Dunfermline Strategic Land Allocation Transport Assessment

Fife Council

Final Report

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DUNFERMLINE STRATEGIC LAND ALLOCATION TRANSPORT ASSESSMENT

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DUNFERMLINE STRATEGIC LAND ALLOCATION TRANSPORT ASSESSMENT

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EXECUTIVE SUMMARY

Introduction

The *Draft Dunfermline and West Fife Local Plan (2010)* prepared by Fife Council (FC) sets out masterplan proposals to deliver a strategic expansion of Dunfermline over the period 2015 – 2030. The proposals involve the development of four separate land parcels located at the western edge of Dunfermline with a mixture of residential, employment and education uses.

SIAS Limited (SIAS) was appointed by FC in September 2009 as part of a term consultancy framework to undertake a Transportation Appraisal of the masterplan proposals as set out in the *Willie Miller Urban Design (WMUD) Strategic Framework (Dunfermline) Final Report (June 2009)*. This Transport Assessment seeks to determine the transportation characteristics of the proposed developments, examining the total demand for travel associated with new housing and employment and establishing the resulting transportation infrastructure requirements associated with key travel modes. A key part of the process is the development, validation and application of an S-Paramics model of the study area.

The outcomes of this study provide outline scheme designs and costings which have been identified to deliver the development proposed in the Fife Structure Plan and the Draft Fife Local Dunfermline & West Fife Local Plan.

The schemes are concept schemes to demonstrate deliverability, however, other schemes and proposals should not be ruled out when considering any detailed Planning Application or if any additional sensitivity testing is undertaken.

The Dunfermline expansion proposals considered in this exercise constitute four distinct land parcels located along the western boundary of the city. From north to south, the land parcels are identified as:

- Wellwood
- Berrylaw
- Liggar Bridge
- Broomhall

The four development areas are shown in Figure 1.

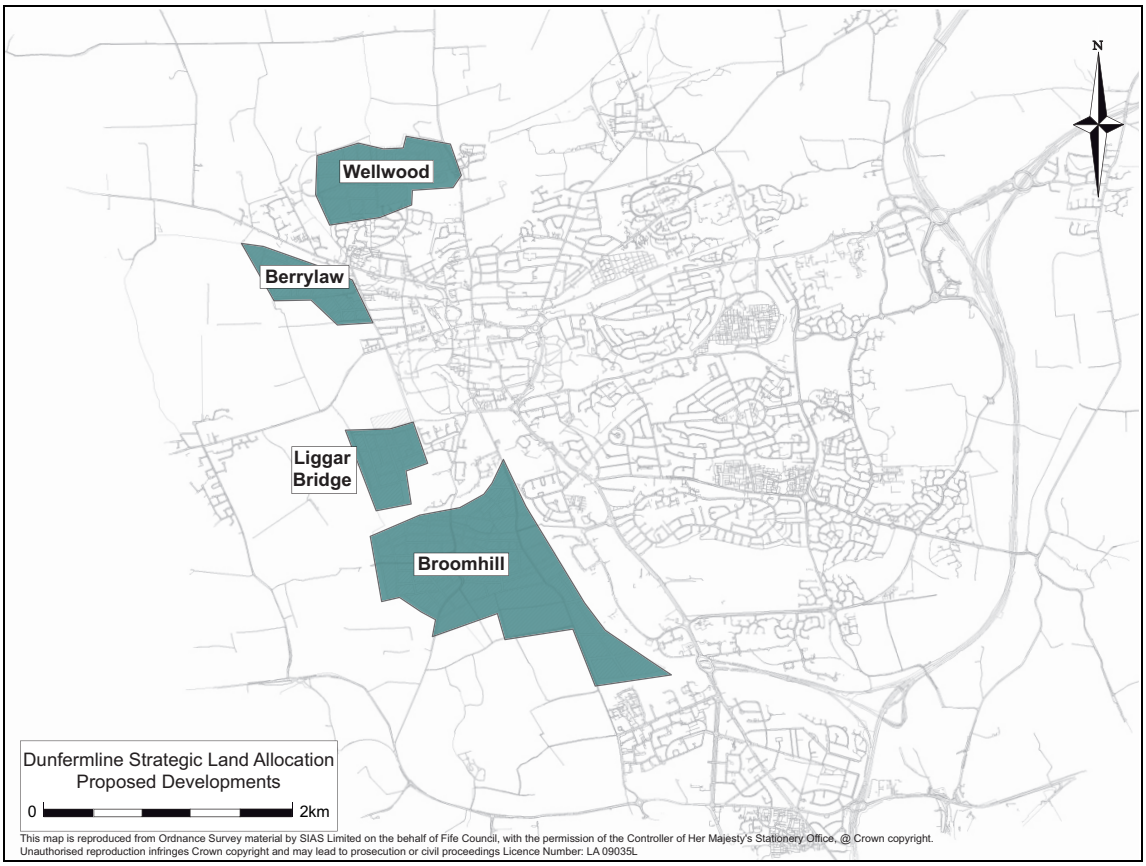

Figure 1 : Dunfermline Western Expansion Development Areas

SIAS worked in conjunction with FC Development Services to identify the scale and type of development proposed in the respective land parcels. This has enabled the assembly of a development schedule for each site.

A number of studies have contributed to this appraisal and are listed as follows:

- *Dunfermline Bus Priority Study (SIAS 2008)*
- *Fife 20 Year Plan for Fife (SIAS 2010)*
- *Dunfermline BRT/LRT Project (Scott Wilson, 2008)*
- *Dunfermline Strategic Framework (WMUD, 2009)*

Existing and Potential Transport Infrastructure

Walking

Dunfermline has an existing network of footways and footpaths within the urban conurbation. In the proposed Strategic Land Allocation areas pedestrian provision is currently limited due to the existing rural nature, but all proposed areas (Wellwood, Berrylaw, Liggar Bridge and Broomhall) have the potential to connect to existing footway networks on at least three flanks towards Dunfermline or Rosyth.

Cycle Routes

Dunfermline has an established network of off road and on road cycleways with a number of National and Regional Cycleways serving the town.

- National Cycle Route 1 provides a long distance cycle route stretching from Dover to the Shetland Islands along the east coast of the UK. In Fife it connects Dunfermline to the Forth Road Bridge and to Kinross.
- National Cycle Route 764 provides a long distance route from Queen Margaret Station in Dunfermline to Alloa.
- Regional Route 65 connects from National Cycle Route 764, through Pittencrieff Park in Dunfermline to Rosyth and National Cycle Route 76 (St Andrews to Stirling).

The majority of facilities in Dunfermline may be within around 20min cycling distance, with the town centre being within 10min cycle. Where possible, new cycling infrastructure should be designed to allow cyclist to maintain a reasonable level of momentum with the aim of providing routes suitable for cycling speeds of between 20 – 30kph.

Bus Based Public Transport

Bus services in Dunfermline are operated largely by Stagecoach East Scotland, as part of its wider Fife network. These include a range of Dunfermline town services, services which operate between Dunfermline and other destinations in Fife and a range of express and longer distance services. Increasingly, buses which operate local services in Dunfermline are to a low-floor specification.

Bus Based Park & Ride

The Ferrytoll Park & Ride facility, located adjacent to the M90 north of the Forth Road Bridge, plays an important role in the context of local and regional bus and coach services. The facility, which provides parking capacity for more than 1,000 cars, serves not only as a Park & Ride, but as a hub for interchange between the various local and express services that use the site.

As part of a wider strategy to increase the share of trips made by public transport, a further Park & Ride facility at Halbeath has now been approved and is due for completion by 2013. It is anticipated that spaces for up to 1,000 cars could be provided. The addition of a Park & Ride facility at Halbeath provides an opportunity to further develop the network of local and express bus services in the Dunfermline area.

Rail Based Public Transport

There are two train stations in Dunfermline; Dunfermline Town to the south of the town centre, and Dunfermline Queen Margaret, to the east of the town centre. The stations are outside a walking distance of 800m, but have the potential to be accessible by cycling, bus, taxi and car sharing.

Rosyth Train Station is close to the Broomhall Strategic Land Allocation area that has the potential at its southern end to be within an acceptable 800m walking distance of Rosyth Station.

The three railway stations are all fully accessible and have a variety of facilities including: secure cycle parking lockers, bus access, disabled car parking and free public car parking. The Town Centre and Dunfermline Queen Margaret Stations also have taxi ranks.

Main Road Links

Dunfermline is bounded to the east by the M90 motorway running south towards Edinburgh and north towards Perth, Dundee and Aberdeen. Key road links in Dunfermline include:

- The A907 Halbeath Corridor
- The A823 Queensferry Corridor
- The A994, which runs west through Crossford towards the Kincardine Bridge
- The B916 Aberdour Road, between the A823 through east Dunfermline to the B981

Development Travel Characteristics

The following elements of the development travel characteristics were quantified during this study:

- Trip generation
- Trip purpose
- Trip length
- Trip distribution
- Model split

Historically, a Transport Impact Appraisal would primarily seek to determine the requirement for highway capacity improvements resulting from additional development related traffic. Under current guidelines, there is a requirement to consider total person trip making activity and the provision of measures to support trips by all travel modes.

Opportunities exist to promote non-car based trip making behaviour, and particularly to increase the proportion of person trips that are made using active travel modes, such as walking and cycling. Through the promotion of sustainable travel modes, FC aspires to achieve a reduction in demand for private car trips. This in turn reduces the degree to which measures are required to mitigate the negative effects of car travel.

Consistent with the aspiration to increase the proportion of trips made on foot, by cyclists and by public transport, FC has researched travel behaviour in British cities whose mode splits represent a lower dependency on trips made by car. Person trips considered in this appraisal were broken down according to the mode split shown in Table 1.

Table 1 : Agreed Mode Split Targets

Mode	Share (%)
Car (driver only)	41%
Car (drive and Passenger)	12%
Walk	20%
Bus	17%
Train	3%
Cycle	8%
Total	100%

Traffic Modelling

This Transport Assessment utilises a calibrated and validated S-Paramics microsimulation model of the Dunfermline Area which has been developed for this study.

Reference Case Forecasting

While scoping the methodology with Transport Scotland it was recommended that Transport Scotland's Land Use and Transport Integration in Scotland (LATIS) service should be approached to discuss if a suitable regional model was available for use for applying forecast growth in this study.

A request for advice was submitted to LATIS on the appropriate regional model to use for forecasting background traffic in the modelling. LATIS recommended the use of the South East of Scotland Transport Partnership (SESTRAN) regional SATURN model, as a suitable methodology for applying forecast growth for this study. This model takes account of multimodal strategic trips influenced by future PT improvements.

The future years required to be assessed in this study are 2015, 2021 and 2029. The SESTRAN regional model cordons for the study area being used as basis for growth. The modelled SESTRAN years are 2007, 2019, 2024 and 2032.

The highway assignment models were provided and cordons of the study area were extracted from the assignments.

To calculate the background traffic growth the absolute growth for each SESTRAN zone to zone movement was extracted for the modelled area. Due to there being a difference between the SESTRAN modelled years and the Dunfermline Strategic Land Appraisal (SLA) modelled years, the growth between each modelled year was assumed to be linear and interpolation was undertaken between the modelled years.

Development Assumptions

The development phasing is to be undertaken using two approaches as shown in Figure 6.1, namely:

- The preferred phasing as specified in the *Draft Dunfermline & West Fife Local Plan (2010)*

- An Alternative Development Phasing approach which has been derived from discussions with potential developers who have contributed to the study

The phasing has been undertaken using two approaches namely the current phasing as stated in the *Willie Miller Urban Design (WMUD) Strategic Framework (Dunfermline) Final Report (June 2009)* shown in Table 2 and an alternative scenario shown in Table 3.

Table 2 : Local Plan Development Scenario Summary

Development	Land Use	2015	2021	2029
Broomhall	Residential	40% (789 Units)	100% (1972 Units)	100% (1972 Units)
	Employment	26% (32.8 Ha)	66% (83.3 Ha)	100% (126.2 Ha)
Berrylaw	Residential		50% (332 Units)	100% (665 Units)
	Employment		50% (4.9 Ha)	100% (9.8 Ha)
Liggar Bridge	Residential		100% (1063 Units)	100% (1063 Units)
	Employment		100% (2.4 Ha)	100% (2.4 Ha)
Wellwood	Residential			100% (1085 Units)
	Employment			100% (22.4 Ha)

Table 3 : Alternative Development Scenario Summary

Development	Land Use	2015	2021	2029
Broomhall	Residential	40% (789 Units)	100% (1972 Units)	100% (1972 Units)
	Employment	40% (50.5 Ha)	100% (126.2 Ha)	100% (126.2 Ha)
Berrylaw	Residential			100% (665 Units)
	Employment			100% (9.8 Ha)
Liggar Bridge	Residential			100% (1063 Units)
	Employment			100% (2.4 Ha)
Wellwood	Residential	40% (434 Units)	100% (1085 Units)	100% (1085 Units)
	Employment	40% (9 Ha)	100% (22.4 Ha)	100% (22.4 Ha)

In each development it is assumed that the construction (i.e. the trip generation) is linear throughout the construction period.

Employment and residential trips generation are disaggregated by each hour in the peak period. Each period length is 3hr and, as such, a profile was applied to represent the different demands levels within each simulated hour.

The trip distribution for each SLA development land parcel was established using the SESTRAN regional model.. By examining the change in trip distribution between the SESTRAN highway assignments which included the SLA development and the highway assignments without (i.e. the assignments used for the Background Growth increments) the distribution for the SLA developments was established.

Transport Impact

Having identified the need for a range of infrastructure interventions, SIAS liaised with Mouchel to establish indicative scheme costs which are incorporated into this report.

A summary of the potential interventions and the stage they are required is presented in Table 6.23 to Table 6.25 for the Reference Case, the Local Plan Phasing and the Alternative Development Phasing.

The level of development specified in the 2015 scenario is assumed to be completed during the period 2011 – 2015, the 2021 scenario contains the additional development assumed between 2016 and 2021 and the 2029 scenario contains the additional development between 2022 and 2029.

As such, the infrastructure will generally not be required at the year of opening. They are required by the year of completion, i.e. 2015, 2021 and 2029. The exact point where the development build is such that interventions are required has not been determined in this study and would require additional sensitivity testing. A factor in this sensitivity testing to consider is the level of employment development build out against the level of housing, i.e. if the employment development is not realised in the timeframe additional houses could be progressed instead.

Table 4 : Summary of Interventions - Reference Case

Scheme	Cost (£m)	2015	2021	2029
Halbeath Road/ Whitefield Road Junction	1.0		✓	
Bothwell Gardens Roundabout	0.3		✓	
Pitreavie Roundabout Signalisation	0.5		✓	
Pitreavie Rbt Widening	0.2			✓
Rumblingwell/ William Street Junction	2.3			✓
Kings Road Signals	1.0			✓
Total Cumulative Cost (£m)		0	1.8	5.3

Table 5 : Summary of Interventions – Local Plan Phasing

Scheme	Cost (£m)	2015	2021	2029
Grange Drive Link Road	4.4	✓		
Halbeath Road/ Whitefield Road Junction	1.0	✓		
Bothwell Gardens Roundabout	0.3	✓		
Pitreavie Roundabout Signalisation	0.5	✓		
Rumblingwell/ William Street Junction	2.3		✓	
William Street/Pittencrief Street Junction	3.2		✓	
Carnegie Drive Bus Gate	0.6		✓	
Coal Road/Lovers Loan	1.8		✓	
Grange Drive/ Queensferry Road Rbt	0.7		✓	
Northern Link Road	11.8			✓
Kings Road Signals	1.0			✓
Pitreavie Rbt Widening	0.2			✓
Total Cumulative Cost (£m)		6.2	14.8	27.8

Table 6 : Summary of Interventions – Alternative Development Phasing

Scheme	Cost (£m)	2015	2021	2029
Grange Drive Link Road	4.4	✓		
Halbeath Road/ Whitefield Road Junction	1.0	✓		
Bothwell Gardens Roundabout	0.3	✓		
Pitreavie Roundabout Signalisation	0.5	✓		
Rumblingwell/ William Street Junction	2.3		✓	
William Street/Pittencrief Street Junction	3.2		✓	
Carnegie Drive Bus Gate	0.6		✓	
Coal Road/Lovers Loan	1.8		✓	
Grange Drive/ Queensferry Road Rbt	0.7		✓	
Northern Link Road	11.8		✓	
Kings Road Signals	1.0			✓
Pitreavie Rbt Widening	0.2			✓
Total Cumulative Cost (£m)		6.2	26.6	27.8

It can be seen from these tables that a proportional level of infrastructure is required to accommodate the four SLAs within Dunfermline.

The notable impact of the Alternative Development Phasing is the Northern Link Road is required to be constructed by 2021.

The schemes are concept schemes to demonstrate deliverability of the SLA development, however, other schemes and proposals should not be ruled out when considering any detailed lanning application or if any additional sensitivity testing is undertaken and alternative solutions identified.

Other Interventions

Reference has been made to other studies such as the Dunfermline Bus Priority Study. The schemes that were proposed could be implemented as part of the overall strategy for Dunfermline. The proposals for the Halbeath and Queensferry corridor amount to approximately £250k.

The infrastructure proposed in this study does not produce any new conflicts with the LRT/BRT Study which could not be addressed during the detailed design phase of any of the schemes.

SIAS has also undertaken liaison with Stagecoach East Scotland in order to establish a broad framework for the introduction and funding of bus services to the developments. As with trips made by pedestrians and cyclists, the rate at which public transport trips take place will be partially dependent on the quality of infrastructure that is provided throughout the developments and it is therefore important that FC, Stagecoach and the respective developer continue to engage as the layout and design of the developments evolves.

Conclusion

The mode spilt targets set by FC is critical to the delivery of this strategy and the internal masterplanning of the developments have a crucial role to play with respect to travel patterns and providing opportunities for encouraging short and medium distance non-car trips.

It is imperative that the recommendations made in this Report in respect of facilities for pedestrians, cyclists and public transport users are taken on board early in the design process allowing residents, visitors and employees to establish sustainable travel habits from the outset.

This study demonstrates that the Local Plan SLA development can be delivered along with high quality highway, public transport, walking, cycling infrastructure which can integrate to achieve the desired mode split targets.

There are a number of measures required to mitigate the impact of the development which require funding and this should be considered through an agreed financial framework between FC and the prospective developers.

1 INTRODUCTION

1.1 Background

The *Draft Dunfermline and West Fife Local Plan (2010)* prepared by Fife Council (FC) sets out masterplan proposals to deliver a strategic expansion of Dunfermline over the period 2015 – 2030. The proposals involve the development of four separate land parcels located at the western edge of Dunfermline with a mixture of residential, employment and education uses.

SIAS Limited (SIAS) and Mouchel were appointed by FC in September 2009, as part of a term consultancy framework, to undertake a Transportation Appraisal of the masterplan proposals as set out in the *Dunfermline Strategic Framework Report (Willie Miller Urban Design (WMUD), 2009)*. This Transport Assessment seeks to determine the transportation characteristics of the proposed developments, examining the total demand for travel associated with new housing and employment and establishing the cumulative impact and the resulting transportation infrastructure requirements associated with key travel modes.

At the outset of the study, separate developers had already established interests in two of the four land parcels. Those developers, I&H Brown and Stirling Developments, have participated in workshops and consultations at key stages of the Transport Assessment process.

Outputs from this Transport Assessment will be used to inform FC, the respective developers and other key stakeholders as to the need for a series of transport interventions required to facilitate proposed development.

Fife Council has stated its aspiration to deliver the strategic expansion of Dunfermline in a manner so as to encourage and promote sustainable travel. All parties recognise that the pursuit of a traditional "predict and provide" approach considering highway trips only would not be desirable. With this in mind, there is a collective willingness to adopt a comprehensive methodology which considers total person trip generation and the forecasting of demand by mode. Such a methodology will allow for the identification and appraisal of suitable infrastructure which can cater for trips across the modes.

Details of SIAS's proposed Transport Assessment Methodology were set out in a Study Inception Note, *Proposed Transport Inception Methodology (SIAS Ref. 72191, December 2009)*. This Methodology was subsequently approved by FC and Transport Scotland.

In 2010 the Scottish Government published *Scottish Planning Policy (SPP)* setting out the requirements of Local Development Plans. *SPP* brings into focus the need to identify necessary infrastructure at an early stage and contain details within Local Development Plans. *SPP* states:

> *Investment in infrastructure may be required as a consequence of existing under provision and/or planned growth. These issues should be addressed in development plans and not left to be resolved through the development management process.*

The impetus to this study was reinforced by *SPP* in identifying necessary transport infrastructure associated with the Dunfermline Settlement Plan.

1.2 Context

The outcomes of this study provide outline scheme designs and costings which have been identified to deliver the development proposed in the Fife Structure Plan and the Draft Fife Local Dunfermline & West Fife Local Plan.

The schemes are concept schemes to demonstrate deliverability of the SLA development, however, other schemes and proposals should not be ruled out when considering any detailed Planning Application or if any additional sensitivity testing is undertaken and alternative solutions identified.

The specific years modelled should be interpreted as milestones at a point where a specific development uptake has been reached. Due to the level of economic uncertainty it is possible that the development build out may not coincide with the specific years modelled in this Report.

This study considers the cumulative impact of the development with two assumed phasing strategies. One of the outputs from this study is a tool which has the ability to consider a wide range of other scenarios as required, e.g. further sensitivity tests could be undertaken to consider the impact of each development in isolation.

1.3 Purpose of Report

This Report sets out to provide the following:

- An explanation of the methodology adopted to quantify the person trip making characteristics of the strategic expansion, and to demonstrate how those person trips are supported by the various available travel modes.
- Background to the application of an S-Paramics microsimulation model of the study area which was used to assess the incremental addition of development related trips to the study network in accordance with anticipated phasing of development.
- The nature of a series of infrastructure enhancements throughout Dunfermline, designed to cater for forecasted future year traffic flows, along with recommendations as to their phased delivery and funding.
- Details of a programme of consultation between SIAS and Stagecoach Fife to identify a strategy for the incorporation of bus-based public transport services in parallel with the phased delivery of the masterplan.
- Details of non-highway based measures necessary to encourage and support trips made by non-car based travel modes; particularly those which are made over a short-medium distance.

1.4 Consultation

Throughout the course of this commission, SIAS has consulted with representatives of a number of bodies as follows:

- Fife Council's Transportation Services and Development Services teams
- JMP Transport Planners, acting as term consultants to Transport Scotland
- Stirling Developments and I&H Brown
- Stagecoach East Scotland

Further details on consultations are provided throughout the Report. In particular, consultations with Stagecoach East Scotland are detailed in Section 8.

1.5 Previous Studies

A number of studies have contributed to this appraisal and are listed as follows:

- *Dunfermline Bus Priority Study (SIAS 2008)*
- *Fife 20 Year Plan for Fife (SIAS 2010)*
- *Dunfermline BRT/LRT Project (Scott Wilson, 2008)*
- *Dunfermline Strategic Framework (WMUD, 2009)*

2 PROPOSED DEVELOPMENT & TRANSPORT PROVISION PRINCIPLES

2.1 Introduction

The Dunfermline expansion proposals considered in this exercise constitute four distinct land parcels located along the western boundary of the city. From north to south, the land parcels are identified as:

- Wellwood
- Berrylaw
- Liggar Bridge
- Broomhall

The four development areas are shown in Figure 2.1

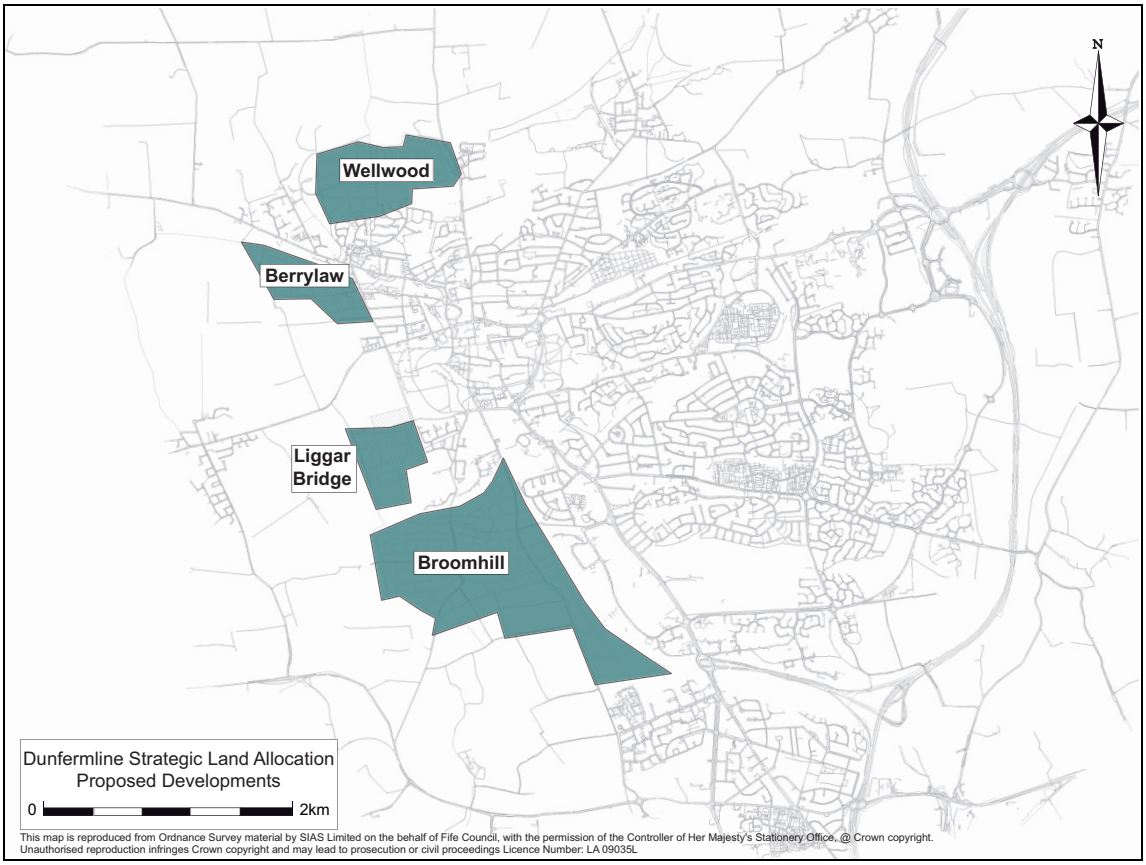

Figure 2.1 : Dunfermline Western Expansion Development Areas

SIAS worked in conjunction with Fife Council Development Services to identify the scale and type of development proposed in the respective land parcels. This has enabled the assembly of a development schedule for each site.

While it is accepted that the characteristics of each land parcel may yet evolve, SIAS has sought to minimise the additional workload that may result from future adjustments by assembling the development schedules and subsequent quantification of person trips in a modular manner.

The development schedules have been assembled using data obtained from the *WMUD Strategic Framework (Dunfermline) Final Report (June 2009)*. Detailed information as to the nature of employment uses for each area was provided by FC.

Details are provided in the *WMUD Final Report* as to the total provision of land for employment and business uses. Given that this appraisal is concerned with total person trips, it was necessary to obtain a forecast of total employment generation for each land use. This approach was preferable to a standard TRICS appraisal, which would only provide forecasts on the basis of floor space or hectares.

The nature of employment delivered throughout the masterplan areas will have a fundamental bearing on the person trip making characteristics. Following discussion with FC, it was agreed that half of the employment land would be equally split between "office-based" employment and "other" employment.

SIAS obtained employment forecasts from FC for each category of employment, as follows:

- Office based 100 jobs per hectare
- Other employment 50 jobs per hectare

It was further agreed that "other" employment would be split between Industrial Estate (75%) and Warehousing uses (25%).

A similar clarification was sought in relation to education trips, resulting in the following data:

- Primary schools 217 pupils/15 staff
- Secondary schools 1,200 pupils/100 staff

Table 2.1 shows the development schedule.

Table 2.1 : Schedule of Proposed Development by Land Use

Housing / Residential					
	Wellwood	Berrylaw	Liggar Bridge	Broomhall	Total
Low Density Housing	280	335	90	710	1,415
Medium Density Housing	657	258	201	534	1,650
High density Housing	148	72	192	728	1,140
Total Residential	1,085	665	483	1,972	4,205
Forecasted Population *	2,387	1,463	1,063	4,338	9,251
Household Occupancy	2.20	2.20	2.20	2.20	
* Population forecast taken from table on Page 33 of WMUD June 2009 report					
Employment / Business					
	Wellwood	Berrylaw	Liggar Bridge	Broomhall	Total
Business Provision (Ha)	11.2	4.9	1.2	63.1	80.4
Office based (Ha)	5.6	2.45	0.6	31.55	40.2
Other employment (Ha)	5.6	2.45	0.6	31.55	40.2
Office based (people)	560	245	60	3,155	4,020
Other employment (people)	280	123	30	1,578	2,010
Total employment (people)	840	368	90	4,733	6,030
Education					
	Wellwood	Berrylaw	Liggar Bridge	Broomhall	Total
Primary Scholls (Ha)	3.2			2.2	5.4
Secondary Schools (Ha)				4.4	4.4

2.2 Draft Dunfermline & West Fife Local Plan

During the course of the study the *Draft Dunfermline & West Fife Local Plan* was published for consultation in 2010. The total housing allocation numbers for the years 2011 – 2026 for the Dunfermline South West, West and North area was identified as 4,200 which equates well to the previously assigned figures as shown in Table 3.1.

The *Draft Dunfermline & West Fife Local Plan* considers Transport and Infrastructure and what will be required to take the Dunfermline Settlement Plan forward. In terms of potential the plan states that there are a significant number of strategic transportation proposals in the vicinity of the Dunfermline Strategic Land Allocation, including: the provision of a Replacement Forth Crossing, proposals for a segregated public transport corridor in the Forth Bridgehead area, the Charlestown Rail Junction, a Rosyth bypass, and additional Park & Ride facilities. These proposals present opportunities to open up the western side of Dunfermline to more sustainable forms of transport.

In terms of specific requirements for this appraisal the *Draft Dunfermline & West Fife Local Plan* requires transportation requirements for the new development to include provision for Bus Rapid Transit routes, local bus routes, walking and cycling routes and road traffic routes.

The Draft Plan states that in the Strategic Land Allocation a distributor road running along the western edge of the city will be required. Two options exist for the provision of the distributor road. Prior to development commencing the preferred option for the road will require to be

finalised. The provision for funding to enable the construction of the main distributor road will be agreed in advance through a financial framework.

The location of land allocations in the Draft Plan has been set to develop neighbourhoods near to existing and future development and infrastructure to support existing facilities and provide support for new development and reduces the need to travel. The neighbourhoods have been designed to be within 10min walking distance of existing and proposed facilities. Integrated within this set of walkable neighbourhoods is a new public transport system based on an integrated street system linking the new areas.

The internal layout of streets shall be determined through a master planning process to which the recommendations from this appraisal can contribute.

2.3 Transport Provision Principles

In addition to the provisions already made in terms of the location and scale of developments in the Dunfermline Settlement Plan there are some key principles to guide the provision of transport provision that are consistent with *SPP* guidance for Transport Assessments. The focus of *SPP* guidance is aimed at reducing emissions from transport sources as a contribution to achieving Scottish Government greenhouses gas emission targets that requires a shift to more sustainable modes of transport and to support the economy by tackling congestion. The *SPP* guidance is relevant for providing some principles for the Dunfermline Settlement Plan.

To ensure that the quality of the residential streets within each development is maintained, the principles set out in the *Designing for Streets (Scottish Government, 2010)* should be applied. The focus of this guidance is a high quality layout and good connectivity between the new development and the existing network. The street geometry, signing, street furniture, street lighting, parking and design and construction are key considerations.

The guidance for new developments should be carried forward into master planning and detailed applications, as follows for all developments:

- Direct links to walking and cycling networks must be made available
- Access to public transport networks must involve walking no more than 400m
- There must not be a detrimental effect on the capacity of the strategic road and/or rail network or local road networks
- The transport assessment must identify satisfactory mechanisms for meeting sustainable transport requirements

In *SPP* it is stated that opportunities for personal travel should be prioritised by mode in the following order: walking, cycling, public transport, car and other motorised vehicles. Buildings and facilities should be accessible on foot and by cycle. Improvements to active transport networks, such as paths and cycle routes, in urban and rural areas will support more sustainable travel choices. The aim is for urban areas to be made more attractive and safer for pedestrians and cyclists, including people with mobility difficulties. Cycle routes and, where relevant, cycle parking and storage should be safeguarded and enhanced wherever possible. Statutory equal opportunities obligations relating to accessibility to different users of different means of transport should be taken into account in development plans and development proposals. Accessibility issues and street layout and design should be part of the design and planning processes from the outset.

SPP also states that Development Plans should identify required new transport infrastructure, including cycle and pedestrian routes. New development areas should be served by public transport accessing a range of potential destinations, or proposals should be put in place to provide public transport. Where enhancement of public transport services or infrastructure is required to serve a new development but would not be provided commercially, a contribution from the developer towards an agreed level of service may be appropriate. The intended approach to developer contributions linked to the transport implications of a proposed development should be set out in the development plan. Disused railways with a reasonable prospect of re-use for rail, tram or active transport should be safeguarded in the development plan.

3 EXISTING SITUATION

3.1 Introduction

The purpose of this Section is to provide a summary of existing conditions in and around Dunfermline, allowing the development proposals to be viewed in context. Details relating to population and transportation infrastructure are provided.

3.1.1 Population and Economy

Population

Dunfermline is the main economic centre in the West Fife area. Mid-2008 Population Estimates provided by the General Registrar of Scotland suggest that the town has a population of approximately 46,430. This is set against a recorded population of 39,229 at the 2001 Census. During the intervening period, strategic housing and employment expansion, particularly concentrated on land to the immediate west of the M90 motorway has led to population growth.

The population of the wider "Dunfermline conurbation" - which includes surrounding towns such as Rosyth, North Queensferry, Crossgates and Inverkeithing - has a population of just under 80,000.

Economic Activity

Key economic activities in Dunfermline include retail, light industry and financial services roles. In addition to retailing activities in the town centre, where a major new shopping complex was completed in 2008, there are other concentrations of retail and leisure activities in the Halbeath and Duloch Park areas.

Major concentrations of economic and employment activity are located in the town centre, and at Pitreavie Industrial Estate and Carnegie Campus to the south. A major new distribution facility is under construction in the Duloch Park area, expected to open towards the end of 2011.

3.2 Existing and Potential Transport Infrastructure

3.2.1 Walking

Dunfermline has an existing network of footways and footpaths within the urban conurbation. In the proposed Strategic Land Allocation areas pedestrian provision is currently limited due to the existing rural nature, but all proposed areas (Wellwood, Berrylaw, Liggar Bridge and Broomhall) have the potential to connect to existing footway networks on at least three flanks towards Dunfermline or Rosyth. The landward "western" sides of the developments may be more limited in the number of connections that could be made and may rely on established Core Path connections to access the Countryside. Consideration of connection points to the pedestrian network often referred to in planning circles as "handshakes" are given in Section 9.

