

2 Need for the Scheme

2.1 Introduction

2.1.1 This chapter describes the pressures facing the Forth Road Bridge and sets out the main reasons why the proposed scheme is considered necessary. A summary of existing traffic conditions in the locality of the proposed scheme is also provided.

2.2 The Forth Road Bridge

2.2.1 The Forth Road Bridge opened in 1964 and forms a key link in Scotland's transport network, providing a strategic connection between the north of Scotland and the central belt, through its connection of the M90 to the M9 through the A90 and M9 Spur. The existence of the bridge crossing is critical to the east of Scotland economy, providing a vital link between Edinburgh, the Lothians and Fife.

Condition of the Forth Road Bridge

2.2.2 The condition of the Forth Road Bridge has deteriorated over time, with the changes in traffic and the effects of climate accepted as the primary factors in this deterioration. These are described further below.

Changes in Traffic

2.2.3 Over its lifetime, the Forth Road Bridge has been subject to a continued increase in traffic volume and traffic intensity, the volume of traffic having increased from 4 million in 1964 to a current level of approximately 24 million vehicles per year.

2.2.4 Heavy Goods Vehicle (HGV) traffic has increased proportionally to the total volume of traffic being carried, the weight of unrestricted HGVs having also increased from 24 tonnes to 44 tonnes. Whilst maintenance is a constant requirement in the operation of the bridge, the issues being experienced are exacerbated by each of these factors.

2.2.5 Existing traffic conditions are summarised in Section 2.4 and described further in the DMRB Stage 3 Scheme Assessment Report, Part C (Jacobs Arup, 2009).

Climatic Influences

2.2.6 The Forth Road Bridge is situated at a relatively northern latitude and subjected to strong winds from the west. Furthermore, high humidity coupled with the cold water of the Firth of Forth leads to regular occurrences of fog during the spring and summer months. These effects and the presence of salt water contribute to the highly corrosive conditions experienced.

Recent Inspection and Management

2.2.7 Whilst the Forth Road Bridge has a significant number of known maintenance issues that are likely to have impacts on road users and the wider economy, the principal focus of concern in recent years has been the condition of the main suspension cables and the bridge's ability to continue as an unrestricted crossing.

Cable Inspection

2.2.8 During 2004 and 2005, the Forth Estuary Transport Authority (FETA) undertook the first internal inspection of the main suspension cables. This inspection revealed that a number of cable wires had broken or were in an advanced state of corrosion, with the loss in cable strength estimated at between 8% and 10% (FETA, 2008a). Estimations at the time predicted that restrictions to HGV

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traffic would be required from 2014, with a closure to all traffic being required from 2020 if cable deterioration could not be reduced.

- 2.2.9 In early 2008, a second cable inspection was undertaken by FETA, which included some areas of cable analysed during the previous study of 2004 and 2005. In July 2008, FETA estimated the loss of strength in the main cables to be 10%, a figure comparable to the upper bound figure estimated from the 2004/2005 work (FETA, 2008a). Whilst the previous predictions for possible traffic restrictions remained valid, with the rate of deterioration tending towards the lower end of the range, HGV restrictions now seem more likely between 2017 and 2021.

Cable Dehumidification

- 2.2.10 In an effort to arrest the rate of deterioration being experienced, FETA has been undertaking work to install dehumidification equipment to the main suspension cables of the bridge. The dehumidification process involves pumping dry air through the voids within the cable, having firstly applied an air-tight neoprene wrapping. Whilst it is hoped that this system will remove the moisture from the cables, and prevent or reduce further deterioration, the initial results of the process will not be known until late 2011/early 2012, when a further evaluation of the cables will take place.

Cable Replacement or Augmentation

- 2.2.11 In February 2008, FETA reported on a study (FETA, 2008b) undertaken to investigate the feasibility of replacing or augmenting (strengthening) the main cables, should this become necessary. Whilst the study stated that cable replacement or augmentation was possible, it concluded that this process was not feasible without a replacement bridge, as the impact on road users and the wider economy would otherwise be too severe.

