7.10 Corridor 10: Edinburgh to Stirling

7.10.1 Setting the Context

Corridor 10 extends from the outskirts of Edinburgh to Stirling and from the Forth Estuary south towards the A89, which is adjacent to the M8 (Corridor 13 – Glasgow to Edinburgh). To the east, several corridors converge within Edinburgh, while to the west, the rail and road links within this corridor merge into Corridor 9 (Glasgow to Perth). The corridor is approximately 61 kilometres in length. As Figure 7.10.1 shows, the rail and road infrastructure form part of the strategic network connecting west towards Glasgow and north towards Perth. This corridor provides access to major population centres including the Stirling Council area, Falkirk Council area, Clackmannanshire and West Lothian. The corridor has a total population of around 127,000[543].

Figure 7.10.2 shows the expected areas of changes in population and employment in the corridor. The total population in the corridor is expected to increase by around four per cent by year 2022. The greatest change in population is expected to be within the West Lothian area with lower population increases within the Stirling and Falkirk Council areas. Only Clackmannanshire is forecast to have a population fall[543]. The number of households within the corridor is expected to increase by approximately 11 per cent between 2005 and 2022[543].

Employment within the corridor is forecast to increase by seven per cent between 2005 and 2022[543]. One of the key areas of employment within this corridor is the Grangemouth oil refineries.

The inactivity rate is forecast to decrease by 14 per cent between 2005 and 2022[543].

Median gross weekly earnings for Falkirk, West Lothian and Clackmannanshire are £395, £384 and £381 per week respectively. Whilst these averages fall below the Scottish average of £412, the median gross weekly earnings in Stirling exceed this at £456[544]. Stirling has an above average number of high earning residents.

Car ownership in the corridor, measured as a percentage of households with access to a car, is higher than the national average of 67 per cent. The car ownership levels are:

- West Lothian Council: 71 per cent;
- Falkirk Council: 69 per cent;
- Stirling Council: 75 per cent; and
- Clackmannanshire Council: 71 per cent[545].

[543] TELMoS
[544] Scottish Economic Statistics 2006, table 4.3, 4.20
[545] Scotland's Census 2001: www.scrol.gov.uk Table KS17

