B	C
A		5	
B	5		5
C		5	

User	Atkins Limited - Epsom	Project				Page 3
Location		File	B_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Prohibited Moves and Interstage Lengths

From Stage	Prohibited Moves To Stage	
	1	**2**
1	X	5
2	5	X

User	Atkins Limited - Epsom	Project				Page 4
Location		File	B_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Stages

Stage Data	
Stage	Phases In Stage
1	AC
2	B

User	Atkins Limited - Epsom	Project				Page 5
Location		File	B_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Links

Link Data							
Ref Num	Link	Type	Full Phase	Arrw Phase	Opposing Arm/Link	R Turn Storage	Max Turn
1/1	Madingley Road E Left Ahead	U	A				
2/1	Uni Access Right Left	U	B				
3/1	Madingley Road W Ahead	U	C				
3/2	Madingley Road W Right	O	C		1/1	2	2

User	Atkins Limited - Epsom	Project				Page 6
Location		File	B_s1_o1.LSG	SCN		Chkd
Title			Controller	Generic	Appvd	

Lanes

Lane Data								
Ref Num	Lane	Length (pcu)	Gradient (%)	Width (m)	Propn Turn(%)	Radius (m)	User Satn	RR67 Satn
1/1	Madingley Road E Left Ahead	Inf	0.00	3.50	5	12.00	1800	1953
2/1	Uni Access Left	Inf	0.00	3.25	100	12.00	1800	1724
2/2	Uni Access Right	8	0.00	3.25	100	20.00	1800	1935
3/1	Madingley Road W Ahead	Inf	0.00	3.25	0	Inf	1800	1940
3/2	Madingley Road W Right	Inf	0.00	3.25	100	20.00	1800	1935

User	Atkins Limited - Epsom	Project				Page 7
Location		File	B_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Traffic Flows

Traffic Flows							
Grp Num	Time Start	Time End	Title	Link Number			
				1/1	2/1	3/1	3/2
1	08:00	09:00	Scenario One Option One	1107	865	258	26
2	08:00	09:00	Scenario One Option Two	1021	799	403	5
3	08:00	09:00	Scenario Two Option One	1085	976	181	58
4	08:00	09:00	Scenario Two Option Two	1099	1144	11	11
5	08:00	09:00	Scenario One Preferred Option	1013	782	237	31

User	Atkins Limited - Epsom	Project				Page 8
Location		File	B_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Parameters Selected

Parameters Selected	
Flow Group	Scenario One Preferred Option
Flow Group Period	08:00 to 09:00
Phase Minimum Type	Street
CycleTime	60
Flow Factor	1.00
Sat Flows Used	RR67

Stage Results

Stage Timings		
Stage Sequence	1	2
Stage Duration	36	14
Stage Change Point	0	41

User	Atkins Limited - Epsom	Project				Page 9
Location		File	B_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Link Results

Link Results												
Link Ref	Link Name	Link Type	Full Phs	Arw Phs	Tot Grn (s)	Dem Flow pcu	Max Satn pcu/h	Cap pcu	Deg Sat %	Tot Del s/pcu	TDel pcuh	Que' pcu
1/1	Madingley Road E Left Ahead	U	A		36	1013	1953	1204	84.1	17.4	4.9	8.3
2/1	Uni Access Right Left	U	B		14	782	3659	911	85.8	33.5	7.3	12.3
3/1	Madingley Road W Ahead	U	C		36	237	1940	1196	19.8	5.8	0.4	1.6
3/2	Madingley Road W Right	O	C		36	31	1935	175	17.7	7.6	0.1	0.2
Cycle Time 60 s				PRC 4.8 %				Total Delay 12.6 PCUh				

Opposed Link Results

Opposed Movement Detail				
Link Ref	Link Name	Arr Grn	Gaps /cyc	Ign /cyc
3/2	Madingley Road W Right	-	0.9	2.0

User	Atkins Limited - Epsom	Project				Page 1
Location		File	C_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Phases

Phase Data						
Phase Name		Phase Type	Assoc Phase	Street Min	Cont MIn
A	Histon Road S	Traffic		7	7
B	DWH Access Right	Traffic		7	7
C	Histon Road N Right	Traffic		7	7
D	Histon Road N Ahead	Traffic		7	7
E	DWH Access Left	Traffic		7	7

User	Atkins Limited - Epsom	Project				Page 2
Location		File	C_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Phase Intergreens

From Phase	Phase Intergreens To Phase				
	A	B	C	D	E
A		10	10		10
B	10		10	10	
C	10	10			10
D		10			10
E	10		10	10	

User	Atkins Limited - Epsom	Project				Page 3
Location		File	C_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Prohibited Moves and Interstage Lengths

From Stage	Prohibited Moves To Stage		
	1	**2**	**3**
1	X	10	X
2	X	X	10
3	10	X	X

User	Atkins Limited - Epsom	Project				Page 4
Location		File	C_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Stages

Stage Data	
Stage	Phases In Stage
1	AD
2	CD
3	BE

User	Atkins Limited - Epsom	Project				Page 5
Location		File	C_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Links

Link Data							
Ref Num	Link	Type	Full Phase	Arrw Phase	Opposing Arm/Link	R Turn Storage	Max Turn
1/1	Histon Road S Left Ahead	U	A				
2/1	DWH Access Right	U	B				
2/2	DWH Access Left	U	E				
3/1	Histon Road N Right	U	C				
3/2	Histon Road N Ahead	U	D				

User	Atkins Limited - Epsom	Project				Page 6
Location		File	C_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Lanes

Lane Data								
Ref Num	Lane	Length (pcu)	Gradient (%)	Width (m)	Propn Turn(%)	Radius (m)	User Satn	RR67 Satn
1/1	Histon Road S Left	6	0.00	3.25	100	12.00	1800	1724
1/2	Histon Road S Ahead	Inf	0.00	3.25	0	Inf	1800	2080
1/3	Histon Road S Ahead	Inf	0.00	3.25	0	Inf	1800	2080
2/1	DWH Access Left	Inf	0.00	3.25	100	12.00	1800	1724
2/2	DWH Access Right	Inf	0.00	3.25	100	20.00	1800	1935
3/1	Histon Road N Ahead	Inf	0.00	3.25	0	Inf	1800	1940
3/2	Histon Road N Ahead	Inf	0.00	3.25	0	Inf	1800	2080
3/3	Histon Road N Right	Inf	0.00	3.25	100	20.00	1800	1935

User	Atkins Limited - Epsom	Project				Page 7
Location		File	C_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Traffic Flows

Traffic Flows								
Grp Num	Time Start	Time End	Title	Link Number				
				1/1	2/1	2/2	3/1	3/2
1	08:00	09:00	Scenario One Option One	689	592	591	182	1183
2	08:00	09:00	Scenario One Option Two	607	100	562	180	1138
3	08:00	09:00	Scenario Two Option One	663	531	639	190	1114
4	08:00	09:00	Scenario Two Option Two	487	370	609	186	1134
5	08:00	09:00	Scenario One Preferred Option	690	230	378	241	1062

User	Atkins Limited - Epsom	Project				Page 8
Location		File	C_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Parameters Selected

Parameters Selected	
Flow Group	Scenario One Preferred Option
Flow Group Period	08:00 to 09:00
Phase Minimum Type	Street
CycleTime	88
Flow Factor	1.00
Sat Flows Used	RR67

Stage Results

Stage Timings			
Stage Sequence	1	2	3
Stage Duration	15	15	28
Stage Change Point	0	25	50

User	Atkins Limited - Epsom	Project				Page 9
Location		File	C_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Link Results

Link Results												
Link Ref	Link Name	Link Type	Full Phs	Arw Phs	Tot Grn (s)	Dem Flow pcu	Max Satn pcu/h	Cap pcu	Deg Sat %	Tot Del s/pcu	TDel pcuh	Que' pcu
1/1	Histon Road S Left Ahead	U	A		15	690	5884	1002	68.9	38.3	7.3	14.3
2/1	DWH Access Right	U	B		28	230	1935	638	36.1	24.7	1.6	3.8
2/2	DWH Access Left	U	E		28	378	1724	568	66.5	32.2	3.4	6.5
3/1	Histon Road N Right	U	C		15	241	1935	352	68.5	45.2	3.0	5.5
3/2	Histon Road N Ahead	U	D		40	1062	4020	1873	56.7	18.9	5.6	14.2
Cycle Time 88 s				**PRC 30.7 %**				**Total Delay 20.9 PCUh**				

User	Atkins Limited - Epsom	Project				Page 1
Location		File	D_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Phases

Phase Data						
Phase Name		Phase Type	Assoc Phase	Street Min	Cont MIn
A	DWH Access	Traffic		7	7
B	Huntingdon Road SE	Traffic		7	7
C	University Access	Traffic		7	7
D	Huntingdon Road NW	Traffic		7	7

User	Atkins Limited - Epsom	Project				Page 2
Location		File	D_s1_o1.LSG	SCN		Chkd	
Title				Controller	Generic	Appvd	

Phase Intergreens

From Phase	Phase Intergreens To Phase			
	A	B	C	D
A		10	10	10
B	10		10	
C	10	10		10
D	10		10	