Consideration of pedestrians must also be made where junction improvements or new junctions are proposed; details are also given in Section 9.

3.3 Core Paths

The *Land Reform (Scotland) Act 2003* states:

> *it is the duty of the local authority to draw up a plan for a system of paths ('core paths') sufficient for the purpose of giving the public reasonable access throughout their area*

These "core paths" systems will be available for recreation and everyday journeys by local people and visitors, providing opportunities for walking, cycling, riding and other activities for all ages and abilities; and, once in place, will form an invaluable nationwide resource. Core paths will be of particular benefit close to where people live, and will be key elements in the path networks that will extend from the centre of settlements through public open spaces and green corridors to connect with the urban fringe and the wider countryside. The *Final Approved Draft Core Paths Plan* was submitted to the Scottish Government together with objections to the plan on Wednesday 9 June 2010. Once approved core paths must be observed when developing masterplans.

3.3.1 Cycle Routes

Dunfermline has an established network of off road and on road cycleways with a number of National and Regional Cycleways serving the town:

- National Cycle Route 1 provides a long distance cycle route stretching from Dover to the Shetland Island along the east coast of the UK. In Fife it connects Dunfermline to the Forth Road Bridge and to Kinross.
- National Cycle Route 764 provides a long distance route from Queen Margaret Station in Dunfermline to Alloa.
- Regional Route 65 connects from National Cycle Route 764, through Pittencrieff Park in Dunfermline to Rosyth and National Cycle Route 76 (St Andrews to Stirling).

Fife Council is also developing proposals for enhanced cycle networks in Dunfermline to complement the Strategic Land Allocation. The proposed indicative cycle routes or enhancements to existing routes are shown in Figure 3.1. It is anticipated that consultation will be required between FC and any developers to establish the linkage points at the edge of developments in any masterplanning.

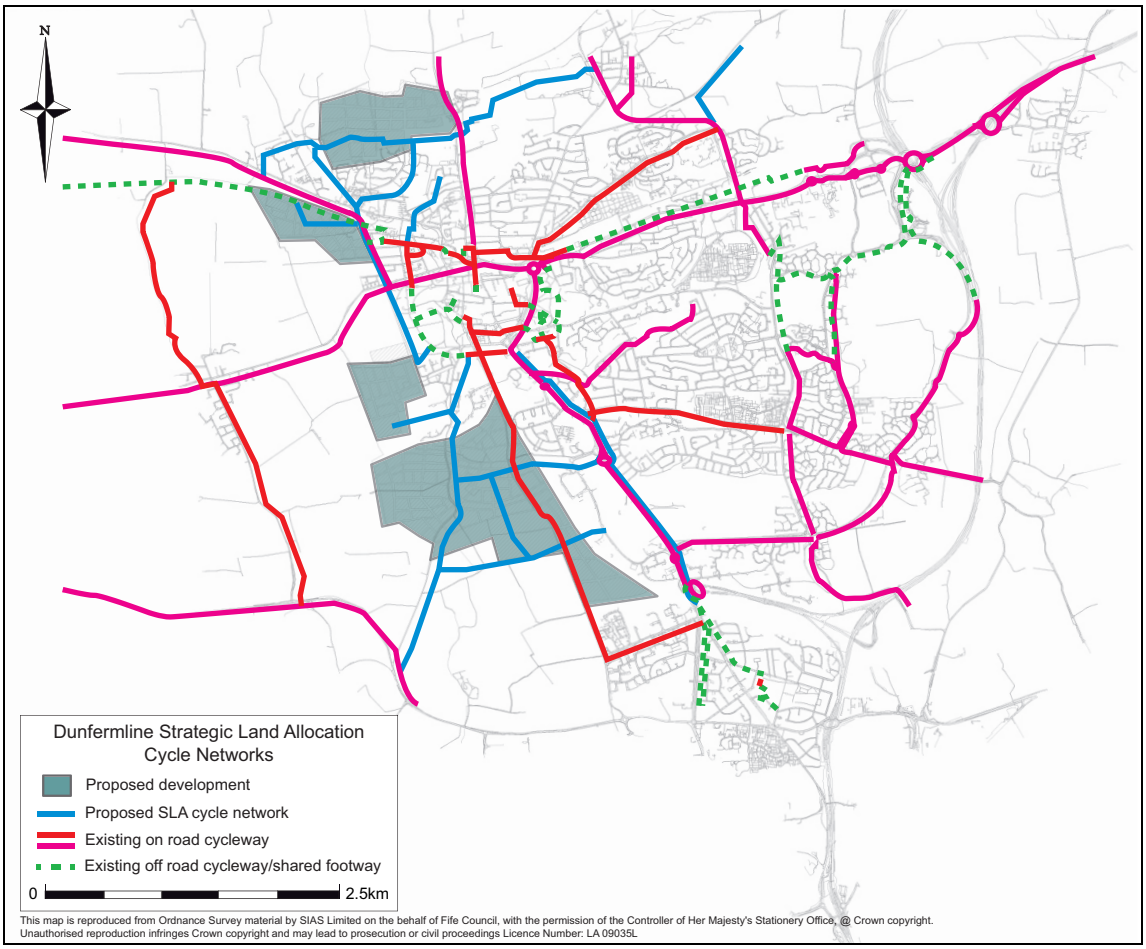

Figure 3.1 : Existing and Potential Cycle Networks

Consideration of cyclists must also be made where junction improvements or new junctions are proposed; details are given in Section 9.

Acceptable cycle distances can depend on topography and physical ability, but some guidance is available on the likely extents of a cycle accessible catchments. *Scottish Transport Appraisal Guidance (STAG)* suggests that cycling thresholds may be two to three times that of walking thresholds that can range from 1.4 – 1.6km walk. For the purposes of this study it is suggested that maximum range of around 5km would incorporate the majority opportunity for cycle based trips from the SLA areas to facilities in and around Dunfermline. It is acknowledged that a cycling range of around 3km would be acceptable to most people with a maximum range of 5km for average ability cyclists.

The cycle travel distance to a number of key facilities has been reviewed to confirm the opportunity to cycle from the SLA areas to sites in Dunfermline. The distances have been taken from points on the existing road network within the development areas using a Geographic Information System (GIS) system.

Table 3.1 : Indication of Cycle Distances (km)

Facility	Wellwood	Berrylaw	Liggar Bridge	Broomhall
Public Transport Interchanges				
Dunfermline Bus Station	1.7	1.3	1.5	2.2
Queen Margaret Train Station	4.0	4.3	4.5	4.9
Dunfermline Town Train Station	2.7	2.4	1.4	1.9
Rosyth Train Station	5.7	5.2	4.2	3.6
Key Town Facilities				
Dunfermine High Street	1.7	1.5	1.5	2.1
Queen Margaret Hospital	3.3	3.7	3.9	4.3
Carnegie College	5.1	5.0	4.8	5.3

Cycle distance taken as the shortest route by 'walking routes' on googlemap direction finder
Wellwood distances are taken a from the northerly most point of East Baldridge Drive
Berrylaw distances are taken from the end of Somerville Avenue
Liggar Bridge distances are taken from 250m west from Coal Road/Lovers Loan junction
Broomhall distances are taken from the junction of Limekilns Road/Gallowridge Hill

Planning Note 75 (the Scottish Government, August 2005) refers to Guidance on Accessibility Measuring Techniques and their Application. In this guidance normal cycling thresholds are presented to assess accessibility. In terms of cycling the following thresholds are given:

- Short Cycle 1,000m
- Normal Cycling distance 2,000m
- General Maximum cycling distance 5,000m

With reference to these thresholds it can be seen that the majority of public transport interchanges and key facilities in Dunfermline will be within or around the maximum cycling distance for a normal cyclist. For all sites the centre of Dunfermline (The high Street and Bus Station) is generally within a normal cycling distance or around 2km.

The distances have been converted into indicative journey times, as shown in Table 3.2.

There is little guidance on what average speed to use for cycle journeys as this is dependent on user ability and topography. A conservative assumption 14km/hr or around three times walking speed has been used in the travel time assessment, allowing for crossing junctions and average ability. For commuter journeys the *Cycling By Design (Scottish Government, 2010)* guidance suggests that commuters to work or education may like to travel on routes where an average speed of 20 – 32kph can be maintained.

Table 3.2 : Indicative Cycle Travel Times (min)

Facility	Wellwood	Berrylaw	Liggar Bridge	Broomhall
Public Transport Interchanges				
Dunfermline Bus Station	7	5	6	9
Queen Margaret Train Station	17	18	19	20
Dunfermline Town Train Station	11	10	6	8
Rosyth Train Station	24	22	18	15
Key Town Facilities				
Dunfermine High Street	7	6	6	9
Queen Margaret Hospital	14	15	16	18
Carnegie College	21	21	20	22

Cycle distance taken as the shortest route by 'walking routes' on googlemap direction finder
Wellwood distances are taken a from the northerly most point of East Baldridge Drive
Berrylaw distances are taken from the end of Somerville Avenue
Liggar Bridge distances are taken from 250m west from Coal Road/Lovers Loan junction
Broomhall distances are taken from the junction of Limekilns Road/Gallowridge Hill
A cycling speed of 9mph (14.4km/hr) has been assummed - this will vary according to user

The results in Table 3.2 indicate that the majority of facilities in Dunfermline may be within around 20min cycling distance, with the town centre being within 10min cycle. Where possible new cycling infrastructure should be designed to allow cyclists to maintain a reasonable level of momentum with the aim of providing routes suitable for cycling speeds of between 20 – 30kph.

3.3.2 Bus Based Public Transport

Bus services in Dunfermline are operated largely by Stagecoach East Scotland, as part of its wider Fife network. These include a range of Dunfermline town services, services which operate between Dunfermline and other destinations in Fife and a range of express and longer distance services. Increasingly, buses which operate local services in Dunfermline are to a low-floor specification.

In recognition of the demand for cross-Forth travel, particularly to locations in central Edinburgh, Stagecoach Fife has invested heavily in high specification vehicles aimed at commuters and shoppers. Vehicles operating longer distance services to Edinburgh include leather seats and on-board Wi-Fi facilities in a particular attempt to make the service attractive to car drivers. Express services include those which operate as part of the wider Megabus and Scottish Citylink network to locations throughout Scotland.

Most local and express routes serve Dunfermline bus station, located on Queen Anne Street in the town centre between Carnegie Drive and High Street. Dunfermline bus station opened in 2008 as part of a wider town centre regeneration project, and includes 14 stances.

The existing bus route network in Dunfermline (May 2011) is shown in schematic diagram shown in Figure 3.2. It can be seen that on the western side of Dunfermline the bus network is not as highly developed as the north, centre and east of the town. Potential new routes associated with the Dunfermline Strategic Land Area based on the outcomes of the distributor route assessment are shown in Section 8.

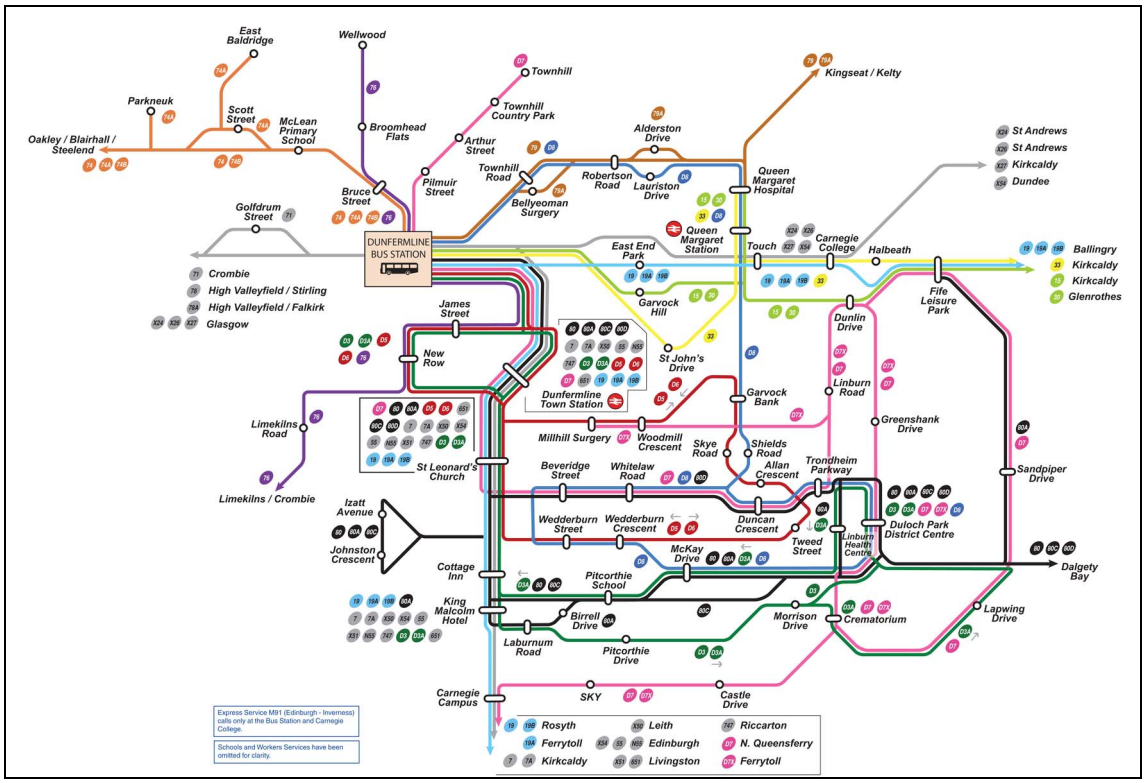

Figure 3.2 : Existing Bus Network

3.4 Bus Based Park & Ride

The Ferrytoll Park & Ride facility located adjacent to the M90 north of the Forth Road Bridge plays an important role in the context of local and regional bus and coach services. The facility, which provides parking capacity for more than 1,000 cars, serves not only as a Park & Ride, but as a hub for interchange between the various local and express services that use the site.

As part of a wider strategy to increase the share of trips made by public transport, a further Park & Ride facility at Halbeath has now been approved and is due for completion by 2013. It is anticipated that spaces for up to 1,000 cars could be provided. The addition of a Park & Ride facility at Halbeath provides an opportunity to further develop the network of local and express bus services in the Dunfermline area.

3.4.1 Rail Based Public Transport

There are two train stations in Dunfermline; Dunfermline Town to the south of the town centre, and Dunfermline Queen Margaret, to the east of the town centre. The stations are outside a walking distance of 800m, but have the potential to be accessible by cycling, bus, taxi and car sharing.

Rosyth Train Station is close to the Broomhall Strategic Land Allocation area that has the potential at its southern end to be within an acceptable 800m walking distance of Rosyth Station. The railway stations are served by trains operating on the Fife Circle, connecting Dunfermline with other destinations in Fife and Stations leading to Edinburgh on a frequent basis (three trains per hour in the morning peak).

The three railway stations are all fully accessible and have a variety of facilities including; secure cycle parking lockers, bus access, disabled car parking and free public car parking. The Town Centre and Dunfermline Queen Margaret Stations also have taxi ranks.

3.4.2 Main Road Links

Dunfermline is bounded to the east by the M90 motorway running south towards Edinburgh and north towards Perth, Dundee and Aberdeen. Key road links in Dunfermline include:

- The A907 Halbeath Road extending from east to west between the town centre and the Junction 3 of the M90, which intersects with the A92
- The A823 Queensferry Road, which extends south eastwards from the town centre towards the A823 motorway and onwards to the M90 at Junction 2
- The A994, which runs westwards from Dunfermline town centre through Crossford and Cairneyhill towards the A985 and ultimately onwards to the Kincardine Bridge
- The B916 Aberdour Road, running east to west from the A823 through the primarily residential concentration to the south east of the town

Proposals for a new distributor route to the west of Dunfermline and associated junction improvements are contained in Section 7.

4 DEVELOPMENT TRAVEL CHARACTERISTICS

4.1 Trip Generation

An exercise was undertaken to quantify the total number of person trips that would be generated from each land use during the AM and PM travel peaks (07:00 – 10:00 and 16:00 – 19:00). Trips from each land use in a development area were aggregated to provide a forecast of total number of person trips associated with that area.

The forecasts consider person trips and provide for trips made by all available travel modes. The appraisal sought to determine the likely demand for infrastructure and facilities associated with the following travel modes:

- Pedestrians
- Cyclists
- Public transport users (bus and rail)
- Car drivers
- Car passengers

Details of the mode split assumptions used in the appraisal are provided in Section 4.5.

An explanation of the methodology used to derive person trips associated with each proposed land use is provided as follows.

4.1.1 Residential Trips

The *WMUD Final Report* states that a total of 4,205 residential properties are proposed throughout the masterplan area.

Following liaison with FC, it was agreed that the quantification of residential trips would be based on a generic household characteristic applicable to Dunfermline as a whole. That is to say, the assessment does not draw distinctions between household type, ownership status or size. Equally, the exercise will not seek to represent differences in occupancy, car ownership and employment status that exist between households. SIAS reviewed 2001 Census data to obtain average household occupancy statistics for the Dunfermline area, giving an average occupancy of 2.20 people per household.

Using this data, SIAS calculated that the combined residential population of the four land parcels would be 9,251 (i.e. 4,205 x 2.20 = 9,251).

The adopted methodology sought to determine how many trips would be generated by a generic household during the AM and PM peak travel periods. SIAS reviewed outputs from the TRICS database to derive the profile of trips generated by, and attracted to, households during each peak. The TRICS analysis only considered sites for which there was multi-modal data, so the outputs can be considered to represent the profile of person trips made during each peak.

The average person trip rate for each hour in the AM and PM peaks was multiplied by the number of houses in the respective development areas to give a forecast of the number of inbound and outbound person trips associated with each development.

Details of the total residential-based person trips for each development area during the AM and PM peak periods are provided in Table 4.1 and Table 4.2.

Table 4.1 : Total Residential Person Trip Generation: AM (07:00 – 10:00)

AM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	130	80	58	237	506
08:00-09:00	288	177	128	524	1,116
09:00-10:00	353	217	157	642	1,370
Total	772	473	344	1,403	2,992
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	434	266	193	789	1,682
08:00-09:00	1,186	727	528	2,155	4,596
09:00-10:00	368	226	164	669	1,427
Total	1,988	1,218	885	3,613	7,705

Table 4.2 : Total Residential Person Trip Generation: PM (16:00 – 19:00)

PM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	703	431	313	1,277	2,723
17:00-18:00	794	487	353	1,443	3,077
18:00-19:00	535	328	238	972	2,072
Total	2,031	1,245	904	3,692	7,872
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	473	290	210	859	1,832
17:00-18:00	456	279	203	828	1,766
18:00-19:00	487	299	217	886	1,889
Total	1,416	868	630	2,573	5,488

The figures provided in the in Table 4.1 and Table 4.2 represent total person trips generation. Details are provided, as follows, as to the breakdown of these person trips by travel mode.

4.1.2 Employment Trips

As explained, SIAS obtained forecasts of total anticipated employment from FC. Data was presented in the context of "jobs per hectare" for office based and other employment types. Following further discussion, it was agreed that the non-office related employment would be split between industrial estate and warehousing uses.

Based on the information provided by FC, SIAS calculated that employment for 6,030 people would be provided throughout the four land parcels, demonstrated as follows:

- The total employment land allocation is 80.4Ha
- Fife Council stated that land should be equally split between "office" and "other" employment uses, giving 40.2Ha each

- Office employment density was forecast by FC as being 100 jobs per hectare resulting in 4,020 jobs (40.2Ha x 100 = 4,020)
- Other employment density was forecast by FC as being 50 jobs per hectare
- At FC's request, other employment was broken up between "industrial estate" and "warehousing" uses at a ratio of 75:25
- A total of 30.1Ha was allocated for industrial estate land, leading to 1,505 jobs (30.1 x 50 = 1,505)
- A total of 10.1Ha was allocated for warehousing land, leading to the creation of 503 jobs (10.1 x 50 = 1,505)

The methodology used to forecast the number of employment-related person trips was consistent for office, warehousing and industrial uses. SIAS reviewed the TRICS database to identify a trip rate and profile for each of the employment categories listed previously.

TRICS output data presents a trip rate which is derived from the floor space of the respective sites considered. For the purposes of this exercise, the relationship between floor space and employment trips is academic because the floor space of the completed employment uses is unknown at present.

For each of the selected TRICS sites, SIAS established the characteristics relating to floor space and total persons employed. SIAS undertook a factoring exercise to convert the trip rate per $100m^2$ to trips per employed person. This established a factor which was then multiplied by the total number of forecasted employees for each land use to provide a person trip rate specific to that use.

A worked example of this methodology based on TRICS site CW-02-A-03 is provided as follows:

- Person trip rate between 08:00 – 08:30 = 1.02 in/0.12 out
- This is based on a GFA of $30,000m^2$
- This equates to 306 person trips in/37 person trips out
- A total of 1,377 people are employed at the facility
- This equates to a rate of 0.22 in (306/1,377)/0.02 out (37/1,377) per person employed

These rates were then multiplied by the number of people employed for the respective uses as follows:

- Office staff total estimated at 4,020 people
- This equates to 893 trips in/107 trips out between 08:00 – 08:30

Details of total estimated person trips for the various employment uses are provided in the following tables.

Table 4.3 and Table 4.4 show the total proposed person trip generation associated with office based employment for the AM and PM peak periods.

Table 4.3 : Total Employment (Office) Based Person Trip Generation: AM (07:00 – 10:00)

AM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	76	33	8	431	549
08:00-09:00	312	137	33	1,760	2,243
09:00-10:00	95	41	10	534	680
Total	484	212	52	2,725	3,472
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	9	4	1	48	61
08:00-09:00	38	17	4	215	273
09:00-10:00	45	20	5	255	325
Total	92	40	10	518	660

Table 4.4 : Total Employment (Office) Based Person Trip Generation: PM (16:00 – 19:00)

PM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	46	20	5	260	332
17:00-18:00	31	14	3	176	224
18:00-19:00	10	4	1	57	72
Total	87	38	9	492	627
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	136	59	15	766	976
17:00-18:00	235	103	25	1,326	1,690
18:00-19:00	61	27	7	345	440
Total	433	189	46	2,437	3,105

Table 4.5 and Table 4.6 show the total proposed person trip generation associated with office based employment for the AM and PM peak periods.

Table 4.5 : Total Employment (Warehousing) Person Trip Generation: AM (07:00 – 10:00)

AM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	10	4	1	57	72
08:00-09:00	12	5	1	68	87
09:00-10:00	8	3	1	44	56
Total	30	13	3	169	215
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	6	3	1	36	46
08:00-09:00	4	2	0	21	27
09:00-10:00	4	2	0	24	31
Total	15	6	2	82	104

Table 4.6 : Total Employment (Warehousing) Person Trip Generation: PM (16:00 – 19:00)

PM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	4	2	0	20	26
17:00-18:00	4	2	0	21	26
18:00-19:00	2	1	0	12	15
Total	9	4	1	53	67
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	6	3	1	35	45
17:00-18:00	19	8	2	105	133
18:00-19:00	4	2	0	23	29
Total	29	29	13	3	208

Table 4.7 and Table 4.8 show the total proposed person trip generation associated with office based employment for the AM and PM peak periods.

Table 4.7 : Total Employment (Industrial Estate) Person Trip Generation: AM (07:00 – 10:00)

AM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	73	32	8	409	522
08:00-09:00	142	62	15	802	1,021
09:00-10:00	85	37	9	477	608
Total	300	131	32	1,688	2,151
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	26	12	3	149	189
08:00-09:00	75	33	8	420	535
09:00-10:00	71	31	8	403	513
Total	172	75	18	972	1,238

Table 4.8 : Total Employment (Industrial Estate) Person Trip Generation: PM (16:00 – 19:00)

PM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	79	35	8	445	567
17:00-18:00	28	12	3	160	204
18:00-19:00	9	4	1	52	66
Total	117	51	12	657	837
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	118	52	13	667	850
17:00-18:00	112	49	12	632	805
18:00-19:00	25	11	3	142	181
Total	256	256	112	27	1,836

4.1.3 Education Trips

Person trips associated with the proposed education land uses were derived following the same methodology for employment trips.

For selected TRICS sites relating to both primary and secondary schools, SIAS established the characteristics relating to floor space and the total number of pupils and staff associated with each school. SIAS undertook a factoring exercise to convert the trip rate per 100m^2 to trips per person. This established a factor which was then multiplied by the total number of forecasted staff and pupils for each school to provide a person trip rate specific to that use.

A worked example of this methodology based on TRICS site DV-04-A-03 is provided as follows:

- Person trip rate between 08:00 – 09:00 = 23.5 in/2.25 out
- This is based on a GFA of 1,245m^2

- This equates to 293 person trips in/28 person trips out
- A total of 260 pupils and staff are based at the school
- This equates to a trip rate of 1.13 in (293/260)/0.11 out (28/260)per person

These rates were then multiplied by the number of staff and pupils for the respective school as follows:

- The total of pupils and staff is estimated at 232 people
- This equates to 261 trips in/25 trips out per person between 08:00 – 09:00

The total number of person trips associated with educational land uses is shown in the tables that follow.

Table 4.9 : Total Primary Education Person Trip Generation: AM (07:00 – 10:00)

AM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	12	0	8	8	28
08:00-09:00	326	0	224	224	774
09:00-10:00	30	0	21	21	71
Total	367	0	253	253	873
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	4	0	3	3	9
08:00-09:00	55	0	38	38	130
09:00-10:00	66	0	46	46	157
Total	125	0	86	86	297

Table 4.10 : Total Primary Education Person Trip Generation: PM (16:00 – 19:00)

PM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	12	0	8	8	29
17:00-18:00	5	0	4	4	12
18:00-19:00	0	0	0	0	0
Total	17	0	12	12	41
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	30	0	20	20	70
17:00-18:00	16	0	11	11	39
18:00-19:00	1	0	0	0	2
Total	47	47	0	32	111

Table 4.11 : Total Secondary Education Person Trip Generation: AM (07:00 – 10:00)

AM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	0	0	35	0	35
08:00-09:00	0	0	1104	0	1104
09:00-10:00	0	0	73	0	73
Total	0	0	1212	0	1212
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
07:00-08:00	0	0	1	0	1
08:00-09:00	0	0	20	0	20
09:00-10:00	0	0	33	0	33
Total	0	0	54	0	54

Table 4.12 : Total Secondary Education Person Trip Generation: PM (16:00 – 19:00)

PM					
IN	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	0	0	21	0	21
17:00-18:00	0	0	25	0	25
18:00-19:00	0	0	16	0	16
Total	0	0	61	0	61
OUT	**Wellwood**	**Berrylaw**	**Liggar Bridge**	**Broomhall**	**Total Person Trips**
16:00-17:00	0	0	500	0	500
17:00-18:00	0	0	90	0	90
18:00-19:00	0	0	20	0	20
Total	0	0	609	0	609

4.2 Trip Purpose

As discussed, the proposed development will deliver a mixture of residential, employment and education land uses, resulting in the generation of person trips with a variety of purposes. SIAS has reviewed outputs from the *Fife Travel Diary Survey (Atkins, March 2005)* in order to understand the trip purpose characteristics of existing travel behaviour. Following discussion with FC, it was agreed that the assessment of the strategic expansion areas will seek to replicate existing trip purpose characteristics.

The *Travel Diary* information contains information on the purpose of all surveyed trips which are associated with residential land uses. Trip purposes are categorised as follows:

- Home-based work commute
- Home-based employer's business
- Home-based education
- Home-based other (including leisure, retail, healthcare and so on)

SIAS has derived the values contained in Table 4.13 from Table 5.3 of the *Travel Diary Final Report* to reflect the split between the four trip categories identified previously.

Table 4.13 : Residential Trips: Breakdown of Trip Purpose (All Day)

Trip Purpose (Housing)	Split (%)
Home to work (commute)	44.3%
Employment Business	2.3%
Education	10.6%
Other	42.8%
Total	100.0%

This break down of all person trips by purpose will be applied to the residential trips, identified in Table 4.1 and Table 4.2, reflecting the range of trip purposes that can be attributed to households.

The values presented in the tables contained in Section 4.1 relate to person trip activity that can be attributed to residential, employment and education based land uses. The appraisal recognises that a proportion of trips associated with employment and education related land uses will be generated from the proposed residential development. For example, in many cases, trips "generated" by residential development will be the same trips that are "attracted" to office based employment.

4.3 Trip Length

The Strategic Expansion proposals present the opportunity to deliver new homes and employment opportunities to Dunfermline. Fife Council recognises that new residential properties will be attractive to existing Fife residents and people from outwith the region, especially those from Edinburgh. Equally, while new employment may be targeted at Fife residents, it is possible that it will generate trips over a greater distance.

In order to reflect these trip making characteristics, SIAS has reviewed the *Travel Diary* to obtain data relating to how existing trips vary by length. The data presented in Table 4.14 shows that around 30% of trips made in Dunfermline are of a distance in excess of 5 miles. This data is replicated from Table 5.6 of the *Travel Diary*.

Table 4.14 : Breakdown of Observed Journey Length Data

	Dunfermline		Fife Total	
Journey Length	No.	%	No.	%
<1 mile	106	12	1,270	16
1 - 4.9 miles	534	59	3,384	43
5 - 8.9 miles	107	12	1,341	17
9 - 14.9 miles	49	5	787	10
15 - 19.9 miles	51	6	376	5
20 miles or more	58	6	792	10
Total	905	100	7,950	100

Trip length is a relevant factor in determining the selection of a travel mode. Knowledge of the split of journey lengths will assist with determining the need for, and nature of infrastructure required to support development related trips.

Details of the mode split adopted for this assessment are provided in Section 4.5.

4.4 Trip Distribution

The identification of person trips has been undertaken using a variety of data sources, with the intention of replicating a number of key trip making characteristics apparent in Dunfermline. While the assessment proposes a fundamental adjustment to the baseline mode split characteristics, it will seek to adopt trip distribution characteristics which are largely consistent with observed data.

One exception to this is that a greater emphasis will be placed on encouraging short distance trips, particularly in the development areas and between each development area and established nodes in Dunfermline.

Highway trips were assessed using the S-Paramics microsimulation model, details of which are provided in the Inception Note. This model was used to assess the impacts of development related trip making and the effects of additional or adjusted infrastructure, including bus priority measures and new crossing facilities for pedestrians.

The trip matrix for the S-Paramics model was developed in parallel with the initial person trip appraisal, using data from the following sources:

- Forth Regional Saturn Model (for external to external trips)
- Roadside interview origin and destination data
- 2001 Census data outputs
- Fife Travel Diary Survey (Atkins, March 2005)

Further details relating to trip distribution are provided in Section 5.2.2.

4.5 Mode Splits

As stated, the assessment sought to determine the demand for infrastructure and facilities associated with a range of travel modes. Historically, a Transport Impact Appraisal would primarily seek to determine the requirement for highway capacity improvements resulting from additional development related traffic. Under current guidelines, there is a requirement to consider total person trip making activity and the provision of measures to support trips by all travel modes.

Opportunities exist to promote non-car based trip making behaviour, and particularly to increase the proportion of person trips that are made using active travel modes, such as walking and cycling. Through the promotion of sustainable travel modes, FC aspires to achieve a reduction in demand for private car trips. This in turn reduces the degree to which measures are required to mitigate the negative effects of car travel.

Consistent with the aspiration to increase the proportion of trips made on foot, by cyclists and by public transport, FC has researched travel behaviour in British cities whose mode splits represent a lower dependency on trips made by car. Person trips considered in this assessment were broken down according to the mode split shown in Table 4.15.

Table 4.15 : Agreed Mode Split Targets

Mode	Share (%)
Car (driver only)	41%
Car (drive and Passenger)	12%
Walk	20%
Bus	17%
Train	3%
Cycle	8%
Total	100%

It is recognised that it is neither practical nor realistic to apply this split in a blanket manner for all person trips. With this in mind, SIAS undertook a review of data from the *Travel Diary* to support assumptions as to how different splits should be applied according to trip purpose and length. This allowed the assessment to represent the fact that most school trips for example are made over a short distance on foot, whereas a large proportion of employment trips may be expected to take place over a longer distance, depending more heavily on public transport and car trips. Further details relating to trip length are provided in Section 4.3.

The mode split presented represents an overall target for trip making activity across the four development areas.

Table 3.10 in the *Travel Diary* contains data relating to mode split by journey purpose. This dataset relates to all Fife and includes responses from respondents whose trips were made in a range of towns.

SIAS processed this data to form an appreciation of the relationship between travel modes and trip purpose, as an initial means of identifying suitable measures to ensure the stated mode split target can be met. While SIAS recognises that there are likely to be restrictions in the use of *Travel Diary* data in this manner, the following tables and analysis have been prepared to facilitate discussion in the context of providing supply measures for the travel demands associated with the developments.

Table 4.16 shows a breakdown of the travel modes adopted for the four home-based trip purposes identified in Section 4.2. These splits have been derived from a total of 15,188 *Travel Diary* records.

Table 4.16 : Mode Split by Trip Purpose (all Fife)

	Trip Purpose (Home Based)				
Travel Mode	**Commute**	**Business**	**Education**	**Other**	**Total**
Car Driver	68.5%	77.5%	28.0%	44.0%	7,757
Car Pax	8.7%	4.5%	5.2%	18.6%	2,159
Walk	9.9%	5.8%	43.6%	20.0%	2,791
Bus	7.0%	4.0%	18.8%	12.7%	1,705
Train	2.1%	1.5%	1.4%	1.0%	213
Bicycle	1.9%	0.3%	0.6%	0.4%	137
Other	1.9%	6.5%	2.3%	3.2%	427
Total	100%	100%	100%	100%	
Survey Records	4,593	400	1,152	9,043	15,188

As stated, the mode split target adopted for this study relates to overall trip making activity. The ability to meet the stated target will depend on a series of interventions to manage car based travel demand, to promote an increase in the proportion of trip made by public transport, and to ensure that facilities are provided to support pedestrian and cycling activity for short to medium distance trips.

Using the data presented in Table 3.10 of the *Travel Diary*, SIAS sought to determine which trip purposes were most dependent on private car use, and to determine where efforts should be focused to influence either an increase or reduction in the share of each travel mode in order to meet the specified target. Table 4.17 shows the total number of survey records related to each trip purpose and mode.

Table 4.17 : Breakdown of Travel Modes by Trip Purpose (all Fife)

	Trip Purpose (Home Based)				
Travel Mode	**Commute**	**Business**	**Education**	**Other**	**Total**
Car Driver	3,145	310	323	3,979	7,757
Car Pax	401	18	60	1,680	2,159
Walk	455	23	502	1,811	2,791
Bus	321	16	217	1,151	1,705
Train	98	6	16	93	213
Bicycle	88	1	7	41	137
Other	85	26	27	289	427
Total	4,593	400	1,152	9,043	15,188

Table 4.18 shows the proportion of the 15,188 trip records that were associated with the each travel purpose and mode. The total column shows the overall share of trip making by the respective travel modes, providing the opportunity to make measured comparisons with the overall mode split target.