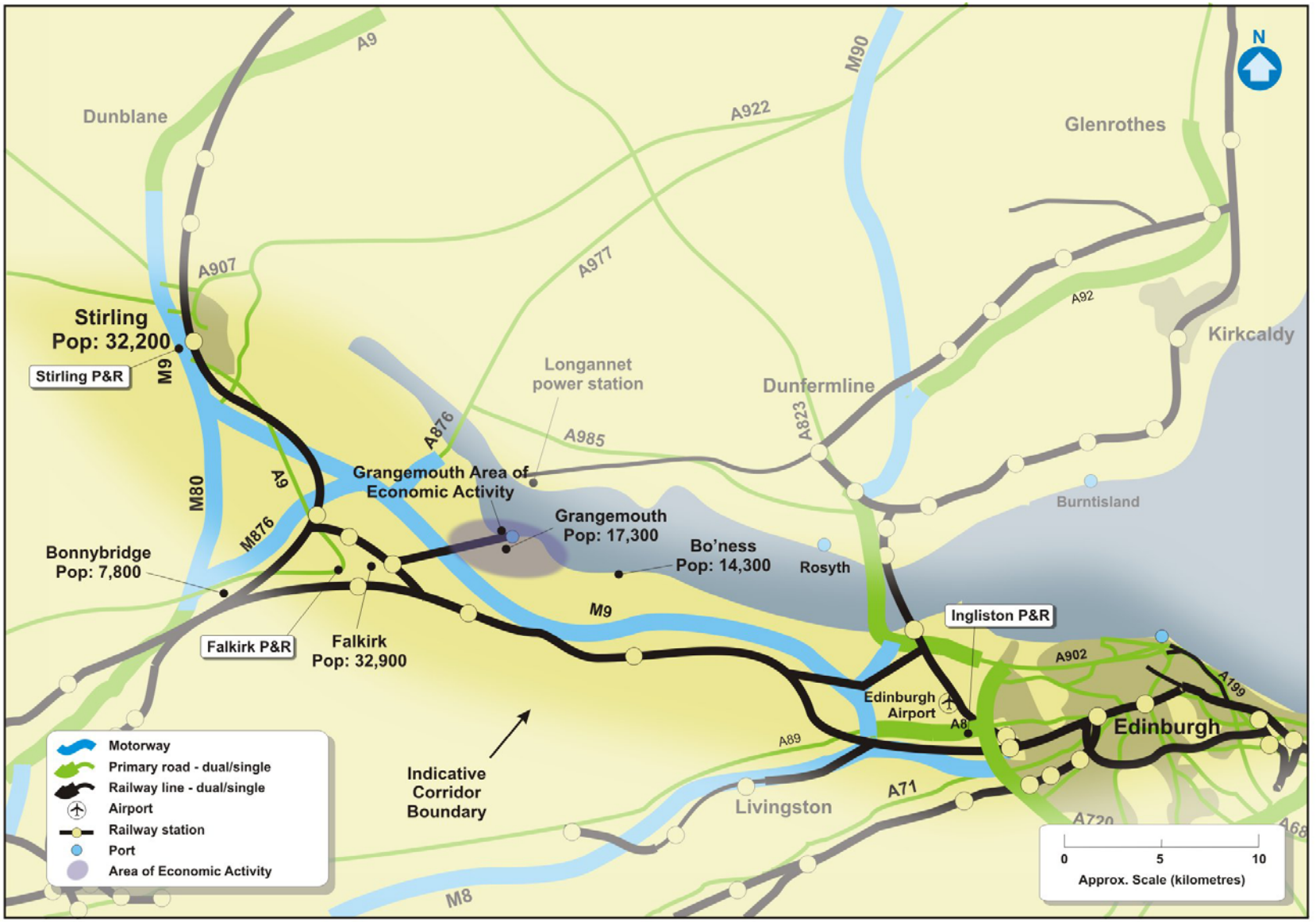

Figure 7.10.1: Setting the Context, Corridor 10 - Edinburgh to Stirling

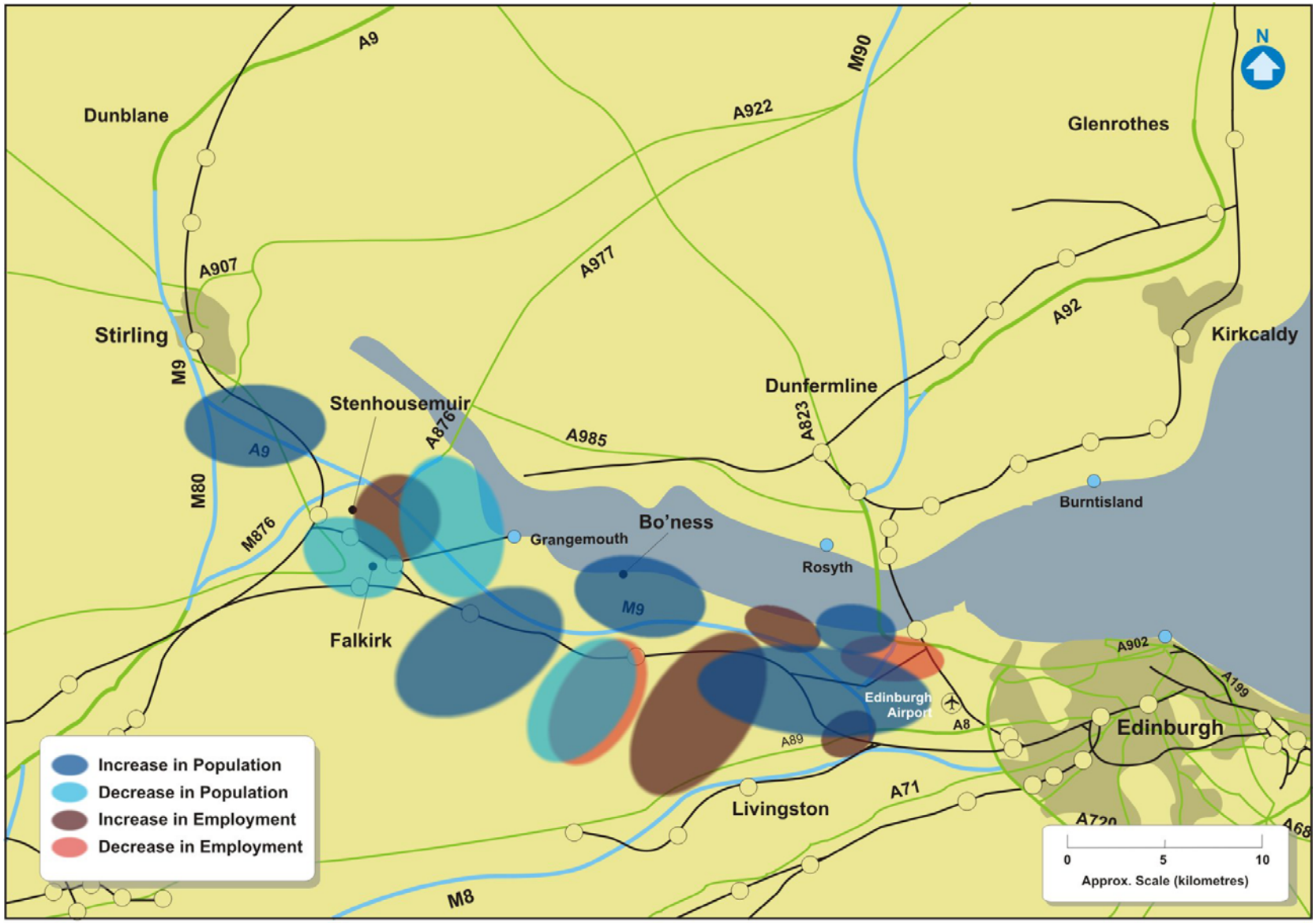

Figure 7.10.2: Changes in Population and Employment, 2005 & 2022, Corridor 10 - Edinburgh to Stirling

7.10.2 Transport Networks and Operations

Infrastructure and Services

The principal elements of the transport network that play a national strategic role are shown in Figure 7.10.1.

The road network includes the following important elements:

- M9 Motorway – linking Edinburgh to Stirling;
- A8 – Newbridge to A720 Edinburgh City Bypass;
- A904 – Falkirk to the Forth Road Bridge;
- M9 Spur – M9 to the Forth Road Bridge;
- A9 – Stirling to Falkirk; and
- A801 (non-trunk) – M9 J4 Polmont to M8 J4 near Whitburn.

The A8 at Newbridge is a key interchange between Edinburgh and West Lothian. The principal roads on the corridor converge at the Newbridge and Echline Junction to the west of Edinburgh. The M9 two-lane motorway, the A8 dual carriageway and the A89 single carriageway all connect at Newbridge, and provide links to the towns in West Lothian and beyond towards Stirling. To the north of these the A904 runs parallel to the M9 and connects to the A90 immediately south of the Forth Road Bridge at Echline Junction. To the west the A9 is a single carriageway road, connecting Stirling and Falkirk, and a number of communities along the route.

The corridor is well served by the rail network. The main service between Edinburgh and Glasgow operates via Haymarket station in the west end of Edinburgh, and Falkirk High. In addition, there are services between Edinburgh and Dunblane. All stations on the route have car parks and nearby bus stops and cater for commuters travelling to Edinburgh and Glasgow. There are two main rail freight flows through the corridor: coal between Hunterston and Longannet uses the line between Carmuirs and Winchburgh Junction before crossing the Forth Bridge; and there are a mixture of container trains and oil trains that serve Grangemouth from destinations across Scotland and the rest of the UK.

Service patterns on the railway are generally:

- Four trains per hour between Edinburgh and Glasgow via Falkirk High; and
- Two trains per hour between Edinburgh and Dunblane.