User	Atkins Limited - Epsom	Project				Page 3
Location		File	D_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Prohibited Moves and Interstage Lengths

From Stage	Prohibited Moves To Stage		
	1	2	3
1	X	10	X
2	X	X	10
3	10	X	X

User	Atkins Limited - Epsom	Project				Page 4
Location		File	D_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Stages

Stage Data	
Stage	Phases In Stage
1	BD
2	A
3	C

User	Atkins Limited - Epsom	Project				Page 5
Location		File	D_s1_o1.LSG	SCN		Chkd
Title			Controller	Generic	Appvd	

Links

Link Data							
Ref Num	Link	Type	Full Phase	Arrw Phase	Opposing Arm/Link	R Turn Storage	Max Turn
1/1	DWH Access Left Ahead	U	A				
1/2	DWH Access Ahead Right	U	A				
2/1	Huntingdon Road SE Right Left Ahead	U	B				
2/2	Huntingdon Road SE Right	O	B		4/1	2	2
3/1	University Access Ahead Left	U	C				
3/2	University Access Ahead Right	U	C				
4/1	Huntingdon Road NW Left Ahead Right	U	D				
4/2	Huntingdon Road NW Right	O	D		2/1	2	2

User	Atkins Limited - Epsom	Project				Page 6
Location		File	D_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Lanes

Lane Data								
Ref Num	Lane	Length (pcu)	Gradient (%)	Width (m)	Propn Turn(%)	Radius (m)	User Satn	RR67 Satn
1/1	DWH Access Left Ahead	Inf	0.00	3.50	82	12.00	1800	1782
1/2	DWH Access Ahead Right	Inf	0.00	3.25	37	20.00	1800	2024
2/1	Huntingdon Road SE Left Ahead	Inf	0.00	3.25	32	12.00	1800	1865
2/2	Huntingdon Road SE Right Ahead	Inf	0.00	3.50	14	20.00	1800	2083
2/3	Huntingdon Road SE Right	Inf	0.00	3.25	100	20.00	1800	1935
3/1	University Access Ahead Left	Inf	0.00	3.50	11	12.00	1800	1938
3/2	University Access Ahead Right	Inf	0.00	3.00	100	20.00	1800	1912
4/1	Huntingdon Road NW Left Ahead	Inf	0.00	3.25	21	12.00	1800	1890
4/2	Huntingdon Road NW Ahead Right	Inf	0.00	3.50	0	20.00	1800	2105
4/3	Huntingdon Road NW Right	Inf	0.00	3.25	100	20.00	1800	1935

User	Atkins Limited - Epsom	Project				Page 7
Location		File	D_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Traffic Flows

Traffic Flows											
Grp Num	Time Start	Time End	Title	Link Number							
				1/1	1/2	2/1	2/2	3/1	3/2	4/1	4/2
1	08:00	09:00	Scenario One Option One	200	143	715	57	154	192	1089	98
2	08:00	09:00	Scenario One Option Two	143	143	633	16	182	181	1426	102
3	08:00	09:00	Scenario Two Option One	217	216	880	65	172	171	1386	9
4	08:00	09:00	Scenario Two Option Two	219	219	853	50	93	170	1487	47
5	08:00	09:00	Scenario One Preferred Option	109	109	764	54	73	78	1384	1

User	Atkins Limited - Epsom	Project				Page 8
Location		File	D_s1_o1.LSG	SCN		Chkd
Title				Controller	Generic	Appvd

Parameters Selected

Parameters Selected	
Flow Group	Scenario One Preferred Option
Flow Group Period	08:00 to 09:00
Phase Minimum Type	Street
CycleTime	88
Flow Factor	1.00
Sat Flows Used	RR67

Stage Results

Stage Timings			
Stage Sequence	1	2	3
Stage Duration	44	7	7
Stage Change Point	0	54	71

User	Atkins Limited - Epsom	Project				Page 9
Location		File	D_s1_o1.LSG	SCN		Chkd
Title		Controller	Generic	Appvd		

Link Results

Link Results												
Link Ref	Link Name	Link Type	Full Phs	Arw Phs	Tot Grn (s)	Dem Flow pcu	Max Satn pcu/h	Cap pcu	Deg Sat %	Tot Del s/pcu	TDel pcuh	Que' pcu
1/1	DWH Access Left Ahead	U	A		7	109	1782	162	67.3	61.4	1.9	3.1
1/2	DWH Access Ahead Right	U	A		7	109	2024	184	59.2	53.1	1.6	2.8
2/1	Huntingdon Road SE Right Left Ahead	U	B		44	764	3948	2019	37.8	14.1	3.0	9.3
2/2	Huntingdon Road SE Right	O	B		44	54	1935	82	66.0	56.5	0.8	1.2
3/1	University Access Ahead Left	U	C		7	73	1938	176	41.4	45.7	0.9	1.7
3/2	University Access Ahead Right	U	C		7	78	1912	174	44.9	47.0	1.0	1.9
4/1	Huntingdon Road NW Left Ahead Right	U	D		44	1384	3995	2043	67.7	18.5	7.1	16.9
4/2	Huntingdon Road NW Right	O	D		44	1	1935	286	0.3	11.0	0.0	0.0
Cycle Time 88 s					PRC 32.8 %				Total Delay 16.4 PCUh			

Opposed Link Results

Opposed Movement Detail				
Link Ref	Link Name	Arr Grn	Gaps /cyc	Ign /cyc
2/2	Huntingdon Road SE Right	-	0.0	2.0
4/2	Huntingdon Road NW Right	-	5.0	2.0

APPENDIX G

TRANSYT Results

Traffic Network Study Tool

Analysis Program Release 5 interin (June 2005)

For sales and distribution information,
program advice and maintenance, contact:

TRL Limited Tel: +44 (0) 1344 770018
Old Wokingham road Fax: +44 (0) 1344 770864
Crowthorne, Berks. Email: softwarebureau@trl.co.uk
RG45 6AU, UK. Web: www.trlsoftware.co.uk

Run with file:- "HISTON FORECAST WITH DEV AMI-REV_UNOPTIMISED.DAT" at 15:41 on 18/07/06

TRANSYT 12.0

Histon Interchange/Bridge Road/Kings Hedges Road - Revised 'With Dev' AM Peak

PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :

NUMBER OF NODES	=	6
NUMBER OF LINKS	=	36
NUMBER OF OPTIMISED NODES	=	6
MAXIMUM NUMBER OF GRAPHIC PLOTS	=	0
NUMBER OF STEPS IN CYCLE	=	60
MAXIMUM NUMBER OF SHARED STOPLINES	=	2
MAXIMUM NUMBER OF TIMING POINTS	=	4
MAXIMUM LINKS AT ANY NODE	=	8

CORE REQUESTED = 9673 WORDS
CORE AVAILABLE = 72000 WORDS
.

DATA INPUT :-

CARD NO. / CARD TYPE

(1)= TITLE:- Histon Interchange/Bridge Road/Kings Hedges Road - Revised 'With Dev' AM Peak

CARD NO.	CARD TYPE	CYCLE TIME (SEC)	NO. OF STEPS PER CYCLE	TIME PERIOD 1-1200 MINS.	EFFECTIVE-GREEN DISPLACEMENTS START (SEC)	END (SEC)	EQUISAT SETTINGS 0=NO 1=YES	0=UNEQUAL CYCLE 1=EQUAL CYCLE	FLOW SCALE 10-200 %	CRUISE-SPEEDS SCALE 50-200 %	CARD32 0=TIMES 1=SPEEDS	OPTIMISE 0=NONE 1=O/SET 2=FULL	EXTRA COPIES FINAL OUTPUT	HILL-CLIMB OUTPUT 1=FULL	DELAY VALUE P PER PCU-H	STOP VALUE P PER 100
2)=	1	120	60	60	2	3	0	0	0	0	1	0	1	0	1290	235

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE															
3)=	2	1	2	3	4	5	6	0	0	0	0	0	0	0	0	0

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET........................					SECOND SET........................					THIRD SET........................				
4)=	7	13	14	0	0	0	15	16	0	0	0	23	24	0	0	0
5)=	7	25	26	0	0	0	33	34	0	0	0	35	36	0	0	0
6)=	7	43	44	0	0	0	45	46	0	0	0	52	521	0	0	0
7)=	7	53	531	0	0	0	0	0	0	0	0	0	0	0	0	0

NODE CARDS: MINIMUM STAGE TIMES (WORKING)

CARD NO.	CARD TYPE	NODE NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
8)=	10	1	7	7	7	7						
9)=	10	2	7	7	7	7						
10)=	10	3	7	7	7	7						
11)=	10	4	7	7	7	7						
12)=	10	5	7	5	7	7						
13)=	10	6	7	7								

NODE CARDS: PRECEDING INTERSTAGE TIMES (WORKING)

CARD NO.	CARD TYPE	NODE NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
14)=	11	1	5	5	5	5						
15)=	11	2	5	5	5	5						
16)=	11	3	5	5	5	5						
17)=	11	4	5	5	5	5						
18)=	11	5	11	0	10	3						
19)=	11	6	7	6								

