



REPORT

To: Special Infrastructure Committee

28 May 2010

From: Head of Finance

Whalsay Transport Links: Cost To Council Of Tunnel Compared To Ferry Service

Report No: F-018-F2

1. Introduction

- 1.1 On 17 February 2010 the Council again debated the issue of Whalsay transport links, and asked for a report to a special Infrastructure Committee looking at the possible costs of a tunnel option, together with a comparison of the long term costs of the tunnel versus the long term costs of continuing a ferry service to Whalsay. This report concentrates on the comparison sought by the Council.

2. Links To The Corporate Plan

- 2.1 The Council's Corporate Plan includes an aim of seeking to ensure the Council is sustainable in everything it does. The affordability of providing key lifeline services, such as the provision of Whalsay transport links is a major component of that.

3. Risk Management

- 3.1 The assessment of long term affordability of options for service delivery involves long term projections of cost, which are inevitably approximate to some degree. The key to managing the risks associated with long term estimation is to do sensitivity analysis on the findings, to establish how robust the conclusions are in the event that some of the key assumptions change over time.

4. Background

- 4.1 The only proper technique for comparing the costs of different options over lengthy time periods is to use discounted cash flows to calculate Net Present Values (NPV). The NPV is a measure of the current lump sum which would have to be spent today to finance an option over the long term, taking into account the investment returns which would be lost if that money is spent. The NPV allows a direct comparison to be made between options with very different cash flow profiles over time. It is therefore entirely suited to comparing a tunnel (with big immediate capital costs, but lesser ongoing operating costs over time) with a ferry service (with lower immediate capital costs, but with a larger mix of ongoing operating costs and periodic renewal costs).

- 4.2 NPV deals with comparative costs for the Council, but there are other considerations for the Council to take into account.
- 4.3 The tunnel option involves much greater initial capital costs than the ferry option, which poses questions about how that can be accommodated within Council financial policy framework. If, for example, the tunnel option costs in the order of £100 million, it will be impossible to accommodate that within the financial policy framework (which states that the capital programme for all projects should not exceed £100 million over five years, and which requires the Council's Reserves to be maintained above £250 million). An exception has already been made to that policy framework for the Anderson High School, but only on the basis that the Charitable Trust would buy it and lease it back. The Charitable Trust does not have the capital to make a further, larger exception for a Whalsay Tunnel, and it is by no means evident that the Council could afford the resulting lease payments, either.
- 4.4 The analysis in this report deals purely with the cost of different options for the Council. As such, it ignores the costs and benefits of these options for the Whalsay community, and indeed for Shetland as a whole. These factors may be highly significant, and deserve full consideration at an appropriate point, but only in respect of options that are affordable for the Council. It is therefore valid for this report to confine itself to the immediate question of relative costs and affordability for the Council.

5. Net Present Value (NPV) Analysis

- 5.1 Attached as Appendix A is the NPV analysis for the various versions of the tunnel versus ferry service comparison. The summary table from that analysis is reproduced below as Table 1.

5.2 Table 1

SUMMARY TABLE OF NET PRESENT VALUES (NPV)					
	Discount Rate	Tunnel NPV	Ferry NPV	Tunnel Over/ (Under) Ferry NPV	Margin of Difference over cheapest option
	%	£million	£million	£million	%
1. BASE CASE					
1.1 £76 million tunnel versus ferry service with 63.7% financial support from Scottish Government (£10k per metre tunnel construction cost)	5	63.2	40.4	22.8	56
1.2 £83 million tunnel versus ferry service with 63.7% financial support from Scottish Government (£11k per metre tunnel construction cost)	5	68.2	40.4	27.8	69
2. BREAK EVEN CASE					
£47 million tunnel versus ferry service with 63.7% financial support from Scottish Government (£5.5k per metre tunnel construction cost)	5	40.7	40.4	0.3	1
3. SENSITIVITY TESTS					
3.1 £76 million tunnel versus ferry service with 0% financial support from Scottish Government (£10k per metre tunnel construction cost)	5	63.2	68.0	(4.7)	(7)
3.2 Base Case at higher discount rate (£10k per metre tunnel construction cost)	8	49.5	29.1	20.3	70

5.3 The Base Case options evaluate the lifetime costs of a drill and blast tunnel compared with the costs over the same period of continuing the ferry service with amended replacement ferries and terminals. Base Case 1.1 is for estimated tunnelling costs of £10,000 per metre, and Base Case 1.2 is for estimated tunnelling costs of £11,000 per metre (£10,000-£11,000 being the current estimated range of tunnelling costs agreed to be achieved for this project). The evaluation includes all connecting road works but doesn't include any estimate of Optimism Bias for the tunnel project (although independent indications suggest that adding 66% to the tunnel estimate would be appropriate to reflect the risks of such an unusual project). Even without an allowance for optimism bias (which would worsen the case for the tunnel option) the NPV results show that in Base Case 1.1 the tunnel is £23 million (56%) more costly, and in Base Case 1.2 the tunnel is £28 million (69%) more costly, than the ferry option. These are not marginal results, and conclusively prove that the tunnel option is very much more costly to the Council than continuing with the ferry service.

- 5.4 It is also the case that the tunnel option, which would cost between £22-29 million for each of three consecutive years would be virtually impossible to programme within the existing Council financial policy framework (which currently provides a maximum of £100 million of funding over 5 years for all projects. Such a financial burden could only be accommodated if no other significant projects were progressed in those years which is, from all points of view unrealistic and undesirable).
- 5.5 The Break Even Case is calculated to determine at what price the tunnel option would cost no more than the ferry option in NPV terms, using the Base Case assumptions. The answer is that the tunnel option only becomes viable against the ferry option at a tunnel option price of £47 million, or a tunnelling price of £5,500 per metre, which is about half the tunnelling price currently envisaged, and lower than any of the range of estimates which have emerged during this process.
- 5.6 Two sensitivity tests are set out in Table 1 and Appendix A.
- 5.7 Sensitivity Test 3.1 shows (using Base Case 1.1 assumptions) that if the Scottish Government permanently and completely stopped giving direct revenue grant assistance to the ferry service (currently 63.7% on gross ferry costs, compared with only £1,500 per kilometre per annum for roads/tunnels) then the tunnel option would be NPV £5 million (7%) cheaper than the ferry. This indicates that if the revenue grant support ceases the tunnel option should be reconsidered, although there will remain the programming problem of coping with the upfront costs of such a large project.
- 5.8 Sensitivity Test 3.2 looks at the effect of the chosen discount rate on the comparison between tunnel and ferry on the Base Case 1.1 assumptions. The Base Case is calculated on a Discount Rate of 5% (the current Council assumption of the long run real cost or rate of return on capital). At a notably higher Discount Rate (8%) the NPV difference narrows marginally (to £20 million) but in proportional terms the extra cost of the tunnel widens to 70% (up from 56%). Assessment of the effect of a lower Discount Rate is not valid in that the Council has never at any time envisaged a long run rate of return on capital of less than 5%. Sensitivity Test 3.2 proves that the conclusion that the tunnel is costlier than the ferry for the Council is extremely insensitive to the choice of Discount Rate.
- 5.9 In summary, on the best information available at the present time, the tunnel option is substantially more expensive for the Council than the continuation of the ferry service to Whalsay. In addition, the Council would find it extremely difficult to programme the much higher upfront costs of the tunnel option. And finally, these conclusions would be amplified if we took any account of the capital refurbishment costs of a tunnel (not known) or if we added on any of the 66% allowance for Optimism Bias which experience elsewhere suggest should be applied to a tunnel project.
- 5.10 The only factors which would be material enough to call that finding into question would be if the Scottish Government ceased to provide expenditure related revenue support grant for the ferry service, or if capital grants in the order of £25-30 million could be obtained for the tunnel, or if there were evidence that the tunnelling cost could be more or less halved to £5,500 per metre. While none of these apply, the Council should

recognise that the continuation of the ferry service to Whalsay is much cheaper for the Council, and therefore represents the best value option, which the Council should pursue.

6. Policy And Delegated Authority

- 6.1 Responsibility for the Capital Programme is a matter for full Council, but it is appropriate for the Council to take the views of the Infrastructure Committee into account in respect of transport link projects as described in Section 12 of the Council's Scheme of Delegation.

7. Conclusions

- 7.1 The Base Case options in Appendix A and Table 1 above show that in Net Present Value terms the tunnel option is much more expensive for the Council than the continuation of the ferry service at a tunnel cost of £76 million (based on tunnelling costs of £10,000 per metre) or at a tunnel cost of £83 million (based on tunnelling costs of £11,000 per metre), especially while the ferry service continues to benefit from direct grant support from the Scottish Government. This conclusion would only need to be revised if any of the assumptions are markedly altered, especially in the event that the tunnel can be built for a much lower cost (break even on current assumptions is £47 million), or if Scottish Government support for ferry services is significantly reduced, or if substantial capital grants become available for tunnels.
- 7.2 Even if the tunnel option had a lower NPV the Council would still face the extreme difficulty of fitting the tunnel option, with its much higher initial capital costs, into its financial policy framework.
- 7.3 Only if the tunnel option had a lower NPV than the ferry option, and the Council's financial policy framework could be altered to accommodate the higher initial capital costs, would it be relevant to evaluate the costs and benefits of the tunnel option for the Whalsay community and the wider community of Shetland as a whole.

8. Recommendations

- 8.1 I recommend that the Committee consider this report and note that in present circumstances the tunnel option is not affordable and it does not represent best value and, consequently, the Committee should reaffirm the intention of pursuing the best value option for the continuation of the ferry service as the transport link to Whalsay.
- 8.2 However, the Committee should also note that a Working Group is looking at the question of alternative and external funding proposals for the tunnel option, which may affect the conclusion in 8.1 above. The Committee should note that the final view on funding will be presented in an updated version of this report to the Council on 30th June 2010.

Date: 19 May 2010

Ref: GJ/DS

Report No: F-018-F2

WHALSAY FIXED LINK : Drill & Blast Tunnel versus New Ferry Service

SUMMARY TABLE OF NET PRESENT VALUES (NPV)					
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WHALSAY FIXED LINK : Drill & Blast Tunnel versus New Ferry Service

PROJECT DETAILS

Whalsay Drill & Blast Tunnel

£000

New Ferry Service

£000

Capital

Project Costs (Construction £10k per metre)	76,143	
Mechanical Equipment Replacement (every 25 years)	3,000	
Linga Vessel replacement cost (every 25 years)		6,000
B600 Vessel replacement cost (every 25 years)		9,000
Terminal refurbishment (every 20 years)		2,300
Terminal reconstruction (every 60 years)		12,000
Capital Grants	0%	0

Revenue

Employee costs		1,446
Operating costs	572	51
Vessels (excluding financing charges)		1,060
Terminals/Stores (excluding financing charges)		147
Overheads (excluding fixed costs)		204
Gross Costs	572	2,908
Revenue Support Grant £1500 per road length km	(13)	(1,852)
Charge income		(387)
Net Costs	559	669

Discounted Cash Flow

Discount Rate (%)

5.00

All amounts at current prices

Financial Year	Project Year	Discount Factor	Whalsay Drill & Blast Tunnel			
			Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
			£000	£000	£000	£000
2009/10	0	1.000	0	0	0	0
	1	0.952	250	0	238	238
	2	0.907	25	0	23	261
	3	0.864	1,500	0	1,296	1,557
	4	0.823	750	0	617	2,174
	5	0.784	1,400	0	1,097	3,270
	6	0.746	27,639	0	20,625	23,895
	7	0.711	22,739	0	16,160	40,056
	8	0.677	21,839	0	14,782	54,838
	9	0.645	0	559	360	55,198
	10	0.614	0	559	343	55,541
	11	0.585	0	559	327	55,868
	12	0.557	0	559	311	56,179
	13	0.530	0	559	296	56,476
	14	0.505	0	559	282	56,758
	15	0.481	0	559	269	57,027
	16	0.458	0	559	256	57,283
	17	0.436	0	559	244	57,527
	18	0.416	0	559	232	57,759
	19	0.396	0	559	221	57,980
	20	0.377	0	559	211	58,191
	21	0.359	0	559	201	58,392
	22	0.342	0	559	191	58,583
	23	0.326	0	559	182	58,765
	24	0.310	0	559	173	58,938
	25	0.295	0	559	165	59,103
	26	0.281	0	559	157	59,261
	27	0.268	0	559	150	59,410
	28	0.255	0	559	143	59,553
	29	0.243	0	559	136	59,689
	30	0.231	0	559	129	59,818
	31	0.220	0	559	123	59,941
	32	0.210	0	559	117	60,059
	33	0.200	3,000	559	711	60,770
	34	0.190	0	559	106	60,876
	35	0.181	0	559	101	60,978
	36	0.173	0	559	97	61,074
	37	0.164	0	559	92	61,166
	38	0.157	0	559	88	61,254
	39	0.149	0	559	83	61,337
	40	0.142	0	559	79	61,416
	41	0.135	0	559	76	61,492
	42	0.129	0	559	72	61,564
	43	0.123	0	559	69	61,633

