Introduction

The Harlow Transportation Study project was overseen by a Steering Group, organised by Harlow Council, and comprised of:

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The opinions and conclusions set out in the Harlow Transportation Study reports are entirely those of the consultants and do not necessarily reflect the formal views of the Steering Group. The reports are made available solely for information purposes and have the status of background technical documents.

The project was commenced in early 2004 and the objectives are described in the Project Brief, which is set out as an appendix to this report. During the project plan period the anticipated date for publication of the Regional Spatial Strategy was revised and it was also necessary to produce a number of additional technical reports, which led to an agreed extension of the project timetable. The project was completed within the original budget, which was fully funded by the Government through the Office of The Deputy Prime Minister.

The two planning scenarios were developed in consultation with EERA in order to provide the project with a basis for technical analysis and evaluation using the TRAM model. A further exercise is currently taking place using the published East of England Plan as a final planning scenario for detailed analysis and evaluation and the results will be published as an additional report as soon as it is available.

The Web display structure has been designed to enable the viewer to browse through the matrix report conclusions and the associated plans by clicking on the appropriate hyperlink boxes. The full report, displayed by chapter with appendix, is also available for viewing with the associated plans and tables. Any part of the report may be printed from the Web display by the viewer for their own use or hard copies of the full report are available for purchase from Harlow Council.

I hope the viewer will find the report is fully informative but further technical enquiries may be made by email to (danny.purton@harlow.gov.uk) or in writing to the Civic Centre, Water Gardens, Harlow, Essex CM20 1WG.

Danny Purton
Project Manager
7th March 2005

Contents (back to index page)

Tables

Figures

Appendices

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1 Introduction

1.1 Background

1.1.1 The London-Stansted-Cambridge corridor has been identified as a potential area for growth and economic regeneration through the Government's Sustainable Communities Plan and Regional Planning Guidance. The area between Epping, North Weald, Harlow and Stansted occupies a key position within this corridor and is the subject of investigation for a number of studies commissioned by the local authorities.

1.1.2 MVA was appointed by Harlow Council to undertake a transport study to test the feasibility of major population and employment growth in the Harlow area against the existing transport infrastructure. Where deficiencies in the transport network are identified, the study will go on to identify, cost and appraise sustainable and innovative transport solutions.

1.1.3 A number of the key study objectives are listed below:

- identify existing and emerging transport problems, issues and opportunities in the study area;
- by examining pinch points/bottlenecks and available transport capacity, identify and broadly locate the scope for additional housing and employment development in the study area;
- identify additional transport schemes that might be required to allow delivery of the development proposals identified in two housing and employment growth planning scenarios.
- for those transport schemes identified, provide an assessment against the Government's New Approach to Transport Appraisal (NATA) criteria.

1.1.4 For ease of reference, a copy of the study brief is included as Appendix A.

1.1.5 MVA's approach to the study includes the development of a strategic area model, based on its in-house Traffic Restraint Analysis Model (TRAM) software.

1.2 Study History

1.2.1 The brief for the study defined that the travel demand forecasts should be developed from one planning data specification.

1.2.2 Shortly after the study was commissioned in December 2003, two planning scenarios were agreed with the Steering Group as a basis for developing input to the transport model. Whilst each scenario included the same quantum of development, the spatial distribution varied significantly. It was recognised at the time that the quantum and distribution of development might change in due course but acknowledged that if necessary this could be dealt with through further, subsequent work. In fact the East of England Plan (RSS14), published for consultation in November 2004, includes proposals that are different from both assumptions for this study but which are most similar to Planning Scenario 1.

1.2.3 During the late Spring of 2004, data collection and preparation was undertaken as part of the early development of the TRAM model. In parallel an assessment of Problems and Opportunities in Harlow was completed and presented to the Steering Group.

HAWP

1.2.4 The Harlow Area Working Party (HAWP) was convened on a number of occasions during the summer of 2004 to provide input to the development of draft Regional Planning Guidance (now known as the draft East of England Plan). In order to inform this process, it was necessary to reach some preliminary views on Harlow's transport needs, based on the emerging transport study but without the benefits of a fully developed TRAM model.

1.2.5 MVA was commissioned to prepare an Interim Transport Assessment (ITA) based on a simpler approach to forecasting future travel patterns associated with housing and employment growth in Harlow. This report was published in July 2004 and its findings were used to inform a submission to EERA from the HAWP group. The ITA is now superseded by The Final Report.

1.2.6 Scheme and Scenario identification for the main study was completed in discussion with the Steering Group during the late summer of 2004. Testing with TRAM followed shortly afterwards and the results from the model were used to inform the subsequent appraisal process.

1.3 The Final Report

1.3.1 This Final Report presents the findings of the main study. It draws together the various strands of work undertaken to identify, model and appraise a range of transport schemes appropriate to one or other or both of the planning scenarios.

1.3.2 The Report builds upon material presented in a number of other technical papers/reports issued to the Steering Group during the course of the project, including:

- Network Reviews
- Public Transport Passenger Survey Analysis Report
- Problems and Opportunities Report
- TRAM Calibration and Validation Report
- Interim Transport Assessment
- Modelling Report

Report Structure

1.3.3 Following this introduction, Chapter 2 provides a summary of Problems and Opportunities in Harlow against the backdrop of the growth agenda; the emphasis being on transportation issues. This Chapter sets the scene for the study, and the material presented is used to inform the process of scheme identification and appraisal described later in the report.

1.3.4 Chapter 3 describes in some detail, the planning scenarios agreed for the study, the transport schemes identified to support the development proposals and the range of tests undertaken with the TRAM model.

1.3.5 Chapter 4 presents the results of the scheme and scenario tests undertaken with TRAM. Key outputs from the model are summarised in a series of tables, charts and diagrams. An interpretation of the results is also provided.

1.3.6 Chapter 5 of the report is an appraisal of the various combinations of planning scenarios with transport schemes. This Chapter includes a set of Appraisal Matrices that demonstrate the degree to which each scenario and scheme variant achieves the NATA objectives for transport.

1.3.7 Chapter 6 outlines the next steps needed to confirm and fully appraise any subsequent land use scenario and transport strategy for the growth of Harlow.

1.3.8 A number of appendices are included as part of the Final Report that, in the main, describe the technical aspects of the modelling process in more detail.

2 Harlow – Summary of Problems and Opportunities

2.1 Harlow Today

2.1.1 Established as a New Town in the early 1950's, Harlow has developed into a modern yet compact urban area broadly in line with the vision of its original master planner, Sir Frederick Gibbend. Notable features of the town include its individual neighbourhoods, each with their own shops, schools and community centres, its green spaces (wedges) that provide a natural break between development areas, and its nine conservation areas.

2.1.2 The majority of the town was built during a period when placing reliance on the private car was not recognised as an unsustainable approach to planning. As such, Harlow has been developed around a strong highway network with a grid street pattern typical of a New Town of its era. Leaving aside localised peak period difficulties in gaining access to the strategic highway network, the town is highly accessible by car. Pedestrian and cycle routes are often grade-separated, assisting safety and the flow of vehicles, and there are extensive parking facilities.

2.1.3 Harlow is served by the West Anglia main line railway and benefits from two stations, the main one being Harlow Town located approximately 1km north of the central business district. Harlow Mill station is located at the north-eastern fringe of the urban area.

2.1.4 Bus is the other main mode of public transport that serves Harlow. A radial network of routes is centred in the recently refurbished bus station located in the central business district.

2.1.5 Further information concerning Harlow's transport network is provided later in this chapter.

2.1.6 Harlow is not without its problems. It has serious social and economic problems at the localised level. The Deprivation Index produced by the (former) DETR shows that Harlow is the most deprived District in Essex. It is the fourth most deprived in the Eastern Region and the 82nd most deprived out of a total of 354 Districts in England.

2.1.7 For many residents and visitors, the town is perceived to have a poor image. Much of the housing stock is of poor quality and the town centre retail offer is unattractive. Although a number of large employers have consolidated their operations in Harlow, there is strong evidence of inward commuting to these jobs. At the same time, many Harlow residents commute out of the District to jobs in London, at Stansted Airport or other areas of the South-East. Access to these areas, though, is not always good with traffic congestion delays or infrequent public transport services.

2.2 Future Growth

2.2.1 The population of the Harlow district has grown steadily over recent years to its current level of around 80,000 people. However, looking to the future, Harlow is on the threshold of experiencing a step change in the rate of its growth.

2.2.2 Harlow's prime location within the London Stansted Cambridge Peterborough (LSCP) corridor, coupled with its regeneration needs, mean that the District is a strong contender for significant development over the coming years to 2021. The draft East of England Plan (Regional Spatial Strategy 14), released for consultation on 8 December 2004, provides for some 26,700 new dwellings in the Harlow area (including North Weald), together with substantial employment growth.

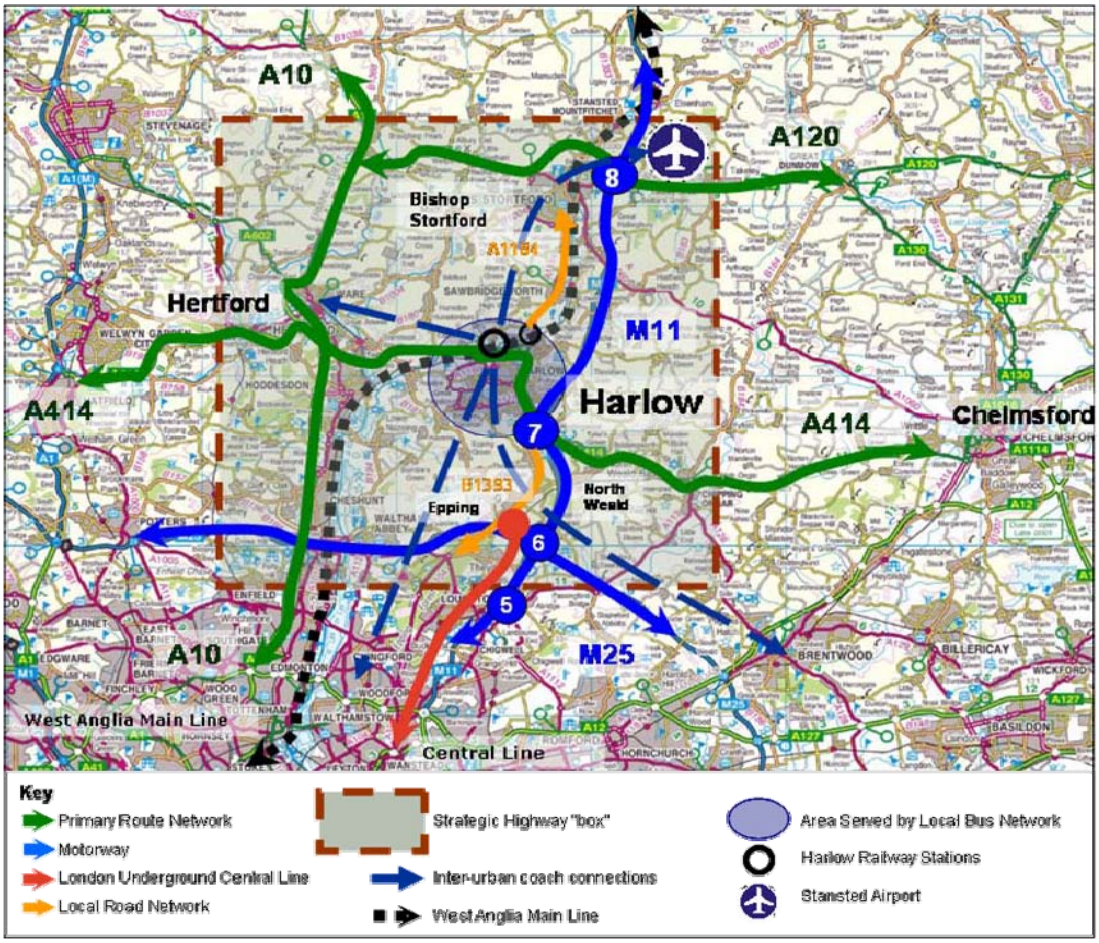
2.2.3 This level of development will clearly result in a range of significant impacts on the District, not least of which is the effect on its transport network. However, if carefully planned and managed, development on this scale could help bring about the regeneration of the town and lead to a strengthening of its potential as an attractive sub-regional centre.

2.3 Transportation Issues

2.3.1 The following sections consider the current transport provision in Harlow and identify existing and emerging problems/issues. The paper then goes on to consider opportunities for improvement to the transport system that could be realised through a combination of local transport policy, the regeneration of the town and the growth agenda for the LSCP corridor.

2.4 The Harlow Transport Context Local and Strategic Highways

2.4.1 Harlow is situated within a highway "box" formed by the A120, M11, M25 and A10. The key connection to this strategic highway box is provided by the A414 which runs west-east from its A10 junction just north of Hoddesdon, through the heart of the town to junction 7 of the M11. The fact that this primary, east-west route 'dog-legs' through central Harlow is a major influence on traffic conditions in the town, as will be explained in more detail later in this chapter.



2.4.2 The fact that Harlow is dependent on one junction access to the strategic motorway network at M11,J7 is unusual in towns of a similar size and character.

Table 2.1 Connections to Similar Towns

Comparable Towns	Motorway / Trunk Road Junction Access
Welwyn Garden City	2.5
Hatfield	4
Stevenage	2
Letchworth	2
Hemel Hempstead	1
Basildon	3
Basingstoke	2
Bracknell	1
Crawley	2

2.4.3 A more local connection to the box is provided by the A1184 which links north-east Harlow to the A120 at Bishop Stortford. Hence there are three main highway corridors through which traffic arrives at/ departs from the Harlow Urban Area:

Table 2.2 Three Main Entry Roads: Peak Hour Traffic Flow

	AM Peak		PM Peak	
	NB	SB	NB	SB
A414 from M11 Junction 7	2000	2100	2200	1800
A414 from Hertford and the West	1100	1000	1600	1000
A1184 from Bishops Stortford and the north	600	1100	900	800

2.4.4 In addition there is a network of minor and unclassified roads that connect the largely rural hinterland of Harlow with its urban area.

Rail

2.4.5 The West Anglia main line passes through Harlow and the town benefits from two railway stations; Harlow Town (main station) and Harlow Mill (local station). Rail services are provided by the train operator 'one' at the following frequencies:-

Table 2.3: Train frequencies to London from Harlow Stations

Station	Frequency to London (trains per hour) Peak	Off-Peak
Harlow Town	6	4
Harlow Mill	2	1

Air

2.4.6 Stansted airport is situated in relatively close proximity to Harlow – approximately 10Km to the north-east of the urban area. Following publication of the Government's White Paper (The Future of Air Transport) Stansted is set to grow significantly with the possibility of a second runway post 2012. It is worth noting here that this study has assumed that the current single runway would be used to its capacity and no second runway would be available.

Bus

2.4.7 Harlow local bus services are provided by several operators, the most dominant of which is Arriva. Bus routes generally radiate from the recently refurbished bus

station which is located on Terminus Street at the heart of the central business district. Coverage of the urban area is good and there are also connections to nearby towns such as Hertford, Chingford, Epping and Loughton.

2.4.8 Service frequencies in the urban area are quite high for a town of Harlow's size with 60 departures per hour from the bus station to destinations within Harlow (not including the Rail Station). This is partly due to competition between bus operators. Vehicle standards vary, with some routes operated by smaller, step-entrance vehicles, while others have high quality, route-branded low-floor vehicles.

2.4.9 The inter-urban routes tend to operate at lower frequencies (typically hourly) with the exception of services to Stansted which operate at a frequency of 4 per hour.

2.4.10 Car ownership in Harlow is slightly higher than the national average with 74.9% of households having access to a car compared to the average of 73.2% across England and Wales. Mode share for trips to, from and within Harlow by bus is fairly typical at around 8%.

Coach

2.4.11 National Express operates frequent coach services along the M11 corridor. Separate routes link central London (Victoria) and east London (Stratford) to Stansted airport. An hourly service from Harlow to Heathrow airport is provided by Arriva.

Walk/Cycle

2.4.12 Typical of a New Town, Harlow benefits from an extensive network of segregated walk/cycle routes. However, there are several missing links in the network, together with a number of issues relating to personal security and the deterioration in quality of the public realm that will be covered in more detail later in this report.

2.5 Problems with the Current Transport Provision

Highways

2.5.1 The M11 motorway flanks the eastern limits of the Harlow Urban Area, providing an important north-south connection and a link to the M25 London orbital. Harlow is served by a single junction (J7) located about 1.5Km to the south-east of the town. During peak periods, J7 regularly suffers from significant traffic congestion, notably on the A414 (western) arm, where a volume to capacity ratio of 1.23 has been measured. Not all of this traffic is related to the M11 as there is a significant volume using B1393 to the south, as well as continuing along A414 to the east. Whilst J7 is conveniently placed for access to the M11 south, motorists heading for Stansted and the M11 north often choose to use the A1184 corridor and J8 of the motorway as an alternative route.

2.5.2 **The location of M11 Junction 7 to the south east of Harlow is less than optional for serving the District and is not what was envisaged when the town was originally planned. This single junction access to the motorway causes strategic and local route choices that are to the detriment of Harlow Urban Area road users and residents.**

2.5.3 As part of this study an up-to-date junction turning count survey was undertaken at J7 of the M11. The following is a summary of the movements to and from each arm of the junction.

Table 2.4: M11 Junction 7 Peak Period Movements (Vehicles)

Movement	AM Peak	PM Peak
To A414 (West)	1962	2217
From A414 (West)	2099	1817
To B1393	907	671
From B1393	635	816
To M11 (South)	1319	868
From M11 (South)	1007	1732
To A414 (East)	630	1403
From A414 (East)	987	673
To M11 (North)	683	595
From M11 (North)	773	716
Total	**11002**	**11508**

2.5.4 **Taken together, the location of J7 relative to the town and the operational limitations of the junction during peak periods result in restricted access to the motorway network from Harlow and the A414 corridor.**

2.5.5 South of Harlow, the location of junctions 5 and 6 of the M11 and the restricted nature of junction 5 means that motorway access to areas such as Epping, Loughton, Woodford and Chingford is poor. This has the effect of forcing more traffic onto the B1393 which serves these areas and is accessed off J7 roundabout. Vehicles leaving the M11 at J7 for these destinations clearly exacerbate the congestion problems at the junction.

2.5.6 Passing through the Harlow Urban Area via Allende Avenue and Edinburgh Way, the A414 carries both local traffic and longer distance through-traffic. To the west of Harlow this road is of high quality dual carriageway standard but, once it reaches the town and turns southwards to cross the River Stort and railway line, it reduces in standard to a single carriageway.

Table 2.5: A414 Allende Avenue Roundabout (Vehicles)

Movement	AM Peak	PM Peak
To A414 Allende Avenue (North)	1100	1600
From A414 Allende Avenue (North)	1000	1000
To Elizabeth Way	500	200
From Elizabeth Way	300	300
To Allende Avenue (South)	600	900
From Allende Avenue (South)	900	600
To A414 Edinburgh Way	800	500
From Edinburgh Way	900	400
To Harlow Town Station	500	200
From Harlow Town Station	200	400
Total	**6800**	**6100**

2.5.7 **There is an immediate bottleneck on the A414 northern approach to the town at the junction of Allende Avenue with Edinburgh Way. This roundabout junction also serves the access to Harlow Town rail station.**

2.5.8 Similar to other towns of its size and form, Harlow's local highway network is generally free-flowing during off-peak hours, but suffers from congestion during peak periods. The north-east quadrant of the town sees the conjunction of the

A1184 with the A414 and other parallel routes into the town centre and experiences regular difficulties. Other congestion hotspots include South Gate, Crown Gate, Latton Park and Southern Way.

Public Transport

2.5.9 Rail services to London (Liverpool Street), Stansted Airport and Cambridge are generally reasonable – with the fastest journey times being 33 minutes, 23 minutes and 44 minutes respectively. However, despite West Anglia route modernisation, capacity remains constrained on this route and Harlow's needs have to compete with others, especially faster services to Stansted Airport.

2.5.10 **Connections from Harlow to locations south and east of the Lea Valley are inconvenient, generally requiring travel via London (Liverpool Street), although it is possible to change onto the North London line at Hackney (with a 15 minute walk between Hackney Downs and Hackney Central Station. Public transport accessibility to these locations, which include north-east London and a number of transport interchange points, is impeded by inter-urban bus services that typically operate on an hourly basis from Harlow with a journey time in the order of an hour.**

2.5.11 Access to the London Underground network can be gained at Epping or Loughton (via the Central Line). The car parks serving these tube stations are regularly full by around 9am which is evidence of significant rail heading that may in part arise from poor public transport accessibility to these stations. There is no readily available data concerning the origin of car based trips to these stations but it is reasonable to assume that a proportion will be from the Harlow area.

2.5.12 Harlow Town railway station is inconveniently located in relation to the Central Business District. The fifteen-minute walk along the undeveloped Allende Avenue corridor is severed by busy roundabouts and is particularly unattractive in bad weather or at night. Whilst attempts have been made to improve bus/rail integration, many town buses extend to the railway station only in peak periods; the off-peak service is relatively poor. Waiting for a bus inside the railway station is not practical and the exposed nature of the bus shelters, coupled with the fact that timings are not always co-ordinated with train arrivals, means that taxi or car is often the preferred mode for onward travel.

2.5.13 The Harlow Urban Area is served by a good network of local bus routes. Buses are well used and facilities are improving. A number of bus priority routes are in place to provide buses with journey time advantages at some of the most congested locations in the town. The bus station has recently been modernised and a real time information system is being implemented.

2.5.14 **There is scope for further improvement to local bus services, particularly in regard to the quality of the bus fleet, the facilities and information provided at bus stops and the integration of ticketing. Some areas may be better served by different routing patterns.**

Walking and Cycling

2.5.15 Although Harlow benefits from a fairly comprehensive network of pedestrian and cycle routes, many of which are fully segregated from the highway network, there are a number of potential barriers to greater use of these modes.

2.5.16 Many of the problems lie in the detail of the networks; for example, inadequate maintenance, poor signing or lack of cycling parking facilities. Other difficulties arise as a result of the segregated nature of some tracks. What was once thought

to be desirable in terms of reducing pedestrian/motorist interaction is now known to present difficulties in terms of personal security. Examples include poorly lit underpasses or subways and routes through open spaces that do not receive natural surveillance from surrounding developments.

2.5.17 Some of Harlow's pedestrian and cycle network requires reassessment to ensure safe and direct linkage between the town centre and its hinterland. Missing links need to be provided and more emphasis placed on improving road crossing facilities for all users, particularly the mobility impaired.

Town Centre Parking

2.5.18 Originally designed for the motorcar, it is not surprising that car parking is plentiful in Harlow, with around 3800 publicly available parking spaces in and around the town centre. However, there is evidence to suggest that there is an over supply of public parking space in the town which has resulted in 'pricing wars' between car park operators, forcing long-stay charges down to as little as £2.50/day.

2.5.19 **The availability of cheap and plentiful car parking (particularly long stay) in town centres runs totally contrary to current policy embodied in documents such as PPG13 and PPG6. Future parking provision is a significant issue for Harlow and the right balance will need to be struck between meeting the needs of regeneration and encouraging more sustainable travel patterns, especially within the new development areas.**

2.5.20 The situation is exacerbated by the large additional amount of private non-residential parking that is associated with most of the employment sites around the town.

2.6 Opportunities

2.6.1 The scale of development proposed for Harlow and the surrounding area could bring forward significant opportunities to improve the local transport networks. In fact, given the congestion levels measured on A414 and in the north east quadrant, the likelihood is that major expansion of the town is unfeasible without major new transportation infrastructure.

2.6.2 In order to maximise any opportunities, land use and transport planning need to be brought together in an integrated way, such that:

- the overall amount of travel is kept to a minimum;
- there is less reliance on the private car and more opportunity to use sustainable modes of travel;
- the area is made more accessible for all members of the community; and
- the transport system supports the regeneration of the town and helps tackle problems of social deprivation.

2.6.3 Part of the way forward will almost certainly involve tackling local transport issues such as car parking supply and the charging regime, the quality and coverage of local bus services and improving facilities for pedestrians and cyclists. However, with the population set to increase by around 50%, such measures alone will be insufficient to deal with the arising transport issues.

2.6.4 Ways need to be explored to take traffic (particularly through traffic) out of the town centre. Relief routes to the north and/or south-west of Harlow have been

considered in the past but have not been taken forward to implementation for a variety of reasons. The expansion proposals offer a new opportunity to revisit the role these or similar routes might play in terms of serving the new development areas, providing strategic highway connections and improving traffic conditions in the town centre.

2.6.5 At the same time, the role that public transport plays in Harlow needs to be revisited. Development on the scale proposed offers the potential for a step change in the public transport offer. Improvements should be focussed not only on linking the development areas to the town centre but also on connecting Harlow to areas south and east of the District that are not well served by existing public transport.

2.6.6 The potential for creating improved accessibility to the London Underground network at Epping via a new public transport corridor should be fully explored, particularly if major development is also to be brought forward at North Weald.

3 Planning Scenarios and Model Runs

3.1 Overview

3.1.1 Options for housing and employment growth in Harlow are being considered from a number of perspectives including:

- Regeneration needs;
- Environmental constraints;
- Master planning principles;
- Transportation requirements;
- Political aspirations.

3.1.2 During late summer/ autumn 2004 the various analyses undertaken by the consultant team (see paragraph 1.3.2) were brought together with the outputs from a number of stakeholder working groups. The aim being to refine a range of planning options into one or more growth scenarios that are considered to have the strongest potential to deliver an appropriate level of growth for Harlow. Outputs from the transport research analysis helped to inform and define this process.

3.2 Background to the Transport Study

3.2.1 At an early stage in the transport study (spring 2004) it was necessary to form a preliminary view on the type of planning scenarios that might emerge later in the year, in order to develop the inputs for the transport model.

3.2.2 Without wishing to prejudice the results of parallel studies, a decision was taken by the project Steering Group to focus the modelling work around two planning scenarios defined by the Group. Each scenario included the same quantum of development but the spatial distribution of the development varied significantly; Planning Scenario 1 was based around a north-south axis of growth whilst Planning Scenario 2 was based around an east-west axis.

3.2.3 Integration between land-use and transport planning was an important consideration in the selection of the planning scenarios; both potentially being consistent with the development of a new public transport corridor, Scenario 1 likely to be consistent with a northern relief route and Scenario 2 likely to be consistent with a southern relief route.

3.2.4 It was recognised by the Steering Group that the quantum and distribution of development might change in due course but acknowledged that this could be dealt with through further model development and additional model runs. In fact the East of England Plan (RSS14), published for consultation in November 2004, includes proposals that are different from both assumptions for this study but which are most similar to Planning Scenario 1.

3.2.5 The two planning scenarios thus sit at the heart of the detailed modelling work. The Harlow TRAM was developed and has been used to assess the effects of a range of different transport schemes linked to each of the planning scenarios.

3.2.6 This Chapter of the Final Report presents the detail of the two planning scenarios, identifies the transport schemes and summarises the tests undertaken with the Harlow TRAM.

3.3 Planning Scenarios

3.3.1 Both planning scenarios were based around the construction of 19000 new housing units over and above existing Local Plan commitments by the year 2021. This was the level of housing anticipated in the 'banked' draft of RSS14 (February 2004). Within this figure a level of new development was also assumed at the North Weald airfield site in each scenario. In both cases a complementary level of new employment was envisaged such that the total supply of jobs in the Harlow Urban Area and the new development areas including North Weald was 61650 by 2021.

3.3.2 The two planning scenarios are summarised in Figures 3.1 and 3.2 below.

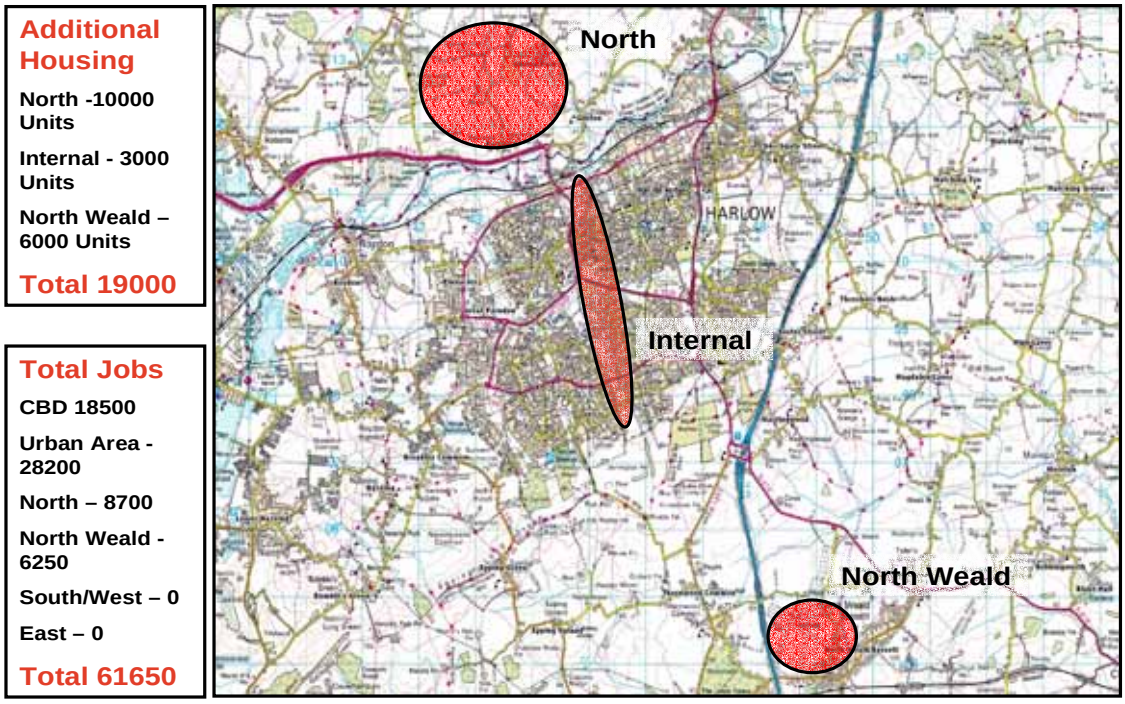


Figure 3.1: Planning Scenario 1 North-South Axis

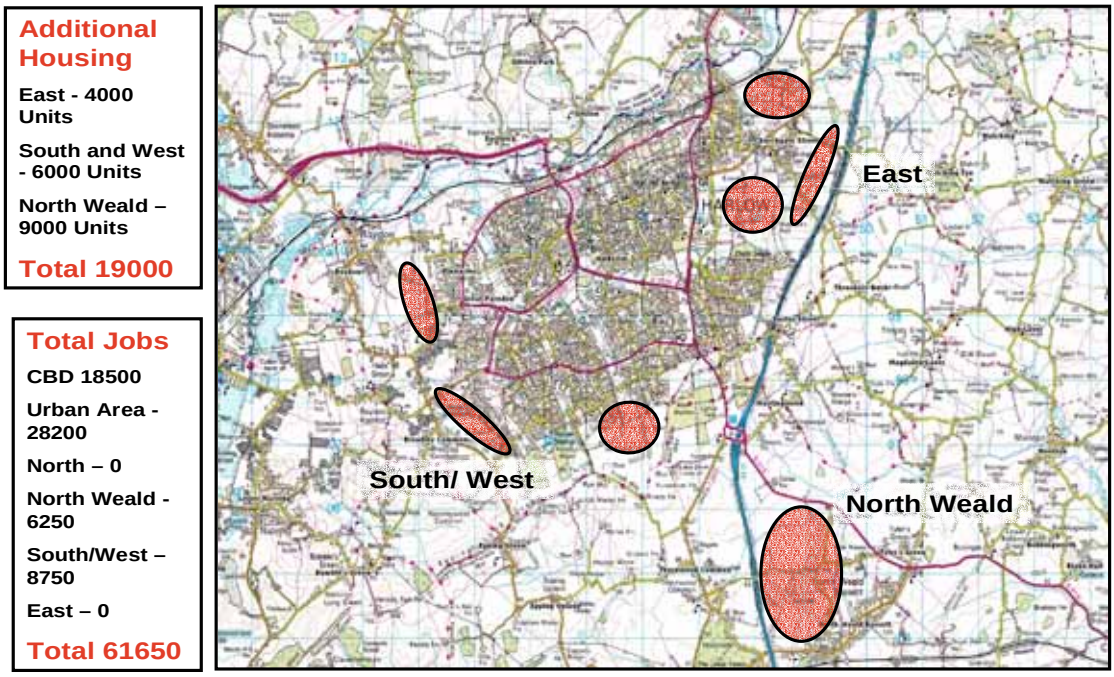


Figure 3.2: Planning Scenario 2 East-West Axis

3.3.3 A Planning Scenario 0 was also devised to provide a reference case to assist with the investigation of impacts and economic analysis of the other two planning scenarios. It assumes only 'background' growth effects, that is, growth without the 19,000 housing units and associated employment developments assumed in the two planning scenarios. This Planning Scenario 0 growth is consistent in terms of the amount and geographical distribution with the background growth included within Planning Scenarios 1 and 2.

3.3.4 Specifically, it assumes a further 1100 housing units are built by 2011 with none built thereafter, and that there are 1500 additional employment places by 2011, 3700 by 2016 and 7400 by 2021.

3.4 Transport Schemes

3.4.1 Three transport schemes were developed and agreed with the Steering Group in outline and tested using the Harlow TRAM:

- High Quality Public Transport Corridor (scheme codes 3A and 3B);
- Northern Relief Route; and
- Southern Relief Route.

High Quality Public Transport Corridor

3.4.2 Broadly following a north-south alignment through the area, the High Quality Public Transport corridor would provide a new link from Harlow town centre to Epping via the new development site at North Weald. Interchange opportunities would be available with the Central Line at Epping, inter-urban coach services at M11 Junction 7, local bus services at Harlow bus station and heavy rail services at Harlow Town railway station. The preliminary alignment of the route through the Harlow Urban Area is such that it passes through some of the Wards with the

highest levels of social deprivation, thus creating improved access from these areas to jobs and services. The route would be extended northwards into the northern development area under Planning Scenario 1. It is illustrated on the Figure 3.3 below.

3.4.3 Within the Harlow TRAM, parameters that the define speed, quality and fare structure for the High Quality Public Transport system have been set to be consistent with a **kerb guided bus-based system.** In addition the frequency of services was assumed to be 10 minutes along the length of the scheme. The system is assumed to include approximately ten stops in each direction at key locations within the development areas, Harlow Town Centre and at the bus and railway stations.

3.4.4 Associated bus services for the new development areas were also assumed to be provided but at a lower frequency of 15 minutes and not in competition with the new High Quality PT Scheme. In contrast, existing bus services in the Harlow Urban Area were left unchanged even if in competition (as this is the likely outcome with the present bus industry regulatory system).

3.4.5 As is shown in Figure 3.3, the scheme also includes a Park and Ride facility located at Junction 7. It is assumed to have a capacity of 1000 car park spaces, which is a minimum level of provision for a facility served by a high frequency service. The catchment area of the Park and Ride has to be defined in advance for modelling and was specified to cover origins in the east and south of Harlow (including the North Weald development area). The destinations were defined to be the Harlow Urban Area and the other new development areas. Use of the facility by Harlow residents to travel to Epping and beyond (to the south) was not included in the assumptions at this stage. Also not included at this stage was any possible use of the facility by coach-based park and ride services on the M11 into London.

3.4.6 This level of specification is appropriate at this stage of scheme development but further investigations of route options, technology and service patterns would require more detailed analysis and modelling of Harlow's public transport system.

3.4.7 Depending on the planning scenario, the length of the scheme ranges between 14 and 16km and is estimated to cost between £95m and £164m.