NODE CARDS: STAGE CHANGE TIMES (WORKING)

CARD NO.	CARD TYPE	NODE NO.	Sgl/Dbl Cycled	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
20)=	12	1	1	42	62	110	2						
21)=	12	2	1	103	116	44	56						
22)=	12	3	1	114	41	82	101						
23)=	12	4	1	71	92	2	31						
24)=	12	5	1	113	36	85	102						
25)=	12	6	1	115	79								

LINK CARDS: GIVEWAY DATA

CARD NO.	CARD TYPE	LINK NO.	PRIORITY LINKS LINK1 NO.	LINK2 NO.	LINK1 ONLY % FLOW	GIVEWAY COEFFS. A1 X100	A2 X100					LINK LENGTH	STOP WT.X100	MAX FLOW	DELAY WT.X100	DISPSN X100
26)=	30	64	61	0	0	22	0	0	0	0	0	200	0	1000	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN START STAGE	LAG	END STAGE	LAG	SECOND GREEN START STAGE	LAG	END STAGE	LAG	LINK LENGTH	STOP WT.X100	SAT FLOW	DELAY WT.X100	DISPSN X100
27)=	31	11	1	1	5	2	0	3	5	4	0	170	0	2175	0	0
28)=	31	13	1	2	5	3	0	4	5	1	0	80	500	1800	0	0
29)=	31	14	0	0	0	0	0	0	0	0	0	80	0	0	0	0
30)=	31	15	1	2	5	3	0	4	5	1	0	80	500	1800	0	0
31)=	31	16	0	0	0	0	0	0	0	0	0	80	0	0	0	0
32)=	31	21	2	1	5	2	0	3	5	4	0	200	-9999	4020	50	0
33)=	31	22	2	1	5	2	0	3	5	4	0	200	-9999	2080	50	0
34)=	31	23	2	2	5	3	0	4	5	1	0	130	500	1800	0	0
35)=	31	24	0	0	0	0	0	0	0	0	0	130	0	0	0	0
36)=	31	25	2	2	5	3	0	4	5	1	0	130	500	1800	0	0
37)=	31	26	0	0	0	0	0	0	0	0	0	130	0	0	0	0
38)=	31	31	3	1	5	2	0	3	5	4	0	200	-9999	3994	50	0
39)=	31	33	3	2	5	3	0	4	5	1	0	90	500	1800	0	0
40)=	31	34	0	0	0	0	0	0	0	0	0	90	0	0	0	0
41)=	31	35	3	2	5	3	0	4	5	1	0	90	500	1800	0	0
42)=	31	36	0	0	0	0	0	0	0	0	0	90	0	0	0	0
43)=	31	41	4	1	5	2	0	3	5	4	0	200	-9999	1940	50	0
44)=	31	42	4	1	5	2	0	3	5	4	0	200	-9999	2080	50	0
45)=	31	43	4	2	5	3	0	4	5	1	0	125	500	1800	0	0
46)=	31	44	0	0	0	0	0	0	0	0	0	125	0	0	0	0
47)=	31	45	4	2	5	3	0	4	5	1	0	125	500	1800	0	0

48)=	31	46	0	0	0	0	0	0	0	0	0	125	0	0	0	0
49)=	31	52	5	1	15	3	0	0	0	0	0	180	500	1868	0	0
50)=	31	521	0	0	0	0	0	0	0	0	0	180	0	0	0	0
51)=	31	53	5	2	5	4	0	0	0	0	0	180	0	2105	0	0
52)=	31	531	0	0	0	0	0	0	0	0	0	180	0	0	0	0
53)=	31	5001	5	2	5	4	0	0	0	0	0	180	0	2075	0	0
54)=	31	55	5	1	11	2	0	0	0	0	0	200	0	1828	0	0
55)=	31	5002	5	1	11	2	0	0	0	0	0	200	0	1828	0	0
56)=	31	56	5	1	11	2	0	0	0	0	0	200	0	1958	0	0
57)=	31	57	5	2	23	1	0	0	0	0	0	200	0	1915	0	0
58)=	31	58	5	4	5	1	0	0	0	0	0	200	0	1925	0	0
59)=	31	61	6	1	6	2	0	0	0	0	0	120	500	1915	0	0
60)=	31	62	6	2	7	1	0	0	0	0	0	200	0	1824	0	0
61)=	31	63	6	1	6	2	0	0	0	0	0	200	-9999	1915	50	0
62)=	31	64	6	1	6	2	0	0	0	0	0	200	-9999	1000	50	0

LINK CARDS: FLOW DATA

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY 1 .... LINK NO.	FLOW	CRUISE SPEED	ENTRY 2 .... LINK NO.	FLOW	CRUISE SPEED	ENTRY 3 .... LINK NO.	FLOW	CRUISE SPEED	ENTRY 4 .... LINK NO.	FLOW	CRUISE SPEED
63)=	32	11	1385	0	62	527	45	63	858	45	0	0	0	0	0	0
64)=	32	13	293	0	41	293	45	0	0	0	0	0	0	0	0	0
65)=	32	14	251	0	45	251	45	0	0	0	0	0	0	0	0	0
66)=	32	15	716	0	42	719	45	0	0	0	0	0	0	0	0	0
67)=	32	16	10	0	45	10	45	0	0	0	0	0	0	0	0	0
68)=	32	21	607	0	0	0	45	0	0	0	0	0	0	0	0	0
69)=	32	22	333	0	0	0	45	0	0	0	0	0	0	0	0	0
70)=	32	23	552	0	11	552	45	0	0	0	0	0	0	0	0	0
71)=	32	24	293	0	13	293	45	0	0	0	0	0	0	0	0	0
72)=	32	25	552	0	11	552	45	0	0	0	0	0	0	0	0	0
73)=	32	26	716	0	15	716	45	0	0	0	0	0	0	0	0	0
74)=	32	31	1226	0	55	275	45	56	412	45	57	532	45	0	0	0
75)=	32	33	10	0	21	10	45	0	0	0	0	0	0	0	0	0
76)=	32	34	196	0	25	196	45	0	0	0	0	0	0	0	0	0
77)=	32	35	333	0	22	333	45	0	0	0	0	0	0	0	0	0
78)=	32	36	10	0	25	10	45	0	0	0	0	0	0	0	0	0
79)=	32	41	716	0	0	0	45	0	0	0	0	0	0	0	0	0
80)=	32	42	716	0	0	0	45	0	0	0	0	0	0	0	0	0
81)=	32	43	463	0	31	463	45	0	0	0	0	0	0	0	0	0
82)=	32	44	333	0	35	333	45	0	0	0	0	0	0	0	0	0
83)=	32	45	251	0	31	251	45	0	0	0	0	0	0	0	0	0
84)=	32	46	10	0	35	10	45	0	0	0	0	0	0	0	0	0
85)=	32	52	331	0	21	331	45	0	0	0	0	0	0	0	0	0
86)=	32	521	1043	0	23	301	45	24	275	45	25	194	45	26	275	45
87)=	32	53	276	0	21	276	45	0	0	0	0	0	0	0	0	0
88)=	32	531	873	0	23	251	45	24	230	45	25	162	45	26	230	45
89)=	32	5001	10	0	0	0	45	0	0	0	0	0	0	0	0	0
90)=	32	55	412	0	0	0	45	0	0	0	0	0	0	0	0	0
91)=	32	5002	10	0	0	0	45	0	0	0	0	0	0	0	0	0
92)=	32	56	412	0	0	0	45	0	0	0	0	0	0	0	0	0
93)=	32	57	532	0	0	0	45	0	0	0	0	0	0	0	0	0
94)=	32	58	138	0	0	0	45	0	0	0	0	0	0	0	0	0
95)=	32	61	1219	0	41	423	45	43	463	45	44	333	45	0	0	0
96)=	32	62	531	0	0	0	45	0	0	0	0	0	0	0	0	0
97)=	32	63	858	0	0	0	45	0	0	0	0	0	0	0	0	0
98)=	32	64	10	0	0	0	45	0	0	0	0	0	0	0	0	0

LINK CARDS : FLARE SATURATION FLOW DATA

	CARD TYPE	LINK NO.	..LANE 1.. SAT. FLOW	CAPAC VEH.	..LANE 2.. SAT. FLOW	CAPAC VEH.	..LANE 3.. SAT. FLOW	CAPAC VEH.
99)=	33	11	2035	6	0	0	0	0
100)=	33	53	2105	19	0	0	0	0
101)=	33	57	2055	4	0	0	0	0

FUEL CARD

		CRUISE CONSTANTS A	B	C	DELAY CONST.	STOP CONST.										
(102)=	37	145	-375	405	115	635	0	0	0	0	0	0	0	0	0	0

LINK DATA: QUEUE CONSTRAINTS

CARD NO.	CARD TYPE	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT
103)=	38	13	6	500	15	6	500	23	8	500	25	8	500	33	6	500
104)=	38	35	6	500	41	40	500	42	40	500	43	11	500	45	11	500
105)=	38	52	30	500	53	45	500	61	26	999	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT*****

.