New Ferry Service			
Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
£000	£000	£000	£000
0	0	0	0
1,000	0	952	952
4,150	0	3,764	4,717
12,800	0	11,057	15,774
6,400	0	5,265	21,039
1,350	0	1,058	22,097
500	0	373	22,470
0	669	475	22,945
0	669	453	23,398
0	669	431	23,829
0	669	410	24,239
0	669	391	24,630
0	669	372	25,002
0	669	355	25,357
0	669	338	25,694
0	669	322	26,016
0	669	306	26,322
0	669	292	26,614
0	669	278	26,892
6,000	669	2,639	29,531
0	669	252	29,783
0	669	240	30,023
0	669	229	30,251
0	669	218	30,469
2,300	669	920	31,390
0	669	197	31,587
0	669	188	31,775
0	669	179	31,954
0	669	171	32,125
9,000	669	2,349	34,474
0	669	155	34,628
0	669	147	34,776
0	669	140	34,916
0	669	134	35,050
0	669	127	35,177
0	669	121	35,298
0	669	115	35,414
0	669	110	35,524
0	669	105	35,628
0	669	100	35,728
0	669	95	35,823
0	669	90	35,913
0	669	86	36,000
0	669	82	36,082

44	0.117	0	559	65	61,698	8,300	669	1,048	37,130
45	0.111	0	559	62	61,760	0	669	74	37,204
46	0.106	0	559	59	61,819	0	669	71	37,275
47	0.101	0	559	56	61,876	0	669	67	37,342
48	0.096	0	559	54	61,930	0	669	64	37,407
49	0.092	0	559	51	61,981	0	669	61	37,468
50	0.087	0	559	49	62,029	0	669	58	37,526
51	0.083	0	559	46	62,076	0	669	56	37,582
52	0.079	0	559	44	62,120	0	669	53	37,635
53	0.075	0	559	42	62,162	0	669	50	37,685
54	0.072	0	559	40	62,202	9,000	669	694	38,379
55	0.068	0	559	38	62,241	0	669	46	38,424
56	0.065	0	559	36	62,277	0	669	44	38,468
57	0.062	0	559	35	62,312	0	669	41	38,509
58	0.059	3,000	559	210	62,522	0	669	39	38,549
59	0.056	0	559	31	62,553	0	669	38	38,586
60	0.054	0	559	30	62,583	0	669	36	38,622
61	0.051	0	559	29	62,611	0	669	34	38,656
62	0.049	0	559	27	62,639	0	669	32	38,689
63	0.046	0	559	26	62,664	0	669	31	38,720
64	0.044	0	559	25	62,689	12,000	669	558	39,278
65	0.042	0	559	23	62,713	0	669	28	39,306
66	0.040	0	559	22	62,735	0	669	27	39,332
67	0.038	0	559	21	62,756	0	669	25	39,358
68	0.036	0	559	20	62,776	0	669	24	39,382
69	0.035	0	559	19	62,796	6,000	669	230	39,612
70	0.033	0	559	18	62,814	0	669	22	39,634
71	0.031	0	559	17	62,832	0	669	21	39,655
72	0.030	0	559	17	62,848	0	669	20	39,675
73	0.028	0	559	16	62,864	0	669	19	39,694
74	0.027	0	559	15	62,879	0	669	18	39,712
75	0.026	0	559	14	62,894	0	669	17	39,729
76	0.025	0	559	14	62,907	0	669	16	39,746
77	0.023	0	559	13	62,920	0	669	16	39,761
78	0.022	0	559	12	62,933	0	669	15	39,776
79	0.021	0	559	12	62,945	9,000	669	205	39,981
80	0.020	0	559	11	62,956	0	669	13	39,994
81	0.019	0	559	11	62,967	0	669	13	40,007
82	0.018	0	559	10	62,977	0	669	12	40,020
83	0.017	3,000	559	62	63,039	0	669	12	40,031
84	0.017	0	559	9	63,048	2,300	669	49	40,080
85	0.016	0	559	9	63,057	0	669	11	40,091
86	0.015	0	559	8	63,065	0	669	10	40,101
87	0.014	0	559	8	63,073	0	669	10	40,111
88	0.014	0	559	8	63,081	0	669	9	40,120
89	0.013	0	559	7	63,088	0	669	9	40,129
90	0.012	0	559	7	63,095	0	669	8	40,137
91	0.012	0	559	7	63,102	0	669	8	40,145
92	0.011	0	559	6	63,108	0	669	8	40,152
93	0.011	0	559	6	63,114	0	669	7	40,159
94	0.010	0	559	6	63,120	6,000	669	68	40,227
95	0.010	0	559	5	63,125	0	669	6	40,234
96	0.009	0	559	5	63,130	0	669	6	40,240
97	0.009	0	559	5	63,135	0	669	6	40,246
98	0.008	0	559	5	63,140	0	669	6	40,251
99	0.008	0	559	4	63,145	0	669	5	40,257
100	0.008	0	559	4	63,149	0	669	5	40,262
101	0.007	0	559	4	63,153	0	669	5	40,267
102	0.007	0	559	4	63,157	0	669	5	40,271
103	0.007	0	559	4	63,160	0	669	4	40,276
104	0.006	0	559	3	63,164	11,300	669	75	40,351
105	0.006	0	559	3	63,167	0	669	4	40,355
106	0.006	0	559	3	63,170	0	669	4	40,358
107	0.005	0	559	3	63,173	0	669	4	40,362
108	0.005	3,000	559	18	63,192	0	669	3	40,365
109	0.005	0	559	3	63,194	0	669	3	40,369
110	0.005	0	559	3	63,197	0	669	3	40,372
111	0.004	0	559	2	63,200	0	669	3	40,375
112	0.004	0	559	2	63,202	0	669	3	40,378
113	0.004	0	559	2	63,204	0	669	3	40,380
114	0.004	0	559	2	63,206	0	669	3	40,383
115	0.004	0	559	2	63,208	0	669	2	40,385
116	0.003	0	559	2	63,210	0	669	2	40,388
117	0.003	0	559	2	63,212	0	669	2	40,390
118	0.003	0	559	2	63,214	0	669	2	40,392
119	0.003	0	559	2	63,216	6,000	669	20	40,412
120	0.003	0	559	2	63,217	0	669	2	40,414
Total Cash Flow		88,143	62,608			113,400	76,221		
NET PRESENT VALUE				63,217				40,414	

NET PRESENT VALUE DIFFERENCE : FIXED LINK COST OVER / (UNDER) FERRY SERVICE COST

22,803

WHALSAY FIXED LINK : Drill & Blast Tunnel versus New Ferry Service

PROJECT DETAILS

Whalsay Drill & Blast Tunnel

£000

New Ferry Service

£000

Capital

Project Costs (Tunnel Construction £11k per metre)	82,695	
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Capital Grants	0%	0

Revenue

Employee costs		1,446
Operating costs	598	51
Vessels (excluding financing charges)		1,060
Terminals/Stores (excluding financing charges)		147
Overheads (excluding fixed costs)		204
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Discounted Cash Flow

Discount Rate (%)

5.00

All amounts at current prices

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	4	0.823	750	0	617	2,174
	5	0.784	1,400	0	1,097	3,270
	6	0.746	29,823	0	22,255	25,525
	7	0.711	24,923	0	17,713	43,238
	8	0.677	24,023	0	16,260	59,498
	9	0.645	0	585	377	59,875
	10	0.614	0	585	359	60,234
	11	0.585	0	585	342	60,576
	12	0.557	0	585	326	60,902
	13	0.530	0	585	310	61,212
	14	0.505	0	585	295	61,507
	15	0.481	0	585	281	61,789
	16	0.458	0	585	268	62,057
	17	0.436	0	585	255	62,312
	18	0.416	0	585	243	62,555
	19	0.396	0	585	232	62,787
	20	0.377	0	585	220	63,007
	21	0.359	0	585	210	63,217
	22	0.342	0	585	200	63,417
	23	0.326	0	585	190	63,608
	24	0.310	0	585	181	63,789
	25	0.295	0	585	173	63,962
	26	0.281	0	585	165	64,126
	27	0.268	0	585	157	64,283
	28	0.255	0	585	149	64,432
	29	0.243	0	585	142	64,574
	30	0.231	0	585	135	64,710
	31	0.220	0	585	129	64,839
	32	0.210	0	585	123	64,961
	33	0.200	3,000	585	717	65,678
	34	0.190	0	585	111	65,789
	35	0.181	0	585	106	65,895
	36	0.173	0	585	101	65,996
	37	0.164	0	585	96	66,092
	38	0.157	0	585	92	66,184
	39	0.149	0	585	87	66,271
	40	0.142	0	585	83	66,354
	41	0.135	0	585	79	66,434
	42	0.129	0	585	75	66,509
	43	0.123	0	585	72	66,581

New Ferry Service			
Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
£000	£000	£000	£000
0	0	0	0
1,000	0	952	952
4,150	0	3,764	4,717
12,800	0	11,057	15,774
6,400	0	5,265	21,039
1,350	0	1,058	22,097
500	0	373	22,470
0	669	475	22,945
0	669	453	23,398
0	669	431	23,829
0	669	410	24,239
0	669	391	24,630
0	669	372	25,002
0	669	355	25,357
0	669	338	25,694
0	669	322	26,016
0	669	306	26,322
0	669	292	26,614
0	669	278	26,892
6,000	669	2,639	29,531
0	669	252	29,783
0	669	240	30,023
0	669	229	30,251
0	669	218	30,469
2,300	669	920	31,390
0	669	197	31,587
0	669	188	31,775
0	669	179	31,954
0	669	171	32,125
9,000	669	2,349	34,474
0	669	155	34,628
0	669	147	34,776
0	669	140	34,916
0	669	134	35,050
0	669	127	35,177
0	669	121	35,298
0	669	115	35,414
0	669	110	35,524
0	669	105	35,628
0	669	100	35,728
0	669	95	35,823
0	669	90	35,913
0	669	86	36,000
0	669	82	36,082

44	0.117	0	585	68	66,649	8,300	669	1,048	37,130
45	0.111	0	585	65	66,714	0	669	74	37,204
46	0.106	0	585	62	66,776	0	669	71	37,275
47	0.101	0	585	59	66,835	0	669	67	37,342
48	0.096	0	585	56	66,891	0	669	64	37,407
49	0.092	0	585	54	66,945	0	669	61	37,468
50	0.087	0	585	51	66,996	0	669	58	37,526
51	0.083	0	585	49	67,045	0	669	56	37,582
52	0.079	0	585	46	67,091	0	669	53	37,635
53	0.075	0	585	44	67,135	0	669	50	37,685
54	0.072	0	585	42	67,177	9,000	669	694	38,379
55	0.068	0	585	40	67,217	0	669	46	38,424
56	0.065	0	585	38	67,255	0	669	44	38,468
57	0.062	0	585	36	67,291	0	669	41	38,509
58	0.059	3,000	585	212	67,503	0	669	39	38,549
59	0.056	0	585	33	67,536	0	669	38	38,586
60	0.054	0	585	31	67,567	0	669	36	38,622
61	0.051	0	585	30	67,597	0	669	34	38,656
62	0.049	0	585	28	67,625	0	669	32	38,689
63	0.046	0	585	27	67,652	0	669	31	38,720
64	0.044	0	585	26	67,678	12,000	669	558	39,278
65	0.042	0	585	25	67,703	0	669	28	39,306
66	0.040	0	585	23	67,726	0	669	27	39,332
67	0.038	0	585	22	67,748	0	669	25	39,358
68	0.036	0	585	21	67,769	0	669	24	39,382
69	0.035	0	585	20	67,790	6,000	669	230	39,612
70	0.033	0	585	19	67,809	0	669	22	39,634
71	0.031	0	585	18	67,827	0	669	21	39,655
72	0.030	0	585	17	67,845	0	669	20	39,675
73	0.028	0	585	17	67,861	0	669	19	39,694
74	0.027	0	585	16	67,877	0	669	18	39,712
75	0.026	0	585	15	67,892	0	669	17	39,729
76	0.025	0	585	14	67,906	0	669	16	39,746
77	0.023	0	585	14	67,920	0	669	16	39,761
78	0.022	0	585	13	67,933	0	669	15	39,776
79	0.021	0	585	12	67,946	9,000	669	205	39,981
80	0.020	0	585	12	67,957	0	669	13	39,994
81	0.019	0	585	11	67,969	0	669	13	40,007
82	0.018	0	585	11	67,979	0	669	12	40,020
83	0.017	3,000	585	62	68,042	0	669	12	40,031
84	0.017	0	585	10	68,051	2,300	669	49	40,080
85	0.016	0	585	9	68,061	0	669	11	40,091
86	0.015	0	585	9	68,070	0	669	10	40,101
87	0.014	0	585	8	68,078	0	669	10	40,111
88	0.014	0	585	8	68,086	0	669	9	40,120
89	0.013	0	585	8	68,094	0	669	9	40,129
90	0.012	0	585	7	68,101	0	669	8	40,137
91	0.012	0	585	7	68,108	0	669	8	40,145
92	0.011	0	585	7	68,114	0	669	8	40,152
93	0.011	0	585	6	68,121	0	669	7	40,159
94	0.010	0	585	6	68,126	6,000	669	68	40,227
95	0.010	0	585	6	68,132	0	669	6	40,234
96	0.009	0	585	5	68,138	0	669	6	40,240
97	0.009	0	585	5	68,143	0	669	6	40,246
98	0.008	0	585	5	68,148	0	669	6	40,251
99	0.008	0	585	5	68,152	0	669	5	40,257
100	0.008	0	585	4	68,157	0	669	5	40,262
101	0.007	0	585	4	68,161	0	669	5	40,267
102	0.007	0	585	4	68,165	0	669	5	40,271
103	0.007	0	585	4	68,169	0	669	4	40,276
104	0.006	0	585	4	68,172	11,300	669	75	40,351
105	0.006	0	585	3	68,176	0	669	4	40,355
106	0.006	0	585	3	68,179	0	669	4	40,358
107	0.005	0	585	3	68,182	0	669	4	40,362
108	0.005	3,000	585	18	68,201	0	669	3	40,365
109	0.005	0	585	3	68,204	0	669	3	40,369
110	0.005	0	585	3	68,207	0	669	3	40,372
111	0.004	0	585	3	68,209	0	669	3	40,375
112	0.004	0	585	2	68,212	0	669	3	40,378
113	0.004	0	585	2	68,214	0	669	3	40,380
114	0.004	0	585	2	68,216	0	669	3	40,383
115	0.004	0	585	2	68,218	0	669	2	40,385
116	0.003	0	585	2	68,220	0	669	2	40,388
117	0.003	0	585	2	68,222	0	669	2	40,390
118	0.003	0	585	2	68,224	0	669	2	40,392
119	0.003	0	585	2	68,226	6,000	669	20	40,412
120	0.003	0	585	2	68,228	0	669	2	40,414
Total Cash Flow		94,695	65,520			113,400	76,221		
NET PRESENT VALUE				68,228				40,414	

