

Orkney Inter-Island Transport Study

Strategic Business Case - Options Appraisal Report

On behalf of **Orkney Islands Council**

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Contents

1	Introduction	8
1.1	This Report	8
1.2	The Orkney Inter-Island Transport Network	8
1.3	Project Overview	9
1.4	Appraisal Methodology	10
1.5	Consultation	21
2	Vessels	23
2.1	Introduction	23
2.2	Vessel Replacement Strategy	23
2.3	Vessel Characteristics – Key Assumptions	28
2.4	Phasing & Cascade of Vessels	33
2.5	Assumptions and Packaging of Capital & Revenue Options	34
3	Air Infrastructure Options	35
3.1	Overview	35
3.2	Accountable Management	35
3.3	Current and Potential Aircraft	36
3.4	Navigational Aids & Runway Enhancements	43
3.5	Use of Existing Assets & Resources	46
3.6	The 2017 PSO Tender	47
3.7	Summary	48
4	Outer North Isles	49
4.1	Capital Investment Timeframe	49
4.2	Identified Problems by Island	49
4.3	Overview – Vessels, Connectivity & Options	64
4.4	Appraisal of Capital Options	77
4.5	Annual Operating Cost Estimates	105
4.6	Public Consultation – Prioritisation	107
5	Flotta and Hoy	116
5.1	Capital Investment Timeframe	116
5.2	Identified Problems	116
5.3	Appraisal of Capital Options	118
5.4	Appraisal of Revenue Options	125
5.5	Annual Operating Cost Estimates	128
5.6	Public Consultation – Prioritisation	129
5.7	Rationale for Selection / Rejection	131
6	Graemsay and Hoy	133
6.1	Capital Investment Timeframe	133
6.2	Identified Problems	133

6.3	Appraisal of Capital Options.....	135
6.4	Appraisal of Revenue Options.....	139
6.5	Annual Operating Cost Estimates	143
6.6	Public Consultation – Prioritisation.....	144
6.7	Rationale for Selection / Rejection	146
7	Rousay, Egilsay and Wyre	147
7.1	Capital Investment Timeframe	147
7.2	Identified Problems.....	147
7.3	Appraisal of Capital Options.....	150
7.4	Appraisal of Revenue Options.....	156
7.5	Annual Operating Cost Estimates	159
7.6	Public Consultation – Prioritisation.....	161
7.7	Rationale for Selection / Rejection	162
8	Shapinsay	163
8.1	Capital Investment Timeframe	163
8.2	Identified Problems.....	163
8.3	Appraisal of Capital Options.....	165
8.4	Appraisal of Revenue Options.....	170
8.5	Annual Operating Cost Estimates	173
8.6	Public Consultation – Prioritisation.....	175
8.7	Rationale for Selection / Rejection	176
9	Financial Summary	177
9.1	Introduction.....	177
9.2	Outer North Isles	177
9.3	Flotta and Hoy	179
9.4	Graemsay and Hoy.....	181
9.5	Rousay, Egilsay and Wyre	182
9.6	Shapinsay.....	183
	List of Abbreviations.....	184

Figures

Figure 1.1:	Orkney Inter-Island Transport Network.....	8
Figure 1.2	Summer Weekday Flight Timetable and Education.....	20
Figure 2.1:	Orkney Islands – Categorisation of Waters	26
Figure 4.1:	Estimated Annual Operating Costs of Appraised Options	106
Figure 4.2:	Eday – Prioritisation of Enhancements	108
Figure 4.3:	North Ronaldsay – Prioritisation of Enhancements	109
Figure 4.4:	Papa Westray – Prioritisation of Enhancements.....	110
Figure 4.5:	Sanday – Prioritisation of Enhancements	111
Figure 4.6:	Stronsay – Prioritisation of Enhancements	112
Figure 4.7:	Westray – Prioritisation of Enhancements	114
Figure 5.1:	Lyness – Flotta – Houton Annual Operating Costs of Appraised Options.....	129

Figure 5.2: Flotta – Prioritisation of Enhancements	130
Figure 5.3: Hoy – Prioritisation of Enhancements	131
Figure 6.1 Moaness - Graemsay - Stromness Annual Revenue Cost Estimates	144
Figure 6.2: Graemsay – Prioritisation of Enhancements	145
Figure 7.1 Tingwall - Rousay / Egilsay / Wyre Annual Operating Costs of Appraised Options	160
Figure 7.2: Rousay / Egilsay / Wyre – Prioritisation of Enhancements	161
Figure 8.1 Shapinsay Estimated Annual Operating Costs of Appraised Options	174
Figure 8.2: Shapinsay – Prioritisation of Enhancements	175