120 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	STAGE 8	STAGE 9	STAGE 10
1	4	42	62	110	2						
2	4	103	116	44	56						
3	4	114	41	82	101						
4	4	71	92	2	31						
5	4	113	36	85	102						
6	2	115	79								

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	-------DELAY-------- UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	----STOPS---- MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	----QUEUE---- MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END	START 2ND	END
11	1310<	3753f	175	13.6	859.4	31.7 +281.0	(999.9)	243	(85.9)	337	+	4120.1	1	47	62	115	2
13	278<	1800S	44	6.4	2.7	0.0 + 0.2	(2.7)	4	(0.3)	4	(0.0)*	4.3	1	67	110	7	42
14	250	13L	44	6.4	15.4	0.9 + 0.2	(13.8)	69	(4.4)	4		18.3	1	67	110	7	42
15	716	1800S	61	6.4	4.8	0.2 + 0.8	(12.2)	31	(5.7)	12	(0.5)*	43.2	1	67	110	7	42
16	10	15L	61	6.4	14.4	0.0 + 0.0	(0.5)	70	(0.2)	12	+	0.7	1	67	110	7	42
21	607	4020	107	16.0	183.5	6.1 + 24.9	(399.1)*	235	(36.4)	37		199.5	2	108	116	49	56
22	333	2080	113	16.0	291.0	4.1 + 22.8	(347.2)*	263	(22.3)	31		173.6	2	108	116	49	56
23	299<	1800S	44	10.4	5.0	0.2 + 0.2	(5.4)	25	(3.5)	7	(0.0)*	22.8	2	1	44	61	103
24	278<	23L	44	10.4	5.2	0.2 + 0.2	(5.2)	22	(1.7)	7		6.8	2	1	44	61	103
25	299<	1800S	78	10.4	12.0	0.5 + 0.5	(12.9)	45	(6.3)	11	(0.2)*	45.4	2	1	44	61	103
26	716	25L	78	10.4	10.2	0.8 + 1.2	(26.2)	36	(6.6)	11	+	32.8	2	1	44	61	103
31	1227	3994	64	16.0	12.6	3.4 + 0.9	(55.2)*	53	(16.7)	19		27.6	3	119	41	87	101
33	9	1800S	17	7.2	26.5	0.1 + 0.0	(0.9)	50	(0.1)	2	(0.0)*	1.5	3	46	82	106	114
34	106<	33L	17	7.2	17.6	0.4 + 0.1	(6.7)	34	(1.7)	2		8.4	3	46	82	106	114
35	295<	1800S	43	7.2	29.7	2.1 + 0.4	(31.3)	52	(4.5)	6	(0.0)*	53.6	3	46	82	106	114
36	5	35L	43	7.2	23.4	0.0 + 0.0	(0.4)	35	(0.1)	6		0.5	3	46	82	106	114
41	716	1940	105	16.0	159.8	6.3 + 25.5	(410.0)*	225	(41.1)	41	(0.0)*	205.2	4	76	92	7	31
42	716	2080	98	16.0	78.5	4.9 + 10.7	(201.5)*	167	(30.5)	24	(0.0)*	100.7	4	76	92	7	31
43	464	1800S	82	10.0	17.8	1.0 + 1.3	(29.6)	87	(10.3)	11	(0.0)*	81.2	4	97	2	36	71
44	295<	43L	82	10.0	15.8	0.5 + 0.8	(16.7)	36	(3.0)	11		19.7	4	97	2	36	71
45	250	1800S	28	10.0	7.2	0.3 + 0.2	(6.5)	35	(2.3)	3	(0.0)*	17.8	4	97	2	36	71
46	9	45L	28	10.0	7.7	0.0 + 0.0	(0.2)	25	(0.1)	3		0.3	4	97	2	36	71
52	311<	1868S	92	14.4	27.0	0.9 + 1.4	(30.1)	63	(5.3)	32	(0.0)*	56.8	5	8	85		
53	259<	3208Sf	56	14.4	22.4	1.4 + 0.2	(20.8)	52	(3.6)	20	(0.0)*	24.4	5	41	102		
55	412	1828	82	16.0	59.7	4.7 + 2.2	(88.1)	105	(11.0)	15		99.1	5	4	36		
56	412	1958	77	16.0	53.8	4.6 + 1.6	(79.5)	100	(10.5)	14		90.0	5	4	36		
57	532	2176f	53	16.0	24.5	3.1 + 0.6	(46.8)	66	(8.9)	12		55.7	5	59	113		
58	138	1925	123	16.0	471.2	2.9 + 15.1	(233.0)	243	(8.5)	21		241.5	5	107	113		
61	1159<	1915	92	9.6	28.9	4.1 + 5.2	(119.9)	65	(20.1)	28	(0.1)*	221.0	6	1	79		
62	531	1824	116	16.0	338.8	9.2 + 40.8	(644.7)	223	(30.2)	61	+	674.8	6	86	115		
63	858	1915	68	16.0	17.1	3.0 + 1.1	(52.7)*	60	(13.2)	19		26.3	6	1	79		

```
   64      10   1000      2  16.0  11.6    0.0 +  0.0  (  0.4)*   35  (  0.1)     0                  0.2     6      1  79
  521     803<    52L    92  14.4  29.6    3.0 +  3.6  ( 85.3)    64  ( 17.0)    32      +         102.2     5      8  85
  531     672<    53L    56  14.4  19.2    3.1 +  0.5  ( 46.3)    48  ( 10.8)    20                 57.1     5     41 102
 5001      10   2075      1  14.4  15.7    0.0 +  0.0  (  0.6)    47  (  0.1)     0                  0.7     5     41 102
 5002      10   1828      2  16.0  35.9    0.1 +  0.0  (  1.3)    74  (  0.2)     0                  1.5     5      4  36
                *** f - average saturation flow for flared link ***
.

    120 SECOND CYCLE  60 STEPS

  TOTAL          TOTAL      MEAN          TOTAL    TOTAL    TOTAL        TOTAL        PENALTY       TOTAL
 DISTANCE         TIME    JOURNEY        UNIFORM  RANDOM+    COST         COST          FOR      PERFORMANCE
TRAVELLED        SPENT     SPEED          DELAY   OVERSAT     OF           OF          EXCESS       INDEX
                                                    DELAY   DELAY        STOPS         QUEUES
(PCU-KM/H)     (PCU-H/H)   (KM/H)      (PCU-H/H)(PCU-H/H)   ($/H)        ($/H)         ($/H)        ($/H)

  2695.7         607.8       4.4          103.9    444.0    (6334.8) + (  495.8)  +  (    4.7)  =    6835.4     TOTALS
------------------------------------------------------------------------------------------------------------------------
                                                                                                                ROUTE

**************************************************************************************************************************************
                              CRUISE                DELAY                 STOPS                TOTALS
                          LITRES PER HOUR      LITRES PER HOUR       LITRES PER HOUR      LITRES PER HOUR

FUEL CONSUMPTION PREDICTIONS      157.1        +     630.1        +      213.3        =     1000.4

NO. OF ENTRIES TO SUBPT  =    1
NO. OF LINKS RECALCULATED=   48

PROGRAM TRANSYT FINISHED
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1          __________________ T R A N S Y T 12 __________________

                          Traffic Network Study Tool

                    Analysis Program Release 5 interin (June 2005)
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           _____________________________________________________


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                  program advice and maintenance, contact:

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 ---------------------------------------------------------------------------
 THE USER OF THIS COMPUTER PROGRAM FOR THE SOLUTION OF AN ENGINEERING PROBLEM IS
 IN NO WAY RELIEVED OF THEIR RESPONSIBILITY FOR THE CORRECTNESS OF THE SOLUTION
 ---------------------------------------------------------------------------

Run with file:- "HISTON_AM_PRF_OPT_UNOPTIMISED_REVA.DAT"   at 16:40   on 10/08/06

TRANSYT 12.0

Histon Interchange/Bridge Road/Kings Hedges Road - Revised 'With Dev' AM Peak


  PARAMETERS CONTROLLING DIMENSIONS OF PROBLEM :
  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

  NUMBER OF NODES                    =    7
  NUMBER OF LINKS                    =   42
  NUMBER OF OPTIMISED NODES          =    1
  MAXIMUM NUMBER OF GRAPHIC PLOTS    =    0
  NUMBER OF STEPS IN CYCLE           =   60
  MAXIMUM NUMBER OF SHARED STOPLINES =    2
  MAXIMUM NUMBER OF TIMING POINTS    =    4
  MAXIMUM LINKS AT ANY NODE          =    8


  CORE REQUESTED =  10564 WORDS
  CORE AVAILABLE =  72000 WORDS
.

          DATA INPUT :-
           ~~~~ ~~~~~
 CARD   CARD
  NO.   TYPE
 (  1)= TITLE:- Histon Interchange/Bridge Road/Kings Hedges Road - Revised 'With Dev' AM Peak
 CARD   CARD   CYCLE  NO. OF   TIME EFFECTIVE-GREEN  EQUISAT 0=UNEQUAL FLOW   CRUISE-SPEEDS   OPTIMISE  EXTRA  HILL-   DELAY    STOP
  NO.   TYPE   TIME    STEPS  PERIOD DISPLACEMENTS  SETTINGS  CYCLE   SCALE   SCALE  CARD32   0=NONE   COPIES  CLIMB   VALUE   VALUE
                        PER   1-1200  START    END     0=NO  1=EQUAL 10-200  50-200 0=TIMES  1=O/SET   FINAL  OUTPUT  P PER   P PER
               (SEC)  CYCLE   MINS.  (SEC)   (SEC)    1=YES  CYCLE     %       %   1=SPEEDS 2=FULL   OUTPUT  1=FULL  PCU-H    100
   2)=   1     120     60      60      2       3        1       0       0       0      1        2        1       0   1290     235
 CARD   CARD                                           LIST  OF  NODES  TO  BE  OPTIMISED
  NO.   TYPE
   3)=   2       7      0       0       0       0       0       0       0       0      0        0        0       0      0       0

                                                        LINKS HAVING SHARED STOPLINES
 CARD   CARD     FIRST SET........................       SECOND SET........................       THIRD SET........................
  NO.   TYPE
   4)=   7      13     14       0       0       0      15      16       0       0      0       23       24       0      0       0
   5)=   7      25     26       0       0       0      33      34       0       0      0       35       36       0      0       0
   6)=   7      43     44       0       0       0      45      46       0       0      0       52      521       0      0       0
   7)=   7      53    531       0       0       0       0       0       0       0      0        0        0       0      0       0

                                 NODE CARDS:  MINIMUM STAGE TIMES (WORKING)
 CARD   CARD   NODE            S1      S2      S3      S4      S5      S6      S7      S8      S9     S10
  NO.   TYPE    NO.
   8)=  10       1              7       7       7       7
   9)=  10       2              7       7       7       7
  10)=  10       3              7       7       7       7
  11)=  10       4              7       7       7       7
  12)=  10       5              7       5       7       7
  13)=  10       6              7       7
  14)=  10       7              7       7       7

                                 NODE CARDS:  PRECEDING INTERSTAGE TIMES (WORKING)
 CARD   CARD   NODE            S1      S2      S3      S4      S5      S6      S7      S8      S9     S10
  NO.   TYPE    NO.
  15)=  11       1              5       5       5       5
  16)=  11       2              5       5       5       5
  17)=  11       3              5       5       5       5
  18)=  11       4              5       5       5       5
  19)=  11       5             11       0      10       3
  20)=  11       6              7       6
  21)=  11       7              5       5       5

                                 NODE CARDS:  STAGE CHANGE TIMES (WORKING)
 CARD   CARD   NODE  Sgl/Dbl   S1      S2      S3      S4      S5      S6      S7      S8      S9     S10
  NO.   TYPE    NO.  Cycled
  22)=  12       1      1      42      62     110       2
  23)=  12       2      1     103     116      44      56
  24)=  12       3      1     114      41      82     101
  25)=  12       4      1      71      99      11      39
  26)=  12       5      1     113      36      85     102
  27)=  12       6      1     115      85
  28)=  12       7      1       0      43      73

                                                   LINK CARDS:   GIVEWAY DATA
                     PRIORITY LINKS   LINK1 GIVEWAY COEFFS.
 CARD   CARD   LINK    LINK1   LINK2    ONLY     A1      A2                                     LINK    STOP     MAX   DELAY  DISPSN
 NO.   TYPE    NO.      NO.     NO.  % FLOW    X100    X100                                   LENGTH WT.X100   FLOW  WT.X100    X100
  29)=  30      64      61       0       0      22       0       0       0       0      0      200       0     1000      0       0

                                                   LINK  CARDS:   FIXED  DATA
                                     FIRST   GREEN                       SECOND  GREEN
 CARD   CARD   LINK     EXIT       START              END              START              END        LINK    STOP     SAT   DELAY   DISPSN
  NO.   TYPE    NO.     NODE    STAGE    LAG     STAGE     LAG     STAGE     LAG     STAGE     LAG  LENGTH  WT.X100  FLOW  WT.X100    X100
  30)=  31      11       1        1       5        2        0        3        5        4        0     170       0    2175      0       0
  31)=  31      13       1        2       5        3        0        4        5        1        0      80     500    1800      0       0
  32)=  31      14       0        0       0        0        0        0        0        0        0      80       0       0      0       0
  33)=  31      15       1        2       5        3        0        4        5        1        0      80     500    1800      0       0
  34)=  31      16       0        0       0        0        0        0        0        0        0      80       0       0      0       0
  35)=  31      21       2        1       5        2        0        3        5        4        0     200   -9999    4020     50       0
  36)=  31      22       2        1       5        2        0        3        5        4        0     200   -9999    2080     50       0
  37)=  31      23       2        2       5        3        0        4        5        1        0     130     500    1800      0       0
  38)=  31      24       0        0       0        0        0        0        0        0        0     130       0       0      0       0
  39)=  31      25       2        2       5        3        0        4        5        1        0     130     500    1800      0       0
  40)=  31      26       0        0       0        0        0        0        0        0        0     130       0       0      0       0
  41)=  31      31       3        1       5        2        0        3        5        4        0     200   -9999    3994     50       0
  42)=  31      33       3        2       5        3        0        4        5        1        0      90     500    1800      0       0
  43)=  31      34       0        0       0        0        0        0        0        0        0      90       0       0      0       0
  44)=  31      35       3        2       5        3        0        4        5        1        0      90     500    1800      0       0
  45)=  31      36       0        0       0        0        0        0        0        0        0      90       0       0      0       0
  46)=  31      41       4        1       5        2        0        3        5        4        0     200   -9999    1940     50       0
  47)=  31      42       4        1       5        2        0        3        5        4        0     200   -9999    2080     50       0
  48)=  31      43       4        2       5        3        0        4        5        1        0     125     500    1800      0       0
```