NET PRESENT VALUE DIFFERENCE : FIXED LINK COST OVER / (UNDER) FERRY SERVICE COST

27,814

WHALSAY FIXED LINK : Drill & Blast Tunnel versus New Ferry Service

PROJECT DETAILS

Whalsay Drill & Blast Tunnel

£000

New Ferry Service

£000

Capital			
Project Costs	46,660		
Mechanical Equipment Replacement (every 25 years)	3,000		
Linga Vessel replacement cost (every 25 years)			6,000
B600 Vessel replacement cost (every 25 years)			9,000
Terminal refurbishment (every 20 years) (3 Terminals)			2,300
Terminal reconstruction (every 60 years) (3 Terminals)			12,000
Capital Grants	0	0 %	0

Revenue

Employee costs			1,446
Operating costs	458		51
Vessels (excluding financing charges)			1,060
Terminals/Stores (excluding financing charges)			147
Overheads (excluding fixed costs)			204
Gross Costs	458		2,908
Revenue Support Grant	£1500 per road length km	(13)	(1,852)
Charge income			(387)
Net Costs	445		669

Discounted Cash Flow**Discount Rate (%)**

5.00

All amounts at current prices

Financial Year	Project Year	Discount Factor	Whalsay Drill & Blast Tunnel				New Ferry Service			
			Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow	Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
			£000	£000	£000	£000	£000	£000	£000	£000
2009/10	0	1.000	0	0	0	0	0	0	0	0
	1	0.952	250	0	238	238	1,000	0	952	952
	2	0.907	25	0	23	261	4,150	0	3,764	4,717
	3	0.864	1,500	0	1,296	1,557	12,800	0	11,057	15,774
	4	0.823	750	0	617	2,174	6,400	0	5,265	21,039
	5	0.784	1,400	0	1,097	3,270	1,350	0	1,058	22,097
	6	0.746	17,812	0	13,291	16,562	500	0	373	22,470
	7	0.711	12,912	0	9,176	25,738	0	669	475	22,945
	8	0.677	12,012	0	8,130	33,868	0	669	453	23,398
	9	0.645	0	445	287	34,155	0	669	431	23,829
	10	0.614	0	445	273	34,428	0	669	410	24,239
	11	0.585	0	445	260	34,688	0	669	391	24,630
	12	0.557	0	445	248	34,936	0	669	372	25,002
	13	0.530	0	445	236	35,172	0	669	355	25,357
	14	0.505	0	445	225	35,397	0	669	338	25,694
	15	0.481	0	445	214	35,611	0	669	322	26,016
	16	0.458	0	445	204	35,815	0	669	306	26,322
	17	0.436	0	445	194	36,009	0	669	292	26,614
	18	0.416	0	445	185	36,194	0	669	278	26,892
	19	0.396	0	445	176	36,370	6,000	669	2,639	29,531
	20	0.377	0	445	168	36,537	0	669	252	29,783
	21	0.359	0	445	160	36,697	0	669	240	30,023
	22	0.342	0	445	152	36,849	0	669	229	30,251
	23	0.326	0	445	145	36,994	0	669	218	30,469
	24	0.310	0	445	138	37,132	2,300	669	920	31,390
	25	0.295	0	445	131	37,264	0	669	197	31,587
	26	0.281	0	445	125	37,389	0	669	188	31,775
	27	0.268	0	445	119	37,508	0	669	179	31,954
	28	0.255	0	445	114	37,621	0	669	171	32,125
	29	0.243	0	445	108	37,730	9,000	669	2,349	34,474
	30	0.231	0	445	103	37,833	0	669	155	34,628
	31	0.220	0	445	98	37,931	0	669	147	34,776
	32	0.210	0	445	93	38,024	0	669	140	34,916
	33	0.200	3,000	445	689	38,713	0	669	134	35,050
	34	0.190	0	445	85	38,797	0	669	127	35,177
	35	0.181	0	445	81	38,878	0	669	121	35,298
	36	0.173	0	445	77	38,955	0	669	115	35,414
	37	0.164	0	445	73	39,028	0	669	110	35,524
	38	0.157	0	445	70	39,098	0	669	105	35,628
	39	0.149	0	445	66	39,164	0	669	100	35,728
	40	0.142	0	445	63	39,227	0	669	95	35,823
	41	0.135	0	445	60	39,287	0	669	90	35,913
	42	0.129	0	445	57	39,345	0	669	86	36,000
	43	0.123	0	445	55	39,399	0	669	82	36,082
	44	0.117	0	445	52	39,451	8,300	669	1,048	37,130

45	0.111	0	445	50	39,501	0	669	74	37,204
46	0.106	0	445	47	39,548	0	669	71	37,275
47	0.101	0	445	45	39,593	0	669	67	37,342
48	0.096	0	445	43	39,636	0	669	64	37,407
49	0.092	0	445	41	39,676	0	669	61	37,468
50	0.087	0	445	39	39,715	0	669	58	37,526
51	0.083	0	445	37	39,752	0	669	56	37,582
52	0.079	0	445	35	39,787	0	669	53	37,635
53	0.075	0	445	34	39,821	0	669	50	37,685
54	0.072	0	445	32	39,853	9,000	669	694	38,379
55	0.068	0	445	30	39,883	0	669	46	38,424
56	0.065	0	445	29	39,912	0	669	44	38,468
57	0.062	0	445	28	39,940	0	669	41	38,509
58	0.059	3,000	445	203	40,143	0	669	39	38,549
59	0.056	0	445	25	40,168	0	669	38	38,586
60	0.054	0	445	24	40,192	0	669	36	38,622
61	0.051	0	445	23	40,215	0	669	34	38,656
62	0.049	0	445	22	40,236	0	669	32	38,689
63	0.046	0	445	21	40,257	0	669	31	38,720
64	0.044	0	445	20	40,276	12,000	669	558	39,278
65	0.042	0	445	19	40,295	0	669	28	39,306
66	0.040	0	445	18	40,313	0	669	27	39,332
67	0.038	0	445	17	40,330	0	669	25	39,358
68	0.036	0	445	16	40,346	0	669	24	39,382
69	0.035	0	445	15	40,361	6,000	669	230	39,612
70	0.033	0	445	15	40,376	0	669	22	39,634
71	0.031	0	445	14	40,390	0	669	21	39,655
72	0.030	0	445	13	40,403	0	669	20	39,675
73	0.028	0	445	13	40,416	0	669	19	39,694
74	0.027	0	445	12	40,428	0	669	18	39,712
75	0.026	0	445	11	40,439	0	669	17	39,729
76	0.025	0	445	11	40,450	0	669	16	39,746
77	0.023	0	445	10	40,461	0	669	16	39,761
78	0.022	0	445	10	40,471	0	669	15	39,776
79	0.021	0	445	9	40,480	9,000	669	205	39,981
80	0.020	0	445	9	40,489	0	669	13	39,994
81	0.019	0	445	9	40,497	0	669	13	40,007
82	0.018	0	445	8	40,506	0	669	12	40,020
83	0.017	3,000	445	60	40,566	0	669	12	40,031
84	0.017	0	445	7	40,573	2,300	669	49	40,080
85	0.016	0	445	7	40,580	0	669	11	40,091
86	0.015	0	445	7	40,587	0	669	10	40,101
87	0.014	0	445	6	40,593	0	669	10	40,111
88	0.014	0	445	6	40,599	0	669	9	40,120
89	0.013	0	445	6	40,605	0	669	9	40,129
90	0.012	0	445	6	40,611	0	669	8	40,137
91	0.012	0	445	5	40,616	0	669	8	40,145
92	0.011	0	445	5	40,621	0	669	8	40,152
93	0.011	0	445	5	40,626	0	669	7	40,159
94	0.010	0	445	5	40,630	6,000	669	68	40,227
95	0.010	0	445	4	40,634	0	669	6	40,234
96	0.009	0	445	4	40,639	0	669	6	40,240
97	0.009	0	445	4	40,642	0	669	6	40,246
98	0.008	0	445	4	40,646	0	669	6	40,251
99	0.008	0	445	4	40,650	0	669	5	40,257
100	0.008	0	445	3	40,653	0	669	5	40,262
101	0.007	0	445	3	40,656	0	669	5	40,267
102	0.007	0	445	3	40,659	0	669	5	40,271
103	0.007	0	445	3	40,662	0	669	4	40,276
104	0.006	0	445	3	40,665	11,300	669	75	40,351
105	0.006	0	445	3	40,668	0	669	4	40,355
106	0.006	0	445	3	40,670	0	669	4	40,358
107	0.005	0	445	2	40,673	0	669	4	40,362
108	0.005	3,000	445	18	40,690	0	669	3	40,365
109	0.005	0	445	2	40,693	0	669	3	40,369
110	0.005	0	445	2	40,695	0	669	3	40,372
111	0.004	0	445	2	40,697	0	669	3	40,375
112	0.004	0	445	2	40,699	0	669	3	40,378
113	0.004	0	445	2	40,700	0	669	3	40,380
114	0.004	0	445	2	40,702	0	669	3	40,383
115	0.004	0	445	2	40,704	0	669	2	40,385
116	0.003	0	445	2	40,705	0	669	2	40,388
117	0.003	0	445	1	40,707	0	669	2	40,390
118	0.003	0	445	1	40,708	0	669	2	40,392
119	0.003	0	445	1	40,709	6,000	669	20	40,412
120	0.003	0	445	1	40,711	0	669	2	40,414
Total Cash Flow		58,660	49,840			113,400	76,221		
NET PRESENT VALUE					<u>40,711</u>				<u>40,414</u>

NET PRESENT VALUE DIFFERENCE : FIXED LINK COST OVER / (UNDER) FERRY SERVICE COST

297

WHALSAY FIXED LINK : Drill & Blast Tunnel versus New Ferry Service

PROJECT DETAILS

Whalsay Drill & Blast Tunnel

£000

New Ferry Service

£000

Capital

Project Costs (Construction £10k per metre)	76,143	
Mechanical Equipment Replacement (every 25 years)	3,000	
Linga Vessel replacement cost (every 25 years)		6,000
B600 Vessel replacement cost (every 25 years)		9,000
Terminal refurbishment (every 20 years)		2,300
Terminal reconstruction (every 60 years)		12,000
Capital Grants	0%	0

Revenue

Employee costs		1,446
Operating costs	572	51
Vessels (excluding financing charges)		1,060
Terminals/Stores (excluding financing charges)		147
Overheads (excluding fixed costs)		204
Gross Costs	572	2,908
Revenue Support Grant	£1500 per road length km	(13)
Charge income		(387)
Net Costs	559	2,521

Discounted Cash Flow

Discount Rate (%)

5.00

All amounts at current prices

Financial Year	Project Year	Discount Factor	Whalsay Drill & Blast Tunnel			
			Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
			£000	£000	£000	£000
2009/10	0	1.000	0	0	0	0
	1	0.952	250	0	238	238
	2	0.907	25	0	23	261
	3	0.864	1,500	0	1,296	1,557
	4	0.823	750	0	617	2,174
	5	0.784	1,400	0	1,097	3,270
	6	0.746	27,639	0	20,625	23,895
	7	0.711	22,739	0	16,160	40,056
	8	0.677	21,839	0	14,782	54,838
	9	0.645	0	559	360	55,198
	10	0.614	0	559	343	55,541
	11	0.585	0	559	327	55,868
	12	0.557	0	559	311	56,179
	13	0.530	0	559	296	56,476
	14	0.505	0	559	282	56,758
	15	0.481	0	559	269	57,027
	16	0.458	0	559	256	57,283
	17	0.436	0	559	244	57,527
	18	0.416	0	559	232	57,759
	19	0.396	0	559	221	57,980
	20	0.377	0	559	211	58,191
	21	0.359	0	559	201	58,392
	22	0.342	0	559	191	58,583
	23	0.326	0	559	182	58,765
	24	0.310	0	559	173	58,938
	25	0.295	0	559	165	59,103
	26	0.281	0	559	157	59,261
	27	0.268	0	559	150	59,410
	28	0.255	0	559	143	59,553
	29	0.243	0	559	136	59,689
	30	0.231	0	559	129	59,818
	31	0.220	0	559	123	59,941
	32	0.210	0	559	117	60,059
	33	0.200	3,000	559	711	60,770
	34	0.190	0	559	106	60,876
	35	0.181	0	559	101	60,978
	36	0.173	0	559	97	61,074
	37	0.164	0	559	92	61,166
	38	0.157	0	559	88	61,254
	39	0.149	0	559	83	61,337
	40	0.142	0	559	79	61,416
	41	0.135	0	559	76	61,492
	42	0.129	0	559	72	61,564
	43	0.123	0	559	69	61,633