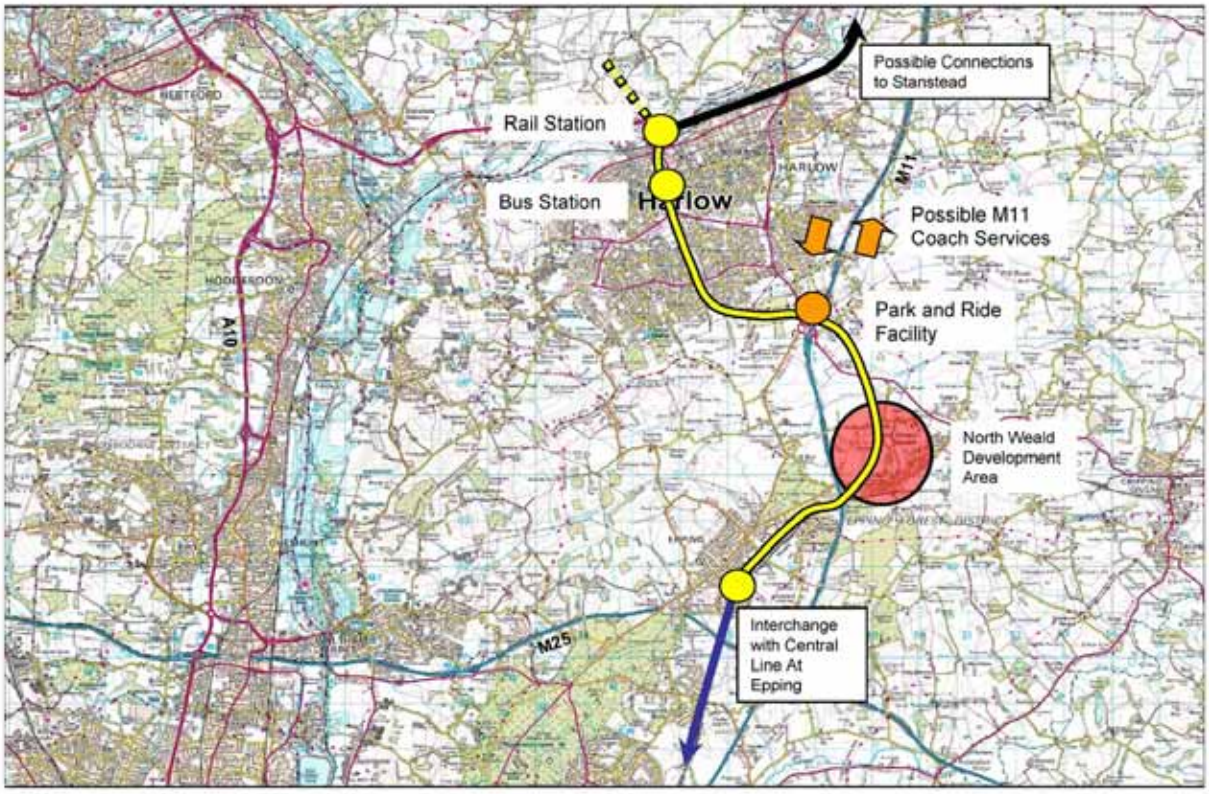


Figure 3.3: High Quality Public Transport Corridor

Relief Routes

3.4.8 The introduction of a new highway link (or links) could potentially create a number of benefits that include:

- facilitating access to the new development areas;
- providing relief to Harlow Urban Area from removal of through-Harlow traffic; and
- providing new routes for public transport.

3.4.9 Two possible relief routes have been assessed; a northern route and a southern route. In each case a number of possible alignment options have been considered. At this stage, the alignments are only broadly defined – more detailed design work would be needed to identify the optimum alignment for any option taken forward.

3.4.10 Preliminary cost estimates have been prepared for each route option with consideration to the engineering complexity of each scheme; in particular, the need for structures to bridge the River Stort flood plain and the West Anglia main line. These can be found in Appendix C.

Northern Relief Route Options

3.4.11 The alignments considered for a northern relief route are depicted on Figure 3.4 opposite and consist of:

- a route **south** of Sawbridgeworth;
- a route **north** of Sawbridgeworth; and
- a Sawbridgeworth **Bypass**.

3.4.12 The Harlow TRAM has been used to assess these options, which are described overleaf using illustrations based on more recent work in collaboration with consultants on parallel projects.

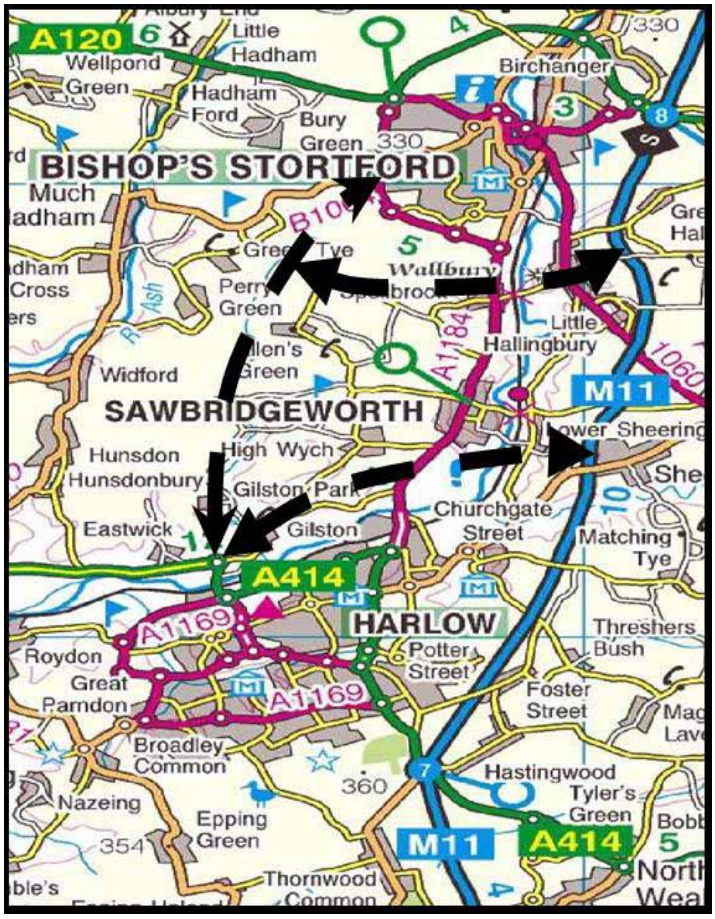


Figure 3.4: Northern Relief Route Options

Northern Relief Route South of Sawbridgeworth (Scheme Code 1A):

3.4.13 A new link road between the A414 (Fifth Avenue junction) and the M11 that follows an alignment south of Sawbridgeworth. This option includes the provision of a new junction with the A1184 and a new motorway junction.

3.4.14 The road would be 6.6km long, of D2AP standard and is estimated to cost £138m-£199m.

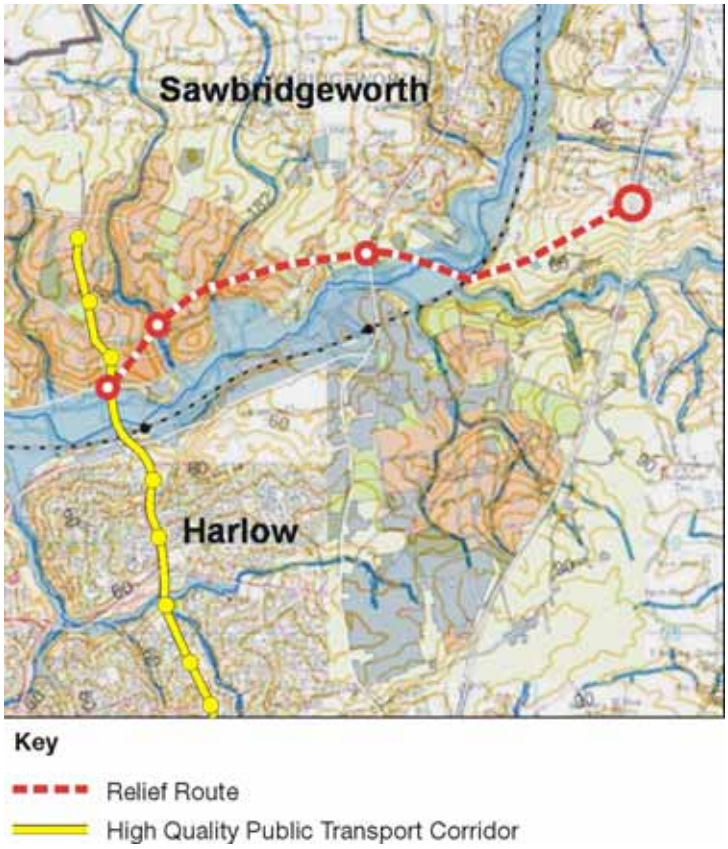


Figure 3.5: Northern Relief Route South of Sawbridgeworth

Northern Relief Route North of Sawbridgeworth (Scheme Code 1C):

3.4.15 A new link road between the A414 (Fifth Avenue junction) and the M11 that follows an alignment north of Sawbridgeworth. This option includes the provision of a new junction with the A1184, minor junctions for the new development and a new motorway junction.

3.4.16 The road would be 10.1km long, D2AP standard and is estimated to cost £183m - £263m.

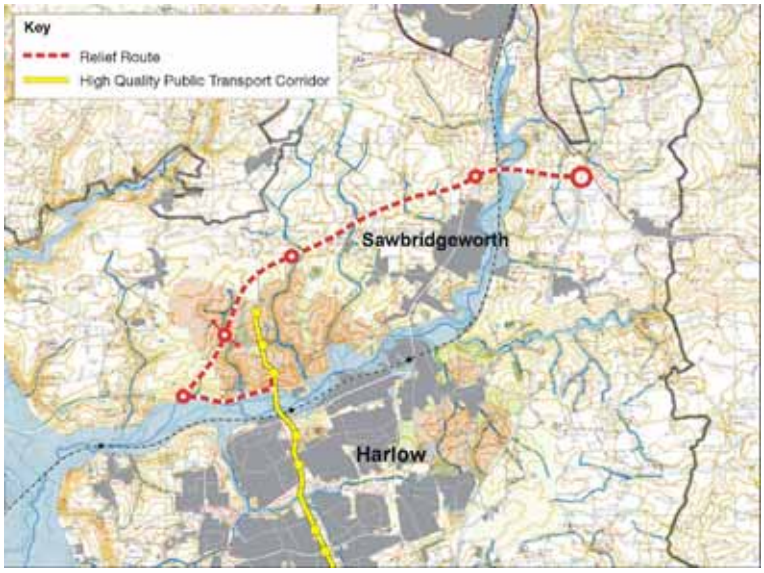


Figure 3.6: Northern Relief Route North of Sawbridgeworth

Sawbridgeworth Bypass (Scheme Code 1B):

3.4.17 A new link road between the A414 and the A1060 (Bishop Stortford Bypass) that follows an alignment to the west of Sawbridgeworth with no intermediate junction other than for access to the new development areas and for minor roads.

3.4.18 The road would be 11.3km long, of D2AP standard and is estimated to cost £200m-£287m including an up-grade to the A120 Bishop Stortford bypass.

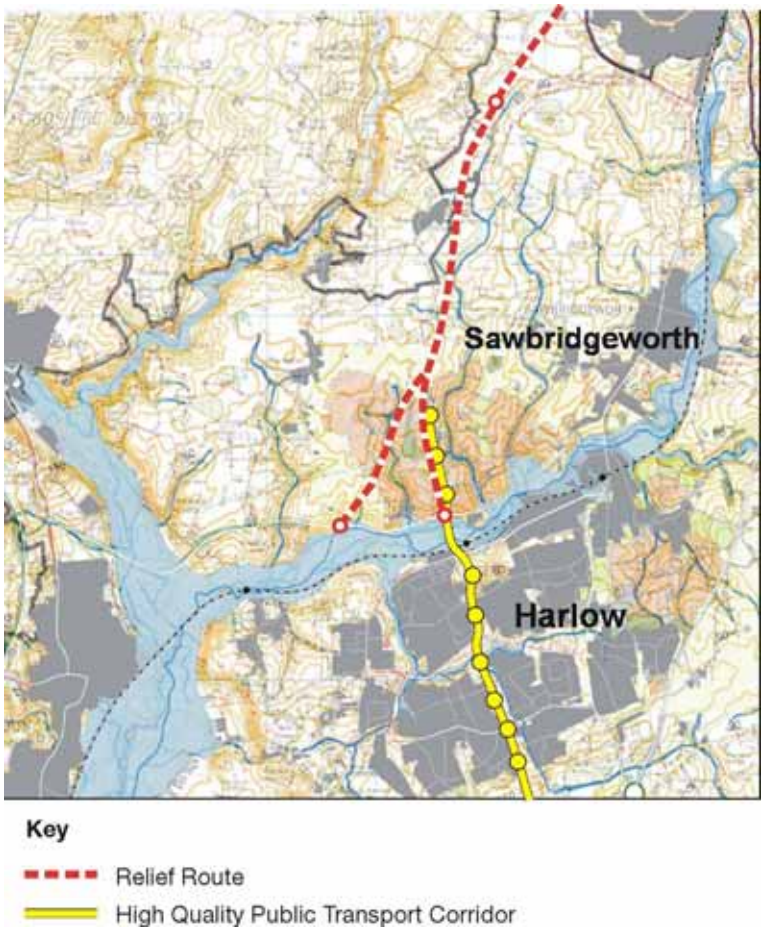


Figure 3.7: Sawbridgeworth Bypass

Southern Relief Route Options

3.4.19 The options for a southern relief route are depicted opposite and consist of routes from M11 junction 7 south and west of Harlow, one either side of the village of Roydon.

3.4.20 **Initial appraisal of the options resulted in the rejection of the option to the west of Roydon prior to TRAM testing on environmental considerations. The adjustment of the rate was such that it crossed the Lea Valley Park, together with an extensive area of the River Stort flood plain at its northern end. This was considered to be unacceptable.**

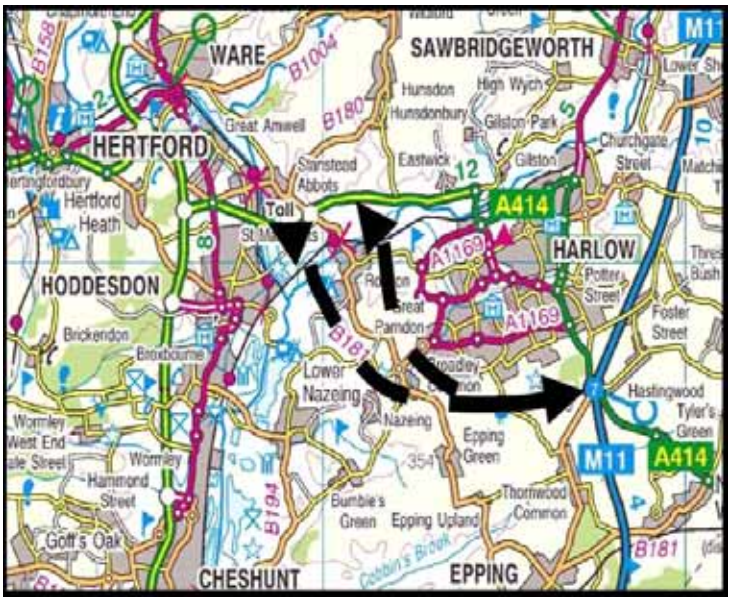


Figure 3.8: Southern Relief Route Options

3.4.21 The TRAM model has been used to assess the following options.

Full Southern Relief Route (Scheme Code 2C):

3.4.22 A new link road between the A414 and Junction 7 of the M11 that follows an alignment to the south west of the Harlow Urban Area, but east of Roydon with 3 intermediate junctions. The road would be 10.2km long, of D2AP standard and is estimated to cost £179m-£258m.

Partial Southern Relief Route (Scheme Code 2B)

3.4.23 The partial route is a link between M11 Junction 7 and Tylers Cross: A new link road as in the full scheme, beginning at Junction 7 but only continuing to Tylers Cross junction on the B181, bypassing the south-western periphery of Harlow. The road would be 5km long, of D2AP standard and is estimated to cost £85m-£122m.

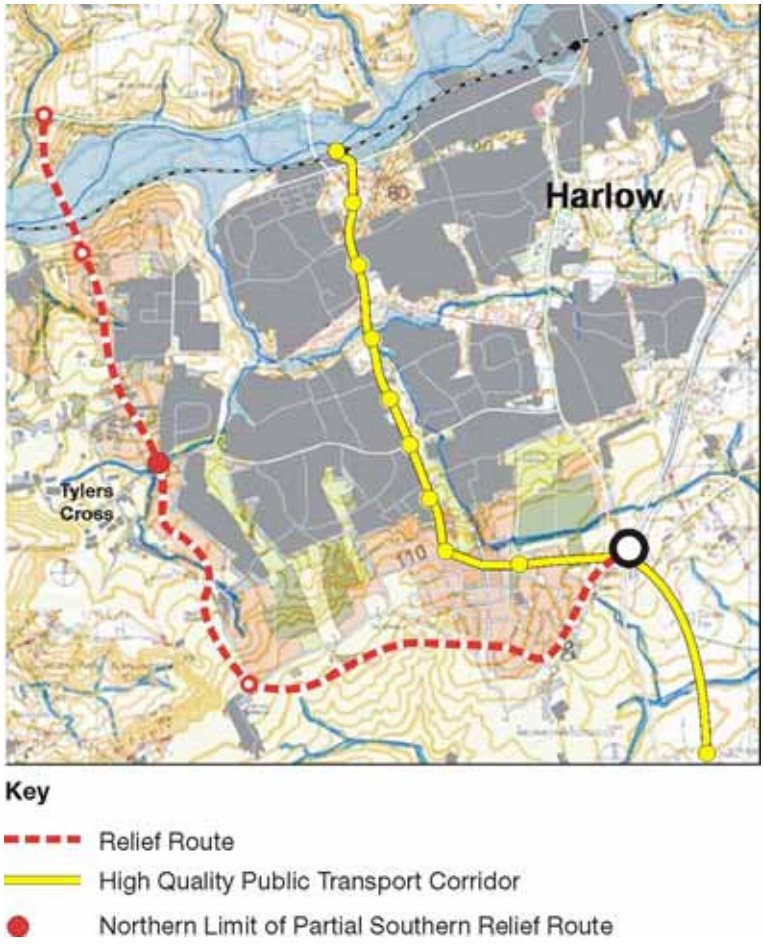


Figure 3.9: Full Southern Relief Route

M11 Junction 7

3.4.24 Common to all highway schemes tested is an improvement to Junction 7 of the M11 that has sufficient capacity to alleviate current and forecast peak period congestion on the approaches and on the sections of the roundabout.

3.5 Primary Model Runs

3.5.1 The Harlow TRAM has been used extensively to test the above transport schemes against the relevant planning scenarios both in isolation and in combination. Model runs have been undertaken for the following years:

- 2011, 2016, 2021

3.5.2 The table below summaries the primary model runs. In all, over a hundred runs have been completed, although some runs have been undertaken for internal purposes only to ensure the quality of the results and to assist in the development of the economic appraisal.

Table 3.1 Summary of Key Schemes Tested

Scheme Code	Scheme Description	Scheme Code	Scheme Description

Scheme Code	Scheme Description	Scheme Code	Scheme Description
		1A + 3A	Northern Relief Road (South of Sawbridgeworth)+ PT Scheme (HT Stn - Epping)
	Planning Scenario 1		
1A	Northern Relief Route (South of Sawbridgeworth + Junction 7 Improvement)	1B + 3A	Sawbridgeworth Bypass + PT Scheme (HT Station – Epping)
1B	Sawbridgeworth Bypass & Junction 7 Improvement	1C + 3A	Northern Relief Road (North of Sawbridgeworth) + PT Scheme (HT Stn - Epping)
1C	Northern Relief Route (North of Sawbridgeworth + Junction 7 Improvement	2B + 3A	Southern Relief Road (Partial) + PT Scheme (HT Station – Epping)
2B	Partial Southern Relief Route, Junction 7 to Tylers Cross	2C + 3A	Southern Relief Road (Full) + PT Scheme (HT Station – Epping)
2C	Full Southern Relief Route	DM	Do Minimum (2003 network)
3B	High Quality PT Scheme (Nth Epping)		**Planning Scenario 0 (Prepared for MVA Use)**
1A+1B	Northern Relief Route (South of Sawbridgeworth + Junction 7 Improvement)	1A	Northern Relief Road (South of Sawbridgeworth)
1B+3B	Sawbridgeworth Bypass & Junction 7 Improvement	1B	Sawbridgeworth Bypass
1C + 3B	Northern Relief Route (North of Sawbridgeworth + Junction 7 Improvement	1C	Northern Relief Route (North of Sawbridgeworth)
2B + 3B	Southern Relief Route, Junction 7 to Tylers Cross	2B	Southern Relief Route (Partial)
2C + 3B	Full Southern Relief Route	2C	Southern Relief Route (Full)
DM	Do Minimum (1003 network)	3A	PT Scheme (HT Station – Epping)
	Planning Scenario 2	3B	PT Scheme (Northern – Epping)
1A	Northern Relief Route (South of Sawbridgeworth)	1A + 3B	Northern Relief Road (South of Sawbridgeworth) + PT Scheme (HT Station - Epping)
1B	Sawbridgeworth Bypass	1B + 3B	Sawbridgeworth Bypass + PT Scheme (HT Station – Epping)
1C	Northern Relief Route (North of Sawbridgeworth)	1C + 3B	Northern Relief Road (North of Sawbridgeworth) + PT Scheme (HT Station - Epping)
2B	Southern Relief Road (Partial)	2B + 3A	Southern Relief Road (Partial) + PT Scheme (HT Station - Epping)
2C	Southern Relief Road (Full)	2C + 3A	Southern Relief Road (Full) + PT Scheme (HT Station - Epping)
3A	PT Scheme (HT Station – Epping)	DM	Do Minimum (2003 network)

Note: All schemes tested except DM include capacity improvement at Junction 7 of the M11

Table 3.2: Summary of Schemes Reported

Scenario	Road Schemes	Variants	PT Schemes
Planning Scenario 1	Northern Relief Road	South of Sawbridgeworth	High Quality Public Transport Scheme
		North of Sawbridgeworth	Epping to Northern Development Area
		Sawbridgeworth Bypass	
	M11, J7 Improvement		M11, J7 Park & Ride Facility
Planning Scenario 2	Southern Relief Road	Full Route A414 to M11	High Quality Public Transport Scheme
		Partial Route Tylers Cross to M11	Epping to Harlow Town Rail Station
	M11, J7 Improvement		M11,J7 Park & Ride Facility

3.6 Local Transport Measures

3.6.1 The primary purpose of the Harlow TRAM is to test the relative merits of major highway and public transport proposals. For consistency, it has been assumed that there are no changes to the local transport networks during the Plan period other than the construction of new accesses to the development sites. In the Harlow Urban Area, it is assumed that the existing parking supply and charging regime will remain unchanged whilst for the development areas parking will be provided at a level that is consistent with demand.

3.7 Model Development, Calibration and Validation

3.7.1 Detailed technical papers covering the above can be found in Appendix B to this report.

4 Model Results

4.1 Introduction

4.1.1 This Chapter of the report presents the results of the scheme tests described and defined in Chapter 3 and undertaken with the Harlow TRAM. Key outputs from the model are summarised in a series of tables, charts and diagrams. In each case the results are reported for future years 2011, 2016 and 2021 and where appropriate a 2003 figure is included as a base year comparator.

4.1.2 For ease of reference, a street plan of Harlow is included at the end of this Chapter (Figure 4.16) that shows the locations of the cepated model link flows summarised in the following Tables.

4.2 Trips generated and attracted by development areas

4.2.1 Table 4.1 shows the total number of person trips per day by car or public transport originating and/or destinating in the development areas in each of the modelled years.

Table 4.1 Total Daily Person Trips Generated By Development Areas (All modes except walk and cycle)

	Planning Scenario 1			Planning Scenario 2		
Location	**2011**	**2016**	**2021**	**2011**	**2016**	**2021**
Northern Development Area	35100	62700	87100	-	-	-
Central Development Area	5900	11500	17600	-	-	-
Eastern Development Area	-	-	-	9500	17100	24100
South-Western Development Area	-	-	-	23400	39100	54400
North Weald Development Area	24000	35500	43900	27300	49200	68100
TOTAL:	65000	109700	148600	60200	105400	146600

4.2.2 Both scenarios generate the same level of trip-making (including walk and cycle trips) as they both provide the same level of new households and jobs. However, the overall number of car vehicle and public transport trips in Scenario 1 is marginally higher than in Scenario 2 as the latter has more and smaller sites that are close to existing developments and local networks, generating slightly more walk and cycle trips.

Loadings onto the network

4.2.3 Larger differences are evident between the scenarios in the volume of car vehicle and public transport person trips that are 'loaded' onto the main transport networks. Due to the larger number of development sites in PS2, each connecting the networks, this scenario loads between 15% and 12% (depending on the year) more car vehicle trips on to the network compared with PS1. Conversely, apart from 2011, PS1 generates and loads more person trips onto public transport network.

4.2.4 Tables 4.2 to 4.5 show the number of daily car vehicle and public transport person trips loaded onto the network by developments area and for each of the highway scheme options. Note that the public transport trips in these tables cover the whole network.

Table 4.2 New Highway Trips Loading Onto Network: Planning Scenario 1

Daily Vehicle Movements Assuming High Quality PT In Place

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Development Area	23500	23500	23400	40700	40500	40400	54900	54700	54400
Central Development Area	4800	4900	4800	9700	9600	9600	14900	14700	14600
North Weald Development Area	14900	14900	14800	26900	26900	26800	35700	35700	35700
Total	43200	43300	43000	77300	77000	76800	105400	105100	104700

Table 4.3 New Public Transport Trips Loading Onto Network: Planning Scenario 1

Daily Person Movements Assuming High Quality PT In Place

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Development Area	4600	4700	4700	10200	10300	10300	15700	15700	15700
Central Development Area	1000	1800	2700	1000	1700	2600	1000	1700	2600
North Weald Development Area	4300	4300	4300	8500	8500	8500	13100	13100	13100
Total	9900	10800	11700	19700	19700	20500	21400	29800	30500

Table 4.4 New Highway Trips Loading Onto Network Planning: Scenario 2

Daily Vehicle Movements Assuming High Quality PT In Place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
Eastern Development Area	8500	8500	15400	15400	21800	21800
South-Western Development Area	20200	19800	34000	33300	46100	45300
North Weald Development Area	21000	20900	37400	37300	50700	50500
Total	49700	49200	86800	86000	118600	117600

Table 4.5 New Public Transport Trips Loading Onto Network: Planning Scenario 2

Daily Person Movements Assuming High Quality PT In Place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
Eastern Development Area	1000	1000	1700	1700	2300	2300
South-Western Development Area	3200	3100	5800	5800	8300	8200
North Weald Development Area	6400	6400	12000	12000	17700	17700
Total	10600	10500	19500	19500	28300	28200

4.2.5 The tables also introduce the differences for each of the highway scheme options described in Chapter 3. For PS1, the South of Sawbridgeworth route shows marginally higher car vehicle trips and lower public transport person trips loaded onto the main network than the other two Northern Relief Route options. For PS2 there is a similar result for the Full Southern Route option compared with the shorter Tylers Cross link option.

4.2.6 The distribution of trips (both highway and public transport) across a broad sector system is provided in Appendix ….. for each time period and Planning Scenario.

4.3 Mode Share

4.3.1 Tables 4.6 and 4.7 show the percentage mode share of person trips originating or destinating in the development areas for each modelled year.

4.3.2 The results show clearly the impact of providing the High Quality Public Transport scheme in terms of attracting users to public transport and the share increases over time with more development and increased congestion.

4.3.3 The Northern and North Weald areas both have larger PT mode shares, reflecting the direct access to both housing and employment by the high quality transport scheme at both these sites.

4.3.4 The lower PT mode share for the south-western development area reflects that fact that only its eastern-most extreme, furthest from the commercial development in this area, is accessible by the new PT route, while the Eastern development area is completely remote from the new PT route and consequently has an even lower mode share.

4.3.5 Overall, a higher public transport mode share is achieved in Scenario 1, making it more consistent with a policy of supporting sustainable public transport.

Table 4.6 Public Transport Mode Share of Development Trips: Planning Scenario 1 Assuming High Quality PT in place

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Development Area	13%	13%	13%	16%	16%	16%	18%	18%	18%
North Weald Development Area	18%	18%	18%	19%	19%	19%	22%	22%	22%
Overall	15%	16%	17%	17%	17%	18%	18%	19%	19%

Note: Central Development Area figures are not shown as they are spread across the existing Harlow Urban Area, although they are included in the Overall figures.

Table 4.7 Public Transport Mode Share of Development Trips: Planning Scenario 2 Assuming High Quality PT in place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
Eastern Development Area	8%	8%	8%	8%	7%	7%
South-Western Development Area	11%	10%	12%	11%	12%	12%
North Weald Development Area	19%	19%	19%	19%	21%	21%
Overall	14%	14%	15%	14%	15%	15%

4.4 Traffic Flows on Strategic Links

Planning Scenario 1

4.4.1 Tables 4.8 and 4.9 show the forecast volume of traffic using each of the Northern Relief Route variants and other key strategic links under Planning Scenario 1 for the AM and PM peak periods respectively.

Table 4.8 Total Traffic Flows on Strategic Links: AM Peak Hour

Planning Scenario 1 Assuming High Quality PT in place, Vehicles 2 way

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Relief Route Western Section	2200	1500	–	3400	2300	–	4500	3100	–
Northern Relief Route Eastern Section	2000	1400	–	3000	1900	–	3600	2600	–
Sawbridgeworth Bypass	–	–	1100	–	–	1500	–	–	1800
M11 J7/7a to 8	7900	7500	6700	8900	8300	7300	9500	9200	7900
M11 J7 to J7a (6200)	7200	7100	6700	8400	7900	7300	9600	8800	7900
M11 South of J7 (8000)	8900	8900	8900	9700	9800	9800	10300	10300	10400
A414 East of J7 (1000)	2300	2300	2200	3300	3300	3200	3700	3700	3600
B1393 South of J7 (1300)	1500	1500	1400	1700	1600	1500	1900	1700	1600
A1184 Harlow Mill (1000)	500	700	1000	900	800	1100	1000	900	1200
A1184 Sawbridgeworth (1000)	1200	700	1000	1400	800	1100	1900	900	1200
A414 E of N Weald (1000)	1300	1300	1300	1500	1500	1500	1900	1800	1700
A414 W of N Dev'mt (2000)	3800	3700	3600	4100	4000	3800	6200	6000	5800

Note: Northern Relief Route split into to two sections either side of the A1184 junction
2003 Base Year flows are shown in brackets. These are modelled flows rather than actual counts and may therefore differ from those shown in Chapter 2.
No M11 J7a with Sawbridgeworth Bypass therefore figures same for both links.

Table 4.9 Total Traffic Flows on Strategic Links: PM Peak Hour

Planning Scenario 1 Assuming High Quality PT in place, Vehicles 2 way

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Relief Route Western Section	2200	1600	–	3400	2100	–	4600	2900	–
Northern Relief Route Eastern Section	2100	1500	–	3100	1900	–	3800	2400	–
Sawbridgeworth Bypass			1100			1500			1900
M11 J7/7a to J8	7800	7300	6400	8600	7900	6900	9300	8800	7600
M11 J7 to J7a (5800)	7100	6900	6400	8200	7400	6900	9200	8200	7600
M11 South of J7 (7600)	8900	8900	8800	9600	9700	9600	10300	10400	10400
A414 East of J7 (900)	2200	2200	2200	3200	3100	3100	3700	3700	3600
B1393 South of J7 (1200)	1500	1500	1400	1600	1600	1500	1800	1700	1600
A1184 Harlow Mill (1000)	500	600	1100	800	700	1100	1000	900	1200
A1184 Sawbridgeworth (1000)	1200	600	700	1400	700	1100	1700	900	1200
A414 E of N Weald (900)	1300	1200	1200	1500	1500	1400	1900	1700	1700
A414 W of N Dev'mt (1500)	3700	3500	3400	4900	4600	4300	6000	5800	5400

Note: Northern Relief Route split into to two sections either side of the A1184 junction
2003 Base Year flows are shown in brackets
No M11 J7a with Sawbridgeworth Bypass, therefore figures same for both links.

Northern Relief Route Variants

4.4.2 The two variants on the Northern Relief Route both attract significant volumes of traffic, although both are comfortably within the design capacity of the dual carriageway roads (3000 pcu per hour per direction). For both scheme variants, the western section carries more traffic than the eastern.

4.4.3 However, the South of Sawbridgeworth alignment attracts around 50% more traffic than the scheme North of Sawbridgeworth, as the former provides a more attractive alternative to the existing A414 for through-Harlow traffic, and provides the northern development area with more direct access to the M11 South. A consequence of this is the higher traffic volumes on the section of the M11 between Junctions 7 and 7A (ie north of J7). This section, in combination with the Northern Relief Route, forms an alternative route to the A414 around Harlow. As will be seen in the next section, it therefore offers greater congestion reduction benefits for Harlow.

4.4.4 The North of Sawbridgeworth alignment is much less effective at performing this role, as a result of the longer journey times involved. However it is more effective as a relief route for the A1184, taking a greater share of trips travelling north from Harlow.

Sawbridgeworth Bypass

4.4.5 Flows on the Sawbridgeworth Bypass are much lower than for the two Northern Relief Routes variants, reflecting that it only acts as a relief route to the A1184 and provides little relief for traffic within or through Harlow.

4.4.6 The volumes attracted to the route would probably only justify construction of a single carriageway road.

Proportion of Development Related Traffic

4.4.7 The proportion of development-related traffic was calculated using a test of Planning Scenario 0 with the appropriate schemes, subtracted from the Planning Scenario 1 also with the relevant scheme, i.e. a with and without new development comparison.

4.4.8 Tables 4.10 and 4.11 show the approximate share of traffic on each of the Northern Relief Route and Sawbridgeworth Bypass variants that can be related to development traffic in the am and pm peak periods respectively.

4.4.9 It can be seen that by 2021, over half the traffic on all of the scheme variants is development-related. It would be questionable as to whether any of these schemes could be justified without a significant amount of the assumed planning scenario developments.

4.4.10 The high proportions for the A414 East of J7 relate to the section nearest the North Weald development area.

Table 4.10 Proportions of Development Traffic on Strategic Links: AM Peak Hour Planning Scenario 1 Assuming High Quality PT in place, Vehicles 2 way

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Relief Route Western Section	36%	31%	-	54%	49%	-	58%	56%	-
Northern Relief Route Eastern Section	38%	20%	-	56%	38%	-	60%	53%	-
Sawbridgeworth Bypass	-	-	38%	-	-	51%	-	-	54%
M11 J7/7a to J8	8%	5%	4%	13%	11%	7%	12%	12%	7%
M11 J7 to J7a	8%	4%	4%	16%	6%	7%	20%	7%	7%
M11 South of J7	8%	8%	7%	12%	12%	12%	13%	13%	13%

A414 East of J7	53%	51%	52%	66%	63%	63%	67%	65%	64%
B1393 South of J7	5%	2%	3%	10%	2%	3%	16%	9%	9%
A1184 Harlow Mill	19%	11%	6%	42%	10%	%6	43%	12%	4%
Sawbridgeworth	14%	4%	2%	29%	5%	5%	68%	7%	7%
A414 E of N Weald	15%	15%	15%	27%	27%	26%	37%	36%	36%
A414 W of N Development	32%	35%	36%	34%	41%	32%	53%	54%	55%

Note: Northern Relief Route split into to two sections either side of the A1184 junction.
No M11 J7a with Sawbridgeworth Bypass, therefore figures same for both links.