2.3 National Context for Bridge Replacement

Strategic Transport Review and Subsequent Studies

- 2.3.1 The Strategic Transport Projects Review (STPR) is a body of work which has been undertaken by Transport Scotland to define the most appropriate strategic investments in Scotland's national transport network between 2012 and 2022. Recent development of the scheme has been within the policy context of the STPR and its subsidiary study the Forth Replacement Crossing Study (FRCS, Jacobs et al., 2007). The scheme has been driven by the uncertainty over the condition and long-term future of the existing Forth Road Bridge as summarised in Section 2.2. Options for a replacement crossing were identified in the FRCS and have been subjected to Scottish Transport Appraisal Guidance (STAG) Part 1 and 2 appraisals. This has led to a decision by the Scottish Ministers to build a new crossing to exist alongside the Forth Road Bridge (dedicated to public transport) as part of a Managed Crossing Scheme.
- 2.3.2 Following the completion of the FRCS, it was announced to Parliament on 19 December 2007 that the Forth Replacement Crossing is to be a cable stayed bridge and that the scheme would be designed to:
- safeguard the capability of future multi-modal use;
 - provide for pedestrians and cyclists;
 - provide for two lanes in each direction for general traffic;
 - incorporate hard shoulders to relieve disruption due to breakdowns and maintenance activity;
 - provide an enhanced service to West Lothian, and;
 - protect and promote economic development areas in Fife.

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- 2.3.3 Following the announcement on 19 December 2007, the Jacobs Arup Joint Venture was appointed in January 2008 to work as a development partner with Transport Scotland to take the project forward.
- 2.3.4 Since the December 2007 announcement, an extensive amount of work has been carried out by Transport Scotland and Jacobs Arup to take the plans to the next stage. Over the last year new information has also become available about the condition of the existing Forth Road Bridge (refer to paragraph 2.2.9), revealing a slightly more positive prognosis. Considering all of this information Transport Scotland has developed a Managed Crossing Scheme for the Forth Replacement Crossing which takes into account the opportunity to utilise the existing bridge in a sustainable way, utilising the existing Forth Road Bridge as a dedicated public transport corridor alongside the new bridge. While the existing bridge is not capable of carrying the main burden of all traffic on its own in the future, this approach allows the Grade A Listed Forth Road Bridge to continue to play an important role in meeting cross-Forth travel demand as a public transport corridor.
- 2.3.5 The continuing use of the existing bridge in the manner described above has also permitted the design of a refined, narrower replacement bridge than previously anticipated. This bridge will carry general road traffic and, importantly, all heavy goods vehicles. The refined strategy for the connecting road network combines the use of traffic management technology, with significant junction improvements and new high-quality dual carriageways. Using the existing bridge and refining the strategy means that it is now estimated that the project will cost between £1.7 and £2.3 billion at outturn prices; a significant reduction in cost on the original budget estimate of £3.2 to £4.2 billion.
- 2.3.6 The strategy addresses all of the project objectives with greater flexibility and with improved value for money, making sensible use of existing infrastructure, reducing environmental impact, and facilitating opportunity for the further development of public transport provision to match demand. The project remains on programme to start construction in 2011 and open in 2016.

National Planning Framework

- 2.3.7 The Scottish Government published the approved National Planning Framework (NPF2) in June 2009. NPF2 is intended to set out strategic development priorities for Scotland to 2030, promoting sustainable economic growth.
- 2.3.8 The Forth Replacement Crossing is listed in NPF2 as a national development and the need for this project is described as follows: *'The Forth Road Bridge has been an essential part of the national road infrastructure for over 40 years. It is vital to the economy of Fife, an essential link for the East Coast Corridor and crucial to the connectivity of Perth and the Highlands and Islands. The main suspension cables of the bridge are showing significant signs of deterioration as a result of corrosion. While a programme of works has been identified to dry out the cables and thus prolong the life of the bridge, there is a considerable risk that this work will not be successful. If that proves to be the case, restrictions to heavy goods vehicles may be needed as early as 2013, with the bridge closing to all traffic by 2019. Complete loss of the road crossing would have very significant adverse economic impacts, both nationally and regionally'*. Therefore the proposed scheme is identified as *'an essential element of national infrastructure'*.
- 2.3.9 Further information relating to national planning framework is provided in Chapter 20 (Policies and Plans).