New Ferry Service			
Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
£000	£000	£000	£000
0	0	0	0
1,000	0	952	952
4,150	0	3,764	4,717
12,800	0	11,057	15,774
6,400	0	5,265	21,039
1,350	0	1,058	22,097
500	0	373	22,470
0	2,521	1,792	24,261
0	2,521	1,706	25,968
0	2,521	1,625	27,593
0	2,521	1,548	29,141
0	2,521	1,474	30,614
0	2,521	1,404	32,018
0	2,521	1,337	33,355
0	2,521	1,273	34,628
0	2,521	1,213	35,841
0	2,521	1,155	36,996
0	2,521	1,100	38,096
0	2,521	1,048	39,143
6,000	2,521	3,372	42,516
0	2,521	950	43,466
0	2,521	905	44,371
0	2,521	862	45,232
0	2,521	821	46,053
2,300	2,521	1,495	47,548
0	2,521	744	48,292
0	2,521	709	49,001
0	2,521	675	49,677
0	2,521	643	50,320
9,000	2,521	2,799	53,119
0	2,521	583	53,702
0	2,521	556	54,258
0	2,521	529	54,787
0	2,521	504	55,291
0	2,521	480	55,770
0	2,521	457	56,227
0	2,521	435	56,663
0	2,521	415	57,077
0	2,521	395	57,472
0	2,521	376	57,848
0	2,521	358	58,206
0	2,521	341	58,547
0	2,521	325	58,872
0	2,521	309	59,181

44	0.117	0	559	65	61,698	8,300	2,521	1,265	60,446
45	0.111	0	559	62	61,760	0	2,521	281	60,726
46	0.106	0	559	59	61,819	0	2,521	267	60,994
47	0.101	0	559	56	61,876	0	2,521	254	61,248
48	0.096	0	559	54	61,930	0	2,521	242	61,491
49	0.092	0	559	51	61,981	0	2,521	231	61,721
50	0.087	0	559	49	62,029	0	2,521	220	61,941
51	0.083	0	559	46	62,076	0	2,521	209	62,151
52	0.079	0	559	44	62,120	0	2,521	199	62,350
53	0.075	0	559	42	62,162	0	2,521	190	62,540
54	0.072	0	559	40	62,202	9,000	2,521	827	63,366
55	0.068	0	559	38	62,241	0	2,521	172	63,539
56	0.065	0	559	36	62,277	0	2,521	164	63,703
57	0.062	0	559	35	62,312	0	2,521	156	63,859
58	0.059	3,000	559	210	62,522	0	2,521	149	64,008
59	0.056	0	559	31	62,553	0	2,521	142	64,150
60	0.054	0	559	30	62,583	0	2,521	135	64,284
61	0.051	0	559	29	62,611	0	2,521	129	64,413
62	0.049	0	559	27	62,639	0	2,521	122	64,535
63	0.046	0	559	26	62,664	0	2,521	117	64,652
64	0.044	0	559	25	62,689	12,000	2,521	640	65,292
65	0.042	0	559	23	62,713	0	2,521	106	65,397
66	0.040	0	559	22	62,735	0	2,521	101	65,498
67	0.038	0	559	21	62,756	0	2,521	96	65,594
68	0.036	0	559	20	62,776	0	2,521	91	65,685
69	0.035	0	559	19	62,796	6,000	2,521	294	65,979
70	0.033	0	559	18	62,814	0	2,521	83	66,062
71	0.031	0	559	17	62,832	0	2,521	79	66,141
72	0.030	0	559	17	62,848	0	2,521	75	66,216
73	0.028	0	559	16	62,864	0	2,521	72	66,288
74	0.027	0	559	15	62,879	0	2,521	68	66,356
75	0.026	0	559	14	62,894	0	2,521	65	66,421
76	0.025	0	559	14	62,907	0	2,521	62	66,483
77	0.023	0	559	13	62,920	0	2,521	59	66,542
78	0.022	0	559	12	62,933	0	2,521	56	66,598
79	0.021	0	559	12	62,945	9,000	2,521	244	66,842
80	0.020	0	559	11	62,956	0	2,521	51	66,893
81	0.019	0	559	11	62,967	0	2,521	48	66,941
82	0.018	0	559	10	62,977	0	2,521	46	66,987
83	0.017	3,000	559	62	63,039	0	2,521	44	67,031
84	0.017	0	559	9	63,048	2,300	2,521	80	67,111
85	0.016	0	559	9	63,057	0	2,521	40	67,151
86	0.015	0	559	8	63,065	0	2,521	38	67,189
87	0.014	0	559	8	63,073	0	2,521	36	67,225
88	0.014	0	559	8	63,081	0	2,521	34	67,260
89	0.013	0	559	7	63,088	0	2,521	33	67,292
90	0.012	0	559	7	63,095	0	2,521	31	67,324
91	0.012	0	559	7	63,102	0	2,521	30	67,353
92	0.011	0	559	6	63,108	0	2,521	28	67,382
93	0.011	0	559	6	63,114	0	2,521	27	67,409
94	0.010	0	559	6	63,120	6,000	2,521	87	67,495
95	0.010	0	559	5	63,125	0	2,521	24	67,520
96	0.009	0	559	5	63,130	0	2,521	23	67,543
97	0.009	0	559	5	63,135	0	2,521	22	67,565
98	0.008	0	559	5	63,140	0	2,521	21	67,587
99	0.008	0	559	4	63,145	0	2,521	20	67,607
100	0.008	0	559	4	63,149	0	2,521	19	67,626
101	0.007	0	559	4	63,153	0	2,521	18	67,644
102	0.007	0	559	4	63,157	0	2,521	17	67,662
103	0.007	0	559	4	63,160	0	2,521	17	67,678
104	0.006	0	559	3	63,164	11,300	2,521	86	67,765
105	0.006	0	559	3	63,167	0	2,521	15	67,780
106	0.006	0	559	3	63,170	0	2,521	14	67,794
107	0.005	0	559	3	63,173	0	2,521	14	67,808
108	0.005	3,000	559	18	63,192	0	2,521	13	67,820
109	0.005	0	559	3	63,194	0	2,521	12	67,833
110	0.005	0	559	3	63,197	0	2,521	12	67,845
111	0.004	0	559	2	63,200	0	2,521	11	67,856
112	0.004	0	559	2	63,202	0	2,521	11	67,867
113	0.004	0	559	2	63,204	0	2,521	10	67,877
114	0.004	0	559	2	63,206	0	2,521	10	67,886
115	0.004	0	559	2	63,208	0	2,521	9	67,896
116	0.003	0	559	2	63,210	0	2,521	9	67,904
117	0.003	0	559	2	63,212	0	2,521	8	67,913
118	0.003	0	559	2	63,214	0	2,521	8	67,921
119	0.003	0	559	2	63,216	6,000	2,521	26	67,946
120	0.003	0	559	2	63,217	0	2,521	7	67,954
Total Cash Flow		88,143	62,608			113,400	287,394		
NET PRESENT VALUE					<u>63,217</u>				<u>67,954</u>

NET PRESENT VALUE DIFFERENCE : FIXED LINK COST OVER / (UNDER) FERRY SERVICE COST

(4,736)

WHALSAY FIXED LINK : Drill & Blast Tunnel versus New Ferry Service

PROJECT DETAILS

Whalsay Drill & Blast Tunnel

£000

New Ferry Service

£000

Capital

Project Costs (Construction £10k per metre)	76,143	
Mechanical Equipment Replacement (every 25 years)	3,000	
Linga Vessel replacement cost (every 25 years)		6,000
B600 Vessel replacement cost (every 25 years)		9,000
Terminal refurbishment (every 20 years)		2,300
Terminal reconstruction (every 60 years)		12,000
Capital Grants	0%	0

Revenue

Employee costs		1,446
Operating costs	572	51
Vessels (excluding financing charges)		1,060
Terminals/Stores (excluding financing charges)		147
Overheads (excluding fixed costs)		204
Gross Costs	572	2,908
Revenue Support Grant	£1500 per road length km	(13)
Charge income		(387)
Net Costs	559	669

Discounted Cash Flow

Discount Rate (%)

8.00

All amounts at current prices

Financial Year	Project Year	Discount Factor	Whalsay Drill & Blast Tunnel			
			Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
			£000	£000	£000	£000
2009/10	0	1.000	0	0	0	0
	1	0.926	250	0	231	231
	2	0.857	25	0	21	253
	3	0.794	1,500	0	1,191	1,444
	4	0.735	750	0	551	1,995
	5	0.681	1,400	0	953	2,948
	6	0.630	27,639	0	17,418	20,365
	7	0.583	22,739	0	13,268	33,634
	8	0.540	21,839	0	11,799	45,433
	9	0.500	0	559	280	45,712
	10	0.463	0	559	259	45,971
	11	0.429	0	559	240	46,211
	12	0.397	0	559	222	46,433
	13	0.368	0	559	206	46,639
	14	0.340	0	559	190	46,829
	15	0.315	0	559	176	47,005
	16	0.292	0	559	163	47,168
	17	0.270	0	559	151	47,319
	18	0.250	0	559	140	47,459
	19	0.232	0	559	130	47,589
	20	0.215	0	559	120	47,709
	21	0.199	0	559	111	47,820
	22	0.184	0	559	103	47,923
	23	0.170	0	559	95	48,018
	24	0.158	0	559	88	48,106
	25	0.146	0	559	82	48,188
	26	0.135	0	559	76	48,263
	27	0.125	0	559	70	48,333
	28	0.116	0	559	65	48,398
	29	0.107	0	559	60	48,458
	30	0.099	0	559	56	48,513
	31	0.092	0	559	51	48,565
	32	0.085	0	559	48	48,612
	33	0.079	3,000	559	281	48,893
	34	0.073	0	559	41	48,934
	35	0.068	0	559	38	48,972
	36	0.063	0	559	35	49,007
	37	0.058	0	559	32	49,039
	38	0.054	0	559	30	49,069
	39	0.050	0	559	28	49,097
	40	0.046	0	559	26	49,123
	41	0.043	0	559	24	49,147
	42	0.039	0	559	22	49,169
	43	0.037	0	559	20	49,189

New Ferry Service			
Capital Cash Flow	Revenue Cash Flow	Discounted Cash Flow	Cumulative Discounted Cash Flow
£000	£000	£000	£000
0	0	0	0
1,000	0	926	926
4,150	0	3,558	4,484
12,800	0	10,161	14,645
6,400	0	4,704	19,349
1,350	0	919	20,268
500	0	315	20,583
0	669	390	20,973
0	669	361	21,334
0	669	334	21,669
0	669	310	21,979
0	669	287	22,265
0	669	266	22,531
0	669	246	22,777
0	669	228	23,004
0	669	211	23,215
0	669	195	23,410
0	669	181	23,591
0	669	167	23,758
6,000	669	1,545	25,303
0	669	143	25,447
0	669	133	25,580
0	669	123	25,703
0	669	114	25,817
2,300	669	468	26,285
0	669	98	26,382
0	669	90	26,473
0	669	84	26,556
0	669	78	26,634
9,000	669	1,038	27,672
0	669	66	27,738
0	669	62	27,800
0	669	57	27,857
0	669	53	27,909
0	669	49	27,958
0	669	45	28,003
0	669	42	28,045
0	669	39	28,084
0	669	36	28,120
0	669	33	28,153
0	669	31	28,184
0	669	28	28,212
0	669	26	28,239
0	669	24	28,263