Table 4.11 Proportions of Development Traffic on Strategic Links: PM Peak Hour Planning Scenario 1 Assuming High Quality PT in place, Vehicles 2 way

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
Northern Relief Route Western Section	36%	31%	–	54%	49%	–	60%	56%	–
Northern Relief Route Eastern Section	37%	20%	–	55%	38%	–	59%	53%	–
Sawbridgeworth Bypass	–	–	38%	–	–	47%	–	-	51%
M11 J7/7a to J8	8%	6%	3%	12%	8%	4%	13%	13%	8%
M11 J7 to J7a	7%	3%	3%	14%	4%	4%	19%	8%	8%
M11 South of J7	8%	8%	8%	12%	12%	11%	14%	15%	15%
A414 East of J7	53%	51%	51%	66%	64%	64%	68%	66%	66%
B1393 South of J7	5%	5%	4%	9%	6%	6%	10%	0	0
A1184 Harlow Mill	19%	16%	4%	32%	12%	7%	43%	18%	4%
Sawbridgeworth	12%	13%	5%	36%	5%	4%	68%	7%	8%
A414 E of N. Weald	18%	17%	13%	33%	32%	31%	40%	38%	37%
A414 W of N Development	24%	34%	35%	36%	41%	40%	53%	56%	55%

Note: Northern Relief Route split into to two sections either side of the A1184 junction

M11 Motorway

4.4.11 Three sections of the M11 have been included in Tables 4.8 – 4.11: North of J7a, North of J7 and South of J7 (NB: Junction 7a is not part of the Sawbridgeworth Bypass scheme). The future year flows on these sections are made up of the following elements:

- continued use by "base year" trips plus any re-routing to the M11 as other current routes become more congested and capacity constrained in the future;
- additional trips due to improved (national) economic performance, continued reductions in household size in Harlow and in the region, and increased car ownership;
- trips related to new development (housing and employment) in the wider region;
- trips related to the new Harlow Growth Options development

4.4.12 Consequently, the development areas of the Harlow Growth Options only account for part of the overall increase in M11 traffic.

4.4.13 Development traffic proportions on the M11 (Tables 4.10 & 4.11) are modest and are at their highest with the South of Sawbridgeworth scheme; for the reasons described above. Even at these levels, the increases would represent only around 1% pa growth. In addition, if the RPG development proposals are fulfilled somewhere else along the M11 corridor, then it is possible that these levels of extra movements would still be expected on these sections of the motorway.

Planning Scenario 2

4.4.14 Table 4.12 and 4.13 show the forecast volume of traffic using each of the Southern Relief Route variants under Planning Scenario 2 for the AM and PM peak hours respectively.

Table 4.12 Total Traffic Flows on Strategic Links: AM Peak Hour

Planning Scenario 2 Assuming High Quality PT in place, Vehicles 2 way

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7 Only	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7 Only	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7 Only
Southern Relief Route Nr Junction 7	2700	1800	3400	2400	4000	3000
Southern Relief Route Tylers Cross	2800	1500	3900	2300	4900	3200
Southern Relief Route Eastwick Rd	3300	0	4200	0	5000	0
M11 North of J7 (6200)	7400	7300	8200	8200	9300	9200
M11 South of J7 (8000)	8600	8200	8900	8600	9300	8900
A414 East of J7 (1000)	3000	2900	3800	3700	4300	4300
B1393 East of J7 (1300)	1600	1500	1900	1900	2100	2100
A1184 Harlow Mill Station (1000)	1200	1300	1500	1500	1700	1700
A1184 Sawbridgeworth (1000)	1200	1300	1500	1500	1700	1700
A414 E of N Weald (1000)	1600	1500	1600	1500	1600	1700

A414 W of N Development (2000)	1500	2600	2000	3400	2500	3900

Note: 2003 Base Year flows are shown in brackets

Table 4.13 Total Traffic Flows on Strategic Links: PM Peak Hour

Planning Scenario 2 Assuming High Quality PT in place, Vehicles 2 way

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7 Only	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7 Only	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7 Only
Southern Relief Route Nr Junction 7	2900	1800	3600	2500	4100	3100
Southern Relief Route Tylers Cross	3100	1500	4000	2200	4900	3100
Southern Relief Route Eastwick Rd	3300	-	4100	-	4800	-
M11 North of J7 (5800)	7300	7200	8000	8000	8700	8800
M11 South of J7 (7600)	8800	8300	8900	8500	9000	8700
A414 East of J7 (900)	3000	2900	3900	3800	4200	4200
B1393 East of J7 (1200)	1600	1600	1800	1800	2200	2100
A1184 Harlow Mill Station (1000)	1300	1300	1500	1500	1800	1700
A1184 Sawbridgeworth (1000)	1300	1300	1500	1500	1800	1700
A414 E of N Weald (900)	1600	1500	1600	1600	1600	1800
A414 W of N Development (1500)	1400	2500	2000	3300	2500	3800

Note: 2003 Base Year flows are shown in brackets

4.4.15 Traffic volumes on the Full Southern Relief Route are significant and in line with those to be expected for a dual carriageway design capacity (3000pcu per direction per lane).

4.4.16 Not surprisingly, the complete route from Eastwick Road to J7 of the M11 attracts significantly more traffic than the shorter version of the route. By 2021, volumes on the Southern Relief Route are between 30 and 50% higher if the full route is built than if only the section between J7 and Tyler's Cross is provided. This indicates that through traffic forms a significant proportion of traffic using the route.

4.4.17 The busiest section of the full route is in fact the northern section, which provides an alternative access to Pinacles and Harlow Town Centre for traffic from the A414 West that avoids the congested Allende Avenue and Velizy Avenue.

4.4.18 The shorter Tyler's Cross option of the Southern Relief Route is effectively only an access road to the development areas, and does little for through traffic and less to relieve congestion in the Harlow Urban Area. The volume of traffic it is forecast to carry may not be sufficient to justify a dual carriageway.

4.4.19 This is emphasised by Tables 4.14 and 4.15 which show the proportion of development traffic on the strategic links during the peak hours (see paragraph

4.4.7 for an explanation of how this was calculated). Development-related traffic dominates on the shorter Tyler's Cross option of the route, and still makes up a significant proportion of the traffic on the Full Southern Relief Route option.

Table 4.14 Proportion of Development Traffic on Strategic Links: AM Peak Hour

Planning Scenario 2 Assuming High Quality PT in place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
Southern Relief Route Nr Junction 7	41%	54%	52%	65%	57%	71%
Southern Relief Route Tylers Cross	46%	61%	54%	73%	64%	79%
Southern Relief Route Eastwick Rd	32%	–	44%	–	49%	–
M11 North of J7	6%	8%	11%	14%	16%	17%
M11 South of J7	0%	0%	0%	1%	0%	0%
A414 East of J7	57%	60%	65%	66%	65%	68%
B1393 South of J7	6%	6%	22%	21%	24%	24%
A1184 Harlow Mill Station	15%	15%	26%	25%	27%	27%
Sawbridgeworth	8%	12%	27%	33%	29%	35%
A414 E of N Weald	21%	23%	8%	20%	6%	18%
A414 W of N Development	13%	23%	25%	24%	32%	38%

Table 4.15 Proportion of Development Traffic on Strategic Links: PM Peak Hour

Note: The proportion of development related traffic is lower than expected for M11 south of J7 compared with PS1. The test of PSO with the SRR, used in the calculation, attracts additional re-routed traffic to this section of the M11, in the order of 5%. The additional development in PS2 will change the composition of trips on this section of M11 but only changes the total flow by a very small amount. Therefore, the method used results in very small proportions being reported.

Planning Scenario 2 Assuming High Quality PT in place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
Southern Relief Route Nr Junction 7	33%	47%	48%	61%	51%	68%
Southern Relief Route Tylers Cross	40%	58%	56%	71%	60%	78%
Southern Relief Route Eastwick Rd	32%	–	46%	–	50%	–
M11 North of J7	7%	9%	10%	13%	13%	16%
M11 South of J7	1%	2%	0%	0%	0%	0%
A414 East of J7	59%	61%	66%	69%	67%	69%

B1393 South of J7	5%	5%	14%	14%	24%	21%
A1184 Harlow Mill Station	15%	15%	21%	24%	30%	27%
Sawbridgeworth	8%	15%	23%	33%	31%	35%
A414 E of N Weald	25%	27%	19%	27%	44%	22%
A414 W of N Development	14%	27%	35%	27%	36%	38%

4.5 Traffic in Harlow Urban Area

4.5.1 For reporting purposes, we define the Harlow Urban Area (HUA) as the built-up area of the town in 2003 and its associated road network. This enables impacts on the existing town to be identified separately. Consequently, the proposed development areas (and the new road schemes) are not included within our Harlow Urban Area figures.

Network Vehicle Kilometres

4.5.2 Figure 4.1 shows the growth in vehicle kilometres within the Harlow Urban Area from 2003 to 2021 under Planning Scenarios 1 and 2. For Planning Scenario 1, it is assumed that the South of Sawbridgeworth alignment of the Northern Relief Route is built, while for Planning Scenario 2 the Full Southern Relief Route is assumed. For both scenarios the High Quality PT scheme is assumed as well. These scheme variants are shown as they offer the greatest relief for traffic in the Harlow Urban Area. For comparison, the effect of both schemes with no development other than that already consented (PSO) is also shown.

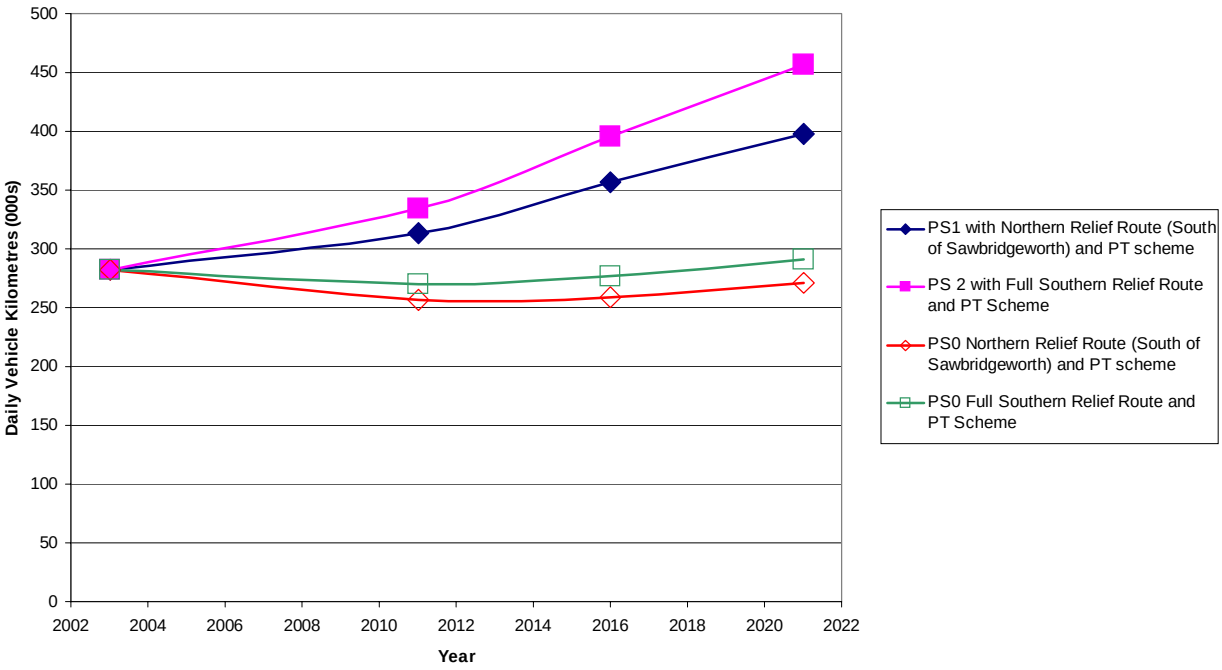


Figure 4.1: Growth in vehicle kilometres in Harlow Urban Area 2003 to 2021, with and without development.

4.5.3 The effectiveness of the schemes alone in relieving traffic in the Harlow Urban Area is demonstrated by the two curves with no development (PSO), i.e. showing only the effect of background growth on traffic levels. The Northern Relief Route is shown to be better at relieving traffic volumes within the urban area.

4.5.4 Moreover, it is interesting to note that in terms of relieving traffic on the urban area, by 2021 both schemes only just cater for the background growth, with urban traffic just 4% lower than 2003 levels with the Northern Relief Route, and 3% above 2003 levels with the Southern Relief Route.

4.5.5 The graph also shows that even with the public transport and relief route schemes in place, there will be substantial additional daily vehicle kilometres in the Harlow area by 2021, 41% in Planning Scenario 1 and 62% in Planning Scenario 2 over the 18 years. This difference in the amount of urban traffic movement reflects both the relative effectiveness of the schemes, and is influenced by the nature of the two planning scenarios.

4.5.6 The Northern Relief Route with PSI generates less vehicle kilometres in the Harlow Urban Area by having both the northern and central development areas closer to the town centre and better-served by public transport than the south-western and eastern development areas in PS2. The distribution shift of trips away from the existing Harlow town centre area to the Northern development zone discussed earlier will also help to relieve traffic volumes in the town.

4.5.7 Against this background, Tables 4.16, 4.17, 4.20 and 4.21 show how peak hour traffic flows on key town centre links are forecast to change over time between 2003 and 2021. Whilst the figures vary by scheme and planning scenario, it is clear that, under any of the circumstances tested, there will be significant traffic growth on Fifth Avenue, Central Avenue and Second Avenue. Localised link and junction improvements that are complementary to the strategic transport schemes will need to be identified to mitigate these traffic impacts as part of the next stage of the work.

4.5.8 Figure 4.2 shows the relative rate of growth of vehicle kilometres in the Harlow Urban Area compared to that in the whole of the TRAM network (additionally includes strategic routes and some secondary links outside the Harlow Urban Area).

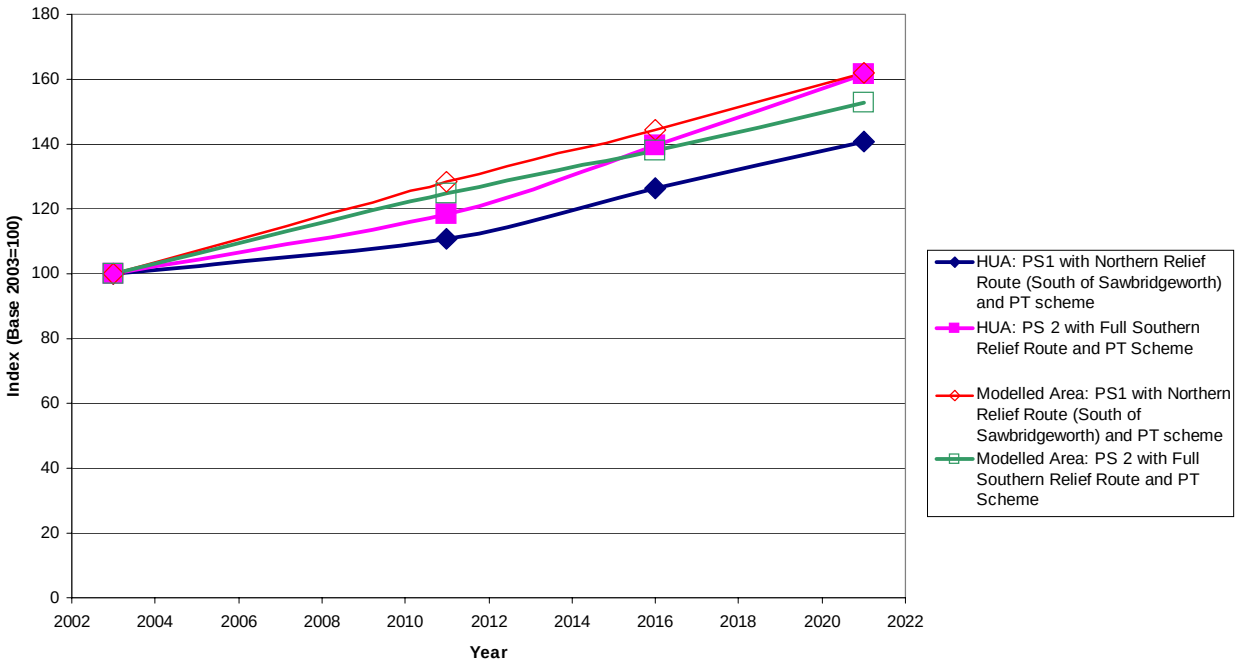


Figure 4.2: Growth in vehicle kilometres within Harlow area vs. the whole modelled area for both Planning Scenarios and their preferred strategies.

4.5.9 There is a contrast between the planning scenarios in terms of the traffic growth in the Harlow Urban Area compared to the whole of the network. While Planning Scenario 2 generates less growth in vehicle kilometres across the whole network at 53%, the growth within the urban area exceeds that on the whole network by 2016 as development takes effect, reaching 62% by 2021. By contrast, Planning Scenario 1 generates growth in vehicle kilometres across the whole network of 62%, but the growth in the urban area is less and only reaches 41% by 2021.

4.5.10 While this shows that Planning Scenario 1 and its associated schemes minimise the amount of additional traffic in the HUA, the main conclusion is that the impact on traffic volumes of the schemes, with their associated development, is more within the HUA (and less outside) with Planning Scenario 2, compared with being more outside the HUA (and less inside) with Planning Scenario 1.

4.5.11 Figure 4.3 compares the vehicle kilometres and average speeds in the Harlow Urban Area in 2003 and in 2021 for each of the Planning Scenarios and scheme variants.

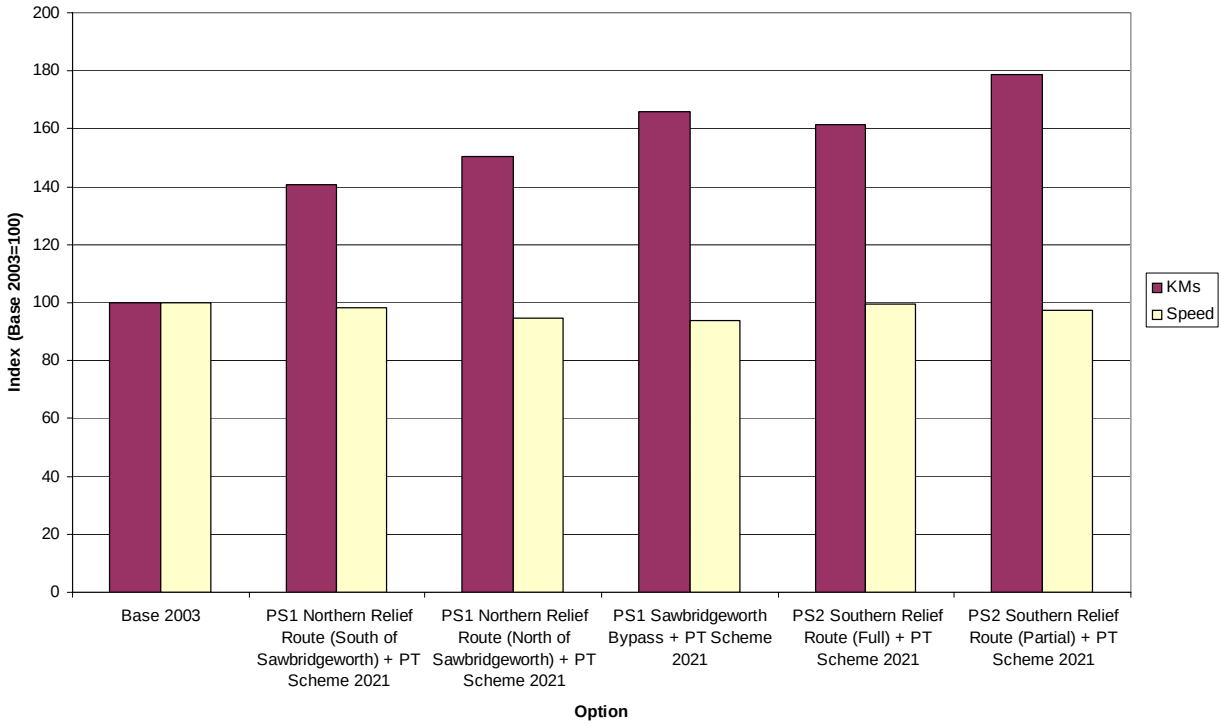


Figure 4.3: Changes in vehicle kilometres and average vehicle speed in Harlow Urban Area from 2003 to 2021.

4.5.12 The chart identifies a significant differentiating point for both the two scenarios and the scheme variants. Generally, as traffic volumes (i.e. vehicle kilometres) increase, speeds decline. This is true for the variant schemes within Planning Scenario 1 and those within 2. Recognising that the information relates to just the HUA, the South of Sawbrdigeworth scheme removes more traffic from the HUA than any other scheme. In addition, even the 41% increase in vehicle kilometres with the South of Sawbridgeworth scheme is achieved with only a small drop in average speeds compared with the 2003 Base.

4.5.13 The second point to note is that for Planning Scenario 2 Full schemes, traffic volumes are higher at 62% but with no change in speeds compared with the 2003 Base. Two conclusions are drawn from this:

- Planning Scenario 2 Full scheme is less efficient at reducing HUA traffic levels (than the two Sawbridgeworth link roads in PSI).

- The re-routing within Harlow to make use of the Full Southern Relief Route has no net effect on average speeds in the HUA.

Harlow Main Distributors

4.5.14 Tables 4.16, 4.17, 4.20 and 4.21 show peak hour traffic flows on key urban distributor links around the town centre that featured in the problem analysis. Tables 4.18, 4.19, 4.22, and 4.23 further emphasise the contribution of development traffic to the pressure on these key links.

Table 4.16 Total Traffic Flows on Distributors: Planning Scenario 1 AM peak

	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
A414 Latton Bush (3400)	3400	3700	3700	3500	4100	4000	3600	4300	4300
A414 Fifth Avenue (2000)	3200	3300	3600	3300	3800	4000	3400	4200	4300
Southern Way (1400)	1400	1400	1400	1600	1600	1600	1800	1800	1800
Edinburgh Way (1500)	1200	1600	1800	1400	1800	2100	1500	2200	2300
Gilden Way (1200)	1100	1200	1300	1400	1400	1500	1600	1700	1800
Central Avenue (1800)	2200	2300	2300	2200	2500	2500	2100	2600	2600
Second Avenue (1800)	2100	2200	2200	2100	2500	2400	2100	2700	2700
Fifth Avenue (S of Station) (1600)	2200	2300	2300	2200	2600	2500	2200	2600	2600

Note: 2003 Base Year flows are show in brackets

Table 4.17 Total Traffic Flows on Distributors: Planning Scenario 1 PM peak Assuming High Quality PT in place, Vehicles 2 way

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
A414 Latton Bush (3500)	3500	3800	3900	3500	4100	4100	3600	4300	4300
A414 Fifth Avenue (1500)	3000	3300	3500	3300	3800	3900	3400	4100	4100
Southern Way (1300)	1400	1300	1300	1400	1400	1400	1600	1700	1600
Edinburgh Way (1000)	900	1200	1500	1000	1500	1800	1100	1800	1900
Gilden Way (1000)	1100	1200	1300	1300	1300	1500	1500	1600	1700
Central Avenue (1700)	2300	2400	2400	2200	2500	2500	2200	2600	2600
Second Avenue (1600)	2000	2200	2200	2000	2400	2400	2000	2500	2500
Fifth Avenue (S of Station) (1400)	2200	2300	2300	2200	2400	2400	2100	2600	2600

Note: 2003 Base Year flows are show in brackets

Table 4.18 AM Peak Proportion of Development Traffic on Distributors

Planning Scenario 1 - Assuming High Quality PT in place

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
A414 Latton Bush	16	16	15	20	25	24	24	27	27
A414 Fifth Avenue	23	25	29	19	28	29	18	30	27
Southern Way	11	10	11	23	24	24	31	32	33
Edinburgh Way	8	21	15	16	26	15	19	23	15
Gilden Way (1200)	10	13	10	17	19	11	22	19	16
Central Avenue	19	23	21	18	30	27	17	29	28
Second Avenue	22	27	27	23	33	32	24	35	33
Fifth Avenue (S of Station)	21	24	23	19	31	28	16	28	26

Table 4.19 PM Peak Proportion of Development Traffic on Distributors

Planning Scenario 1 - Assuming High Quality PT in place

Year	2011			2016			2021		
	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wth Bypass	With Northern Relief Route		With S'wrth Bypass
Location	South of S'wth	North of S'wth		South of S'wth	North of S'wth		South of S'wth	North of S'wth	
A414 Latton Bush	14	15	14	16	21	21	17	24	23
A414 Fifth Avenue	26	29	32	26	33	32	20	29	27
Southern Way	7	6	6	16	18	19	24	29	28
Edinburgh Way	9	26	18	17	33	20	18	36	14
Gilden Way (1200)	8	10	11	14	16	11	19	20	10
Central Avenue	19	23	22	18	27	25	14	27	26
Second Avenue	26	30	30	27	38	38	22	37	36
Fifth Avenue (S of Station)	23	26	26	21	29	27	14	28	27

The following points can be drawn from the results:

- changes in flow from the 2003 Base Year flows to 2011 vary from:
  - reductions (Edinburgh Way and Gilden Way with the South of Sawbridgeworth scheme)
  - no significant change (A414 Latton Bush and Southern Way)
  - increases (Fifth Avenue, Central Avenue and Second Avenue);
- changes in flow over time from 2011 to 2021 also vary with:
  - no or low growth (Central Avenue, Second Avenue, Fifth Avenue and A414 Latton Bush);
  - medium to high growth (Southern Way, Edinburgh Way and Gilden Way);
- of the three schemes, the South of Sawbridgeworth scheme results in lower traffic flows on these key links compared with the other two schemes.

Table 4.20 AM Peak Two-Way Traffic Flows on Town Centre Link Planning Scenario 2 - Assuming High Quality PT In Place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
A414 Latton Bush (3400)	3200	3400	3500	3800	3600	3900
A414 Fifth Avenue (2000)	1600	2700	2100	3500	2500	3800
Southern Way (1400)	1100	1100	1300	1400	1500	1600
Edinburgh Way (1500)	1800	1900	2200	2300	2500	2500
Gilden Way (1200)	1700	1700	1900	2000	2100	2200
Central Avenue (1800)	1600	2200	1800	2500	1900	2500
Second Avenue (1800)	1800	2100	2000	2300	2200	2400
Fifth Avenue, S of Station (1600)	1200	2000	1400	2300	1600	2400

Note: 2003 Base Year flows are show in brackets

Table 4.21 PM Peak Two Way Traffic Flows on Distributors Planning Scenario 2 – Assuming High Quality PT in Place

Year	2011		2016		2021	
Location	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route	With Link between Tylers Cross and M11 J7
A414 Latton Bush (3500)	3400	3600	3500	3800	3600	3900
A414 Fifth Avenue (1500)	1500	2600	2100	3400	2600	3800
Southern Way (1300)	1000	1100	1200	1300	1400	1500
Edinburgh Way (1000)	1500	1700	2000	2100	2400	2500
Gilden Way (1000)	1700	1800	2000	2100	2200	2300
Central Avenue (1700)	1600	2200	1800	2500	1900	2600
Second Avenue (1600)	1700	1900	1900	2200	2100	2300
Fifth Avenue, S of Station (1400)	1200	1900	1400	2300	1500	2300

Note: 2003 Base Year flows are show in brackets

Table 4.22 AM Peak Proportion of Development Traffic on Distributors Planning Scenario 2 – Assuming High Quality PT in Place

Year	2011		2016		2021	
Location	With Full Southern Relief Route %	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route %	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route %	With Link between Tylers Cross and M11 J7
A414 Latton Bush	11	14	26	23	25	25
A414 Fifth Avenue	21	21	26	28	27	25
Southern Way	14	22	40	41	44	50
Edinburgh Way	16	16	15	21	22	18
Gilden Way	28	28	31	31	33	31
Central Avenue	13	16	27	24	28	22
Second Avenue	17	23	34	28	34	26
Fifth Avenue (S of Station)	12	17	29	22	28	19

Table 4.23 PM Peak Proportion of Development Traffic on Distributors Planning Scenario 2 – Assuming High Quality PT in Place

Year	2011		2016		2021	
Location	With Full Southern Relief Route %	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route %	With Link between Tylers Cross and M11 J7	With Full Southern Relief Route %	With Link between Tylers Cross and M11 J7
A414 Latton Bush	13	15	22	21	20	23
A414 Fifth Avenue	21	23	23	34	34	34
Southern Way	20	23	42	43	45	50
Edinburgh Way	19	20	18	29	31	30
Gilden Way	30	30	36	33	34	32
Central Avenue	15	17	26	26	31	28
Second Avenue	19	24	29	34	34	36
Fifth Avenue (S of Station)	16	19	26	29	29	27

4.5.15 The following points can be drawn from the Planning Scenario 2 results for the Full SRR scheme:

- changes in flow from 2003 Base Year to 2011 vary from:
  - reductions (A414 Latton Bush, Fifth Avenue, Southern Way and Central Avenue);
  - no significant change (Second Avenue); to
  - increases (Edinburgh Way and Gilden Way);
- changes in flow over time from 2011 to 2021 also vary but at higher levels than with Planning Scenario 1:
  - low growth (<20%) (A414 Latton Bush and Central Avenue);
  - medium growth (20% - 30%) (Gilden Way and Second Avenue);
  - high growth (>30%) (Southern Way, Edinburgh Way and Fifth Avenue);
- of the two schemes, the Full SRR scheme results in lower traffic flows than with the Partial scheme;
- highest proportion (>40% in 2021) of development-related traffic is recorded on Southern Way which also shows high traffic growth.

4.6 Impact on through traffic

4.6.1 Figure 4.4 shows both the total number of vehicle trips in the Harlow Urban Area, together with the percentage of through trips.

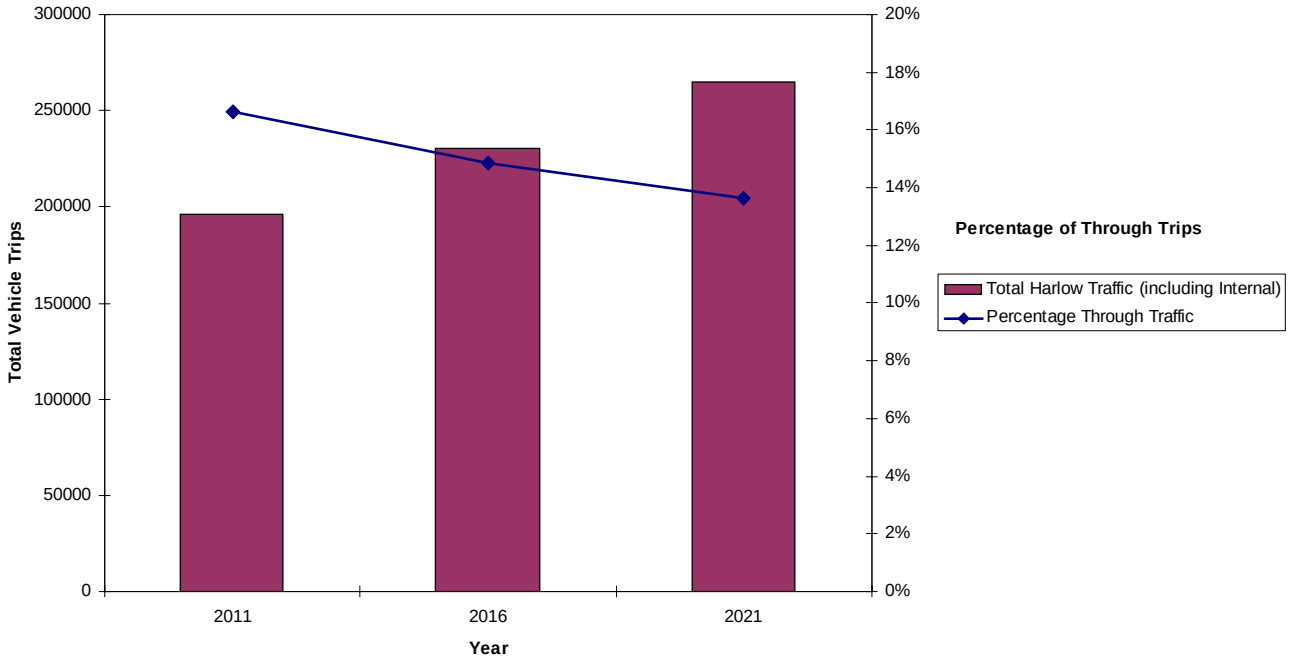


Figure 4.4: Growth in Trips and Proportion of Through Traffic

Planning Scenario 1South of Sawbridgeworth Scheme

4.6.2 The new developments generate increased trip-making in the Harlow Urban Area of about 35% between 2011 and 2021 and general economic trends also increase slightly (about 6%) the volume of through trips. However, the proportion of traffic in the Harlow Urban Area that is through traffic declines from about 17% to just over 13% between 2011 and 2021.

4.7 PT scheme patronage – Planning Scenario 1

4.7.1 Figures 4.5 to 4.8 illustrate patronage on the High Quality Public Transport Corridor for Scenario 1, with the Northern Relief Route in place. Park & Ride demand for a facility at Junction 7 and patronage related to the new developments are identified separately.