There are frequent bus services along the corridor providing good access to local destinations and Edinburgh. Services are provided by Citylink and First. Citylink service 909 operates between Edinburgh and Dunblane along the A8 and M9 via Grangemouth. The First service 38 operates between Edinburgh and Stirling via the A8, Newbridge, Kirkliston, B9080, A803 and the A9.

Service patterns are generally:

- One service per hour between Edinburgh and Dunblane (Citylink); and
- Two services per hour between Edinburgh and Stirling (First).

The corridor also provides access to the port of Grangemouth which is accessible by road and rail. Grangemouth port handles the largest quantity of freight in Scotland and lies adjacent to the bulk of Scotland's petrol, chemical and plastic industries and accommodates several life science companies. This sector remains significant, both in local terms - employing over 2,100 people - as well as nationally - contributing over £1 billion annually to the Scottish economy[546].

Integrated tickets in the corridor are available in the form of the *PLUSBUS* ticket and the 'One-Ticket'. *PLUSBUS* covers rail journeys into Edinburgh and Stirling and provides the addition of unlimited bus travel within the destination. The 'One-Ticket' gives unlimited travel on bus or bus and rail within designated zones radiating from Edinburgh towards Dundee, Perth, Stirling, Dunbar, Bathgate and Shotts.

Asset Management

In 2007, 22 per cent of the trunk road network pavement[547] in this corridor is judged to require structural strengthening as it has no theoretical residual strength. This compares with a national level of four per cent[548]. Under Transport Scotland's planned maintenance schedule, the net figure for the corridor is expected to fall to 14 per cent by 2012.

Further details on asset management, including bus and rail, are provided in Chapter 4.

Demand Management

There are few bus priority measures at present in the corridor; therefore bus journeys are affected by road congestion to the same extent as the car. Car parks are available at several railway stations on the corridor. Falkirk[549] and Stirling[550] have Park-&-Ride facilities on the outskirts of town with CCTV coverage and sheltered waiting areas. Parking is free at all Park-&-Ride sites and whilst some station car parks have a fee for using them, the cost of doing so is deducted from the commuter's rail fare.

[546] Falkirk Council: http://www.falkirk.gov.uk/services/community/community_education/grangemouth_local_plan.pdf
[547] Transport Scotland SERIS Database
[548] STS No. 25 (2006) Table 5.5
[549] Falkirk Council: www.falkirk.gov.uk
[550] Stirling Council: www.stirling.gov.uk

Programmed Schemes

The following are programmed schemes and developments in the corridor illustrated in Figure 7.10.3:

- A876 Upper Forth Crossing;
- A876 Kincardine Bridge refurbishment;
- Stirling - Alloa - Kincardine Rail Link;
- Improved rail access to Edinburgh Airport; and
- Stirling to Larbert signalling enhancements.

The A876 Upper Forth Crossing will provide a new bridge over the Forth to accommodate traffic heading towards Clackmannan and the upper Forth area, while the existing crossing will continue to provide a connection to Fife and the north via the M876 and M90 motorways.

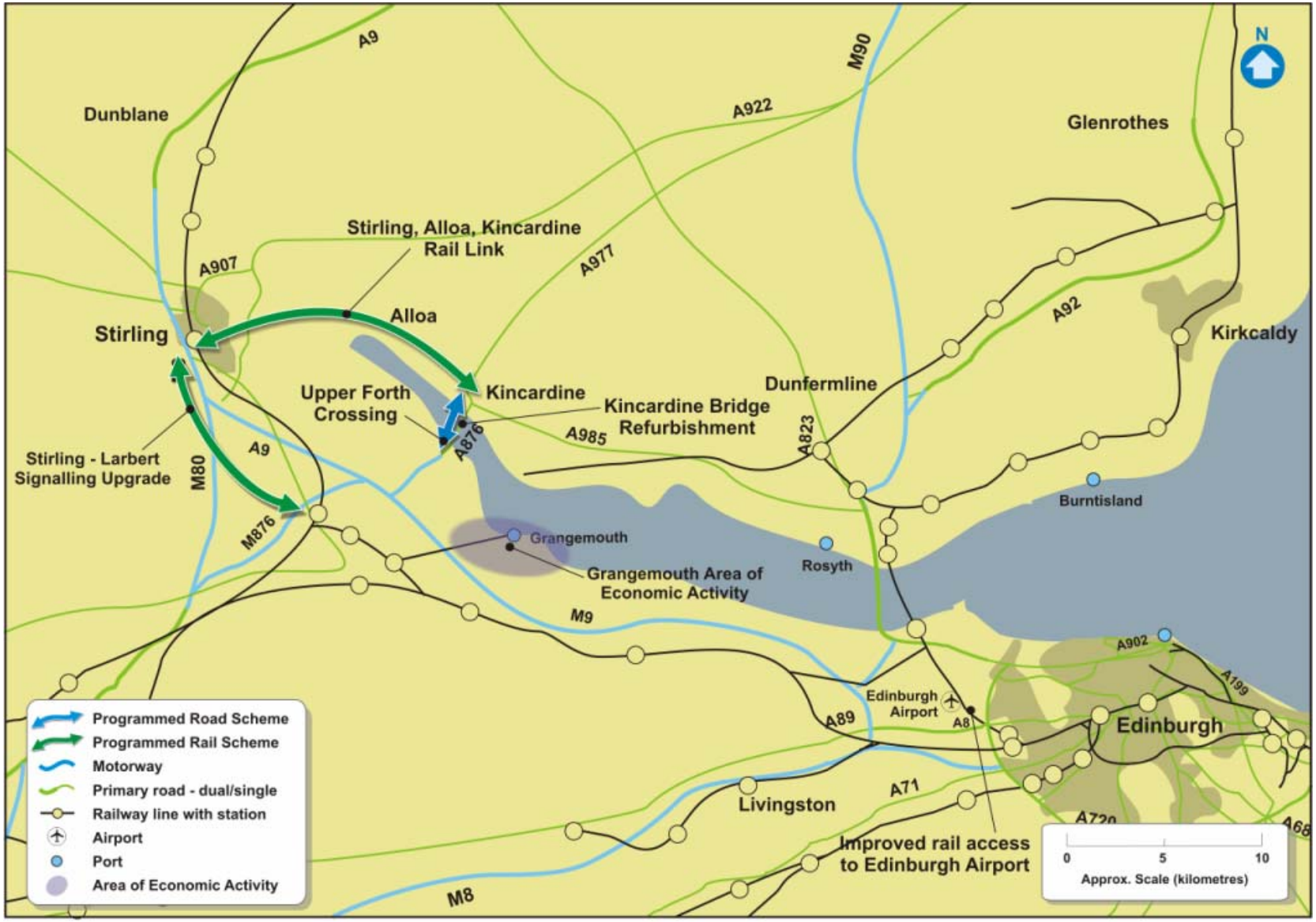

Figure 7.10.3: Programmed Transport and Land Use Developments, Corridor 10 - Edinburgh to Stirling