44	0.034	0	559	19	49,208	8,300	669	303	28,567
45	0.031	0	559	18	49,226	0	669	21	28,588
46	0.029	0	559	16	49,242	0	669	19	28,607
47	0.027	0	559	15	49,257	0	669	18	28,625
48	0.025	0	559	14	49,271	0	669	17	28,642
49	0.023	0	559	13	49,284	0	669	15	28,657
50	0.021	0	559	12	49,296	0	669	14	28,671
51	0.020	0	559	11	49,307	0	669	13	28,684
52	0.018	0	559	10	49,317	0	669	12	28,697
53	0.017	0	559	9	49,326	0	669	11	28,708
54	0.016	0	559	9	49,335	9,000	669	152	28,859
55	0.015	0	559	8	49,343	0	669	10	28,869
56	0.013	0	559	8	49,351	0	669	9	28,878
57	0.012	0	559	7	49,358	0	669	8	28,886
58	0.012	3,000	559	41	49,399	0	669	8	28,894
59	0.011	0	559	6	49,405	0	669	7	28,901
60	0.010	0	559	6	49,410	0	669	7	28,908
61	0.009	0	559	5	49,415	0	669	6	28,914
62	0.008	0	559	5	49,420	0	669	6	28,920
63	0.008	0	559	4	49,424	0	669	5	28,925
64	0.007	0	559	4	49,428	12,000	669	92	29,017
65	0.007	0	559	4	49,432	0	669	4	29,021
66	0.006	0	559	3	49,436	0	669	4	29,026
67	0.006	0	559	3	49,439	0	669	4	29,029
68	0.005	0	559	3	49,442	0	669	4	29,033
69	0.005	0	559	3	49,445	6,000	669	33	29,066
70	0.005	0	559	3	49,447	0	669	3	29,069
71	0.004	0	559	2	49,449	0	669	3	29,072
72	0.004	0	559	2	49,452	0	669	3	29,074
73	0.004	0	559	2	49,454	0	669	2	29,077
74	0.003	0	559	2	49,456	0	669	2	29,079
75	0.003	0	559	2	49,457	0	669	2	29,081
76	0.003	0	559	2	49,459	0	669	2	29,083
77	0.003	0	559	1	49,460	0	669	2	29,085
78	0.002	0	559	1	49,462	0	669	2	29,087
79	0.002	0	559	1	49,463	9,000	669	22	29,109
80	0.002	0	559	1	49,464	0	669	1	29,110
81	0.002	0	559	1	49,465	0	669	1	29,111
82	0.002	0	559	1	49,466	0	669	1	29,113
83	0.002	3,000	559	6	49,472	0	669	1	29,114
84	0.002	0	559	1	49,473	2,300	669	5	29,118
85	0.001	0	559	1	49,474	0	669	1	29,119
86	0.001	0	559	1	49,475	0	669	1	29,120
87	0.001	0	559	1	49,475	0	669	1	29,121
88	0.001	0	559	1	49,476	0	669	1	29,122
89	0.001	0	559	1	49,477	0	669	1	29,123
90	0.001	0	559	1	49,477	0	669	1	29,123
91	0.001	0	559	1	49,478	0	669	1	29,124
92	0.001	0	559	0	49,478	0	669	1	29,124
93	0.001	0	559	0	49,479	0	669	1	29,125
94	0.001	0	559	0	49,479	6,000	669	5	29,130
95	0.001	0	559	0	49,479	0	669	0	29,130
96	0.001	0	559	0	49,480	0	669	0	29,131
97	0.001	0	559	0	49,480	0	669	0	29,131
98	0.001	0	559	0	49,480	0	669	0	29,131
99	0.000	0	559	0	49,481	0	669	0	29,132
100	0.000	0	559	0	49,481	0	669	0	29,132
101	0.000	0	559	0	49,481	0	669	0	29,132
102	0.000	0	559	0	49,481	0	669	0	29,132
103	0.000	0	559	0	49,482	0	669	0	29,133
104	0.000	0	559	0	49,482	11,300	669	4	29,137
105	0.000	0	559	0	49,482	0	669	0	29,137
106	0.000	0	559	0	49,482	0	669	0	29,137
107	0.000	0	559	0	49,482	0	669	0	29,137
108	0.000	3,000	559	1	49,483	0	669	0	29,137
109	0.000	0	559	0	49,483	0	669	0	29,138
110	0.000	0	559	0	49,483	0	669	0	29,138
111	0.000	0	559	0	49,483	0	669	0	29,138
112	0.000	0	559	0	49,484	0	669	0	29,138
113	0.000	0	559	0	49,484	0	669	0	29,138
114	0.000	0	559	0	49,484	0	669	0	29,138
115	0.000	0	559	0	49,484	0	669	0	29,138
116	0.000	0	559	0	49,484	0	669	0	29,138
117	0.000	0	559	0	49,484	0	669	0	29,138
118	0.000	0	559	0	49,484	0	669	0	29,139
119	0.000	0	559	0	49,484	6,000	669	1	29,139
120	0.000	0	559	0	49,484	0	669	0	29,139
Total Cash Flow		88,143	62,608			113,400	76,221		
NET PRESENT VALUE					<u>49,484</u>				<u>29,139</u>

NET PRESENT VALUE DIFFERENCE : FIXED LINK COST OVER / (UNDER) FERRY SERVICE COST

20,345



REPORT

To: Special Infrastructure Committee

28 May 2010

**From: Head of Transport
Infrastructure Services Department**

WHALSAY TUNNEL UPDATE ON WORK DONE TO DATE

1. Introduction

- 1.1. On 2 February 2010 the Infrastructure Committee considered a report on the continuing development of the Whalsay Transport Link and in particular the choice of site for a new ferry terminal in Whalsay (min. ref. 05/10).
- 1.2. The Committee decided to note the recommendations of the report and instructed officers to carry out more detailed work to investigate the provision of a tunnel to Whalsay as an alternative to the ferry service as the transport link to Whalsay.
- 1.3. On 17 February 2010 the Council again debated the issue of Whalsay transport links (min. ref. 06/10), and asked for a report to a special Infrastructure Committee looking at the possible costs of a tunnel option, together with a comparison of the long term costs of the tunnel versus the long term costs of continuing a ferry service to Whalsay. A report by the Head of Finance addressing this matter is also on the agenda for this meeting.
- 1.4. The remainder of the report summarises the motion adopted by the Infrastructure Committee on 2 February 2010, details the work that has been done to date including updated information from the report originally intended for the Special Infrastructure Committee on 20 April 2010, draws conclusions from that work and offers recommendations on the next steps.
- 1.5. The creation of a MOWG was decided at the Council meeting on 19 May (Min Ref 71/10)

2. Links to Council Priorities

- 2.1. The Council's Corporate Plan states *"Shetland's communities are scattered and have a diverse set of needs. To best address those, we must have sustainable road, sea and air transport systems, both internal and external, that ensure everyone is able to access the places, services and opportunities they need."*

- 2.2. The Shetland Transport Strategy states : -

Section 6.2. - *Work on appraising strategic alternatives has confirmed the desirability of developing a fixed links strategy for Shetland – principally for the benefits accruing from reduced revenue burdens, but also facilitating improved accessibility and wider opportunities for service delivery efficiencies. The principal links to be considered are between Lerwick and Bressay, Mainland Shetland and Yell, Yell and Unst, and also Mainland Shetland and Whalsay.*

Section 6.20 – *ZetTrans is committed to the improvement of the Whalsay ferry service and is currently undertaking a STAG Part 2 Study examining future options for the service including consideration of new vessels and terminals.*

- 2.3. The Council adopted the recommendations of the STAG Whalsay Link Study on 10 June 2008 (Infrastructure Committee min. ref. 44/08)

3. Risk Management

- 3.1. The most significant risks at present relate to continued uncertainty over the nature of the transport link to Whalsay.
- 3.2. Although detailed design of the Laxo terminal is well advanced the project has been put on hold while the Council considers this matter further. This will have an effect on the Council's Capital programme and the Head of Capital Programming will deal with the detail through his normal reporting process.
- 3.3. If there is a need to extend the length of time that current infrastructure and vessels are required to provide the transport link beyond the originally anticipated time of 2014 there will be a need to understand the following matters:
- The consequences in terms of the additional revenue required for increased maintenance requirements; and
 - The impacts on the economic and social conditions of the Whalsay Community if the current constraints remain in place for longer than anticipated.
- 3.4. If the current constraints on the transport link prevail over the medium term (i.e. beyond 5 years) this could lead to political, economic and social risks due to inadequacy of the transport link and the reduced ability of the Whalsay Community to access opportunities and services essential to its sustainability.

4. Background

- 4.1. At its meeting of 2 February 2010 the Infrastructure Committee noted but did not approve recommendations 16.1 to 16.3 of report TR-05-10-F (Min Ref 5/10) and approved a further recommendation (recommendation 16.4) in the following terms: -

- 16.4.1. *the Infrastructure Committee seeks a report from an expert Scandinavian sub-sea tunnelling consultant, with a proven track record in this field, which would, after initial ground and seabed investigation, set out indicative capital and revenue costs for a fixed link to Whalsay;*
- 16.4.2. *the report will show clearly the level of risk built into the calculations and the extent to which they might be mitigated;*
- 16.4.3. *the report will show a realistic timescale for the completion of a fixed link, recognising the frailty of the existing infrastructure;*
- 16.4.4. *the report will recognise the UK consent process and show that initial discussion with appropriate officials does not present insurmountable barriers to the project;*
- 16.4.5. *the Head of Finance provides comment on the financial implications and confirms whether the fixed link option provides best value;*
- 16.4.6. *the report be presented by the chosen expert in the first cycle after the summer recess in 2010 or sooner if possible recognising the urgency in replacing the existing infrastructure; and*
- 16.4.7. *the capital identified at 14.2 in the report [report TR-05-10-F] for 2010/11 be used in the first instance for the works identified in 16.4.1 to 16.4.4.*

4.2. Following on from this instruction officers have held an initial workshop including, amongst others, a representative of the company Tunnel & Geoconsult who introduced the view to members of the Whalsay Community that tunnels could be built for significantly lower costs than had previously been believed. Anecdotal information suggests that there was a widely held belief that a tunnel to Whalsay may cost as little as £35 million.

4.3. The remainder of this report: -

- summarises the outcome of the recent workshop;
- summarises additional work that has been undertaken since the workshop including meetings with the Norwegian Public Roads Authority and draws preliminary conclusions from what has been learned so far; and
- summarises the background to the Whalsay STAG outcomes
- Offers a view on the matters that remain to be addressed in light of the Council decision of 19 May 2010. (Min Ref 71/10)

5. Summary of Workshop

5.1. The Workshop report is referred to as Appendix 1 in this report but to save duplicating large volumes of material Members can perhaps refer

to the version that was issued with the report originally intended for the Special Infrastructure Committee on 20 April 2010 (which was postponed) or copies are available in the Members' Room.

5.2. The objectives set for the workshop held on 1st and 2nd March 2010 were: -

- *to generate a shared understanding of all the factors that must be considered and taken into account in development of a project budget for a drill and blast tunnel in Shetland. It is anticipated that to achieve this it is necessary to:*
 - *clearly understand the methodology adopted in the preparation of Norwegian tunnelling costs estimates and what is included in the estimates;*
 - *clearly understand the methodology adopted in the preparation of cost estimates for tunnelling in Shetland (using the Bressay project as a case study) and what is included in the estimates;*
 - *clearly understand the factors that affect project timescales, from inception to delivery, which have been suggested as less than five years to deliver a Whalsay tunnel;*
- *reach a consensus amongst the delegates at the workshop on a generic cost per metre that can be used in the appraisal of tunnel projects in Shetland (recognising that different locations will be subject to variation dependent on site specific conditions); and*
- *prepare a discussion paper that can be used as the basis of a report and presentation to Shetland Islands Council's Infrastructure Committee to support.*

5.3. Section 4 of the report in Appendix 1 details the Key Findings of the Workshop and appraises how they meet the objectives set.

5.4. Summary of the Key Findings: -

5.4.1. The concept of Drill and Blast Tunnelling commonly used in Norway is a proven technology and is relevant in the context of sub-sea tunnelling in Shetland.

5.4.2. Tunnelling costs in Norway currently average £9,500 per metre.

5.4.3. A consensus was reached that for the purposes of developing a project budget for a tunnel to Whalsay that a cost of £10,000 to £11,000 per metre should be used.

5.4.4. A tunnel to Whalsay would take at least 6 to 8 years to plan, procure, build and complete.

5.4.5. There is unlikely to be any significant funding support from Scottish Government and European funding is likely to be limited to relatively small contributions if any.

6. Summary of Additional Work Undertaken

6.1. Since the Workshop further work has been undertaken to expand on the issues explored at the workshop. The main pieces of work that have been carried out are: -

6.1.1. Discussions and meetings have taken place with the Norwegian Public Roads Administration (NPRA).

6.1.2. Refinement of alignment options has been carried out to identify the shortest possible crossing route for a tunnel to Whalsay.

6.1.3. The Council's Roads Service has carried out an initial appraisal of requirements for connecting roads in terms of preliminary views on alignments, works required to construct new roads or upgrade existing roads and the associated costs and timescales that should be considered.

6.1.4. The Head of Finance has carried out a financial appraisal of a tunnel to Whalsay compared to continued operation of the ferry service over a 120 year appraisal period.

6.2. Dialogue with Norwegian Public Roads Authority (NPRA).

6.2.1. Initially discussions took place by email with a representative from the NPRA. They are the client body for tunnelling projects in Norway and hold responsibility for the development, procurement and operation of tunnels in Norway.

6.2.2. Indications are that the process of developing major infrastructure projects in Norway is broadly similar to Scotland in terms of planning, budget preparation, consents and timescales required.

6.2.3. Two representatives of the NPRA offered to visit Shetland (all costs met by NPRA) to meet with officers to discuss further the costs of tunnelling in Norway and technical and procedural detail of how they approach the planning and delivery of tunnelling projects in Norway.

6.2.4. They met with officers on 15 April 2010 and visited Whalsay and on 16 April 2010 gave two presentations to available Members which have been circulated to all Members. They have kindly agreed to attend this meeting of the Committee also and will give their presentations once more.

6.3. Refinement of Tunnel Alignments

6.3.1. At the time of the workshop in March tunnel alignments had been developed to a fairly low level of detail.

6.3.2. Further detailed work has been carried out which has concluded that the shortest tunnel length achievable is of the order of

6.3km compared to 5.5km as was thought at the time of the workshop.

6.3.3. It is this option that has been used in the financial modelling detailed in the report on this agenda by the Head of Finance.

6.4. Assessment of Tunnel Alignments in Relation to Road Networks on Mainland and in Whalsay

6.4.1. The Council's Roads Service has reviewed the various alignment options considered at the workshop and the more refined 6.3 km option (Option 1A in memo attached as Appendix 2).

6.4.2. It is costs and timescales for road improvements and new road construction associated with Option 1A that have been included in the financial modelling carried out by the Head of Finance.