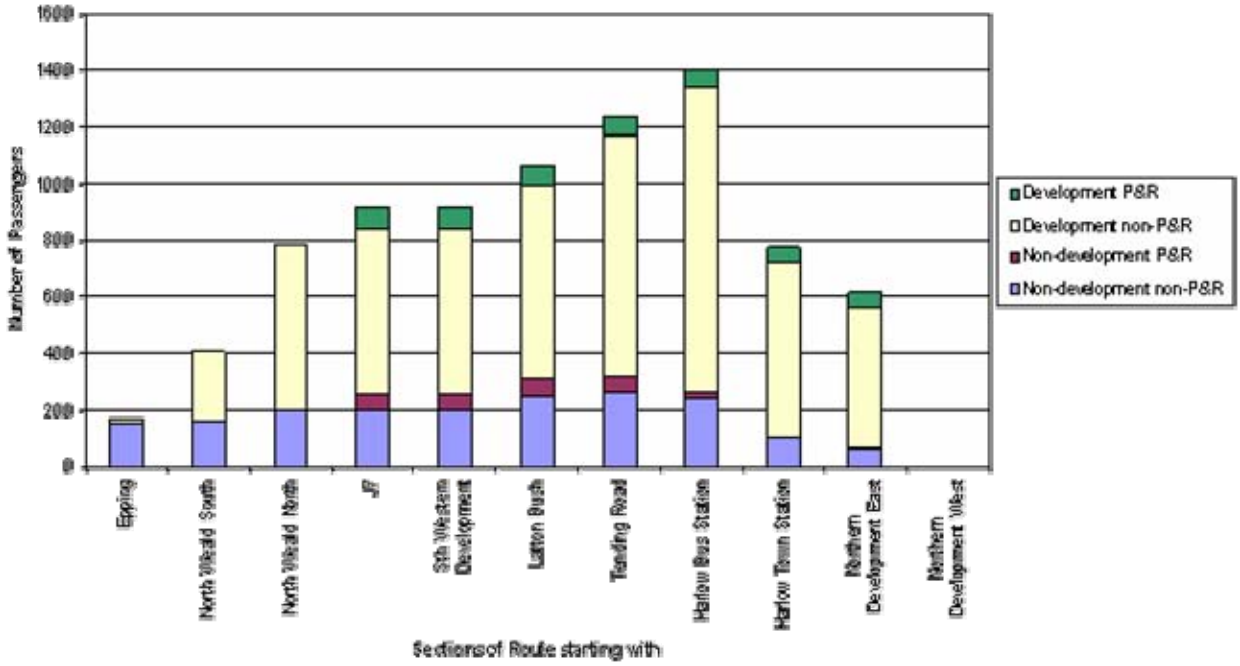


Figure 4.5: Planning Scenario 1 AM Peak Northbound High Quality PT Corridor Patronage

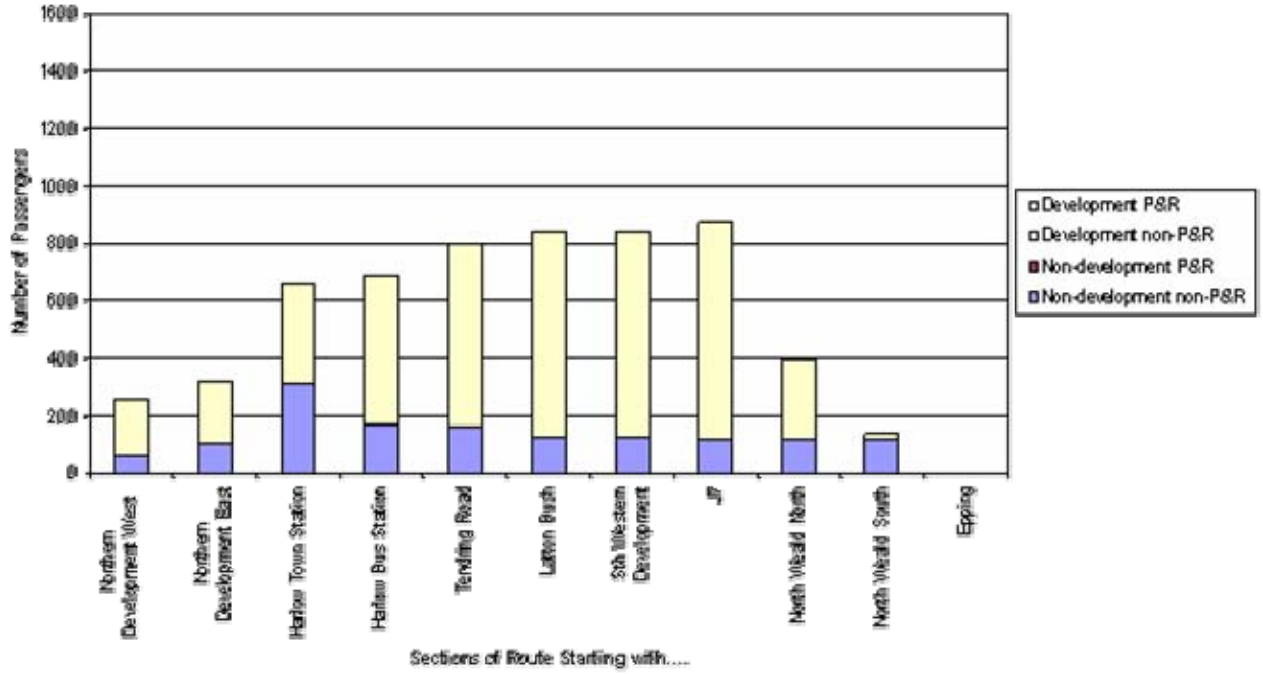


Figure 4.6: Planning Scenario 1 AM Peak Southbound High Quality PT Corridor Patronage

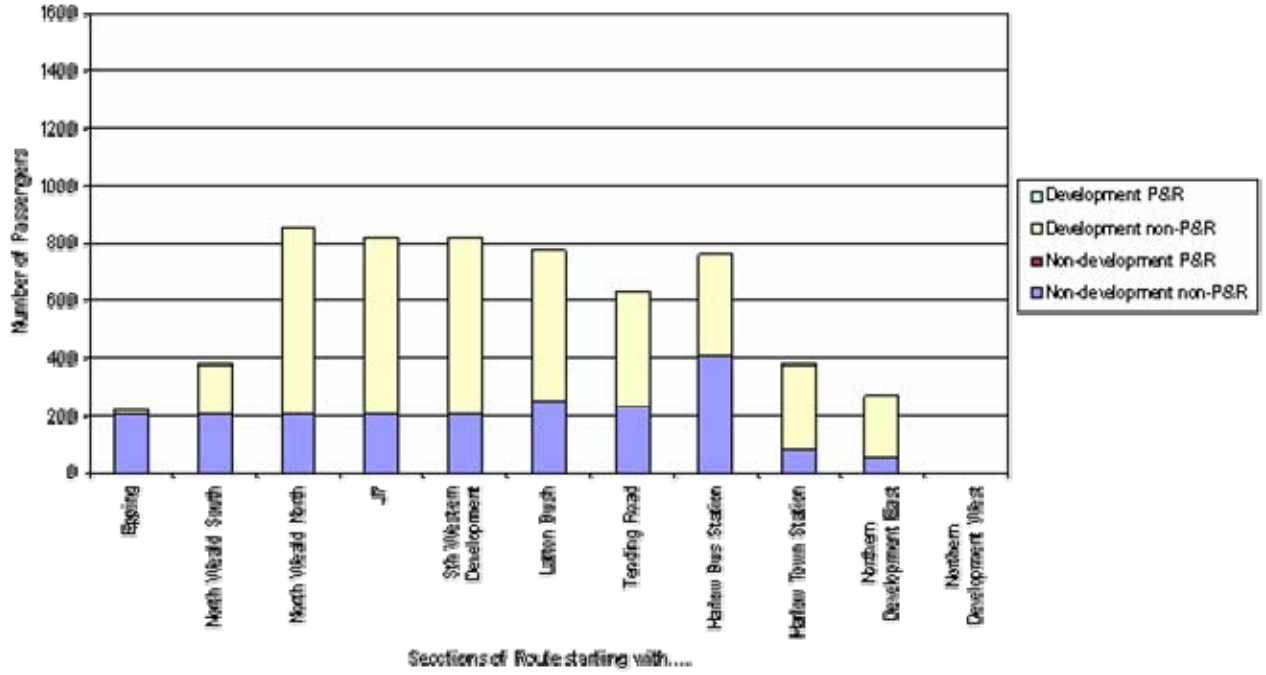


Figure 4.7: Planning Scenario 1 PM Peak Northbound High Quality PT Corridor Patronage

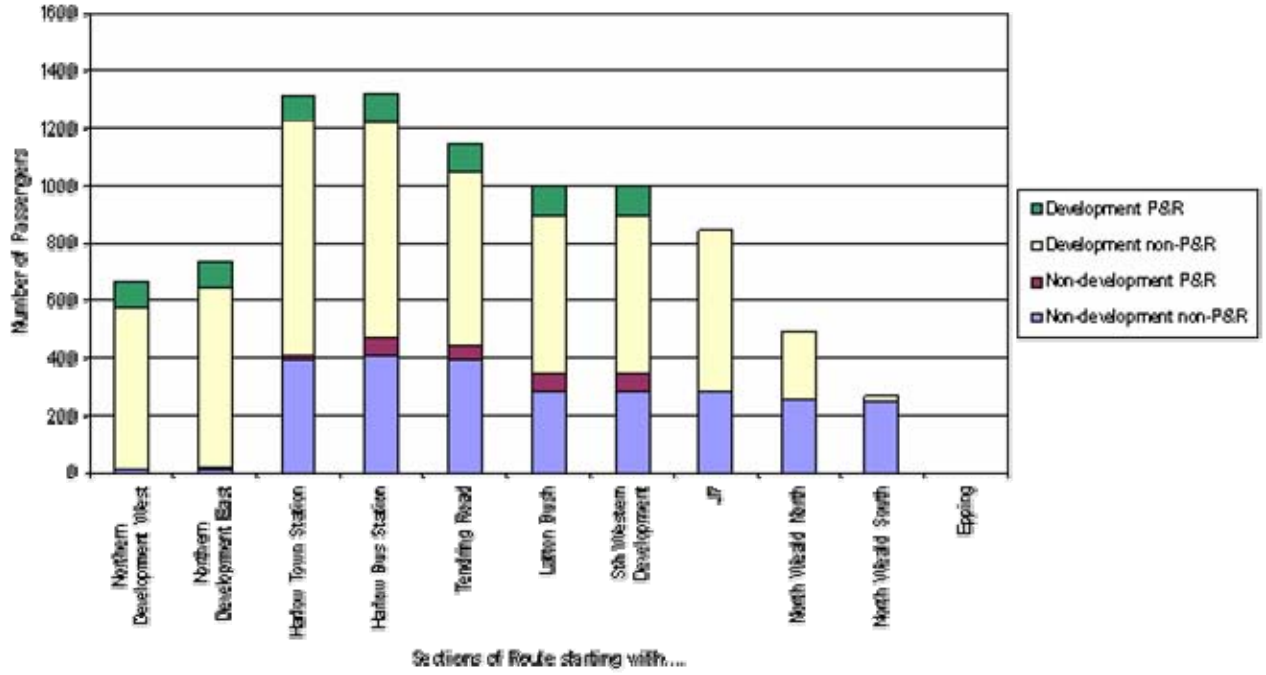


Figure 4.8: Planning Scenario 1 PM Peak Southbound High Quality PT Corridor Patronage

4.7.2 The AM and PM peak hour patronage levels on each section of the route show:

- for non-development patronage (excluding P&R) the highest demand is on sections passing through Harlow town centre and, importantly, between the bus station and the Harlow Town rail station;
- P&R demand is inbound (northbound) to Harlow in the AM peak hour and outbound in the PM, with slightly higher patronage during the PM peak hour as is normally experienced on P&R schemes;
- the majority of demand comes from trips related to the new development areas; noticeably greater patronage than from the Harlow Urban Area, and the reasons are as follows:
  - just under 5km of the 16km PT Scheme is within the Harlow Urban Area and only about half of that is passing through/by residential areas (Passmores, Stewards, Tye Green, Latton Bush);
  - there is competition from existing conventional bus services within the Harlow Urban Area, both in terms of lower walk access times, combined frequencies and fare levels; whereas only minimal (15 min frequency) bus services have been included within the development areas;
  - access times to the PT corridor services within the development area are assumed to be less due to integrated design of the scheme with the housing developmet;
- movements to Epping are predominantly from the existing Harlow Urban Area (and would probably be transferred from existing bus services); North Weald trips are attracted into Harlow;
- a significant part of the development-related patronage on the northern section is related to the employment opportunities in the northern development area demonstrating the importance of the distribution of new trips and the attraction between the commercial areas in the northern development area and the town centre;
- a noticeable level of patronage is also using the scheme to travel in the AM peak to the North Weald development area from the Harlow Urban Area.

4.7.3 Figure 4.9 shows how the patronage levels, in terms of total boardings in either direction, vary by time of day.

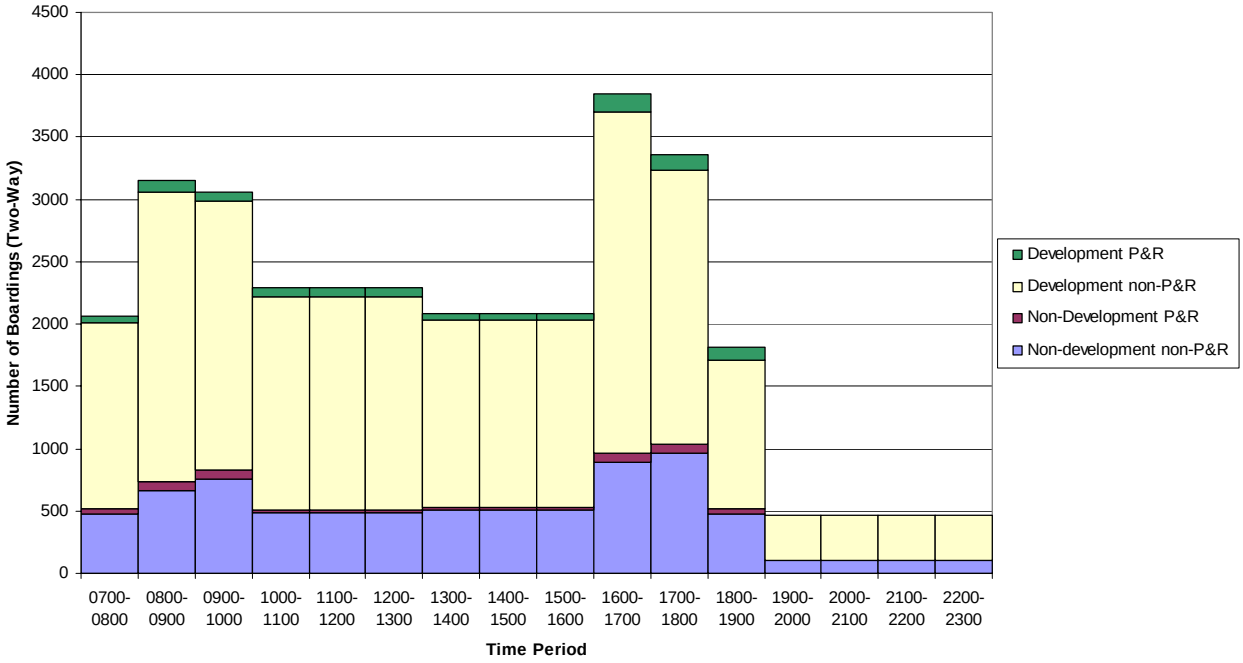


Figure 4.9: Planning Scenario 1 High Quality PT Corridor Patronage Profile by Time of Day.

4.7.4 Patronage levels vary intuitively during the day, with interpeak patronage still reasonably strong compared to the peaks.

4.8 PT corridor patronage – Planning Scenario 2

4.8.1 Graphs 4.10 to 4.13 illustrate the patronage levels on the PT corridor in Planning Scenario 2, with the full Southern Relief Route.

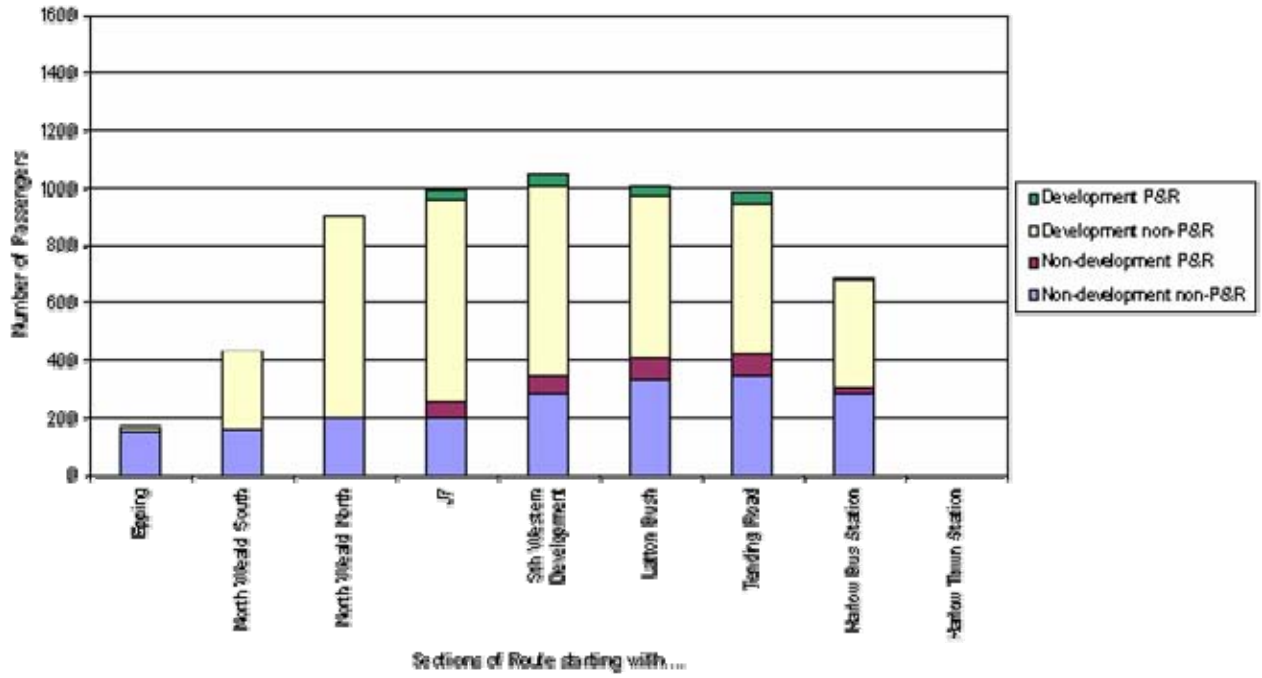


Figure 4.10 Planning Scenario 2 AM Peak Northbound High Quality PT Corridor Patronage

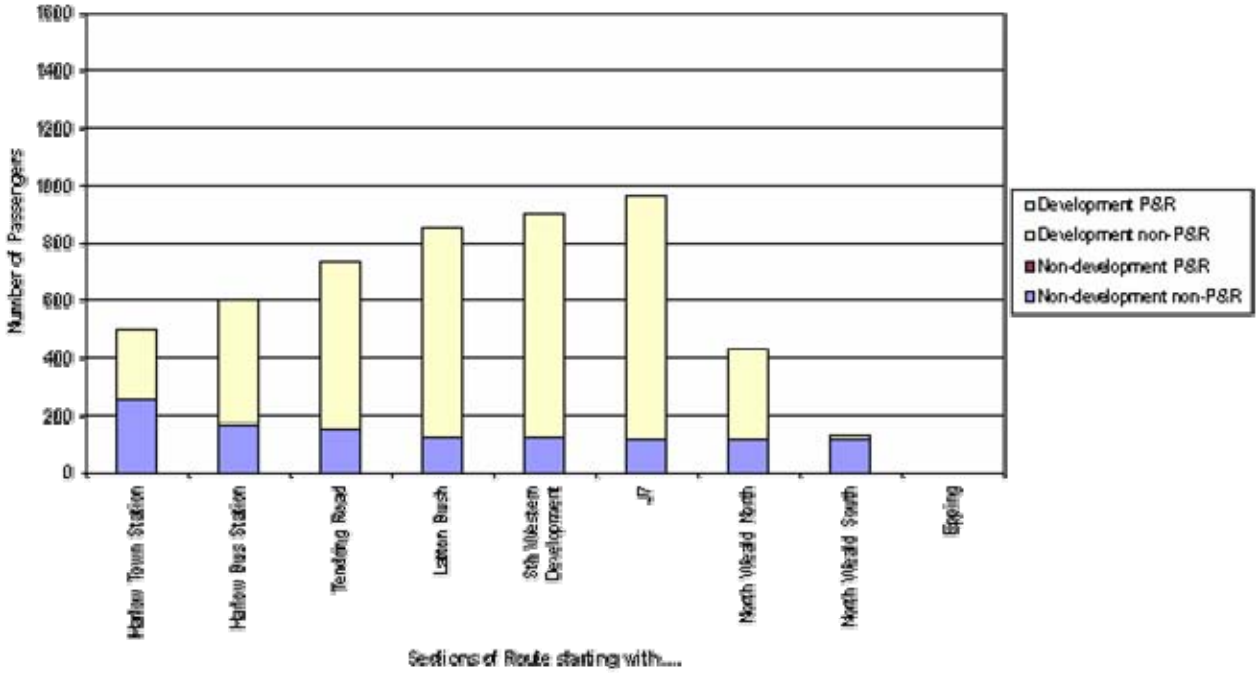


Figure 4.11 Planning Scenario 2 AM Peak Southbound High Quality PT Corridor Patronage

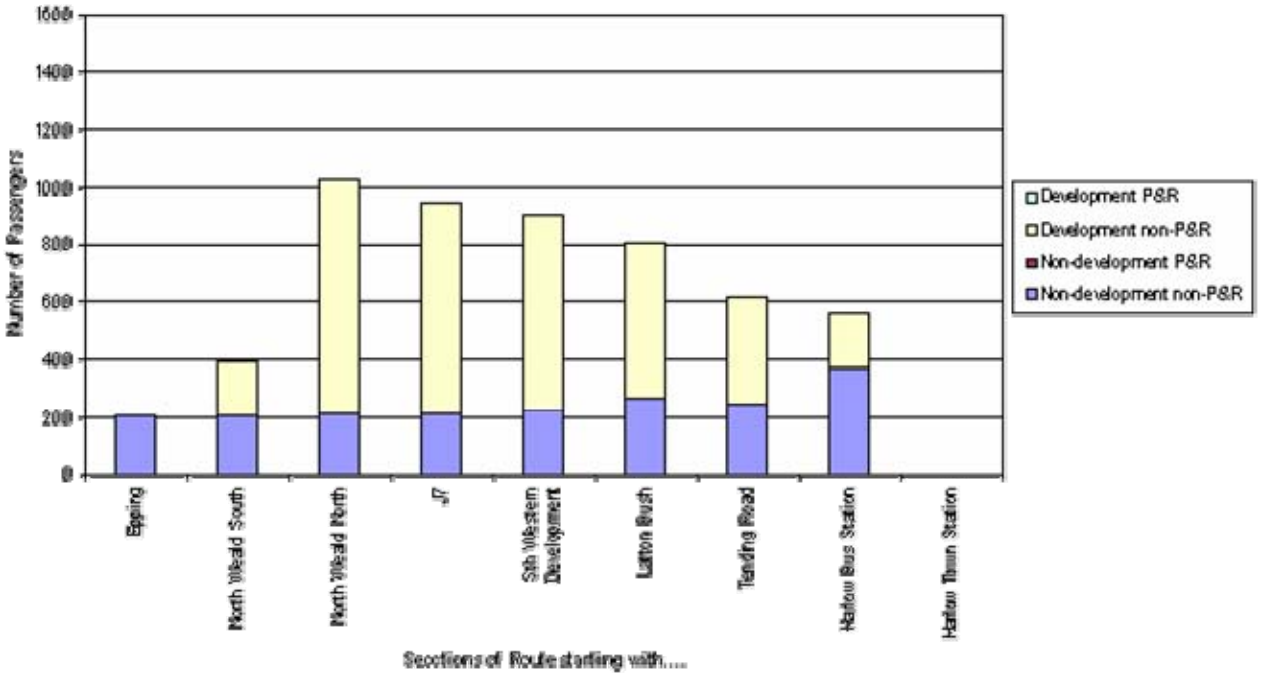


Figure 4.12 Planning Scenario 2 PM Peak Northbound High Quality PT Patronage

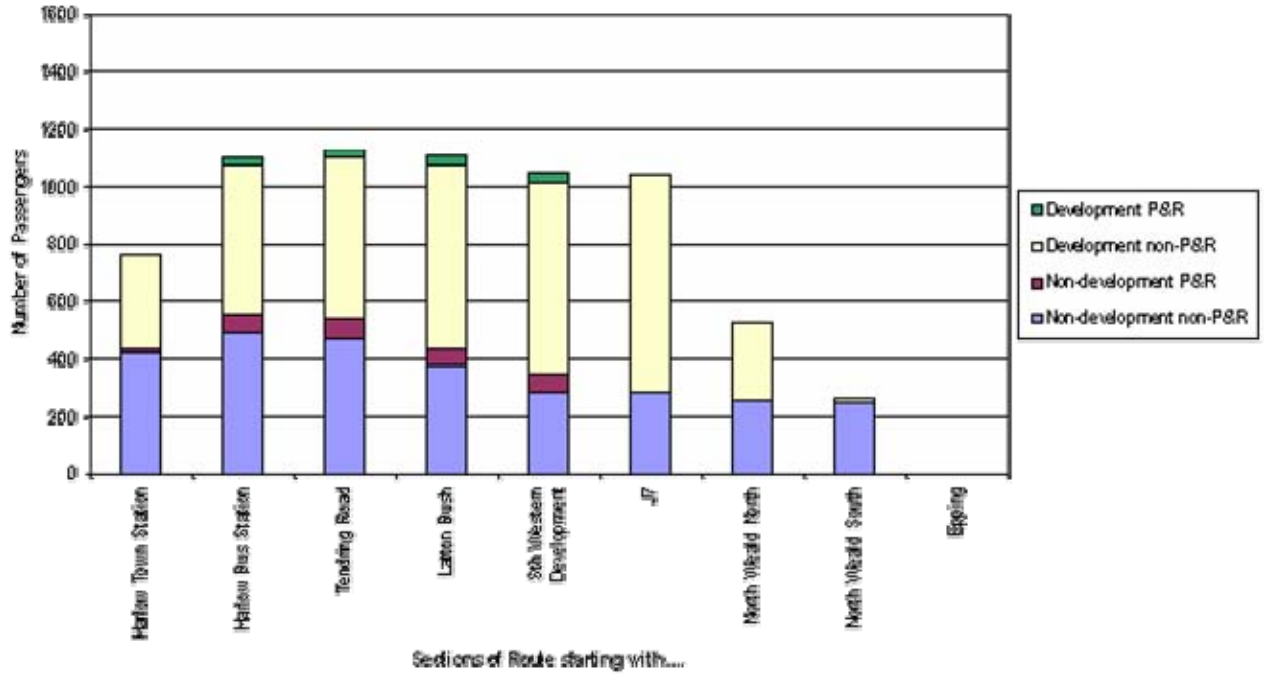


Figure 4.13 Planning Scenario 2 PM Peak Southbound High Quality PT Corridor Patronage

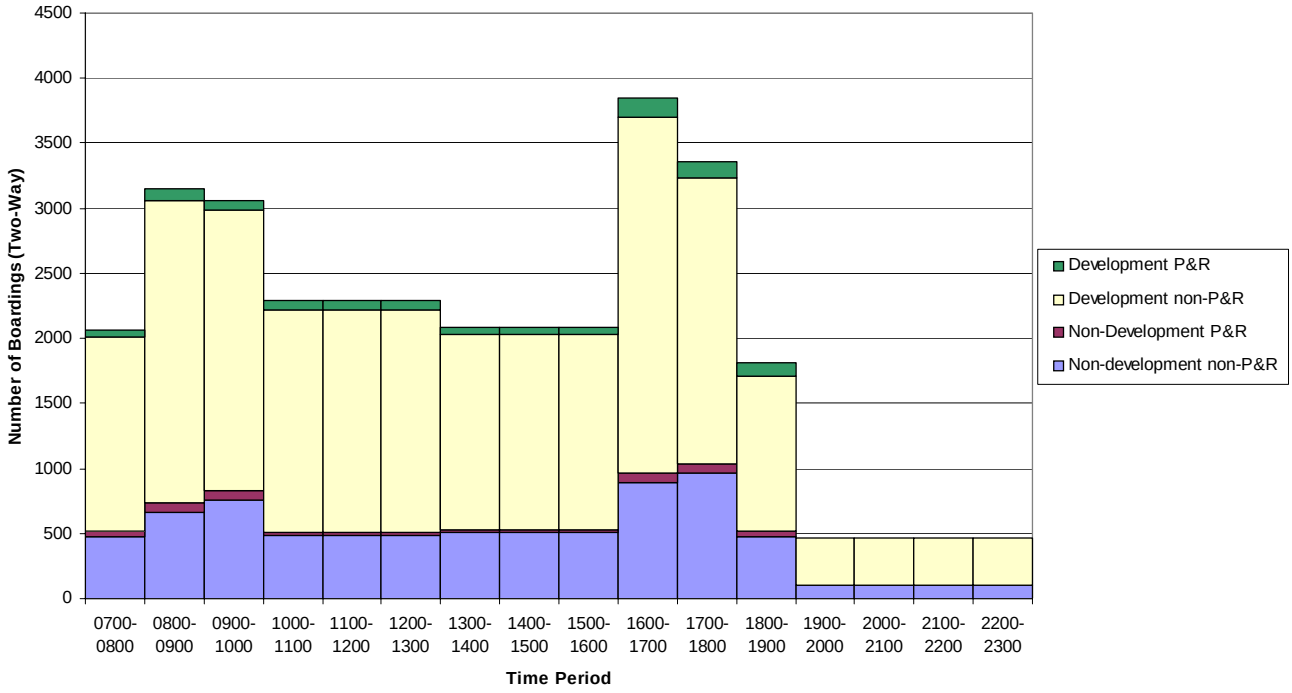


Figure 4.14 Planning Scenario 2 High Quality PT Corridor Patronage Profile by Time of Day

4.8.2 The AM and PM peak hour patronage levels on each section of the route show:

- for non-development patronage (excluding P&R) the highest demand is on sections passing through Harlow town centre and, importantly, between the bus station and Harlow Town rail station;
- P&R demand is inbound (northbound) in the AM peak hour and outbound in the PM;
- the majority of demand comes from the development areas; significantly more than from Harlow Urban Area – for the same reasons described in paragraph 4.7.2 for Planning Scenario 1;
- movements to Epping are predominantly from the existing Harlow Urban Area and probably would have transferred from existing bus services.

4.8.3 Comparisons between patronage levels of Planning Scenarios 1 and 2 show:

- AM peak northbound passenger numbers are greater in Planning Scenario 1 – emphasising the better synergy and the level of use into the northern development area;
- conversely the southbound patronage is more similar but with more demand in Planning Scenario 2 – possibly reflecting a greater use by employees to North Weald as other development areas are less-well served by the PT scheme;
- the same comments apply in the reverse directions in the PM peak hour.

4.9 Benchmarking

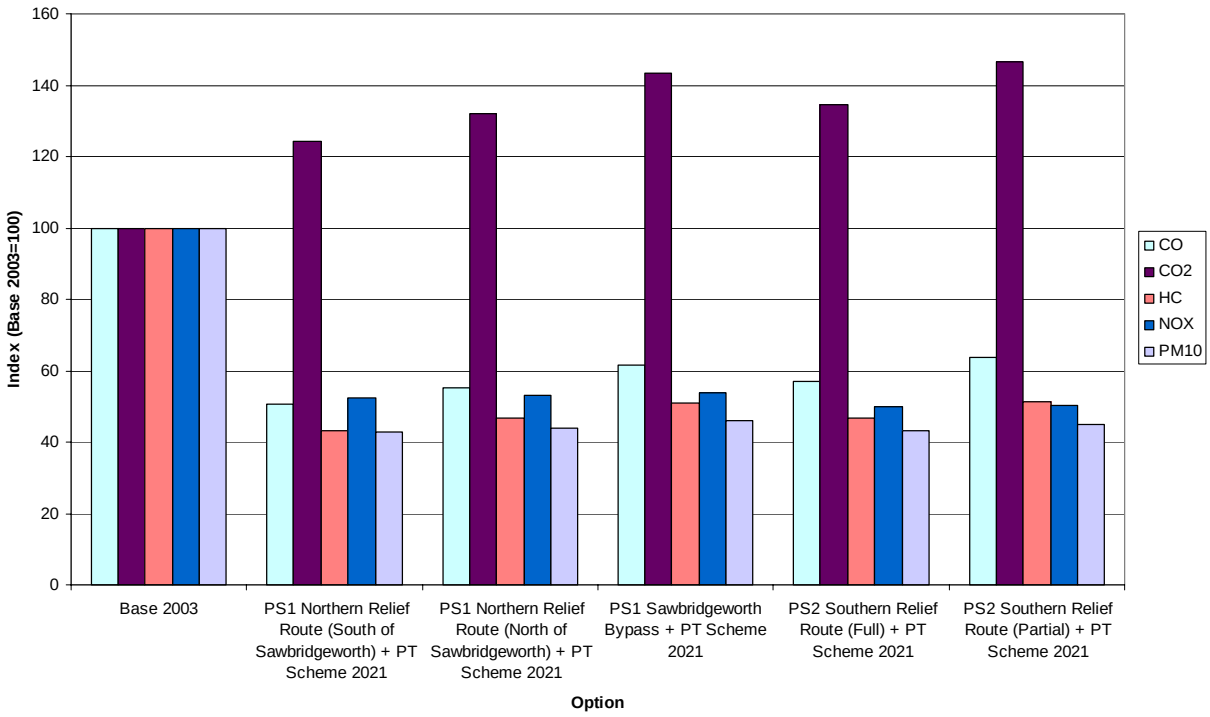
4.9.1 A benchmark is provided by the Luton Translink Kerb-Guided Bus scheme that recently secured LTP funding. The main corridor of the scheme serves a population of 50, 000 (comparable to that of Harlow's development areas) in the Dunstable and Houghton Regis area. The planned frequency is greater, at around 20 buses per hour, and most of the established bus services currently serving the area will remain and be in competition.

4.9.2 The daily patronage figures for the Harlow scheme are higher than those forecast for the Luton Translink. The figures for the non-development (Harlow Urban Area) look compatible and, given that the immediate catchments for the two proposals are of similar size, this gives further confidence in the forecasts. It is the new development areas that increase the Harlow scheme's patronage well above Luton Translink figures.

4.9.3 As discussed earlier in paragraph 4.7.2, the primary reason for the higher figures is the assumptions made on the route pattern and level of complementary or competitive bus services that were required for this early stage of the scheme's development and appraisal. Consequently, although the assumptions made at this stage are reasonable, given the preliminary feasibility stage of scheme development, it is recognised that more investigations are required to develop the scheme specification and refine the appraisal. In the meantime, the forecasts are developed here from a good basis to determine the potential patronage of a high quality public transport scheme serving most of the proposed development areas.

4.10 Environmental Impacts

4.10.1 Figure 4.15 shows vehicle emission levels in the Harlow Urban Area in 2021



relative to those in the base year 2003.

Figure 4.15: Vehicle Emission Levels in the Harlow Urban Area

4.10.2 It shows that in spite of the increased traffic levels in the urban area due to new development and background growth, forecast improvements in vehicle and engine technology will ensure that emissions except Carbon Dioxide will be lower than they are today.

4.10.3 In general, those schemes that offer the greatest relief to traffic volumes across the Harlow Urban Area (PS1: South of Sawbridgeworth, PS2: Full SRR scheme) also lead to the lowest emission levels. The differences with the Partial SRR result from different changes to vehicle speeds and trip length.

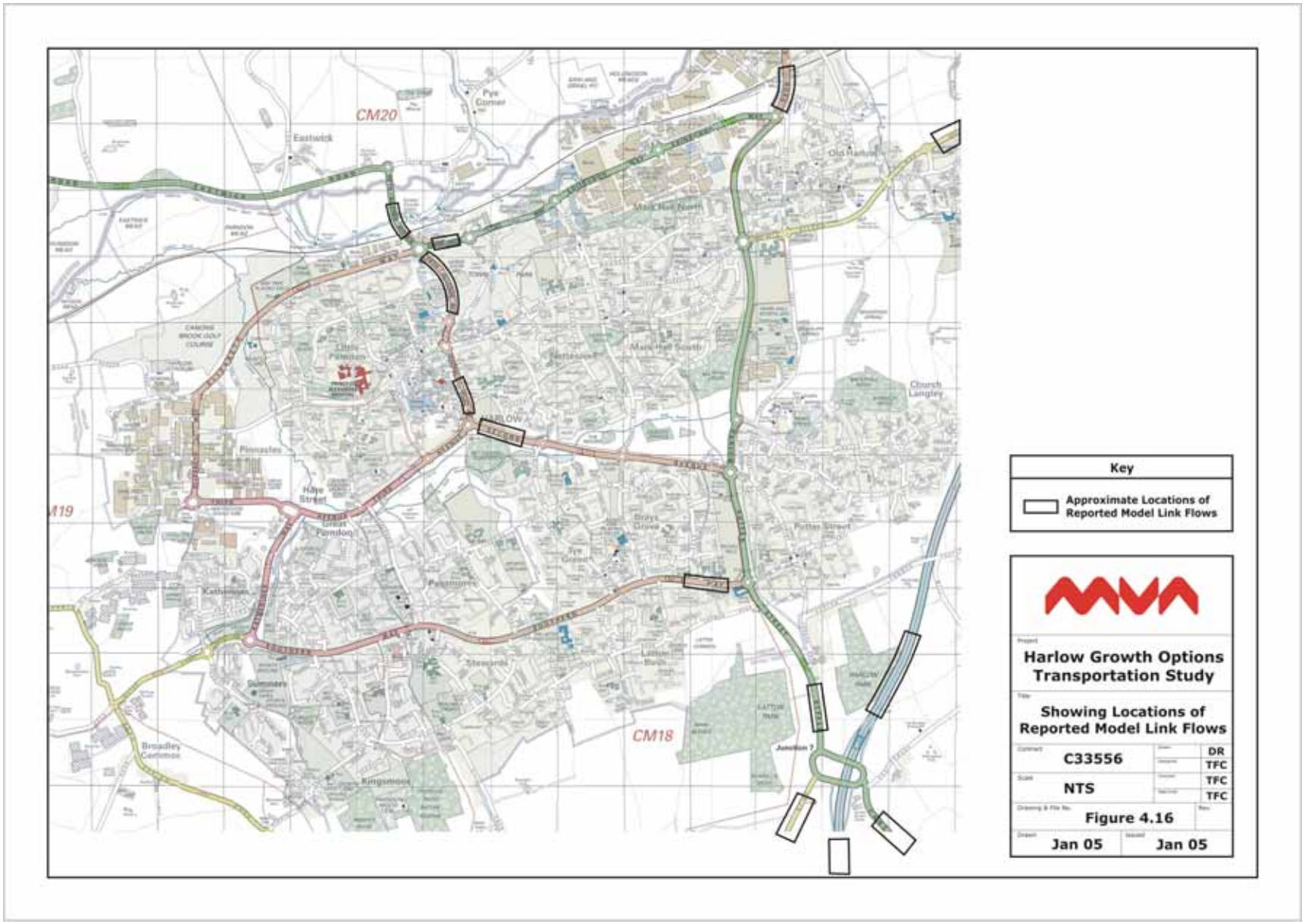


Figure 4.16 Streetmap

5 Strategy and Scenario Appraisal

5.1 Introduction

5.1.1 Presented in this Chapter of the report is an appraisal of the scenarios and schemes described in Chapter 3, using the Harlow TRAM results presented in Chapter 4 and against the Government's New Approach to Appraisal (NATA) criteria. Although not of sufficient detail to represent a full scheme appraisal (or Annex E submission) the adopted approach has attempted to embrace the four key strands of NATA in order to demonstrate the robustness of the proposals. These strands can be summarised as:

- a set of Appraisal Matrices that demonstrate the degree to which each scheme or set of scheme achieves the five central Government objectives for transport (environment, safety, economy, accessibility and integration);
- as assessment of the degree to which local and regional policy objectives are met;
- an assessment of the extent to which the problems and opportunities described earlier in this report are respectively ameliorated or realised by the alternative proposals; and
- supporting analyses covering among other things, affordability and financial sustainability, practicality and public acceptability.