Table 4.18 : Proportion of all Home-Based Trips by Travel Mode and Purpose

	Trip Purpose (Home Based)				
Travel Mode	**Commute**	**Business**	**Education**	**Other**	**Total**
Car Driver	20.7%	2.0%	2.1%	26.2%	51%
Car Pax	2.6%	0.1%	0.4%	11.1%	14%
Walk	3.0%	0.2%	3.3%	11.9%	18%
Bus	2.1%	0.1%	1.4%	7.6%	11%
Train	0.6%	0.0%	0.1%	0.6%	1%
Bicycle	0.6%	0.0%	0.0%	0.3%	1%
Other	0.6%	0.2%	0.2%	1.9%	3%
Total	30%	3%	8%	60%	100%

Mode split data is presented elsewhere in the *Travel Diary* in relation to specific trip types or by day of the week. SIAS has used mode split data relating to trip purpose in order to help identify which trip types should be influenced most as a means of reducing or increasing the share of a particular travel mode. Table 4.19 shows a comparison between the observed mode split data for Dunfermline and FC's stated targets as derived from Fife wide data. It is desired to increase or at least maintain the proportion of car passengers relative to car drivers.

Table 4.19 : Comparison of Observed Average Mode Split with FC Target

Mode	**Av. Observed**	**Target**	**Action**
Car Driver	51%	41%	reduction
Car Passenger	14%	12%	increase
Walk	18%	20%	increase
Bus	11%	17%	increase
Train	1%	3%	increase
Cycle	1%	8%	increase
Other	3%	0%	increase
Total	100%	100%	-

The mode split adopted for this Transport Assessment was specified by FC on the basis that it represented a positive shift towards non-car based travel modes. This is consistent with the aspiration that the Dunfermline Strategic Expansion represents an opportunity to prompt a more sustainable approach to urban living as set out in the *Strategic Framework Report*.

Assumptions made during the person trip generation forecasting exercise were supported by data from the *Travel Diary*, which contains datasets for key towns throughout the FC area relating to aspects of travel such as travel mode, trip purpose and trip length. Analysis of data for the each of the towns covered by the dataset highlights that there is marked variation in the mode splits. Rates of pedestrian trip making in St Andrews are far greater than in Kirkcaldy, whereas the share of trips made by car in Cupar far exceeds that in St Andrews. This confirms that the mode split of a particular town is influenced by the characteristics and demographics of that town. In respect of public transport usage, Dunfermline has a greater proportion of trips made by bus than any other part of Fife. This can be partly attributed to the gravity draw of employment trips to Edinburgh and the availability of good bus services both in Dunfermline town centre and at Ferrytoll.

The travel diary contains summary statistics for “All Fife”, “East”, “Mid” and “West” Fife, and for each of the respective towns in the study area. For each of these areas, summary mode split statistics are provided, once again highlighting that there is a degree of variation between each area.

Set in the context of “All Fife”, the successful adoption of the study mode split would represent an increase in the share of trips made on foot, by bicycle and by public transport. However, set in the context of Dunfermline which has more positive baseline characteristics, the target split appears less ambitious. For clarification, there is no implication in this TA that measures are required to reduce rates of pedestrian and cycle activity.

It should also be noted that the target mode split applies only to the development trips, where an important opportunity exists to influence travel behaviour through design. The TA does not presume that adjustments are necessary to established trip making patterns throughout the study area.

5 TRAFFIC MODELLING

5.1 Dunfermline 2009 Base S-Paramics Model

This Transport Assessment utilises an S-Paramics microsimulation model of the Dunfermline Area which has been developed for this study. The model development is reported in the *Dunfermline S-Paramics2009 Base Model, Model Development Report, (SIAS Ref. 72654, April 2011).*

The 2009 Base model was developed for the following time periods:

- AM Period 07:00 – 10:00
- Inter Peak Period 11:00 – 14:00
- PM Period 16:00 – 19:00

5.1.1 Reference Case Forecasting

While scoping the methodology with Transport Scotland it was recommended that Transport Scotland's LATIS service should be approached to discuss if a suitable regional model was available for use for applying forecast growth in this study.

A request for advice was submitted to LATIS on the appropriate regional model to use for forecasting background traffic in the modelling. LATIS recommended the use of the SESTRAN regional SATURN model, as a suitable methodology for applying forecast growth for this study. This model takes account of multimodal strategic trips influenced by future PT improvements.

The future years required to be assessed in this study are 2015, 2021 and 2029. The SESTRAN regional model cordons for the study area being used as basis for growth. The modelled SESTRAN years are 2007, 2019, 2024 and 2032.

A request for the final highway assignment models from the SESTRAN regional model for the available years was requested for the full Structure Plan development, with and without the Dunfermline SLA development being considered in this study. The highway assignments without the Dunfermline SLA development were used to calculate the background traffic growth and the assignments with the full Structure Plan development would be used for calculating the distribution of the SLA development traffic, which is discussed later in this Section.

The highway assignment models were provided and cordons of the study area were extracted from the assignments.

To calculate the background traffic growth the absolute growth for each SESTRAN zone to zone movement was extracted for the modelled area. Due to there being a difference between the SESTRAN modelled years and the Dunfermline SLA Appraisal modelled years, the following growth methodology was applied.

The growth between each modelled year would be assumed to be linear when interpolating between modelled years. The following calculations were adopted for the three Dunfermline SLA Appraisal modelled years, 2015, 2021 and 2029:

- 2015 = 2009 base demands + (6/12 * SESTRAN 2019 - SESTRAN 2007)

- 2021 = 2015 demands+(4/12 * SESTRAN 2019 - SESTRAN 2007)+(2/5 * SESTRAN 2024 - SESTRAN 2019)
- 2029 = 2021 demands+(3/5 * SESTRAN 2024 - SESTRAN 2019)+(5/8 * SESTRAN 2032 - SESTRAN 2024)

As the SESTRAN model covers a large area it is recognised that some trips will take longer than the modelled peak hours to complete their journey. In the SESTRAN highway assignment there is an option to extract 'demands' or 'actual' trips. Demand trips represent the demand for the movements, whereas the actual trips take account of the upstream queues on the network. The use of the demand cordon may overestimate the actual peak hour demand for the study area being considered. The growth calculations will be composed of a mix of demand and actual cordoned movements to account for this. The following methodology was applied:

- Int – Int – Demand
- Int – Ext – Demand
- Ext – Ext – Actual
- Ext – Int – Actual

The SESTRAN regional model outputs peak hour demands which is inconsistent with the S-Paramics model which models a 3hr peak period. To reflect this peak hour expansion factors were derived using observed data collected for the development of the 2009 Base model. The expansion factors used are contained in Table 5.1

Table 5.1 : Expansion Factors

Peak Period	Expansion Factor
AM	2.51
IP	2.84
PM	2.74

Given the two tier process that has been adopted it is the case, as expected that the zones in the SESTRAN model were more aggregated and the zones in the Dunfermline S-Paramics model are more disaggregated. Following the extraction of the SESTRAN trip matrices the trips were required to be distributed to the Dunfermline S-Paramics zoning system.

The SESTRAN model zones generally covered a number of S-Paramics model zones. The S-Paramics zones falling into each SESTRAN zone were established. The required SESTRAN zone to zone growth must be "distributed" onto the relevant S-Paramics zone to zone movements.

The applied background growth represent two elements of growth: background growth and development related growth. The application of the SESTRAN growth to the S-Paramics matrices considers this.

The existing Fife Local Plan(s) were consulted to establish the location of proposed development (housing and commercial). The amount of development (number of houses and area of commercial development) proposed/allotted for each SESTRAN and S-Paramics Zone will be established. Allocations of commercial land were converted to housing units to allow total development to be established and used. 1Ha of commercial land is assumed to be equivalent to 30 housing units in the context of defining the overall scale of development. The

SESTRAN growth was applied to the S-Paramics matrices in different ways, depending on the development situation.

1. No Development in either origin or destination SESTRAN Zone
   All growth assumed to be background traffic growth. Proportion of existing S-Paramics zone to zone movements in the SESTRAN zone to zone movement will be split proportionally between S-Paramics movements.
2. Development in either origin or destination SESTRAN zone
   25% of growth assumed to be background, 75% assumed to be development related. The background proportion has been applied as per 1. For S-Paramics zones in the origin/destination SESTRAN sector containing development, the proportion of development across the relevant S-Paramics zones will be used to apply the growth. For the origin/destination SESTRAN zone with no development, the proportion of the existing S-Paramics model demands will be used to spread the growth onto the relevant zones.
3. Development in both origin and destination SESTRAN Zone
   25% of growth assumed to be background, 75% demand related. Background proportion applied as per 1. For S-Paramics zones in the origin/destination SESTRAN sector witnessing development, the proportion of development across the relevant S-Paramics zones will be used to apply the growth.

The S-Paramics 2009 base matrices will always be used to establish proportions required, regardless of the future year being considered.

It is assumed that a simple global split between background and development growth is applied and that the SESTRAN model accounts correctly for tidality, etc.

In some cases the proportion of background to development growth was amended locally, based on increase in commercial/housing stock with developments in place. A more refined methodology was applied to make commercial land allocations equivalent with housing.

In the S-Paramics model car parks were used to split the demand load points. Currently this is based on vehicles originating evenly between load points and destinating at the load point providing lowest cost route. This does not allow the growth to be applied to any specific loading points relating to developments. The model could be amended to do so, either by amending the car park capacities and model settings relating to car parks, or by adding new zones for the growth/developments, and assigning only the relevant car park(s) to these.

In some cases the application of growth can result in negative demand due to the inherent differences in the zone coverage and matrices as they were developed independently of each other. Demands which have been reduced to negative values after the application of the growth, based on a small negative increment will be set to zero. Demands which have become negative from values of more than 10 will have a percentage growth applied, rather than an absolute growth. An absolute value will be calculated from the existing S-Paramics matrices sectored to SESTRAN zone level and the required percentage decrease will be applied to the matrices in the normal manner.

In some cases the application of growth from the SESTRAN zone to zone movements are being applied to S-Paramics zone to zone movements where no demands exist. In this case, the increment cannot be applied as nothing exists to generate proportions. In this case the relevant S-Paramics origin and destination totals for the zones in the SESTRAN zone will be applied using the method described, rather than proportions specific to the zones in the SESTRAN movement.

5.2 Development Traffic Modelling

This section sets out the assumptions that have been used in the traffic modelling to represent travel characteristics for the car trips for each development.

As stated the phasing is to be undertaken using two approaches, namely:

- The phasing as specified in the proposed Local Plan
- An Alternative Development Phasing approach which has been derived from discussions with potential developers who have contributed to the study

The two approaches namely the current phasing as stated in the *Strategic Framework Report* shown in Figure 5.1 and an alternative scenario shown in Figure 5.2.

Table 5.2 : Local Plan Development Scenario Summary

Development	Land Use	2015	2021	2029
Broomhall	Residential	40% (789 Units)	100% (1972 Units)	100% (1972 Units)
	Employment	26% (32.8 Ha)	66% (83.3 Ha)	100% (126.2 Ha)
Berrylaw	Residential		50% (332 Units)	100% (665 Units)
	Employment		50% (4.9 Ha)	100% (9.8 Ha)
Liggar Bridge	Residential		100% (1063 Units)	100% (1063 Units)
	Employment		100% (2.4 Ha)	100% (2.4 Ha)
Wellwood	Residential			100% (1085 Units)
	Employment			100% (22.4 Ha)

Table 5.3 : Alternative Development Scenario Summary

Development	Land Use	2015	2021	2029
Broomhall	Residential	40% (789 Units)	100% (1972 Units)	100% (1972 Units)
	Employment	40% (50.5 Ha)	100% (126.2 Ha)	100% (126.2 Ha)
Berrylaw	Residential			100% (665 Units)
	Employment			100% (9.8 Ha)
Liggar Bridge	Residential			100% (1063 Units)
	Employment			100% (2.4 Ha)
Wellwood	Residential	40% (434 Units)	100% (1085 Units)	100% (1085 Units)
	Employment	40% (9 Ha)	100% (22.4 Ha)	100% (22.4 Ha)

5.2.1 Trip Generation

Zones

New zones have been added to the model to represent the SLA development trips. At least two new zones are required per land parcel, such that employment and residential trips can be represented separately. Each development which has been allocated a zone for each land use as detailed Table 5.4.

Table 5.4 : Development Zone Numbers

Development	Land Use	Zone Number
Broomhall	Residential	154
	Employment	155
Berrylaw	Residential	159
	Employment	158
Liggar Bridge	Residential	157
	Employment	156
Wellwood	Residential	161
	Employment	160

As discussed, future year matrices are required for 2015, 2021, 2029. These years will include the trips relevant to the SLA Sites in place in those years, based on the proposed phasing being considered.

Residential trips and Employment trips generated and attracted by the SLA land parcels have been considered when developing the SLA trip matrices. The total trips to and from each development was defined and split between employment and residential. The total residential and employment trips to/from each land parcel was established from this. These are the totals required to be added to represent each development site.

Consideration of the phasing/proportion complete in each future year was accounted for and the resulting increments were proportioned accordingly in a simple manner as:

Proportion of “total” land parcel to be applied
=
(future year required-construction start year)/total construction years for development.

In each development it is assumed that the construction (i.e. the trip generation) is linear throughout the construction period.

The trip generation is for the entire AM and PM periods, unlike the Reference Case demands, so no peak hour expansion factor was required.

All trips are assumed to be car trips. The demand matrices currently have two levels – light and heavy. An additional matrix level was added to represent the new SLA residential and employment trips. This simplified the process of profiling, ensuring that the development trips are car only, without a car/LGV split.

Profiles

Employment and residential trip generation are disaggregated by each hour within the peak period. Each period length is 3hr and, as such, a profile was applied to represent the different demands levels within each simulated hour. The following profiles were applied to the relevant development trip types:

- SLA Residential IN
- SLA Residential OUT
- SLA Employment IN
- SLA Employment OUT

It is assumed that the development profiles are flat in each modelled hour with the assigned trips within each hour calibrated to the correct hourly trip generation totals.

5.2.2 Trip Distribution

Unlike the Reference Case growth methodology the development trips are not using SESTRAN to generate absolute growths; they are supplied from the SLA development trip generation. This methodology, however, uses the SESTRAN regional model to derive the trip distribution.

The development trip generation is provided for the entire period, so when considering this we can use "demand" outputs from the SESTRAN model.

To establish the trip distributions for each land parcel each SESTRAN zone which contained a SLA development land parcel was established. By examining the change in trip distribution between the SESTRAN highway assignments which included the SLA development and the highway assignments without (i.e. the assignments used for the Background Growth increments) a distribution for the SLA developments can be established.

Some of the SESTRAN zones which contained the SLA developments were not within the cordon used for the background growth development. To derive the SLA distributions a new cordon with all the relevant zones internal to the cordon was created. It is assumed that all SLA development is in place in 2032 and this highway assignment year was used to derive the distributions which assumes all SLA developments are in place.

For the SLA development, a distribution matrix representing the effects of SLA development only was generated which was generated by subtracting the cordon demands from the highway assignment model without the SLA from the cordon demands from the highway assignment model with the SLA. The difference provides us with a distribution for the trips associated with the full SLA development. The following details which journey purpose matrices were used to derive the relevant SLA trip distribution.

AM:

- Residential Out — Car commuter, car non work other
- Residential In — Car in work, car non work other
- Employment In — Car commuter
- Employment Out — Car in work

PM:

- Residential Out — Car Non Work Other + Car In work
- Residential In — Car commuter, car non work other
- Employment In — Car in work
- Employment Out — Car commuter

The resulting distributions used for the SLA development are shown in Appendix A. The distributions do not necessarily compare to the current *Fife Travel Diary* distributions as they have come from a different source which takes account of future distributions not existing ones.

Over and above this, an assumption regarding trips between the SLA development land parcels as a whole was considered. As agreed with FC, 30% of the employment trips in the SLA areas

are assumed to come from within the SLA areas. As such, the distribution was treated in two parts: in and between SLA zones, and to/from SLA zones from outwith the SLA zones.

The 30% is assumed to apply with all SLA development in place (i.e. full development of all phases). With some phases not developed, the absolute values resulting from the application of the 30% split were adjusted.

For example, for one SLA development (say) 1,000 employment car trips are attracted, 300 must come from the SLA residential zones with all phases in place. 700 come from outwith. The 300 trips from the SLA will be distributed based on the relevant origin proportions to the destination zone, across SLA zones only, and considering internal zone trips from SESTRAN. The trips from outwith will be based on the relevant origin proportions to the destination zone, across zones outwith the SLA zones.

With less of the phases in place, the distribution to/from outwith the SLA zones remains the same, but the internal distribution is altered, as there are less internal generators. The balance of within/outwith trips for the given employment parcel must be reduced accordingly to ensure the employment totals are met, by considering the absence of the other phases, and how many employment trips these generate. The external to employment trips should be increased accordingly. Say we develop the first two of the four phases, with the remaining two phases forecast to generate half of the 30% internal trips with all development in place. Trips from the two developed phases to employment in our given parcel would be 150 (down from 300) and external trips must go up to 150 to balance the adjustment. As the other phases are developed, more of the employment is taken up from local residential, and the external trips to employment get reduced to meet the 30% internal. This reflects people who are employed in the SLA living in the SLA.

The calculations resulting from this employment split dictate how the residential trips are split between internal and external SLA trips and these must be adjusted in a manner similar to the above to reflect less than full development.

The difference between the required SLA employment generated from internal residential and total residential required at any stage defines the residential outbound. This takes account of the issue of double counting with generated residential trips. All residential trips associated with SLA development are assumed to be new.

For simplicity, all AM employment outbound and PM Residential outbound trips are assumed to be associated to non SLA zones.

The remaining employment trips come from non SLA zones, distributed based on the calculated SESTRAN distribution. This distribution remains fixed for all phasing, based on the “all in” assumption. The proportion of non SLA to SLA employment trips will change as the phasing moves forward, culminating in a 70/30 split, as noted previously. Some of these trips can be assumed to be new employment trips, and some existing employment trips which move due to relocation or change of job.

The proportion considered as new trips can simply be added, the proportion of shifting trips require an equivalent reduction to be made for each relevant non SLA movement. SESTRAN outputs were examined to establish, for each individual SLA, and each origin zone for each, the split between new and shifting trips for each movement in the distribution. For any given origin zone contributing trips to the distribution, the change in trips originating from the zone with and without the SLA development can be established. Where no change occurs in the total, it can be

assumed that the trips to the SLA have all shifted from other destinations; these were identified, and the required reductions made proportionally to account for the shifted trips.

For sites where the total trips originating increases, and if no non SLA movements see a decrease, the SLA trips can all be assumed to be new. Where an increase in origin is witnessed, and some non SLA destinations observe a decrease, then the SLA trips was assumed to be composed of some shifting and some new. The proportion of shifting to new was established, by looking at the total decreases as a proportion of total going to SLA zones from the origin (based on the SESTRAN output). The volume of shifted trips was then established from the required total to the SLA zone from the given zone, and the balancing reductions made proportionally to the destinations witnessing a decrease.

5.3 Matrix Totals

The resulting matrix totals from the process is summarised in Table 5.5 and Table 5.6 for the AM and PM periods.

Table 5.5 : Matrix Summary Totals (AM Period)

	2009	2015	2021	2029
Base	46,100	-	-	-
Reference Case	-	49,525	51,875	56,368
Local Plan SLA	-	51,553	57,615	65,226
Alternative SLA	-	52,943	59,965	65,226

Table 5.6 : Matrix Summary Totals (PM Period)

	2009	2015	2021	2029
Base	57,419	-	-	-
Reference Case	-	62,291	65,046	69,403
Local Plan SLA	-	64,330	70,696	78,292
Alternative SLA	-	65,267	73,808	78,292

6 TRANSPORT IMPACT AND TRANSPORT INTERVENTIONS

6.1 Introduction

The transport impact of the developments has been identified along with the required mitigation measures for the years 2015, 2021 and 2029. In addition, it is important to understand what measures would be required in the Reference Case to provide a highway network with reasonable operation.

The phasing has been undertaken using two approaches namely the current phasing as stated in the *Draft Dunfermline & West Fife Local Plan (2010)* shown in Figure 5.1 and an alternative scenario shown in Figure 5.2.

It is important to define how this appraisal has been structured and how the timescales of the mitigation measures are interpreted.

The level of development specified in the 2015 scenario is assumed to be completed during the period 2011-2015, the 2021 scenario contains the additional development assumed between 2016 and 2021 and the 2029 scenario contains the additional development between 2022 – 2029.

As such the infrastructure will generally not be required at the year of opening. They are required by the year of completion, i.e. 2015, 2021 and 2029. The exact point where the development build is such that interventions are required has not been determined in this study and would require additional sensitivity testing. A factor in this sensitivity testing to consider is the level of employment development build out against the level of housing, i.e. if the employment development is not realised in the timeframe additional houses could be progressed instead.

6.2 2015 Reference Case

A 2015 Reference Case model was developed using growth information from the SESTRAN Regional model and does not include any SLA developments in Dunfermline.

The development of the Reference Case model included the development trips and proposed scheme for the TESCO store located off Carnegie Drive. The scheme includes a signalised interchange, which connects the development with Carnegie Drive at its junction with Pilmuir Street.

With background growth applied to the 2009 matrices, the 2015 model has been analysed to assess if any interventions are required.

In the AM peak there is little increase in overall congestion when compared to the 2009 Base model. There is increased congestion on the A823(M) approach to Pitreavie Roundabout which extends onto the M90 mainline between 08:50 – 09:20. Bothwell Gardens roundabout is also becoming congested between 08:50 – 09:30 on the St Margarets Drive and Woodmill Street approaches.

In the PM peak again there is little increase in overall congestion when compared to the 2009 Base model. There is increased congestion on the Elgin Street/Netherton Broad Street junction, which at peak times between 17:30 – 18:40 extends back to Bothwell Gardens Roundabout. With the new signal arrangement on Carnegie Drive associated with the TESCO development there is additional operational queueing on Carngie Drive and on Pilmuir Street. At times the queues extend to Sinclair Gardens, affecting the St Margarets Drive approach. There is

additional congestion on all approaches to the Whitefield Road/Halbeath Road Junction which begins at 17:10 and continues up until 18:50. This will affect the accessibility to Queen Margaret Hospital. There is congestion on the north approach to the Queensferry Road/ Carnegie Avenue roundabout between 17:50 – 18:40 where the queues extend back to the Sports Ground Access.

No interventions are required at this stage, however, there is notable congestion as the following junctions are considered to be approaching capacity:

- Whitefield Road/Halbeath Road/Linburn Road junction
- A9156 Netherton Broad Street/A823(M) Bothwell Street junction (Bothwell Gardens Roundabout)
- Pitreavie Roundabout

6.3 2015 Development Scenarios

The 2015 scenario includes two phasing assumptions for the SLAs, namely:

Local Plan Phasing:

- 40% Broomhall residential development (789 Units)
- 26% Broomhall Employment development (32.8Ha)

Alternative Development Phasing:

- 40% Broomhall residential development (789 Units)
- 40% Broomhall Employment development (50.5Ha)
- 40% Wellwood residential development (434 Units)
- 40% Wellwood Employment development (9Ha)

Initially a sensitivity test was undertaken to understand when any additional infrastructure should be implemented in context to the completion of the developments. This considers a link between Limekilns Road, Grange Road and Queensferry Road, as well as other schemes associated with the impact of the development.

Each scenario has been compared to a 2015 Reference Case model.

The impact of the development on the road network and the interventions required to mitigate the impact have been undertaken, considering both the 2015 scenario and how any interventions fit in with the overall SLA developments up to 2029.

6.4 2015 Local Plan Development Phasing

To understand the impact of the schemes external to the Broomhall development on the road network, a comparison was made between both the Local Plan SLA phasing, the Alternative Development Phasing and the Reference Case. To recap the main areas where junctions are considered to approaching capacity in the 2015 Reference Case are:

- Whitefield Road/Halbeath Road/Linburn Road junction
- A9156 Netherton Broad Street/A823(M) Bothwell Street junction (Bothwell Gardens Roundabout)
- Pitreavie Roundabout

From investigations undertaken as part of this study which have referenced previous studies, the following schemes that are required given that these schemes are approaching capacity:

- Whitefield Road/Halbeath Road/Linburn Road junction upgraded
- A9156 Netherton Broad Street/A823(M) Bothwell Street junction (Bothwell Gardens Roundabout) reconfigured and signalised (no right turn from Netherton Broad Street to Queensferry Road).
- Signalisation of Pitreavie Roundabout
- Access to the Broomhall Site via a link road from Grange Drive which joins the A823 Queensferry Road at King Malcolm roundabout

With increase congestion at the traffic signals at the Halbeath Road/ Whitefield Road junction an improvement is required. This scheme was identified and costed in the Dunfermline Bus Priority Study (SIAS 2008). This scheme relieves the junction and maintains easy access to Queen Margaret Hospital as well as progression through the Halbeath corridor.

The improvement to Bothwell Gardens roundabout increases capacity by signalising the junction and providing a more direct access from St Margarets Drive to Netherton Broad Street. In addition the right turn movement from Netherton Broad Street is banned. This scheme provides significant relief to the junction congestion.

The signalisation of Pitreavie roundabout is required to increase capacity and mange the queues on the A823(M). This scheme was identified as part of the Rosyth Park & Choose Transport Assessment undertaken by WSP in 2007 and included in the Dunfermline Bus Priority Study. This scheme provides improved accessibility to and from the M90 which aims to minimise the rat-running through Rosyth which can occur during the AM peak when there is significant congestion on the M90 approaching the Forth Road Bridge.

An access road has been provided between the Grange Drive/ Queensferry Road roundabout and Grange Road. With the Full SLA allocation in place this road should be to single carriageway standard. This road provides convenient access to the Queensferry Road corridor for the Broomhall development and for the other developments as they emerge. Again with convenient access onto the Queensferry Road corridor this aims to minimise any re-routeing through Rosyth via Grange Road.

Details of the concept designs and costs of these schemes are contained in Section 7 of this Report. The costs as summarised in Section 6.15.

Table 6.1 : 2015 Local Plan Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Halbeath Road/ Whitefield Road Junction	1.0
Reconfigured Bothwell Gardens Roundabout	0.3
Grange Drive Link Road	4.4
Pitreavie Roundabout signalisation	0.5
Total Cost	6.2

With the infrastructure in place the operational assessment of the modelled traffic is discussed as follows.

In the AM peak, with the additional development and associated infrastructure there is little increase in the overall congestion when compared to the Reference Case. The queue on the A823(M) approach to Pitreavie Roundabout has been reduced with queues being distributed on the north and south arms of the roundabout. The addition of the Bothwell Gardens roundabout improvement reduces the queues significantly to levels similar to the Reference Case. The improvement to the Whitefield Road/Halbeath Road junction reduces the queues at this junction to operational queues.

In the PM peak there is little additional congestion compared to the Reference Case. The improvement to Bothwell Gardens roundabout reduces the queues to levels similar to that observed in the Reference Case. There is little queueing on the approaches to the Whitefield Road/Halbeath Road roundabout throughout the PM period.

6.5 2015 Alternative Development Phasing

To understand the impact of the schemes external to the Broomhall development on the road network, a comparison was made between both the Local Plan SLA phasing, the Alternative Development Phasing and the Reference Case. To recap the main areas where junctions are considered to approaching capacity are:

- Whitefield Road/Halbeath Road/Linburn Road junction
- A9156 Netherton Broad Street/A823(M) Bothwell Street junction (Bothwell Gardens Roundabout)
- Pitreavie Roundabout

From investigations undertaken as part of this study which have referenced previous studies, the following schemes that are required given that these schemes are approaching capacity are:

- Whitefield Road/Halbeath Road/Linburn Road junction upgraded
- A9156 Netherton Broad Street/A823(M) Bothwell Street junction (Bothwell Gardens Roundabout) reconfigured and signalised (no right turn from Netherton Broad Street to Queensferry Road)
- Signalisation of Pitreavie Roundabout
- Access to the Broomhall Site via a link road from Grange Drive which joins the A823 Queensferry Road at King Malcolm roundabout

The schemes outlined above are consistent with the schemes identified using the Local Plan Development phasing approach. Details of the concept designs and costs of these schemes are contained in Section 7 of this Report. The costs as summarised in Section 6.15.

It should be noted that investigations undertaken with this study have concluded that if the Wellwood development is constructed where access is only permitted from East Baldridge Drive and Pilmuir Street and development construction is split between the two access points such that the traffic is distributed evenly there will be no requirement for local interventions at the Rumblingwell/William Street Junction. This should be clarified at the submission of the relevant Transport Assessment for this site. If the Alternative Development Phasing is loaded fully onto East Baldridge Drive then intervention at this junction would be required.

There are additional access opportunities for the Wellwood development which could utilise Lady Nairn Road, Douglas Drive, Douglas Park and Tramayne Place as a means of distributing the traffic across the road network, but they would descend on two main access points on

Rumblingwell and Pilmuir Street. It is important to note that multiple points of access is a requirement of the *Manual for Streets (DfT 2007)*.

With the infrastructure in place the operational assessment of the modelled traffic is discussed as follows.

In the AM peak, with the additional development and associated infrastructure there is little increase in the overall congestion when compared to the Reference Case. The queue on the A823(M) approach to Pitreavie Roundabout has been maintained to similar levels to the Reference Case. The addition of the Bothwell Gardens roundabout improvement reduces the queues significantly to levels lower than the Reference Case. The improvement to the Whitefield Road/Halbeath Road junction reduces the queues at this junction to operational queues.

In the PM peak there is little additional congestion compared to the Reference Case. The improvement to Bothwell Gardens roundabout reduces the queues to levels similar to that observed in the Reference Case. There is little queueing on the approaches to the Whitefield Road/Halbeath Road roundabout throughout the PM period.

6.5.1 Comparison with Reference Case

A comparison of the model statistics has been undertaken comparing the following:

- 2015 Reference Case
- 2015 Local Plan Development Phasing
- 2015 Alternative Development Phasing

The statistics that have been compared are:

- Peak Hour Flows
- Journey Times on key corridors

Peak Hour Flow Comparison

Table 6.2 contains a flow summary of the key links on the network for the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours for the 2015 Reference Case, and Local Development Plan Phasing and Alternative Development Phasing both with external infrastructure.

Table 6.2 : 2015 with External Infrastructure Peak Hour Flows (vehs/hr)

		AM			PM		
Location	Direction	Ref Case	LDP Final	ALT Final	Ref Case	LDP Final	ALT Final
William Street	NB	288	311	477	487	449	677
	SB	480	424	624	397	298	495
Baldridgeburn	EB	490	632	711	456	550	652
	WB	346	384	401	498	526	577
Pilmuir Street	NB	198	227	259	245	290	263
	SB	230	281	276	245	261	260
Carnegie Drive	EB	921	1,153	1,231	985	1,110	1,168
	WB	571	571	726	538	615	733
Townhill Street	NB	303	315	280	588	605	589
	SB	577	638	680	671	652	674
Appin Crescent	EB	684	677	698	1,103	1,069	1,084
	WB	932	1,114	1,172	865	864	947
Halbeath Rd (E)	EB	1,107	1,142	1,162	1,356	1,509	1,526
	WB	1,241	1,362	1,412	1,203	1,336	1,368
St Margarets Drive	NB	784	973	976	989	1,336	1,388
	SB	947	1,781	1,854	786	1,590	1,662
Netherton Brd St	EB	741	269	293	936	429	514
	WB	773	945	995	820	894	936
Queensferry Rd (N)	NB	1,145	1,067	1,040	1,478	1,305	1,270
	SB	1,175	1,157	1,188	1,275	1,192	1,217
Queensferry Rd (S)	NB	1,386	1,489	1,468	1,538	1,626	1,418
	SB	1,547	1,489	1,529	1,468	1,440	1,525
Limekilns Rd	NB	84	218	226	156	269	300
	SB	113	293	270	110	242	209
Grange Road	NB	113	155	226	253	124	378
	SB	108	133	159	168	224	232
A985 Rosyth	EB	700	767	810	728	789	825
	WB	579	641	692	751	770	806
A823(M)	EB	1,289	1,296	1,262	1,386	1,403	1,415
	WB	1,483	1,751	1,738	1,136	1,138	1,136
Coal Road	SB	514	364	467	506	326	334
	NB	382	458	488	576	674	672

It can be seen from Table 6.2 that the flows on Netherton Broad Street reduce in the eastbound direction in both the AM and PM peaks with the introduction of the link road. The most significant difference is the flows on St Margarets Drive which has increased by approximately 900 vehicles in the southbound direction in both the AM and PM peak hours. The PM peak hour flow in the northbound direction has increased by approximately 400 vehicles.

Journey Time Comparison

Journey time comparisons for three strategic routes through Dunfermline; have been compared for the 2015 Reference Case, Local Plan Phasing with and without the link road. The three routes are as described as follows and detailed in Figure 6.1:

- Route 1: Follows the A823 from Sinclair Gardens Roundabout to Queensferry Road/ Carnegie Avenue Roundabout, along St Margarets Drive, Bothwell Street, Hospital Hill and Queensferry Road (Queensferry Road Corridor)

- Route 3: Follows the A907 from Sinclair Gardens Roundabout to Halbeath Interchange, along Halbeath Road (Halbeath Corridor)
- Route 5: Follows the A907 from Sinclair Gardens Roundabout to Carnock Road/Lundin Road Junction, along Carnegie Drive, Glen Bridge, Pittencrieff Street, William Street, Rumblingwell and Carnock Road (Rumblingwell Corridor)

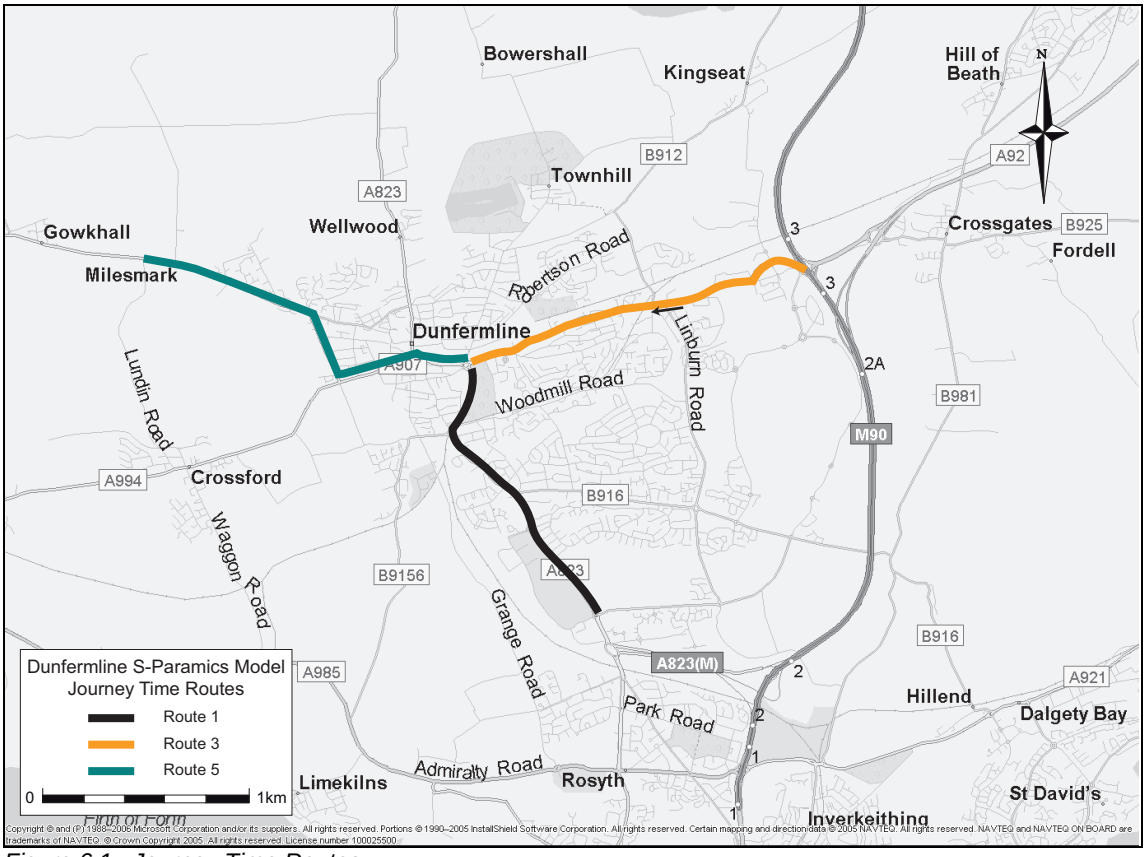

Figure 6.1 : Journey Time Routes

The AM and PM peak period journey time comparisons for the 2015 Reference Case, and Local Development Plan Phasing and Alternative Development Phasing are shown in Appendix B.

