JACOBS ARUP

A report on behalf of Transport Scotland and in association with Natural Capital

Forth Replacement Crossing

Sustainability Appraisal and Carbon Management Report

Appendix 2:

Sustainability Appraisal Framework

November 2009

TRANSPORT SCOTLAND

natural CAPITAL

JACOBS ARUP

Appendix 2: Sustainability Appraisal Framework

Sustainability Appraisal Framework				Applicability					
Sustainability Objectives		**Target**	**Indicators**	**Quantitative Indicator**	**Qualitative Indicator**	**Stage 3 Design**	**Tender Design**	**Final Design and Construction**	**Operation**
Economic									
1	To design, build and operate a reliable crossing	To reduce the number of planned daytime[1] lane FRC closures[2] (excluding the hard shoulder) compared to existing Forth Road Bridge (FRB)	Predicted[3] number of planned closures	✓		X	X	X	
			Actual[4] number of planned closures	✓					X
		To reduce the number of unplanned lane closures on the FRC caused by non-weather events (e.g. vehicle breakdowns) compared to existing FRB	Predicted number of unplanned (non-weather) closures[5]	✓		X	X	X	
			Actual number of unplanned (non-weather) closures	✓					X
		To reduce the number of FRC closures[6] due to adverse weather conditions compared to existing FRB	Predicted number of closures to any class of vehicle due to adverse weather conditions	✓		X	X	X	
			Actual number of closures to any class of vehicle due to adverse weather conditions	✓					X
2	To contribute to the improvement of cross-Forth access to economic opportunities	To contribute towards improved journey time reliability[7]	Percentage of road journeys that do not take longer than 115% of the average journey time (Traffic Scotland Local Trunk Road Congestion Indicator 4)	✓		X	X	X	
		To contribute towards increasing the employment catchment areas of major centres of economic activity by public transport.	The proposed scheme is designed to not preclude improvements in public transport, but responsibility for their delivery (and therefore monitoring) lies beyond the scope of this project. An indicator for monitoring this target has not been identified			X	X	X	
		To contribute to the reduction of lost travel time associated with traffic congestion	Average time lost per vehicle kilometre[8]	✓		X	X	X	X

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3	To contribute towards the development of cross-Forth public transport opportunities	Maximise the opportunities for multi-modal travel across the Forth Estuary	Provision of cross-Forth infrastructure to facilitate multi-modal transport		✓	X	X	X	X
4	To minimise the scheme footprint and severance of land	Minimise land-take for the scheme	Proportion (%) of land returned to agricultural use	✓		X	X	X	
			Proportion (%) of landholdings, businesses, residential properties and areas of community land significantly affected as a result of land take	✓		X	X	X	
			Absolute area of agricultural land lost by land type[9]						
		Minimise the negative impacts of land severance	Proportion (%) of affected agricultural land holdings where the degree of severance less than 10% of the total land holding	✓		X	X	X	
			Proportion (%) of land holdings affected by severance where access will be maintained through the provision of new or upgraded overbridges/underpasses as part of the scheme or through accommodation works	✓		X	X	X	
5	To adopt sustainable resource management in design and construction	Develop a sustainable resource management framework	A sustainable resource management strategy in place and in use		✓	X	X	X	
		Minimise material use through careful design and adopting material reduction measures	Development of a specific materials plan[10]		✓	X	X	X	
			Percentage reduction in specific materials from Stage 3 design	✓		X	X	X	

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Social									
6	To ensure that community engagement takes place at all the key stages in the FRC project process as set out in 'Engaging with Communities'	To make sure that all groups whose interests are affected by the proposed scheme are identified and have access to information and opportunity to engage	Demonstrate a thorough and inclusive stakeholder identification process		✓	X	X	X	
		To select appropriate methods of engagement for target audiences and to make sure information is made available at appropriate stages in the project	Range of methods of engagement and communication channels		✓	X		X	
			Delivery of consultation commitments in 'Engaging with Communities'		✓	X		X	
		To provide opportunity for two-way dialogue and ensure stakeholder feedback is considered during the design development process	Facilities for stakeholders to feed into the project development		✓	X		X	
			Demonstrate stakeholder comment has been taken into consideration during the project development		✓	X		X	
7	To improve local accessibility and reduce community severance	Reduce community severance by reducing traffic on local roads within 400m[12] of the main carriageway centre line	Number of pedestrian/cycle paths which would experience a reduction in traffic flows at non-signalised road crossing points[11]	✓		X	X	X	
		Improve walking and cycling provision and integration within the scheme catchment	Number of paths/cycleways improved/created/disrupted	✓		X	X	X	
		Contribute to the improvement of access to public transport	Percentage increase in the number of households within 400m[12] of a high frequency bus service	✓		X	X	X	