49)=	31	44	0	0	0	0	0	0	0	0	0	125	0	0	0	0
50)=	31	45	4	2	5	3	0	4	5	1	0	125	500	1800	0	0
51)=	31	46	0	0	0	0	0	0	0	0	0	125	0	0	0	0
52)=	31	52	5	1	15	3	0	0	0	0	0	180	500	1868	0	0
53)=	31	521	0	0	0	0	0	0	0	0	0	180	0	0	0	0
54)=	31	53	5	2	5	4	0	0	0	0	0	180	0	2105	0	0
55)=	31	531	0	0	0	0	0	0	0	0	0	180	0	0	0	0
56)=	31	5001	5	2	5	4	0	0	0	0	0	180	0	2075	0	0
57)=	31	55	5	1	11	2	0	0	0	0	0	200	0	1828	0	0
58)=	31	5002	5	1	11	2	0	0	0	0	0	200	0	1828	0	0
59)=	31	56	5	1	11	2	0	0	0	0	0	200	0	1958	0	0
60)=	31	57	5	2	23	1	0	0	0	0	0	90	0	1915	0	0
61)=	31	58	5	4	5	1	0	0	0	0	0	90	0	1925	0	0
62)=	31	61	6	1	6	2	0	0	0	0	0	120	500	1915	0	0
63)=	31	62	6	2	7	1	0	0	0	0	0	200	0	1824	0	0
64)=	31	63	6	1	6	2	0	0	0	0	0	200	-9999	1915	50	0
65)=	31	64	6	1	6	2	0	0	0	0	0	200	-9999	1000	50	0
66)=	31	71	7	1	5	2	0	0	0	0	0	200	0	1828	0	0
67)=	31	72	7	1	5	2	0	0	0	0	0	200	0	3600	0	0
68)=	31	73	7	3	5	1	0	0	0	0	0	200	0	1828	0	0
69)=	31	74	7	3	5	1	0	0	0	0	0	200	0	1958	0	0
70)=	31	75	7	1	5	3	0	0	0	0	0	90	0	3600	0	0
71)=	31	76	7	2	5	3	0	0	0	0	0	90	0	1958	0	0