Economic Considerations

- 2.3.10 Without a replacement crossing, the wider economic impact of closure or restricted use of the Forth Road Bridge on the local economies of Fife and the Lothians and the national economy of Scotland, would be very significant. To illustrate the scale of this potential impact, the FETA cable augmentation study (FETA, 2008b) included a preliminary economic assessment which addressed

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the wider impact on the economies of Fife and the Lothians resulting from traffic disruption, delays and reduced accessibility related to the works.

2.3.11 The impact on the economy resulting from cable replacement/augmentation works depends on the structure and competitiveness of the local market. It could potentially increase costs to the travelling public, add to distribution costs, affect customer markets and lead to a competitive disadvantage. The inconvenience and added cost of travel could potentially discourage tourism and reduce recreational travel. The net effect would be to reduce business and government revenues resulting in a contraction in economic activity and a loss of jobs.

2.3.12 If the works were undertaken without a replacement bridge to carry traffic, the FETA cable augmentation study forecast (FETA, 2008b) that the disruption caused would reduce business turnover by between £539 million and £1,320 million and reduce business output by between £443 million and £1,085 million in Scotland as a whole. Cable replacement was regarded as the preferred option and yielded the higher end figures, as well as the possibility of job losses of 3200, many of which would be permanent.

2.4 Existing Traffic Conditions

2.4.1 The Forth Road Bridge and its associated connecting roads form a strategically important section of Scotland's road network linking Edinburgh, Perth, Dundee, and Aberdeen via the A90 and the M90. The bridge itself carries in excess of 65,000 vehicles per day which equates to 70% of all cross-Forth traffic, with the bridge crossings at Kincardine and the Forth Rail Bridge providing alternative routes or means of travel.

2.4.2 The information below provides a context to the importance of the road network and the importance of cross-Forth traffic, and highlights key areas of traffic congestion that the proposed scheme would seek to address. More detailed information regarding traffic is provided in the DMRB Stage 3 Scheme Assessment Report, Part C (Jacobs Arup, 2009).

North of the Firth of Forth

2.4.3 The principal road connections north of the Firth of Forth are:

- M90/A90 Inverkeithing - Fraserburgh Trunk Road;
- A921 forming an east-west route between Kirkcaldy and Admiralty Junction (M90 Junction 1);
- A985 Kincardine – Rosyth Trunk Road forming an east-west route between Admiralty Junction (M90 Junction 1) and Kincardine;
- A823/A823(M) Pitreavie Spur Trunk Road forming an east-west route between Masterton Junction (M90 Junction 2) and Dunfermline; and
- A907/A92 East Fife Regional Road forming an east-west route between Kirkcaldy and Dunfermline via Halbeath Interchange (M90 Junction 2a/M90 Junction 3).

2.4.4 The M90, as a part of the Scottish trunk road network, provides a link between the Forth Road Bridge and the northeast of Scotland via the A90. Commencing at Admiralty Junction (Junction 1), the M90 operates as a dual two lane motorway with hard shoulder. Whilst facilitating strategic long distance travel, the M90 is also a heavily utilised commuter route, serving the towns of Rosyth, Inverkeithing and Dunfermline, and east Fife through junctions at Admiralty, Masterton (Junction 2) and Halbeath (Junction 2A/Junction 3).

2.4.5 South of the M90, the A90, a dual carriageway operated by Fife Council, provides the link between the M90 and Forth Road Bridge. Ferrytoll Junction, situated on approach to the bridge, provides access to Rosyth, North Queensferry, Inverkeithing and Rosyth Dockyard via the B980, B981 and Ferry Toll Road respectively.