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	Sustainability Objectives	Target	Indicators	Quantitative Indicator	Qualitative Indicator	Stage 3 Design	Tender Design	Final Design and Construction	Operation
8	To provide a scheme that accommodates the needs of disabled people	Ensure all non-motorised user routes impacted by the scheme are designed in accordance with Transport Scotland's "Disability Discrimination Act Good Practice Guide for Roads"	The number of pedestrian or cyclist networks retained or amended on their current alignment, or aligned in accordance with Transport Scotland's "Disability Discrimination Act Good Practice Guide for Roads".	✓		X	X	X	
		Ensure the needs of disabled people are given due consideration in the design of all aspects of the scheme	Consideration of disabled access in the development of the design.		✓	X	X	X	
			Emergency telephones accessible to disabled people		✓	X	X	X	
			Temporary footpaths/ cycleway diversions during construction in accordance with Transport Scotland's "Disability Discrimination Act Good Practice Guide for Roads"		✓	X	X	X	
9	To contribute to the promotion of healthy lifestyle opportunities and social inclusion	Maintain the quality and accessibility of open or green space[13]	The number of open/green spaces in the vicinity of the scheme experiencing significant positive/negative effects, measured according to direct loss, effects on amenity, views and accessibility	✓		X	X	X	
				✓		X	X	X	
		Seek to create direct employment opportunities for local people including those in deprived communities	Training places provided that are recognised and accredited by the CITB-Construction Skills and which lead to a qualification of at least Scottish Vocational Qualification (SVQ) Level 2 or higher.		✓	X		X	

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			Training places provided that are recognised and accredited by Professional Bodies (such as the Institution of Civil Engineers) leading to membership of the Professional Body.		✓			X	
			The number of employment opportunities for those who are currently long-term unemployed.	✓				X	
			Proportion of training and employment opportunities taken by local people, and for residents of deprived areas.	✓				X	
		Contribute to the improvement in public transport access to economic opportunities where this is a factor in deprivation	Public Transport journey times to key economic centres[14] in the region for communities where geographic access is a factor in high levels of deprivation		✓	X	X	X	
		Avoid increasing health inequalities during the construction process	Proportion of the population in deprived communities directly affected by construction impacts[15]	✓		X	X	X	
			Proportion of the population in non-deprived communities directly affected by construction impacts						
10	To provide a safe design for both vehicle travellers and non-motorised users	To reduce the risk/likelihood of accidents as compared to existing FRB	Predicted accident rates[16]	✓		X	X	X	
			Actual accident rates[17]	✓					X
Environmental									
11	To reduce, reuse and recycle	Minimise absolute volumes and difference	Predicted cut and fill design volumes[18]	✓		X		X	

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	materials and products where practicable	between cut and fill earthworks quantities	Predicted cut and fill design volumes[19]	✓			X	X	
			Actual cut and fill volumes achieved	✓				X	
			Predicted and actual proportions by volume of cut material that is used on site as part of the works	✓		X	X	X	
			Predicted and actual proportions by volume of fill material that is site won (including modified material)	✓		X	X	X	
			Actual proportion by volume of material present on site that has been incorporated into the project as opposed to being disposed of off site	✓		X	X	X	
			Actual quantities of recycled materials used during construction	✓				X	
		Maximise % of earthworks materials sourced locally	Predicted % materials sourced locally – within 10km[20]	✓		X	X	X	
			Predicted % materials sourced locally – within 80km [24]	✓		X	X	X	
			Actual % materials sourced locally– within 10km [24]	✓				X	
			Actual % materials sourced locally – within 80km [24]	✓				X	
		Maximise use of reused/recycled products	Predicted[21] % of materials used that are from recycled sources	✓		X	X	X	
			Actual % of materials used that are from recycled sources	✓				X	