7.10.3 Travel Patterns

Travel patterns for the corridor are presented in Figure 7.10.4. Table 7.10.1 below provides a summary of the demand levels and mode share in the corridor.

Table 7.10.1: Summary of Demand (12 Hour) and Public Transport Share[551]

		Between Edinburgh and Stirling	Within Corridor	Between Corridor and Edinburgh	Between Corridor and Stirling	Between Corridor and other destinations	Total Trips
2005	Total Trips	13,500	44,000	27,200	29,100	86,000	199,800
	% of Corridor	7%	22%	14%	14%	43%	100%
	PT Trips	1,900	700	7,300	700	3,600	14,200
	PT Share	14%	2%	27%	2%	4%	7%
2022	Total Trips	17,700	48,500	32,900	36,500	113,500	249,100
	% of Corridor	7%	19%	13%	15%	46%	100%
	PT Trips	2,200	1,300	8,200	1,100	3,900	16,700
	PT Share	12%	3%	25%	3%	3%	7%
Change	Total Trips	+31%	+10%	+21%	+25%	+32%	+25%
	PT Trips	+16%	+86%	+12%	+57%	+8%	+18%

In 2005, there were approximately 200,000 trips in the corridor in an average 12-hour day. Of these, 14,200 (seven per cent) were public transport trips. It is forecast that by 2022 the total trips will increase to approximately 250,000 per day and public transport trips will increase to approximately 16,700. Compared to 2005, this is a 25 per cent increase in total trips, with an overall 18 per cent increase in public transport trips. This increase in public transport trips is a result of the forecast increase in rail demand of approximately 30 per cent.

[551] TMfS:05

Only a small proportion (seven per cent) of trips on the corridor are between Stirling and Edinburgh. Approximately one fifth of trips are wholly within the corridor, and approximately 30 per cent are to Edinburgh and Stirling, the urban centres at either end. Almost half of the travel demand from the corridor (43 per cent) is directed to destinations outside of the corridor, mainly to the western areas of the Central Belt. The rail network is busy due to frequent services between Glasgow and Edinburgh and other destinations. The three main railway stations in this corridor; Stirling, Linlithgow, and Falkirk (Grahamston) collectively have a passenger throughput of 3.8 million passengers per annum (2005)[552]. Over 1.7 million of these trips are through Stirling station.

This general pattern is expected to continue into the future with a slight increase in trips to areas beyond Stirling and Edinburgh, indicating an increase in average distance travelled.

ATC data from the SRTDb gives a figure of approximately twelve per cent HGV traffic on the M9 at Linlithgow553. Grangemouth, in addition to bulk oil imports, handled nearly three million tons of freight including 140,000 containers, compared to Leith which handled just over two million tons554. The majority of this freight traffic moves by road. This is reflected in the forecast 50 per cent increase in HGV traffic on the corridor over the period to 2022. In addition, rail freight movement is expected to increase at Grangemouth and between Stirling and Kincardine following the opening of the rail line via Alloa.

Whilst public transport links on the corridor are generally good, there are several factors that may influence trip choice. Location of employment in the suburban business parks, the general ease of access on the inter-urban sections of the M9 and the high car ownership in the corridor all conspire to reduce the use of public transport. It is noticeable, however, that just over one quarter of all trips to Edinburgh are by public transport.

The railway stations in this corridor have a total throughput of some 5.7 million passengers per annum (2005), with Linlithgow and Stirling the busiest stations.[555]

Edinburgh Airport handled over 8.4 million passengers in 2005[556], and is one of the fastest growing airports in Scotland. The airport is located adjacent to the A8 at Ingliston, towards the east end of the corridor and therefore has a particular impact on travel in its vicinity. Further details regarding Edinburgh Airport are provided within the specific text on the Edinburgh Urban Network.

[552] STS No. 25 (2006) Table 8.7
[553] SRTDb
[554] STS No. 25 (2006) Table 10.3
[555] Rail industry LENNON data (Station Usage 2004/2005)
[556] STS No. 25 (2006) Table 9.7