Tables

Table 1.1: Summary of Education Arrangement by Island.....	18
Table 2.1: Candidate Vessels	30
Table 2.2: Estimated Vessel Costs	30
Table 3.1: Loganair Britten-Norman Islanders	36
Table 4.1: North Ronaldsay Transport Problems.....	50
Table 4.2: Papa Westray Transport Problems	52
Table 4.3: Westray Transport Problems.....	54
Table 4.4: Sanday Transport Problems.....	56
Table 4.5: Stronsay Transport Problems.....	58
Table 4.6: Eday Transport Problems.....	61
Table 4.7: ONI Ferry Connectivity by Season	67
Table 4.8: ONI Ferry Operating Day by Season	68
Table 4.9: Ferry Rotations Per Day From Kirkwall.....	72
Table 4.10: ONI Timetabled Operating Hours per week (excluding start and end of day)	73
Table 4.11: ONI Timetable Scenarios	74
Table 4.12: ONI Implied Running Hours Requirement.....	75
Table 4.13: ONI – Crew & Vessel Scenarios	75
Table 4.14: Outer North Isles Fixed Links – Appraisal against Objectives	80
Table 4.15: Outer North Isles Fixed Links – Appraisal against STAG Criteria.....	81
Table 4.16: Outcome of Appraisal, Outer North Isles Fixed Links	82
Table 4.17: Outer North Isles, North Ronaldsay & Papa Westray – Appraisal against Objectives	85
Table 4.18: Outer North Isles, North Ronaldsay & Papa Westray – Appraisal against STAG Criteria	85
Table 4.19: Outcome of Appraisal, Outer North Isles, North Ronaldsay & Papa Westray	87
Table 4.20: Required Harbour Infrastructure Improvements with Type 2a and Type 2b Vessels	88
Table 4.21: Outer North Isles, Ro-Ro / Lo-Lo Options – Appraisal against Objectives	90
Table 4.22: Outer North Isles, Ro-Ro / Lo-Lo Options – Appraisal against Objectives	92
Table 4.23: Outcome of Appraisal, Outer North Isles, Ro-Ro / Lo-Lo Options	94
Table 4.24: Outer North Isles, Ro-Ro / Lo-Lo Harbours Options – Appraisal against Objectives	96
Table 4.25: Outer North Isles, Ro-Ro / Lo-Lo Harbours Options – Appraisal against Objectives	97
Table 4.26: Outcome of Appraisal, Outer North Isles, Ro-Ro / Lo-Lo Harbours Options	98
Table 4.27: Outer North Isles, Passenger Only Vessel Options – Appraisal against Objectives	99
Table 4.28: Outer North Isles, Passenger Only Vessel Options – Appraisal against Objectives	99
Table 4.29: Outcome of Appraisal, Outer North Isles, Passenger Only Vessel Options	100
Table 4.30: Outer North Isles, Air Capital Options – Appraisal against Objectives	101
Table 4.31: Outer North Isles, Air Capital Options – Appraisal against STAG Criteria.....	103
Table 4.32: Outcome of Appraisal, Outer North Isles, Passenger Only Vessel Options	105
Table 4.33: ONI Operating Costs 2015-16.....	105
Table 4.34: Eday – Collated Comments.....	108
Table 4.35: North Ronaldsay – Collated Comments.....	110
Table 4.36: Papa Westray – Collated Comments	111
Table 4.37: Sanday – Collated Comments.....	112
Table 4.38: Stronsay – Collated Comments.....	113
Table 4.39: Westray – Collated Comments.....	114
Table 5.1: Houton – Lyness - Flotta Transport Problems	116