The results for the Queensferry Road corridor (Route 1) in the northbound direction shows that in the AM period the journey times in both the Local Plan Phasing and the Alternative Development Phasing development models have increased by approximately 2min compared to the Reference Case. In the PM, the journey times have reduced to a similar level to the Reference Case model between 15:30 – 17:30; thereafter, the delay has reduced compared against the Reference Case model by up to 10min.

In the AM and PM periods for the southbound direction, the analysis shows that the journey times have improved with both development scenarios when compared against the Reference Case model. Journey times in the AM have reduced from a peak of approximately 16min to 7min. Similarly, in the PM journey times have reduced from a peak of 17min to 8min.

The results for the Halbeath corridor (Route 3) in the eastbound direction for the AM period show that for both development scenarios, journey times remain similar to the Reference Case

model. In the PM period the development scenarios reduce the journey times by up to 4min, when compared against the Reference Case model.

In the AM period for the westbound direction the analysis shows that for the alternative scenario, journey times remain similar to the Reference Case model. The local plan phasing scenario is an improvement over the reference case up to 3min. In the PM period, there are distinct peaks in the delays at 16:30, 17:50 and 18:30. Both development scenarios have increased the journey times at 16:30 by up to 6min and at 17:50 by up to 3min. At 18:30 the local plan phasing scenario increases the journey times by 5min and the alternative phasing reduces the journey time 3min.

The results for the Rumblingwell corridor (Route 5) in the eastbound direction demonstrate that the journey times in both the AM and PM peaks increase by up to 8min at peak times (09:00 and 17:30) when compared to the Reference Case. In the AM peak westbound direction the local plan phasing scenario increases the journey times up to 8min at 09:20 compared to the Reference Case. The alternative phasing scenario reduces the journey times to approximately 2min less than the Reference Case. In the PM peak westbound direction the local plan phasing scenario is demonstrates similar journey time to the Reference Case whereas the alternative scenario reduces journey times by up to 8min.

Public Transport Journey Times

Table 6.3 and Table 6.4 show the average journey times for key town centre passenger transport routes for the AM and PM peak periods.

Table 6.3 : Passenger Transport Journey Times (AM Period)

		2015		Differences	
AM	**Ref Case**	**LDP SLA**	**Alt Phase SLA**	**LDP - Ref Case**	**Alt Phase - Ref Case**
7 & 19 Nbd	00:22:21	00:24:33	00:22:45	+ 00:02:12	+ 00:00:25
7 & 19 Sbd	00:21:24	00:17:05	00:17:46	- 00:04:19	- 00:03:38
33 Wbd contd 1	00:19:39	00:11:31	00:12:13	- 00:08:07	- 00:07:26
33 Ebd	00:12:35	00:10:10	00:10:41	- 00:02:25	- 00:01:54
55 Nbd	00:20:04	00:25:00	00:22:43	+ 00:04:55	+ 00:02:38
55 Sbd	00:21:52	00:18:36	00:19:33	- 00:03:16	- 00:02:19

Table 6.4 : Passenger Transport Journey Times (PM Period)

		2015		Differences	
PM	**Ref Case**	**LDP SLA**	**Alt Phase SLA**	**LDP - Ref Case**	**Alt Phase - Ref Case**
7 & 19 Nbd	00:36:32	00:29:22	00:27:39	- 00:07:10	- 00:08:52
7 & 19 Sbd	00:26:48	00:18:52	00:19:59	- 00:07:56	- 00:06:49
33 Wbd contd 1	00:20:21	00:15:12	00:15:35	- 00:05:09	- 00:04:46
33 Ebd	00:19:08	00:11:08	00:12:24	- 00:08:00	- 00:06:44
55 Nbd	00:32:54	00:25:49	00:24:35	- 00:07:04	- 00:08:18
55 Sbd	00:26:00	00:19:52	00:20:34	- 00:06:08	- 00:05:26

Table 6.3 shows that in the AM period, when comparing the 2015 LDP with the 2015 Reference Case model, there are time savings all on routes, apart from the 55, 7 and 19 northbound, which experience delays of up to 5min from the Reference Case. The Alternative phasing scenario

demonstrates similar journey times when compared to the Reference Case, however, in increases reduce to a maximum of 3min.

Table 6.4 shows that during the PM period, there are significant journey time savings with both 2015 phasing scenarios are compared against the 2015 Reference Case model. These savings vary between 5min and 9min.

Global Queue Statistics

As an indicator of model operation, the average number of queued vehicles for the modelled area and a cordon around the town centre is displayed in the following graphs for the AM and PM period. Figure 6.2 shows the two areas that have been analysed for queued vehicles.

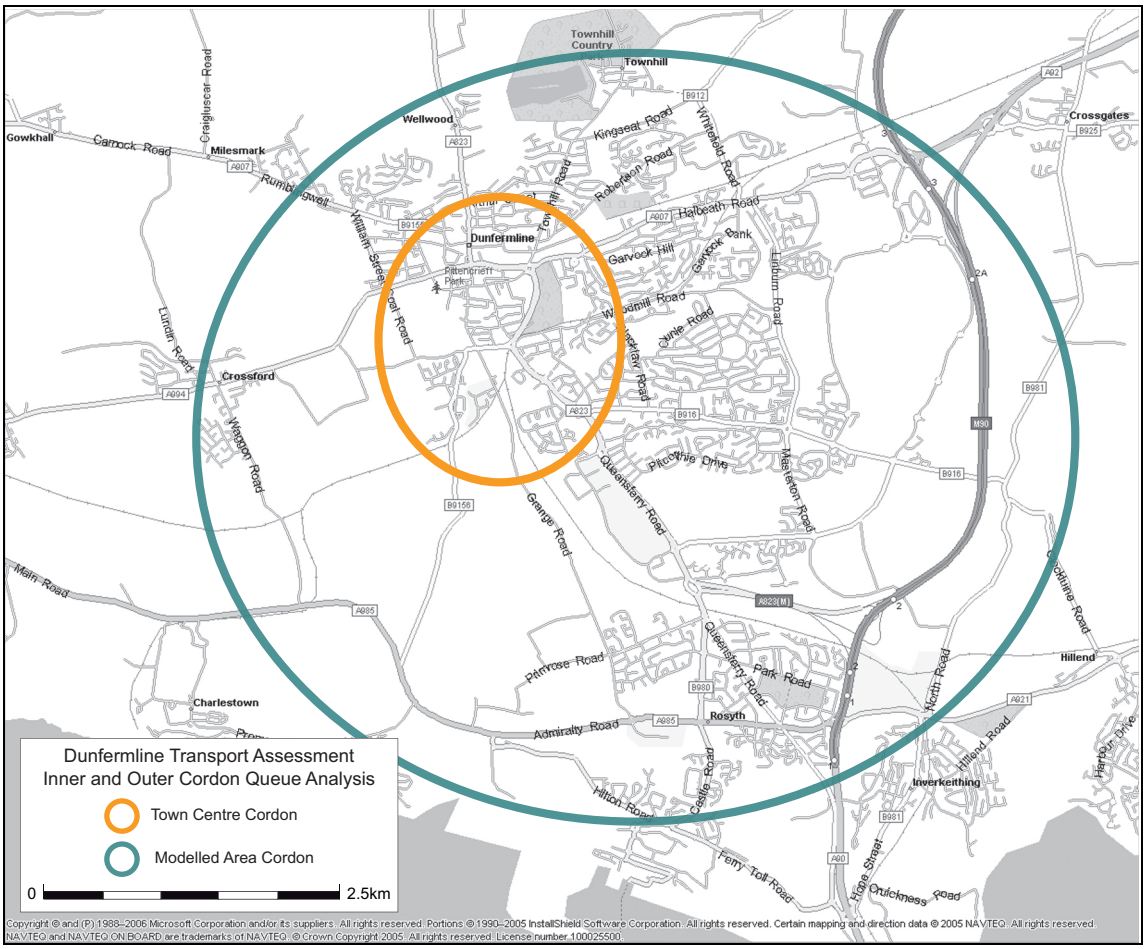

Figure 6.2 : Inner and Outer Cordon Queue Analysis

Figure 6.3 and Figure 6.4 shows the average number of vehicles queueing across the whole model for the Local Plan phasing with infrastructure in place for the AM and PM peak period.

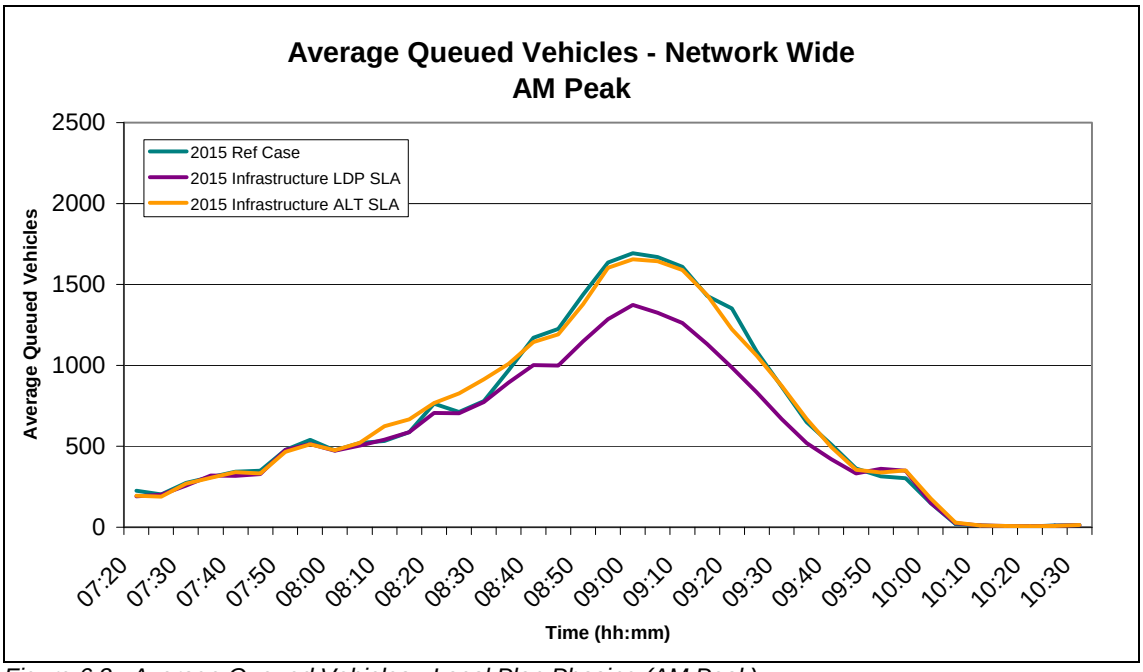

Figure 6.3 : Average Queued Vehicles - Local Plan Phasing (AM Peak)

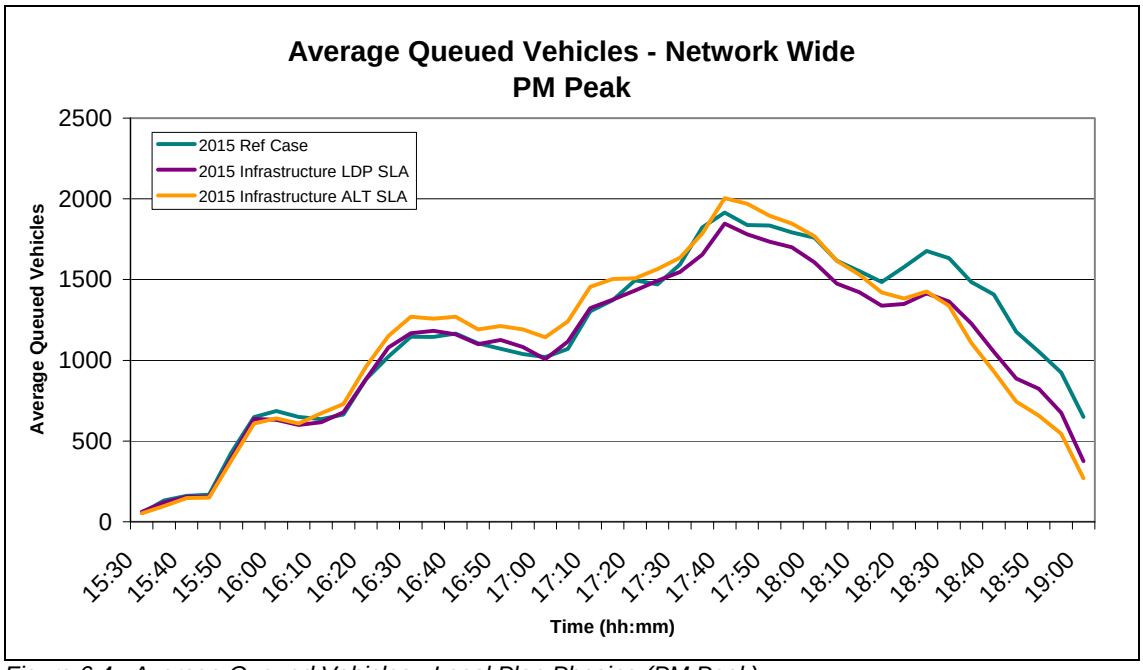

Figure 6.4 : Average Queued Vehicles - Local Plan Phasing (PM Peak)

These figures demonstrate that when considering queues across the network the measures included for both the 2015 Local Plan and Alternative Development Phasing scenarios generally mitigate the impact of the additional traffic associated with the development in both the AM and PM peak periods.

Figure C1 and Figure C2 contained in Appendix C shows the levels of queueing in the town centre for the Local Plan and the alternative phasing compared to the Reference Case for the

AM and PM peak period. These figures demonstrate that when considering queues in the town centre the measures included for both development phasing scenarios mitigate the impact of the additional traffic associated with the development. The Local Plan phasing shows a benefit to the town centre in the AM peak.

Network Summary Statistics

The network summary statistics have been extracted for each model and are detailed in Table 6.3 and Table 6.4 for the AM and PM period.

Table 6.5 : Network summary Statistics, External Infrastructure (AM Period)

Scenario	Total Network Time (hr)	Total Distance (km)	Vehicles	Average Network Speed (mph)	Average Journey Time (min)
Ref Case	5,359	186,277	58,518	21.6	330
Local Plan SLA	5,506	197,802	61,185	22.3	324
Alt SLA Phasing	6,044	205,945	62,538	21.2	348

Table 6.6 : Network summary Statistics, External Infrastructure (PM Period)

Scenario	Total Network Time (hr)	Total Distance (km)	Vehicles	Average Network Speed (mph)	Average Journey Time (min)
Ref Case	7,438	222,317	69,456	18.6	385
Local Plan SLA	7,627	233,145	72,422	19.0	380
Alt SLA Phasing	8,049	239,556	73,357	18.5	395

Table 6.5 and Table 6.6 support the outcomes of the queueing statistics with the measures included for both development phasing scenarios mitigating the impact of the additional traffic associated with the development.

6.6 Conclusion of 2015 Assessment

The impact of the 2015 local plan and alternative phasing is successfully mitigated by the following schemes:

- Whitefield Road/Halbeath Road/Linburn Road junction upgraded to a roundabout (Linburn Roundabout)
- A9156 Netherton Broad Street/A823(M) Bothwell Street junction (Bothwell Gardens Roundabout) reconfigured and signalised (no right turn from Netherton Broad Street to Queensferry Road)
- Signalisation of Pitreavie Roundabout
- Access to the Broomhall Site via a link road from Grange Drive which joins the A823 Queensferry Road at King Malcolm roundabout

The costs of the aforementioned schemes are summarised in Table 6.7.

Table 6.7 : 2015 Local Plan Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Halbeath Road/ Whitefield Road Junction	0.8
Reconfigured Bothwell Gardens Roundabout	0.3
Grange Drive Link Road	4.4
Pitreavie Roundabout signalisation	0.5
Total Cost	6.0

As demonstrated by the journey times, the queueing statistics and network summary statistics the schemes successfully mitigate the impact of the development.

The exact date that the development infrastructure is required has not been assessed within this study however the funding constraints of the developers under the current economic climate does allow a level of concession in relation to the time the schemes are required.

It is likely that a proportion of the Broomhall development could be implemented without the Grange Drive Link Road. It is acknowledged that there is likely to be delays at the Grange Road/Netherton Broad Street. This delay could be managed with a link between Elgin Street and Limekilns Road as an interim scheme which was identified in the Dunfermline Bus Priority Study (SIAS 2008) at a cost of £540k in 2005 prices.

As with all the development assumptions the employment build out rate could differ from the assumed rates in this study, e.g. if the employment uptake is less than assumed then there is scope to build more houses, however, this scenario should be assessed in the future to consider the different trip patterns and determine the any additional impact.

A proportion of the Wellwood development could be developed without providing any additional infrastructure other than development access. Sensitivity tests in this study have concluded that the 40% Wellwood development considered in the 2015 alternative scenario should not be developed with only one access onto the Rumblingwell/William Street Junction but should share access points with Pilmuir Street. Again the assumed employment uptake could vary which would allow an opportunity for additional houses to be built.

6.7 2021 Reference Case

The 2021 Reference Case growth was derived from the SESTRAN model and does not include any SLA development trips. As with the 2015 Reference Case the trips associated with TESCO to be located off Carnegie Drive is included.

Initial model runs were undertaken to identify, if any, areas of the network which do not have the capacity to accommodate the assigned traffic demands. In the AM peak, the main areas of congestion are:

- St Margarets Drive approach to Bothwell Gardens roundabout (AM Peak)
- A823(M) approach to Pitreavie Roundabout (AM Peak)
- Queensferry Road approach to Bothwell Gardens roundabout (PM Peak)
- Whitefield Road/Halbeath Road junction

An iterative procedure was undertaken to relieve the congested areas and from this the following schemes would be required by 2021:

- Signalisation of Pitreavie roundabout
- Signalisation of Bothwell Gardens roundabout
- Whitefield Road/Halbeath Road/Linburn Road roundabout

In the AM peak, the resulting network operation is good on Halbeath Road between Halbeath roundabout and east of the Appin Crescent/Garvock Hill roundabout. Carnegie Drive is congested with queueing on Pilmuir Street up to Arthur Street between 09:20 – 09:30. Bothwell Gardens roundabout is busy, but operates without excessive congestion. The Aberdour Road approach to Queensferry Road queues between 09:00 – 09:40. There is congestion on all arms of Pitreavie Roundabout, however, the signalisation of the roundabout has provided queueing levels on the A823(M) to levels similar to that shown in the 2015 Reference Case.

In the PM peak, there is congestion on Carnegie Drive between the Tesco Interchange east and Sinclair Gardens roundabout. Queues occur on the east approach to Sinclair Gardens extending east beyond the Whitefield Roundabout. Bothwell Gardens operates without significant delay and the Queensferry Road/Aberdour Road junction experiences congestion between 17:30 – 18:50.

6.8 2021 Development Scenarios

The 2021 scenario includes two phasing assumptions for the SLAs, namely:

Local Plan Phasing:

- 100% Broomhall residential development (1,972 Units)
- 66% Broomhall employment development (83.3Ha)
- 50% Berrylaw residential development (332 Units)
- 50% Berrylaw employment development (4.9Ha)
- 100% Liggar Bridge residential development (1,063 Units)
- 100% Liggar Bridge employment development (2.4Ha)

Alternative Development Phasing:

- 100% Broomhall residential development (1,972 Units)
- 100% Broomhall employment development (126.2Ha)
- 100% Wellwood residential development (1,085 Units)
- 100% Wellwood employment development (22.4Ha)

Initially a sensitivity test was undertaken to understand when any additional infrastructure should be implemented in context to the completion of the developments. This considers links between Limekilns Road, Grange Road, Queensferry Road and Coal Road, and other schemes associated with the impact of the development.

Each scenario has been compared to a 2021 Reference Case model.

The impact of the development on the road network and the interventions required to mitigate the impact have been undertaken, considering both the 2021 scenario and how any interventions fit in with the overall SLA developments up to 2029.

6.9 2021 Local Plan Development Phasing

The impact that the development uptake would have on the existing network was considered as part of this assessment. The objective was to consider if no interventions were constructed until the developments were completed what would be the impact of the highway network.

The 2021 Local Plan Phasing includes the following:

- 100% Broomhall residential development (1,972 Units)
- 66% Broomhall employment development (83.3Ha)
- 50% Berrylaw residential development (332 Units)
- 50% Berrylaw employment development (4.9Ha)
- 100% Liggar Bridge residential development (1,063 Units)
- 100% Liggar Bridge employment development (2.4Ha)

Initial model runs were undertaken to identify, if any, areas of the network which do not have the capacity to accommodate the assigned traffic demands. The main areas of congestion are:

- William Street
- Coal Road
- Netherton Broad Street
- Halbeath Corridor
- Netherton Broad Street

An iterative procedure was undertaken to relieve the congested areas and from this the following schemes would be required by 2021:

- Link between Grange Drive link road and Coal Road
- Upgraded junction at Coal Road/Lovers Loan,
- Upgrade junction at Coal Road/Pittencrief Street
- Junction improvement at William Street/Rumblingwell
- Improvement to the Grange Drive/Queensferry Road roundabout
- Carnegie Drive Bus Gate

It is anticipated that new link between Grange Drive link road and Coal Road will be designed through effective masterplanning as part of the Broomhall and Liggar Bridge Developments. For this reason this link road has not been costed, but it is expected that it will be to a single carriageway standard given the peak flows are 600 vehicles per hour in one direction.

The improvements to the Coal Road/ Lovers Loan and Coal Road/Pittencrief Street provide additional capacity which is required to accommodate the development. The detailed design should include with adequate cycle and pedestrian facities to avoid discouragement of these key mode through the corridors linked by these junctions. There are potential alternative schemes

which avoid land acquisition on William Street if required, e.g. re-routeing William Street west of Berrylaw Place.

The junction improvement at the William Street/Rumblingwell junction is a roundabout. A signalised scheme was investigated, but could not be accommodated in the available land. In the detailed design pedestrian facilities should be included set back from the approaches to the roundabout to ensure adequate pedestrian and cycle provision.

The improvement to the Grange Drive/Queensferry Road roundabout is increasing the size of the roundabout and increasing the north approach to the roundabout. This is required to increase the capacity between this junction and the B916 Aberdour Road which avoids any queues blocking back into the junction.

The Carnegie Drive Bus Gate is required to remove through trips between the Bus Station exit and William Street. This measure forces traffic to use alternative routes which are now in place and the result is reduced congestion on Carnegie Drive in peak periods.

Details of the concept designs and costs of these schemes are contained in Section 7 of this Report. The costs are summarised in Table 6.8.

Table 6.8 : 2021 Local Plan Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Upgrade of Coal Road/Lovers Lane	1.8
Upgrade of William Street/Pittencrief Street	3.2
Improvement to William Street/Rumblinwell Junction	2.3
Grange Drive Roundabout	0.7
Carnegie Drive Bus Gate	0.6
Total Cost	8.6

With the aforementioned infrastructure in place the operational assessment of the modelled traffic is discussed as follows.

In the AM peak, with the additional development and associated infrastructure the network operation is improved when compared to the Reference Case. The queue on the A823(M) approach to Pitreavie Roundabout has been retained at similar levels to the Reference Case. Bothwell Gardens roundabout operates without excessive queueing. The Halbeath corridor operates well between Halbeath Roundabout and Halbeath Road. The Grange Drive Link Road/ Coal Road and William Street operate well with operational queueing at the intermediate junctions.

In the PM peak there is an improvement over the Reference Case congestion. There is congestion on the south approach of A823 Queensferry Road/Grange Drive Link Road of approximately 600m. There is also queueing on the north approach Queensferry Road Carnegie Avenue roundabout of 400m. There is little queueing on the approaches to the Whitefield Road/ Halbeath Road roundabout throughout the PM period and Bothwell Gardens is operating without excessive congestion. Carnegie Drive experiences reduced congestion due to the addition of the bus gate.

6.10 2021 Alternative Development Phasing

The impact that the development uptake would have on the existing network was considered as part of this assessment. The objective was to consider if no interventions were constructed until the developments were completed what would be the impact of the highway network.

The 2021 Alternative Development Phasing includes the following:

- 100% Broomhall residential development (789 Units)
- 66% Broomhall Employment development
- 100% Wellwood residential development (789 Units)
- 100% Wellwood Employment development

Initial model runs using the 2021 Local Plan infrastructure was used to identify, if any, areas of the network which do not have the capacity to accommodate the assigned traffic demands. The main areas of congestion are:

- William Street
- Coal Road
- Netherton Broad Street
- Halbeath Corridor
- Netherton Broad Street
- Carnegie Drive Corridor

An iterative procedure was undertaken to relieve the congested areas and from this the following schemes would be required by 2021:

- Link between Grange Drive link road and Coal Road
- Upgraded junctions at Coal Road/Lovers Loan, Coal Road/Pittencrief Street
- Junction improvement at William Street/Rumblingwell
- Improvement to the Grange Drive/Queensferry Road roundabout
- Carnegie Drive Bus Gate
- Link between Pilmuir Street and Whitefield Road (North Link Road)

The description of the first five schemes is contained in Section 6.7, however, the Link between Pilmuir Street and Whitefield Road (North Link Road) is required to relieve the congestion on the Carnegie Drive corridor. It should be noted that the Northern Link Road (NLR) has been costed using the alignment as set out in the *Draft Local Plan*. The function of this link at this point in time is to relieve the Town Centre congestion on Carnegie Drive, reduce the flows in Dunfermline Town Centre and provide future development opportunities to the north of Dunfermline which could be beyond the timescales of this assessment, i.e. 2030+.

Details of the concept designs and costs of above schemes are contained in Section 7 of this Report. The costs are summarised in Table 6.9.

Table 6.9 : 2021 Alternative Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Upgrade of Coal Road/Lovers Lane	1.8
Upgrade of William Street/Pittencrief Street	3.2
Improvement to William Street/Rumblinwell Junction	2.3
Grange Drive Roundabout	0.7
Carnegie Drive Bus Gate	0.6
Northern Link Road	11.8
Total Cost	20.4

With the infrastructure in place the operational assessment of the modelled traffic is discussed as follows.

In the AM peak, with the additional development and associated infrastructure it is an improvement when compared to the Reference Case. The queue on the A823(M) approach to Pitreavie Roundabout has been maintained to similar levels to the Reference Case. Bothwell Gardens roundabout operates without excessive queueing. The Halbeath corridor operates well between Halbeath Roundabout and Halbeath Road east of Whitefield Road. The Grange Drive Link Road/Coal Road and William Street links operate well with operational queueing at the intermediate junctions.

In the PM peak there is an improvement over the Reference Case congestion. There is congestion on the south approach of A823 Queensferry Road/Grange Drive Link Road of approximately 200m. There is also queueing on the north approach Queensferry Road Carnegie Avenue roundabout of 300m. There is little queueing on the approaches to the Whitefield Road/ Halbeath Road roundabout throughout the PM period and Bothwell Gardens is operating without excessive congestion. Carnegie Drive experiences reduced congestion due to the addition of the bus gate.

6.10.1 Comparison with Reference Case

A comparison of the model statistics has been undertaken comparing the following:

- 2021 Reference Case
- 2021 Local Plan Development Phasing
- 2021 Alternative Development Phasing

Peak Hour Comparison

Table 6.10 contains a flow summary of the key links on the network for the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours for the 2021 Reference Case, Local Development Plan Phasing and Alternative Development Phasing both with external infrastructure.

Table 6.10 : 2021 External Infrastructure Peak Hour Flows (vehs/hr)

			AM			PM	
Location	**Direction**	**Ref Case**	**LDP Final**	**ALT Final**	**Ref Case**	**LDP Final**	**ALT Final**
William Street	NB	308	637	866	458	1,090	1,147
	SB	387	629	898	362	610	562
Baldridgeburn	EB	673	971	1,067	553	1,081	868
	WB	399	532	374	541	745	510
Pilmuir Street	NB	255	231	193	300	217	243
	SB	290	332	345	227	354	337
Carnegie Drive	EB	1,215	1,008	1,068	971	924	841
	WB	554	602	455	524	601	573
Townhill Street	NB	314	254	258	509	527	471
	SB	614	665	677	662	646	680
Appin Crescent	EB	643	747	666	958	1,165	1,009
	WB	1,072	1,151	1,151	663	954	985
Halbeath Rd (E)	EB	1,189	1,231	1,262	1,476	1,520	1,536
	WB	1,351	1,488	1,609	1,348	1,458	1,456
St Margarets Drive	NB	1,031	1,144	1,141	1,255	1,635	1,583
	SB	1,884	2,047	2,253	1,445	1,800	1,928
Netherton Brd St	EB	366	416	387	457	634	644
	WB	906	999	1,004	979	1,086	1,050
Queensferry Rd (N)	NB	1,153	1,124	1,129	1,388	1,472	1,330
	SB	1,413	1,412	1,590	1,150	1,233	1,349
Queensferry Rd (S)	NB	1,523	1,461	1,510	1,663	1,536	1,515
	SB	1,613	1,708	1,774	1,514	1,492	1,494
Limekilns Rd	NB	118	296	281	140	340	302
	SB	185	312	300	162	302	266
Grange Road	NB	148	338	439	234	422	388
	SB	93	131	232	205	367	329
A985 Rosyth	EB	736	816	903	747	830	849
	WB	596	748	856	796	847	838
A823(M)	EB	1,415	1,473	1,425	1,513	1,493	1,518
	WB	1,900	1,896	1,890	1,203	1,198	1,197
Coal Road	SB	229	988	1,138	352	823	693
	NB	417	696	760	637	991	980
Western Distributor Road	SB		594	683		447	268
	NB		353	335		464	351
Broomhall Road	EB		1,124	1,134		1,246	710
	WB		1,075	1,258		813	593
East Distrbutor Road	EB		1,038	1,020		1,135	706
	WB		846	942		596	433
Northern Link road	EB			235			364
	WB			481			322

It can be seen that the significant increases in traffic volumes are concentrated around Coal Road, and the distributer roads connecting each development (Western and East Distributer Road) to Queensferry Road with reductions on Carnegie Drive.

Journey Time Comparison

The journey time comparisons for the 2021 Reference Case, Local Development Plan Phasing and Alternative Development Phasing are shown in Appendix D.

The results for the Queensferry Road Corridor (Route 1) in the northbound direction for the AM period confirm that the development increases journey times in both phasing scenarios by up to 9min. This is due to the congestion on the Queensferry Road approach to Bothwell Gardens roundabout. In the PM period, the Alternative Development Phasing journey times are less than the Reference Case, with the peak journey time reducing by approximately 8min. The local plan development scenario is similar to the Reference Case at peak times.

In the southbound direction for the AM peak, the Route 1 results shows that the journey times of the Local Plan Phasing are slightly higher by up to 3min compared to the Reference Case model. The peak journey time of the Alternative Development Phasing doubles, increasing the journey time by up to 5min in comparison with the Reference Case. In the PM period, delays of up to 7min are experienced in both phasing models, when compared against the Reference Case model.

The eastbound Halbeath corridor (Route 3) in the AM period with both development scenarios, journey times remain consistent with the Reference Case. In the PM period the development journey times increase by up to 4min when compared to the Reference Case. In the westbound direction the AM period shows that both phasing scenarios experiencing slower journey times by up to 4min compared to the Reference Case. In the PM period the development scenarios provide significant benefits of up to 1hr compared to the Reference Case.

The Rumblingwell corridor (Route 5) eastbound AM and PM peak results demonstrate that the development scenarios provide a benefit in journey time of up to 6min compared to the Reference Case. A similar trend is observed in the westbound direction with the development journey time savings being up to 14min compared to the Reference Case.

Public Transport Journey Times

Table 6.11 and Table 6.12 show the average journey times for key town centre passenger transport routes for the AM and PM peak periods.

Table 6.11 : Passenger Transport Journey Time Routes (AM Period)

		2021		Differences	
AM	**Ref Case**	**LDP SLA**	**Alt Phase SLA**	**LDP - Ref Case**	**Alt Phase - Ref Case**
7 & 19 Nbd	00:26:29	00:25:40	00:28:38	- 00:00:49	+ 00:02:09
7 & 19 Sbd	00:18:14	00:19:07	00:20:17	+ 00:00:53	+ 00:02:03
33 Wbd contd 1	00:14:25	00:12:14	00:14:18	- 00:02:11	- 00:00:07
33 Ebd	00:11:26	00:11:13	00:11:15	- 00:00:14	- 00:00:11
55 Nbd	00:26:12	00:25:22	00:27:33	- 00:00:50	+ 00:01:22
Link Road Nbd	N/A	00:28:16	00:31:38	N/A	N/A
55 Sbd	00:18:55	00:20:10	00:21:39	+ 00:01:15	+ 00:02:44
Link Road Sbd	N/A	00:21:57	00:23:18	N/A	N/A

Table 6.12 : Passenger Transport Journey Time Routes (PM Period)

		2021		Differences	
PM	**Ref Case**	**LDP SLA**	**Alt Phase SLA**	**LDP - Ref Case**	**Alt Phase - Ref Case**
7 & 19 Nbd	00:43:17	00:32:09	00:27:00	- 00:11:07	- 00:16:16
7 & 19 Sbd	00:23:13	00:23:13	00:22:26	00:00:00	- 00:00:47
33 Wbd contd 1	00:26:57	00:11:59	00:10:31	- 00:14:58	- 00:16:26
33 Ebd	01:00:15	00:13:56	00:12:41	- 00:46:19	- 00:47:34
55 Nbd	00:35:29	00:29:05	00:23:16	- 00:06:23	- 00:12:12
Link Road Nbd	N/A	00:34:21	00:28:10	N/A	N/A
55 Sbd	00:24:32	00:25:15	00:23:22	+ 00:00:43	- 00:01:10
Link Road Sbd	N/A	00:23:47	00:22:40	N/A	N/A

Table 6.11 shows that in the AM period, the bus passenger journey times do not vary greatly, when comparing both the 2021 development scenarios against the 2021 Reference Case model. There are time savings of up to 1min and delays of up to 3min on southbound routes including the 55, 7 and 19.