6.5. Financial Modelling and Economic Appraisal of Alternatives.

6.5.1. The technique adopted in the Head of Finance's report on this agenda is means of informing investment decisions taking into account the time value of money when comparing projects with very different cost/benefits flow characteristics over a long period of time.

6.5.2. As acknowledged in the report the analysis concerns itself with how a tunnel option and the ferry option recommended in the STAG compare in terms of their impact on Council resources over a 120 year period expressed at today's prices.

6.5.3. The report also acknowledges that are other factors that may be significant in terms of other costs and these deserve full consideration at an appropriate point.

6.5.4. Some work has already been undertaken to assess Transport Economic and Efficiency benefits and the Economic Development Unit is working closely with the Transport Service to explore wider economic factors relating to fixed link and ferry alternatives.

6.5.5. Within the timeframe available a wider cost/ benefit analysis will be carried out looking into the social and economic factors and fed in to the analysis also and reported to the Council meeting of 30 June 2010.

7. Preliminary Conclusions from Work to Date

7.1. A summary of the preliminary conclusions of our work to date is included here for the Committee's initial consideration.

7.2. Workshop and Developing a Major Transport Project.

7.2.1. In the presentations on the agenda today Dr Annie Say will summarise the work done at the Workshop in March 2010 and the preliminary conclusions that can be drawn from that. Dr Say will also briefly cover the process the Scottish Government's transport agency Transport Scotland would expect a project like this to follow.

7.3. Time Required to Deliver a Tunnel to Whalsay.

7.3.1. From the Workshop it was considered that it would take at least 6 to 8 years to plan, procure, build and complete a tunnel to Whalsay.

7.3.2. Subsequent discussions with the Norwegian Public Roads Authority tell us that a normal timescale for development of a project of this nature in Norway is 12 years from conception to completion of construction.

7.4. Capital and Revenue Costs.

7.4.1. From the workshop it was determined that estimates of the cost of a tunnel to Whalsay should be based on no less than £10,000 to £11,000 per metre.

7.4.2. Using a tunnel length of 6361m (which is currently considered to be the shortest achievable tunnel length) this gives a lower bound cost for the tunnel alone of between £63.61 million and £69.97 million.

7.4.3. The indicative costs of constructing connecting roads and improving existing roads on the mainland and Whalsay is £7.6 million.

7.4.4. Estimates of costs for developing the project (fees, design, consents, site investigations, surveys, insurances, etc.) come to £4.93 million.

7.4.5. This gives an overall range of capital cost at this stage of £76.143 million to £82.695 million.

7.4.6. It can be shown at this stage therefore that the anecdotal estimate of £35 million as the cost of a tunnel to Whalsay is entirely unrealistic. As I understand it that broad estimate was based on a tunnel of 5km at a cost of £7000/m.

- 7.4.7. Discussions with NPRA suggest that an allowance of £3 million every 25 years should be included in project estimates to accommodate replacement of tunnel plant and equipment such as pumps, lighting, ventilation and monitoring systems.
- 7.4.8. Members should also note that these figures contain no allowance for Risk or Optimism Bias (see Annex C of the workshop report for an explanation of Optimism Bias) which Treasury Guidance directs us to use in these circumstances. If this was applied (66% for the tunnel element and 44% for other elements of cost) the cost estimates are in the range £123.63 million to £134.19 million¹
- 7.4.9. The financial analysis in the report on this agenda by the Head of Finance does not take account of Optimism Bias on either a tunnel or ferries and terminals.
- 7.4.10. Although this is not consistent with how Treasury Guidance would direct us to carry out preparation of estimates for the purposes of financial appraisal and decision making, the analysis contained in the Head of Finance's report shows that even adopting this extremely optimistic scenario, with no compensating allowance for the current unknowns, a tunnel to Whalsay does not represent value for money for the Council in the long term based on the assumptions in the analysis. Wider economic opportunities and disbenefits of a tunnel have not been considered to date in detail.

8. Summary of Whalsay STAG Outcomes

- 8.1. To put all of this in the context of the original Whalsay STAG appraisal, Appendix 3 to this report contains the Executive Summary to the Whalsay STAG report and this summarises the objectives of the study, the options considered, the rationale applied to the appraisal at the time and the conclusions reached.
- 8.2. Like all STAG appraisals the report reflects circumstances and conditions at the time of the study and Members may view matters differently now compared to then and Members may wish to see the STAG refreshed to reflect and appraise any changes since the study was originally carried out (see section 9.6 of this report).

9. Some Important Matters to be Researched and Understood by Council Meeting 30 June 2010

9.1. Norwegian Experience in Developing and Delivering Tunnel Projects

¹ The reason these numbers are higher than previously reported (£111 million) is that previous work limited itself purely to considering the cost of the tunnel and did not explore the necessary improvements to the connecting roads.

- 9.1.1. The Committee will hear today from a number of representatives from Norway who work in different fields of tunnelling. These are: -
- Gisle Fossberg – Senior Engineer (Contracting Section), Norwegian Public Roads Authority.
 - Jan Eirik Henning – Senior Engineer, Norwegian Public Roads Administration.
 - Eivind Grøv – Research Manager and Professor with SINTEF, President of the Norwegian Tunnelling Association and Vice President of the International Tunnelling Association.
 - Kjetil Vikane – Vice President of Business Unit, AF Anlegg (Contractor with experience in tunnel construction).
 - Per Arne Moen – Owner of Tunnel and Geoconsult who specialise in permanent rock support of tunnels and caverns, geological follow up, field survey and pre-investigations. Mr Moen will be accompanied by a colleague, Mr Sigve Martinsen.
- 9.1.2. Professor Andy Sloan will attend to offer views on how the Norwegian experience and UK experience relate to each other.
- 9.1.3. From this session we hope to be able to compare Norwegian experience and performance with the Shetland context and what allowances for time and cost, if any, need to be made for our different circumstances.

9.2. Time Required to Develop and Deliver a Project

- 9.2.1. The presentations by the Norwegian representatives will consider the matter of timescale required to deliver a tunnel project.
- 9.2.2. The importance of this matter relates to the length of time that the Whalsay Community must deal with the current capacity constraints and the risks associated with infrastructure and ferries being operated significantly beyond their design lives and the potential effects on the sustainability of the community should the Council change its policy from ferries to a tunnel.

9.3. Understanding of Costs to the Council

- 9.3.1. This is clearly a critical factor for Members to understand both in terms of capital cost and ongoing revenue costs. It is noted that Members have heard costs quoted from various sources in various contexts ranging from £35 million to £135 million for a tunnel to Whalsay. There is no doubt that this contributes to a confusing environment for Members to take decisions within.

9.3.2. There are also differing views on how costs can be met and the recently established Member Officer Working Group will research the potential for securing funding from other sources with the aim of reducing the burden on Council resources.

9.3.3. The next report to Council will build on the capital and revenue cost estimates for a tunnel to Whalsay to include allowances for risk and unknowns that should be taken account of in the overall project budget for planning and decision making purposes.

9.4. Likelihood of External Grant Funding or Other Methods of Funding

9.4.1. The Member Officer Working Group established on 19 May will undertake research into this matter and the conclusions will be included in the report to the Council on 30 June 2010.

9.5. Method of Financial Comparison Between Alternatives

9.5.1. The Head of Finance's report uses the concept of Net Present Value using Discounted Cash Flow Analysis to enable comparison of different alternatives over a long period with very different capital and revenue cost profiles to be compared at today's prices.

9.5.2. At the Council meeting of 19 May it was clear that Members are interested in establishing whether there are alternative means of carrying out comparative financial appraisals.

9.5.3. In Transport appraisal and wider Public Sector appraisal processes this is the only accepted approach to comparing the financial performance of different alternatives over an appraisal period.

9.6. The role of Scottish Transport Appraisal Guidance

9.6.1. Section 1 of the Scottish Transport Appraisal Guidance states:
-

1.1.1 The Scottish Government's Purpose is 'to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth'. The Scottish Transport Appraisal Guidance (STAG) supports this Purpose by providing a clear and robust framework to identify potential transport interventions.

1.1.2 Commissioning authorities and their agents should be aware that only options which emerge from a STAG study will be considered where Government funding, support or approval is required for changes to the transport system. This will be reported in a STAG Report, which will include the rationale behind a potential transport intervention presented in a clear, evidence-led, manner.

Such presentation provides the information required by a decision maker to make informed choices.

- 9.6.2. It can be seen therefore that the Council will need to demonstrate to Government that any intervention that they are seeking support for, either in terms of direct funding or in terms of support for an application for European funding, must be shown to be justified through a competent and thorough STAG appraisal.
- 9.6.3. I do not believe this prevents the principle of funding being explored at a high level initially but ultimately the Council will have to undertake an update of the Whalsay STAG to establish in an objective and evidence based manner whether a tunnel to Whalsay is the most effective solution best meeting local transport planning objectives and Government transport objectives.

10. Financial Implications

- 10.1. There are no financial implications arising from this report that are not already included in approved budgets.

11. Policy and Delegated Authority

- 11.1. Matters relating to provision of transportation services and infrastructure are delegated to the Infrastructure Committee as part of its remit in Section 12 of the Council's Scheme of Delegation. The Infrastructure Committee has authority to proceed with the project in terms of the STAG Whalsay Link Study as agreed by the Council. However, for the avoidance of doubt, and to ensure clarity of the policy position, the recommendations in this report are being presented to the Council for a decision.

12. Recommendations

- 12.1. I recommend that the Infrastructure Committee note the content of this report

Report Number : TR-21-10-F2

Appendix 1
Workshop Report
(Available in the Members Room)

Appendix 2 – Roads Service Preliminary Assessment of Tunnel Alignments

MEMO

To: Transport

From: Roads

Attn: Michael Craigie

If calling please ask for
Colin Gair
Direct Dial: 4867

Medium: paper

Date: 07 April 2010

Our Ref: CJG/SMG/R/B2/17

Your Ref:

Whalsay Tunnel Options Roads Infrastructure Comments

Following our meeting of 15 March 2010 I was asked to provide some input on each of the four tunnel route options being explored.

This response was to consider the implications and likely costs of connecting the various tunnel portal options into the existing public road network in an appropriate manner.

Subsequent to our meeting I was forwarded a fifth option that has been investigated to a higher degree than the other four. I have also commented briefly upon this proposal.

Option 1 – Hoo Field to Hamister

Total route length = 11,575m

Tunnel length (portal to portal) = 5,515m

New road length = 3,380 + 890 + 925 = 5,195m (4,370m)*

Upgraded road length = 900m (1,375m)*

Length of improvements to provide tie-ins/ junctions = 800m

Estimate of roads infrastructure costs = £7.1 million (£6.8 million)

* Hamister route option

This is the northern most route option presented for consideration.

The alignment as presented did not identify a tunnel portal location at the Whalsay end so I undertook some basic calculations using the information supplied to identify a likely location. Without this assumption it would not be possible to give any meaningful comment upon the Whalsay end of things.

Mainland

The mainland portal presents on the south-east face of Hoo Field at approximately the 28m contour. The ground in this location falls fairly steeply at around 1 in 5 (20%) toward the sea cliffs that lie about 110m away.

Any route out of this area for a road needs to follow the contours carefully to minimise both earthworks volumes and the extents of both cut and fill slopes. Any route in this location would have a significant impact but it is not

clear as to how visible a new road would be due to the nearest vantage point being some 4km away.

There is a choice of route, either above or between the Pund of Levaneap houses. Routing above the houses at around the 50m contour will involve significant earthworks. It is likely that a route between the houses, following the existing road to Levaneap, will involve much less earthworks and should allow flatter gradients.

The route would then skirt the south end of Burga Water before joining the alignment of the existing B9071 Vidlin road to the north of Pundbank. The B9071 at this point is nominally single track and would therefore require to be upgraded to a full double track carriageway width to the end of the existing improved section at Flugarth.

The length of new road for this route is 3,380m, with an additional 900m of the B9071 to be upgraded. 600M of new road to provide tie-ins to severed roads would also be required.

With the cost of new road construction in this type of terrain typically £1 million to £1.3 million per kilometre, depending on the rock volume and cut/fill balance. I would place an estimate of some £4.5 million on the new road and tie-ins.

The cost of upgrading the B9071 is unlikely to be significantly less per kilometre due to the difficulties in working on or closely adjacent to an existing alignment. I would therefore estimate £0.8 million for this work.

Whalsay

With respect to the portal location and orientation, calculated by me for the Whalsay end of the tunnel in the absence of other information, the route heads towards the Loch of Huxter. This location would afford a reasonable junction location onto an existing public road but it would not serve the majority of the islands population very well. To form the new junction it is likely that the existing road would need some upgrading works on the approach to the junction.

A high quality and fairly direct link back from the tunnel route to the main Symbister to Brough road would be essential. A route skirting the edge of the 'meadows' below Sodom and Skiberhoull tying into the existing public road at the south side of the North Voe should be possible.

The route from the assumed portal location to the junction at the Loch of Huxter is some 890m long, and the link back to the Symbister to Brough road comes to about 925m, giving a length of new road on Whalsay of some 1,815m. A thoughtful design which carefully matched cut and fill volumes should not be particularly expensive or visually intrusive. I would estimate construction costs here to be in the region of £0.9 million per kilometre, giving an estimate of some £1.8 million for the road works on Whalsay for this option.