Table 5.2: Lyness – Flotta – Houton Capital Options – Appraisal against Objectives	121
Table 5.3: Lyness – Flotta – Houton Capital Options – Appraisal against STAG Criteria	123
Table 5.4: Houton – Lyness – Flotta Revenue Options – Appraisal against Objectives.....	126
Table 5.5: Houton-Lyness-Flotta Revenue Options – Appraisal against STAG Criteria.....	127
Table 5.6: Lyness – Flotta – Houton Operating Costs 2015-16	128
Table 5.7 Summary of Houton – Lyness - Flotta Options	128
Table 5.8: Flotta – Other Comments	130
Table 5.9: Hoy – Other Comments.....	131
Table 5.10: Outcome of Appraisal, Houton – Lyness - Flotta	131
Table 6.1: Moaness - Graemsay – Stromness Transport Problems	133
Table 6.2: Moaness - Graemsay - Stromness Capital Options – Appraisal against Objectives	137
Table 6.3: Moaness - Graemsay - Stromness Capital Options – Appraisal against STAG Criteria ...	138
Table 6.4: Moaness - Graemsay - Stromness Revenue Options – Appraisal against Objectives.....	140
Table 6.5: Moaness-Graemsay-Stromness Revenue Options – Appraisal against STAG Criteria ...	142
Table 6.6: Moaness - Graemsay - Stromness Operating Costs 2015-16	143
Table 6.7: Summary of Moaness - Graemsay - Stromness Options.....	143
Table 6.8: Graemsay – Other Comments	145
Table 6.9: Outcome of Appraisal, Moaness – Graemsay - Stromness	146
Table 7.1: Rousay - Egilsay - Wyre Transport Problems	147
Table 7.2: Tingwall – Rousay / Egilsay / Wyre Capital Options – Appraisal against Objectives	152
Table 7.3: Tingwall-Rousay/Egilsay/Wyre Capital Options – Appraisal against STAG Criteria.....	154
Table 7.4: Tingwall – Rousay / Egilsay / Wyre Revenue Options – Appraisal against Objectives ...	157
Table 7.5: Tingwall-Rousay / Egilsay / Wyre Revenue Options – Appraisal against STAG Criteria ..	158
Table 7.6: Tingwall – Rousay / Egilsay / Wyre Operating Costs 2015/16.....	159
Table 7.7 Summary of Tingwall - Rousay - Egilsay - Wyre Options	159
Table 7.8: Rousay / Egilsay / Wyre – Other Comments.....	161
Table 7.9: Outcome of Appraisal, Tingwall – Rousay / Egilsay / Wyre	162
Table 8.1: Shapinsay Transport Problems.....	163
Table 8.2: Shapinsay Capital Options – Appraisal against Objectives	166
Table 8.3: Shapinsay Capital Options – Appraisal against STAG Criteria.....	167
Table 8.4: Shapinsay Revenue Options – Appraisal against Objectives	171
Table 8.5: Shapinsay Revenue Options – Appraisal against STAG Criteria	172
Table 8.6: Shapinsay Operating Costs 2015-16	173
Table 8.7: Summary of Shapinsay Options.....	173
Table 8.8: Shapinsay – Other Comments	175
Table 8.9: Outcome of Appraisal, Shapinsay.....	176
Table 9.1: Summary of Ferry Options Costs – Outer North Isles.....	177
Table 9.2: Summary of Options Costs – Flotta and Hoy.....	179
Table 9.3: Summary of Options Costs – Graemsay and Hoy	181
Table 9.4: Summary of Options Costs – Rousay, Egilsay & Wyre.....	182
Table 9.5: Summary of Options Costs – Shapinsay	183

Appendices

Appendix A: Outer North Isles ASTs, Harbour Drawings & Environmental Constraints Maps

Appendix B: Houton – Lyness - Flotta ASTs, Harbour Drawings & Environmental Constraints Maps

Appendix C: Stromness – Moaness - Graemsay ASTs, Harbour Drawings & Environmental Constraints Maps

Appendix D: Rousay – Egilsay - Wyre ASTs, Harbour Drawings & Environmental Constraints Maps

Appendix E: Shapinsay ASTs, Harbour Drawings & Environmental Constraints Maps

Appendix F: High Level Harbour Infrastructure Works Costings

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1 Introduction

1.1 This Report

1.1.1 This Report forms the second part of the Strategic Business Case for the Orkney Inter-Island Transport Study (OIITS). It follows the 'Strategic Business Case - Pre-Appraisal Report' which developed and sifted a range of options, in response to a combination of network wide and island specific problems, issues and opportunities. The two reports taken together form the full Strategic Business Case. A PowerPoint based summary of the main findings is provided alongside this report.