Table 6.12 shows that during the PM period, there are significant time savings in both development scenarios for the 33 eastbound, 19 northbound and 33 westbound bus routes when compared against the 2021 Reference Case model. The exception is the 55 southbound in the 2021 local plan scenario which experiences a slight increase in journey times of approximately 45s in comparison with the Reference Case.

Global Queue Statistics

Figure 6.5 and Figure 6.6 shows the average number of vehicles queueing across the whole model for the Local Plan phasing without any infrastructure in place for the AM and PM peak period.

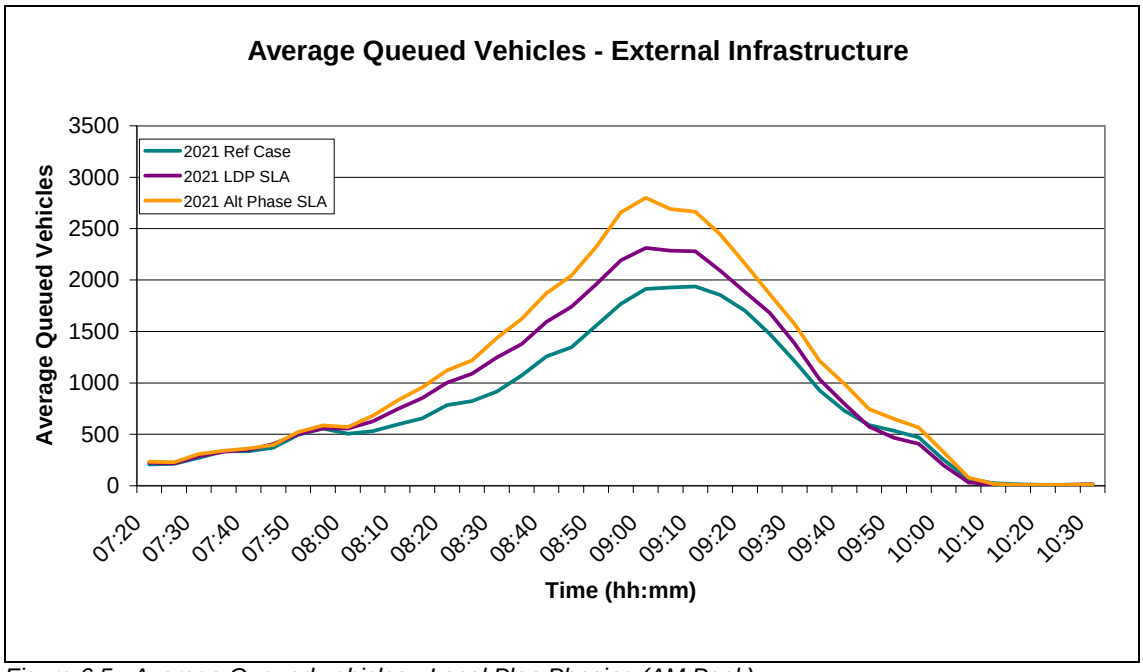

Figure 6.5 : Average Queued vehicles - Local Plan Phasing (AM Peak)

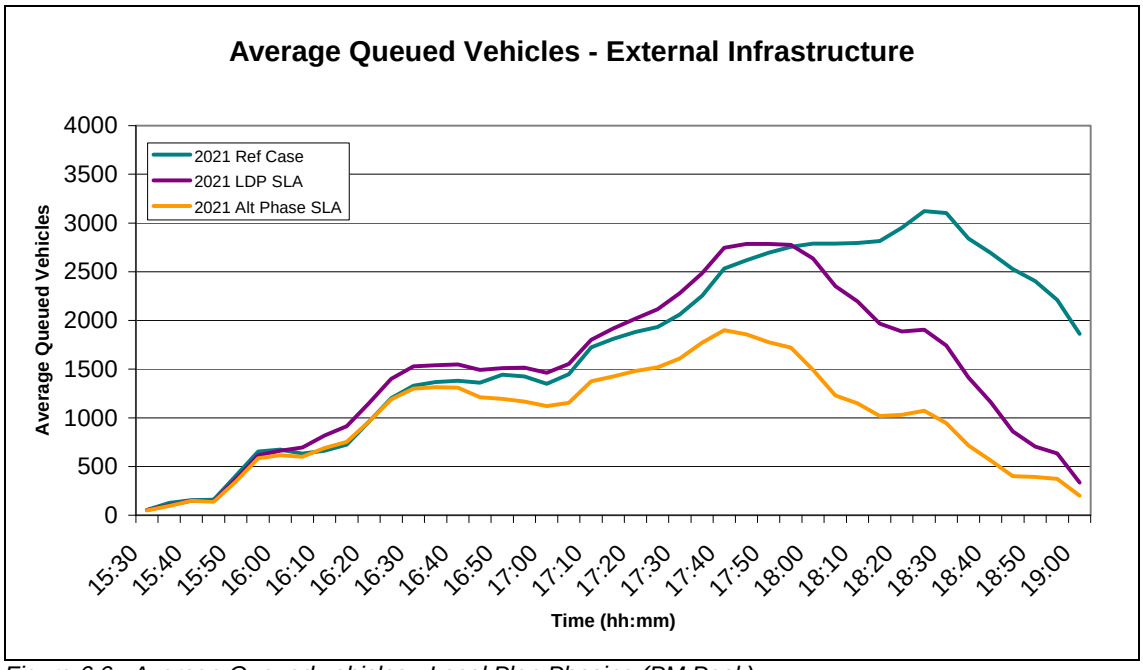

Figure 6.6 : Average Queued vehicles - Local Plan Phasing (PM Peak)

These figures demonstrate that when considering queues cross the network the measures included for both the 2025 Local Plan and Alternative Development Phasing scenarios mitigate the impact of the additional traffic associated with the development. There is an increase in the queueing in the AM peak, however, the queues in the PM peak return to a free flow network; whereas in the Reference Case the model experiences excessive congestion which does not return to free flow conditions before 19:00.

Appendix E shows the levels of queueing in the town centre cordon for the Local Plan phasing without any infrastructure in place for the AM and PM peak period. Figures E1 and E2 (Appendix E) show the levels of queueing in the town centre for the local plan and alternative phasing compared to the reference case for the AM and PM period. These figures again demonstrate a slight increase in the AM peak and a significant decrease in queueing the in PM peak within the town centre.

Network Summary Statistics

The network summary statistics have been extracted for each model and are detailed in Table 6.13. and Table 6.14 for the AM and PM period.

Table 6.13 : Network summary Statistics, 2021 External Infrastructure (AM Period)

Scenario	Total Network Time (hr)	Total Distance (km)	Vehicles	Average Network Speed (mph)	Average Journey Time (min)
Ref Case	6,165	200,739	61,503	20.2	361
Local Plan SLA	7,331	226,792	67,324	19.2	392
Alt SLA Phasing	8,034	242,137	69,382	18.7	417

Table 6.14 : Network summary Statistics, 2021 External Infrastructure (PM Period)

Scenario	Total Network Time (hr)	Total Distance (km)	Vehicles	Average Network Speed (mph)	Average Journey Time (min)
Ref Case	10,670	239,709	73,147	14.2	517
Local Plan SLA	9,497	264,699	78,898	17.4	432
Alt SLA Phasing	7,844	253,275	76,382	20.1	370

Table 6.13. and Table 6.14 support the outcomes of the queueing statistics with the measures included for both development phasing scenarios mitigating the impact of the additional traffic associated with the development.

6.11 Conclusion of 2021 Assessment

The impact of the 2021 local plan phasing is successfully mitigated by the following schemes:

- Link between Grange Drive link road and Coal Road
- Upgraded junctions at Coal Road/Lovers Loan, Coal Road/Pittencrief Street
- Junction improvement at William Street/Rumblingwell
- Improvement to the Grange Drive/Queensferry Road roundabout

The costs of the above schemes are summarised in Table 6.15.

Table 6.15 : 2021 Local Plan Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Upgrade of Coal Road/Lovers Lane	1.8
Upgrade of William Street/Pittencrief Street	3.2
Improvement to William Street/Rumblinwell Junction	2.3
Grange Drive Roundabout	0.7
Carnegie Drive Bus Gate	0.6
Total Cost	8.6

In addition to the above the impact of the 2021 alternative phasing is successfully mitigated by the following schemes:

- Carnegie Drive Bus Gate (with the alternative phasing only)
- Link between Pilmuir Street and Whitefield Road (with the alternative phasing only)

The costs of the above schemes are summarised in Table 6.16.

Table 6.16 : 2021 Alternative Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Upgrade of Coal Road/Lovers Lane	1.8
Upgrade of William Street/Pittencrief Street	3.2
Improvement to William Street/Rumblinwell Junction	2.3
Grange Drive Roundabout	0.7
Carnegie Drive Bus Gate	0.6
Northern Link Road	11.8
Total Cost	20.4

As demonstrated by the journey times, queueing statistics and the network summary statistics the schemes mitigates the impact of the development.

The exact dates that the development infrastructure is requires has not been assessed within this study, however, the funding constraints of the developer under the current economic climate does allow a level of concession in relation to the time the schemes are required.

As with all the development assumptions the employment build out rate could differ from the assumed rates in this study, e.g. if the employment uptake is less than assumed then there is scope to build more houses, however, this scenario should be assessed to consider the different trip patterns and determine the any additional impact.

When considering the alternative development scenario it is important to note that the inclusion of the Northern Link Road while it is required to facilitate the Wellwood development it has secondary opportunities which benefit the wider area, namely:

- The ability to reduce road capacity within the town centre and improve the environment
- Provide a high quality restricted zone on Carnegie Drive which is an urban environment opportunity with regards to public realm.

- Provide a link road which could serve as an access point for development onto the road network to the north of Dunfermline beyond the timescales of this study

Analysis was undertaken on the 2029 full SLA which indicates that approximately 20% of traffic using the Northern Link Road comes from the Wellwood development and a further 7% comes from the other developments. This supports the statements that this link has other functions.

6.12 2029 Reference Case

The 2029 Reference Case demands were calculated using the SESTRAN model and do not include any SLA development trips. As with the 2015 and 2021 Reference Case, the trips associated with the TESCO to be located off Carnegie Drive are included.

Initial model runs were undertaken to identify, if any, areas of the network which do not have the capacity to accommodate the assigned traffic demands. In the AM peak, the main areas of congestion are:

- Rumblingwell/William Street (AM peak)
- Sinclair Gardens/Bothwell Gardens roundabout (AM Peak)
- A823(M) approach to Pitreavie roundabout (AM Peak)
- Queensferry Road approach to Bothwell Gardens roundabout (PM Peak)
- Whitefield Road/Halbeath Road junction

An iterative procedure was undertaken to relieve these congested areas and from this the following schemes would be required by 2029:

- Widening of Pitreavie roundabout north approach
- Improvement to Rumblingwell/William Street
- Signalisation of Kings Road Roundabout

With the infrastructure in place the operational assessment of the modelled traffic is discussed as follows.

In the AM peak, the network operation is very congested. The Rumblingwell/William Street Junction is very congested, as is Sinclair Gardens and Bothwell Gardens roundabout. There is also congestion on the Carnegie Drive extending through Sinclair Gardens roundabout and along the Halbeath corridor back to Linburn Roundabout. There is also congestion on all approaches, however, the queue on the A823(M) extends back almost to the M90.

The PM peak is also very congested. There is congestion on the William Street/Rumblingwell Junction which extends down Coal Road. There is also queueing from Carnegie Drive which extends onto Sinclair Gardens and along Halbeath Road beyond Linburn Roundabout. There is also queueing on the north approach to Pitreavie roundabout and the south approach to the Kings Road/A907 roundabout.

6.13 2029 with Full SLA Development

The impact that the development uptake would have on the existing network was considered as part of this assessment. The objective was to consider what would be the impact on the highway network if no interventions were constructed until the developments were completed.

The 2029 Full SLA Development includes the following:

- 100% Broomhall Employment and Residential development (126.2Ha/1,972 Units)
- 100% Wellwood Employment and Residential development (22.4Ha/1,085 Units
- 100% Liggar Bridge Employment and Residential development (2.4Ha/1,063 Units)
- 100% Berrylaw Employment and Residential development (9.8 Ha/665 Units)

Initial model runs were undertaken to identify, if any, areas of the network which do not have the capacity to accommodate the assigned traffic demands. The main areas of congestion are:

- Rumblingwell/William Street
- Pilmuir Street
- Halbeath Corridor
- Netherton Broad Street
- Sinclair Gardens
- Pitreavie Roundabout/Rosyth Area

To relieve these congested areas the following schemes would be required by 2029 for the local plan phasing scenario in addition to those stated in the 2021 assessment:

- Northern link road between Pilmuir Street and Whitefield Road
- Signalisation of Kings Road/A985

The Northern Link Road and the bus gate are required in 2021 with the alterative phasing however the signalisation of the Kings Road junction with the A985 is require in 2029.

Considering the projected flows associated with all SLA developments the Northern link road should be two-way single carriageway.

It is acknowledged that the 2029 scenario is busy, but the congestion is not excessive. With the infrastructure in place the operational assessment of the modelled traffic is discussed as follows.

In the AM peak, with all the additional development and associated infrastructure in place it is an improvement when compared to the Reference Case. The queue on the A823(M) approach to Pitreavie Roundabout is reduce to operational levels, however, the south approach of Pitreavie roundabout is busy but is operating well. The A985 is also congested on the east approach to the Queensferry Road/Castlandhill Road. The junction between Rumblingwell and William Street is congested as is the Halbeath corridor and Bothwell Gardens roundabout, but the congestion is not excessive.

In the PM peak there is an improvement over the Reference Case congestion. There is congestion on the south approach of A823 Queensferry Road/ Grange Drive Link Road of approximately 600m. There is also queueing on the north approach to Queensferry Road Carnegie Avenue roundabout of 400m. There is a queue on the A985 East Approach to the A985/Limekilns Road junction. There is little queueing on the approaches to the Whitefield Road/ Halbeath Road roundabout throughout the PM period and Bothwell Gardens is operating without excessive congestion. There are queues on the east approach to Sinclair Gardens roundabout extending east the Halbeath corridor to Linburn roundabout.

In the modelled distribution taken from the SESTRAN model there are a number of trips from the SLA development assigned to travel through Rosyth and with the scope of this microsimulation model the routeing does not react and re-route due to the queues on the M90 approach to the Forth Road Bridge or any additional congestion in Rosyth. A sensitivity test was undertaken which adjusted the distribution from the SLA's to use Pitreavie roundabout as the preferred route to the Forth Road Bridge and this was observed to reduce the congestion in Rosyth to levels similar to the Reference Case. This demonstrates the importance of maintaining sufficient capacity at Pitreavie Roundabout to ensure that this is the preferred route for SLA development traffic.

6.13.1 2029 Comparison with Reference Case

A comparison of the model statistics has been undertaken comparing the following:

- 2029 Reference Case
- 2029 External Infrastructure with Full SLA Development

The statistics that have been compared are:

- Peak Hour Flows
- Journey times for key corridors
- Public transport journey times
- Global and town centre queue statistics
- Global network statistics

Peak Hour Flow Comparison

Table 6.17 contains a flow summary of the key links on the network for the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours for the 2029 Reference Case and External Infrastructure with Full SLA Development.

Table 6.17 : 2029 External Infrastructure with Full SLA Development Peak Hour Flows (vehs/hr)

		AM		PM	
Location	**Direction**	**Ref Case**	**SLA**	**Ref Case**	**SLA**
William Street	NB	347	967	384	1,597
	SB	305	1,016	272	765
Baldridgeburn	EB	1,161	1,104	963	966
	WB	599	451	709	569
Pilmuir Street	NB	273	279	267	302
	SB	410	495	487	463
Carnegie Drive	EB	1,205	1,185	1,004	955
	WB	795	536	893	605
Townhill Street	NB	247	275	484	561
	SB	672	687	677	796
Appin Crescent	EB	735	696	1,039	1,107
	WB	1,145	1,148	893	898
Halbeath Rd (E)	EB	1,477	1,485	1,579	1,511
	WB	1,464	1,718	0	1,719
St Margarets Drive	NB	1,118	1,322	1,532	1,854
	SB	2,059	2,361	1,730	2,079
Netherton Brd St	EB	450	513	745	737
	WB	1,065	1,031	868	1,087
Queensferry Rd (N)	NB	1,150	1,231	1,093	1,618
	SB	1,328	1,620	1,210	1,422
Queensferry Rd (S)	NB	1,551	1,604	1,667	1,734
	SB	1,555	1,744	1,486	1,536
Limekilns Rd	NB	93	227	169	282
	SB	260	344	140	324
Grange Road	NB	143	369	173	347
	SB	149	216	231	486
A985 Rosyth	EB	894	867	758	740
	WB	785	788	830	895
A823(M)	EB	1,213	1,225	1,553	1,553
	WB	1,703	1,785	1,193	1,178
Coal Road	SB	654	1,265	550	849
	NB	467	898	433	1,454
Western Distributor Road	SB		869		390
	NB		369		789
Broomhall Road	EB		1,013		1,337
	WB		1,241		930
East Distrbutor Road	EB		933		1,118
	WB		1,050		827
Northern Link road	EB		375		709
	WB		692		516

It can be seen from Table 6.17 that the flows on new infrastructure are well used in both the AM and PM peak periods. The flows on William Street has increased as well as Coal Road which is expected given their proximity to the developments. The flows on Queensferry Road have increased with the SLA in place. The flows on Carnegie Drive have reduced compared to the Reference Case due to the introduction of the Bus Gate.

Journey Time Comparison

The journey time comparisons for the 2029 Reference Case and 2029 External Infrastructure with Full SLA Development are shown in Appendix F.

The Queensferry Road corridor (Route 1) northbound analysis shows that with the full SLA in place with the associated infrastructure in the AM period the journey times is significantly better that the 2029 Reference Case with journey time saving of up to 50min. In the PM period there is journey time savings of up to 7min with the full SLA in place compared with the Reference Case model.

In the Southbound direction AM period, the results show that with the full SLA in place the peak journey time has reduced from approximately 7min in the Reference Case to 4.5min. In the PM peak the journey times are similar in both scenarios.

The Halbeath corridor (Route 3) eastbound results show that with the full SLA in place the journey times in the AM period will remain the similar in both scenarios. In the PM, the results show that there are increased journey times of up to 6min with the full SLA and associated infrastructure. In the westbound direction in both the AM and PM peaks the journey times with the SLA in place are improved when compared to the Reference Case.

The Rumblingwell corridor (Route 5) in the eastbound direction results for both the AM and PM peaks demonstrate that the journey times remain similar to the Reference Case. In the Westbound direction the journey times are significantly improved when compared to the Reference Case with reduction by up to 18min.

Public Transport Journey Times

Table 6.18 and Table 6.19 show the average journey times for key town centre passenger transport routes for the AM and PM peak periods.

Table 6.18 : Passenger Transport Journey Time Routes (AM Period)

		2029	
AM	**Ref Case**	**Full SLA**	**Difference**
7 & 19 Nbd	00:26:55	00:33:53	+ 00:06:59
7 & 19 Sbd	00:22:23	00:26:32	+ 00:04:10
33 Wbd contd 1	00:13:54	00:13:49	- 00:00:05
33 Ebd	00:12:25	00:12:49	+ 00:00:24
55 Nbd	00:26:46	00:37:12	+ 00:10:26
Link Road Nbd	N/A	00:40:37	N/A
55 Sbd	00:23:37	00:26:44	+ 00:03:07
Link Road Sbd	N/A	00:27:08	N/A

Table 6.19 : Passenger Transport Journey Time Routes (PM Period)

PM	Ref Case	2029 Full SLA	Difference
7 & 19 Nbd	00:53:33	00:25:20	- 00:28:13
7 & 19 Sbd	00:23:15	00:25:10	+ 00:01:55
33 Wbd contd 1	00:23:34	00:11:49	- 00:11:45
33 Ebd	00:25:11	00:15:30	- 00:09:41
55 Nbd	00:45:33	00:21:42	- 00:23:51
Link Road Nbd	N/A	00:26:22	N/A
55 Sbd	00:25:49	00:27:08	+ 00:01:19
Link Road Sbd	N/A	00:28:13	N/A

Table 6.18 shows that in the AM peak period with the SLA in place, there are significant delays to bus routes travelling from Rosyth to the town centre, Route 7, 19 and 55, where buses experience an increase in journey times of 15min when compared to the 2029 Reference Case. Route 33 and 55 experiences slight delays. The bus route "link Road Nbd" which access the town centre via the new infrastructure through Broomhall and Coal Road demonstrates that choosing this route and avoiding Bothwell Gardens roundabout can maintain journey time comparable to the Reference Case.

Table 6.19 shows that during the PM peak period in 2029, there are significant time savings for all routes apart from Route 7 and 19 Southbound, which experience a slight delay, when compared to the 2029 Reference Case model.

Global Queue Statistics

Figure 6.7 and Figure 6.8 shows the average number of vehicles queueing across the whole model for the Local Plan phasing without any infrastructure in place for the AM and PM peak period.

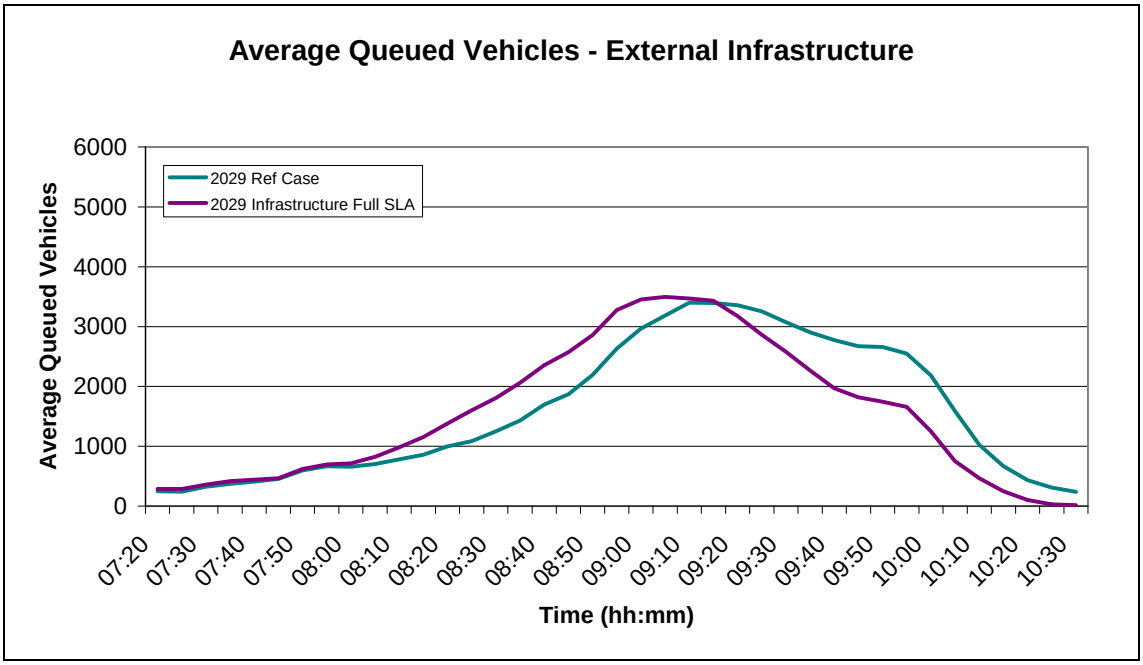

Figure 6.7 : Average Queued Vehicles - Local Plan Phasing (AM Peak)

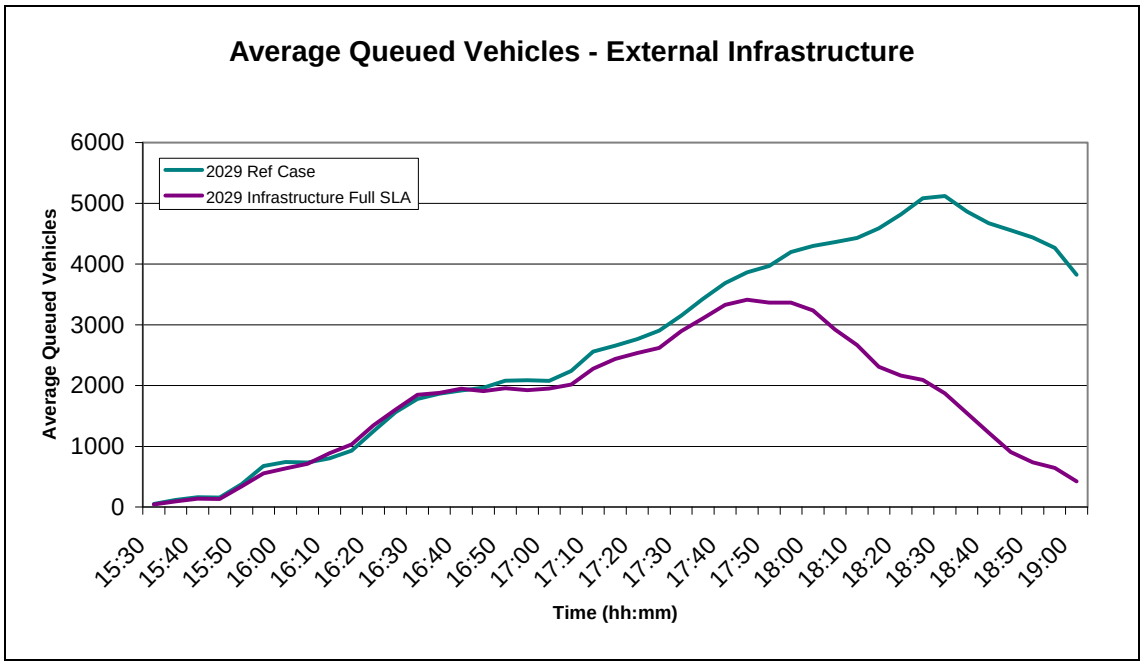

Figure 6.8 : Average Queued Vehicles - Local Plan Phasing (PM Peak)

In the AM peak the levels of queueing are similar to the Reference Case whereas the levels of queueing in the PM peak are significantly reduced when compared to the Reference Case. These figures demonstrate that when considering queues cross the network the measures included for the 2029 Local Plan Development scenario mitigate the impact of the additional traffic associated with the development.

Appendix G contains figures showing the levels of queueing in the town centre cordon for the Local Plan phasing without any infrastructure in place for the AM and PM peak period.

These figures demonstrate that when considering queues in the town centre the measures included for both development phasing scenarios mitigate the impact of the additional traffic associated with the development. The Local Plan phasing shows a benefit to the town centre in both the AM and PM peaks with reducing queueing levels.

Global Summary Statistics

The network summary statistics have been extracted for each model and are detailed in Table 6.20 and Table 6.21 for the AM and PM period.

Table 6.20 : Network summary Statistics – AM Period

Scenario	Total Network Time (hr)	Total Distance (km)	Vehicles	Average Network Speed (mph)	Average Journey Time (min)
Ref Case	8,998	221,436	66,002	15.3	491
Local Plan SLA	11,260	265,974	74,878	14.7	541

Table 6.21 : Network summary Statistics – PM Period

Scenario	Total Network Time (hr)	Total Distance (km)	Vehicles	Average Network Speed (mph)	Average Journey Time (min)
Ref Case	16,654	262,991	77,378	9.8	775
Local Plan SLA	11,475	299,904	86,400	16.2	478

Table 6.20 and Table 6.21 support the outcomes of the queueing statistics with the measures included for both development phasing scenarios mitigating the impact of the additional traffic associated with the development. The AM peak average network speed is similar, however, the PM peak demonstrates a significant improvement.

6.14 Summary of 2029 SLA Assessment

The impact of the 2029 SLA local development phasing scenario is mitigated by the following schemes:

- Northern link road between Pilmuir Street and Whitefield Road
- Widening of north approach to Pitreavie roundabout
- Signalisation of Kings Road/A985

It should be noted that with the alternative phasing scenario the Northern Link Road is required in 2021.

The costs of the above schemes are summarised in Table 6.22.

Table 6.22 : 2029 Local Plan Phasing Scheme Cost Summary

Scheme Location	Scheme Cost (£m)
Northern Link Road	11.8
Widening of north approach to Pitreavie roundabout	0.2
Signalisation of Kings road	1.0
Total Cost	13.0

As demonstrated by the journey time, queueing statistics and network summary statistics the schemes successfully mitigate the impact of the development.

6.15 Summary of Interventions

A summary of the interventions and the stage they are required is presented in Table 6.23 to Table 6.25 for the Reference Case, the Local Plan Phasing and the Alternative Development Phasing.

Table 6.23 : Summary of Interventions – Reference Case

Scheme	Cost (£m)	2015	2021	2029
Halbeath Road/ Whitefield Road Junction	1.0		✓	
Bothwell Gardens Roundabout	0.3		✓	
Pitreavie Roundabout Signalisation	0.5		✓	
Pitreavie Rbt Widening	0.2			✓
Rumblingwell/ William Street Junction	2.3			✓
Kings Road Signals	1.0			✓
Total Cumulative Cost (£m)		0	1.8	5.3

Table 6.24 : Summary of Interventions – Local Plan Phasing

Scheme	Cost (£m)	2015	2021	2029
Grange Drive Link Road	4.4	✓		
Halbeath Road/ Whitefield Road Junction	1.0	✓		
Bothwell Gardens Roundabout	0.3	✓		
Pitreavie Roundabout Signalisation	0.5	✓		
Rumblingwell/ William Street Junction	2.3		✓	
William Street/Pittencrief Street Junction	3.2		✓	
Carnegie Drive Bus Gate	0.6		✓	
Coal Road/Lovers Loan	1.8		✓	
Grange Drive/ Queensferry Road Rbt	0.7		✓	
Northern Link Road	11.8			✓
Kings Road Signals	1.0			✓
Pitreavie Rbt Widening	0.2			✓
Total Cumulative Cost (£m)		6.2	14.8	27.8

Table 6.25 : Summary of Interventions – Alternative Development Phasing

Scheme	Cost (£m)	2015	2021	2029
Grange Drive Link Road	4.4	✓		
Halbeath Road/ Whitefield Road Junction	1.0	✓		
Bothwell Gardens Roundabout	0.3	✓		
Pitreavie Roundabout Signalisation	0.5	✓		
Rumblingwell/ William Street Junction	2.3		✓	
William Street/Pittencrief Street Junction	3.2		✓	
Carnegie Drive Bus Gate	0.6		✓	
Coal Road/Lovers Loan	1.8		✓	
Grange Drive/ Queensferry Road Rbt	0.7		✓	
Northern Link Road	11.8		✓	
Kings Road Signals	1.0			✓
Pitreavie Rbt Widening	0.2			✓
Total Cumulative Cost (£m)		6.2	26.6	27.8

It can be seen from these tables that a proportional level of infrastructure to accommodate the four SLAs in Dunfermline.

The notable impact of the Alternative Development Phasing is the Northern Link Road is required to be constructed by 2021.

To put the interventions in a financial context Table 6.26 shows the potential level of investment required over the appraisal period.

Table 6.26 : Summary of Interventions Cost Summary

Year	Scheme Cost (£m)
2015	6.2
2021 Local Plan Phasing	8.6
2021 Alternative Phasing	20.4
2029 Local Plan Phasing	13
2029 Alternative Phasing	1.2

To put the interventions in context the location of each intervention is listed as follows and shown in Figure 6.9:

1. Linburn Roundabout (£1.0m)
2. Bothwell Gardens Roundabout (£200k)
3. Signalisation of Pitreavie Roundabout (£500k)
4. Widening of north approach to Pitreavie roundabout (£200k)
5. William Street/Rumblingwell Junction (£2.3m)
6. William Street/Pittencriff Street (£3.2m)
7. King's Road Signals
8. Northern Link Road (£11.8m)
9. Grange Drive/ Queensferry Road Roundabout Improvements (£700k)
10. Grange Drive Link Road (£1.0m)
11. Grange Road/Grange Drive Link Road (not costed)
12. Limekilns Road junction with development (not costed)
13. Coal Road/Lovers Loan (£1.8m)
14. Carnegie Drive Bus Gate (£600k)

The total cost of the schemes that have been costed is £27.8m. If should be noted that there is potential for efficiency savings on some of the schemes which are outlined in this section.

It should be noted that these schemes are to demonstrate the required level of infrastructure allows the development to be delivered. This may not be the only solution and there may be alternatives which could be investigated through detailed analysis.