Alternatively, depending upon the levels of the route leading away from the portal, it may be possible to tie back into the Hamister road. Upgrading this existing road to provide a link onto the Symbister to Brough road would negate the need for a new link below Sodom and Skiberhoull. This option for the road link on Whalsay may realise a saving of some £300K, but possibly more importantly the visual and environmental impact may be a lot less.

Option 2 – Levaneap to Sodom

Total route length = 10,720m

Tunnel length (portal to portal) = 6,515m

New road length = 2,090 + 215 + 1,000 = 3,305m

Upgraded road length = 900m

Length of improvements to provide tie-ins/ junctions = 800m

Estimate of roads infrastructure costs = £4.7 million

Mainland

The mainland portal presents very close to the Levaneap houses. It appears that a route from this portal to the same alignment identified for Option 1 through the Pund of Levaneap houses would be possible. However, there is obviously a high level of risk that should the portal location or level have to move, say due to ground conditions along the route, that this tie-in could not be achieved. That would result in a longer route down past the old steading of Hamar to tie-in to the B9071 Vidlin road. The additional 300 metre length would add about £0.3 million to the costs.

The portion of the route identified for Option 1 that could also be used for this tunnel option is the easier section to construct. As such the construction costs per kilometre would be at the lower end of the estimates given under Option 1 above. I would therefore estimate that the new road would cost about £2.6 million including tie-ins.

The cost of upgrading the B9071 would be the same as for Option 1; £0.8 million as estimated previously.

Whalsay

The Whalsay portal was shown as emerging within the Sodom houses so I have slewed the tunnel across slightly to the north to avoid them. This realignment also allowed the route to present itself with a better approach to the existing public road at the Loch of Huxter.

Similar to Option 1 this junction, while tying nicely into the public road network, would not serve the majority of Whalsay residents particularly well and a high quality road link back to the Symbister to Brough road would also be essential.

A route would appear feasible, skirting the 'meadow' below Hamister to join the public road at the north side of North Voe. Linking up to the Hamister road as an alternative route would be possible but would present no benefits other than impact on the landscape in this circumstance.

The estimated cost of new roads and upgrades to existing roads for the Whalsay end would be some £1.3 million.

Option 3 – Billister to Symbister Ness

*Total route length = 8,190m**

Tunnel length (portal to portal) = 5,785m

New road length = 1,935 + 470 = 2,405m

*Upgraded road length = 0m**

Length of improvements to provide tie-ins/ junctions = 150m

*Estimate of roads infrastructure costs = £2.7 million**

* Does not include works to the B9075 Nesting Loop road – see separate comment

Mainland

This tunnel route breaks ground near to Billister in North Nesting, very close to a group of existing houses.

It may be possible to divert the road route to the south around these houses but it is probably more practical to re-align the first section of the tunnel so that it emerges in the right area.

The route to/ from the tunnel would skirt the Billister and Laxfirth houses to the south side of the Burn of Laxfirth before joining the B9075 Nesting loop road near to the existing junction. The line of this route should offer little challenge to construction. The length of this route is some 1,935 metres, which I would estimate at costing around £1.9 million with tie-ins.

However, this route to the B9075 still leaves drivers some 5.7 kilometres (3.5 miles) from the B9071 Voe to Vidlin road at Laxo, and 9.5 kilometres (5.9 miles) from the A970 Lerwick to Voe road at Catfirth. This issue is discussed separately below.

Whalsay

The Whalsay end of Option 3 presented within a group of existing houses on Symbister Ness overlooking the harbour. While this is a nice central area and close to the road link from the existing ferry terminal there is very little room due to existing developments. Portals require significant space due to the depth and potential length of the cuttings required to get down to the tunnel invert level, which is always located a good depth below existing ground levels.

By re-aligning or swinging the tunnel route a little to the south of the current line it may be possible to miss the Symbister Ness houses and achieve a tie-in to the public road at the head of the beach at Symbister.

This would be a fairly short tie-in route but it crosses a wet 'meadow' area at the head of the beach. This would almost certainly require significant excavation of unsuitable material and the import of a large quantity of rock.

It may be possible to win sufficient rock on-site from the tunnel portal area to construct this route, although accessing the portal site without the access may be a challenge.

This short route will be expensive in terms of cost per kilometre, I would say in the order of £1.7 million per kilometre. This would give an estimate of some £0.8 million for this section of road. However, no other road improvements would be required by the project as it effectively links into the public road network where the old ferry service did.

Option 4(a) – Kirkabister to Symbister

*Total route length = 8,205m**

Tunnel length (portal to portal) = 6,140m

New road length = 1,620 + 445 = 2,065m

*Upgraded road length = 0m**

Length of improvements to provide tie-ins/ junctions = 150m

*Estimate of roads infrastructure costs = £3.0 million**

* Does not include works to the B9075 Nesting Loop road – see separate comment

Tunnel Option 4 is the southern most of the options being considered.

Mainland

The mainland end presents at Kirkabister in North Nesting, while the Whalsay end was shown up to a point at Sandwick, south of Symbister, but no portal location was identified.

For the purposes of this exercise two possible portal locations were determined from the limited information given. Obviously, in terms of tunnel design neither of these points may be suitable or achievable but some reference is needed in order to make any proper comment on the route.

The mainland end of the tunnel presents within Kirkabister very close to the existing houses. This is in all likelihood an unworkable location due to the houses and the archaeological significance of the area. The nearest likely location for a tunnel portal would be some 40m to the north, beyond the Loch of Kirkabister. A route from here could probably be found out to the existing junction with the B9075 at Brettabister, although constructing such a route over virgin ground may well raise significant opposition due to the history of the area.

In any event such a route would still leave drivers somewhat short of the main spine route public road network, being some 7.9 kilometres (4.9 miles) from the B9071 Voe to Vidlin road at Laxo, and 7.3 kilometres (4.5 miles) from the A970 Lerwick to Voe road at Catfirth. This issue is discussed separately below.

Should the relocated portal position and access route be acceptable then a likely cost for the required road works and tie-ins would be in the order of £2.2 million.

Whalsay

On Whalsay one of the options for a portal location for this tunnel route would be in the same area as Option 3. This would require swinging the tunnel alignment northwards under the bay of Sandwick towards Symbister. The tunnel would then emerge around the ridge line between Sandwick and the 'meadow' at Symbister.

This would allow a nice short tie-in to the existing public road at Symbister, the same as per Option 3. However, the portal location would be within fairly low-lying ground with little leeway for variation due to adjacent development. This portal location is at such a low level that it may be susceptible to a rise in sea levels.

With a length of 145m and a construction cost the same as the link for Option 3 the estimate for these road works would be £0.8 million.

Option 4(b) – Kirkabister to North Voe

*Total route length = 9,330m**

Tunnel length (portal to portal) = 7,140m

New road length = 1,620 + 570 = 2,065m

*Upgraded road length = 0m**

Length of improvements to provide tie-ins/ junctions = 150m

*Estimate of roads infrastructure costs = £2.7 million**

* Does not include works to the B9075 Nesting Loop road – see separate comment

Whalsay

The second option for a Whalsay portal for Option 4 involved continued the tunnel route along its proposed heading northeast under Sandwick before swinging northwards to emerge from the hillside above the North Voe 'meadow' between Skiberhoull and Sodom.

While this portal location leads to a longer tunnel the route alignment presents well and allows a good link into the existing public road at North Voe. The resulting 570m access would have a construction cost of around £0.5 million.

Works to the B9075 required for Options 3 & 4

Both tunnel options that emerge in the North Nesting area connect into the public road network at the B9075 Nesting loop road. This road runs from the A970 Lerwick to Voe road at Catfirth northwards through Nesting until it meets the B9071 Voe to Vidlin road at Laxo, a total distance of 15.2 kilometres (9.4 miles).

This route is single track for its whole length other than at a few localized improvements for blind bends or crests. In order for this route to carry traffic to and from any Whalsay fixed link a significant improvement scheme to upgrade the road to double track would be required.

The southern end of the route has a reasonable amount of roadside development, which would restrict somewhat the design of any new alignment and add to construction costs slightly.

The central section follows the coastline on a steep hillside overlooking the sea and construction along this section would be expensive both due to the topography, limited routing options and presence of rock at or near the surface.

The north section of the road is relatively undeveloped and crosses a number of hills and crests, predominately covered in a thick layer of peat. Construction costs in this terrain would be about typical for Shetland, at approximately £1.1 million per kilometre.

Option 3

For Option 3 a route to the north and the B9071 would be shorter and cheapest at around £6.2 million, but would leave you with a travel route that was 9.4 kilometres (5.8 miles) longer than the south route. Routing to the south and the A970 at Catfirth would obviously cost more, I would estimate around £12.5 million, but would give a shorter and quicker journey time from the portal to Lerwick at around 6 minutes less.

If the north route were chosen for cost reasons then there is a risk that a number of drivers may choose to travel the shorter route southwards along the unimproved B9075. This option would appear to offer trip time savings of over 2 minutes compared to the improved north route. This would be of serious concern to us as Roads Authority due to the obvious increased risk for accidents between drivers travelling quickly along a single-track road to get to the tunnel. We would therefore recommend that the southern route was the only viable option.

Option 4

For Option 4 the south route is not only shorter and quicker but it is cheaper as well. Providing a new double track road from Brettabister to the A970 at Catfirth would cost around £9.1 million.

Improving the B9075 Nesting loop road from the A970 at Catfirth northwards to serve either of the tunnel options would provide significant community benefits beyond those realised by a fixed link to Whalsay. It would enhance access to existing developments in both North and South Nesting and make more attractive significant areas for additional development due to the improved access to the A970 and Lerwick.

Improving the B9075 would increase the overall roads costs for Options 3 & 4 and these total costs are listed below: -

- Option 3 - £8.9 million (to North and not recommended)
- Option 3 - £15.2 million
- Option 4 (a) - £12.1 million
- Option 4 (b) - £11.8 million

Option 1A – Hethri Knowe to Setter Hill

This additional alignment option was forwarded to me for comment on 29 March 2010.

Total route length = 10,174m

Tunnel length in plan (portal to portal) = 6,147m

Tunnel length in 3D = 6,361m

New road length = 2,770 + 360 = 3,130m

Upgraded road length = 600 + 750 = 1,350m

Length of improvements to provide tie-ins/ junctions = 600m

Estimate of roads infrastructure costs = £5.8 million

Mainland

The mainland portal presents on the south-west face of Hethri Knowe at approximately the 78m contour.

Any route out of this area for a road should follow the contours carefully to minimise both earthworks volumes and the extents of both cut and fill slopes. This type of alignment arrangement can often allow much shallower grades.

The route alignment shown for the access road climbs steeply over the north shoulder of Hoo Field before dropping down to skirt the south end of Burga Water. It then continues on to join the alignment of the existing B9071 Vidlin road to the north of Pundbank. The B9071 at this point is nominally single track and would therefore require to be upgraded to a full double track carriageway width to the end of the existing improved section at Flugarth.

The length of new road for this route is 2,770m, with 900m of the B9071 to be upgraded. 600M of new road to provide tie-ins to severed roads would also be required.

With the cost of new road construction in this type of terrain typically £1 million to £1.3 million per kilometre, depending on the rock volume and cut/fill balance. I would place an estimate of some £3.9 million on the new road and tie-ins.

The cost of upgrading the B9071 is unlikely to be significantly less per kilometre due to the difficulties in working on or closely adjacent to an existing alignment. I would therefore estimate £0.8 million for this work.

Whalsay

The Whalsay portal presents to the north of Setter Hill above Newpark. The alignment and level of this portal location allows a good access link down to the Symbister to Brough road.

The Symbister to Brough road at this location is generally double track but there is a 650m section back towards North Park that still needs to be widened. There are also a couple of areas where further improvements would need to be made if the road were to carry most of the traffic coming into and out of the island.

The cost of constructing the new access link and bringing the relevant length of the Symbister to Brough road up to a minimum standard, similar to the sections of this road that have already been improved, would be in the region of £1.1 million.

Summary

While there is the potential for significant community benefit from the improvement of the B9075 Nesting loop road associated with a mainland portal location within Nesting the road construction costs are also significantly higher. The corresponding tunnel routes are also longer and therefore probably more expensive.

A portal location accessing onto the B9071 Voe to Vidlin road would also bring some community benefit through the improvement of a portion of that road. However, the smaller amount of improvement works required, the amount of improved road already within the area and the greater distance from Lerwick all combine to reduce the overall benefit accrued.

On Whalsay there is limited scope for the location of a portal due to the amount of development in the general landfall area for any tunnel proposal. The one constant is the need to have a good quality access connection into the existing Symbister to Brough Road, preferably in the area between Symbister and North Park. This location provides the best access for the majority of Whalsay residents based on the existing public road network in the island. It also minimises the amount of existing road that needs to be improved with the associated disruption that such works involve.

To the various construction costs mentioned above allowances for the various professional fees, land purchase and accommodation works costs and contingencies need to be added.

The respective totals for each option are tabulated below.