1.2 The Orkney Inter-Island Transport Network

1.2.1 The Orkney inter-island transport network, which consists of a combination of ferry and air services, connects 13 islands¹ with Orkney mainland and each other (in some cases). A map of the network is shown below:

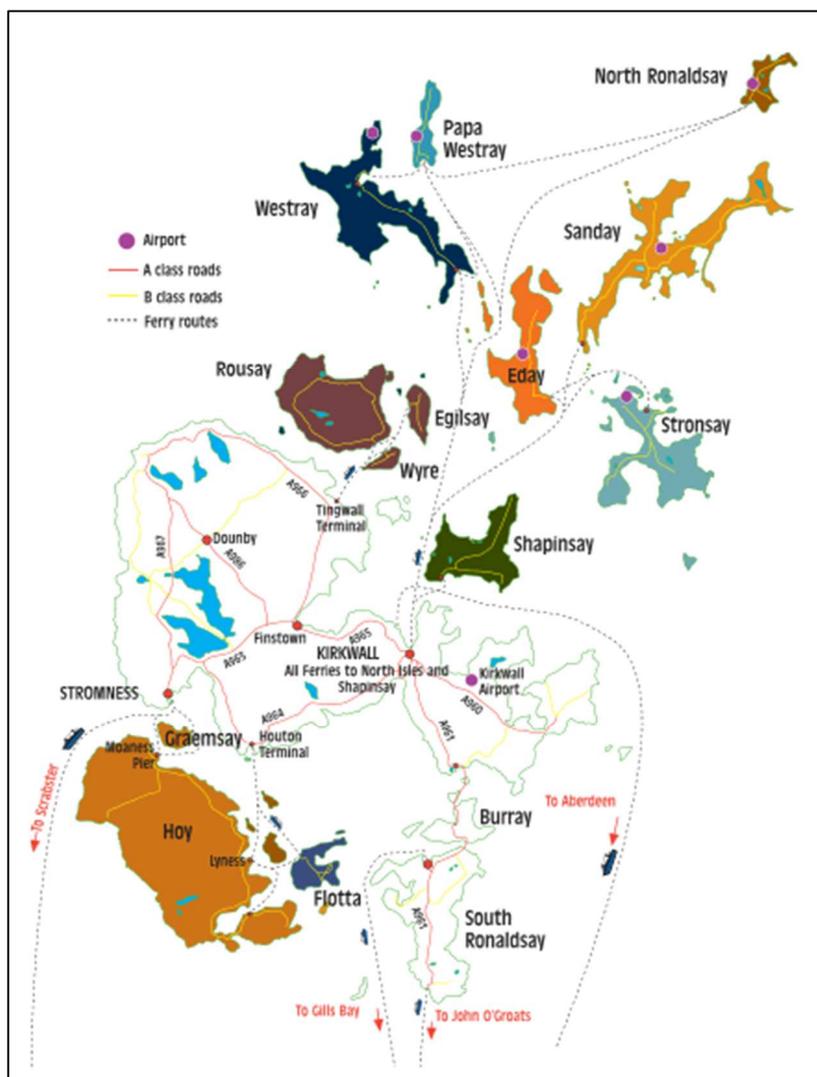


Figure 1.1: Orkney Inter-Island Transport Network

¹ North Ronaldsay, Papa Westray, Westray, Eday, Sanday, Stronsay, Rousay, Egilsay, Wyre, Shapinsay, Graemsay, Flotta and Hoy.

- 1.2.2 These lifeline connections support the economies of Orkney's island communities as well as providing personal accessibility to employment opportunities and access to key services such as education, health and leisure opportunities.
- 1.2.3 The inter-island transport network has been supported in both capital and revenue terms by the Council over many years. Whilst this remains the case, ageing assets, escalating costs and a reduction in the funding available at the local authority level has led to a need to consider the future of the inter-island transport network at the strategic level. The context here is that the issue of responsibility for the funding and provision of these services has been debated for many years. This study is being undertaken in tandem with a parallel study which is considering the wider question of roles and responsibilities, and in accordance with a nationally recognised approach and references in terms of other lifeline services.
- 1.2.4 To this end, the Council, supported by Transport Scotland, HITRANS and Highlands & Islands Enterprise (HIE) commissioned the Orkney Inter-Island Transport Study (OIITS), with a view to developing and appraising options for the future of the inter-island transport services.