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Sustainability Objectives		Target	Indicators	Quantitative Indicator	Qualitative Indicator	Stage 3 Design	Tender Design	Final Design and Construction	Operation
		Promote the restoration and development of brownfield/contaminated sites within areas affected by the scheme	Area of brownfield/contaminated land brought back into beneficial use, according to environmental risk[22]	✓		X	X	X	
12	To minimise embodied energy and carbon associated with the construction of the scheme	Seek to minimise the embodied energy and carbon associated with key materials and their transport to site	Estimated embodied energy and carbon[23]	✓		X	X	X	
			Actual embodied energy and carbon in materials, transportation and waste	✓				X	
		Minimise energy use and all carbon emissions during construction	Predicted[24] energy requirement and CO_2 emissions	✓		X	X	X	
			Actual energy used and CO_2 emissions	✓				X	
13	To minimise carbon emissions once the scheme is opened to traffic	Seek to reduce CO_2 emissions from vehicles crossing the Forth at Queensferry compared with existing FRB	Predicted CO_2 emissions per veh-km[25]	✓		X	X	X	
		Minimise the energy requirements of the scheme (once it is open to traffic) to the minimum necessary for safe operation	Predicted[26] energy requirements	✓		X	X	X	
			Actual energy requirement	✓					X
		Maximise % of required energy for the scheme (once opened to traffic) acquired from renewable sources	Predicted[27] energy sources		✓	X	X	X	
			Actual energy sources		✓				X
14	To protect and enhance the natural heritage including local biodiversity	To minimise number of sites designated for natural heritage conservation and protected species affected and significance of any adverse impacts	Number and type of sites (e.g. international and local) and protected species impacted and significance of predicted impacts[28]	✓	✓	X	X	X	
			Actual impacts on sites and protected species during construction[29]		✓			X	

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Sustainability Objectives		Target	Indicators	Quantitative Indicator	Qualitative Indicator	Stage 3 Design	Tender Design	Final Design and Construction	Operation
		To protect and enhance biodiversity	Number of watercourses impacted and significance of predicted impacts[30]	✓	✓	X	X	X	
			Actual number of watercourses impacted and significance of impacts[31]	✓	✓			X	
			Actual impacts on water quality[35]		✓			X	
			Number of reported roadkills of protected species[32]	✓					X
			Percentage area of new habitats compared with areas lost[33]	✓		X	X	X	
			Number of new records of species and habitats of nature conservation value[34]	✓					X
15	To protect the landscape, historic environment and cultural heritage	Develop alignment and design to avoid or minimise impacts on the landscape resource and character, and setting of cultural heritage features	Reported significance of residual landscape effects[35]		✓	X	X	X	X
			Number of and significance of direct and indirect residual effects on cultural heritage sites[39]	✓	✓	X	X	X	
			Actual number of and significance of direct and indirect residual effects on archaeological sites and monuments[39]	✓	✓			X	
16	To reduce noise and air emissions	Manage effectively, construction noise impacts and reduce and mitigate significant operational noise impacts where practicable	Noise level changes and associated changes in nuisance levels at quantified numbers of dwellings/groups of dwellings within 600m in accordance with DMRB methodology	✓		X	X	X	
			Number of legitimate complaints about noise nuisance	✓					X

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	Sustainability Objectives	Target	Indicators	Quantitative Indicator	Qualitative Indicator	Stage 3 Design	Tender Design	Final Design and Construction	Operation
		Air quality limit values (absolute concentrations) not to be exceeded (40µg/m3 for NO_2; 18µg/m^3 for PM_{10}) at selected residential properties and other sensitive receptors[36]	Absolute concentrations (µg/m^3) for NO_2 and PM_{10} at selected residential properties and other sensitive receptors[49]	✓		X	X	X	X
		Dust deposition to be contained within rate limit values	Dust deposition rates during construction that exceed 200mg/m^2/day	✓				X	
			Dust deposition rates for biological SSSIs that exceed 1000mg/m^2/day	✓				X	
17	To protect water quality, geomorphology and maximise the use of sustainable drainage systems for environmental and hydrological benefit	Limit impacts and significance of residual effects on water quality and pass majority of runoff through SUDS	Percentage of mainline[37] drainage passing through SUDS	✓		X	X	X	X
		Limit watercourse re-alignments and limit number of watercourse crossings	Attainment of CAR Licence		✓	X	X	X	