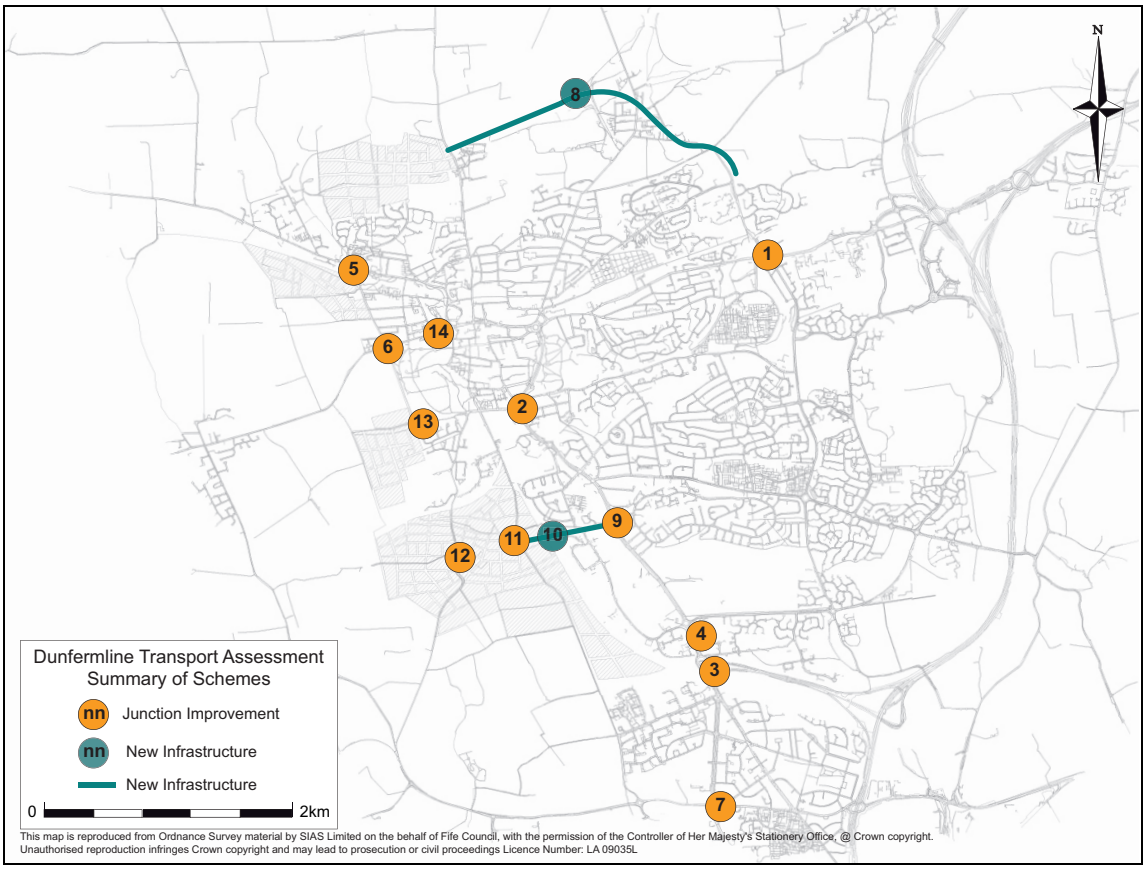

Figure 6.9 : Scheme locations

6.15.1

7 SCHEME SUMMARY

7.1 Introduction

The following schemes, shown in Figure 6.9, have been costed and a concept design has been developed to illustrate the schemes outlined in this appraisal:

1. Halbeath Road/ Whitefield Road Junction (£1.0m)
2. Bothwell Gardens Roundabout (£300k)
3. Signalisation of Pitreavie Roundabout (£500k)
4. Widening of north approach to Pitreavie roundabout (£200k)
5. William Street/Rumblingwell Junction (£2.3m)
6. William Street/Pittencriff Street (£3.2m)
7. King's Road Signals (£1.0m)
8. Northern Link Road (£11.8m)
9. Grange Drive/ Queensferry Road Roundabout Improvements (£700k)
10. Grange Drive Link Road (£4.4m)
11. Grange Road/Grange Drive Link Road (not costed)
12. Limekilns Road junction with development (not costed)
13. Coal Road/Lovers Loan (£1.8m)
14. Carnegie Drive Bus Gate (£600k)

The total cost of the schemes that have been costed is £27.8m.

It should be noted that these schemes are to demonstrate the required level of infrastructure that allows the development to be delivered. This may not be the only solution and there may be alternatives which could be investigated through more detailed analysis.

The location of each scheme is shown in Figure 7.1.

Scheme concept designs have not been drawn up for the junctions which are not in the SLA developments red line boundaries, but illustrations from the S-Paramics model of the junction arrangements have been included in this section. Larger drawings are contained in Appendix H.

The costs have considered the following issues:

- Land Availability
- Utilities
- Infrastructure
- 10% contingency
- 2011 prices

It should be noted that the scheme costs exclude optimism bias which is currently 44% for a Stage 1 *Design Manual for Roads and Bridges* (*DMRB)* assessment.

7.2 Halbeath Road/Whitefield Road Junction

Intervention is required at the junction of Whitefield Road and Halbeath Road in the form of a roundabout shown in Figure 7.1. This scheme is required around 2015 when the first phase of SLA development is in place.

This scheme makes a significant relief to the local road network. This scheme also provides good accessibility into Queen Margaret Hospital. This scheme was identified as part of the Dunfermline Bus Priority Study (SIAS 2008) and has been costed at £1.0m in 2011 prices. The scheme includes provision for pedestrians and cyclists.

It is noted that the movement from Halbeath Road (west) to Linburn Road is a banned turn. This is likely to result in some form of re-routeing and possible additional infrastructure may be required to mitigate this.

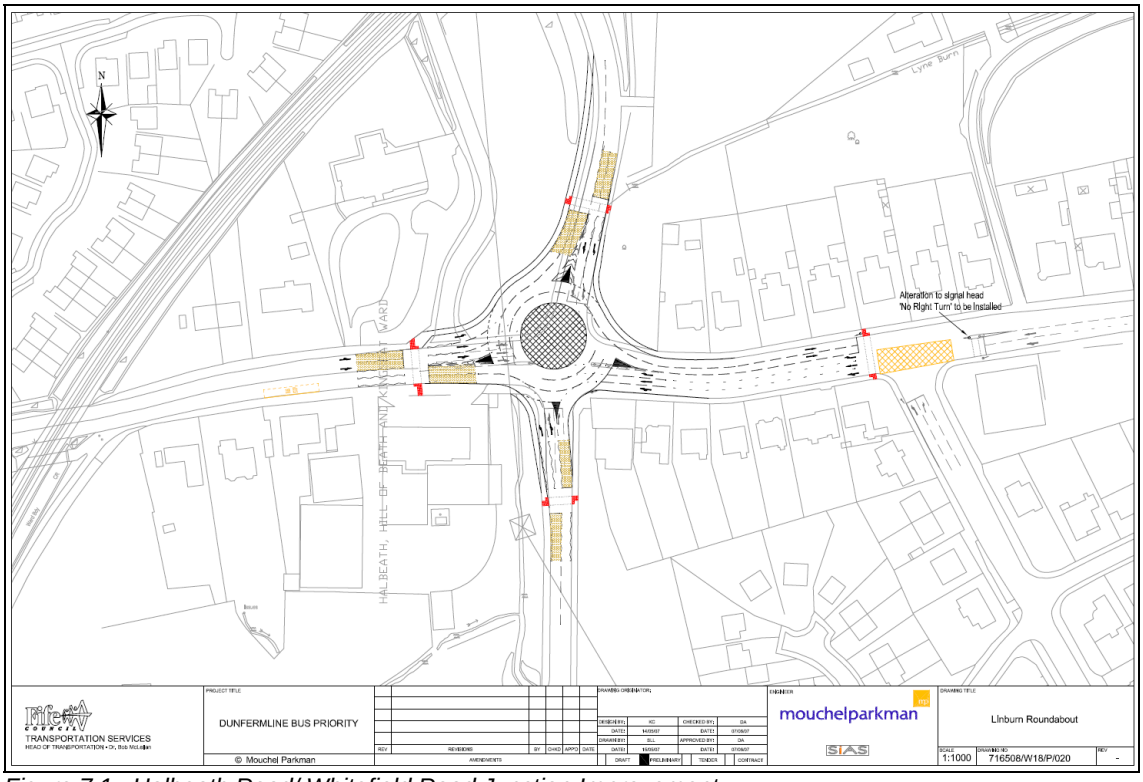

Figure 7.1 : Halbeath Road/ Whitefield Road Junction Improvement

7.3 Bothwell Gardens Roundabout

Intervention is required at Bothwell Gardens around 2015 with the first phase of the SLA in the form of a signalised interchange accommodating the rail viaduct which bisects the roundabout. The proposed scheme utilises the existing roundabout and incorporates signals to maximize the throughput at the junction. This scheme also provides a direct route eastbound from St Margarets Drive to Netherton Broad Street. This scheme is illustrated in Figure 7.2.

It is expected that the detailed design will include the existing pedestrian crossing across Netherton Broad Street albeit it might be in a slightly different location. The existing pedestrian crossing on the Queensferry Road approach is unaffected by this scheme.

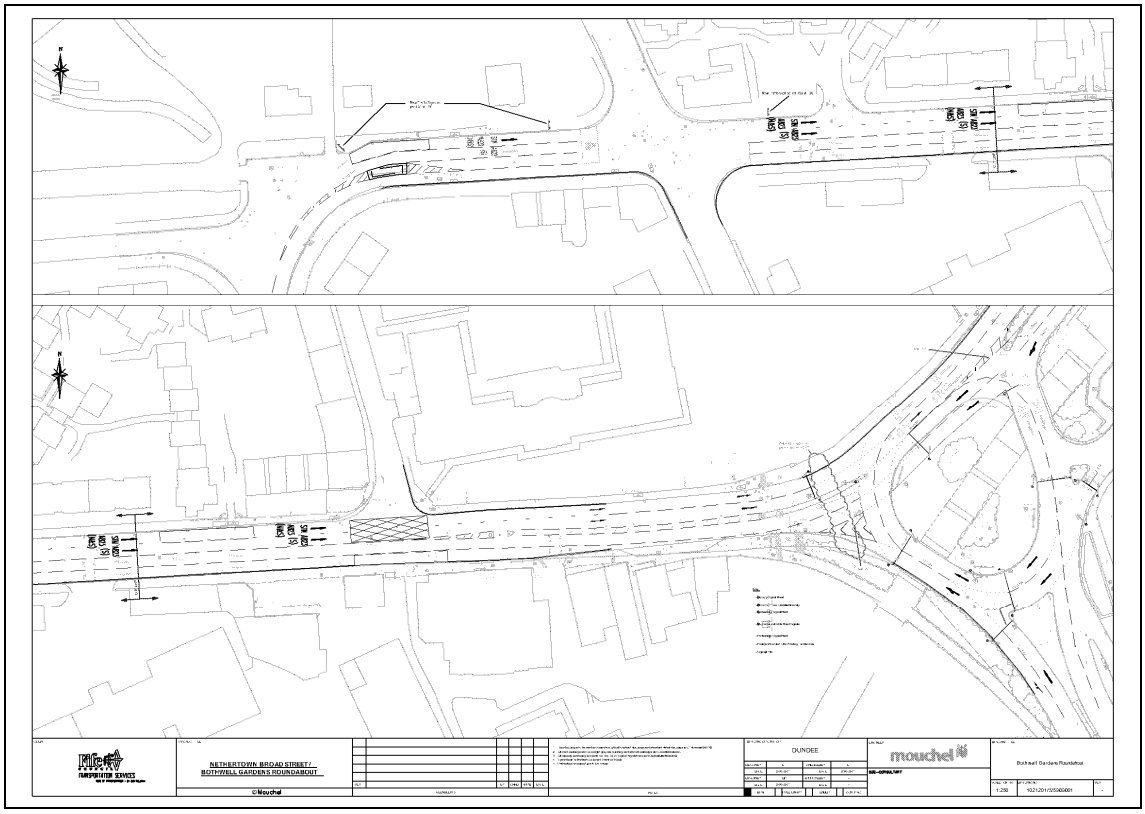

Figure 7.2 : Bothwell Gardens Roundabout

This scheme is estimated to cost £280k in 2011 prices. The assumptions that have been applied in the cost are:

- Horizontal alignment was designed in accordance with FC Standards. No vertical design was carried out at this stage.
- Adverse crossfall present on two lanes travelling West from St Margarets Dr (A823) to B9156. The level of the carriageways travelling underneath the railway must allow the required head room for large vehicles. Insufficient distance from the carriageways directly underneath the railway to the horizontal curve may restrict the required raise in levels to achieve the desired crossfall. Recommend further investigation of achievable vertical alignment.
- The width of the lanes between A823 (St Margarets Dr) and the B9156 (Netherton Broad Street) has been increased to 4m to rovide vehicles a smooth swept path round the proposed island.

- Localised pinch points on the footway outside the Brig Fish and Chip Bar.

7.4 Signalisation of Pitreavie Roundabout

Mitigation is require required at the A823 Queensferry Road/A823(M) roundabout in 2015 when the first Phase of the SLA development in the form of signalisation of Pitreavie Roundabout. This is required as excessive congestion builds up on the A823(M) in the AM peak.

This scheme was identified as part of the Rosyth Park and Choose scheme recently promoted by Transport Scotland and FC, where the Planning Application was submitted in 2008. The result of this scheme is a balance of queues across all the approaches to the roundabout. Figure 7.3 provides an illustration of the scheme.

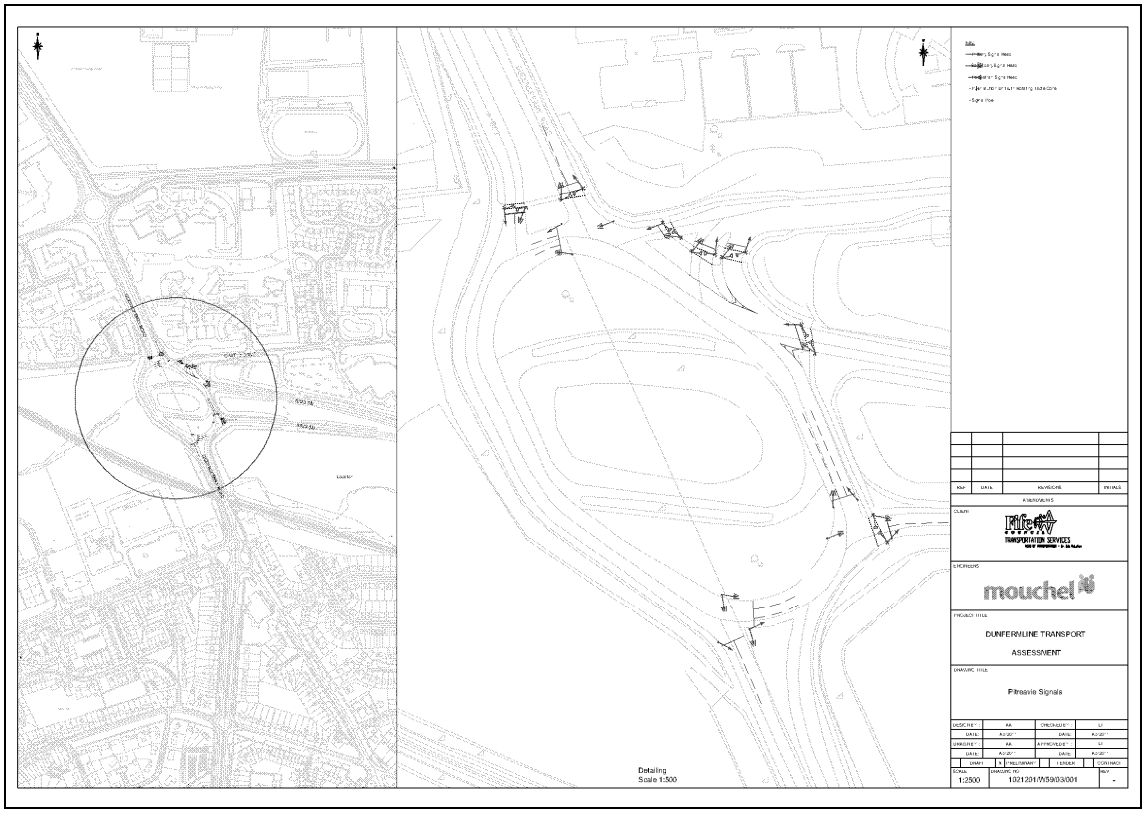

Figure 7.3 : Pitreavie Roundabout Signalisation

This scheme has been identified as part of this study and has been costed at £500k in 2011 prices.

7.5 Widening of north approach to Pitreavie roundabout

A scheme is required where the north approach to Pitreavie roundabout is widened to three lanes and is 300m long. In addition the dedicated Sky exit onto the A823(M) is removed and the circulating carriageway is widened to accommodate three lanes. This is illustrated in Figure 7.4. A 3m shared pedestrian/cycleway should be provided on the widened approach.

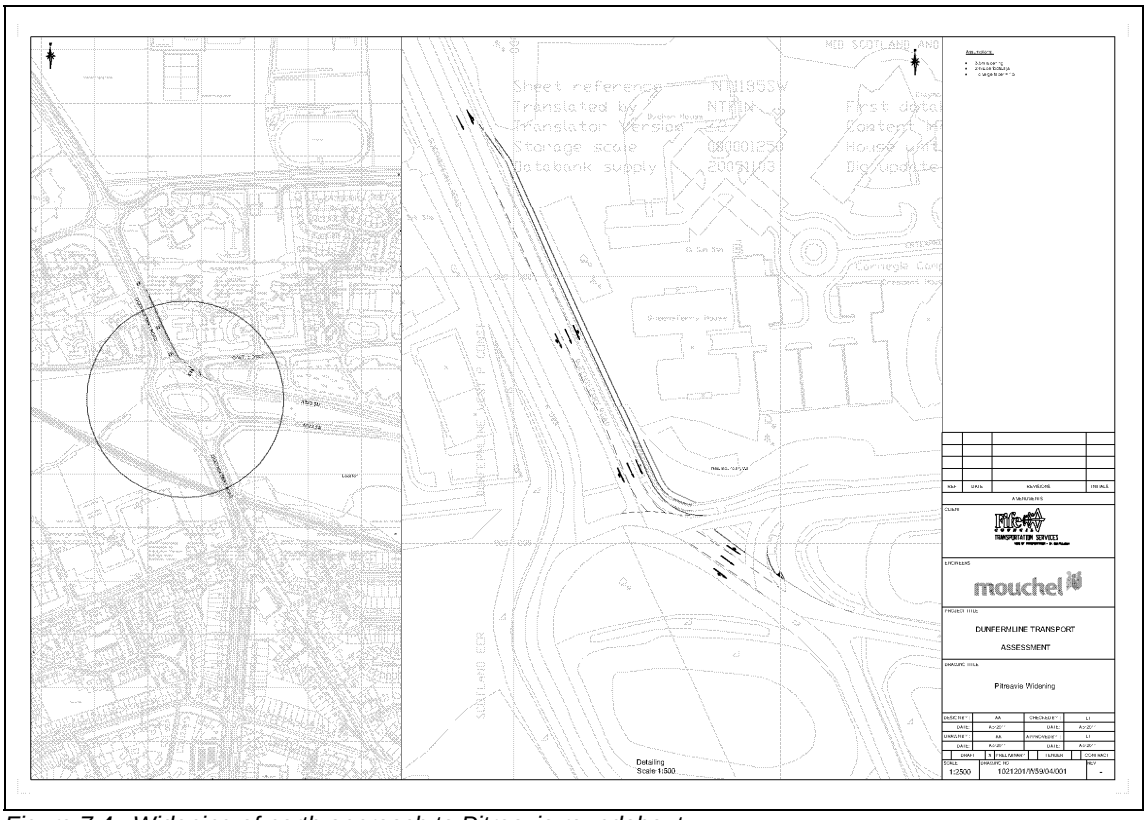

Figure 7.4 : Widening of north approach to Pitreavie roundabout

This scheme has been identified as part of this study and has been costed at £200k in 2011 prices.

7.6 William Street/Rumblingwell Junction

A scheme within the area shown in Figure 7.5 is required to provide additional capacity at the William Street/Rumblingwell Junction. A solution can be developed within the developers land however alternative solutions can be developed which could satisft the same objective. It is expected that through the detailed design process pedestrian and cycle crossing facilities on the approaches will be included.

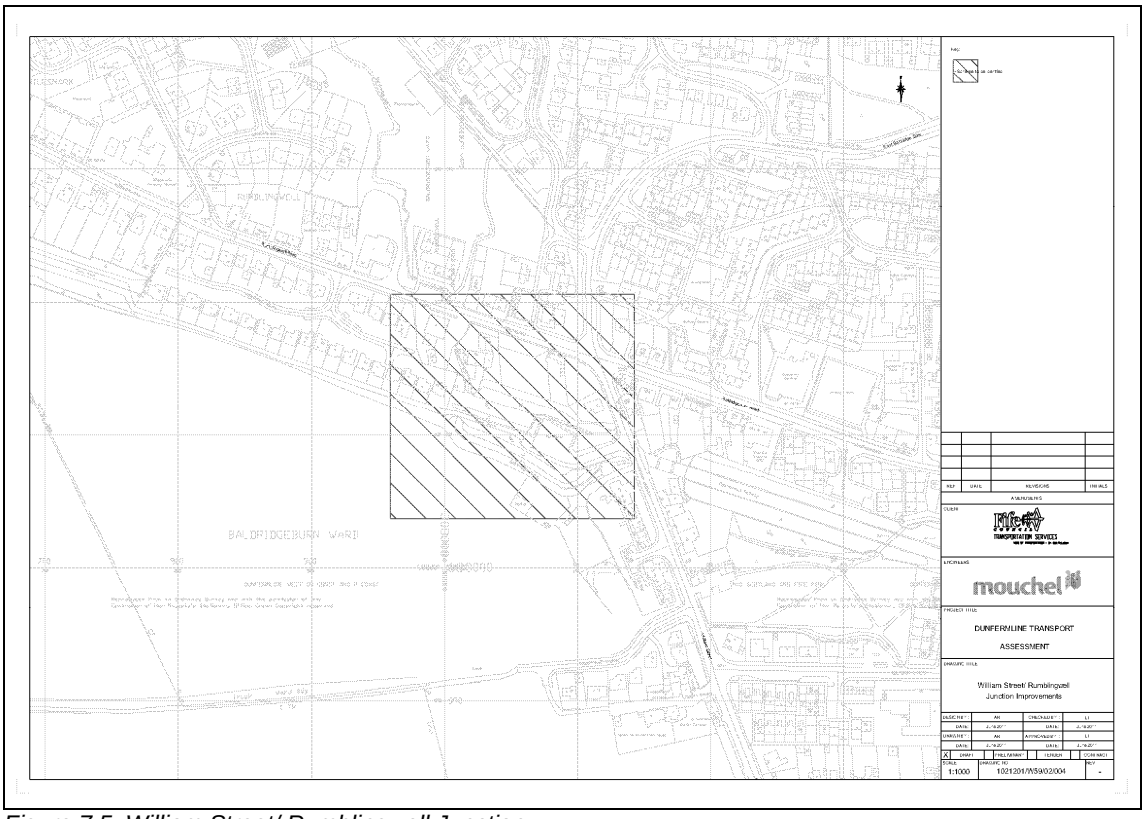

Figure 7.5 :William Street/ Rumblingwell Junction

This schemes investigated in this study have identified, taking account the level of capacity required, that the scheme is likely to cost around £2.3m in 2011 prices.

7.7 William Street/Pittencrieff Street

A scheme within the area shown in Figure 7.6 is required to provide additional capacity at the William Street/Pittencrieff Street signalised junction. A solution can be developed within the developers land however alternative solutions can be developed which could satisfy the same objective. It is expected that through the detailed design process pedestrian and cycle crossing facilities on the approaches will be included.

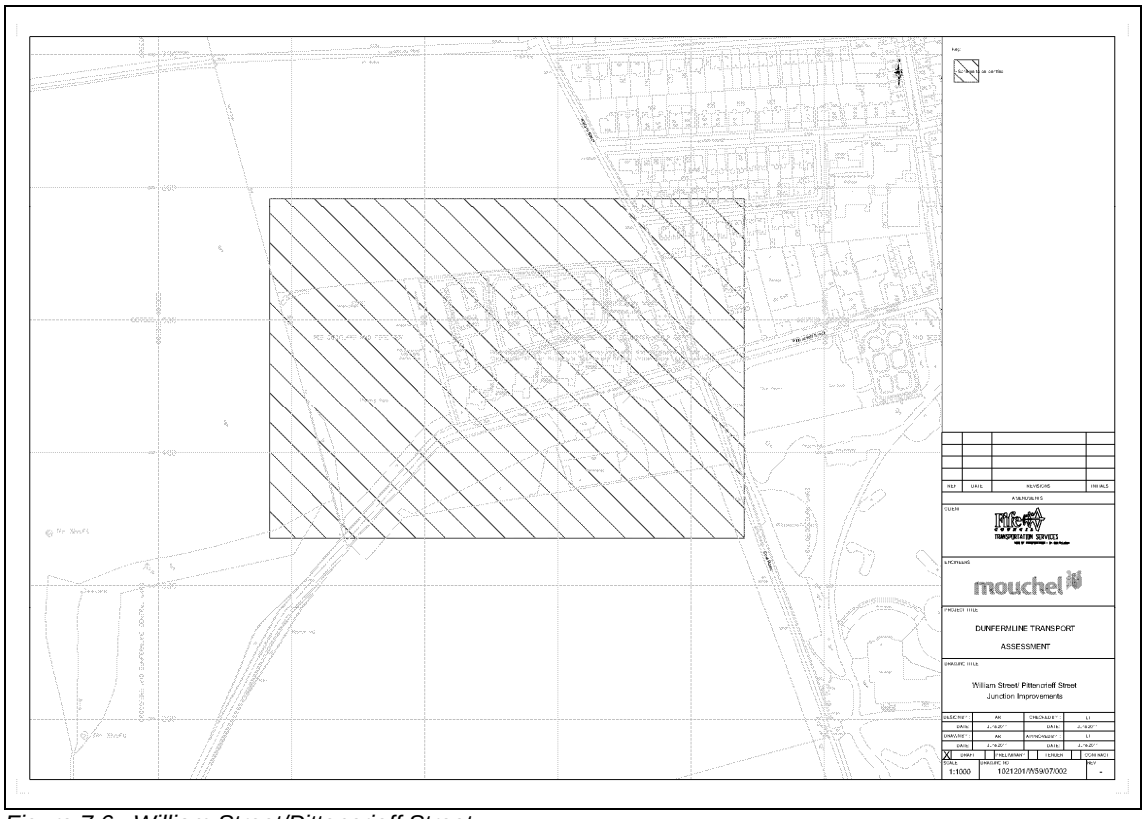

Figure 7.6 : William Street/Pittencrieff Street

This schemes investigated within this study have identified, taking account the level of capacity required, that the scheme is likely to cost around £3.2m in 2011 prices.

7.8 King's Road Signals

A scheme is required where the existing Kings Road/A985 junction is reconfigured into a signalised junction. The scheme is illustrated in Figure 7.7.

It is expected in the detailed design that adequate cyclist/pedestrian facilities will be provided to allow connection with the cycle network and local footway connections.

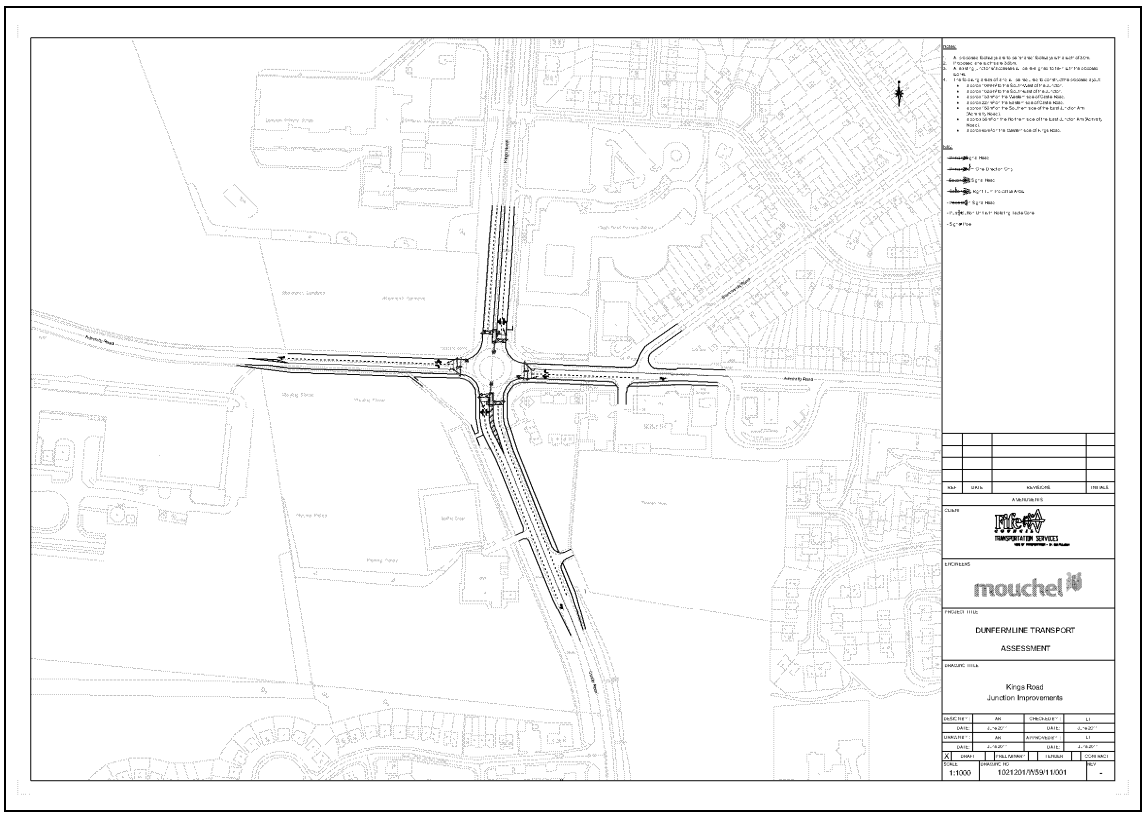

Figure 7.7 : Kings Road Signals

This scheme has been identified as part of this study and has been costed at £1.0m in 2011 prices.

7.9 Northern Link Road

Mitigation is required in the form of a northern link road between Pilmuir Street and Whitefield Road. Figure 7.8, demonstrates the alignment of the Link Road which is consistent with the indicative route contained in the Dunfermline and West Fife Local Plan *(Map DUN077)*.

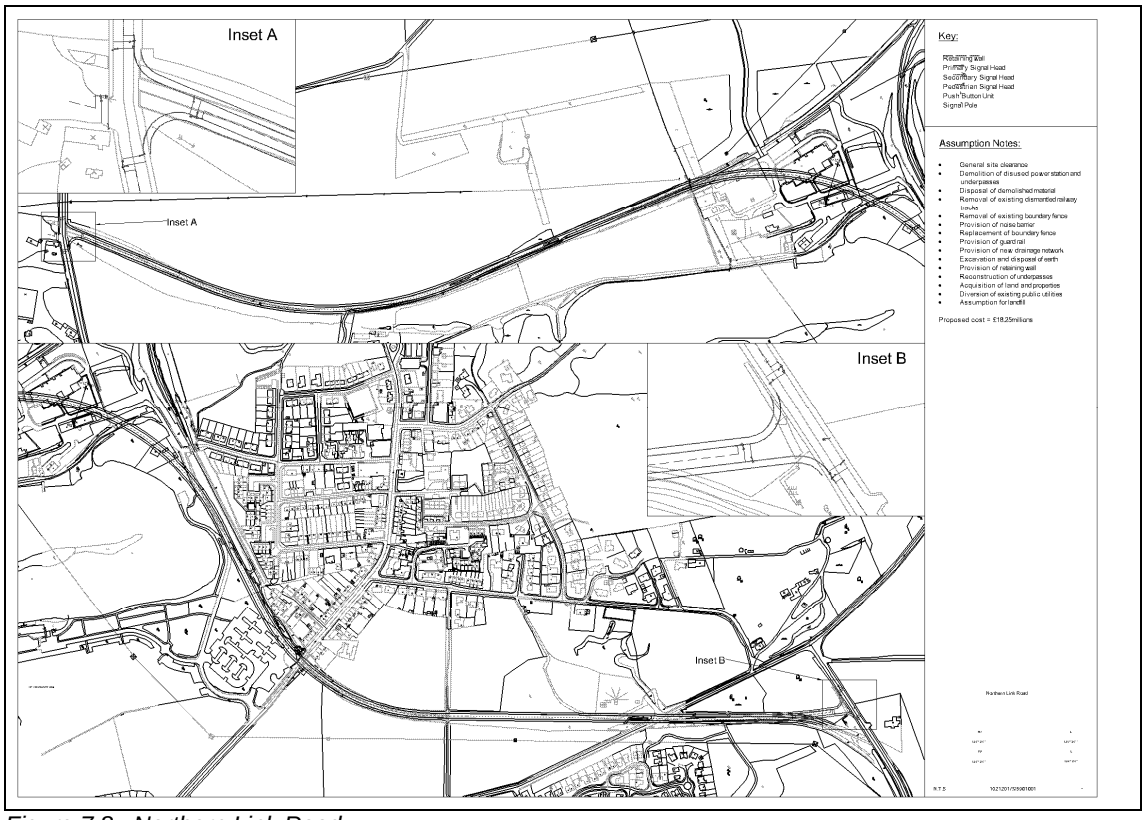

Figure 7.8 : Northern Link Road

At the Whitfield Road junction, signalisation is required to manage the flow of traffic through the junction. The junction to the east is the existing Whitefield Road, and the west junction is with Pilmuir Road.

The scheme has been costed at £11.8m in 2011 prices. It should be noted that if the Townhill Road and Kingseat Road crossings assume underpasses then the additional cost to the scheme will be around £6m. In addition this scheme cost assumes a 'worst case' scenario with regards to the treatment of the disused power station which attributed up to £2.5m to the overall cost.

The assumptions for the Northern Link Road costs are as follows:

- General Site clearance due to medium/high amount of trees and bushes covering the region; making assumption of 2.0m verge each side of the proposed road
- Assumption for 100% class U1A/U1B unacceptable material
- Disposal of class U1A/U1B and class U2 material using 15 to 20 tonnes capacity lorry for haul distance up to 10km
- Removal of existing dismantled railway tracks
- Removal of existing boundary fence

- Provision of noise barrier, where the proposed road passes through/near housing/populated area
- Replacement of boundary fence
- Provision of guard rail at junctions and crossings for pedestrians and cyclists
- Provision of new drainage network including drain pipes, gullies and chambers
- Demolition, excavation and disposal of acceptable and unacceptable materials including potential contaminated land (disused power station)
- Provision of retaining wall for embankment due to close proximity of housing/populated area
- Assumed 20% cost for land and properties acquisition for proposed construction of road
- Assumed 10% cost for diversion of existing public utilities
- Assumed 10% cost for contingencies
- Assumption for landfill for proposed road alignment to form a junction
- Total cost for proposed construction of road based on assumption stated in notes = £11.8million

7.10 Grange Drive Link Road/Queensferry Road Roundabout Improvements

Mitigation is require required at the Grange Drive/A823 Queensferry Road roundabout in 2021 when the second Phase of the SLA development in the form of increased roundabout approach and circulating capacity and signalisation of the roundabout itself. This is required as excessive congestion builds up from this junction.

The result of this scheme is an improved throughput and balance of queues across all the approaches to the roundabout. The modifications are shown in Figure 7.9.