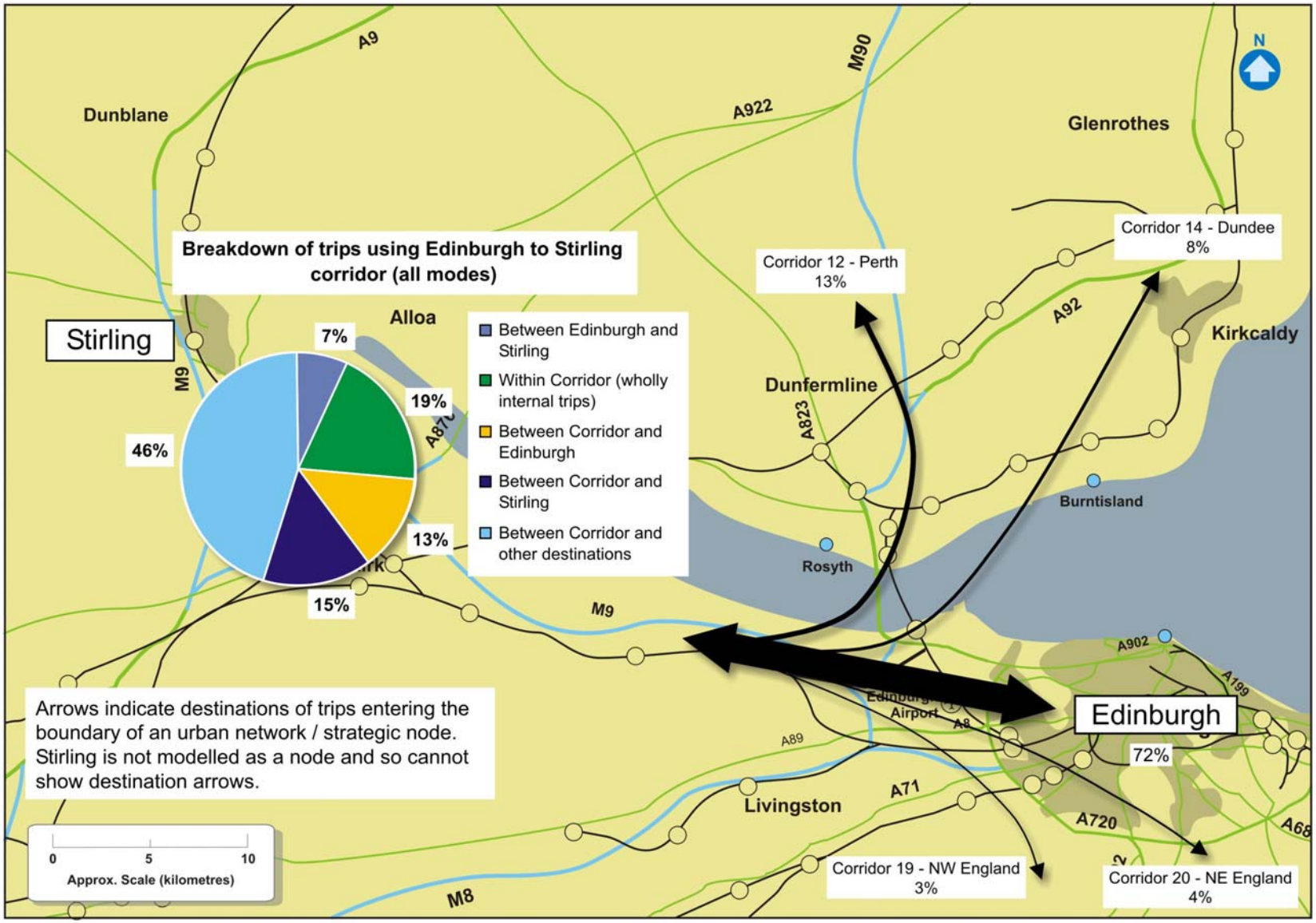

Figure 7.10.4 Travel Patterns 2022, Corridor 10 – Edinburgh to Stirling

7.10.4 Performance Review

Journey Times and Connections

This section addresses the following questions from Table 3.1:

- Does the network offer competitive journey times?
- Is the network operating efficiently and reliably?
- Where are the delays and when do they occur?

The majority of journeys are made by road within the corridor and the majority of these journeys make use of the M9. The comparison of average speeds across the morning and evening peaks and the inter-peak period between 2005 and 2022 on the M9 between Stirling and Edinburgh is shown in Figure 7.10.5.

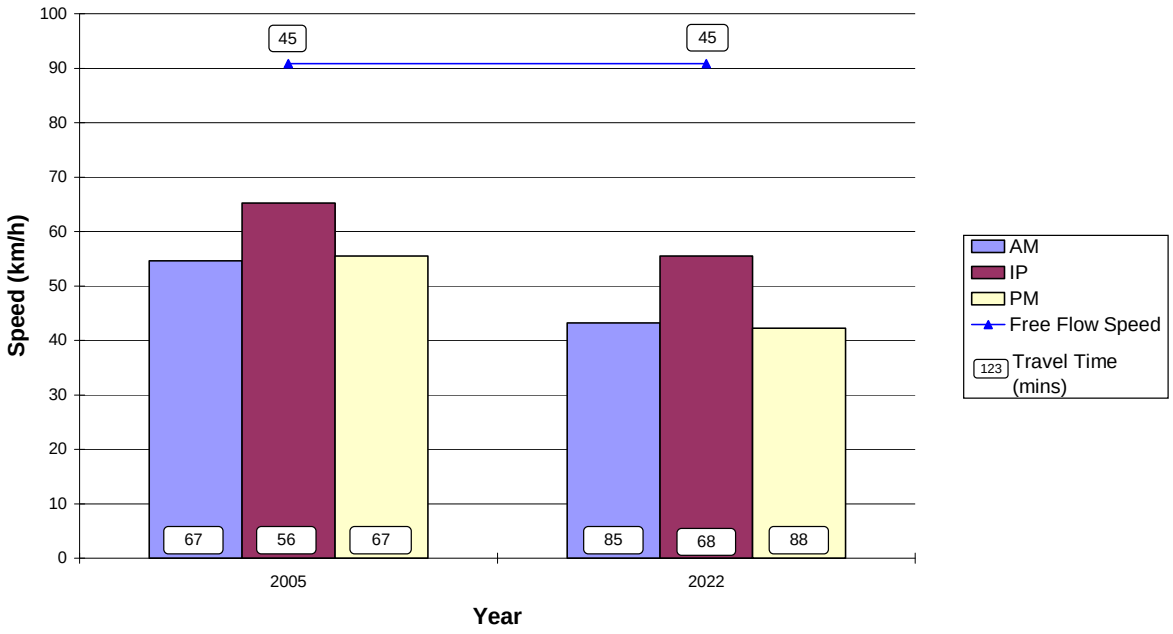

Figure 7.10.5: Average Road Speeds (Corridor 10)[557]

Travel time along this corridor in 2005 is similar in both the morning and evening peak at 1 hour 7 minutes whilst travel time in the off peak is 56 minutes. This contrasts with a free flow travel time of 45 minutes. By 2022 travel time in all time periods has deteriorated. During the morning and evening peaks the time has increased to 1 hour 25 and 1 hour 28 minutes respectively, whilst travel time in the off peak has increased to 1 hour 8 minutes. Free flow travel time remains unchanged at 45 minutes.