5.1.2 The appraisal has been undertaken in accordance with the various guidance documents issued by the DfT including, Guidance on Local Transport Plans and Major Scheme Appraisal in Local Transport Plans, both underpinned by the Guidance on the Methodology for Multi Modal Studies. A simplified economic assessment has been undertaken that is in line with the HM Treasury Green Book requirements.

Appraisal Process

5.1.3 A two stage process has been adopted. Initially, for each Planning Scenario, an assessment of alternative combinations of transport schemes has been undertaken. This enabled a scheme (or set of schemes) to be identified that, in the view of the consultant team, performs best against the NATA criteria for each Planning Scenario. The best performing schemes were then taken forward to a higher level assessment summary for the two Planning Scenarios.

5.1.4 As explained ion Chapter 3 for simplicity and to reduce the number of variants, the High Quality Public Transport corridor is common to all strategies that have been appraised.

5.2 Summary of Stage 1 Appraisal

Planning Scenario 1

5.2.1 **Transport Provision:** The three variants differ in their highway provision with three routes:

- South of Sawbridgeworth
- North of Sawbridgeworth
- Sawbridgeworth Bypass

5.2.2 The first two access M11 at a new junction (J7a) and the latter uses the Bishops Stortford Bypass to gain access to M11 Junction 8.

5.2.3 The following summary of the scheme appraisals, presented in full in Table 5.1 at the end of this chapter, concentrates only on the issues that differentiated one scheme from the others.

5.2.4 **Engineering Feasibility:** The principal difference is the South of Sawbridgeworth scheme has a longer viaduct/bridge construction across the flood plan and the railway, but North of Sawbridgeworth scheme's vertical alignment across the same flood plain but further north may prove more difficult due the proximity of the A1184 junction and the railway. Sawbridgeworth Bypass appears to have least engineering feasibility problems, but little investigation of the route has been undertaken.

5.2.5 **Operational Feasibility:** The South of Sawbridgeworth scheme requires a new M11 junction to be constructed to the north-east of Harlow which will create new patterns of movement on the motorway but provide traffic relief to Junction 7 thereby reducing the scale of improvement required at this location. The North of Sawbridgeworth scheme is similar but attracts less use of the M11 to the south. The Sawbridgeworth Bypass will add to existing movements on the Bishops Stortford Bypass that may produce operational difficulties.

5.2.6 **Outline Scheme Costs:** the South of Sawbridgeworth scheme has the lowest cost by about £50m to £60m. All other scheme elements have equal costs.

5.2.7 **Key Local Objectives:** It is only Strategic Transport that differentiates the three schemes. The South of Sawbridgeworth scheme provides relief for the A414 route through Harlow but uses part of M11 to achieve it. The Sawbridgeworth Bypass scheme provides relief to A1184 and is of very little benefit to A414. The North of Sawbridgeworth scheme provides some benefit to both A414 and A1184 but under-achieves on both.

5.2.8 **Congestion:** South of Sawbridgeworth scheme produces reductions in congestion within the Harlow Urban Area especially in the problematic north-eastern sector. The Sawbridgeworth Bypass achieves little benefit within the HUA.

5.2.9 **Accessibility:** Severance issues for the Harlow Urban Area and the new northern development area may be greatest with the South of Sawbridgeworth scheme, but there are also issues with the other two schemes. Public transport accessibility is greatest for Sawbridgeworth with the north and south schemes. Development site access is greatest with the South of Sawbridgeworth scheme especially as the North Weald and northern development areas can link without travelling through the existing HUA.

5.2.10 **Economic Appraisal:** This requires some explanation at this stage that is applicable to all appraisals. Economic appraisal is part of the NATA criteria, but the application of recommended conventional economic cost benefit analysis to the Harlow Growth Options scenarios and schemes is not straightforward.

5.2.11 Firstly the study objective is to appraise the transport schemes and not the related planning scenarios, and to do so in a way that follows guidance as closely as possible and provides an appraisal that can provide decision-makers with the confidence to take some or all schemes forward to more details design and investigation.

5.2.12 In conventional appraisal there is a single Reference Case and a number of Variant Cases and the difference between RC and VC should only be the Scheme being

appraised which is partly ensured by having the growth forecasts in each Case identical.

5.2.13 In the application for Harlow the conventional approach needs careful consideration as the transport schemes are linked to development scenarios such that the development scenarios can not proceed without transport schemes. Furthermore the Reference Case would need to have development but no scheme and this will tend to overestimate scheme benefits by producing an overloaded Reference Case. Additionally the scheme Variant Cases would be different as Planning Scenarios are different.

Table 5.2 Economic Analysis Reference and Variant Cases

Planning Scenario	Do Minimum	Transport Schemes Northern Schemes	Southern Schemes
PS0	Used for investigations		
PS1	Reference Case1	Variant Case 1	
PS2	Reference Case 2		Variant Case2

5.2.14 A range of investigations were undertaken to see how much the approach might over-estimate benefits and where the scheme benefits occur. Principally the benefits are likely to be over-estimates but the use of the Harlow TRAM ameliorates most of these. As Harlow TRAM includes all travel modes and all traveller responses to changing costs and congestion, and as the Harlow Urban Area is generally congested in future years, most of the traveller benefits between the Reference Case and the Variant Cases is on trips outside the Harlow Urban Area.

5.2.15 Note that the Harlow TRAM generates summary information that provides economic analysis of highway and public transport schemes including taking account of fare and parking changes. At this stage though it cannot populate a full Transport Economic Efficiency (TEE) table.

5.2.16 Our conclusion is that the transport modelling used to prepare the traveller responses and changes in costs used by the economic appraisal is fully comprehensive (possibly more so than is usual for highway schemes at this stage), but that the significant level of development that is linked to the sets of schemes will tend to produce over-estimates of economic benefits. This propensity to over-estimate economic benefits should be noted but should not preclude the use of the analysis in deciding whether the scheme or schemes should go forward for more detailed investigation.

5.2.17 Of the three Planning Scenario 1 sets of schemes, the South of Sawbridgeworth scheme generates the highest Present Value of Benefits at £1037m and is achieved at the lowest cost (Present Value of Costs is £339m) producing the most favourable Benefit to Cost (BCR) ratio of 3.1.

5.2.18 **Transport Reliability:** All schemes remove traffic from the Harlow Urban Area to a greater or lesser extent. Furthermore the additional development-related traffic will place pressures on certain links within the network for which no mitigating scheme has been included. However, across the three schemes, the South of Sawbridgeworth scheme provides the most relief from traffic congestion in the Harlow Urban Area, resulting on the highest average speeds and the best estimated levels of reliability, especially for M11-related movements.

5.2.19 **Integration:** Generally across the modal and policy issues the South of Sawbridgeworth scheme provides the most benefit.

5.2.20 **Community impact and Public Acceptability:** Generally the Sawbridgeworth Bypass would produce the least impact under these topics.

5.2.21 **Funding Issues:** All schemes are similar but the South of Sawbridgeworth scheme costs the least and carries the greatest proportion of development-related traffic.

Planning Scenario 2

5.2.22 **Transport Provision:** The two variants differ in their highway provision with a Full Southern Relief Route (SRR) and a Partial SRR (from Tylers Cross to M11 J7).

5.2.23 The following summary of the scheme appraisals presented in full in Table 5.3 at the end of this chapter and concentrates only on the issues that differentiated one scheme from the others.

5.2.24 **Engineering Feasibility:** The principal difference is that the Full scheme requires a viaduct and bridge over the River Stort and the railway.

5.2.25 **Outline Scheme Costs:** The Full scheme costs are just greater than twice the Partial Scheme (for scheme lengths of 10km and 5km respectively).

5.2.26 **Key Local Objectives:** The key issue is that the Full scheme provides a complete bypass of the Harlow Urban Area with benefits to A414 through traffic, relief to the town centre and western and southern residential areas. The Partial scheme provides proportionately far less benefit against these objectives.

5.2.27 **Congestion:** The Full scheme enables more of the development-related traffic in the south and west to have a better choice of routes and avoid the Harlow Urban Area, thus providing congestion relief to the town. However, existing HUA movements that want to use the Full scheme and access it at one of the intermediary junctions result in more traffic in the south and west neighbourhoods and little overall net reduction in traffic volume.

5.2.28 **Safety and Environmental Impacts:** Marginal safety benefits from the Partial scheme but most environmental benefit in terms of vehicle emissions comes from the Full scheme.

5.2.29 **Economic Appraisal:** The Full scheme produces the higher Present Value of Benefits (£1679m - 70% greater than the Partial scheme). Scheme costs are higher with a PVC of £368m (50% higher than the Partial scheme). The resultant NPV (£1310m) and BCR (4.6) are also higher than the Partial scheme. The discussion and comments on the approach to the economic appraisal provided in paragraphs 5.2.10 – 5.2.16 should be read in conjunction with this summary.

5.2.30 **Reliability and Integration:** The greater route choice available to a wider number of trips would produce more improvements with the Full scheme than the Partial scheme. The Full scheme with intermediary junctions provides greater integration benefits particularly from the additional access rout to Harlow's Princess Alexandra Hospital.

5.2.31 **Community Impact and Acceptability:** Terminating the Partial scheme at Tylers Cross would cause impacts on the local rural road network to the west and in the village communities.

5.2.32 **Funding:** The Partial scheme is cheaper and carries a higher proportion of development-related traffic. The Full scheme meets more local and strategic objectives and therefore would better qualify for contributions from public funds.

5.3 Summary of Stage 2 Appraisal

5.3.1 The stage 2 appraisal considered the best performing schemes identified from the stage 1 appraisal. It is presented in Table 5.4 at the end of this chapter and covers the following scenarios and scheme combinations:

Planning Scenario 1

- A Northern Relief Route running South of Sawbridgeworth that connects the A414(W) with the M11 via a new all movement junction (7A) and a junction with A1184;
- A major improvement to M11 junction 7;
- A High Quality Public Transport corridor connecting Epping, North Weald, Harlow town centre and the Northern development area with a P&R facility at Junction 7 of the M11;.

Planning Scenario 2

- A Full Southern Relief Route running south-west of Harlow and connecting the M11, Junction 7 to the A414 (east of Roydon) with intermediary junction;
- A major improvement to M11, Junction 7;
- A High Quality Public Transport corridor connecting Epping, North Weald and Harlow town centre (terminating at Harlow Town railway station) with a P&R facility at Junction 7 of the M11.

Transport Provision

5.3.2 **Engineering Feasibility:** All of the transport schemes considered will present a range of engineering challenges, but none are considered unfeasible. Both the Northern and Southern Relief Routes require new road and railway bridges to cross the River Stort and the London – Cambridge mainline. A more extensive length of viaduct is likely to be required for the Northern Relief Route because of the topography of the land and its alignment across the flood plain.

5.3.3 The southern section of the High Quality Public Transport corridor runs along part of the disused Epping to Chipping Ongar single track tube line. Depending on whether single or twin track running is required, this corridor may need to be widened. If the scheme is extended to the north of Harlow Town railway station, then construction of new rail and river bridges will be required.

5.3.4 **Operational Feasibility:** The Northern Relief Route requires a new M11 junction to be constructed to the north-east of Harlow. This new junction will create new patterns of movement on the motorway but provide traffic relief to Junction 7 thereby reducing the scale of improvement required at this location.

5.3.5 It is likely that some on-street running of the High Quality Public Transport vehicles will be required within the Harlow Urban Area. If a high degree of priority is to be maintained, then there will be potential impacts on other road users.

5.3.6 **Outline Capital Costs:** Overall the costs for the schemes associated with Planning Scenario 1 are around 10% lower than the schemes associated with Planning Scenario 2. The cost/kilometre for the Northern Relief Route is higher than that for the Southern Relief Route due to the engineering complexity of the scheme. If the High Quality Public Transport corridor is extended into the northern development area (Planning Scenario 1), the resultant cost of the scheme will be around 20% higher.

Local Policy Objectives

5.3.7 Both planning scenarios would appear to be broadly consistent with the regeneration of Harlow, based on emerging findings from the Harlow Regeneration Study; both would help strengthen Harlow's potential as an attractive sub-regional centre along the M11 corridor. The concentrated form of Planning Scenario 1 enhances its regional gravitational pull but, to be successful, strong connections between the northern development area and the rest of the Harlow Urban Area will need to be created. Conversely, the "edge of urban area" development associated with Planning Scenario 2 is likely to create a more dispersed town that could potentially encourage retail and commercial development that might threaten the centre.

5.3.8 With either planning scenario, a new High Quality Public Transport corridor would be created, bringing benefits of improved accessibility and integration to the local community (see below). Under Planning Scenario 1 all of the development areas could be directly served by the new route. This is not the case for Planning Scenario 2 where local conventional bus connections would be required to serve some of the development areas to the south, west and east of Harlow.

5.3.9 In terms of access to the strategic transport network, the highway proposals associated with Planning Scenario 1 improve access to/from north-east Harlow whilst the Scenario 2 proposals improve access to/from south-west Harlow. In both scenarios access to the bus and railway station is improved.

5.3.10 With the exception of the North Weald site, all of the development areas are within a reasonable cycling distance of Harlow town centre. It could be argued that the south-western and eastern development sites are better connected to the existing cycle network but the expectation is that new links would then be created to/from other sites to provide good walk/cycle accessibility. The larger, more self contained development areas in Planning Scenario 1 offer greater potential for internal walking and cycling.

National/Regional Objectives

5.3.11 Both planning scenarios are broadly consistent with the emerging East of England Plan (RSS14) and would help deliver the housing and employment growth in the London-Stansted-Peterborough-Cambridge corridor as required by the Government. However, as noted in Chapter 1, neither of the planning scenarios reflects the exact distribution of housing and employment now being consulted upon in the East of England Plan.

Shared Priority Targets

5.3.12 **Congestion:** The transport proposals associated with Planning Scenario 1 provide significant benefits to the A414 (particularly Edinburgh Way) and A1184 corridor and some benefits to the rest of the Harlow Urban Area. The A414 also sees significant benefits from Planning Scenario 2 but in general the benefits are more dispersed across the network under this scenario.

5.3.13 Development traffic is concentrated more on key links (for example Allende and Velizy Avenue) under Planning Scenario 1, causing localised congestion and lower speeds. Under Planning Scenario 2, the development is more dispersed across the local highway network.

Environmental Impacts

5.3.14 The following section draws on information extracted from the environmental study prepared by Chris Blandford Associates.

5.3.15 The indicative alignment of the Northern Relief Route (South of Sawbridgeworth) passes close to, but avoids the most critical environmental constraints on the northern fringe of Harlow, notably Pishiobury Park and the Gibberd Garden (both registered historic parks or gardens). The route crosses the River Stort flood plain at an oblique angle which means that an extensive section of viaduct would be needed. The elevated setting of the route at this location is likely to be a key issue in terms of visual intrusion to the landscape. Noise impacts would occur both during construction and throughout the operational life of the Relief Route. Appropriate mitigation measures would be needed to protect any noise sensitive residential receptors close to the route.

5.3.16 The indicative alignment of the full Southern Relief Route passes to the east of the conservation area, around the village of Roydon to the west of a Site of Special Scientific Interest (SSSI) that falls within the River Stort flood plain (Oak Pollard) and to the south of two SSSI at Hospital Wood and Random Wood (both local Nature Reserves). As such it avoids the most critical environmental constraints on the southern and western fringes of Harlow. The route crosses the River Stort flood plain and West Anglia mainline requiring a section of viaduct that would have a visual impact on the landscape. Noise impacts would occur both during construction and throughout the operational life of the Relief Route and appropriate mitigation measures would be required for any affected properties.

5.3.17 Within the District of Harlow, the indicative alignment of the public transport corridor passes through an area of woodland to the south of Latton Bush and through the central Green Wedge which is designated as a moderate environmental constraint. Detailed information is not currently available concerning the environmental features of the area to the south of the M11, Junction 7, but it is not anticipated that the alignment of the public transport corridor would be affected by any critical environmental constraints between Harlow and Epping. Noise impacts would occur during construction and as a result of public transport vehicles using the corridor during its operational lifetime. The high quality public transport scheme will be fast and reliable, provide a high degree of passenger comfort, good information and a safe travelling environment. As such it will deliver a very positive journey ambiance for passengers.

5.3.18 In terms of local air quality, Planning Scenario 2 generates a higher overall level of emissions within the Harlow Urban Area than Planning Scenario 1 (60% increase compared with 40%) but generates lower emissions beyond this area. Under Planning Scenario 2, the development traffic within the urban area is more dispersed which results in a higher growth in vehicle kilometres and a consequent higher increase in emissions.

5.3.19 **Accessibility and Integration:** The High Quality Public Transport corridor improves accessibility within the Harlow Urban Area and to locations south and east of the town that are currently unattractive to travel to by public transport. By passing through some of the Wards with the highest levels of social deprivation, the route will help create new opportunities for those living in these Wards to access employment and essential services.

5.3.20 Under either planning scenario, the public transport corridor will provide a key link between the bus and railway stations, thereby improving integration between modes. It will also serve a Park & Ride site located in the vicinity of Junction 7 of the M11.

Other NATA Objectives

Economic Appraisal: The Present Value of Benefits for Planning Scenario 1 at £1037m are nearly 40% lower than the PVB for Planning Scenario 2 (£1679m). However, the costs of Planning Scenario 1 schemes are lower (but by less than 10%). Consequently the NPV and BCR for Planning Scenario 2 are more advantageous at £1311m and 4.6 respectively. The discussion and comments on the approach to the economic appraisal provided in paragraphs 5.2.10 – 5.2.16 should be read in conjunction with this summary.

Deliverability

5.3.21 The highway schemes could be progressed through Highway Orders, typically with a timescale of 5-7 years. Around 60% of the traffic carried by either the Northern Relief Route or Southern Relief Route in 2021 is forecast to be development related and as such it would be reasonable to expect a significant contribution towards the costs from developers. However, given the overall cost of the transport package and the other draws on developer contributions through the planning process, it is likely that there will be a significant shortfall. This would need to be made up through Local Transport Plan Major Scheme Bids or some other form of public sector funding. Key economic indicates benchmark well against similar schemes and should meet Government value for money requirements.

5.3.22 The public transport proposal would require Transport and Water Act approval. Based on recent experience, this could take 7-12 years to achieve due to long development and appraisal processes. Major public transport schemes currently require 25% local contributions towards scheme costs.

Harlow Growth Options Study: Scenario 1 Scheme Appraisal Matrix (Table 5.1)

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
Strategy Description	- Northern Relief Route running South of Sawbridgeworth and new M11 J7A - Improvements to J7 of M11 - High Quality PT corridor from Northern development zone to Epping + P&R facility at M11 J7	- Sawbridgeworth Bypass - Improvements to J7 of M11 - High Quality PT corridor from Northern development zone to Epping + P&R facility at M11 J7	- Northern Relief Route running North of Sawbridgeworth and new M11 J7A - Improvements to J7 of M11 - High Quality PT corridor from Northern development zone to Epping + P&R facility at M11 J7	**Modelling Report**
Additional Housing (above consented development)	PS1: additional 19000 units: 10000 in northern development area, 3000 in HUA, 6000 at North Weald			
Total Jobs	PS1: total of 61650 including 8700 jobs in northern development area and 6250 at North Weald			
Transport Provision	High Quality Public Transport corridor; Epping-North Weald-Harlow (Northern Development) with P&R at M11 J7 Northern Relief Route D2AP standard (south of Sawbridgeworth with new M11 junction) M11 J7 improvements	High Quality Public Transport corridor; Epping-North Weald-Harlow (Northern Development) with P&R at M11 J7 Sawbridgeworth Bypass D2AP standard M11 J7 improvements	High Quality Public Transport corridor; Epping-North Weald-Harlow (Northern Development) with P&R at M11 J7 Northern Relief Route D2AP standard (north of Sawbridgeworth with new M11 junction) M11 J7 improvements	Schemes 1A and 1C link A414 Eastwick Road roundabout to M11 at new Junction 7A with intersection on A1184. S'worth Bypass links s A414 Eastwick Road roundabout with Bishop's Stortford Bypass
- Engineering Feasibility	PT corridor constrained to single track-alignment Epping-North Weald. Northern Relief Route requires extensive viaduct to cross River Stort flood plain. New motorway junction. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site. New bridge required for PT corridor to access northern development.	PT corridor constrained to single track-alignment Epping-North Weald. Sawbridgeworth bypass requires cross-country route that may be difficult to fit into landscape. New motorway junction. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site. New bridge required for PT corridor to access northern development.	PT corridor constrained to single track-alignment Epping-North Weald. Northern relief route requires viaduct to cross R Stort flood plain that is also close to A1184 junction and railway bridge. New motorway junction. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site. New bridge required for PT corridor to access northern area.	South of S'worth scheme has longer viaduct/bridge construction but North of S'worth scheme's vertical alignment may prove expensive. S'worth Bypass appears to have least problems.
- Operational Feasibility	PT corridor frequency constrained by single track alignment Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	PT corridor frequency constrained by single track alignment Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	PT corridor frequency constrained by single track alignment Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	Limited experience of public transport schemes of this type (guided bus) in the UK. Sustainability may be affected by aggressive response from existing bus operators.

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
- Outline Capital Cost Range (includes optimism bias)	Northern Relief Route £138–199m High Quality Public Transport corridor; Epping-North Weald-Harlow (North) - £114-164m + operating costs and subsidy M11 J7 improvements £10- 14m	Sawbridgeworth Bypass £200-287m High Quality Public Transport corridor; Epping-North Weald-Harlow (North) - £114-164m + operating costs and subsidy M11 J7 improvements £10- 14m	Northern Relief Route 183-263m High Quality Public Transport corridor; Epping-North Weald-Harlow (North) - £114-164m + operating costs and subsidy M11 J7 improvements £10- 14m	
Local Policy Objectives				
Key Local Objectives				
- Harlow's Regional Position	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with the HUA is difficult	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with the HUA is difficult	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with the HUA is difficult	South of S'worth scheme provides best linkage to M11 for access to south and north from Harlow town centre. North of S'worth scheme better suited for access to north and Stansted. S'worth Bypass only orientated to northern access and less direct access to M11.
- Regeneration of Harlow	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study Significant development within existing urban area and adjacent northern development may assist regeneration	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study Significant development within existing urban and adjacent northern development area may assist regeneration	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study Significant development within existing urban area and adjacent northern development may assist regeneration	
- Town Centre Development	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town.	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town.	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town.	All schemes place pressure on key town centre-northern development linkage: South of S'worth greatest stress; S'worth Bypass least. South of S'worth leads to lower overall traffic levels in town, and provides link from town centre to north and south, others more orientated towards north.
- Public Transport Usage	All development areas directly served by new High Quality Public Transport service.	All development areas directly served by new High Quality Public Transport service.	All development areas directly served by new High Quality Public Transport service.	

Harlow Growth Options Study: Scenario Appraisal Matrix

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
- Strategic Transport	Additional M11 junction. Improved access to rail and bus stations by PT, but additional traffic near station may impede road access. Provides A414 Harlow Bypass route in combination with M11 with faster journey times.	Improved access to rail and bus stations by PT, but additional traffic near station may impede road access. Provides relief to A1184 from Harlow to Bishop's Stortford.	Additional M11 junction. Improved access to rail and bus stations by PT, but additional traffic near station may impede road access. Provides some relief to A1184, but not effective alternative to current A414 route.	S'worth Bypass gives only one access point to M11, which is distant from large Northern Development area. Only South of S'worth scheme provides realistic A414 bypass
- Walking and Cycling	Development areas are largely within cycling catchment of Central Business District. Some locations are within walking catchment	Development areas are largely within cycling catchment of Central Business District. Some locations are within walking catchment	Development areas are largely within cycling catchment of Central Business District. Some locations are within walking catchment	
Key Regional Objectives				
National Policy Framework	Helps deliver housing and employment growth in LSPC Corridor	Helps deliver housing and employment growth in LSPC Corridor	Helps deliver housing and employment growth in LSPC Corridor	
Shared Priority Targets				
Congestion				
- Impacts on Local and Strategic Road Networks	South of S'worth provides effective A414 Harlow bypass in conjunction with M11, providing relief within Harlow, especially Edinburgh Way, although increases pressure on Allende and Velizy Avenues from traffic using it to access Town Centre. Increases traffic flows on J7-J7a section of M11, but turning flows at J7 reduced. PT corridor may reduce road capacity at key points especially J7.	Provides relief to A1184 Harlow-Bishop's Stortford. No relief to Harlow Urban Area, and concentrates N-S flows on A414 Allende and Velziy Avenues. PT corridor may reduce road capacity at key points especially J7.	Provides relief to A1184 Harlow-Bishop's Stortford. Minimal relief to Harlow Urban Area, and concentrates N-S flows on A414 Allende and Velizy Avenues. PT corridor may reduce road capacity at key points especially J7.	South of S'worth provides A414 Harlow Bypass route and traffic relief in Harlow Urban Area. North of S' worth and S'worth Bypass more orientated towards relieving A1184 and northbound traffic from Harlow, leading to more northern development traffic penetrating Harlow Urban Area.
Safety	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Slightly lower speeds in HUA with S'worth Bypass than South of S'worth, leading to marginal safety benefit.
Environmental Impacts	Effect of increased traffic more than offset by improvements in vehicle emissions over period	Effect of increased traffic more than offset by improvements in vehicle emissions over period	Effect of increased traffic more than offset by improvements in vehicle emissions over period	→ **Environmental Report** South of S'worth generates higher vehicle kilometres and

Harlow Growth Options Study: Scenario Appraisal Matrix

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
	2003-2021.	2003-2021.	2003-2021.	hence emissions than other two scheme but generates least traffic/ emissions in HUA.
Accessibility				
Severance	Northern Relief Route, mainline railway and River Stort form a barrier between northern development area and town centre	Sawbridgeworth bypass has minimal contribution to several effects, but severs some additional country lanes.	Northern Relief Route, mainline railway and River Stort form a barrier between northern development area and town centre	S'worth Bypass has lesser effect on northern development severance, but may have negative impacts on existing country lanes.
Public Transport	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London. Relief route provides improved access to Harlow town station from Sawbridgeworth area.	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London Relief route provides improved access to Harlow town station from Sawbridgeworth area.	
Social Inclusion	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	Scenario 1 internal development site incorporates known areas of social deprivation. Public transport scheme benefits those in the community without access to a car.
Development Site Access	South of S'worth offers best access to/from northern development site to north and south, and allows access to A1184 without penetrating Harlow. Allows North Weald to northern area traffic to use M11 avoiding Harlow. All development sites served by PT corridor.	S'worth Bypass offers best access to/from northern development from Bishop's Stortford/A120, but not elsewhere. No access benefits for North Weald. All development sites served by PT corridor.	North of S'worth offers good access to/from northern development to M11 north and Bishop's Stortford. No access benefits for North Weald. All development sites served by PT corridor.	South of S'worth provides best access to northern development area and offers benefits for North Weald. S'worth Bypass offers worst overall level of access for development.
Other NATA Objectives				
Economy				
- Transport Economic Efficiency	60-year Appraisal: PVB: £1,036.5m PVC: £339.2m NPV: £697.3m BCR: 3.1	60-year Appraisal: PVB: £605.0m PVC: £418.4m NPV: £186.6m BCR: 1.4	60-year Appraisal: PVB: £899.0m PVC: £396.8m NPV: £502.2m BCR: 2.3	South of S'worth likely to meet government value for money criteria, North of S'worth borderline, and S'worth Bypass unlikely to pass.
- Economic Regeneration	Concentration could enhance regeneration opportunities. For the town centre the northern	Concentration could enhance regeneration opportunities. For the town centre the northern	Concentration could enhance regeneration opportunities. For the town centre the northern	South of S'worth offers best overall level of access to key employment and commercial

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
	development could be both an opportunity and a threat. South of S'worth offers best access to key Town Centre and Northern Development sites from outside Harlow.	development could be both an opportunity and a threat. South of S'worth offers poorest access to key Town Centre and Northern Development sites from outside Harlow.	development could be both an opportunity and a threat. South of S'worth offers moderate access to key Town Centre and Northern Development sites from outside Harlow.	areas form outside the town.
- Transport Reliability	New M11 junction and Northern Relief Route create more route choices resulting in improved road and public transport network reliability. Short distance use of the M11 between J7 and J7a will be offset by less conflict at J7. Development traffic in the existing urban area will tend concentrated on certain links and result in lower average speeds and reduced reliability. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 35.6kph	Sawbridgeworth bypass will relieve A1184 route and offer some reliability improvements. Development traffic in the existing urban area will tend concentrated on certain links and result in lower average speeds and reduced reliability. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 34.1kph	New M11 junction and Northern Relief Route create more route choices resulting in improved road and public transport network reliability . Some short distance use of the M11 between J7 and J7a will be offset by less conflict at J7. Development traffic in the existing urban area will tend concentrated on certain links and result in lower average speeds and reduced reliability. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 34.4kph	South of S'worth offers most relief from traffic in Harlow Urban Area, resulting in highest average vehicle speeds and best levels of reliability. S'worth Bypass weakest in this respect. 2003 = 36.3kph
Integration				
- Modal	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	All schemes improve road access to Harlow Town Station. South of S'worth probably provides most benefits in this respect.
- Policy	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	South of S'worth best supports access to northern development sites.

Harlow Growth Options Study: Scenario Appraisal Matrix

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
Supplementary Appraisal Issues				
Community Impact	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	All schemes offer some reduction in traffic impact for Sawbridgeworth, but S'worth Bypass best and South of S'worth worst.
Public Acceptability	Intensification of development will have an impact on local communities and the transport network in the urban area South of S'worth will have significant visual impact.	Intensification of development will have an impact on local communities and the transport network in the urban area S'worth Bypass will have some visual impact	Intensification of development will have an impact on local communities and the transport network in the urban area North of S'worth will have some visual impact.	South of S'worth likely to be most controversial in terms of impact on local area. 1B has minimal impact.
Deliverability				
Approvals	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Public Inquiry will almost certainly be triggered. The deliverability of a Northern Relief Route will require the approval of three Highway authorities
Timescales	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Based on current trends. Experience points to long development and appraisal phases for major public transport schemes S'worth Bypass likely to be quickest of relief route scheme to progress, South of S'worth slowest
Funding Issues				
- Developer Contributions	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 60 % of traffic in 2021 on the Northern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 50% of traffic in 2021 on the Northern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 55 % of traffic in 2021 on the Northern Relief Road is development related	Overall volume of development traffic on South of S'worth much higher than 1B.
- Local Contributions	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Public transport major schemes require 25% local contribution to scheme costs
- Central Government Contributions	Will be needed through LTP Major Scheme Bids or other funding mechanism	Will be needed through LTP Major Scheme Bids or other funding mechanism	Will be needed through LTP Major Scheme Bids or other funding mechanism	

Harlow Growth Options Study: Scenario 2 Strategy Appraisal Matrix (Table 5.3)

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
Strategy Description	- Southern Relief Route running from J7 of M11 to Tyler's Cross - Improvements to J7 of M11 - High Quality PT corridor from Harlow Town Station to Epping with P&R at M11 J7	- Southern Relief Route running from J7 of M11 to A414 Eastwick Road - Improvements to J7 of M11 - High Quality PT corridor from Harlow Town Station to Epping with P&R at M11 J7	→ **Modelling Report** Partial scheme shorter version of Full scheme
Additional Housing (above consented development)	PS2: Additional 19000 units: 4000 in eastern development area, 6000 in south-western development area and 9000 at North Weald		
Total Jobs	PS2: Total of 61650 including 8700 new jobs in south-western development area and 6250 at North Weald		
Transport Provision	High Quality Public Transport corridor; Epping-North Weald-Harlow Town Station with P&R at M11 J7 Southern Relief Route D2AP standard (M11 J7 to Tyler's Cross) M11 Junction 7 improvements	High Quality Public Transport corridor; Epping-North Weald-Harlow Town station with P&R at M11 J7 Southern Relief Route D2AP standard (M11 J7 to A414 Eastwick Road) M11 Junction 7 improvements	Full scheme provides complete A414 relief route, avoiding Harlow Urban Area.
- Engineering Feasibility	No major structures envisaged for relief route. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site.	Full Southern Relief Route requires viaduct to cross River Stort and railway. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site.	
- Operational Feasibility	PT corridor frequency constrained by single track alignment. Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	PT corridor frequency constrained by single track alignment. Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	Limited experience of public transport schemes of this type (guided bus) in the UK. Sustainability may be affected by aggressive response from existing bus operators.
- Outline Capital Cost Range (includes optimism bias)	Southern Relief Route £85-122m (includes M11 J7 improvement) High Quality Public Transport corridor; Epping-North Weald-Harlow (Central) - £95-137m+ operating costs and subsidy	Southern Relief Route £179–258m (includes M11 J7 improvement) High Quality Public Transport corridor; Epping-North Weald-Harlow (Central) - £95-137m+ operating costs and subsidy	
Local Policy Objectives			
Key Local Objectives			→ **Problems & Opportunities Report**
- Harlow's Regional Position	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre	

Harlow Growth Options Study: Scheme Appraisal Matrix

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
- Regeneration of Harlow	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study	→ **Harlow Regeneration Study**
- Town Centre Development	More dispersed edge of town development could threaten centre.	More dispersed edge of town development could threaten centre.	Full scheme offers potential alternative route into town for A414 West Traffic.
- Public Transport Usage	Some development areas directly served by new High Quality Public Transport but peripheral areas more awkward to serve. Eastern development area could be served by existing bus lane corridors	Some development areas directly served by new High Quality Public Transport but peripheral areas more awkward to serve Eastern development area could be served by existing bus lane corridors	
- Strategic Transport	Improved access to Harlow rail and bus stations by PT Improved access for south-west Harlow to strategic road network.	Improved access to Harlow rail and bus stations Improved access for south-west and north-west Harlow to strategic road network. Creates A414 Harlow bypass route	Full scheme offers wider strategic benefits, including removal of through A414 traffic from Harlow and links to north-west as well as south from all western of Harlow.
- Walking and Cycling	Development areas are largely within cycling catchment of Central Business District. South West and N Weald developments more self contained, with better potential for walking and cycling trips.	Development areas are largely within cycling catchment of Central Business District. South West and N Weald developments more self contained, with better potential for walking and cycling trips.	Southern Relief Route may be a barrier to walking and cycling from SW development area into existing Harlow Urban Area.
Key Regional Objectives	Consistent with emerging RPG	Consistent with emerging RPG	
National Policy Framework	Helps deliver housing and employment growth in LSCP Corridor	Helps deliver housing and employment growth in LSCP Corridor	→ **Sustainable Communities Plan**
Shared Priority Targets			
Congestion			→ **Modelling Report**
- Impacts on Local and Strategic Road Networks	Minimal congestion relief within Harlow. Increased turning flows at J7 of M11. Little impact on the M11 north of Junction 7, but increased 'turning flows' at J7. Significant development traffic within urban area.	Significant congestion relief within urban area with diversion of A414 through traffic. Little impact on the M11 north of Junction 7, but increased 'turning flows' at J7. Better route choice for development traffic travelling to northwest. Provides alternative route for traffic from north west of Harlow.	Partial scheme only acts as access route to development area, while Full scheme provides Harlow bypass for A414 traffic, and hence greater decongestion.
Safety	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Slightly reduced speeds in HUA with Partial scheme, leading to marginal safety benefit.
Environmental Impacts	Full scheme generates higher vehicle kilometres and hence emissions over whole network, but reduced vehicle km in urban area.	Full scheme generates higher vehicle kilometres and hence emissions over whole network, but reduced vehicle km in urban area.	→ **Environmental Report** Full scheme generates higher vehicle kilometres and hence emissions over whole network, but reduced vehicle km in urban area.