LINK CARDS: FLOW DATA

					ENTRY 1			ENTRY 2			ENTRY 3			ENTRY 4		
CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	LINK NO.	FLOW	CRUISE SPEED	LINK NO.	FLOW	CRUISE SPEED	LINK NO.	FLOW	CRUISE SPEED	LINK NO.	FLOW	CRUISE SPEED
72)=	32	11	1209	0	62	491	45	63	855	45	0	0	0	0	0	0
73)=	32	13	206	0	41	206	45	0	0	0	0	0	0	0	0	0
74)=	32	14	211	0	45	226	45	0	0	0	0	0	0	0	0	0
75)=	32	15	749	0	42	749	45	0	0	0	0	0	0	0	0	0
76)=	32	16	10	0	45	10	45	0	0	0	0	0	0	0	0	0
77)=	32	21	623	0	0	0	45	0	0	0	0	0	0	0	0	0
78)=	32	22	343	0	0	0	45	0	0	0	0	0	0	0	0	0
79)=	32	23	534	0	11	528	45	0	0	0	0	0	0	0	0	0
80)=	32	24	208	0	13	206	45	0	0	0	0	0	0	0	0	0
81)=	32	25	534	0	11	528	45	0	0	0	0	0	0	0	0	0
82)=	32	26	758	0	15	749	45	0	0	0	0	0	0	0	0	0
83)=	32	31	1260	0	55	197	45	56	491	45	57	551	45	0	0	0
84)=	32	33	10	0	21	10	45	0	0	0	0	0	0	0	0	0
85)=	32	34	148	0	25	139	45	0	0	0	0	0	0	0	0	0
86)=	32	35	346	0	22	343	45	0	0	0	0	0	0	0	0	0
87)=	32	36	10	0	25	10	45	0	0	0	0	0	0	0	0	0
88)=	32	41	813	0	0	0	45	0	0	0	0	0	0	0	0	0
89)=	32	42	813	0	0	0	45	0	0	0	0	0	0	0	0	0
90)=	32	43	532	0	31	532	45	0	0	0	0	0	0	0	0	0
91)=	32	44	347	0	35	346	45	0	0	0	0	0	0	0	0	0
92)=	32	45	226	0	31	226	45	0	0	0	0	0	0	0	0	0
93)=	32	46	10	0	35	10	45	0	0	0	0	0	0	0	0	0
94)=	32	52	341	0	21	340	45	0	0	0	0	0	0	0	0	0
95)=	32	521	1034	0	23	291	45	24	113	45	25	215	45	26	413	45
96)=	32	53	284	0	21	283	45	0	0	0	0	0	0	0	0	0
97)=	32	531	864	0	23	243	45	24	95	45	25	180	45	26	345	45
98)=	32	5001	10	0	0	0	45	0	0	0	0	0	0	0	0	0
99)=	32	55	491	0	0	0	45	0	0	0	0	0	0	0	0	0
100)=	32	5002	10	0	0	0	45	0	0	0	0	0	0	0	0	0
101)=	32	56	491	0	0	0	45	0	0	0	0	0	0	0	0	0
102)=	32	57	551	0	72	516	45	73	295	45	0	0	0	0	0	0
103)=	32	58	154	0	72	144	45	73	83	45	0	0	0	0	0	0
104)=	32	61	1486	0	41	607	45	43	532	45	44	347	45	0	0	0
105)=	32	62	501	0	0	0	45	0	0	0	0	0	0	0	0	0
106)=	32	63	855	0	0	0	45	0	0	0	0	0	0	0	0	0
107)=	32	64	10	0	0	0	45	0	0	0	0	0	0	0	0	0
108)=	32	71	30	0	0	0	45	0	0	0	0	0	0	0	0	0
109)=	32	72	660	0	0	0	45	0	0	0	0	0	0	0	0	0
110)=	32	73	378	0	0	0	45	0	0	0	0	0	0	0	0	0
111)=	32	74	230	0	0	0	45	0	0	0	0	0	0	0	0	0
112)=	32	75	1062	0	55	240	45	53	231	45	531	704	45	0	0	0
113)=	32	76	241	0	55	54	45	53	53	45	531	160	45	0	0	0

LINK CARDS : FLARE SATURATION FLOW DATA

			..LANE 1..		..LANE 2..		..LANE 3..	
	CARD TYPE	LINK NO.	SAT. FLOW	CAPAC VEH.	SAT. FLOW	CAPAC VEH.	SAT. FLOW	CAPAC VEH.
114)=	33	11	2035	6	0	0	0	0
115)=	33	53	2105	19	0	0	0	0
116)=	33	57	2055	4	0	0	0	0

FUEL CARD

		CRUISE CONSTANTS A	B	C	DELAY CONST.	STOP CONST.									
(117)=	37	145	-375	405	115	635	0	0	0	0	0	0	0	0	0

LINK DATA: QUEUE CONSTRAINTS

CARD NO.	CARD TYPE	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT	LINK NO.	LIMIT QUEUE	QUEUE WEIGHT
118)=	38	13	6	500	15	6	500	23	8	500	25	8	500	33	6	500
119)=	38	35	6	500	41	40	500	42	40	500	43	11	500	45	11	500
120)=	38	52	30	500	53	45	500	61	26	999	0	0	0	0	0	0

*****END OF SUBROUTINE TINPUT*****

.

120 SECOND CYCLE 60 STEPS

INITIAL SETTINGS
- (SECONDS)

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	STAGE 8	STAGE 9	STAGE 10
1	4	42	62	110	2						
2	4	103	116	44	56						
3	4	114	41	82	101						
4	4	71	99	11	39						
5	4	113	36	85	102						
6	2	115	85								
7	3	0	43	73							

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	-------DELAY-------- UNIFORM RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	----STOPS---- MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	----QUEUE---- MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END	START 2ND	END (SECONDS)
11	1089<	3753f	145	13.6	634.1	21.2 +170.7	(999.9)	241	(74.2)	209	+	2548.8	1	47	62	115	2
13	197	1800S	34	6.4	3.4	0.1 + 0.1	(2.4)	9	(0.4)	4	(0.0)*	4.6	1	67	110	7	42
14	212	13L	34	6.4	15.3	0.8 + 0.1	(11.6)	82	(4.4)	4		16.1	1	67	110	7	42
15	750	1800S	63	6.4	5.9	0.4 + 0.8	(15.7)	22	(4.2)	9	(0.2)*	38.1	1	67	110	7	42
16	10	15L	63	6.4	16.2	0.0 + 0.0	(0.6)	83	(0.2)	9	+	0.8	1	67	110	7	42
21	623	4020	109	16.0	222.8	6.9 + 31.7	(497.4)*	248	(39.4)	45		248.7	2	108	116	49	56
22	343	2080	116	16.0	334.9	4.6 + 27.3	(411.6)*	268	(23.4)	36		205.8	2	108	116	49	56
23	332<	1800S	41	10.4	5.9	0.3 + 0.2	(7.0)	33	(4.5)	8	(0.0)*	29.4	2	1	44	61	103
24	199	23L	41	10.4	7.6	0.3 + 0.1	(5.4)	43	(2.3)	8		7.7	2	1	44	61	103
25	332<	1800S	84	10.4	18.7	1.0 + 0.8	(22.2)	65	(8.9)	15	(1.7)*	74.8	2	1	44	61	103
26	759	25L	84	10.4	15.4	1.5 + 1.7	(42.0)	60	(11.7)	15	+	53.7	2	1	44	61	103
31	1260	3994	65	16.0	17.3	5.1 + 0.9	(78.1)*	63	(20.1)	21		39.0	3	119	41	87	101
33	9	1800S	15	7.2	26.4	0.1 + 0.0	(0.9)	50	(0.1)	1	(0.0)*	1.5	3	46	82	106	114
34	92<	33L	15	7.2	18.5	0.4 + 0.1	(6.1)	50	(1.9)	1		8.0	3	46	82	106	114
35	297<	1800S	44	7.2	29.7	2.1 + 0.4	(31.7)	51	(4.5)	6	(0.0)*	54.3	3	46	82	106	114
36	6	35L	44	7.2	22.9	0.0 + 0.0	(0.5)	49	(0.1)	6		0.6	3	46	82	106	114

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (PCU-H/H)	DELAY RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END 1ST	START 2ND	END 2ND
41	813	1940	105	16.0	139.7	5.3 +	26.2	(407.0)*	218	(45.1)	41	(0.1)*	203.9	4	76	99	16	39
42	813	2080	98	16.0	63.3	4.0 +	10.3	(184.3)*	152	(31.6)	23	(0.0)*	92.1	4	76	99	16	39
43	532	1800S	99	10.0	67.6	2.3 +	7.7	(128.9)	161	(21.8)	30	(8.6)*	281.0	4	104	11	44	71
44	298<	43L	99	10.0	73.2	1.8 +	4.3	(78.2)	138	(12.2)	30	+	90.4	4	104	11	44	71
45	227	1800S	28	10.0	10.9	0.5 +	0.2	(8.9)	64	(3.7)	4	(0.0)*	27.3	4	104	11	44	71
46	8	45L	28	10.0	9.5	0.0 +	0.0	(0.3)	22	(0.1)	4		0.3	4	104	11	44	71
52	312<	1868S	95	14.4	36.0	1.1 +	2.0	(40.3)	66	(5.8)	36	(0.6)*	72.3	5	8	85		
53	260<	3208Sf	58	14.4	22.5	1.4 +	0.2	(21.0)	50	(3.6)	19	(0.0)*	24.6	5	41	102		
55	491	1828	98	16.0	105.7	5.9 +	8.5	(186.0)	141	(17.6)	24		203.6	5	4	36		
56	491	1958	91	16.0	74.1	5.7 +	4.4	(130.5)	118	(14.8)	20		145.2	5	4	36		
57	551	2176f	55	7.2	32.5	4.4 +	0.6	(64.2)	72	(10.1)	13		74.2	5	59	113		
58	154	1925	137	7.2	619.3	4.1 +	22.4	(341.8)	250	(9.8)	29	+	351.6	5	107	113		
61	1408<	1915	104	9.6	110.7	7.6 +	35.7	(558.4)	147	(55.8)	83	(34.4)*	1181.4	6	1	85		
62	501	1824	137	16.0	584.9	11.5 +	69.9	(999.9)	248	(31.7)	91	+	1081.8	6	92	115		
63	855	1915	63	16.0	12.8	2.2 +	0.8	(39.2)*	51	(11.0)	16		19.6	6	1	85		
64	10	1000	2	16.0	9.6	0.0 +	0.0	(0.3)*	30	(0.1)	0		0.2	6	1	85		
71	30	1828	5	16.0	30.9	0.2 +	0.0	(3.3)	69	(0.5)	1		3.8	7	5	43		
72	660	3600	56	16.0	37.0	6.1 +	0.6	(87.5)	82	(13.8)	19		101.3	7	5	43		
73	378	1828	58	16.0	37.6	3.3 +	0.7	(51.0)	82	(7.9)	11		58.9	7	78	0		
74	230	1958	33	16.0	31.8	1.8 +	0.2	(26.2)	73	(4.3)	6		30.5	7	78	0		
75	924<	3600	45	7.2	12.1	2.7 +	0.4	(40.0)	26	(6.9)	9		46.9	7	5	73		
76	210<	1958	50	7.2	36.8	1.7 +	0.5	(27.7)	62	(3.8)	5		31.5	7	48	73		
521	838<	52L	95	14.4	42.5	4.6 +	5.3	(127.7)	77	(20.4)	36	+	148.0	5	8	85		
531	701<	53L	58	14.4	19.0	3.2 +	0.5	(47.7)	46	(10.1)	19		57.8	5	41	102		
5001	10	2075	1	14.4	15.7	0.0 +	0.0	(0.6)	47	(0.1)	0		0.7	5	41	102		