[557] TMfS:05

In 2005, average speeds in the morning and evening peaks were less than 60kph (40mph). By 2012 these speeds are expected to have fallen by a further 5kph in the peaks whilst the inter-peak period is relatively unchanged. By 2022 the peak speeds are expected to have reduced further and the inter-peak is forecast to be similar to the current peak levels.

With average speeds on the M9 considered undesirable, and an absence of journey time reliability issues, the expected decreases in travel speed indicate problems at junctions and especially on the approaches to or within Edinburgh at Newbridge Interchange, the M9 Spur and Hermiston Gait. This is reflected in the forecast increase in journey times of almost 20 minutes in peak periods.

A comparison of road, bus and rail travel times is shown in Figure 7.10.6[558] for trips along the corridor in the morning peak. This indicates that rail services are competitive against travel by road. Rail is forecast to become more competitive in future years as road journey times increase whilst rail journey times remain unchanged.

Rail service reliability is measured as the percentage of trains actually run in the last 12 months, split into seven service groups. The reliability of the services in Corridor 10 is:

- First ScotRail Express 94.2 per cent (target 92 per cent); and
- First ScotRail East 88.6 per cent (target 90 per cent)[559].

A contributing factor in the reliability of the rail journey times is the operational constraint on the approaches to Haymarket Station due to the heavy rail demand.

[558] Journey times for bus/rail include a 20 minute walk/wait time
[559] http://www.firstgroup.com/scotrail/content/aboutus/ourperformance.php

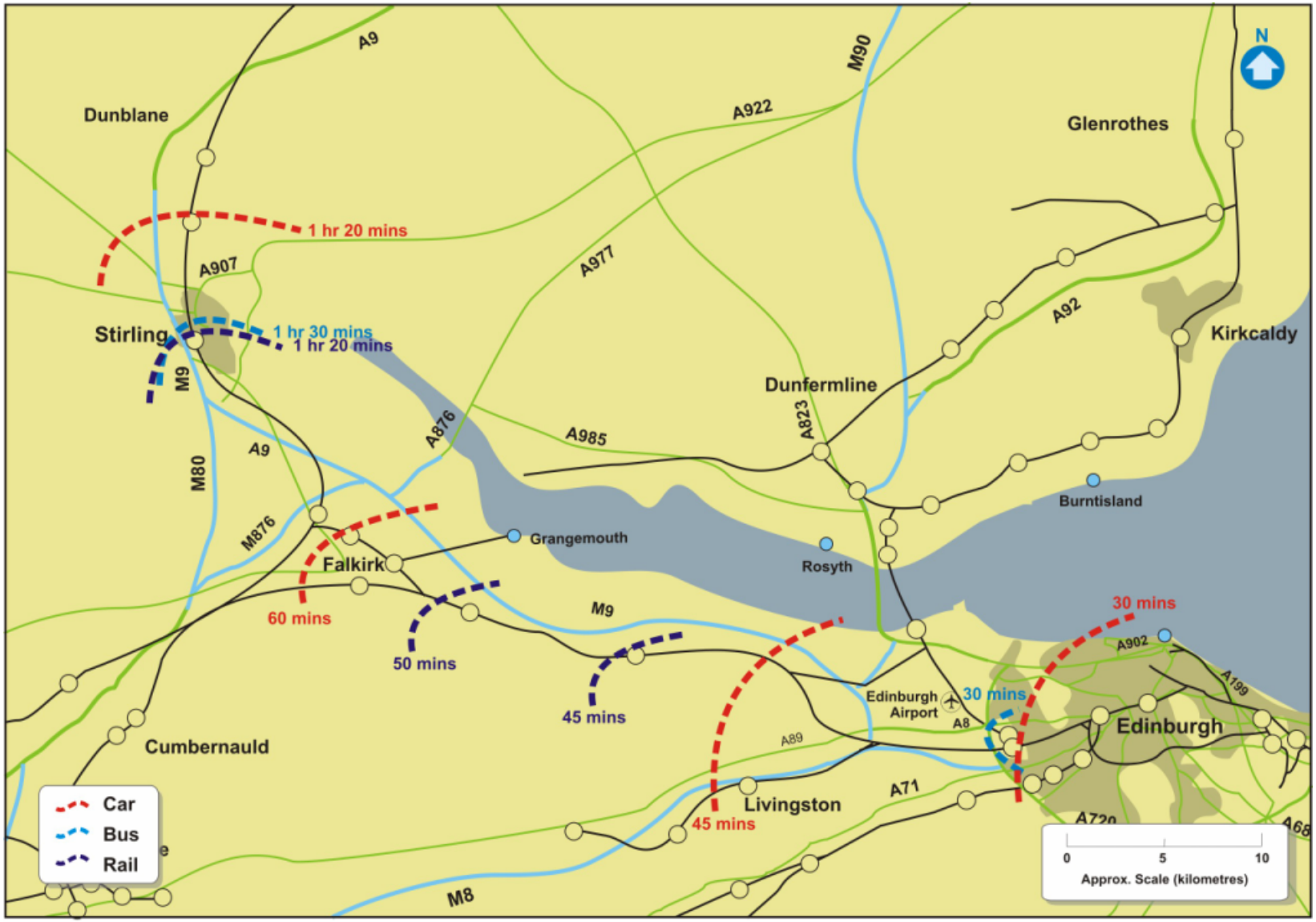

Figure 7.10.6: Journey Time to Edinburgh City Centre by Road/Rail (2005 AM peak), Corridor 10 - Edinburgh to Stirling

The key delay points on road network in the corridor are[560]:

- M9 Newbridge Interchange;
- M8 Junction 2 (M9 spur); and
- A8 Junction 1, Hermiston Gate (interchange for A71 and A720 City Bypass).