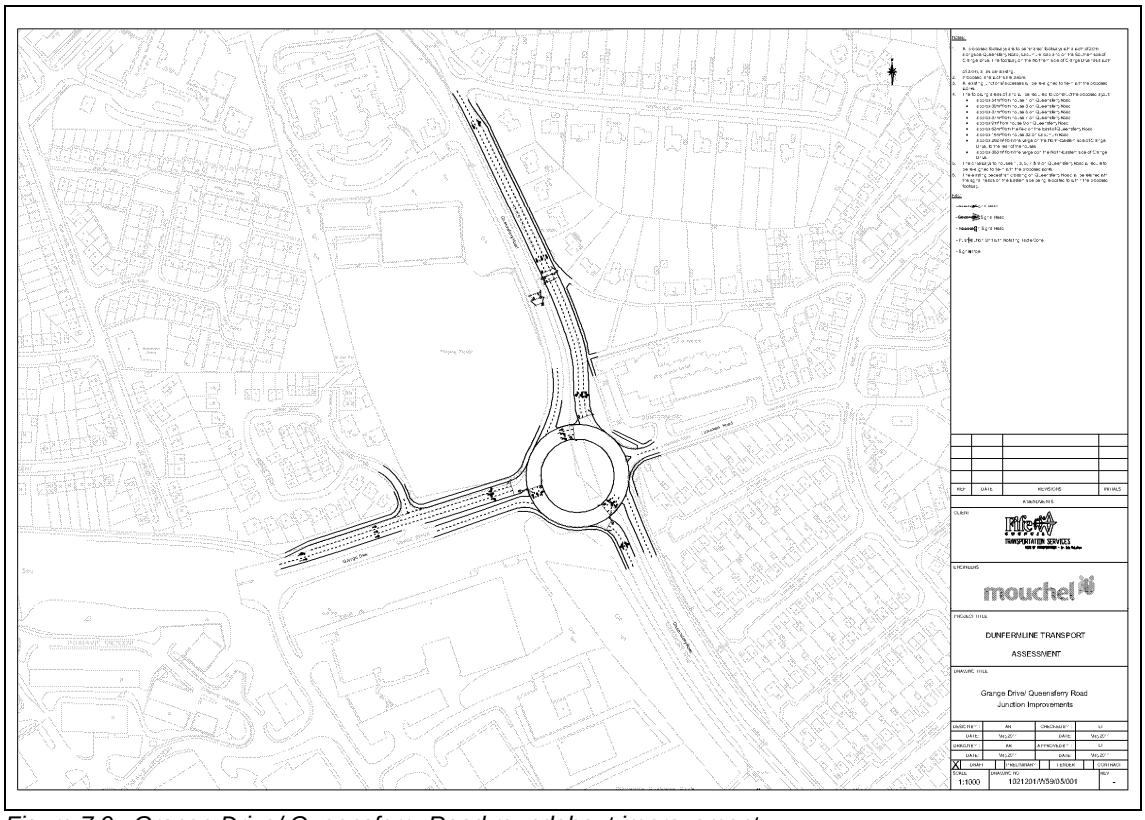

Figure 7.9 : Grange Drive/ Queensferry Road roundabout improvement

The scheme has been costed at £700k in 2011 prices.

7.11 Grange Drive Link Road

The impact of the new development on the existing network is significant enough to require a dedicated access onto the primary road network around 2015. Access will be provided onto the A823 Queensferry Road, via a link road between Grange Road and Grange Drive. This link is shown in Figure 7.10. The access to the north of Pitreavie Business Park off Grange Drive will be a signalised junction with pedestrian and cycling provision.

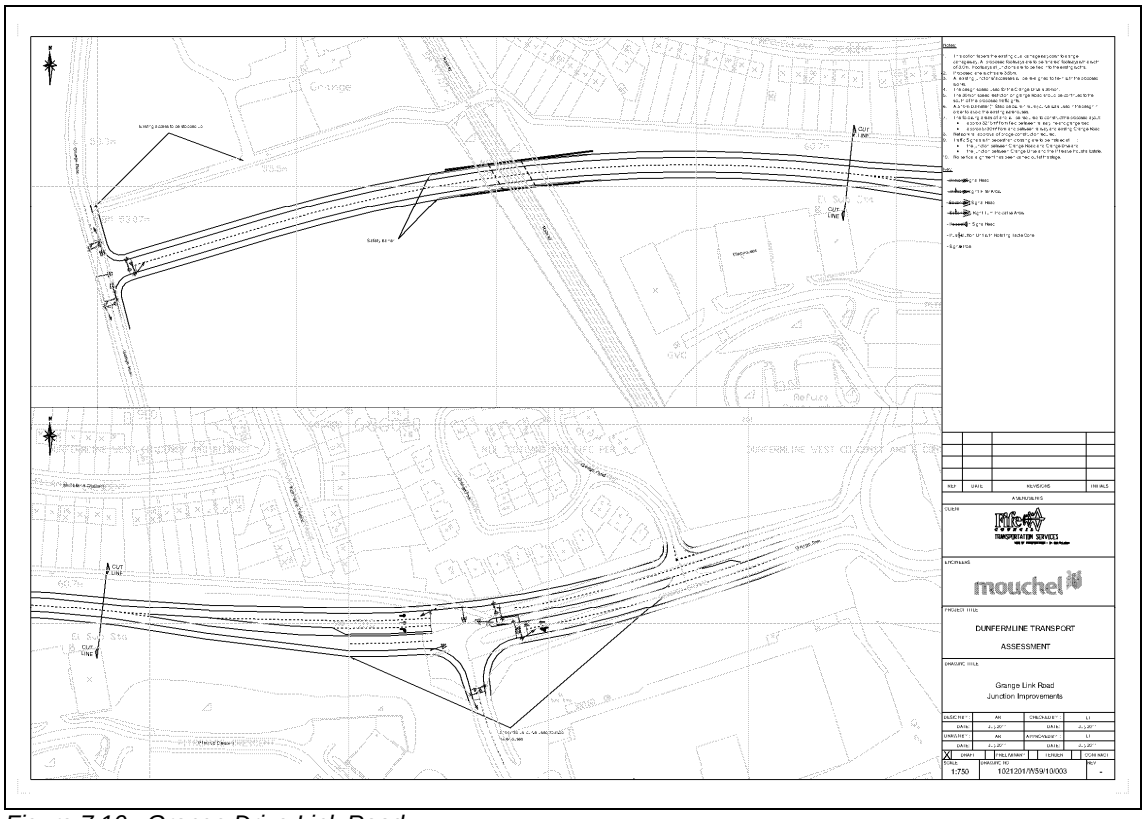

Figure 7.10 : Grange Drive Link Road

The scheme has been costed at £4.4m in 2011 prices.

7.12 Coal Road/Lovers Loan Junction

Mitigation is required in 2021 in the second phase of the SLA development, in the form of a signalised junction at the Coal Road/Lovers Loan/West Distributer Road. This is required as excessive congestion builds up from this junction.

The scheme results in improved throughput and balance of queues across all the approaches to the junction. The improvement is shown in Figure 7.11. It is expected that through the detailed design process adequate pedestrian and cycling provision will be provided to link in with the adjacent facilities which will be provided in the development masterplan development.

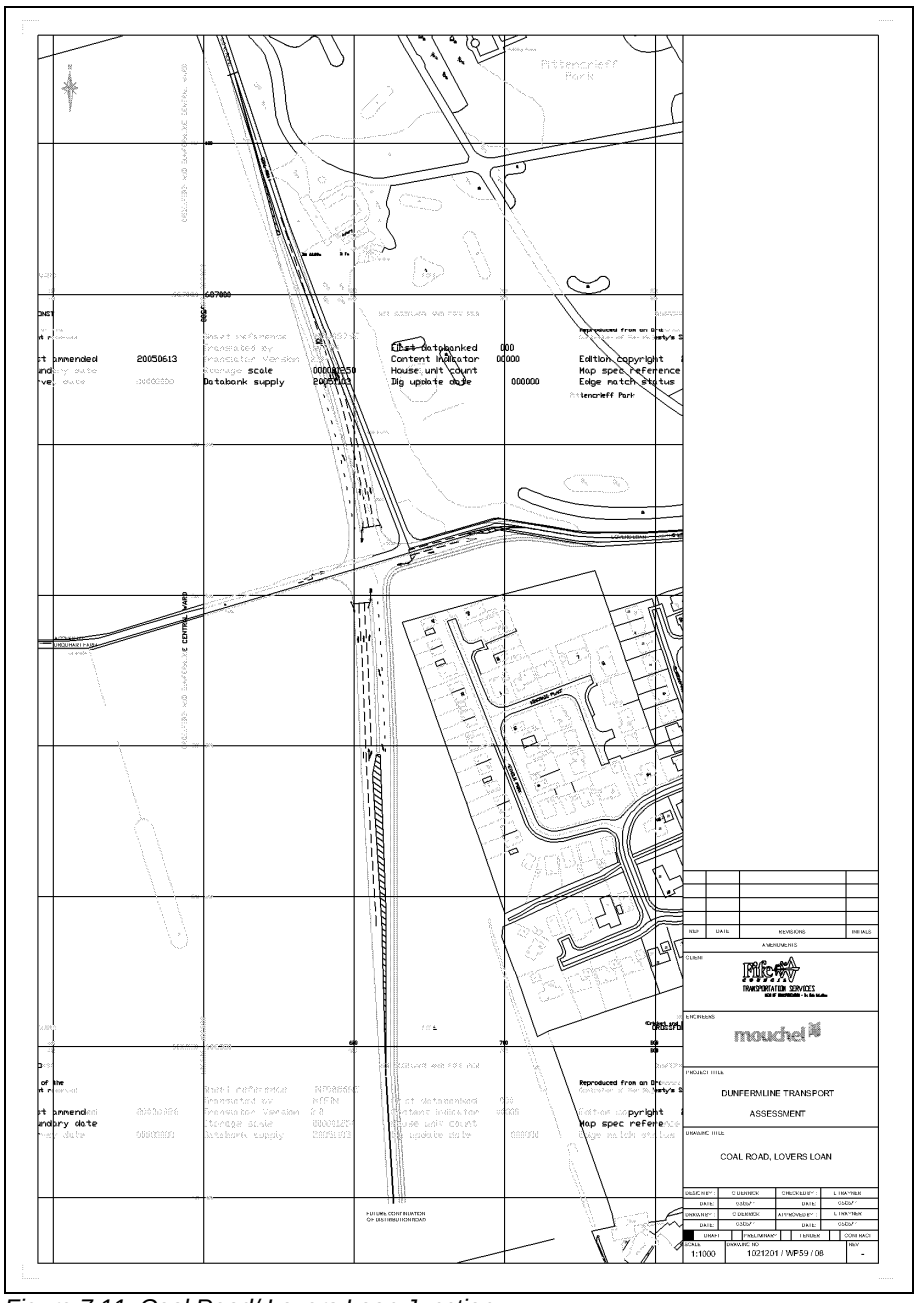

Figure 7.11 :Coal Road/ Lovers Loan Junction

This scheme has been costed at £1.8m in 2011 prices.

7.13 Carnegie Drive Bus Gate

The Carnegie Drive Bus Gate involves closing the Carnegie Drive opposite the new TESCO store to general traffic. This scheme does not include the new traffic arrangement associated with the new TESCO store, however, it could be easily linked into the scheme with little change in cost. This scheme will allow opportunities for urban realm improvements and controlling the access of non-service bus traffic. This is illustrated in Figure 7.12.

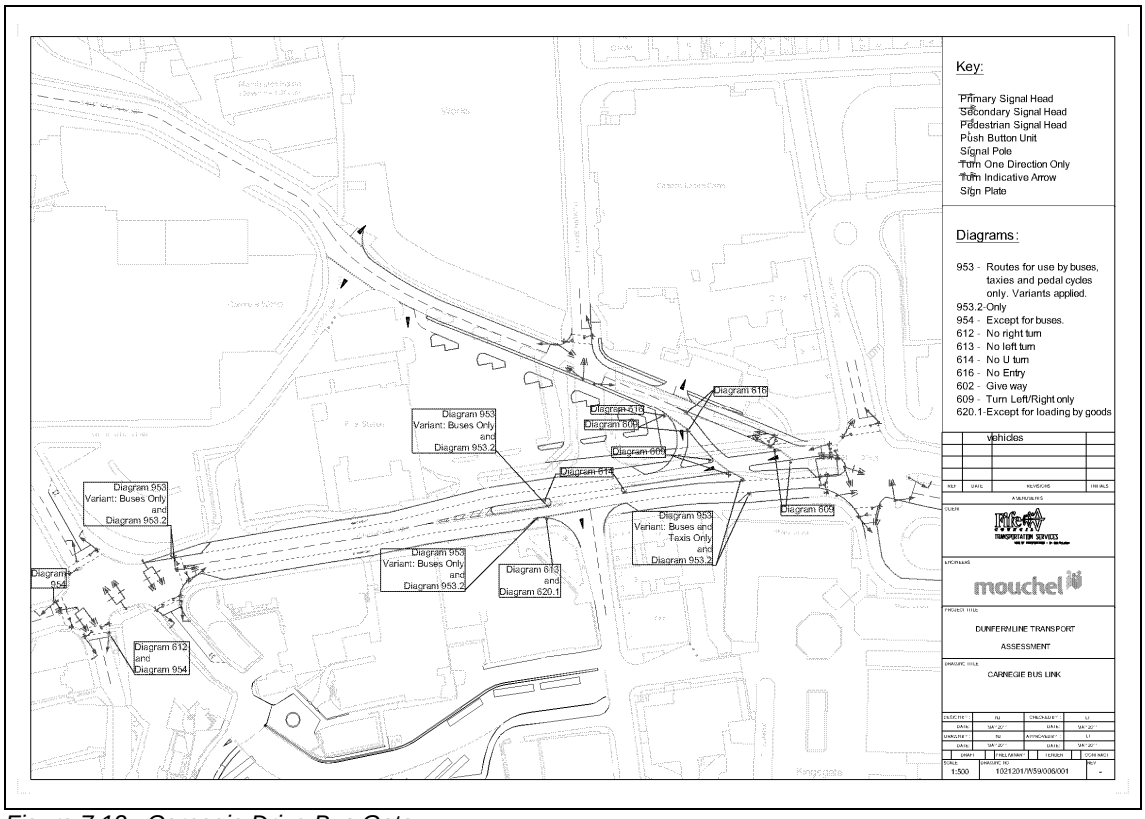

Figure 7.12 : Carnegie Drive Bus Gate

This scheme has been costed at £600k in 2011 prices.

7.14 Additional Considerations

Two schemes that have not been designed and costed are:

- Grange Drive/Grange Road Junction
- Limekilns Road/Grange Drive Link Road Junction

7.14.1 Grange Drive/Grange Road Junction

It is expected that through effective master planning in the Broomhall SLA the major road network will be defined with numerous entrances to a distributer street, possibly converging on a junction at Grange Road/Grange Drive Link Road. A signalised junction is assumed which would be similar in capacity terms as the Coal Road/Lovers Loan Junction. Although is has not been designed and costed it has been modelled and this comparison provides an indication of the scale of junction required to serve the development.

It is expected that the signalised junction will provide suitable provision for both cyclists and pedestrians as this is a key junction for both modes accessing the wider network.

7.14.2 Limekilns Road/ Grange Drive Link Road Junction

A signalised junction similar in scale to the Grange Drive/Grange Road junction highlighted above. Again it is expected that through effective master planning in the Broomhall SLA itself, the primary road network will be defined with numerous accesses converging on a junction on Limekilns Road. Although is has not been designed and costed it has been modelled and this comparison provides an indication of the scale of junction required to serve the development.

In the modelling exercise it suggests that there will be a new link between Broomhall and Liggar Bridge which crosses the railway line. From analysis of the traffic flows it is feasible that this link will utilise Limekilns Road link Broomhall to the south and Liggar Bridge to the north of the railway line.

It is expected that the signalised junction will provide suitable provision for both cyclists and pedestrians as this is a key junction for both modes accessing the wider network.

8 PUBLIC TRANSPORT STRATEGY

8.1 Introduction

The successful delivery of the masterplan is dependent on the incorporation of design measures and the effective application of planning techniques to maximise the proportion of total person trip activity that is supported by non-car based travel modes.

The S-Paramics model used to determine the need for, and nature of, mitigation measures resulting from the phased delivery of the masterplan considers only trips made by car. That is to say, it does not explicitly model trip making activities by other travel modes. The model applications have been undertaken on the basis that the target mode split has been "achieved" and that appropriate measures have been adopted elsewhere to ensure the masterplan can support trips made by pedestrians, cyclists and public transport users, consistent with the share shown in Section 4.5.

A key element of SIAS's programme of consultation during the Transport Assessment process was a series of workshops held with Stagecoach East Scotland's Operations Director. Details are provided in the following sections as to the nature and outcome of the discussions.

8.2 Bus Priority

In this study reference has been made to the Dunfermline Bus Priority Study (2008) which is reported in *Dunfermline Bus Priority Study Option Testing Report*.

The outcomes of this study were short term 'quick win' measures and medium term schemes which are designed to improve bus journey time reliability and consider issues such as driver frustration.

The schemes proposed from this study form a significant element of the public transport strategy. The two corridors considered were:

- The A907 Halbeath Road corridor between Sinclair Gardens Roundabout and the M90 Halbeath Interchange
- The A823 Queensferry Road corridor between Bothwell Gardens roundabout and Pitreavie Roundabout

Using the information from this study Dunfermline Bus Priority Study and applying it to the outcomes of the Dunfermline Transport Assessment the following schemes should be considered within the public transport strategy for Dunfermline.

8.2.1 A907 Halbeath Corridor

There is an opportunity to significantly enhance the corridor for Public Transport through the following measures which are illustrated in Figure 8.1:

- A bus lane between between its junction with Whitefield Road and the area adjacent to Dunfermline Athletic Football Ground
- The removal of bus lay-bys between the ASDA access and Halbeath Interchange
- An improvement to the Halbeath Road/Whitefield Road Junction

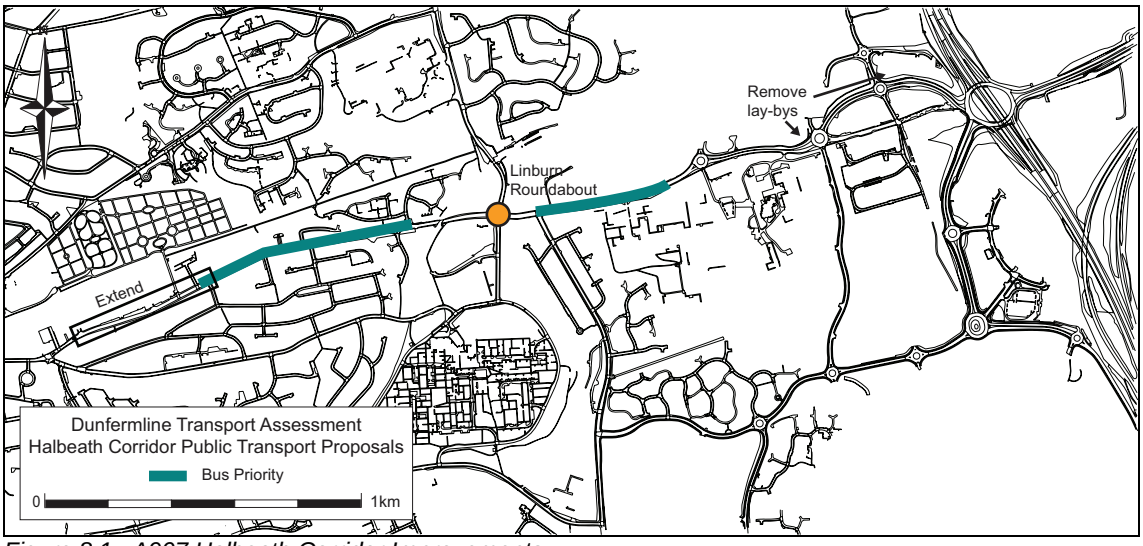

Figure 8.1 : A907 Halbeath Corridor Improvements

The improvement at the Halbeath Road/Whitefield Road Junction was proposed as a roundabout with the Linburn Road junction modified with a banned right turn from Halbeath Road (west) to Linburn Road. This was designed to ensure that it could be accommodated within current standards and costed at £1.0m. This improvement reduces delays throughout the study assessment in a currently congested network demonstrating that the scheme provides long term benefits.

A bus lane on Halbeath Road between its junction with Whitefield Road and the area adjacent to Dunfermline Athletic Football Ground was designed for the eastbound direction. With the implimentastion of the roundabout at the Halbeath Road/Whitefield Road Junction the reduced delays eastbound conclude that no eastbound bus lane is required.

An outcome of this assessment is congestion propagating back from Sinclair Gardens roundabout, through Appin Crescent and onto Halbeath Road which delays public transport journeys. The pedestrian crossings in this area also reduce throughput which extends the length and duration of the queues. A westbound bus lane would provide an opportunity to manage the queues and minimise any delays to public transport.

This scheme could be combined with a queue management system which could manage the traffic through Appin Crescent. Appin Crescent has been designated as an Air Quality Management area and, as such, requires interventions to reduce it emissions. Such interventions using queue management were successfully implemented in Cupar Town Centre and it is proposed that this concept is assessed and implemented if the case is fully demonstrated. This intervention would require some form of signalisation on Garvock Hill Street to the south-east, so all traffic entering Appin Crescent can be managed.

To the east there are proposed improvements to the public transport operation by removing the four lay-bys east of the ASDA superstore and replacing them with on-street bus stops. This will avoid buses having to wait for a gap to pull out of the lay-bys and continue their journeys. There is potential to enhance the public transport priority by introducing bus lanes around the bus stops to ensure that they receive priority when entering and leaving the bus stops.

This strategy combines well with the recent announcement by Transport Scotland to progress the construction and delivery of the Halbeath Park & Choose development located to the east of Halbeath Interchange.

This multi-faceted approach ensure good public transport access between Dunfermline Town Centre and East Dunfermline and beyond combined with good access to Queen Margaret Hospital.

A summary of the combined cost of the schemes identified previously is shown as follows:

*Table 8.1 : Halbeath Corridor Costs**

Scheme	Cost
Bus Lane (Carnegie College)	£20k
Bus Lane East of Kingseat Rd	£20k
Bus Priority East of Linburn Rd	£30k**
Halbeath Road/ Whitefield Road Junction	£1.0k
Bus Priority – (Daviot Rd to Garvock Hill)	£80k**
Total Excluding Linburn Roundabout	£150k

* All costs in 2005 prices
** The above costs have not been costed in detail and are broad estimates

8.2.2 A823 Queensferry Road Corridor

The public transport measures identified for the A823 corridor as illustrated in Figure 8.2 include the following:

- Removal of all bus lay-bys on the Queensferry Road corridor between Bothwell Gardens roundabout and Pitreavie Roundabout
- Bus priority lanes between Carnegie Drive roundabout and Grange Drive Roundabout
- Signalisation of Bothwell Gardens Roundabout
- Additional lane on the north approach to Pitreavie roundabout

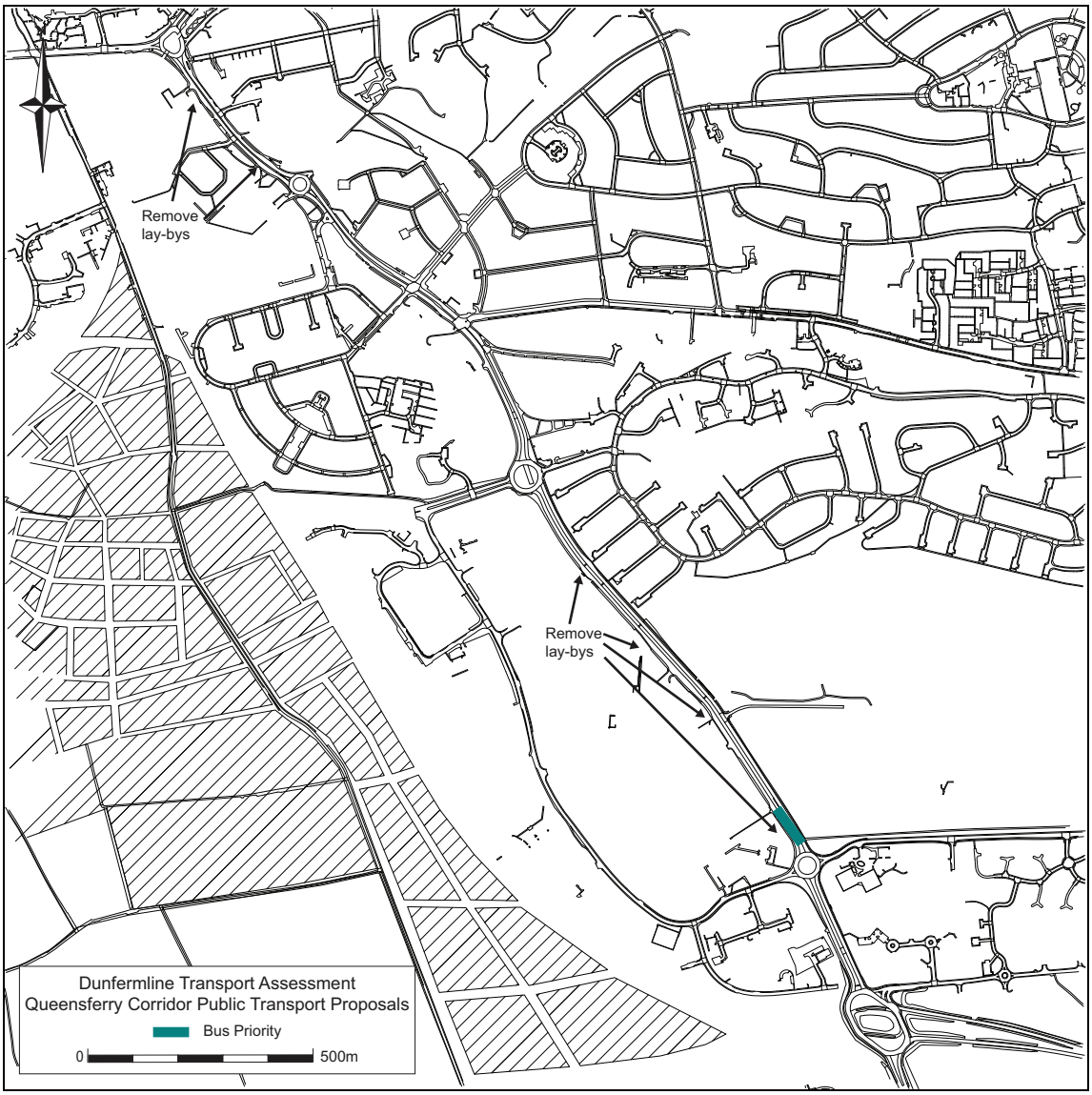

Figure 8.2 : A823 Queensferry Road Corridor Improvements

The removal of the bus lay-bys is recommended to improve the journey reliability of the bus services. The expected congestion on Bothwell Street between Aberdour Road and Bothwell Gardens would preclude any on-street bus lanes as proposed in the Bus Priority Study. Any bus lanes would be required to be off line.

To the south of the Grange Drive roundabout, even with the proposed schemes there is moderate congestion on the link south to Pitreavie roundabout. This requires bus lay-bys to be removed along this section in both directions and allows opportunity for providing bus lanes to maintain bus service times. This bus priority at the expense of private vehicle journeys could potentially ease journey times north of Aberdour Road, making both bus and rail public transport more attractive due to the potential time and inconvenience saving.

A summary of the combined cost of the schemes identified previously is shown as follows:

*Table 8.2 : Halbeath Corridor Costs**

Scheme	Cost
Bus Lay-by/Lane (South of Carnegie Drive)	£11k
Bus Lay-by/Lane (outside ASDA)	£25k
Bus Lay-by/Lane (south of Grange Dr Rbt)	£22k
Bus Lay-by/Lane (opp Pitreavie Athletic Centre)	£11k
Bus Lay-by/Lane (north of Carnegie Ave Rbt)	£27k
Total Excluding Linburn Roundabout	£96k

* All costs in 2005 prices

8.2.3 Summary

The inclusion of the schemes detailed in the Dunfermline Bus Priority Study could provide benefit to the public transport network in the current road network with some relatively minor improvements costing around £250k. It should be noted that these schemes could be implemented in the short term providing immediate benefit to travel in Dunfermline and encouraging the use of public transport by reallocating road space which is current allocated to all users including the private car.

8.3 LRT/BRT Study

An assessment into the effect of the proposals and their integration with the proposals set out in the *Dunfermline BRT/LRT* Study has been undertaken.

The underlying objective, as stated in the Report, that the expansion of the public transport network should be strongly linked to land use planning is common to this study, however, this should be expanded to transport planning in general. Transport planning can ensure that sufficient planning of the highway network can facilitate good public transport links combined with non car modes to provide a balanced transport network achieving the objectives of FC.

It is noted from the stakeholder consultation that the Rosyth Bypass was included in the LRT/BRT Study. This scheme has not been considered as part of this appraisal.

When considering the schemes identified in this study it is noted that the majority of routes are consistent with the proposals outlined in this study. A summary of the proposed LRT and BRT networks with the SLA developments in place are contained in Appendix I. Figure 8.3 shows the areas where specific conflicts occur between the outcome of this study.

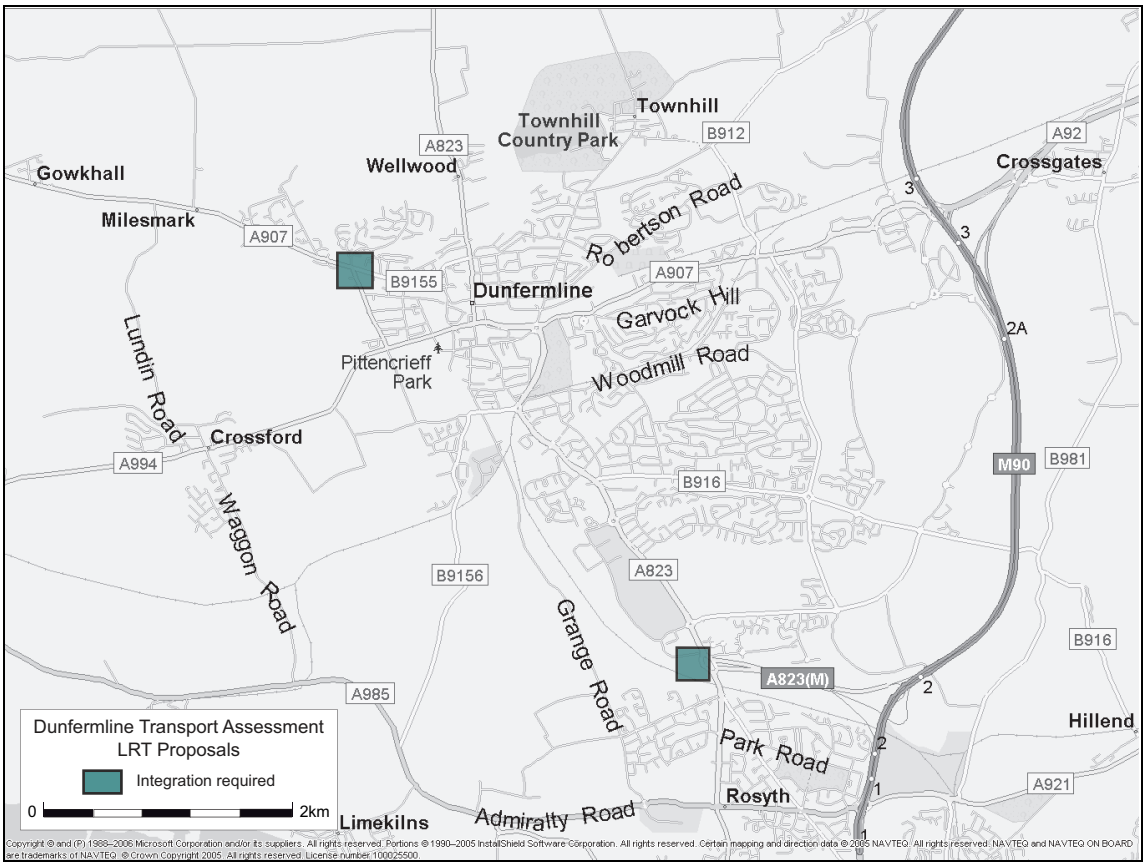

Figure 8.3 : Conflicts with LRT/BRT Network

Specific reference has been made below to key junctions identified in this study and how they interact with the BRT/LRT proposals.

8.3.1 Rumblingwell/William Street Junction

The proposed junction in this study does not match the same alignment of the land envelope plan, however, the route from this junction into the town centre utilises a disused railway which runs over William Street. This study utilises the existing road alignment as much as possible and utilises the whole of William Street. This suggests that the integration between the two routes would need to be looked at in more details with respect to land levels.

The LRT alignment on William Street uses an off-line entrance into open space when approaching the junction with Rumblingwell. It is reasonable to assume that given the lack of land contained in this open land a junction could be engineered to integrate the two corridors. This would require further investigation.

The LRT alignment shown in the BRT/LRT study at the south end of William Street at the junction with Pittencrief Street utilises the same alignments as identified in this study.

The BRT routes are similar to the potential public transport routes identified within this study. Any integration between off line and on line routes can be engineered during the detailed design of the junction and the proposals identified in this study to not obstruct the opportunities presented in the LRT/BRT study.

8.3.2 A823 Pitreavie Roundabout

The off line BRT/LRT route that extends from Pitreavie roundabout northwest through the Broomhall development linking with Coal Road is not affected by the proposals within this study. The issue requiring attention is the BRT linkage between this route and existing road network. The could either be via Primrose Lane to adjacent to the Railway Line linking to the B980 between the entrance to the Rosyth rail station car park and Pitreavie roundabout.

8.3.3 Limekilns Road

At the north end of this route it is noted that the route crosses the railway line west of Liggar Place. If this route was a BRT route then it could conceivably use Limekilns Road to cross the railway line and continue north through another route towards Coal Road as lees infrastructure would be required (even using the existing road).

8.3.4 A823 between Pitreavie Roundabout and Bothwell Gardens Roundabout

This corridor is not significantly effected by the LRT/BRT proposal, however, the widening on the north approach to Pitreavie roundabout and the widening on the north approach to Grange Drive roundabout should be considered given these schemes impact on the available land adjacent to the existing roads,

The congestion between Grange Drive roundabout and Bothwell Gardens could be an issue in terms of delay to BRT services so consideration should be given to either providing an on line route using bus priority or additional infrastructure to allow services to access the town centre from the west rather than using St Margarets Drive.

The overall conclusion is there is no significant conflict between the proposals identified within this study and the LRT/BRT study that did not exist previously, The conflict points are the same and they should be resolved through the detailed design process.

8.4 Consultation

The ability to achieve the mode split target is dependent on the effective incorporation of public transport at an early stage in the development. Public transport needs to be accessible and needs to serve the travel demands of those who live and work in the area. Where possible, it is desirable to provide public transport services from the outset, as trip makers in the area establish new routines and travel habits.

With this in mind, SIAS has engaged with Stagecoach East Scotland throughout the Transport Assessment process in order to determine the operating conditions necessary to accommodate high quality bus services and to obtain views as to suitable mechanisms for the funding and delivery of new services.

Face-to-face consultations with Stagecoach were held in October 2010 and March 2011, supplemented by e-mail correspondence throughout the period. Details are provided, as follows, of key recommendations resulting from the consultations.

8.5 Operating Conditions

The layout and design of the SLA developments must be taken forward in a manner that facilitates good access to bus services for passengers, and permits effective service operation.