1.3 Project Overview

- 1.3.1 The purpose of this phase of the Orkney Inter-Island Transport Study (OIITS) is to undertake a **proportionate** STAG-based options appraisal across the internal Orkney air and ferry network. The overall approach to this options appraisal is to analyse each island / mini-network in turn considering current and future connectivity needs in the light of the current provision of vessels, harbours, services, aircraft, airstrips and timetables. This island-level analysis is however set within a network-wide context to ensure a consistency of approach across the Orkney Islands.
- 1.3.2 The output of this process is a **set of options for each island / mini-network**, which have been subjected to a proportionate initial appraisal process. The intention is that this subset of options will be taken forward to a more detailed analysis leading to the selection of a preferred option in each case. Given the network coverage (serving thirteen islands), the analysis and outputs of the appraisal are strategic in nature and proportionate to the wide geographic scope of the study.
- 1.3.3 The Outer North Isles mini-network was considered at a high level in a previous study and thus, in this study, a more detailed appraisal of options for these islands is provided than for the Inner and South Isles, although the level of analysis for all islands is commensurate with what is required at this stage of the appraisal.
- 1.3.4 It is important to note that the air and ferry services provide lifeline connections where there is no alternative should the service fail. This study is ultimately concerned with developing a long-term strategy to provide certainty, ensure the financially sustainable continuity of services in line with the needs of each island community and develop a level of service consistent with national reference points / service level standards.

Business Case Context

- 1.3.5 Transport Scotland has published 'Guidance on the Development of Business Cases' (January 2016). There are three main stages to this:
- Stage 1 - Scoping: Strategic Business Case (SBC) – analyses a variety of options which tackle the problems, issues and objectives identified;
 - Stage 2 – Planning: Outline Business Case (OBC) – identifies the Preferred Option; and
 - Stage 3 – Procurement: Final Business Case (FBC) – undertaken during procurement phase.

- 1.3.6 Overall, the Business Case development process comprises the so-called ‘five-case’ model as follows:
- The Strategic Case – making the case for change / investment;
 - The (socio) Economic Case – optimising value for money in terms of economic, social and environmental impacts;
 - The Commercial Case – commercial viability;
 - The Financial Case – financial viability; and
 - The Management Case – achievability.
- 1.3.7 The STAG-based options appraisal process is seen as forming the substantive part of the **SBC**. In this context, STAG (and hence this study) will provide the SBC for the future development of Orkney Inter-Island transport links.
- 1.3.8 The study also provides key inputs to the Strategic and (socio) Economic cases of the OBC, where these will be revisited / refreshed if necessary. A parallel workstream being undertaken by Orkney Islands Council and Transport Scotland will ultimately inform the Commercial, Financial and Management cases, and this material can be brought together to form the OBC.
- 1.3.9 It is assumed that any individual element of this OBC will ultimately require an FBC prior to any investment being made.
- 1.3.10 This study therefore provides the Strategic Business Case for the future of the Orkney Internal Air and Ferry services. It will also consider the case for fixed links where appropriate. A broad investment timescale for each island / mini-network will be included as part of the analysis.

1.4 Appraisal Methodology

Overview

- 1.4.1 This chapter notes some of the key issues driving the appraisal, setting out how the STAG approach has been applied in the context of this study. There were a number of challenges in the application of the guidance in this context and it is necessary to set these out here and explain how we have addressed them.

Ensuring a Proportionate Approach

- 1.4.2 This section sets out how we have addressed a number of the challenges presented by the study scope and scale.

Study Scale

- 1.4.3 The principal challenge with this study is that it is attempting to appraise options for thirteen very different islands in a consistent and coherent fashion. Given the scale of the study and its strategic nature, the study inputs and appraisal do not provide the level of depth that a ‘stand-alone’ STAG study would provide. As set out in the previous chapter, there will need to be further development of the shortlist of options at OBC stage.

Case for Investment

- 1.4.4 A STAG appraisal is generally commissioned on the basis of one or more ‘problems’ which are seen to be inhibiting the required performance of the transport network, with a consequential impact on the local, regional and / or national economy. The identified

problems form the basis of the objectives, which in turn are used as part of the appraisal of options.

- 1.4.5 OIITS follows this approach in principle but is also a wider strategy for the future of the inter-island transport network. It therefore considers islands where the options are generally more focussed on asset replacement at life expiry, rather than necessarily being investment to address a specific transport problem. It may therefore be that what will emerge as the 'preferred option' for a certain island in the OBC actually does little to contribute incrementally towards the objectives and STAG criteria (these may already be being met by the current service), rather it ensures continuity of service through asset replacement, without which the island economy would be unable to function. That said, given the age and problems associated with the assets in the Orkney inter-island context, it is likely that in most cases, investment over and above the Do Minimum will be required.