The AADT[561] flow on the M9 near Stirling is around 22,500 vehicles, but increases to around 45,000 at the busier sections near Newbridge. Whilst these AADTs are within capacity, the merging of traffic at Newbridge causes congestion.

Table 7.10.2 shows the projected morning peak load factors (ratio of demand to supply) on the rail services in the corridor for the various years, as reported in Network Rail's Route Utilisation Strategy. As these figures are averages across a number of train services, it suggests that trains running in the peak periods will be overcrowded.

Table 7.10.2: Rail Peak Load Factors[562]

	Base	2011	2016	2026
Dunblane - Edinburgh	0.78	0.85	0.92	1.00

Given that peak load factors on the network are high and passenger levels are set to increase, the current rail provision is unlikely to cope with future demand whilst buses offer an increasingly uncompetitive alternative to car or rail travel in the corridor

Emissions (CO_2 only)

This section of the report addresses the issue:

- What is the level of transport based emissions within the corridor?

CO_2 per person kilometres are forecast to rise from 162 tonnes / million person kilometres to 172 tonnes / million person kilometres between 2005 and 2022 in this corridor. This is a result of CO_2 emissions rising at a slightly greater rate than person kilometres between 2005 and 2022[563].

The road based transport network produced 234,000 tonnes of CO_2 in Corridor 10 in 2005. This equates to approximately four per cent of the total transport related CO_2 emissions in Scotland.

[560] TMfS:05
[561] Transport Scotland: Scottish Roads Traffic Database
[562] Network Rail: Scotland Route Utilisation Strategy March 2007: Table 8
[563] TMfS:05

By 2022, it is forecast that CO_2 emissions in Corridor 10 will rise to around 308,000 tonnes, remaining at around four per cent of Scotland's road based transport related CO_2 emissions in 2022.

The rail network produced 5,500 tonnes of CO_2 in Corridor 10 in 2007. This equates to approximately six per cent of the total rail based CO_2 emissions in Scotland[564].

Therefore, it is estimated that the road and rail based transport network collectively produced 239,500 tonnes of CO_2 in Corridor 10 in 2005. This equates to approximately four per cent of the total road and rail based transport related CO_2 emissions in Scotland.

Quality / Accessibility / Affordability

The following paragraphs address the issues of:

- Does public transport provision match origin/destination analysis?
- How competitive is public transport compared with the car?
- Do capacity issues impact on public transport service?
- How safe is the network?

The strategic transport provision in this corridor is focused on serving Edinburgh, Stirling and the main towns situated along the corridor such as Falkirk. These services successfully cater for trip demand to Edinburgh as reflected in the relatively high level of public transport share.

This infrastructure and service provision provide for effective business interaction between and among the centres of this corridor, with commuting opportunities by public transport and private car permitting suitable return journeys to be made within a working day.

Both road and rail based public transport are competitive when compared against travel by car along the corridor, with rail being the quicker of the two public transport modes of travel.

Table 7.10.3 [565] provides an assessment of bus service quality on the strategic long distance services in the corridor on a scale of one to five, with one being 'poor' and five being 'excellent'. Frequency and reliability have been identified as good, with all other factors average. Journey times on bus services will be affected by the forecast reduction in average speeds on the roads.

[564] AEA (2001) Rail Emission Model Final Report; www.nationalrail.co.uk; www.networkrail.co.uk
[565] Bus Users UK

Table 7.10.3: Assessment of Bus Service Quality[566]

Services	Service Operators	Annual Journeys	Reliability	Frequency	Simplicity	Value	Coverage	Vehicle Quality
38, 909	Citylink, First Bus	44,000	3	4	3	3	4	3

Many areas in this corridor (e.g. Falkirk) enjoy high levels of public transport accessibility. New public transport schemes planned for the future in combination with a rise in the opportunities available to access will increase this further. However, car travel is generally more competitive and is forecast to remain so in the future as a result of new road schemes planned for the Central Belt e.g. M80 Stepps to Haggs.

There are concentrations of people without cars in former Social Inclusion Partnership areas around Camelon with a greater dependency on public transport for access to key services. However, whilst public transport accessibility in these areas is not always good, it is not as low as some areas in other corridors.

The accident and fatal accident rates on the M9 between Edinburgh and Stirling are both lower than the national rate for motorways[567].

Studies of bus and rail passengers for the corridor for travel in the evening reveal no major issues regarding safety[568].

Summary of Infrastructure and Operational Constraints

Key constraints are shown in Figure 7.10.7, including:

- Delay and congestion on the M9 and M8 between Newbridge and Edinburgh City Bypass;
- A801 single carriageway constraint for road access from Falkirk and Grangemouth to the wider strategic network to the south;
- Capacity constraints on the Edinburgh – Glasgow shuttle service between Haymarket and Glasgow Queen Street with additional pressure to use services via Dunblane;
- Small number of passing loops is constraining to additional services;
- Rail constraint at Newbridge Junction;
- Currently no rail connection to Edinburgh Airport; and
- Many station car parks sites at capacity.

[566] Bus Users UK (Qualititative Assessment – 1: very poor; 5: excellent)
[567] Transport Scotland SERIS Database
[568] Scottish Household Survey 2003/2004: Perceptions of safety from crime during evening bus/rail travel