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- 2.4.6 The Average Annual Daily Traffic (AADT) volumes for the principal routes north of the Forth are shown on Figure 4.3.
- 2.4.7 The most heavily trafficked section of the A90/M90 is located between the Admiralty and Masterton Junctions, where traffic from the A985, A921 and A823(M) interacts with strategic traffic on the mainline.
- 2.4.8 In the AM peak, it is common for large traffic queues to build up on the southbound approach to the Forth Road Bridge. These queues can extend for several kilometres, the close spacing of the junctions on approach to the bridge further exacerbating the problem as traffic from Dunfermline, Rosyth, Inverkeithing and North Queensferry attempts to join the mainline carriageway.
- 2.4.9 The southbound AM flow on the M90 is slightly higher than the equivalent northbound flow of vehicles during the same hour. With tidal traffic flows, which are commonly the result of commuting trips, the reverse of the AM flow pattern is typically observed during the PM period.

South of the Firth of Forth

- 2.4.10 The principal links south of the Firth of Forth are:
- A90 between the north of Edinburgh and South Queensferry;
 - M9 Spur (including the recently constructed M9 Spur Extension) between M9 Junction 1A and Scotstoun Junction;
 - M9 Edinburgh – Stirling – Thurso Trunk Road;
 - M8/A8 Edinburgh – Greenock Trunk Road;
 - A8/A89 forming an east-west route between Edinburgh, West Lothian and beyond;
 - A8000 forming a north-south route between South Queensferry and Kirkliston
 - A720 Edinburgh City Bypass; and
 - A904 forming an east-west route between Bo'ness and South Queensferry.
- 2.4.11 The principal road links providing connection between the Forth Road Bridge, Edinburgh, and the central Scotland motorway network, are the A90 and the recently completed M9 Spur Extension, owned and operated by the City of Edinburgh Council.
- 2.4.12 Upgraded as a part of the M9 Spur Extension contract in 2007, the A90 on approach to the Forth Road Bridge operates as an urban dual three lane carriageway west of the new Scotstoun Junction. Scotstoun Junction, a free flow junction situated west of Dalmeny, allows traffic from the north of Edinburgh (A90) and traffic from the M9, using the extended M9 Spur, to merge on the southern approach to the Forth Road Bridge.
- 2.4.13 Access between West Lothian and the Forth Road Bridge is typically taken via Echline Junction and the A904, a regional road operated by the City of Edinburgh Council and West Lothian Council. This route provides direct access to Newton and Bo'ness, whilst also providing westbound access to M9 Junction 2 via the B8046 at Philipston.
- 2.4.14 Access to South Queensferry and Kirkliston is provided via the A8000 and B800.
- 2.4.15 The AADT volumes for the principal routes south of the Forth are shown on Figure 2.2.
- 2.4.16 The most heavily trafficked roads associated with the Forth Road Bridge south of the Firth of Forth are the A90 to/from Edinburgh and the M9, south of M9 Junction 1A.
- 2.4.17 In the AM period, it is common for southbound traffic to queue back onto the M9 Spur. The completion of this route has encouraged some southbound traffic to re-route to the M9 from the

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A90 and Barnton Junction. This increase in traffic regularly forms a queue on the M9 Spur as it approaches M9 Junction 1A. The M9 Spur narrows from two lanes to one lane as it merges with the M9 eastbound and this narrowing of the carriageway contributes to the formation of a queue at this location.

- 2.4.18 In the PM period, northbound queues form approaching the Forth Road Bridge. These queues are largely as a result of the two lanes associated with the A90 merging with the two lanes from the M9 Spur. This results in three lanes being provided to Echline Junction where a lane drop arrangement to the junction reduces the carriageway to two traffic lane lanes on approach to the bridge. Traffic from the A904 and A8000 merging with the A90 northbound via Echline Junction further contributes to the congestion experienced.

2.5 References

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