Harlow Growth Options Study: Scheme Appraisal Matrix

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
Accessibility			
Severance	Southern Relief Route may increase severance with impacts on the rural lanes to the south of Harlow (or increase costs to maintain access)	Southern Relief Route may increase severance with impacts on the rural lanes to the south of Harlow (or increase costs to maintain access)	M11 remains a barrier to accessibility between North Weald and Harlow. Partially mitigated by PT link. Slightly less severance effect from Partial scheme.
Public Transport	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London, but some development areas cannot be served as well (eg Nazeing)	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London, but some development areas cannot be served as well (eg Nazeing)	
Social Inclusion	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	
Development Site Access	Construction access to south western development area difficult without part of the Southern Relief Route	Construction access to south western development area difficult without part of the Southern Relief Route. Full route offers access to SW site from north and south	
Other NATA Objectives			
Economy			
- Transport Economic Efficiency	60-year Appraisal: PVB: £981.6m PVC: £245.6m NPV: £735.9m BCR: 4.0	60-year Appraisal: PVB: £1,678.6m PVC: £368.0m NPV: £1,310.6m BCR: 4.6	Both schemes meet government value-for-money requirements.
- Economic Regeneration	Increased reliance on local regeneration opportunities linked to peripheral development	Increased reliance on local regeneration opportunities linked to peripheral development. Route 2C offers improved access to Pinacles industrial area.	→ **Economic Regeneration Report**
- Transport Reliability	M11 J7 continues to be the sole focus of both through A414 traffic and turning 11 movements, increasing the reliance of smooth operation of the key junction. Development traffic channelled towards J7 because of lack of northern access. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 35.4kph (2003 = 36.3kph)	Southern Relief Route reduces through traffic resulting in improved road and public transport network reliability. M11 J7 continues to be the sole focus of both through A414 traffic and turning 11 movements, increasing the reliance of smooth operation of the key junction. Development traffic in the existing urban area may be more widely dispersed resulting in lower impacts on speeds. Public Transport corridor and highway intersections may effect reliability of either	Higher overall of decongestion offered by 2C results in higher overall reliability of transport system. Average vehicle speed in HUA in 2021 with Full scheme similar to current.

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
		or both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 36.1kph (2003 = 36.3kph)	
Integration			
- Modal	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance). No direct PT link to Town Station from Eastern and parts of Western development site.	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance) Station from Eastern and parts of Western development site. Bypass provides alternative link to Harlow Town Station from South-Western Development avoiding Town centre.	Exact configuration of PT access to Eastern and South-western sites uncertain as reliant on commercial bus operators.
- Policy	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by public transport to Harlow hospital. Full scheme provides alternative road access to Hospital via Pinacles	Full scheme provides improved road access to Hospital.
Supplementary Appraisal Issues			
Community Impact	More dispersed patterns of new employment may not provide as many local opportunities for Harlow residents	More dispersed patterns of new employment may not provide as many local opportunities for Harlow residents Access to/from south-western development area better with Full scheme	Southern Relief Route draws more traffic towards rural communities in the south west, especially at Tyler's Cross end of Partial scheme.
Public Acceptability	Southern Relief Route is potentially invasive in the immediate rural area	Southern Relief Route is potentially invasive in the immediate rural area	The High Quality Public Transport scheme will have impacts along the route notably within the green wedges of Harlow Some long term public awareness of both highway schemes, but less so with Partial scheme.
Deliverability			
Approvals	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Public Inquiry will almost certainly be triggered
Timescales	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Based on current trends. Experience points to long development and appraisal phases for major public transport schemes. Partial scheme can be delivered more quickly than Full scheme, or may provided an interim solution before progressing with Full scheme route.

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
Funding Issues			
- Developer Contributions	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 75 % of traffic in 2021 on the Southern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 60 % of traffic in 2021 on the Southern Relief Road is development related, although volume much higher than in Partial scheme.	Transport infrastructure is only one draw on developer contributions through the Section 106 process
- Local Contributions	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Public transport major schemes require 25% local contribution to scheme costs
- Central Government Contributions	Will be needed through LTP Major Scheme Bids or other funding mechanism	Will be needed through LTP Major Scheme Bids or other funding mechanism	

Harlow Growth Options Study: Scenario Appraisal Matrix (Table 5.4)

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
Scenario Description	North–south axis with internal intensification and North Weald	East–west axis and North Weald	→ **Modelling Report**
Additional Housing (above consented development)	Additional 19000 new units; 10000 in northern development area , 3000 in Harlow Urban Area , 6000 at North Weald	Additional 19000 units; 4000 in eastern development area, 6000 in south-western development area, 9000 at North Weald	Total additions are the same and about 50% increase on current Harlow Urban Area (HUA). Note that development in North Weald is greater in Scenario 2
Total Jobs	Total of 61650 including 8700 new jobs in northern development area and 6250 at North Weald	Total of 61650 including 8700 new jobs in south-western development area and 6250 at North Weald	Note, no employment in eastern development area
Transport Provision	High Quality Public Transport corridor-Epping-North Weald-Harlow (North) with J7 P&R. Northern Relief Route D2AP standard (South of Sawbridgeworth with new M11 junction). M11 J7 improvements	High Quality Public Transport corridor-Epping-North Weald-Harlow (Central) with J7 P&R. Southern Relief Route D2AP standard (FullvA414 to M11 J7). M11 J7 improvements	PS1 assumes new PT around northern development area. PS2 assumes additional local bus services connecting eastern and south-western development area to rest of HUA
- Engineering Feasibility	Northern Relief Route requires extensive viaduct to cross River Stort flood plain New motorway junction needed New river and rail bridges required for both highway and public transport schemes	Southern Relief Route requires viaduct to cross River Stort and bridge over railway	Construction of Northern Relief Route more complex but 3.6km shorter than Southern Relief Route. Extending the High Quality Public Transport corridor into the northern development area (Scenario 1) requires new river and rail bridges.
- Operational Feasibility	Some on-street running associated with public transport corridor – potential highway impacts, particularly in town centre New M11 Junction creates new patterns of movement linking with Junctions 7 and 8	Some on-street running associated with public transport corridor – potential highway impacts, particularly in town centre	Few public transport schemes of this type (guided bus) implemented in the UK. PS1 -7km distance between new M11 Junction and J7 is greater than minimum between junstions. PS2 needs larger scale improvement at Junction 7
- Outline Capital Cost Range (includes optimism bias)	Northern Relief Route (Length 6.6 km) £138–199m. High Quality Public Transport corridor - Epping-North Weald-Harlow (North) (Length 16 km) £114-164m + operating costs and subsidy. M11 J7 improvements £10- 14m	Southern Relief Route (Length 10.2 km) £179–258m (includes M11 J7 improvement). High Quality Public Transport corridor - Epping-North Weald-Harlow (Central) (Length 14 km) £95-137m+ operating costs and subsidy.	Southern Relief Route approximately 3.6km longer than Northern Relief Route Extending the High Quality Public Transport corridor into the northern development area (Scenario 1) requires new river and rail bridges thus increasing costs
Local Policy Objectives			
Key Local Objectives			→ **Problems & Opportunities Report**
- Harlow's Regional Position	Helps strengthen Harlow's potential as an attractive sub regional centre along the M11 corridor, broadening the regional knowledge economy and offering the potential to	Helps strengthen Harlow's potential as an attractive sub regional centre along the M11 corridor, broadening the regional knowledge economy and offering the potential to	Scenario 1 better serves the growing needs of Stansted whilst Scenario 2 is more orientated towards London.

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
	develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with Harlow Urban Area is difficult	develop a competitive shopping centre. Edge of urban area developments creates a more dispersed town.	
- Regeneration of Harlow	Consistent with the 'Higher Growth - More Dynamic' scenario recommended by the Harlow Regeneration Study. Location of some development within existing urban area may assist regeneration	Consistent with the 'Higher Growth - More Dynamic' scenario recommended by the Harlow Regeneration Study	→ **Harlow Regeneration Study** Potential benefits include more diverse employment opportunities, reduction in deprivation, improved housing stock, improved leisure, retail and community facilities, better transport links and improved accessibility. Scenario 1 enhances regeneration potential
- Town Centre Development	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town	More dispersed edge of town development could threaten centre.	Greater potential benefits with Scenario 1 provided that a strong connection is made with the northern development area. Scenario 1 includes concentration of development in the town centre.
- Public Transport Usage	All development areas could be directly served by new High Quality Public Transport route	Some development areas could be directly served by new High Quality Public Transport route but part of south west and eastern areas would rely on local bus connections	Both scenarios create a new HQ PT connection between Harlow and north London. HQ PT usage higher in PS1 as development better concentrated along PT route and part of PS2 awkward to serve directly
- Strategic Transport	Additional M11 junction. Improved access to Harlow rail and bus stations. Improved access for north-east Harlow to strategic road network	Improved access to Harlow rail and bus stations. Improved access for south-west Harlow to strategic road network.	Scenario 2 continues to rely on single point of access to/from M11 which compares poorly with other similar towns
- Walking and Cycling	Northern development area is within cycling catchment of Central Business District. Some locations would be within walking catchment of centre but not the rest of the Harlow walk and cycle network	Development areas are just within cycling but not walking catchment of Central Business District. South west and eastern developments well connected to existing networks, with better potential for walking and cycling trips.	More dispersed nature of Scenario 2 offers less potential for walking to /from central Harlow than PS1. Larger more self-contained development areas in PS1 offer greater potential for internal walking and cycling. 1.3% more trips from development areas made by car or PT in PS1 than PS2.
Key Regional Objectives	Broadly consistent with emerging Regional Spatial Strategy 14 (East of England Plan)	Broadly consistent with emerging Regional Spatial Strategy 14 (East of England Plan)	
National Policy Framework	Helps deliver housing and employment growth in London – Stansted – Peterborough – Cambridge Corridor	Helps deliver housing and employment growth in London – Stansted – Peterborough – Cambridge Corridor	→ **Sustainable Communities Plan**

Harlow Growth Options Study: Scenario Appraisal Matrix

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
Shared Priority Targets			
Congestion			→ **Modelling Report**
- Impacts on Local and Strategic Road Networks	Key beneficial impacts of the transport investment in the existing urban area, on the A414, especially Edinburgh Way, and A1184. 20% increase in flows in 2021 on the M11 north of Junction 7, but reduced 'turning' flows at J7. Development traffic concentrated more on key links (Allende and Velizy Avenue etc) in HUA causing localised congestion and lower speeds. 41% growth in vehicle kilometres in Harlow Urban Area and 62% growth in vkms over whole study area between 2003 and 2021.	Key beneficial impacts of the transport investment in the existing urban area and on the A414, but with smaller impacts on Edinburgh Way. 13% increase in flows in 2021 on the M11 north of Junction 7, and increased 'turning flows' at J7. Development traffic within existing urban area more dispersed, but still some more congestion and slower speeds. 62% growth in vehicle kilometres in Harlow Urban Area and 53% growth in vkms over whole study area between 2003 and 2021.	Transport schemes as tested not designed to mitigate all development traffic impacts or general increases in congestion. Also schemes perform strategic functions. Level of development suggests worsening congestion over time; the transport schemes only just cater for 'background' growth in existing Harlow Urban Area traffic by 2021, and cannot fully mitigate additional growth due to development. PS1 has greater beneficial impact on strategic traffic. PS2 benefits more of the existing HUA. Difference in impacts on M11 north of J7 from development traffic only 7% in PS2
Safety	Level of development suggests increased accident exposure/risk that is mitigated in part by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part by the transport schemes	
Environmental Impacts	**Landscape** Requires an extensive (3km) viaduct to cross River Stort flood plain. **Heritage** Alignment close to Gibberd Garden and Pishiobury Garden **Local Air Quality** Overall increase (approx 40%) in emissions across HUA. Benefits from use of PT scheme. Other direct environmental impacts will be difficult to mitigate. Potential impacts of constructing additional PT scheme over floodplain etc. **Journey Ambiance** High Quality Public Transport scheme will be fast and reliable, provide a high degree of passenger comfort, good information and a safe travelling environment.	**Landscape** Requires a short (2km) viaduct to cross River Stort flood plain. Cuts the natural ridge to south of Harlow **Local Air Quality** Overall increase (approx 60%) in emissions across HUA. Benefits from the use of the public transport scheme **Journey Ambiance** High Quality Public Transport scheme will fast and reliable, provide a high degree of passenger comfort, good information and a safe travelling environment. **Construction Impacts** Significant impacts on adjoining areas of existing development during construction phase.	→ **Environmental Report** Elevated setting of Northern Relief Route is a key issue. PS2 generates higher overall increases in emissions than PS1 across HUA, but has lower emissions outside. High Quality Public Transport scheme will generate some small scale air quality and noise benefits, more noticeable for PS1.
Accessibility			
Severance	Northern Relief Route adds to the barrier formed by mainline railway and River Stort form a barrier between northern development area and town centre	Southern Relief Route may increase severance to west and south with impacts on the rural lanes (or increased costs to maintain access)	M11 remains a barrier to accessibility between North Weald and Harlow partly mitigated by PT scheme. Concentration of severance issues in PS1 may provide opportunity for more effective solutions to be achieved through planning and design

Harlow Growth Options Study: Scenario Appraisal Matrix

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
Public Transport	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London, but some development areas cannot be served as well (eg Nazeing)	PS2 will require more local bus services to maintain accessibility
Social Inclusion	High Quality Public Transport corridor runs through some of the Wards with the highest indices of social deprivation. helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the Wards with the highest indices of social deprivation. helping to improve accessibility to jobs and local amenities	PS1 internal development site incorporates known areas of social deprivation. Public transport scheme benefits those in the community without access to a car
Development Site Access	Construction access to all development sites possible without highway schemes.	Construction access to south western development area difficult without part of the Southern Relief Route	More scope to build out (not occupy) some of Scenario 1 in advance of highway schemes. Possibility that construction materials for PS1 can be sourced locally
Other NATA Objectives			
Economy			
- Transport Economic Efficiency	60-year Appraisal: PVB: £1,036.5m PVC: £339.2m NPV: £697.3m BCR: 3.1	60-year Appraisal: PVB: £1,678.6m PVC: £368.0m NPV: £1,310.6m BCR: 4.6	Key indicators benchmark well against similar transport schemes and should meet government value for money requirements. Good balance of benefits between Road and PT users – schemes work well for both user groups. Some PS2 benefit related to assumed local bus services
- Economic Regeneration	Internal development area could enhance regeneration opportunities. For the town centre the northern development could be both an opportunity and a threat	Increased reliance on local regeneration opportunities separate from peripheral development	→ **Economic Regeneration Report**
- Transport Reliability	New M11 junction and Northern Relief Route create more route choices involving M11 and A1184 resulting in improved road and public transport network reliability. Short distance use of the M11 between J7 and J7a will be partly offset by less conflict at J7. Development traffic in the existing urban area concentrated on certain links and result in lower average speeds and reduced reliability. Slightly lower average speeds in Harlow Urban Area	Southern Relief Route reduces through-traffic resulting in improved road and public transport network reliability. M11 J7 continues to be the sole focus of both through A414 and B1393traffic and turning M11 movements, increasing the reliance on smooth operation of this key junction. Development traffic in the existing urban area may be more widely dispersed resulting in lower impacts on speeds. Average speed in urban area virtually unchanged.	High Quality Public Transport system, with segregation in key locations will improve public transport reliability. Reduced dependency on J7 in PS1 would improve reliability of strategic network.
Integration			
- Modal	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride(local and long distance)	Scenario 2 may be difficult to fully integrate with the new high quality or existing public transport systems

Harlow Growth Options Study: Scenario Appraisal Matrix

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
- Policy	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility only by public transport to Harlow hospital	Scenario 2 benefits less from the improved regional road access to Harlow hospital
Supplementary Appraisal Issues			
Community Impact	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	More dispersed patterns of new employment may not provide as many local opportunities for Harlow residents	Northern Relief Route reduces transport impact on Sawbridgeworth Southern Relief Route draws more traffic towards rural communities in the area south west of Harlow
Public Acceptability	Intensification of development will have an impact on local communities and the transport network in the urban area Visual impact of Northern Relief Route likely to be a key issue	Southern Relief Route is potentially invasive in the immediate rural area	The High Quality Public Transport scheme will have impacts along the route notably within the green wedges of Harlow Some long term public awareness of both highway schemes
Deliverability			
Approvals	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Public Inquiry will almost certainly be triggered
Timescales	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Based on current trends. Experience points to long development and appraisal phases for major public transport schemes.
Funding Issues			
- Developer Contributions	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 60 % of traffic in 2021 on the Northern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 60 % of traffic in 2021 on the Southern Relief Road is development related	Transport infrastructure is only one draw on developer contributions through the Section 106 process PS1 schemes are £20-30m lower than PS2
- Local Contributions	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Public transport major schemes require 25% local contribution to scheme costs
- Central Government Contributions	Will be needed through LTP Major Scheme Bids or other funding mechanism. BCR of 3.1 should meet government value-for-money criterion.	Will be needed through LTP Major Scheme Bids or other funding mechanism. BCR of 4.6 should meet government value-for-money criterion.	

Harlow Growth Options Study: Scenario Appraisal Matrix

6 Next Steps

6.1 How Far has the Study Gone?

6.1.1 This Transport Study has tested the feasibility of two alternative planning scenarios against a range of major transport schemes. It has also provided an initial appraisal of the identified transport options for each planning scenario against the Government's NATA criteria, thereby enabling the relative merits of each variant to be readily understood.

6.1.2 As part of the study, a sophisticated multi-modal strategic area transport model (Harlow TRAM) has been developed, calibrated and validated. This model is now available as a useful tool to help in the assessment of any alternative land use/transportation scenarios that may emerge.

6.2 Future Planning Scenarios

6.2.1 The two planning scenarios that form the basis of this study are hypothetical and were based on the best information that was available at the time, when a decision regarding quantum and distribution of development had to be taken for modelling purposes.

6.2.2 The draft East of England Plan - Regional Spatial Strategy 14 (RSS 14) was launched for consultation on 8 December 2004. This document identifies Harlow as a "strategic growth location" and sets out proposals for new housing and employment in the area that can be summarised as follows:

- major urban extensions to the north to provide at least 10,000 dwellings and substantial employment growth by 2021;
- development within and east of Harlow to provide 8000 dwellings, and some more limited development to the south and west of Harlow;
- mixed used housing/employment development at North Weald airfield and the surrounding land to accommodate up to 6000 new dwellings by 2021.

6.2.3 These draft proposals suggest the potential for more intensive development than that assumed for the Transportation Study; also a variation to the spatial distribution of the development.

6.2.4 Given that the TRAM model is readily available, it would now seem prudent to update the model input data to make it consistent with the RSS and complete a further set of model runs. This would provide a revised set of forecasts and enable the major schemes identified through this study to be tested against the draft East of England Plan proposals.

6.3 Local Transport Strategies

6.3.1 To date, the TRAM model has been used as a tool to help in the assessment of alternative major transport schemes. By using the model in this way, it has been possible to provide a comparison of the relative merits of a range of schemes against key assessment criteria.

6.3.2 The model has the capability to analyse the effects of local transport strategies that might be complementary to major scheme proposals (examples include parking restraint, local traffic management, congestion charging and off-site highway works associated with a particular development site) although this functionality has not so far been used to any significant extent.

6.3.3 As preferred transport schemes emerge over the coming months, it would be sensible to take the opportunity to use TRAM to assess the combined effects of major schemes with local transport strategies. In this way the optimum integrated transport package for Harlow can be identified.

6.4 Public Transport Provision in the Development Areas

6.4.1 The modelling work undertaken to date assumes that the development areas are served either directly by the High Quality Public Transport corridor or by conventional buses offering a similar level of service to that experienced elsewhere in Harlow. In addition, within the areas, simple assumptions have been made as no road layouts were available. These assumptions are consistent with the current level of detail available on development site layout.

6.4.2 As more detailed layout plans emerge, it will be possible to undertake a more detailed bus network planning exercise to ensure that public transport accessibility is maximised, the development areas are well connected to the existing Harlow Urban Area and any opportunities for bus priority are fully realised.

6.4.3 Any changes to the level of service could then be introduced into the Harlow TRAM model

6.5 Highway Schemes

6.5.1 The detail of the highway schemes should be reviewed in a similar way to the public transport provision as the detail of the development areas emerges. This will involve further consideration of the location of access points and junctions and a refinement of the broad alignments that have been identified to date.

6.6 Detailed Appraisal of Major Schemes

6.6.1 The scheme appraisal completed to date helps to demonstrate the robustness of the transport proposals against the Government's NATA objectives. It is not, however, of sufficient detail to represent a full scheme appraisal (or Annexe E submission). The assessment undertaken thus far suggests that, whilst developer contributions towards transport infrastructure could be significant, there is likely to be a significant funding gap associated with any of the major schemes. If this is the case, then some form of public funding will be necessary that is justified by a detailed scheme appraisal undertaken in line with the HM Treasury Green Book requirements.

6.6.2 Outputs from the Harlow TRAM model will provide some of the key data that is needed for this detailed appraisal.

Harlow Growth Options Study: Scenario Appraisal Matrix (Table 5.4) Contents index

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
Scenario Description	North–south axis with internal intensification and North Weald	East–west axis and North Weald	→ **Modelling Report**
Additional Housing (above consented development)	Additional 19000 new units; 10000 in northern development area , 3000 in Harlow Urban Area , 6000 at North Weald	Additional 19000 units; 4000 in eastern development area, 6000 in south-western development area, 9000 at North Weald	Total additions are the same and about 50% increase on current Harlow Urban Area (HUA). Note that development in North Weald is greater in Scenario 2
Total Jobs	Total of 61650 including 8700 new jobs in northern development area and 6250 at North Weald	Total of 61650 including 8700 new jobs in south-western development area and 6250 at North Weald	Note, no employment in eastern development area
Transport Provision	High Quality Public Transport corridor-Epping-North Weald-Harlow (North) with J7 P&R. Northern Relief Route D2AP standard (South of Sawbridgeworth with new M11 junction). M11 J7 improvements	High Quality Public Transport corridor-Epping-North Weald-Harlow (Central) with J7 P&R. Southern Relief Route D2AP standard (FullvA414 to M11 J7). M11 J7 improvements	PS1 assumes new PT around northern development area. PS2 assumes additional local bus services connecting eastern and south-western development area to rest of HUA
- Engineering Feasibility	Northern Relief Route requires extensive viaduct to cross River Stort flood plain New motorway junction needed New river and rail bridges required for both highway and public transport schemes	Southern Relief Route requires viaduct to cross River Stort and bridge over railway	Construction of Northern Relief Route more complex but 3.6km shorter than Southern Relief Route. Extending the High Quality Public Transport corridor into the northern development area (Scenario 1) requires new river and rail bridges.
- Operational Feasibility	Some on-street running associated with public transport corridor – potential highway impacts, particularly in town centre New M11 Junction creates new patterns of movement linking with Junctions 7 and 8	Some on-street running associated with public transport corridor – potential highway impacts, particularly in town centre	Few public transport schemes of this type (guided bus) implemented in the UK. PS1 -7km distance between new M11 Junction and J7 is greater than minimum between junstions. PS2 needs larger scale improvement at Junction 7
- Outline Capital Cost Range (includes optimism bias)	Northern Relief Route (Length 6.6 km) £138–199m. High Quality Public Transport corridor - Epping-North Weald-Harlow (North) (Length 16 km) £114-164m + operating costs and subsidy. M11 J7 improvements £10- 14m	Southern Relief Route (Length 10.2 km) £179–258m (includes M11 J7 improvement). High Quality Public Transport corridor - Epping-North Weald-Harlow (Central) (Length 14 km) £95-137m+ operating costs and subsidy.	Southern Relief Route approximately 3.6km longer than Northern Relief Route Extending the High Quality Public Transport corridor into the northern development area (Scenario 1) requires new river and rail bridges thus increasing costs
Local Policy Objectives			
Key Local Objectives			→ **Problems & Opportunities Report**
- Harlow's Regional Position	Helps strengthen Harlow's potential as an attractive sub regional centre along the M11 corridor, broadening the regional knowledge economy and offering the potential to	Helps strengthen Harlow's potential as an attractive sub regional centre along the M11 corridor, broadening the regional knowledge economy and offering the potential to	Scenario 1 better serves the growing needs of Stansted whilst Scenario 2 is more orientated towards London.

Harlow Growth Options Study: Scenario Appraisal Matrix Contents index

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
	develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with Harlow Urban Area is difficult	develop a competitive shopping centre. Edge of urban area developments creates a more dispersed town.	
- Regeneration of Harlow	Consistent with the 'Higher Growth - More Dynamic' scenario recommended by the Harlow Regeneration Study. Location of some development within existing urban area may assist regeneration	Consistent with the 'Higher Growth - More Dynamic' scenario recommended by the Harlow Regeneration Study	→ **Harlow Regeneration Study** Potential benefits include more diverse employment opportunities, reduction in deprivation, improved housing stock, improved leisure, retail and community facilities, better transport links and improved accessibility. Scenario 1 enhances regeneration potential
- Town Centre Development	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town	More dispersed edge of town development could threaten centre.	Greater potential benefits with Scenario 1 provided that a strong connection is made with the northern development area. Scenario 1 includes concentration of development in the town centre.
- Public Transport Usage	All development areas could be directly served by new High Quality Public Transport route	Some development areas could be directly served by new High Quality Public Transport route but part of south west and eastern areas would rely on local bus connections	Both scenarios create a new HQ PT connection between Harlow and north London. HQ PT usage higher in PS1 as development better concentrated along PT route and part of PS2 awkward to serve directly
- Strategic Transport	Additional M11 junction. Improved access to Harlow rail and bus stations. Improved access for north-east Harlow to strategic road network	Improved access to Harlow rail and bus stations. Improved access for south-west Harlow to strategic road network.	Scenario 2 continues to rely on single point of access to/from M11 which compares poorly with other similar towns
- Walking and Cycling	Northern development area is within cycling catchment of Central Business District. Some locations would be within walking catchment of centre but not the rest of the Harlow walk and cycle network	Development areas are just within cycling but not walking catchment of Central Business District. South west and eastern developments well connected to existing networks, with better potential for walking and cycling trips.	More dispersed nature of Scenario 2 offers less potential for walking to /from central Harlow than PS1. Larger more self-contained development areas in PS1 offer greater potential for internal walking and cycling. 1.3% more trips from development areas made by car or PT in PS1 than PS2.
Key Regional Objectives	Broadly consistent with emerging Regional Spatial Strategy 14 (East of England Plan)	Broadly consistent with emerging Regional Spatial Strategy 14 (East of England Plan)	
National Policy Framework	Helps deliver housing and employment growth in London – Stansted – Peterborough – Cambridge Corridor	Helps deliver housing and employment growth in London – Stansted – Peterborough – Cambridge Corridor	→ **Sustainable Communities Plan**

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Congestion			→ **Modelling Report**
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Safety	Level of development suggests increased accident exposure/risk that is mitigated in part by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part by the transport schemes	
Environmental Impacts	**Landscape** Requires an extensive (3km) viaduct to cross River Stort flood plain. **Heritage** Alignment close to Gibberd Garden and Pishiobury Garden **Local Air Quality** Overall increase (approx 40%) in emissions across HUA. Benefits from use of PT scheme. Other direct environmental impacts will be difficult to mitigate. Potential impacts of constructing additional PT scheme over floodplain etc. **Journey Ambiance** High Quality Public Transport scheme will be fast and reliable, provide a high degree of passenger comfort, good information and a safe travelling environment.	**Landscape** Requires a short (2km) viaduct to cross River Stort flood plain. Cuts the natural ridge to south of Harlow **Local Air Quality** Overall increase (approx 60%) in emissions across HUA. Benefits from the use of the public transport scheme **Journey Ambiance** High Quality Public Transport scheme will fast and reliable, provide a high degree of passenger comfort, good information and a safe travelling environment. **Construction Impacts** Significant impacts on adjoining areas of existing development during construction phase.	→ **Environmental Report** Elevated setting of Northern Relief Route is a key issue. PS2 generates higher overall increases in emissions than PS1 across HUA, but has lower emissions outside. High Quality Public Transport scheme will generate some small scale air quality and noise benefits, more noticeable for PS1.
Accessibility			
Severance	Northern Relief Route adds to the barrier formed by mainline railway and River Stort form a barrier between northern development area and town centre	Southern Relief Route may increase severance to west and south with impacts on the rural lanes (or increased costs to maintain access)	M11 remains a barrier to accessibility between North Weald and Harlow partly mitigated by PT scheme. Concentration of severance issues in PS1 may provide opportunity for more effective solutions to be achieved through planning and design

Harlow Growth Options Study: Scenario Appraisal Matrix Contents index

Performance Indicator	Planning Scenario 1 (PS1)	Planning Scenario 2 (PS2)	Key Differences in Performance or Comments
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Social Inclusion	High Quality Public Transport corridor runs through some of the Wards with the highest indices of social deprivation. helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the Wards with the highest indices of social deprivation. helping to improve accessibility to jobs and local amenities	PS1 internal development site incorporates known areas of social deprivation. Public transport scheme benefits those in the community without access to a car
Development Site Access	Construction access to all development sites possible without highway schemes.	Construction access to south western development area difficult without part of the Southern Relief Route	More scope to build out (not occupy) some of Scenario 1 in advance of highway schemes. Possibility that construction materials for PS1 can be sourced locally
Other NATA Objectives			
Economy			
- Transport Economic Efficiency	60-year Appraisal: PVB: £1,036.5m PVC: £339.2m NPV: £697.3m BCR: 3.1	60-year Appraisal: PVB: £1,678.6m PVC: £368.0m NPV: £1,310.6m BCR: 4.6	Key indicators benchmark well against similar transport schemes and should meet government value for money requirements. Good balance of benefits between Road and PT users – schemes work well for both user groups. Some PS2 benefit related to assumed local bus services
- Economic Regeneration	Internal development area could enhance regeneration opportunities. For the town centre the northern development could be both an opportunity and a threat	Increased reliance on local regeneration opportunities separate from peripheral development	→ **Economic Regeneration Report**
- Transport Reliability	New M11 junction and Northern Relief Route create more route choices involving M11 and A1184 resulting in improved road and public transport network reliability. Short distance use of the M11 between J7 and J7a will be partly offset by less conflict at J7. Development traffic in the existing urban area concentrated on certain links and result in lower average speeds and reduced reliability. Slightly lower average speeds in Harlow Urban Area	Southern Relief Route reduces through-traffic resulting in improved road and public transport network reliability. M11 J7 continues to be the sole focus of both through A414 and B1393traffic and turning M11 movements, increasing the reliance on smooth operation of this key junction. Development traffic in the existing urban area may be more widely dispersed resulting in lower impacts on speeds. Average speed in urban area virtually unchanged.	High Quality Public Transport system, with segregation in key locations will improve public transport reliability. Reduced dependency on J7 in PS1 would improve reliability of strategic network.
Integration			
- Modal	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride(local and long distance)	Scenario 2 may be difficult to fully integrate with the new high quality or existing public transport systems

Harlow Growth Options Study: Scenario 1 Scheme Appraisal Matrix (Table 5.1)(3.5 3.6 3.7)

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
Strategy Description	- Northern Relief Route running South of Sawbridgeworth and new M11 J7A - Improvements to J7 of M11 - High Quality PT corridor from Northern development zone to Epping + P&R facility at M11 J7	- Sawbridgeworth Bypass - Improvements to J7 of M11 - High Quality PT corridor from Northern development zone to Epping + P&R facility at M11 J7	- Northern Relief Route running North of Sawbridgeworth and new M11 J7A - Improvements to J7 of M11 - High Quality PT corridor from Northern development zone to Epping + P&R facility at M11 J7	**Modelling Report**
Additional Housing (above consented development)	PS1: additional 19000 units: 10000 in northern development area, 3000 in HUA, 6000 at North Weald			
Total Jobs	PS1: total of 61650 including 8700 jobs in northern development area and 6250 at North Weald			
Transport Provision	High Quality Public Transport corridor; Epping-North Weald-Harlow (Northern Development) with P&R at M11 J7 Northern Relief Route D2AP standard (south of Sawbridgeworth with new M11 junction) M11 J7 improvements	High Quality Public Transport corridor; Epping-North Weald-Harlow (Northern Development) with P&R at M11 J7 Sawbridgeworth Bypass D2AP standard M11 J7 improvements	High Quality Public Transport corridor; Epping-North Weald-Harlow (Northern Development) with P&R at M11 J7 Northern Relief Route D2AP standard (north of Sawbridgeworth with new M11 junction) M11 J7 improvements	Schemes 1A and 1C link A414 Eastwick Road roundabout to M11 at new Junction 7A with intersection on A1184. S'worth Bypass links s A414 Eastwick Road roundabout with Bishop's Stortford Bypass
- Engineering Feasibility	PT corridor constrained to single track-alignment Epping-North Weald. Northern Relief Route requires extensive viaduct to cross River Stort flood plain. New motorway junction. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site. New bridge required for PT corridor to access northern development.	PT corridor constrained to single track-alignment Epping-North Weald. Sawbridgeworth bypass requires cross-country route that may be difficult to fit into landscape. New motorway junction. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site. New bridge required for PT corridor to access northern development.	PT corridor constrained to single track-alignment Epping-North Weald. Northern relief route requires viaduct to cross R Stort flood plain that is also close to A1184 junction and railway bridge. New motorway junction. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site. New bridge required for PT corridor to access northern area.	South of S'worth scheme has longer viaduct/bridge construction but North of S'worth scheme's vertical alignment may prove expensive. S'worth Bypass appears to have least problems.
- Operational Feasibility	PT corridor frequency constrained by single track alignment Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	PT corridor frequency constrained by single track alignment Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	PT corridor frequency constrained by single track alignment Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	Limited experience of public transport schemes of this type (guided bus) in the UK. Sustainability may be affected by aggressive response from existing bus operators.