End Notes

[1] Daytime refers to 06:00 to 20:00
[2] Closures refers to one or more lanes on the bridge being closed to traffic
[3] This number will be predicted based on the design team's knowledge. It will be compared to the trend for the existing Forth Road Bridge based on an extrapolation of 10 years of historical data (1999-2009 average annual number)
[4] These will be logged as they happen and the average number will be built up over the first 5-10 years
[5] The main benefit that FRC will offer over FRB is the presence of the hard shoulders as emergency refuges for vehicles that break down. If a vehicle can get to the hardshoulder then there is no lane closure. Not all breakdowns will make it across to the hardshoulder, so some judgement will be required in setting the target. The FRB data does not capture the extent of disruption cause by accidents or the duration of closures. To give a quantitative measure it will almost certainly be necessary to make an assumption on how much disruption a breakdown causes (also for accidents and other incidents), e.g. "a van breaking down in a traffic lane blocks one lane for one hour", or similar
[6] 'Closures', not 'restrictions'. It is assumed the measure is the bridge being closed to any traffic class, not just the imposition of a speed limit because of fog, ice, etc
[7]Current journey times across the Forth Road Bridge are not reliable since the current network is very sensitive to variations in the weather and other factors that can cause serious disruption (e.g. accidents, slow vehicles etc). This objective is not about making journey times quicker but about smoothing out the variability and thus making them more reliable
[8] Average time lost per vehicle kilometre is the time lost per vehicle kilometre averaged over the year. It is effectively "additional travel time" divided by the "total volume of traffic" (expressed as total vehicle kilometres travelled). This gives the average delay encountered by a vehicle travelling one kilometre. Transport Scotland's Local Trunk Road Congestion Indicator 2
[9] Agricultural land class – prime, non-prime, woodland and scrub
[10] The materials plan will focus on a list of the key materials that will make up the main proportion of the road and bridge infrastructure (i.e. steel, concrete, earthworks, crushed aggregate, aluminium, bitumen, membranes, wood, paints and coatings)
[11] 'Non-signalised' is where there is a drop curb provided
[12] 400m has become an accepted standard for a 'suitable walking distance' and is derived from Scottish Government guidance on 'Minimum Standards for Open Space' and is featured in NPPG 11: Sport, Physical recreation and Open Space
[13] In PAN 65: Planning and Open Space – Open or green space is defined as including public parks and gardens, private gardens or grounds, amenity greenspace, playspace for children and teenagers, sports areas, green corridors, natural/semi-natural greenspaces, allotments and community growing spaces, civil space, burial grounds, other functional greenspace
[14] Key economic centres are listed as: Edinburgh City Centre; Edinburgh Park, South Gyle; Granton Waterfront; Leith; Livingstone; Edinburgh Airport; A701 Corridor (biotechnology and knowledge-based industries); Edinburgh Royal Infirmary (biomedical research park); Dunfermline; Lochgelly; Kirkcaldy; Levenmouth; and Glenrothes.
[15] Calculated by superimposing a map from the 'Disruption due to Construction' study over a map from the Scottish Index of Multiple Deprivation
[16] This number will be predicted based on the design team's knowledge. It will be compared to the trend for the existing Forth Road Bridge based on an extrapolation of 10 years of historical data (1999 – 2009 average annual number)
[17] This will be specific to the scheme area
[18] These are derived from the Stage 3 design
[19] These are derived from the contractor's design
[20] There are two definitions of 'local' in this context
[21] As predicted in the Stage 3 design
[22] There is a small area of former landfill on the northern side of the scheme
[23] The figures for embodied energy and carbon have been derived through an iterative process that has involved the use of scoping and design to reduce the amounts of embodied energy and carbon in the materials and processes to be used

[24] This figure is derived from the Stage 3 design
[25] This number will be predicted using the TMFS ENEVAL model and based on the design team's knowledge. It will be compared to the trend for the existing Forth Road Bridge based on an extrapolation of 10 years of historical data (1999 – 2009 average annual number)
[26] This figure is derived from the Stage 3 design
[27] This figure is derived from the Stage 3 design
[28] As derived from the EIA process and the Environmental Statement
[29] This figure is derived from the Stage 3 design
[30] As derived from the EIA process and the Environmental Statement
[31] Data to be obtained from monitoring programmes either from SEPA existing monitoring stations or instigated by Transport Scotland
[32] Data obtained from SNH; local wildlife groups; local councils
[33] Data derived at end of construction by Transport Scotland
[34] Data obtained from SNH; local wildlife groups; local councils
[35] These indicators are taken from the Environmental Statement
[36] These are all located within the local air quality study area, together with representative residential properties within 200m of road links affected by the proposed scheme outside the local study area. Contour maps show pollutant concentrations for years 2017 and 2032
[37] 'Mainline' is defined as sections of road that are either motorway or trunk road