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120 SECOND CYCLE 60 STEPS

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	MEAN TIMES PER PCU DELAY (SEC)	DELAY UNIFORM (PCU-H/H)	DELAY RANDOM+ OVERSAT (U+R+O=MEAN Q) (PCU-H/H)	COST OF DELAY ($/H)	MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	QUEUE AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST	END 1ST	START 2ND	END 2ND
5002	10	1828	2	16.0	35.9	0.1 +	0.0	(1.3)	74	(0.2)	0		1.5	5	4	36		

*** f - average saturation flow for flared link ***

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
3066.2	630.9	4.9	126.3	436.4	(6450.9) +	(811.6) +	(399.9) =	7662.4	TOTALS

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	178.6	+	647.2	+	273.9	=	1099.8

NO. OF ENTRIES TO SUBPT = 1
NO. OF LINKS RECALCULATED= 58

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120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18
- (SECONDS)

1	4	42	62	110	2
2	4	103	116	44	56
3	4	114	41	82	101
4	4	71	99	11	39
5	4	113	36	85	102
6	2	115	85		
7	3	36	79	109	

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
3066.2	630.0	4.9	125.4	436.4	(6433.3) +	(815.6) +	(399.9) =	7648.8	TOTALS

NO. OF ENTRIES TO SUBPT = 4
NO. OF LINKS RECALCULATED= 69

.

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48
- (SECONDS)

1	4	42	62	110	2
2	4	103	116	44	56
3	4	114	41	82	101
4	4	71	99	11	39
5	4	113	36	85	102
6	2	115	85		
7	3	36	79	109	

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
3066.2	630.0	4.9	125.4	436.4	(6433.3) +	(815.6) +	(399.9) =	7648.8	TOTALS

NO. OF ENTRIES TO SUBPT = 3
NO. OF LINKS RECALCULATED= 60

.

120 SECOND CYCLE 60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :- 18 48 -1
- (SECONDS)

1	4	42	62	110	2
2	4	103	116	44	56
3	4	114	41	82	101
4	4	71	99	11	39
5	4	113	36	85	102
6	2	115	85		
7	3	36	85	108	

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)	TOTAL COST OF STOPS ($/H)	PENALTY FOR EXCESS QUEUES ($/H)	TOTAL PERFORMANCE INDEX ($/H)	
3066.2	629.5	4.9	124.6	436.8	(6428.3) +	(814.5) +	(399.8) =	7642.5	TOTALS

NO. OF ENTRIES TO SUBPT = 13
NO. OF LINKS RECALCULATED= 127

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120 SECOND CYCLE 60 STEPS

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INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1  18
 - (SECONDS)

    1       4     42      62     110      2
    2       4    103     116      44     56
    3       4    114      41      82    101
    4       4     71      99      11     39
    5       4    113      36      85    102
    6       2    115      85
    7       3     36      85     108

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME      JOURNEY        UNIFORM   RANDOM+    COST          COST            FOR        PERFORMANCE
TRAVELLED        SPENT       SPEED          DELAY    OVERSAT     OF            OF            EXCESS         INDEX
                                                      DELAY     DELAY         STOPS          QUEUES
(PCU-KM/H)     (PCU-H/H)    (KM/H)       (PCU-H/H)(PCU-H/H)   ($/H)         ($/H)           ($/H)         ($/H)

  3066.2         629.5        4.9          124.6    436.8     (6428.3) + (  814.5)  +  ( 399.8)   =    7642.5      TOTALS

NO. OF ENTRIES TO SUBPT  =     3
NO. OF LINKS RECALCULATED=    60
.

    120 SECOND CYCLE  60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1  18  48
 - (SECONDS)

    1       4     42      62     110      2
    2       4    103     116      44     56
    3       4    114      41      82    101
    4       4     71      99      11     39
    5       4    113      36      85    102
    6       2    115      85
    7       3     36      85     108

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME      JOURNEY        UNIFORM   RANDOM+    COST          COST            FOR        PERFORMANCE
TRAVELLED        SPENT       SPEED          DELAY    OVERSAT     OF            OF            EXCESS         INDEX
                                                      DELAY     DELAY         STOPS          QUEUES
(PCU-KM/H)     (PCU-H/H)    (KM/H)       (PCU-H/H)(PCU-H/H)   ($/H)         ($/H)           ($/H)         ($/H)

  3066.2         629.5        4.9          124.6    436.8     (6428.3) + (  814.5)  +  ( 399.8)   =    7642.5      TOTALS

NO. OF ENTRIES TO SUBPT  =     3
NO. OF LINKS RECALCULATED=    76
.

    120 SECOND CYCLE  60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1  18  48   1
 - (SECONDS)

    1       4     42      62     110      2
    2       4    103     116      44     56
    3       4    114      41      82    101
    4       4     71      99      11     39
    5       4    113      36      85    102
    6       2    115      85
    7       3     37      86     109

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME      JOURNEY        UNIFORM   RANDOM+    COST          COST            FOR        PERFORMANCE
TRAVELLED        SPENT       SPEED          DELAY    OVERSAT     OF            OF            EXCESS         INDEX
                                                      DELAY     DELAY         STOPS          QUEUES
(PCU-KM/H)     (PCU-H/H)    (KM/H)       (PCU-H/H)(PCU-H/H)   ($/H)         ($/H)           ($/H)         ($/H)

  3066.2         629.4        4.9          124.5    436.8     (6426.8) + (  814.8)  +  ( 399.8)   =    7641.4      TOTALS

NO. OF ENTRIES TO SUBPT  =     3
NO. OF LINKS RECALCULATED=    60
.

    120 SECOND CYCLE  60 STEPS

INTERMEDIATE SETTINGS - INCREMENTS SO FAR :-   18  48  -1  18  48   1  -1
 - (SECONDS)

    1       4     42      62     110      2
    2       4    103     116      44     56
    3       4    114      41      82    101
    4       4     71      99      11     39
    5       4    113      36      85    102
    6       2    115      85
    7       3     36      86     111

  TOTAL          TOTAL        MEAN          TOTAL    TOTAL     TOTAL         TOTAL          PENALTY        TOTAL
 DISTANCE         TIME      JOURNEY        UNIFORM   RANDOM+    COST          COST            FOR        PERFORMANCE
TRAVELLED        SPENT       SPEED          DELAY    OVERSAT     OF            OF            EXCESS         INDEX
                                                      DELAY     DELAY         STOPS          QUEUES
(PCU-KM/H)     (PCU-H/H)    (KM/H)       (PCU-H/H)(PCU-H/H)   ($/H)         ($/H)           ($/H)         ($/H)

  3066.2         629.4        4.9          124.6    436.6     (6425.9) + (  814.4)  +  ( 399.8)   =    7640.1      TOTALS

NO. OF ENTRIES TO SUBPT  =     9
NO. OF LINKS RECALCULATED=   109
.