The incorporation of bus services should be regarded as a key objective during the design stages. Land parcels should be laid out with access to bus routes in mind, designing out severance that might otherwise serve as an impediment to potential or intending bus users.

There is a preference that bus corridors are provided through the centre of each land parcel, which when combined with frontage development, will ensure a large proportion of trip makers have sight of a visible public transport service, increasing the likelihood that the target mode split can be met.

The placement of bus stops should take into account walkable catchments, enabling local residents and employees to access routes within 400m. A network of direct pedestrian links should be established between key trip generators and bus stops, where high quality shelters and bus information should be provided. Pedestrians should also be able to cross roads safely within the vicinity of bus stopping locations. Secure cycle parking linked to cycle routes and real-time bus information should also be provided at all bus stops.

Clearly marked out bus stops accompanied by associated parking and waiting restrictions should be provided throughout each development. This will ensure buses can stop parallel to the kerb line, serving the needs of all passengers and reducing the likelihood that buses themselves present delays to general traffic.

Stagecoach operates a variety of vehicles in Dunfermline, ranging from small midi-buses to 15m tri-axle rigid single deck coaches. In the fullness of time, it is likely that different vehicles will be used to operate the various types of routes that will be incorporated into the development, including local town services and longer distance commuter services. All links and junctions which are to be served by buses should be designed to a standard capable of accommodating 15m vehicles.

In each development, the opportunity should be taken to incorporate traffic management measures which give priority to buses over general traffic.

8.6 Service Delivery and Growth

Stagecoach has indicated that while it is clearly desirable to incorporate bus services into the development at an early stage, the rate of occupation of new residential and employment properties is unlikely to generate sufficient patronage at the outset to sustain new services at a commercial level.

In recognition of this, Stagecoach would advocate the introduction of services in an incremental manner, initially establishing a basic core local service operating at a frequency of one bus per hour.

As passenger numbers increase, in line with the increasing occupation of new residential units, and with the establishment of new employment facilities, Stagecoach would anticipate that service frequency could be increased accordingly.

Initially, it is likely that Stagecoach would seek to serve the new developments by extending existing routes in a logical manner. Doing so provides the opportunity to provide enhancements to the local bus network without introducing duplicative buses over catchments which are already served.

An approach that favours incremental extensions to existing bus routes potentially also reduces the commercial risk. Extra vehicles required to serve the new development could be added into

an existing service pattern, minimising the additional cost and reducing the likelihood that passengers are abstracted from existing routes.

In terms of introducing bus services to the respective developments, an early priority should be to provide links with Dunfermline town centre. An objective of this Transport Assessment is to ensure trips made by bus account for a growing proportion of total person trips associated with the development. Ultimately, Stagecoach considers that there are opportunities to provide direct journeys to Edinburgh during peak travel periods, however, bus service frequencies will be enhanced in response to the growing demand that will result from the phased build-out of the developments.

Stagecoach is fully aware of the development proposals and the phased manner in which the masterplan will be built. Given the timescales involved, it is not possible to state the precise manner in which bus routes will be adjusted, and ultimately added to the network, however, Stagecoach has demonstrated a clear willingness to work with both FC and the respective developers to ensure suitable provision.

8.7 Funding Mechanisms

In anticipation of growing patronage, Stagecoach would ultimately seek to incorporate bus services to the developments as part of the wider commercial Dunfermline network. From their inception, however, new routes or incremental extensions to existing routes would be likely to require financial support.

Financial support or subsidy would be required on a sliding scale for a period of time, likely be a minimum of five years. Assuming a fixed level of service, as passenger numbers increased, the level of subsidy required would reduce over time, leading to a point where a route could be operated with no required subsidy.

Stagecoach has indicated that it is willing to hold discussions with the respective developers as to the nature of funding agreements to establish bus services to the developments. The allocation of funds directly from developers to Stagecoach is likely to be the preferred means of funding routes, as is the case in other Stagecoach operations throughout the UK.

8.8 Summary

The development of a bus strategy will initially be based around links to Dunfermline bus station, with potential to integrate with Ferrytoll Park & Ride at a future date. Stagecoach has indicated that the opportunity to participate in discussions relating to the SLA has been welcome, allowing the company to consider the proposals in the context of the existing Dunfermline and Fife networks as well as other strategic considerations, such as the Replacement Forth Crossing and the proposed Park & Ride facility at Halbeath

9 SUSTAINABLE TRANSPORT INTERVENTIONS

9.1 Introduction

Fife Council has stated that it wishes to promote the use of active travel modes, particularly for short-distance trips. As shown in Table 4.14, trips of less than one mile account for up to 12% of all trips, and trips between 1 and 5 miles account for approximately 60% of all trips.

In order to achieve the aspired mode split targets, set out in Table 4.15, it will be necessary to promote pedestrian, cycle and public transport based travel for short-medium distance trips. For trips over a medium to long distance, the number of car based trips can be balanced through the provision of high quality public transport and the promotion of car sharing initiatives.

A fundamental consideration in facilitating trips by non-car based travel modes is the ease with which trip makers can access those respective modes. As the detailed designs of the various development areas evolves, it will be necessary to ensure that they are developed around a network of core shared-use paths that provide safe, secure and direct connectivity between the various land uses. Achieving the necessary share of public transport based trips will be dependent on the incorporation of bus priority measures, and the design of roads through each development that are suitable for buses. It will be crucial to ensure that routes penetrate each development site entering at one side and exiting via another, rather than turning in a particular site.

SIAS has undertaken an initial audit of the development areas using accessibility criteria consistent with *STAG*. Indicative existing accessibility isochrones showing 400m, 800m and 1,600m pedestrian walking distances from the centroid of each development area are shown in Figure 9.1. It is expected that the provision of a connected and permeable network of streets within each development to existing facilities will improve the walking distance to facilities. This figure also shows the indicative alignment of proposed bus priority measures as identified by a separate study by SESTRANS.

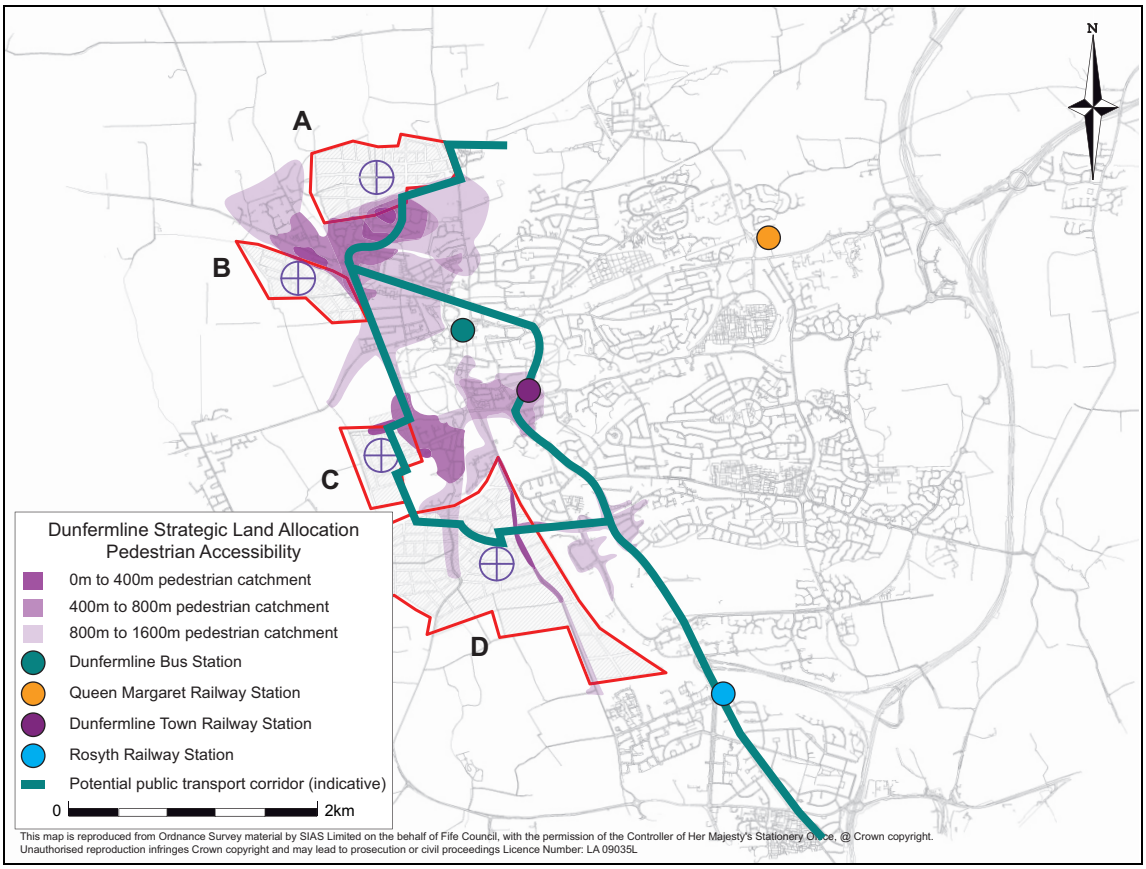

Figure 9.1 : Initial Existing Accessibility Appraisal

In addition to the provision of pedestrian routes in the land parcels, it is crucial that facilities are provided to support trips by non-motorised users between each of the developments and between the developments and other parts of Dunfermline.

In particular, it is important that trips between the respective developments and existing facilities in Dunfermline within a reasonable walking distance of around 1,600m are provided to maximise the potential that they can be accessed without using a car. The greater the number of pedestrian connections providing the most direct routes to facilities, the more sustainable accessibility will have the potential to be.

SIAS has undertaken a desktop exercise to identify likely routes between the development areas and established parts of Dunfermline. Figure 9.2 shows a number of "handshakes" – points where the development sites intersect with other established routes. Subsequent stages of the appraisal will examine the suitability of using these routes for pedestrian and cycle based trips, and the potential feasibility for upgrading them as required.

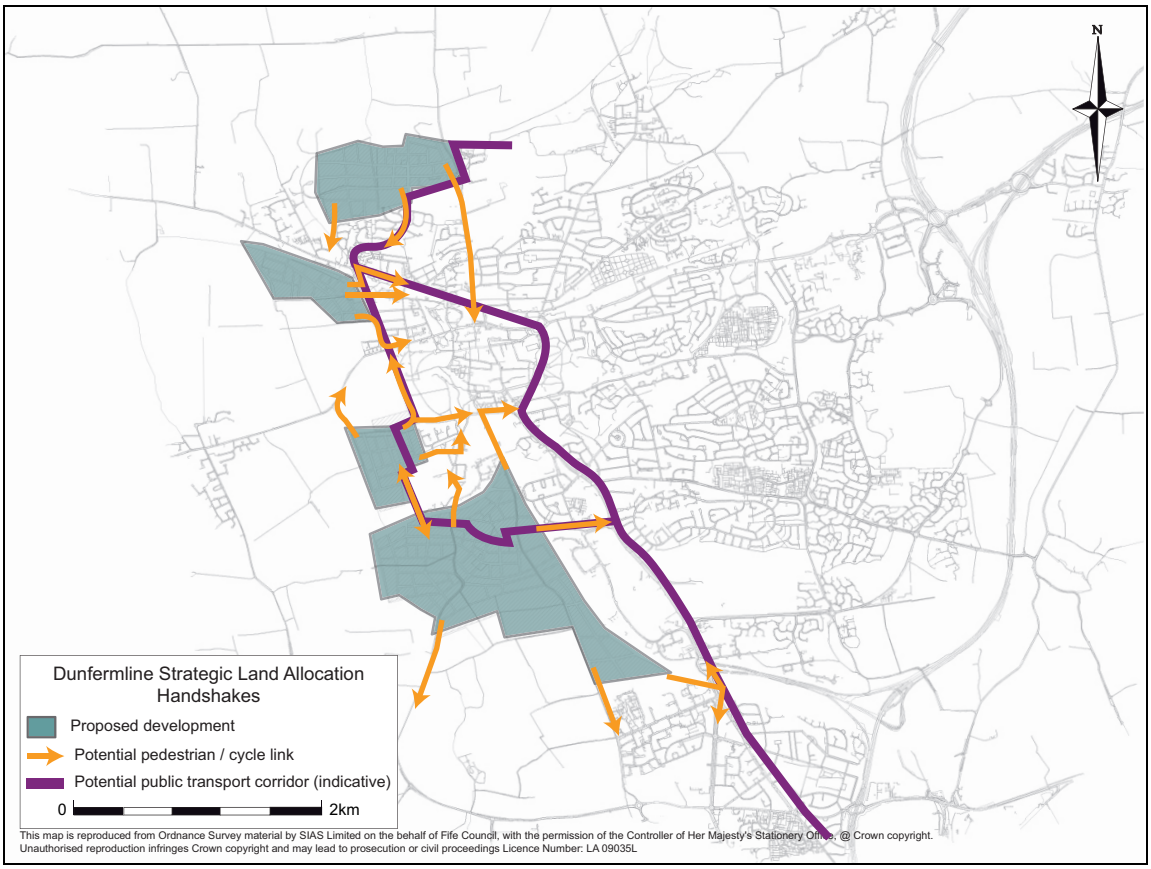

Figure 9.2 : Indicative "Handshakes"

9.2 Walking Interventions

The walking interventions are will generally be concentrated in the developments due to the low distances travelled, however, the schemes identified in this study should include in the detailed design process, adequate pedestrian provision. The improvements to the junctions have been chosen with pedestrian facilities in mind – such that Signalised junctions have been preferred over roundabouts, with the exception of the William Street/Rumblingwell junction.

There are walking opportunities from the periphery of each development which currently exist, the master planning should seek to develop those and the cycle links highlighted as follows.

9.3 Cycling Interventions

The transport infrastructure that has been identified within this study has an interaction with the existing cycle network in Dunfermline. This section considers different locations across the transport network and considers the influence the Strategic Land Areas and their associated infrastructure improvements have on it.

All of the considerations should be considered within the detailed design of each scheme so any disruption to cyclists is minimised.

9.3.1 Kings Road/A985

This Scheme provides an opportunity for enhanced connectivity between Dunfermline via Grange Road, Primrose Lane and north Rosyth to the north, and the main town of Rosyth and Rosyth Dockyard across the A985 to the south.

This Scheme will provide benefit to cyclist both in terms of safety and reduced delay. This will encourage the use of cycling as a commuter trip to and from the Dockyard, which is a major employer in the area. The A985 is currently well used and would benefit with a high quality cycle crossing in this location with the nearest pedestrian crossing located 30m to the east.

9.3.2 Pitreavie Interchange

The signalised interchange at Pitreavie provides an opportunity to provide a high quality connection between Rosyth and Primrose and the A823 Queensferry Road and Eastern Dunfermline.

This also provides the opportunity to integrate the cycle network with Rosyth Rail Station with safe route for cyclists.

9.3.3 A823 Widening

The two widening schemes on the A823 located on the north approach to Pitreavie roundabout and the north approach to the Grange Drive Roundabout could influence the space available for off road cycle routes. The detailed design of the scheme should consider the location and level of provision for cyclist along the sections within the widening.

9.3.4 Internal to Broomhall

The cycle network in Broomhall will be dictated by the internal master planning, but there is a number of locations where the external cycle network can connect with the cycle routes. There is two locations to the east to connect to Queensferry Road, namely the underbridge below the Grange Drive which could be part of the Grange Drive Link Road and the underbridge which connects into Pitreavie Business Park. Both require very little work to connect to the main road network and local employers. These links are key influences in achieving potential cycling commuter trips from the Broomhall Development.

To the south both Grange Road and Limekilns Road provide good links to the Fife Coastal Cycle Routes and Rosyth and the Dockyard. With the potential explanation of the employment area to the south east of the development there is potential for cycle routes to connect with Primrose Lane.

To the north there is an opportunity to maximise the use of Grange Road and Limekilns Road by reducing the speeds through 20mph zones and other traffic calming measures, such as speed humps.

To the west the internal master planning of the Liggar Bridge development should provide a connection between Broomhall and Coal Road. This provides a new connection to the west and north west Dunfemrline and access the town centre via Pittencrieff Park.

9.3.5 Internal to Liggar Bridge

There is an opportunity to connect Dunfermline Town Centre via Pittencrieff Park, Lovers Lane and Coal Road. Currently Pittencrieff Park is bordered by high walls which would be a deterrent and a barrier to cyclists. There is an opportunity to provide an open attractive cycle environment between Liggar Bridge and the Town Centre by introducing new links through Pittecrieff Park..

To the east and south connections would be made via the infrastructure between Limekilns Road to the east highlighted in the references to the Broomhall development.

9.3.6 Internal to Wellwood

There is an opportunity to provide high quality links east from the Welwood development onto Pilmuir Street using the existing road north of Colton. There is also a potential link from Queen Anne High School which could connect to the development. To the South there are multiple opportunities to connect this development which converge on the Rumblingwell/William Street junction. The proposed junction arrangement is not ideal for cyclists, however, adequate provision for crossings should be provided on the north, east and west approaches to the roundabout. This will connect to a substantial off road cycle route which lies on the disused railway running west of Dunfermline. There are also opportunities to the west through Parkneuk which could integrate with the route on the disused railway line.

9.3.7 Internal to Berrylaw

The Berrylaw development can be integrated with the disused railway line to the north highlighted above. To the south and east the site can link with the town centre via Pittencrieff Street and through Pittencrieff Park. This provides good linkage to the town centre which will attract commuter trips given the journey is 1km. To the west there is an extensive minor road network which can be used to link to Crossford and beyond.

9.3.8 Town Centre

With so many opportunities to link the development with the town centre it is essential that facilities are provided for storing bicycles securely. There is an opportunity to encourage linked trips with the bus station by providing more cycle facilities. There is also good links with Dunfermline Town Rail Station which again should be encouraged with adequate cycle lockers.

The topography is an issue when considering opportunities. With the Broomhall Development being lower than the town centre, consideration should be given to a cycle hub located either at Dunfermline Town railway station immediately south of the town centre to avoid the severe gradients within the heart of Dunfermline Town Centre which are more appropriate for walking.

9.4 Public Transport Interventions

The Public Transport Strategy, in Section 8, has discussed a number of issues: consultation with bus operators, operating conditions, service delivery and growth and funding mechanisms. It has not been possible at this stage in the process to identify exact route or service changes until further detail on phasing is established.

It is, however, possible to set out the potential opportunities for bus links that new roads in the SLA area could bring, as shown in Figure 9.3. It can be seen that the previously undeveloped

public transport area to the west of Dunfermline has the potential to expand the available network coverage in Dunfermline to cover the SLA areas.

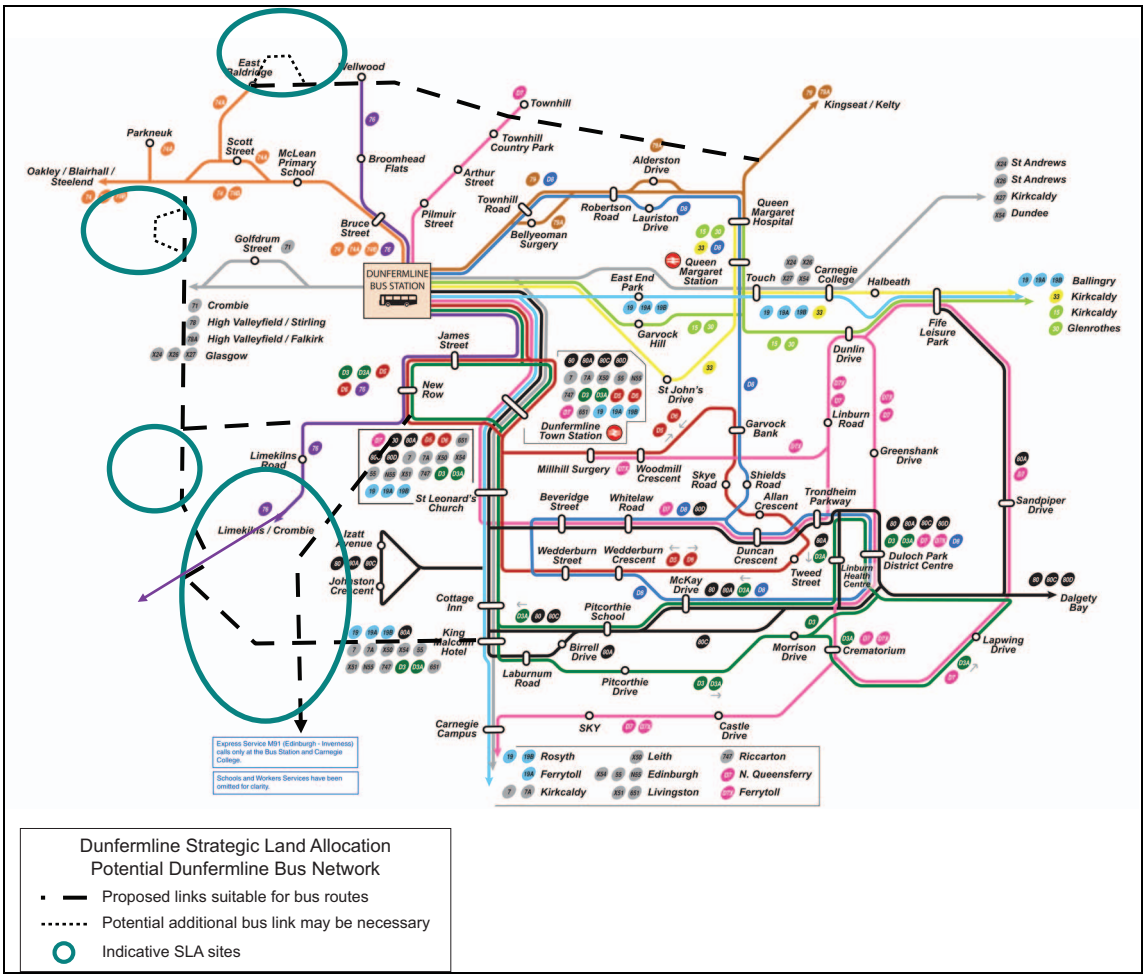

Figure 9.3 : Potential Dunfermline Bus Network

9.5 Summary of Sustainable Transport Interventions

This study has sought to demonstrate that the proposed western expansion of Dunfermline can be taken forward in a manner that promotes sustainable trip making habits, and which provides opportunities to enhance the provision and quality of public transport. The methodology adopted demonstrates clearly that the trip making characteristics of the various land uses proposed in the masterplan vary and that opportunities exist in a number of areas to promote active travel and public transport use.

Fife Council has set out clear aspirations to reduce the proportion of person trips that are taken up by private car, with targets to increase the share of pedestrian, cycle and public transport trips. SIAS has highlighted through an initial discussion of the proposals in the context of standard accessibility criteria that the four development areas offer strong potential to sustain active travel and public transport use, and that there are opportunities to integrate the developments with existing infrastructure in Dunfermline.

Key to achieving these targets will be the incorporation of measures and general site design to facilitate such trips. The evolving masterplan must continue to bear these principles in mind,

with collaboration between the respective developers and FC. Initial liaison with Stagecoach Fife has highlighted that early engagement with public transport operators is also necessary.

9.6 Sustainable Transport Principles and Outline Intervention Guidelines

Subject to the general acceptance by all parties as to the methodology adopted in this study, SIAS recommends that the study proceeds with the following key principles in mind:

- The internal layout of the development areas should consider the general principles discussed in Section 4 relating to pedestrian and cycle accessibility - a network of core shared-use paths that provide safe, secure and direct connectivity between the various land uses will be required.
- Integration between walking and cycling travel modes and public transport should feature as a strong design objective in and between each development area – access to bus stops must be made by direct walking routes, cycle parking should be available at neighbourhood hubs.
- The internal layout of the respective development areas should be designed around a backbone public transport corridor which should be served by services offering both local and strategic functions – all parts of development being within 400m of a bus stop.
- Discussions should take place at an early stage to involve FC's public transport unit and Stagecoach Fife with a view to developing a broad specification for public transport provision – it is likely that a minimum level of provision will be required, such as an hourly day time bus service from a threshold level of the first 50 houses occupied.
- Particular attention should be paid to the provision of high quality public transport during the travel peaks, with the specific intention to reduce the number of car trips associated with home-based commuter trips – it is likely that a minimum level of bus provision shall include coverage of the peak periods of travel to and from work, such as 06:00 – 09:00 and 16:00 – 19:00.
- Public transport infrastructure should be used to its maximum potential throughout the day and, in addition to targeting commuters, public transport services should seek to cater for retail, medical and leisure trips where possible, prompting an adjustment to lifestyle behaviours – at least one set of bus shelters shall be required at hub points in each neighbourhood.
- Emphasis should be made to provide integration between travel modes in a number of key areas, particularly to promote links between the development areas and key public transport hubs and interchanges – each SLA area shall be accessible to a train station or bus interchange by a regular bus service where they are more than 800m walking distance away.
- Infrastructure adjustments should be introduced at key nodes throughout Dunfermline to facilitate improved public transport reliability, enhancing this mode's standing as a realistic alternative to private cars – bus priority or junction improvements introduced where required.
- A strategy should be developed to promote a package of measures consistent with safe routes to school principles – a comprehensive School Travel Plan will be required for each school.

- New employer developments must aim for sustainable transport targets - All employment developments throughout the areas should be required through planning conditions to develop and maintain ‘Travel Plans’ with targets consistent with the key principles of this document.
- New residential developments must aim for sustainable transport targets - All residential developments should provide a ‘Travel Pack’ for new residents that contains information on access to walking, cycling and public transport routes, distances to key facilities and travel information. To be implemented from the outset of the first occupation. ‘Mock ups’ to be included in Transport Assessments.

10 CONCLUSIONS

10.1 Introduction

SIAS Limited (SIAS) was appointed by Fife Council (FC) in September 2009 to undertake a Transportation Appraisal of proposals set out in the *Draft Dunfermline West Fife Local Plan (2010)* to deliver a strategic expansion of Dunfermline. Four separate land parcels have been identified for the strategic expansion, which will be comprised of more than 4,200 new residential properties and 80Ha of employment land.

The primary objective of the Transport Assessment was to build an S-Paramics microsimulation model of the greater Dunfermline area to establish what measures might be necessary to accommodate the car-based trips that will be added to the study network as a result of the phased delivery of the developments, and to provide guidance on their phasing and cost.

10.2 Quantification of Person Trips

The *Willie Miller Urban Design (WMUD) Strategic Framework (Dunfermline) Final Report (June 2009)* states that the expansion of Dunfermline is "a fresh approach towards more strategic thinking about sustainability, place and distinctiveness". Following initial scoping meetings with representatives of FC's Transportation section, the Project Team agreed a mode split target which promoted an increase in the share of person trips made by non-car based travel modes. In particular, the Transport Assessment has proceeded on the basis that the layout and design of the respective land parcels will serve to naturally promote trip making by pedestrians, cyclists and public transport users.

Using data provided by FC's Development Services Team, SIAS assembled a schedule of proposed development for each of four land parcels. SIAS undertook an analysis of a variety of data sources including *Fife Travel Diary Survey (Atkins, March 2005)* and outputs from 2001 Census Data to determine baseline travel characteristics for the study area. Outputs from the Census and *Travel Diary* analysis were then used to quantify the likely total person trip generation of each land parcel. Application of the agreed mode split target led to the quantification of the total number of new car based trips (including both drivers and passengers). For clarification, trip matrices developed for the S-Paramics models only included car based trips.

The trip generation element of this Transport Assessment demonstrates the share of all person trip making in the respective travel peaks that will be taken up by available transport modes. Trips made on foot, by bicycle and on public transport account for a significant proportion of all person trip making activity and it is critical that the standard of design applied to the respective land parcels adequately caters for such trips. The layout of land uses within each land parcel, their proximity to shared paths and public transport facilities will have a direct bearing on the ease with which residents, workers and visitors move within and between the various developments. As the process moves on, it is crucial that the internal layout of each land parcel is underpinned by the key principles of *Designing for Streets (Scottish Government, 2010)* and that FC works with the respective developers to establish a "design code" relating to these key aspects.

The S-Paramics element of this assessment considers the impact of car-based trips associated with the development areas on the wider study area. Car-based trips which feature in the trip matrix account for only a proportion of total person trip making activity, so there is a direct relationship between the ability to cater for non-car based trips and the number of car trips that the developments may be capable of generating.

It is imperative that the recommendations made in this report in respect of facilities for pedestrians, cyclists and public transport users are taken on board early in the design process allowing residents, visitors and employees to establish sustainable travel habits from the outset.

10.3 Model Development and Application

SIAS developed a fully validated S-Paramics traffic model to represent 2009 base conditions in the study area to assess the impact of the proposed development. Future year trip matrices were developed using outputs from the South East of Scotland Transport Partnership (SESTRAN) regional traffic model and Land-Use and Transport Integration in Scotland (LATIS) for each of the forecast years (2015, 2021 and 2029) in accordance with the anticipated phasing of development.

Applications of the model were undertaken to determine the need for infrastructure improvements at key junctions resulting from the incremental introduction in development traffic. Traffic queues, journey times and global network statistics were used as a key indicator of network performance throughout the appraisal process, and where necessary remedial measures were identified to reduce levels of queueing. Many of the remedial measures that are proposed as part of this appraisal have previously been identified and tested on behalf of FC. In that respect, the methodology adopted to resolve issues of traffic queueing and delay is consistent with the strategy already being pursued by the authority.

10.4 Impact and Mitigation Measures

Having identified the need for a range of infrastructure interventions, SIAS liaised with Mouchel to establish indicative scheme costs which are incorporated into this report.

A summary of the interventions and the stage they are required is presented in Table 10.1 to Table 10.3 for the Reference Case, the Local Plan Phasing and the Alternative Development Phasing.

The level of development specified in the 2015 scenario is assumed to be completed during the period 2011-2015, the 2021 scenario contains the additional development assumed between 2016 and 2021 and the 2029 scenario contains the additional development between 2022 – 2029.

As such the infrastructure will generally not be required at the year of opening. They are required by the year of completion, i.e. 2015, 2021 and 2029. The exact point where the development build is such that interventions are required has not been determined in this study and would require additional sensitivity testing. A factor in this sensitivity testing to consider is the level of employment development build out against the level of housing, i.e. if the employment development is not realised in the timeframe additional houses could be progressed instead.

Table 10.1 : Summary of Interventions - Reference Case

Scheme	Cost (£m)	2015	2021	2029
		-	-	-
Linburn Roundabout	0.8		✓	✓
Bothwell Gardens Roundabout	0.3		✓	✓
Pitreavie Roundabout Signalisation	0.5		✓	✓
Pitreavie Rbt Widening	0.2			✓
Rumblingwell/ William Street Junction	2.3			✓
Kings Road Signals	TBC			✓
Total Cost (£m)		0	1.6	4.1

Table 10.2 : Summary of Interventions – Local Plan Phasing

Scheme	Cost (£m)	2015	2021	2029
Grange Drive Link Road	4.4	✓	✓	✓
Linburn Roundabout	0.8	✓	✓	✓
Bothwell Gardens Roundabout	0.3	✓	✓	✓
Pitreavie Roundabout Signalisation	0.5	✓	✓	✓
Rumblingwell/ William Street Junction	2.3		✓	✓
William Street/Pittencrief Street Junction	3.2		✓	✓
Carnegie Drive Bus Gate	0.6		✓	✓
Coal Road/Lovers Loan	1.8		✓	✓
Grange Drive/ Queensferry Road Rbt	0.7		✓	✓
Northern Link Road	11.8			✓
Kings Road Signals	TBC			✓
Pitreavie Rbt Widening	0.2			✓
Total Cost (£m)		6	14.6	26.6

Table 10.3 : Summary of Interventions – Alternative Development Phasing

Scheme	Cost (£m)	2015	2021	2029
Grange Drive Link Road	4.4	✓	✓	✓
Linburn Roundabout	0.8	✓	✓	✓
Bothwell Gardens Roundabout	0.3	✓	✓	✓
Pitreavie Roundabout Signalisation	0.5	✓	✓	✓
Rumblingwell/ William Street Junction	2.3		✓	✓
William Street/Pittencrief Street Junction	3.2		✓	✓
Carnegie Drive Bus Gate	0.6		✓	✓
Coal Road/Lovers Loan	1.8		✓	✓
Grange Drive/ Queensferry Road Rbt	0.7		✓	✓
Northern Link Road	11.8		✓	✓
Kings Road Signals	TBC			✓
Pitreavie Rbt Widening	0.2			✓
Total Cost (£m)		6	26.4	26.6

The proportional level of infrastructure to accommodate the four SLAs in Dunfermline can be seen from these tables.

The notable impact of the Alternative Development Phasing is the Northern Link Road is required to be constructed by 2021.

The schemes are concept schemes to demonstrate deliverability of the Dunfermline Strategic Land Appraisal (SLA) development, however, other schemes and proposals should not be ruled out when considering any detailed Planning Application or if any additional sensitivity testing is undertaken and alternative solutions identified.

10.5 Other Interventions

As stated, the models used in this appraisal were based on a mode split that assumed other measures to manage car based travel demand had also been put in place. Details are provided in Sections 3 and 4 of this Report of the different trip purposes, trip lengths and mode split assumptions. A key objective of the transport strategy adopted for the respective land parcels will be to maximise the extent to which trips are made by travel modes other than the car. At such time as detailed applications for each development are prepared, it is imperative that FC sets out rigid guidelines as to the layout and integration of the proposed land uses to encourage trip making by pedestrians, cyclists and public transport users. Analysis of the Travel Diaries highlights that a large proportion of person trips are over distances which are generally walkable or cyclable. The incorporation of a network of pedestrian and cycle paths will make such trips easier, helping to reduce the "need" for car based trips.

Reference has been made to other studies such as the Dunfermline Bus Priority Study. The schemes that were proposed could be implemented as part of the overall strategy for Dunfermline. The proposals for the Halbeath and Queensferry corridor amount to approximately £250k.

The infrastructure proposed in this study does not produce any new conflicts with the LRT/BRT study which could not be addressed during the detailed design phase of any of the schemes.

SIAS has also undertaken liaison with Stagecoach East Scotland in order to establish a broad framework for the introduction and funding of bus services to the developments. As with trips made by pedestrians and cyclists, the rate at which public transport trips take place will be partially dependent on the quality of infrastructure that is provided throughout the developments and it is therefore important that FC, Stagecoach and the respective developer continue to engage as the layout and design of the developments evolves.

10.6 Conclusion

It is imperative that the recommendations made in this Report in respect of facilities for pedestrians, cyclists and public transport users are taken on board early in the design process allowing residents, visitors and employees to establish sustainable travel habits from the outset.

This study demonstrates that the Local Plan SLA development can be delivered along with high quality highway, public transport, walking, cycling infrastructure which can integrate to achieve the desired mode split targets.

There are a number of measures required to mitigate the impact of the development which require funding and this should be considered through an agreed financial framework between FC and the prospective developers.

The mode spilt targets set by FC is critical to the delivery of this strategy and the internal masterplanning of the developments have a crucial role to play with respect to travel patterns and providing opportunities for encouraging short and medium distance non-car trips.