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
- Outline Capital Cost Range (includes optimism bias)	Northern Relief Route £138–199m High Quality Public Transport corridor; Epping-North Weald-Harlow (North) - £114-164m + operating costs and subsidy M11 J7 improvements £10- 14m	Sawbridgeworth Bypass £200-287m High Quality Public Transport corridor; Epping-North Weald-Harlow (North) - £114-164m + operating costs and subsidy M11 J7 improvements £10- 14m	Northern Relief Route 183-263m High Quality Public Transport corridor; Epping-North Weald-Harlow (North) - £114-164m + operating costs and subsidy M11 J7 improvements £10- 14m	
Local Policy Objectives				
Key Local Objectives				
- Harlow's Regional Position	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with the HUA is difficult	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with the HUA is difficult	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre. Concentrated development enhances regional 'gravitational' pull but connectivity with the HUA is difficult	South of S'worth scheme provides best linkage to M11 for access to south and north from Harlow town centre. North of S'worth scheme better suited for access to north and Stansted. S'worth Bypass only orientated to northern access and less direct access to M11.
- Regeneration of Harlow	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study Significant development within existing urban area and adjacent northern development may assist regeneration	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study Significant development within existing urban and adjacent northern development area may assist regeneration	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study Significant development within existing urban area and adjacent northern development may assist regeneration	
- Town Centre Development	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town.	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town.	Increased support and concentration in the Town Centre. Strong connectivity with the northern development area is essential to unite the town.	All schemes place pressure on key town centre-northern development linkage: South of S'worth greatest stress; S'worth Bypass least. South of S'worth leads to lower overall traffic levels in town, and provides link from town centre to north and south, others more orientated towards north.
- Public Transport Usage	All development areas directly served by new High Quality Public Transport service.	All development areas directly served by new High Quality Public Transport service.	All development areas directly served by new High Quality Public Transport service.	

Harlow Growth Options Study: Scenario Appraisal Matrix (Maps 3.5 3.6 3.7 Contents index)

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
- Strategic Transport	Additional M11 junction. Improved access to rail and bus stations by PT, but additional traffic near station may impede road access. Provides A414 Harlow Bypass route in combination with M11 with faster journey times.	Improved access to rail and bus stations by PT, but additional traffic near station may impede road access. Provides relief to A1184 from Harlow to Bishop's Stortford.	Additional M11 junction. Improved access to rail and bus stations by PT, but additional traffic near station may impede road access. Provides some relief to A1184, but not effective alternative to current A414 route.	S'worth Bypass gives only one access point to M11, which is distant from large Northern Development area. Only South of S'worth scheme provides realistic A414 bypass
- Walking and Cycling	Development areas are largely within cycling catchment of Central Business District. Some locations are within walking catchment	Development areas are largely within cycling catchment of Central Business District. Some locations are within walking catchment	Development areas are largely within cycling catchment of Central Business District. Some locations are within walking catchment	
Key Regional Objectives				
National Policy Framework	Helps deliver housing and employment growth in LSPC Corridor	Helps deliver housing and employment growth in LSPC Corridor	Helps deliver housing and employment growth in LSPC Corridor	
Shared Priority Targets				
Congestion				
- Impacts on Local and Strategic Road Networks	South of S'worth provides effective A414 Harlow bypass in conjunction with M11, providing relief within Harlow, especially Edinburgh Way, although increases pressure on Allende and Velizy Avenues from traffic using it to access Town Centre. Increases traffic flows on J7-J7a section of M11, but turning flows at J7 reduced. PT corridor may reduce road capacity at key points especially J7.	Provides relief to A1184 Harlow-Bishop's Stortford. No relief to Harlow Urban Area, and concentrates N-S flows on A414 Allende and Velziy Avenues. PT corridor may reduce road capacity at key points especially J7.	Provides relief to A1184 Harlow-Bishop's Stortford. Minimal relief to Harlow Urban Area, and concentrates N-S flows on A414 Allende and Velizy Avenues. PT corridor may reduce road capacity at key points especially J7.	South of S'worth provides A414 Harlow Bypass route and traffic relief in Harlow Urban Area. North of S' worth and S'worth Bypass more orientated towards relieving A1184 and northbound traffic from Harlow, leading to more northern development traffic penetrating Harlow Urban Area.
Safety	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Slightly lower speeds in HUA with S'worth Bypass than South of S'worth, leading to marginal safety benefit.
Environmental Impacts	Effect of increased traffic more than offset by improvements in vehicle emissions over period	Effect of increased traffic more than offset by improvements in vehicle emissions over period	Effect of increased traffic more than offset by improvements in vehicle emissions over period	→ **Environmental Report** South of S'worth generates higher vehicle kilometres and

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
	2003-2021.	2003-2021.	2003-2021.	hence emissions than other two scheme but generates least traffic/ emissions in HUA.
Accessibility				
Severance	Northern Relief Route, mainline railway and River Stort form a barrier between northern development area and town centre	Sawbridgeworth bypass has minimal contribution to several effects, but severs some additional country lanes.	Northern Relief Route, mainline railway and River Stort form a barrier between northern development area and town centre	S'worth Bypass has lesser effect on northern development severance, but may have negative impacts on existing country lanes.
Public Transport	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London. Relief route provides improved access to Harlow town station from Sawbridgeworth area.	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London Relief route provides improved access to Harlow town station from Sawbridgeworth area.	
Social Inclusion	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	Scenario 1 internal development site incorporates known areas of social deprivation. Public transport scheme benefits those in the community without access to a car.
Development Site Access	South of S'worth offers best access to/from northern development site to north and south, and allows access to A1184 without penetrating Harlow. Allows North Weald to northern area traffic to use M11 avoiding Harlow. All development sites served by PT corridor.	S'worth Bypass offers best access to/from northern development from Bishop's Stortford/A120, but not elsewhere. No access benefits for North Weald. All development sites served by PT corridor.	North of S'worth offers good access to/from northern development to M11 north and Bishop's Stortford. No access benefits for North Weald. All development sites served by PT corridor.	South of S'worth provides best access to northern development area and offers benefits for North Weald. S'worth Bypass offers worst overall level of access for development.
Other NATA Objectives				
Economy				
- Transport Economic Efficiency	60-year Appraisal: PVB: £1,036.5m PVC: £339.2m NPV: £697.3m BCR: 3.1	60-year Appraisal: PVB: £605.0m PVC: £418.4m NPV: £186.6m BCR: 1.4	60-year Appraisal: PVB: £899.0m PVC: £396.8m NPV: £502.2m BCR: 2.3	South of S'worth likely to meet government value for money criteria, North of S'worth borderline, and S'worth Bypass unlikely to pass.
- Economic Regeneration	Concentration could enhance regeneration opportunities. For the town centre the northern	Concentration could enhance regeneration opportunities. For the town centre the northern	Concentration could enhance regeneration opportunities. For the town centre the northern	South of S'worth offers best overall level of access to key employment and commercial

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
	development could be both an opportunity and a threat. South of S'worth offers best access to key Town Centre and Northern Development sites from outside Harlow.	development could be both an opportunity and a threat. South of S'worth offers poorest access to key Town Centre and Northern Development sites from outside Harlow.	development could be both an opportunity and a threat. South of S'worth offers moderate access to key Town Centre and Northern Development sites from outside Harlow.	areas form outside the town.
- Transport Reliability	New M11 junction and Northern Relief Route create more route choices resulting in improved road and public transport network reliability. Short distance use of the M11 between J7 and J7a will be offset by less conflict at J7. Development traffic in the existing urban area will tend concentrated on certain links and result in lower average speeds and reduced reliability. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 35.6kph	Sawbridgeworth bypass will relieve A1184 route and offer some reliability improvements. Development traffic in the existing urban area will tend concentrated on certain links and result in lower average speeds and reduced reliability. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 34.1kph	New M11 junction and Northern Relief Route create more route choices resulting in improved road and public transport network reliability . Some short distance use of the M11 between J7 and J7a will be offset by less conflict at J7. Development traffic in the existing urban area will tend concentrated on certain links and result in lower average speeds and reduced reliability. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 34.4kph	South of S'worth offers most relief from traffic in Harlow Urban Area, resulting in highest average vehicle speeds and best levels of reliability. S'worth Bypass weakest in this respect. 2003 = 36.3kph
Integration				
- Modal	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance)	All schemes improve road access to Harlow Town Station. South of S'worth probably provides most benefits in this respect.
- Policy	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by both road and public transport to Harlow hospital	South of S'worth best supports access to northern development sites.

Harlow Growth Options Study: Scenario Appraisal Matrix (Maps 3.5 3.6 3.7 Contents index)

Performance Indicator	Schemes 1A+2A+3B South of Sawbridgeworth	Schemes 1B+2A+3B Sawbridgeworth Bypass	Schemes 1C+2A+3B North of Sawbridgeworth	Key Differences or Comments
Supplementary Appraisal Issues				
Community Impact	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	More local employment opportunities and improved access to employment for socially deprived groups in existing Harlow	All schemes offer some reduction in traffic impact for Sawbridgeworth, but S'worth Bypass best and South of S'worth worst.
Public Acceptability	Intensification of development will have an impact on local communities and the transport network in the urban area South of S'worth will have significant visual impact.	Intensification of development will have an impact on local communities and the transport network in the urban area S'worth Bypass will have some visual impact	Intensification of development will have an impact on local communities and the transport network in the urban area North of S'worth will have some visual impact.	South of S'worth likely to be most controversial in terms of impact on local area. 1B has minimal impact.
Deliverability				
Approvals	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Public Inquiry will almost certainly be triggered. The deliverability of a Northern Relief Route will require the approval of three Highway authorities
Timescales	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Based on current trends. Experience points to long development and appraisal phases for major public transport schemes S'worth Bypass likely to be quickest of relief route scheme to progress, South of S'worth slowest
Funding Issues				
- Developer Contributions	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 60 % of traffic in 2021 on the Northern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 50% of traffic in 2021 on the Northern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 55 % of traffic in 2021 on the Northern Relief Road is development related	Overall volume of development traffic on South of S'worth much higher than 1B.
- Local Contributions	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Public transport major schemes require 25% local contribution to scheme costs
- Central Government Contributions	Will be needed through LTP Major Scheme Bids or other funding mechanism	Will be needed through LTP Major Scheme Bids or other funding mechanism	Will be needed through LTP Major Scheme Bids or other funding mechanism	

Harlow Growth Options Study: Scenario 2 Strategy Appraisal Matrix (Table 5.3)(Map 3.9)

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
Strategy Description	- Southern Relief Route running from J7 of M11 to Tyler's Cross - Improvements to J7 of M11 - High Quality PT corridor from Harlow Town Station to Epping with P&R at M11 J7	- Southern Relief Route running from J7 of M11 to A414 Eastwick Road - Improvements to J7 of M11 - High Quality PT corridor from Harlow Town Station to Epping with P&R at M11 J7	→ **Modelling Report** Partial scheme shorter version of Full scheme
Additional Housing (above consented development)	PS2: Additional 19000 units: 4000 in eastern development area, 6000 in south-western development area and 9000 at North Weald		
Total Jobs	PS2: Total of 61650 including 8700 new jobs in south-western development area and 6250 at North Weald		
Transport Provision	High Quality Public Transport corridor; Epping-North Weald-Harlow Town Station with P&R at M11 J7 Southern Relief Route D2AP standard (M11 J7 to Tyler's Cross) M11 Junction 7 improvements	High Quality Public Transport corridor; Epping-North Weald-Harlow Town station with P&R at M11 J7 Southern Relief Route D2AP standard (M11 J7 to A414 Eastwick Road) M11 Junction 7 improvements	Full scheme provides complete A414 relief route, avoiding Harlow Urban Area.
- Engineering Feasibility	No major structures envisaged for relief route. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site.	Full Southern Relief Route requires viaduct to cross River Stort and railway. Upgrade to J7 to increase capacity, accommodate PT corridor and Park and Ride site.	
- Operational Feasibility	PT corridor frequency constrained by single track alignment. Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	PT corridor frequency constrained by single track alignment. Potential impacts of PT corridor on highway network, especially town centre, and J7. Highway network intersection may affect reliability of PT	Limited experience of public transport schemes of this type (guided bus) in the UK. Sustainability may be affected by aggressive response from existing bus operators.
- Outline Capital Cost Range (includes optimism bias)	Southern Relief Route £85-122m (includes M11 J7 improvement) High Quality Public Transport corridor; Epping-North Weald-Harlow (Central) - £95-137m+ operating costs and subsidy	Southern Relief Route £179–258m (includes M11 J7 improvement) High Quality Public Transport corridor; Epping-North Weald-Harlow (Central) - £95-137m+ operating costs and subsidy	
Local Policy Objectives			
Key Local Objectives			→ **Problems & Opportunities Report**
- Harlow's Regional Position	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre	Helps strengthen Harlow's role as an attractive sub regional centre by creating a growth point in the M11 corridor, broadening the regional knowledge economy and offering the potential to develop a competitive shopping centre	

Harlow Growth Options Study: Scheme Appraisal Matrix (Map 3.9) (contents index)

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
- Regeneration of Harlow	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study	Consistent with the 'Higher Growth More Dynamic' scenario recommended by the Harlow Regeneration Study	→ **Harlow Regeneration Study**
- Town Centre Development	More dispersed edge of town development could threaten centre.	More dispersed edge of town development could threaten centre.	Full scheme offers potential alternative route into town for A414 West Traffic.
- Public Transport Usage	Some development areas directly served by new High Quality Public Transport but peripheral areas more awkward to serve. Eastern development area could be served by existing bus lane corridors	Some development areas directly served by new High Quality Public Transport but peripheral areas more awkward to serve Eastern development area could be served by existing bus lane corridors	
- Strategic Transport	Improved access to Harlow rail and bus stations by PT Improved access for south-west Harlow to strategic road network.	Improved access to Harlow rail and bus stations Improved access for south-west and north-west Harlow to strategic road network. Creates A414 Harlow bypass route	Full scheme offers wider strategic benefits, including removal of through A414 traffic from Harlow and links to north-west as well as south from all western of Harlow.
- Walking and Cycling	Development areas are largely within cycling catchment of Central Business District. South West and N Weald developments more self contained, with better potential for walking and cycling trips.	Development areas are largely within cycling catchment of Central Business District. South West and N Weald developments more self contained, with better potential for walking and cycling trips.	Southern Relief Route may be a barrier to walking and cycling from SW development area into existing Harlow Urban Area.
Key Regional Objectives	Consistent with emerging RPG	Consistent with emerging RPG	
National Policy Framework	Helps deliver housing and employment growth in LSCP Corridor	Helps deliver housing and employment growth in LSCP Corridor	→ **Sustainable Communities Plan**
Shared Priority Targets			
Congestion			→ **Modelling Report**
- Impacts on Local and Strategic Road Networks	Minimal congestion relief within Harlow. Increased turning flows at J7 of M11. Little impact on the M11 north of Junction 7, but increased 'turning flows' at J7. Significant development traffic within urban area.	Significant congestion relief within urban area with diversion of A414 through traffic. Little impact on the M11 north of Junction 7, but increased 'turning flows' at J7. Better route choice for development traffic travelling to northwest. Provides alternative route for traffic from north west of Harlow.	Partial scheme only acts as access route to development area, while Full scheme provides Harlow bypass for A414 traffic, and hence greater decongestion.
Safety	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Level of development suggests increased accident exposure/risk that is mitigated in part, by the transport schemes and increased development density	Slightly reduced speeds in HUA with Partial scheme, leading to marginal safety benefit.
Environmental Impacts	Full scheme generates higher vehicle kilometres and hence emissions over whole network, but reduced vehicle km in urban area.	Full scheme generates higher vehicle kilometres and hence emissions over whole network, but reduced vehicle km in urban area.	→ **Environmental Report** Full scheme generates higher vehicle kilometres and hence emissions over whole network, but reduced vehicle km in urban area.

Harlow Growth Options Study: Scheme Appraisal Matrix (Map 3.9) (contents index)

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
Accessibility			
Severance	Southern Relief Route may increase severance with impacts on the rural lanes to the south of Harlow (or increase costs to maintain access)	Southern Relief Route may increase severance with impacts on the rural lanes to the south of Harlow (or increase costs to maintain access)	M11 remains a barrier to accessibility between North Weald and Harlow. Partially mitigated by PT link. Slightly less severance effect from Partial scheme.
Public Transport	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London, but some development areas cannot be served as well (eg Nazeing)	Improved accessibility to Harlow Urban Area, bus and rail stations, North Weald and north London, but some development areas cannot be served as well (eg Nazeing)	
Social Inclusion	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	High Quality Public Transport corridor runs through some of the most socially deprived areas of the town helping to improve accessibility to jobs and local amenities	
Development Site Access	Construction access to south western development area difficult without part of the Southern Relief Route	Construction access to south western development area difficult without part of the Southern Relief Route. Full route offers access to SW site from north and south	
Other NATA Objectives			
Economy			
- Transport Economic Efficiency	60-year Appraisal: PVB: £981.6m PVC: £245.6m NPV: £735.9m BCR: 4.0	60-year Appraisal: PVB: £1,678.6m PVC: £368.0m NPV: £1,310.6m BCR: 4.6	Both schemes meet government value-for-money requirements.
- Economic Regeneration	Increased reliance on local regeneration opportunities linked to peripheral development	Increased reliance on local regeneration opportunities linked to peripheral development. Route 2C offers improved access to Pinacles industrial area.	→ **Economic Regeneration Report**
- Transport Reliability	M11 J7 continues to be the sole focus of both through A414 traffic and turning 11 movements, increasing the reliance of smooth operation of the key junction. Development traffic channelled towards J7 because of lack of northern access. Public Transport corridor and highway intersections may effect reliability of either or both both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 35.4kph (2003 = 36.3kph)	Southern Relief Route reduces through traffic resulting in improved road and public transport network reliability. M11 J7 continues to be the sole focus of both through A414 traffic and turning 11 movements, increasing the reliance of smooth operation of the key junction. Development traffic in the existing urban area may be more widely dispersed resulting in lower impacts on speeds. Public Transport corridor and highway intersections may effect reliability of either	Higher overall of decongestion offered by 2C results in higher overall reliability of transport system. Average vehicle speed in HUA in 2021 with Full scheme similar to current.

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
		or both modes, especially at J7. Average speed in Harlow Urban Area (2021) = 36.1kph (2003 = 36.3kph)	
Integration			
- Modal	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance). No direct PT link to Town Station from Eastern and parts of Western development site.	Improved bus/bus, bus rail, and bus tube integration. Also Park and Ride (local and long distance) Station from Eastern and parts of Western development site. Bypass provides alternative link to Harlow Town Station from South-Western Development avoiding Town centre.	Exact configuration of PT access to Eastern and South-western sites uncertain as reliant on commercial bus operators.
- Policy	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by public transport to Harlow hospital	Consistent with an holistic approach to land use/transportation planning. Improved accessibility by public transport to Harlow hospital. Full scheme provides alternative road access to Hospital via Pinacles	Full scheme provides improved road access to Hospital.
Supplementary Appraisal Issues			
Community Impact	More dispersed patterns of new employment may not provide as many local opportunities for Harlow residents	More dispersed patterns of new employment may not provide as many local opportunities for Harlow residents Access to/from south-western development area better with Full scheme	Southern Relief Route draws more traffic towards rural communities in the south west, especially at Tyler's Cross end of Partial scheme.
Public Acceptability	Southern Relief Route is potentially invasive in the immediate rural area	Southern Relief Route is potentially invasive in the immediate rural area	The High Quality Public Transport scheme will have impacts along the route notably within the green wedges of Harlow Some long term public awareness of both highway schemes, but less so with Partial scheme.
Deliverability			
Approvals	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Roads schemes can be progressed through Highway Orders. High Quality Public Transport requires Transport and Works Act approval	Public Inquiry will almost certainly be triggered
Timescales	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Highway Schemes – 5-7 Years. High Quality Public Transport scheme – 7-12 Years	Based on current trends. Experience points to long development and appraisal phases for major public transport schemes. Partial scheme can be delivered more quickly than Full scheme, or may provided an interim solution before progressing with Full scheme route.

Harlow Growth Options Study: Scheme Appraisal Matrix (Map 3.9) (contents index)

Performance Indicator	Schemes 2B+3A Partial Scheme	Schemes 2C+3A Full Scheme	Key Differences in Performance or Comments
Funding Issues			
- Developer Contributions	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 75 % of traffic in 2021 on the Southern Relief Road is development related	Could be significant, but likely to fall a long way short of full infrastructure costs. Approximately 60 % of traffic in 2021 on the Southern Relief Road is development related, although volume much higher than in Partial scheme.	Transport infrastructure is only one draw on developer contributions through the Section 106 process
- Local Contributions	Possible small scale contributions and public transport subsidy if required	Possible small scale contributions and public transport subsidy if required	Public transport major schemes require 25% local contribution to scheme costs
- Central Government Contributions	Will be needed through LTP Major Scheme Bids or other funding mechanism	Will be needed through LTP Major Scheme Bids or other funding mechanism	

Appendix A

Copy of the Study Brief

Harlow Growth Options - Brief for Transportation Study

1. Introduction

The area between North Weald, Epping, Harlow and Stansted occupies a key strategic position in the M11 corridor. The London–Stansted-Cambridge corridor has been identified as a potential area for growth and economic regeneration through the Sustainable Communities Plan and Regional Planning Guidance.

A number of studies have taken place to look at the growth potential in the area in and around Harlow. Recently, Essex County Council have been working with partners on a Harlow Options Study to identify where housing growth could be accommodated in an area within a ten mile radius of Harlow including Epping and North Weald and East Hertfordshire. The final results of this study are in the process of being published and they will inform Regional Planning Guidance.

In addition the Government has been consulting on the future growth of airports and has looked at Stansted airport in this context. Growth at Stansted would have implications for transport movements in the area. Essex County Council, and other partners, have appointed consultants to give this aspect further consideration through the Stansted M11 Corridor Study. The study considers, among other issues, the potential transport requirements to accompany different levels of housing and growth associated with alternative development scenarios for the area and will also inform Regional Planning Guidance.

If this area is identified specifically as having significant housing growth and regeneration potential this will have to be developed in conjunction with sustainable transport investment and infrastructure to address existing congestion problems and prevent future ones which could lead to people and businesses leaving the area rather than moving into it.

The London to South Midlands multi modal study sought to address strategic transport issues and requirements, and the Harlow Area Transport Strategy (HATS - see below) seeks to address existing local (urban) intra-Harlow measures.

Within the HATS, a programme of policies, objectives and initiatives are detailed along four corridors for the period 2001 to 2005. These include Corridor A (Second Avenue, Fifth Avenue and Third Avenue), Corridor B (Southern Way and Katherines Way), Corridor C (First Avenue and Fourth Avenue) and Corridor D (A414). For each corridor, bus and cycle lanes have and will be provided to achieve a sustainable and integrated transport system.

Although a range of sustainable measures have been implemented via HATS, there has been a significant increase in traffic congestion in the Harlow area in the past few years affecting both north-south and east–west routes into and out of Harlow. It is clear that unless integrated and sustainable solutions are developed on an inter-urban basis in the Epping-Harlow - Stansted corridor the emerging traffic problems will never be solved. [An example of the problem is that a traffic incidents on the M25 now cause Harlow to go into gridlock several times a year]. This is further exacerbated by the high levels of in and out commuting in the Harlow and Epping areas by car and relatively low levels of investment in public transport infrastructure.

Although the Harlow Options and Stansted M11 Corridor Studies proposed some inter-urban transport measures for the area, these were not assessed in sufficient depth or detail in terms of proving the case for investment, and examining impacts on issues such as delivering housing numbers and the environment.

This new study will therefore undertake a transportation study to test the feasibility of further population and employment growth in the area against the existing transport infrastructure. It will then identify, appraise, and cost sustainable and innovative transport solutions to address current and future congestion issues in the identified areas, and to identify what levels of development might be achieved as a result of delivery of each of these schemes.

2. Policy Framework-

Policy documents that set the context for the study at the national, regional and local levels, including:

- Nationally – the Government's integrated transport White Paper (July 1998), and subsequent policy documents including "Transport 2010; the Ten Year Plan for Transport", "Delivering Better Transport: Progress Report" and the Guidance on the Methodology for Multi-Modal Studies (GOMMMS). Other relevant policy documents include Planning Policy Guidance Notes, Planning Policy Statements and Sustainable Communities Building for the Future.

- Regionally – Regional Planning Guidance for East Anglia (RPG6) and the South East (RPG9), emerging policy for the new East of England region (to form RPG14) including the Regional Transport Strategy, and the findings and recommendations from the various multi modal studies undertaken in the area including London to South Midlands (LSM), London to Ipswich (LOIS), and London Orbital (ORBIT). The London Stansted Cambridge sub-regional study (2002).

- Locally – Structure Plans for Essex and Hertfordshire, Local Plans for Harlow, Harlow 2020 Vision, Epping Forest and East Hertfordshire, Local Transport Plans (2001-2006)/Annual Progress Reports for Essex and Hertfordshire, Highways Agency programmes and plans for the area, the Strategic Rail Authority's Strategic Plan (2003), and the Harlow Area Transportation Strategy (HATS).

- In addition it is expected that the study will consider the outcomes from the Harlow Options Study and Stansted M11 Corridor Study

3. Objectives

The study objectives are to:

- Identify existing, and emerging, transport problems, issues and opportunities– in the study area

- By examining pinch points /bottlenecks and available transport capacity, identify and broadly locate the scope for additional housing and employment development in the study area based on the existing network and committed future transport schemes."

- Identify additional transport schemes that might be required to allow delivery of the development proposals identified in two housing and employment growth scenarios that will be provided to the successful consultants by the study client on commencement of the project. These will include indicative spatial allocations of growth [for time periods 2011, 2016 and 2021]"

- Consider and propose what levels of housing growth might be possible with lower levels of additional transport provision based on an assessment of the differing levels/timing of housing growth tested in the bullet point above

- Provide costings for the transport proposals, taking into account issues of risk assessment and optimism bias as set out in the Treasury 'Green Book', and seek to identify funding sources

- Schemes proposed so far as potentially worthy of further consideration include a potential tram/guided bus route linking Stansted/Harlow/Epping, elongating the roundabout southwards at M11 J7 to provide greater weaving lengths and queue storage capacity, an A414 south west ring route around Harlow, and/or a new route to the north of the town with a new junction 7A on the M11. These schemes have not been subject to any detailed appraisal and the consultants may well propose schemes that perform better, or are more appropriate than these following their review of problems, issues and opportunities

- Provide costings for the transport proposals and seek to identify funding sources

- Identify transport corridors that will need to be safeguarded for development control purposes, and consider whether those corridors currently safeguarded for transport use could be brought into use.

- For those transport schemes identified, provide an assessment against the Government's New Approach to Transport Appraisal (NATA) criteria. The level of appraisal undertaken should be sufficient to demonstrate the robustness of the proposed scheme such that the scheme could subsequently be taken forward with confidence for a full major scheme appraisal/submission by the relevant transport delivery agent. Consultants should indicate why each proposed scheme is considered necessary and why it should be taken forward in preference to alternative measures.

- Where there are clear linkages between schemes and it is considered appropriate to bundle these together due to transport synergies, or to facilitate further housing growth, then undertake an appraisal of the combined "packages" of measures

- Seek to ensure that where possible the proposals that emerge seek to minimise car use, reduce the impact of transport on the environment, and promote social inclusion, and at the same time offer value for money, are realistic and deliverable, and have an eye on the availability of funding

4. Scope of Work

It is anticipated that the following may need to be addressed although the views of consultants on alternative approaches to satisfy the study objectives would be very welcome:

- A new transport model for the main inter-urban routes is required to be prepared and validated, following a review of existing reports and data. Once the model has been validated this will be termed the baseline model, from which existing transport problems and issues could be reviewed.

- Produce a baseline scenario that includes committed, and planned, land use developments and transport proposals for 2011, 2016 and 2021 (ie: the proposed RPG time horizon).

- Based on consideration of available data, earlier reports, information gathered through liaison with stakeholders, and (where possible) the model, understand and set out how the constraints, problems and opportunities identified above might evolve into the future and provide a commentary on how transport conditions will change in the study area in the absence of further interventions.

- Identify, the scope for further housing and employment growth in the study area with no further intervention in transport measures beyond those schemes currently planned/programmed based on the schedule of potential development sites to be provided by the study client

- Identify additional transport schemes that might be required to allow delivery of the development proposals to be identified in the two housing and employment growth scenarios to be provided by the study client being mindful that these need to be realistic, affordable and offer value for money.

- Undertake iterations based on differing levels of housing and/or longer timescales for completion of the growth scenarios which will allow consideration of what levels of housing are possible with lower levels of transport provision

- For those transport schemes identified, a scheme feasibility report should be prepared, to demonstrate that the identified scheme is deliverable and feasible, and that the identified scheme/route is the optimum to maximise housing growth areas whilst minimising environmental impact

- For those transport schemes identified, undertake model testing to forecast impacts and provide an analysis of the potential physical transport impact of the schemes on modal split, local traffic flows and delays, public transport patronage and so on. A key issue will be the siting of any new roads in the landscape relative to a revised green belt boundary and potential urban extensions. The consultants carrying out the transport study will therefore need to liase with those carrying out the environmental study which is also being funded by ODPM through the growth areas fund.

- For those transport schemes identified, provide an assessment against the Government's New Approach to Transport Appraisal criteria. This should include an economic appraisal that reflects the thrust of HM Treasury Green Book requirements. The level of appraisal undertaken should be sufficient to demonstrate the robustness of the proposed scheme such that the scheme could subsequently be taken forward with confidence by the relevant transport delivery agent

- Consultants will be required to propose a suitable land use development baseline for the NATA appraisal having reviewed the schedule of potential sites with the study client so that all proposed transport schemes are appraised, where possible, on a common basis, as well as being tested to understand the level of growth that each might facilitate

- Liaise with the relevant delivery agent on each scheme to achieve agreement on desirability, deliverability, realism and affordability

- Give preliminary views on the priority of the identified schemes to determine whether they are "critical" or merely "desirable" in helping to bring about housing growth, and seek to identify the level and broad location of housing growth that each scheme might (individually) support from a transport perspective

- Identify robust scheme cost estimates, which take account of optimism bias, and put forward recommendations for funding sources identifying, in particular, the scope for attracting private sector funds such as developer contributions

- If relevant, undertake a final model test and appraisal of combined impact of implementing all schemes recommended in the Study and document results to set out and understand between-scheme synergies

- Consult with key stakeholders at two points in the study process; the first being in the problem/scheme identification stage and the second being on completion of the study. A list of potential contacts is provided in section 6 of this brief.

- Links to the environmental assessment study findings should be made, and the findings from that work should be used to inform scheme identification/development, and the NATA appraisal against the "environment" objective

- In addition, the consultants will be required to attend monthly Steering Group meetings, prepare monthly progress notes, and to produce the deliverables set out in section 5 below.

5. Study inputs and reporting

Study Inputs – apart from a transport model for Harlow and the surrounding growth areas, it is anticipated that most of the required study inputs can be drawn from members of the Steering Group. These include the various reports/data produced through the Harlow Options and Stansted M11 Corridor Studies (including planning and environmental constraints, spatial and economic details and the proposed growth levels and locations), output from the various multi modal studies, and importantly existing traffic flow data from Harlow/ECC/HCC/HA and that developed for the London to South Midland Multi Modal Study. The note on data availability included with this brief should assist with this.

Reporting – two main study reports are required. These will be presented in draft for discussion by the Steering Group:

Problems, Issues and Opportunities report – **(milestone date – March 2004)** this should set out existing transport problems, issues and opportunities in the Harlow area and define a transport baseline scenario including all committed schemes, and identify the levels of growth that could be achieved in the study area assuming that no further transport measures (beyond the baseline) are taken forward. It is assumed that, where relevant and if possible, model outputs will be used to inform this process.

Final Report – **(milestone date – Draft June 2004 – Published September 2004)** to include an overview of the study process, modelling and methodology, consultation and to set out the recommended schemes including:

- a full scheme description and, where relevant, indicative plans
- their physical impact in terms of transport movements
- a scheme feasibility report to demonstrate that the identified scheme is deliverable and feasible, and that the identified route is the optimal route to maximise housing growth areas with minimal environmental impact
- their justification including Appraisal Summary Tables and an economic appraisal
- a clear understanding of the levels of housing growth that each scheme can facilitate and support

In addition to the two main reports identified above, technical reports on the following aspects will be required:

- Inception Report **(milestone date – January 2004)** to define in detail the consultants appreciation of the study including data sources, methodology and outputs
- Transport model development report, including calibration and validation details and data **(milestone date – June 2004)**
- Transport Forecasting Report, **(milestone date – June 2004)** describing development of the baseline scenarios
- Short stand alone reports for each identified transport scheme **(milestone date – September 2004)** reporting on the criteria set out in "Final Report" above

6. Study management

The client for the study will be Harlow Council who will appoint a Project Manager as the day-to-day contact for the Study and a Study Manager for technical liaison with the Consultants. The Study will report to a Technical Steering Group on a monthly basis that will include representatives from:

- Harlow Council
- Epping Forest District Council
- East Hertfordshire District Council
- Essex County Council
- Hertfordshire County Council
- East of England Regional Assembly
- Government Office for the East of England

A wider group of stakeholders whose views could be sought at key stages of the project are likely to include:

- Strategic Rail Authority
- Highways Agency
- East of England Development Agency
- Broxbourne Borough Council
- Uttlesford District Council
- Environment Agency
- English Partnerships
- Other partners as and when appropriate

7. Programme

The Study programme is driven by one key date; the proposed Public Examination (PE) of Draft RPG for the East of England in Autumn 2004. The Study will need to inform this process and for this reason completion by June 2004 would allow consideration of the study findings by key stakeholders, and participants in the PE, prior to the PE opening.

Appendix B

Model Development, Calibration and Validation

1 Model Development Calibration and Validation

1.1 Introduction

1.1.1 To meet the key study objectives, a strategic area modelling system for Harlow and the surrounding area was developed using MVA's Traffic Restraint Analysis Model (TRAM) software. It is designed to examine how policies for transport improvement and traffic restraint might affect travel in an urban area. The modelling system is able to generate forecast travel patterns related to new development areas and use these to test different transport improvements.

1.2 Why we used TRAM

1.2.1 There are number of key characteristics of the TRAM software which are particularly pertinent for its use in the Harlow context:

- use of linked outward and return trips (tours) for home-based trips;
- detailed modelling of time periods using nine periods to represent the 24-hour week-day – this allows time of day choice within user-defined bounds to be modelled;
- detailed parking choice model – type and location of parking, Park and Ride and Park and Walk modelling;
- strategic transport network with key links;
- highly segmented demand model involving road, public transport and slow modes; and
- ability to model congestion charging.

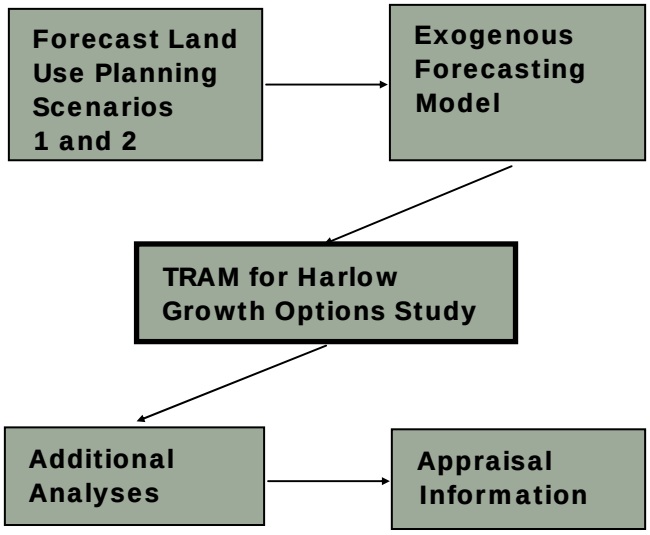
1.2.2 These features allow the key traveller responses associated with restraint policies to be modelled explicitly within the system:

- change in trip frequency;
- change in trip destination;
- change in main mode of travel (car, PT, Walk/cycle);
- change in time of travel;
- change in traffic route of travel (eg avoiding charged cordons);
- choice of parking type and location; and
- choice of PT route (bus, train etc)

1.3 Description of the Model

1.3.1 The modelling system is shown in Figure A.1.1 and consists of the core TRAM for the study with a preceding **Exogenous Forecast Model** that uses the Planning Scenario data as input and a following process of additional analysis and calculation of information for appraisals.