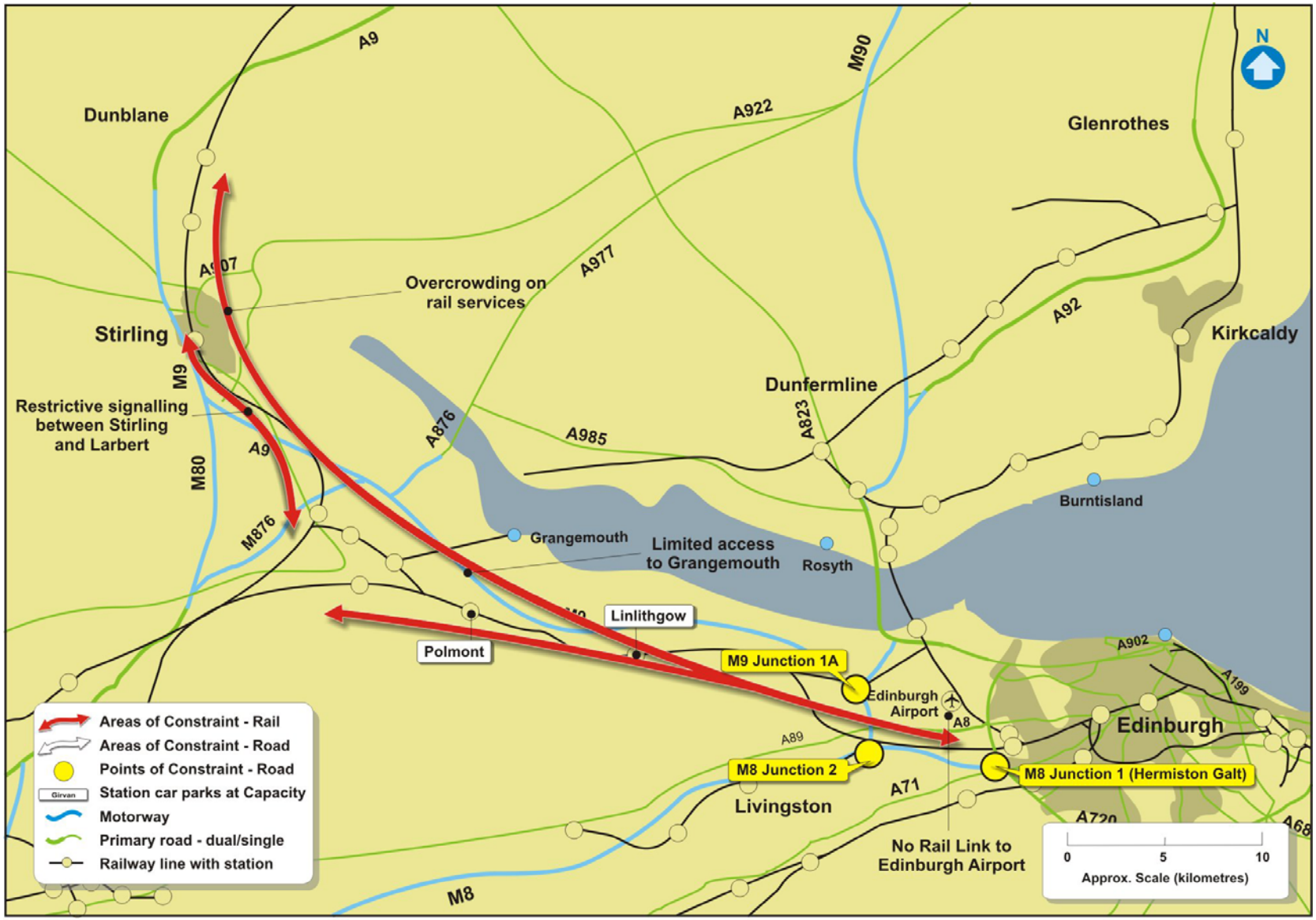

Figure 7.10.7: Areas of Constraint on the Network, Corridor 10 - Edinburgh to Stirling

7.10.5 Summary and Conclusions

Overall, how well does the transport network perform?

The Edinburgh to Stirling corridor is a key motorway and mainline rail link in the national strategic network. Both road and rail facilities are well used and heavily trafficked. Access to Edinburgh in the peak is restricted. There is congestion at some junctions to and from the M9 where speeds are low compared to the free flow speed, and congestion between Newbridge Interchange and the City Bypass however there are no journey time reliability issues in the corridor.

There is crowding on trains to Edinburgh. Haymarket station is heavily congested in the peaks due to the limited platform availability and track capacity. There are capacity constraints on the Edinburgh – Glasgow shuttle service between Haymarket and Glasgow Queen Street with additional pressure to use services via Dunblane. There are rail signalling issues between Stirling and Falkirk and no rail connection to Edinburgh Airport. The station car parks are operating at capacity.

Will the transport network meet future demand, particularly in areas of economic activity?

Future increases in demand will increase pressure on the transport system. The forecast is for additional congestion on the M9 and Newbridge, and increased passenger demand on trains which are already at capacity.

For road, average speeds throughout the day are expected to drop significantly between 2005 and 2022. Average travel times are expected to rise resulting in increased journey time variability. The ratio of average morning peak hour speeds to free flow speeds is less than 60 per cent. These are the roads where future speeds are expected to fall most as congestion increases.

Rail journey times are expected to remain unchanged over the same time period offering a more competitive mode of travel. As a result of the forecast increase in demand, the rail network, including stations will not be able to operate efficiently and reliably.

The frequency and reliability of public transport is good.

What are the key drivers that will impact on performance in the future?

Total population, employment levels and numbers of households are expected to rise between 2005 and 2022 increasing the demand for travel and putting increasing pressure on the existing network.

Grangemouth's importance as a strategic freight hub will lead to increased pressure on the adjacent road network and the wider rail network. As well as the need to improve local connections there will be a requirement to provide freight paths on the rail network.

Location of employment in the suburban business parks and their distance from current public transport facilities, the general ease of access on the inter-urban sections of the M9 and the high car ownership in the corridor all conspire to reduce the use of public transport.

However, rail services are competitive against travel by road, for journeys east of Falkirk. This is likely to be further emphasised on existing point to point trips in future years as average journey times by road are expected to increase while rail journey times are likely to remain unchanged. Any growth in rail patronage will however be constrained by available capacity on the trains.

What are the key problems associated with delivering the KSOs?

Public transport's mode share is expected to remain constant to 2022. However, whilst journey times on the road network are forecast to increase, journey times by rail will remain the same, thus making rail a more competitive alternative to driving. Providing additional rail capacity to maintain the railway network's competitiveness will be a key issue.

Congestion affects the reliability of inter-city bus services.

Forecast overcrowding on the rail network and the poor perceptions of safety on public transport are other key issues.

Increased levels of congestion on the road network will have a negative impact on journey time reliability, particularly in the peak periods.