	1	2	3	4(a)	4(b)	1A
<i>Total route length</i>	11,575m	10,720m	8,190m	8,250m	9,330m	10,174m
<i>Tunnel length in plan (portal to portal)</i>	5,515m	6,515m	5,785m	6,140m	7,140m	6,145m
<i>New road length</i>	5,195m	3,300m	2,405m	2,065m	2,190m	3,130m
<i>Upgraded road length</i>	900m	900m	9,505m	7,250m	7,250m	1,350m
<i>Length of improvements to provide tie-ins/junctions</i>	800m	800m	150m	150m	150m	600m
<i>Estimate of roads Construction costs</i>	£7.1M	£4.7M	£15.2M	£12.1M	£11.8M	£5.8M
<i>Estimate of roads Project costs</i>	£9.4M	£6.3M	£19.7M	£15.6M	£14.4M	£7.6M

The one variable that cannot be costed as such, and also cannot be properly quantified, is the time required to gain access to all of the ground required for road works. In general the longer the route, the greater the number of landowners/tenants that need to be identified and dealt with. The greater the number of landowners the higher the probability that at least one will be difficult to identify/contact, or settle with. This unknown needs to be factored, somehow, into the program for any such project.

If you require any other information or feedback please feel free to give Colin Gair a call.

Head of Roads

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Appendix 3 – Whalsay STAG Study Executive Summary

Executive Summary

Introduction

ZetTrans commissioned Faber Maunsell to undertake a detailed examination of options with regard to the transport link between Whalsay and the Shetland Mainland¹. The analysis follows Scottish Transport Appraisal Guidance (STAG²). This note summarises the STAG process undertaken in order to reach a preferred option to be considered for funding.

The 'Do Nothing' option is considered to be unacceptable. Currently the route suffers capacity constraints at peak times which is reported to be hampering the commuter base of the island. Almost one quarter (22% or 160 residents) of the working population on Whalsay commute to the Mainland and depend on a regular and reliable ferry service. Current issues with capacity lead to uncertainty about being able to travel which can cause personal stress to people and potentially make continued commuting to the Mainland untenable. Added to this is the uncertainty regarding the state of the infrastructure and the vessels serving the route. The infrastructure is currently operating at its limit in terms of berthing pressures with ever increasing maintenance costs required to keep the service operational. The route is served by two vessels, MV 'Linga' and MV 'Hendra'. MV 'Hendra' was recently refurbished to extend her serviceable life but it is not anticipated that this could be extended further and she will need to come out of regular service use in approximately 2014; waiting time on new ferries is three years and can be potentially up to five years.

These factors all combine to provide a bleak future picture for Whalsay under the 'Do Nothing' scenario with ongoing capacity constraints hampering access to economic activity for residents of the island and increasing likelihood of service disruptions due to the aging infrastructure and vessels. All of this could serve to make living on Whalsay and commuting to the Mainland untenable which could in turn generate population decline on the island as people move off in search of employment opportunities.

Whalsay is the most populated of the Shetland Islands and the Whalsay route is the third busiest on the Shetland network. The route has been experiencing sustained and continued growth in passenger and vehicle numbers.

Problems and Opportunities

Analysis of the problems and opportunities has been undertaken and found the key problems to be:

- Aging vessels and changing legislation with regard to ferry design standards which affects the medium term use of MV 'Hendra';
- Aging infrastructure and increasing berthing pressures and increasing rate of wear and tear on the terminal infrastructure;
- Vehicle capacity problems aboard the ferries, particularly during peak commuting times, as well as problems related to the booking system and service gaps - commuting to the Mainland is essential for 22% of the working population on Whalsay (approximately 160 people);
- Restricted capacity for HGVs and taller vehicles on MV 'Linga'; due to competition for space the vehicle deck, there can be lengthy delays for larger vehicles;
- Marine congestion in Symbister Harbour;
- Concern regarding affordability, both in terms of affordability of fares as well as the importance of finding an affordable solution for funding bodies; and

¹ Shetland Mainland will be referred to simply as the Mainland within the remainder of this document which is distinct from the "Scottish Mainland" or "UK Mainland"

² STAG is the official appraisal framework developed by the Scottish Government to aid transport planners and decision-makers in the development of transport policies, plans, programmes and projects in Scotland.

- Concerns expressed over the operational reliability of the ferries with regard to operation in inclement weather as well as continuation of service during times of repair and routine maintenance.

Statutory Context and Planning Objectives

National, regional and local policies have been reviewed as part of this study and common theme is the emphasis on the importance of efforts to sustain island communities, and accept that local and central funding will be central to the sustaining of these, often isolated, populations.

Following assessment of the problems, opportunities and statutory context for the study a list of planning objectives was prepared. These objectives are six-fold:

- To deliver a solution that is affordable (for funding bodies);
- To deliver a solution that is operationally sustainable;
- To at least maintain the current level of accessibility to the island;
- To reduce conflict between ferry and other harbour users;
- To better match supply and demand; and
- To ensure that the socio-economic characteristics of the island are not constrained.

Option Generation and Sifting

A long list of options was generated and sifted to produce a list of options for appraisal. The following list shows those that were appraised at STAG Part 1 and Stag Part 2 and the outcome of this appraisal:

- **Option 1 ('Do minimum' option)** – *This option would see Laxo and Vidlin, renewed or replaced on a like-for-like basis and the current location of the Whalsay terminal within Symbister Harbour, renewed or replaced on a like-for-like basis; MV 'Linga' and MV 'Hendra' would be retained until life expiry, then replaced on a broadly like-for-like basis.*

This option provides an essential benchmark against which the other options can be compared. It performs only marginally better than the Do Nothing scenario however as it does not address the capacity constraints and would see the uncertainty involved with commuter travel continue. Congestion issues at Symbister would continue and the socio economic prospects for Whalsay would be compromised. The option has little impact on the environment, safety, integration or accessibility.

- **Option 2** – *Laxo is retained as the Mainland terminal, with Vidlin retained as diversionary terminal. Both terminals are replaced with new, larger terminals capable of accommodating 31 vehicle capacity vessels. Symbister remains the Whalsay Ferry terminal but is extended to be capable of accommodating 31 vehicle capacity vessels. One new 31 vehicle capacity vessel is introduced to operate alongside MV 'Linga'*

This option sees the capacity constraints addressed in the medium term and allows the route to grow whilst also removing the current uncertainties with commuter travel. The terminal upgrades would improve their reliability. Two options were investigated for extending Symbister; an outward and inward extension. The outward extension allows greater separation of the marine traffic and better addresses the issue of congestion at Symbister but the risks involved with constructing a breakwater in deep water and the risks involved with the construction (whereby the existing northern breakwater would have to be removed thus leaving the harbour exposed) have been deemed too significant to take this option forward. The outward extension was therefore dropped following STAG Part 1 appraisal. The inward extension of Symbister allows the larger ferries to make use of the harbour but does not fully address the congestion issues within the harbour. This option has little impact in terms of the environment, accessibility, integration or safety.

- **Option 3** – *Option 3 is the same as option 2 in infrastructure terms but sees two new 31 vehicle capacity vessels introduced onto the route*

As above with option 2, the outward extension of Symbister is ruled out due to technical risks; the inward extension is retained but does not fully address the congestion issues at the harbour. The introduction of two new 31-vehicle vessels onto the route addresses the capacity constraints but is significantly more expensive in the early years when compared with option 2.

The introduction of two new larger vessels is therefore considered unnecessary when one new larger vessel operating alongside MV 'Linga' addresses the capacity constraints and this option has been dropped after STAG Part 2 appraisal.

- **Option 4** - *Laxo is retained as the Mainland terminal, with Vidlin retained as diversionary terminal. Both terminals are replaced with new, larger terminals capable of accommodating 31 vehicle capacity vessels. The Whalsay Ferry Terminal is relocated to North Voe with a new terminal constructed capable of accommodating 31 vehicle capacity vessels. One new 31 vehicle capacity vessel is introduced to operate alongside MV 'Linga'*

This option sees the capacity constraints addressed in the medium term and allows patronage on the route to continue to grow whilst also removing the current uncertainties with commuter travel. The terminal upgrades would improve their reliability. Developing North Voe addresses the congestion issues at Symbister and provides a more efficient operational arrangement. Due to developing an undeveloped voe, this option, has negative environmental impacts in terms of landscape and visual impacts. It has little impact on safety, integration or accessibility.

- **Option 5** – *Option 5 is the same as option 4 in infrastructure terms but sees two new 31 vehicle capacity vessels introduced onto the route*

As above with option 4, the relocation of the ferry terminal to North Voe has environmental impacts but addresses the issues of congestion at Symbister harbour and, through the introduction of larger vessels addresses the capacity constraint issues. The introduction of two new larger vessels is therefore considered unnecessary when one new larger vessel operating alongside MV 'Linga' addresses the capacity constraints and this option has been dropped after STAG Part 2 appraisal.

- **Options 6 and 7** – *These were the fixed link options of a bridge and tunnel respectively*

Fixed links would provide a long term solution to capacity issues and remove uncertainty for commuter traffic. It would address the issues of congestion at Symbister. However, in light of the relative urgency to provide a solution for the Whalsay transport link and the timescales involved in constructing such a fixed link and the competing demand for fixed links from other islands within Shetland it is not considered that a fixed link is a feasible solution in the medium term for Whalsay.

- **Option 8** – *Grunna Voe is developed as the Mainland terminal and Vidlin is not upgraded as diversionary terminal since the attraction of Grunna Voe is more sheltered berthing conditions and therefore an anticipated reduction in the number of diversions that would be required. Symbister is retained as the Whalsay Ferry Terminal and is upgraded to be capable of accommodating 31 vehicle capacity vessels. One new 31 vehicle capacity vessel is introduced to operate alongside MV 'Linga'*

This option addresses the capacity constraints in the medium term. However, following detailed assessment of weather records, etc. concern exists about the performance of this option in inclement weather since Vidlin would not be upgraded and would therefore not be capable of accommodating the larger vessel. At these times the service would reduce to being served by only MV 'Linga'. In this sense, the option does not address the uncertainty issues which affect commuter traffic. Additionally, this option sees a largely undeveloped area at Grunna Voe developed to provide a ferry terminal with the associated visual and landscape impacts. The option also introduces additional journey time for vehicles accessing / egressing Grunna Voe compared with Laxo with associated negative TEE and safety impacts. The option has little impact on accessibility and integration. Due to the poor performance of this option in economic terms and the environmental impact and the inability of the option to address the uncertainty issues affecting commuter traffic, this option has been dropped following STAG Part 2 appraisal.

- **Option 9** – *Grunna Voe is developed as the Mainland terminal and Vidlin is not upgraded as diversionary terminal since the attraction of Grunna Voe is more sheltered berthing conditions and therefore an anticipated reduction in the number of diversions that would be required. The Whalsay Ferry Terminal is relocated to a new ferry terminal at North Voe capable of accommodating 31 vehicle capacity vessels. One new 31 vehicle capacity vessel is introduced to operate alongside MV 'Linga'*

As above, this option addresses the capacity constraints in the medium term, however it does not address the uncertainty issues which affect commuter traffic. This option has negative impacts on TEE and safety associated with increased length of journey accessing / egressing Grunna Voe and has the negative environmental impacts of developing North Voe. The option has little impact on accessibility and integration. Due to the poor performance of this option in economic terms and the environmental impact and the inability of the option to address the uncertainty issues affecting commuter traffic, this option has been dropped following STAG Part 2 appraisal.

A full appraisal has been undertaken for the options and the key monetary summaries are provided in the table below.

	PVB	PVC	NPV	BCR*
Option 1 – Do-Minimum	£7,787,840	(£30,543,449)	(£22,755,609)	0.25
Option 2 – Symbister with extension, plus upgraded Laxo terminal, plus one new 31-vehicle ferry vessel and MV 'Linga'	£9,235,932	(£64,437,157)	(£55,201,226)	0.14
Option 3 – Symbister with extension, plus upgraded Laxo terminal, plus two new 31-vehicle ferry vessels	£9,641,710	(£74,566,203)	(£64,924,493)	0.13
Option 4 – North Voe terminal, with Laxo terminal, plus one new 31-vehicle ferry and MV 'Linga'	£9,235,932	(£60,821,128)	(£51,585,197)	0.15
Option 5 – North Voe terminal, with Laxo terminal, plus two new 31-vehicle ferries	£9,641,710	(£70,950,174)	(£61,308,464)	0.14
Option 8 – Grunna Voe, plus one new 31-vehicle ferry and MV 'Linga', plus Symbister terminal with extension	£8,127,956	(£63,627,705)	(£55,499,749)	0.13
Option 9 – Grunna Voe, plus one new 31-vehicle ferry and MV 'Linga', plus North Voe terminal	£8,127,956	(£60,011,676)	(£51,883,720)	0.14

*Ratio not monetary value

Taking this information along with the assessment of the performance of the options against the planning objectives, the government objectives and technical and deliverability issues, the preferred option has emerged as Option 4.

Summary and Conclusions

The STAG analysis examined the benefits and disadvantages associated with each of the option packages. Through careful appraisal against the study objectives and against the five national transport strategies, the recommended preferred Option comprises the following elements:

- Retention and maintenance of MV 'Linga'
- Introduction of one larger-sized ferry vessel (31 vehicle capacity) to replace MV 'Hendra';
- Upgrading of Laxo ferry terminal to accommodate larger-sized ferries;
- Development of North Voe as a replacement ferry terminal on Whalsay; and
- Upgrade of Vidlin to remain as diversionary port capable of accommodating the larger ferry and MV 'Linga'.

The next steps for this study would be to finalise designs for each of the terminals in order that the works can be procured. For this, North Voe requires a degree of testing to determine the position of the breakwaters and to ensure the facility can be built in the Voe as anticipated.

The STAG study outputs should be revised following such works to ensure the preferred option is still the preferred option and stacks up against the others in terms of delivering against the objectives.