Figure A.1.1 Modelling System



1.3.2 The input planning data for this stage of the study has been defined in two Planning Scenarios, although other scenarios can be specified for use. The definitions of numbers of households and levels of employment used with sets of trip rates in the Exogenous Forecast Model to produce the trip ends by mode for TRAM. Within this system the land-use planning assumptions are taken as fixed projections and do not vary with changes in the level of transport supply, as would be the case in a full land-use transport interaction model.

1.3.3 However, there is interaction between the two main components of TRAM: the travel demand matrices and the network supply. Transport policies and schemes are represented by changes in the elements of transport provision, referred to in the model as **supply**, and these influence the costs of travel.

1.3.4 TRAM seeks an equilibrium state in which changes in the consequent cost of travel are balanced by changes in the amount of travel, referred to in the model as **demand**. In this way TRAM properly reflects the full impacts often referred to as induced traffic when related to an improved road.

1.3.5 Demand and supply combine together in this equilibrium to determine the costs of travel, represented by a combination of time and money referred to as **generalised cost**. When supply is changed, the cost of travel changes (eg through a new road) and in response demand changes as well. On the other hand, when demand changes on a particular mode, the costs of travel change for a given level of supply. TRAM employs an **iterative** procedure in which changes in demand and generalised cost iterate until a **converged** state is reached.

1.3.6 TRAM operates in two ways: a base run which represents the known input data and provides a representation of the base year transport system, and forecast runs in which possible changes to supply are input and changes in demand are generated.

1.3.7 Demand is represented by a set of matrices that quantify the numbers of movements between pairs of zones which make up the area under study. TRAM has a highly **disaggregate** representation of demand: there is a separate matrix of movements for each combination of purpose of travel, time of travel, type of household and means of travel.

1.3.8 For this study, travel demand data has been assembled from number of sources.

1.3.9 Highway demand data has been taken from three existing models: a Saturn Highway model of the Harlow Town area; NAOMI, the large area strategic highway

model covering the whole of South-East England, as used in the Orbit multi-modal study; and the London to South Midland multi-modal model. Trip end data from the National Trip End Model (NTEM) has also been employed to update and combine these data sources.

1.3.10 Public Transport data has come from three sources: A Town Centre survey carried out in March 2004 by MVA for Harlow Council as part of this study; Electronic Ticket Machine (ETM) data supplied by the main local bus operator, Arriva; and the London to South Midland multi-modal model.

1.3.11 Given the expense required in undertaking full-scale surveys, slow mode (walk and cycle) demand data was synthesised from the limited amount of data available and the highway demand data using techniques established in earlier models.

1.3.12 The traveller responses described in paragraph 1.2.2 determine the specification of TRAM with respect to the sequence of choices and their sensitivity to changes in travel costs (see Figure A.1.2).

1.3.13 The levels of disaggregation of demand lead to a **nested choice hierarchy** implemented in TRAM. The hierarchy is as follows:

- **frequency**: the number of tours or trips originating from a zone;
- **destination**: the number of tours or trips going to a zone;
- **mode**: the main means of travel used; and
- **time**: the combination of time periods travelled in for a tour or single time period for a non-home-based trip.

1.3.14 For **car travel** there are two lower levels of choice: type of parking and zone of parking. Parking choice is only modelled where the destination is a designated parking zone, which in this study includes the whole of Harlow town and the new development zones. Parking is not modelled for non-home-based trips as no information is available to distinguish these parking activities.

1.3.15 For travel by **public transport** there is a lower level of choice of route. A route is composed of stages by various means of public transport. In the base model, up to two routes are defined: one using only bus (plus walking to and from stops) and one by rail, if it is available for part of particular journey. In the forecast model high quality public transport (e.g. kerb Guided Bus) is available, referred to as TRAM in Figure A.1.2. For the other main mode, **walking and cycling**, there are no lower levels of choice modelled in TRAM.

1.3.16 Choices of frequency, destination, mode and time are estimated using an **incremental logit model** and are only used in the forecast run. Parking choice and public transport route choice are levels estimated using an **absolute logit model** in both base and forecast runs.

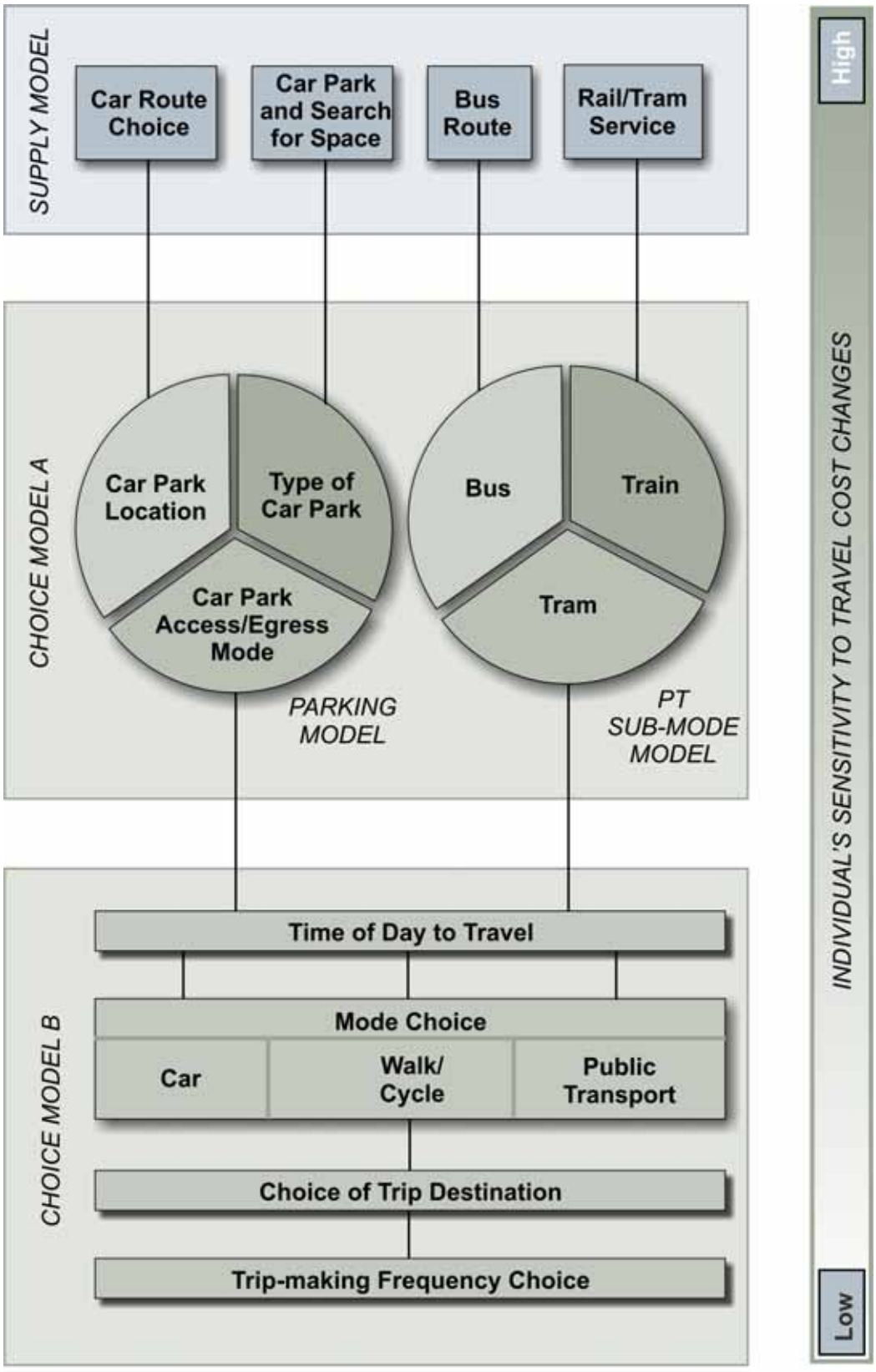


Figure A.1.2 TRAM Traveller Responses

1.3.17 Transport supply in TRAM is represented by a network of **nodes and links**. Individual junctions at single nodes are not modelled. The cost of travelling on each link is dependent on the amount of travel on that link and the capacity of that link and downstream junction. In the supply module, demand is assigned onto the network by a process called **'loading'**. For movements between each pair of zones an appropriate path is found in each direction, and in each time period.

1.3.18 The TRAM network for Harlow has been developed from the existing Saturn Highway model, and expanded to cover a wider area encompassing key adjacent areas such as the Lea valley, Bishop's Stortford, Stansted Airport and Epping.

1.3.19 TRAM will automatically consider informal **Park-and-Ride** from any zone modelled as a parking zone within the TRAM model (ie all study area zones). The only current example of park and ride in Harlow is use of car as an access mode to the railway network. In common with most transport models, such behaviour is currently modelled as being an entirely PT-based trip.

1.3.20 However, formal park and ride from specific Park-and-Ride facilities such as at Junction 7 is modelled separately at the end of a forecast using output information on routes and costs in order to estimate patronage from M11 through trips.

1.3.21 TRAM requires a number of aspects of **parking supply** to be input, as follows:

- the number of each type of parking space in each zone;
- the parking charges for each type of parking and for each parking duration (ie for each from-home and to-home journey time pair).

1.3.22 This information was collected from the data supplied by Harlow Council, site visits by MVA staff, and in the case of PNR, contacting companies directly. From our experience of PNR data collection on other studies, any estimate of overall capacity of PNR will be subject to more uncertainty than other aspects of the Parking Inventory.

1.3.23 The values relating to both the value of time and vehicle operating costs were taken from the March 2001 Transport Economics Note (TEN); other values were taken from applications of the TRAM model to Edinburgh and Bristol. The only values which are not available from previous applications of TRAM relate to the size of zones, where estimated values based on the zone size and average speeds for the relevant mode were used.

1.3.24 Base demand is input in the **forecast run** in the same form as it is input to the base. Base origin-destination costs and search times, initial link times, parking charges, road user charges and public transport fares are all required as is the case for the base model. Changes in these data with respect to the base will represent the transport strategy being tested in the forecast run. Other supply-related data may also be changed to reflect the transport strategy, parking capacities being of particular importance. Infrastructure changes are represented by having forecast highway and public transport networks which differ from those input in the base run.

1.3.25 In the forecast run, TRAM starts in the same way as for the base run, but for an initial number of loops only the absolute choices of parking site and public transport route are implemented. This is to provide a more stable point at which to implement the incremental choices higher up the hierarchy.

1.4 Calibration and Validation

Calibration

1.4.1 In order to calibrate TRAM supply models with respect to observed data, a **series** of base runs were undertaken in which adjustments to supply inputs are made until an acceptably-close agreement between outputs and observations is achieved. For a model of this kind, this level of agreement need not necessarily be as comprehensive as would be expected in the validation of a more detailed single mode network transport model, but must show that the model provides an acceptable representation of the current situation to act as a base against which strategies can be tested.

1.4.2 Demand modelling in TRAM is an incremental model form which effectively uses all of the available input data to determine current demand by mode rather than trying to predict it using a mathematical model. In addition, it is not possible to validate a strategic model to the same level of detail as conventional spatially detailed highway or public transport assignment models.

1.4.3 Instead we report here, the results of the model calibration and validation process by comparing base model outputs with relevant data observed locally and nationally.

1.4.4 In addition, we report the result of acceptance tests which report how the model responds to a range of artificial variant cases (public transport fare changes, fuel price increases and parking charges) and report how well the model replicates known elasticities in these areas.

1.4.5 Table 3.1 shows the **mode share** statistics for the model compared with the Tempro database average for the Harlow Town area.

Table 2.1 Mode Share – Trips to/from/within Harlow

Mode	Car	Bus	Rail
Modelled Share of trips (Harlow Town)	85.5%	12.6%	1.9%
Tempro Share of trips (Harlow Town)	90.5%	8.2%	1.3%
Modelled Share of Person-km (Harlow Town)	81.0%	19.0%(PT Combined)	

1.4.6 The above figures show that mode shares in the model are good, with car slightly under-represented in terms of number of trips, and the two public transport modes slightly over-represented.

1.4.7 It was not possible to provide separate bus and rail shares of person km for trips to/from/within Harlow. The difference in the share of trips and person km between car and PT will reflect the relatively higher than average volume of long distance rail commuting to London from and through Harlow.

1.4.8 With respect to the overall **level of travel demand**, the use of Tripend data based on NTEM trip rates and land use data should ensure that the overall level of demand in the model is consistent, but as a check, the 24-hour total number of modelled car person trips originating or destined to the Harlow urban area can be compared with the same data for an average weekday for the equivalent area of Tempro. The modelled car trips total 189417, while those in Tempro equal 166895, a difference of 13%. Comparison of the supplied population data for the Harlow Town area and the equivalent data in Tempro also reveals a discrepancy, in this case of about 8%. However , there is a mismatch in the Harlow area defined in Tempro and the area covered by the Harlow TRAM zones. In light of this the overall level of car demand seems reasonable. Given that the mode shares above seem reasonable, then the level of demand for PT is also considered reasonable

1.4.9 Comparison of the base model against published information shows that the overall level of demand in the model is reasonable, as is the split of demand between modes. As a further form of validation, a number of key **link flows** in the model have been compared with traffic count data, and are found to be consistent.

Validation

1.4.10 To validate the assignment of link traffic flows to the network, a validation of assigned link flows against traffic counts has been undertaken.

1.4.11 The modelled versus observed flows are summarised in Figure 2.3. The figure shows that the assigned link flows are reasonably consistent with the traffic count

data, most falling close to the 'ideal' line. Certainly, for a strategic model such as this one, the validation is acceptable.

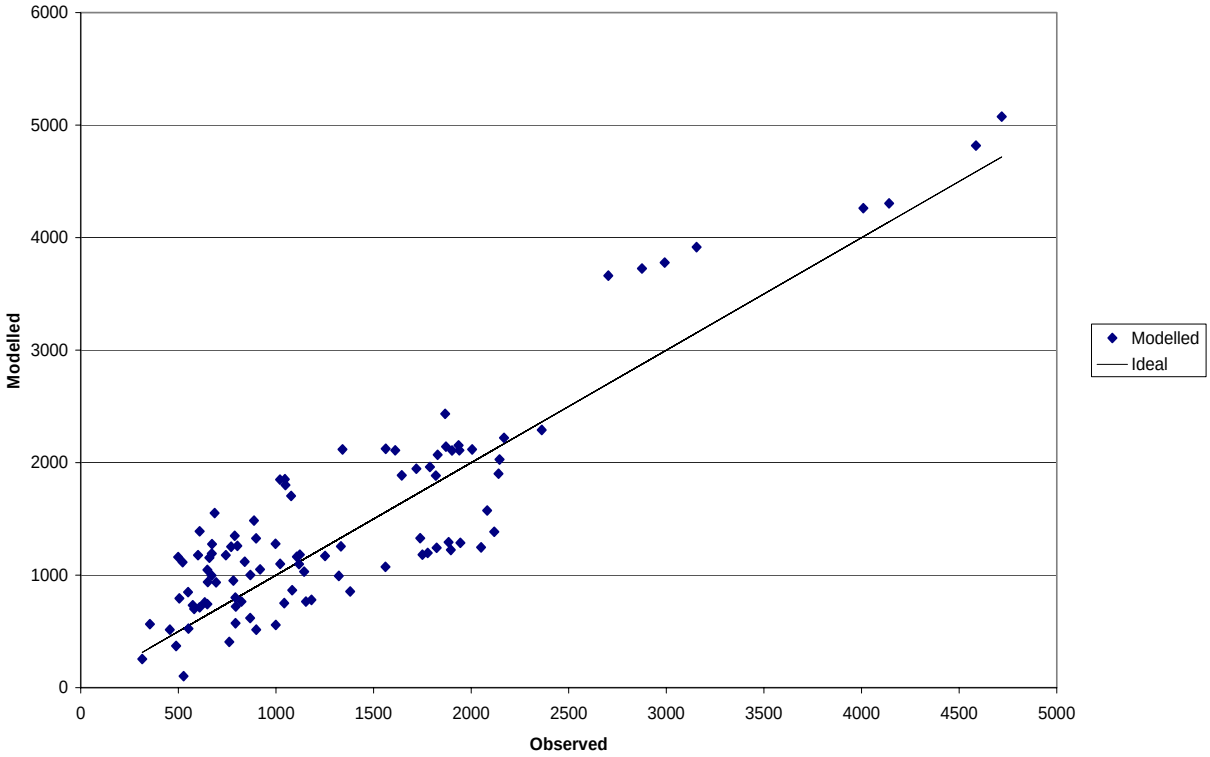


Figure 2.3: Modelled vs. Observed Link Flows

Acceptance Tests

1.4.12 As part of the validation process, a series of Acceptance Tests has been run with TRAM in forecast mode, to test how the model responds to a number artificial 'policies'.

1.4.13 The following tests were undertaken:

- 30% increase in fuel prices (with published elasticity value ranges used as a benchmark;
- 50% reduction in all public transport fares (with published elasticity value ranges used as a benchmark);
- 100% increase in public on-street parking charges – plausibility of results used; and
- a 'carrot and stick' test using a combination of the tolling, public transport fare reduction and parking charge changes from the other tests.

1.4.14 The response of the model to these changes was compared with published elasticities to determine whether the model responded in the expected manner. The full set of results are presented in the Harlow TRAM Calibration and Validation Report.

1.4.15 The magnitude of response in some cases was quite low compared to published elasticities, but the published data relates to models with large area networks and/or single modes. It is also recognised that there is a considerable variation around the single values that are published. For these reasons and the fact that the results are of a similar order to responses obtained from similar models in

other studies, they are accepted as valuable indication of the acceptable validation of the Harlow Growth Options TRAM.

Appendix C

Sector Analysis

Planning Scenario 1 - Schemes 1A+3B 2021
Sector Analysis of High Quality PT Scheme Person Trips

Table C1: TOTAL FLOWS

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	0	290	496	0	799	1718	3303
Harlow other	291	163	1245	246	2226	2827	6996
Buffer	755	1232	1104	29	426	149	3695
External	0	268	29	0	2280	940	3517
N Weald Dev	740	1919	422	2274	59	245	5660
Northern Dev	1686	2108	159	954	251	36	5194
TOTAL	3471	5980	3455	3503	6041	5915	28365

Table C2: AM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	0	3	6	0	74	179	262
Harlow other	26	8	129	40	325	385	912
Buffer	37	120	105	20	69	11	361
External	0	8	0	0	203	75	286
N Weald Dev	60	62	51	416	10	25	624
Northern Dev	52	34	10	191	38	3	329
TOTAL	175	234	303	667	718	677	2774

Table C3: Interpeak 1 (3-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	0	46	175	0	177	400	797
Harlow other	88	41	176	44	559	839	1747
Buffer	182	199	195	0	63	32	670
External	0	49	3	0	361	140	553
N Weald Dev	175	341	76	484	5	42	1123
Northern Dev	437	361	29	194	32	7	1060
TOTAL	882	1036	654	722	1196	1460	5952

Table C4: Interpeak 2 (3-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	0	82	142	0	136	325	684
Harlow other	62	33	175	22	330	441	1063
Buffer	234	249	188	8	74	33	787
External	0	53	7	0	448	201	710
N Weald Dev	147	446	68	349	7	40	1057
Northern Dev	419	569	31	149	44	7	1219
TOTAL	863	1432	611	528	1039	1047	5520

Table C5: PM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	0	0	34	0	168	179	382
Harlow other	0	0	118	0	222	174	513
Buffer	8	124	260	0	74	25	490
External	0	0	7	0	565	211	783
N Weald Dev	151	595	76	293	19	68	1203
Northern Dev	374	633	46	122	49	7	1231
TOTAL	533	1352	541	415	1096	665	4602

Planning Scenario 2 - Schemes 2C+3A 2021
Sector Analysis of High Quality PT Scheme Person Trips

Table C6: TOTAL FLOWS

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	0	282	468	0	0	1596	304	2650
Harlow other	282	102	1130	208	0	4467	270	6459
Buffer	746	1135	1150	29	0	1093	46	4199
External	0	231	29	0	0	0	0	260
Eastern Dev	0	0	0	0	0	131	30	161
N Weald Dev	1531	3886	1073	0	68	66	682	7354
SW Dev	297	242	46	0	28	697	0	1313
TOTAL	2856	5878	3897	237	96	8097	1336	22447

Table C7: AM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	0	3	6	0	0	100	9	118
Harlow other	36	12	101	25	0	496	23	693
Buffer	36	138	109	20	0	126	4	432
External	0	7	0	0	0	0	0	8
Eastern Dev	0	0	0	0	0	11	2	12
N Weald Dev	229	315	172	0	4	10	23	753
SW Dev	60	19	5	0	1	94	0	178
TOTAL	362	494	393	45	5	845	62	2205

Table C8: Interpeak 1 (3-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	0	41	160	0	0	307	40	548
Harlow other	81	18	160	36	0	1045	51	1391
Buffer	184	170	205	0	0	190	10	759
External	0	45	3	0	0	0	0	49
Eastern Dev	0	0	0	0	0	40	8	47
N Weald Dev	338	846	209	0	17	8	140	1565
SW Dev	63	53	11	0	6	197	0	331
TOTAL	665	1174	749	36	24	1801	250	4705

Table C9: Interpeak 2 (3-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	0	78	126	0	0	279	59	542
Harlow other	54	18	157	20	0	784	52	1085
Buffer	227	235	194	8	0	204	9	877
External	0	47	8	0	0	0	0	55
Eastern Dev	0	0	0	0	0	24	6	30
N Weald Dev	291	755	182	0	14	9	157	1419
SW Dev	36	47	8	0	6	109	0	207
TOTAL	607	1179	675	28	20	1415	283	4220

Table C10: PM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	0	62	63	0	0	239	62	426
Harlow other	14	15	184	29	0	375	25	641
Buffer	25	150	135	0	0	117	5	432
External	0	37	4	0	0	0	0	41
Eastern Dev	0	0	0	0	0	11	4	15
N Weald Dev	124	494	88	0	7	10	107	839
SW Dev	18	24	5	0	4	40	0	92
TOTAL	181	782	478	29	11	793	203	2487

Planning Scenario 1 - Schemes 1A+3B 2021
Sector Analysis of High Quality PT Scheme Person Trips

Table C11: TOTAL FLOWS

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	1538	4372	2529	1048	800	1796	12083
Harlow other	4415	6156	3745	1674	2249	2964	21202
Buffer	2582	3959	20091	8586	461	354	36032
External	1161	1807	8650	0	2487	1677	15782
N Weald Dev	742	2224	460	2482	259	245	6412
Northern Dev	1762	2934	405	1664	251	183	7199
TOTAL	12200	21451	35880	15454	6506	7219	98710

Table C12: AM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	152	155	102	100	74	186	768
Harlow other	909	552	439	260	327	410	2895
Buffer	255	356	1990	609	71	20	3301
External	136	106	701	0	229	138	1311
N Weald Dev	61	68	57	458	32	25	701
Northern Dev	65	48	56	343	38	19	569
TOTAL	1577	1284	3345	1770	772	797	9545

Table C13: Interpeak 1 (3-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	393	636	557	131	177	412	2306
Harlow other	845	1180	466	226	562	857	4136
Buffer	503	775	3871	1711	69	54	6983
External	179	280	1648	0	386	255	2749
N Weald Dev	176	384	83	516	41	42	1243
Northern Dev	451	502	72	321	32	33	1411
TOTAL	2547	3757	6698	2906	1266	1653	18828

Table C14: Interpeak 2 (3-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	253	914	612	138	136	336	2389
Harlow other	661	1119	604	156	334	457	3331
Buffer	629	760	3850	844	78	63	6225
External	161	270	938	0	483	364	2216
N Weald Dev	147	493	74	377	41	40	1172
Northern Dev	430	763	66	244	44	34	1581
TOTAL	2281	4319	6144	1759	1117	1294	16914

Table C15: PM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	141	781	347	161	84	100	1613
Harlow other	240	658	456	208	135	123	1821
Buffer	177	482	1997	1318	42	56	4073
External	152	269	1015	0	311	200	1947
N Weald Dev	76	374	41	168	31	34	723
Northern Dev	193	455	38	116	24	20	845
TOTAL	979	3020	3893	1971	628	533	11023

Planning Scenario 2 - Schemes 2C+3A 2021
Sector Analysis of High Quality PT Scheme Person Trips

Table C16: TOTAL FLOWS

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	1415	4271	2454	1007	206	1600	728	11682
Harlow other	4314	5233	3498	1527	356	4731	1904	21563
Buffer	2495	3702	20007	8584	252	1297	341	36677
External	1118	1663	8694	0	561	2882	757	15675
Eastern Dev	205	353	253	565	232	139	76	1824
N Weald Dev	1536	4672	1284	2869	135	599	702	11797
SW Dev	729	1905	343	766	75	712	777	5307
TOTAL	11812	21800	36532	15318	1816	11960	5287	104524

Table C17: AM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	140	144	89	77	3	100	33	586
Harlow other	937	489	367	207	14	510	251	2774
Buffer	263	385	1981	622	8	134	26	3420
External	145	106	697	0	19	298	57	1322
Eastern Dev	46	58	59	132	24	11	6	336
N Weald Dev	230	331	192	429	5	70	23	1280
SW Dev	129	130	54	120	5	94	41	573
TOTAL	1889	1642	3439	1587	77	1217	438	10291

Table C18: Interpeak 1 (3-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	378	597	517	122	22	307	130	2073
Harlow other	788	996	426	198	60	1081	453	4001
Buffer	478	734	3865	1699	40	238	70	7125
External	170	263	1658	0	90	529	156	2866
Eastern Dev	45	86	49	110	51	41	18	400
N Weald Dev	339	973	310	692	28	121	143	2605
SW Dev	175	384	72	160	18	200	228	1236
TOTAL	2373	4033	6897	2981	307	2518	1198	20307

Table C19: Interpeak 2 (3-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	225	890	579	134	43	279	133	2284
Harlow other	589	918	533	145	77	837	347	3445
Buffer	606	731	3827	841	55	244	54	6357
External	150	248	942	0	122	541	120	2123
Eastern Dev	28	63	44	99	46	26	16	322
N Weald Dev	292	908	203	453	31	104	161	2151
SW Dev	113	429	63	141	15	113	190	1064
TOTAL	2004	4187	6191	1813	387	2144	1020	17746

Table C20: PM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	128	749	349	168	38	239	118	1789
Harlow other	232	565	481	204	53	416	146	2097
Buffer	159	414	1985	1318	39	143	42	4099
External	137	238	1045	0	86	318	94	1917
Eastern Dev	6	21	14	30	23	12	8	113
N Weald Dev	124	637	95	213	19	65	111	1264
SW Dev	36	202	27	60	8	42	70	444
TOTAL	821	2825	3995	1993	264	1235	588	11723

Planning Scenario 1 - Schemes 1A+3B 2021
Sector Analysis of High Quality PT Scheme Person Trips

Table C21: TOTAL FLOWS

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	11961	5259	5083	923	714	1317	25256
Harlow other	5421	57116	16276	3113	2441	3061	87429
Buffer	5123	17779	364543	50119	8732	12270	458567
External	1098	3363	51877	214704	5439	10267	286747
N Weald Dev	761	2458	8660	5357	434	196	17865
Northern Dev	1320	3062	12137	10144	191	578	27432
TOTAL	25683	89037	458575	284360	17951	27690	903297

Table C22: AM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	1206	440	227	40	59	90	2063
Harlow other	761	6494	1316	214	242	240	9268
Buffer	950	2683	40893	5156	910	1096	51689
External	127	416	4236	21805	367	458	27408
N Weald Dev	95	410	1284	774	57	23	2642
Northern Dev	187	566	2111	1640	33	76	4613
TOTAL	3326	11010	50066	29630	1667	1983	97683

Table C23: Interpeak 1 (3-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	3129	1198	1210	183	176	321	6218
Harlow other	1257	12397	2679	467	391	506	17697
Buffer	975	3581	82518	9719	1521	2127	100441
External	178	528	9512	39310	910	1823	52262
N Weald Dev	198	505	1838	945	78	30	3593
Northern Dev	335	636	2595	1927	27	101	5619
TOTAL	6071	18845	100353	52550	3103	4908	185830

Table C24: Interpeak 2 (3-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	1631	772	864	139	106	191	3704
Harlow other	699	7904	2580	527	369	436	12515
Buffer	599	2402	51646	7405	1343	1736	65131
External	138	455	8256	29577	963	1840	41229
N Weald Dev	93	256	989	671	59	22	2092
Northern Dev	149	272	1120	1182	20	74	2816
TOTAL	3309	12060	65456	39503	2860	4299	127487

Table C25: PM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	N Weald Dev	Northern Dev	TOTAL
Harlow TC	1244	658	725	121	79	168	2995
Harlow other	508	6579	2421	442	359	501	10810
Buffer	326	1621	40930	5459	1162	1884	51382
External	78	303	6133	19500	638	1376	28029
N Weald Dev	64	226	836	523	54	26	1729
Northern Dev	106	266	1144	902	23	76	2517
TOTAL	2326	9654	52188	26948	2315	4031	97461

Planning Scenario 2 - Schemes 2C+3A 2021
Sector Analysis of High Quality PT Scheme Person Trips

Table C26: TOTAL FLOWS

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	10758	4684	4747	597	517	1014	1162	23477
Harlow other	4804	50886	17029	2351	2423	5022	4951	87466
Buffer	4855	18677	361848	49849	6968	17490	15448	475134
External	781	2625	51524	209374	2794	7013	6194	280303
Eastern Dev	515	2415	6929	2799	228	575	257	13718
N Weald Dev	1059	5034	17363	7015	578	785	834	32667
SW Dev	1156	4925	15312	6186	258	827	586	29251
TOTAL	23927	89245	474752	278171	13765	32725	29431	942016

Table C27: AM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	1093	421	227	34	21	61	93	1949
Harlow other	661	5903	1160	174	140	353	521	8912
Buffer	1046	3189	40331	5151	284	1293	1480	52774
External	78	312	4128	21520	114	518	594	27263
Eastern Dev	84	423	1196	483	21	38	30	2273
N Weald Dev	154	857	2743	1108	80	101	140	5182
SW Dev	159	697	2114	854	22	58	66	3970
TOTAL	3275	11800	51899	29324	681	2422	2924	102325

Table C28: Interpeak 1 (3-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	2832	1045	998	100	109	205	265	5553
Harlow other	1155	10923	2704	351	487	866	967	17452
Buffer	809	3660	82301	9751	1382	3031	3054	103988
External	129	374	9499	38418	554	1215	1224	51413
Eastern Dev	103	466	1457	589	61	110	63	2850
N Weald Dev	221	1010	3540	1430	140	134	161	6637
SW Dev	257	978	3180	1285	67	138	138	6042
TOTAL	5506	18456	103681	51923	2799	5699	5872	193935

Table C29: Interpeak 2 (3-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	1451	660	670	62	88	168	163	3261
Harlow other	601	6987	2752	354	397	811	659	12561
Buffer	461	2413	51413	7267	1216	2930	2228	67927
External	81	354	8144	28257	488	1175	893	39390
Eastern Dev	65	311	879	355	35	109	33	1787
N Weald Dev	125	534	1990	804	71	106	83	3713
SW Dev	138	582	1889	763	34	128	70	3604
TOTAL	2922	11839	67735	37862	2328	5427	4128	132242

Table C30: PM Peak (1-hour)

	Harlow TC	Harlow other	Buffer	External	Eastern Dev	N Weald Dev	SW Dev	TOTAL
Harlow TC	1117	591	816	84	74	125	145	2952
Harlow other	463	5855	2726	336	365	709	637	11092
Buffer	338	1542	40468	5409	1056	2383	1939	53135
External	65	251	6165	19407	423	955	777	28044
Eastern Dev	42	193	514	208	21	67	23	1068
N Weald Dev	93	403	1521	614	49	96	76	2852
SW Dev	116	546	1614	652	29	119	63	3137
TOTAL	2234	9382	53824	26711	2016	4454	3660	102281

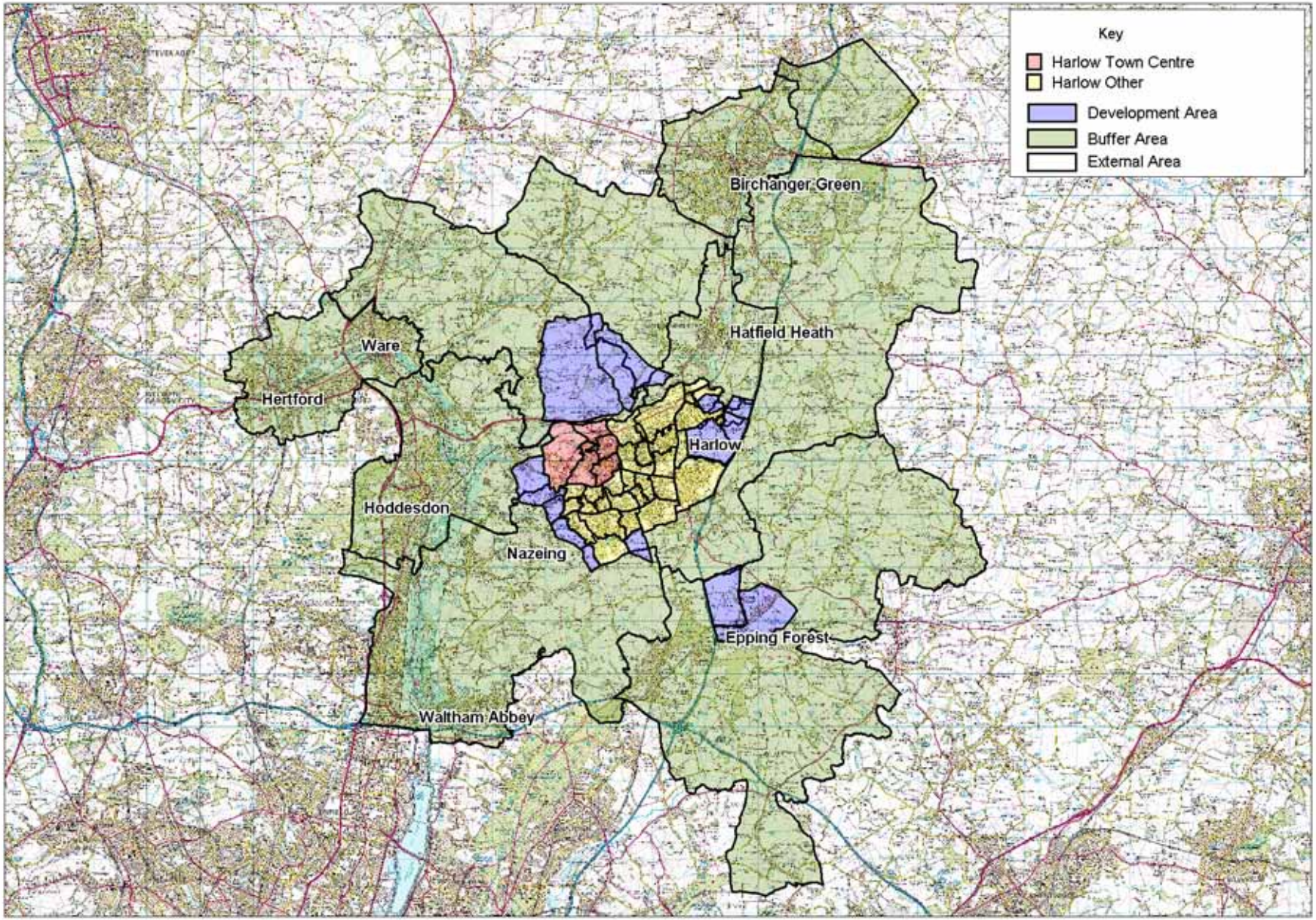


Figure C1: Location of Areas used in Sector Analysis Matrices

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