    120 SECOND CYCLE  60 STEPS

FINAL SETTINGS OBTAINED WITH INCREMENTS :-   18  48  -1  18  48   1  -1   1
 - (SECONDS)

  NODE   NUMBER   STAGE   STAGE   STAGE   STAGE   STAGE  STAGE   STAGE   STAGE   STAGE   STAGE
   NO   OF STAGES   1       2       3       4       5      6       7       8       9      10

    1       4     42      62     110      2
    2       4    103     116      44     56
    3       4    114      41      82    101
    4       4     71      99      11     39
    5       4    113      36      85    102
    6       2    115      85
    7       3     37      87     112

 LINK    FLOW    SAT   DEGREE  MEAN TIMES  -------DELAY--------   ----STOPS----   ----QUEUE----  PERFORMANCE  EXIT   GREEN TIMES
NUMBER   INTO    FLOW    OF     PER PCU    UNIFORM RANDOM+ COST    MEAN    COST   MEAN              INDEX.     NODE   START  START
         LINK           SAT    CRUISE              OVERSAT  OF     STOPS    OF    MAX.  AVERAGE  WEIGHTED SUM             END     END
                                    DELAY  (U+R+O=MEAN Q) DELAY    /PCU    STOPS         EXCESS  OF ( ) VALUES           1ST     2ND
      (PCU/H) (PCU/H)  (%)   (SEC) (SEC)     (PCU-H/H)    ($/H)    (%)     ($/H)   (PCU)  (PCU)      ($/H)                (SECONDS)

   11    1089<  3753f   145  13.6 634.1   21.2 +170.7  (999.9)    241  ( 74.2)    209      +         2548.8       1      47  62 115   2
   13     197   1800S    34   6.4   3.4    0.1 +  0.1  (  2.4)      9  (  0.4)      4  ( 0.0)*         4.6       1      67 110   7  42
   14     212     13L    34   6.4  15.3    0.8 +  0.1  ( 11.6)     82  (  4.4)      4                 16.1       1      67 110   7  42
   15     750   1800S    63   6.4   5.9    0.4 +  0.8  ( 15.7)     22  (  4.2)      9  ( 0.2)*        38.1       1      67 110   7  42
   16      10     15L    63   6.4  16.2    0.0 +  0.0  (  0.6)     83  (  0.2)      9      +           0.8       1      67 110   7  42
   21     623   4020    109  16.0 222.8    6.9 + 31.7  (497.4)*   248  ( 39.4)     45                248.7       2     108 116  49  56
   22     343   2080    116  16.0 334.9    4.6 + 27.3  (411.6)*   268  ( 23.4)     36                205.8       2     108 116  49  56
   23     332<  1800S    41  10.4   5.9    0.3 +  0.2  (  7.0)     33  (  4.5)      8  ( 0.0)*        29.4       2       1  44  61 103
   24     199     23L    41  10.4   7.6    0.3 +  0.1  (  5.4)     43  (  2.3)      8                  7.7       2       1  44  61 103
   25     332<  1800S    84  10.4  18.7    1.0 +  0.8  ( 22.2)     65  (  8.9)     15  ( 1.7)*        74.8       2       1  44  61 103
   26     759     25L    84  10.4  15.4    1.5 +  1.7  ( 42.0)     60  ( 11.7)     15      +          53.7       2       1  44  61 103
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31	1259	3994	65	16.0	19.4	5.9 +	0.9	(87.7)*	65	(20.8)	26		43.8	3	119	41	87	101
33	9	1800S	15	7.2	26.4	0.1 +	0.0	(0.9)	50	(0.1)	1	(0.0)*	1.5	3	46	82	106	114
34	92<	33L	15	7.2	18.5	0.4 +	0.1	(6.1)	50	(1.9)	1		8.0	3	46	82	106	114
35	297<	1800S	44	7.2	29.7	2.1 +	0.4	(31.7)	51	(4.5)	6	(0.0)*	54.3	3	46	82	106	114
36	6	35L	44	7.2	22.9	0.0 +	0.0	(0.5)	49	(0.1)	6		0.6	3	46	82	106	114
41	813	1940	105	16.0	139.7	5.3 +	26.2	(407.0)*	218	(45.1)	41	(0.1)*	203.9	4	76	99	16	39
42	813	2080	98	16.0	63.3	4.0 +	10.3	(184.3)*	152	(31.6)	23	(0.0)*	92.1	4	76	99	16	39
43	531	1800S	99	10.0	67.8	2.4 +	7.6	(129.0)	161	(21.8)	30	(8.6)*	281.1	4	104	11	44	71
44	298<	43L	99	10.0	73.2	1.8 +	4.3	(78.1)	138	(12.2)	30	+	90.3	4	104	11	44	71
45	227	1800S	28	10.0	11.0	0.5 +	0.2	(8.9)	64	(3.7)	4	(0.0)*	27.4	4	104	11	44	71
46	8	45L	28	10.0	9.5	0.0 +	0.0	(0.3)	22	(0.1)	4		0.3	4	104	11	44	71
52	312<	1868S	95	14.4	36.0	1.1 +	2.0	(40.3)	66	(5.8)	36	(0.6)*	72.3	5	8	85		
53	260<	3208Sf	58	14.4	22.5	1.4 +	0.2	(21.0)	50	(3.6)	19	(0.0)*	24.6	5	41	102		
55	491	1828	98	16.0	105.7	5.9 +	8.5	(186.0)	141	(17.6)	24		203.6	5	4	36		
56	491	1958	91	16.0	74.1	5.7 +	4.4	(130.5)	118	(14.8)	20		145.2	5	4	36		
57	551	2176f	55	7.2	27.1	3.5 +	0.6	(53.4)	93	(13.1)	18	+	66.6	5	59	113		
58	154	1925	137	7.2	620.4	4.2 +	22.4	(342.4)	250	(9.8)	29	+	352.2	5	107	113		
61	1408<	1915	104	9.6	110.7	7.6 +	35.7	(558.3)	147	(55.8)	83	(34.4)*	1181.3	6	1	85		
62	501	1824	137	16.0	584.9	11.5 +	69.9	(999.9)	248	(31.7)	91	+	1081.8	6	92	115		
63	855	1915	63	16.0	12.8	2.2 +	0.8	(39.2)*	51	(11.0)	16		19.6	6	1	85		
64	10	1000	2	16.0	9.6	0.0 +	0.0	(0.3)*	30	(0.1)	0		0.2	6	1	85		
71	30	1828	4	16.0	26.1	0.2 +	0.0	(2.8)	62	(0.5)	1		3.3	7	42	87		
72	660	3600	48	16.0	30.5	5.1 +	0.5	(72.0)	74	(12.5)	17		84.5	7	42	87		
73	378	1828	61	16.0	40.0	3.4 +	0.8	(54.2)	85	(8.2)	11		62.4	7	117	37		
74	230	1958	34	16.0	33.5	1.9 +	0.3	(27.6)	75	(4.4)	6		32.0	7	117	37		
75	924<	3600	43	7.2	5.8	1.1 +	0.4	(19.3)	23	(6.2)	11		25.4	7	42	112		
76	210<	1958	61	7.2	52.0	2.2 +	0.8	(39.2)	92	(5.7)	8		44.8	7	92	112		
521	838<	52L	95	14.4	42.5	4.6 +	5.3	(127.7)	77	(20.4)	36	+	148.0	5	8	85		
531	701<	53L	58	14.4	19.0	3.2 +	0.5	(47.7)	46	(10.1)	19		57.8	5	41	102		
5001	10	2075	1	14.4	15.7	0.0 +	0.0	(0.6)	47	(0.1)	0		0.7	5	41	102		

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120 SECOND CYCLE 60 STEPS

LINK NUMBER	FLOW INTO LINK (PCU/H)	SAT FLOW (PCU/H)	DEGREE OF SAT (%)	MEAN TIMES PER PCU CRUISE (SEC)	DELAY (SEC)	DELAY UNIFORM (U+R+O=MEAN Q) (PCU-H/H)	RANDOM+ OVERSAT	COST OF DELAY ($/H)	STOPS MEAN STOPS /PCU (%)	COST OF STOPS ($/H)	QUEUE MEAN MAX. (PCU)	AVERAGE EXCESS (PCU)	PERFORMANCE INDEX. WEIGHTED SUM OF ( ) VALUES ($/H)	EXIT NODE	GREEN TIMES START 1ST (SECONDS)	END	START 2ND	END
5002	10	1828	2	16.0	35.9	0.1 +	0.0	(1.3)	74	(0.2)	0		1.5	5	4	36		

*** f - average saturation flow for flared link ***

TOTAL DISTANCE TRAVELLED (PCU-KM/H)	TOTAL TIME SPENT (PCU-H/H)	MEAN JOURNEY SPEED (KM/H)	TOTAL UNIFORM DELAY (PCU-H/H)	TOTAL RANDOM+ OVERSAT DELAY (PCU-H/H)	TOTAL COST OF DELAY ($/H)		TOTAL COST OF STOPS ($/H)		PENALTY FOR EXCESS QUEUES ($/H)		TOTAL PERFORMANCE INDEX ($/H)	
3066.2	629.3	4.9	124.5	436.6	(6425.0)	+	(814.8)	+	(399.8)	=	7639.5	TOTALS

ROUTE

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	CRUISE LITRES PER HOUR		DELAY LITRES PER HOUR		STOPS LITRES PER HOUR		TOTALS LITRES PER HOUR
FUEL CONSUMPTION PREDICTIONS	178.6	+	645.3	+	275.9	=	1099.8

NO. OF ENTRIES TO SUBPT = 3
NO. OF LINKS RECALCULATED= 60

PROGRAM TRANSYT FINISHED