Timescales & Phasing

- 1.4.6 Linked to the above point, it should be borne in mind that OIITS is taking a 30 year view² of the future of inter-island transport in the Orkney Islands. For a subset of the islands under consideration, capital investment may not be required immediately, although all assets will need to be replaced in the medium-term at the latest (with some assets requiring urgent replacement). The study sets out a phased approach to investment in the options which at this stage are considered appropriate for each of the islands. However, given the longevity of the study horizon, it will be important to revisit and confirm the options remain the most appropriate in the OBC, particularly for medium to long-term options.
- 1.4.7 It should be noted that this study does not include consideration of the costs of maintaining existing assets. However, shoreside infrastructure will need to be replaced at life expiry and there may be need for vessel life extension works. However, the costs included in this study are only for enhancements to existing infrastructure.

Do Minimum & Reference Case

Capital Options

- 1.4.8 We considered two options for defining the 'Do Minimum' for capital investment:
- Option 1: Maintain and continue to operate the existing assets until life expiry. The appraisal would factor in the increasing costs and risks associated with continuing to operate these assets. However, there would come a point where they simply could not continue to be operated and the service would cease. This approach, which is akin to a 'Do Nothing', was the position adopted by Transport Scotland in the Forth Replacement Crossing (FRC) appraisal.
 - Option 2: Assume that capital assets are replaced on a like-for-like basis at the point of life expiry (nominally assumed to be 30 years).
- 1.4.9 It should be noted that the choice of Do Minimum impacts only on the absolute rather than the relative performance of options in the appraisal – i.e. any option compared to the equivalent of a 'Do Nothing' would perform relatively better than when compared to a like-for-like replacement.
- 1.4.10 After detailed consideration, we have assumed the Do Minimum in relation to capital options is like-for-like replacement at life expiry. This has been the precedent in Scottish ferry studies to date.

² The 30 year horizon was based on an anticipated 30 year life of a ferry (used by Transport Scotland in the Ferries Plan) but the study does consider larger capital investment such as fixed links over the H.M. Treasury *Green Book* recommended 60 years.

- 1.4.11 From an appraisal perspective, the Reference Case and Do Minimum are considered to be one and the same in the context of this study as there is no committed investment in the air or ferry service at present (although there is a commitment in the Islands Prospectus to consider the funding needs of inter-island transport).

Revenue Options

- 1.4.12 The Do Minimum and Reference Case in relation to revenue options is assumed to be the continuation of present day funding (although not necessarily using the same funding mechanism as that applied currently).
- 1.4.13 Whilst appropriate, this does raise a question as to whether there should be a nationally consistent Do Minimum for lifeline transport connections. At present, the inter-island ferry service (less so the air service) in Orkney has on average fewer connections and a shorter operating day than the equivalent in the Clyde & Hebrides and Shetland Islands, largely due to the historic and current availability of funding. A 'Do Minimum' which maintains the status quo could perpetuate the historic under-provision of services in the Orkney archipelago. Although this Do Minimum therefore does not represent an 'acceptable' option for the future, it is defined here for the purposes of providing a datum for the appraisal of other options.

Fixed Links

- 1.4.14 The potential for the construction of fixed links across Orkney has been periodically considered over the years. Whilst fixed link options are considered in this appraisal, it is important to set out the wider context for such connections at the outset.
- 1.4.15 The costs of the proposed fixed links are just one aspect of the overall discussion surrounding such potential connections. Fixed links have high-up front costs with the benefits accruing over a long period of time (typically assumed to be 60 years in appraisal). This contrasts with ferry and air infrastructure, which tends to have a lower up-front capital cost, albeit there will be perhaps two cycles of replacement over a 60 year period.
- 1.4.16 The consequence of this is that, where a fixed link is identified as an economically and socially beneficial option (i.e. it has a positive benefit-cost ratio), there remains a question of how it can be funded within existing budgets and the opportunity cost (i.e. other projects not taken forward as a result of spending on the fixed link) of pursuing such a project. This is a key point in the Orkney inter-island context – even where it can be demonstrated that a fixed link is an economically and socially beneficial option, there would remain a question over how such a project would be funded.
- 1.4.17 Historically, the discussion of fixed links in Orkney was premised on an assumption of local authority funding. However, the driver of this study is that the Council cannot sustainably fund the *current* capital and revenue needs of the inter-island transport services. As it is not currently conceivable that the Council will have access to the scale of funds or prioritise this level of capital spending on fixed links, any case for future funding of fixed links will in all probability have to be made at the national level given the scale of capital spending implied.
- 1.4.18 These connections will therefore be competing for funding with other national transport schemes, and would have to be developed in the context of Scottish Government policy and priorities. In addition to competition at the national level, there would also potentially be competition from other fixed link proposals within Scotland.
- 1.4.19 These points suggest that it would be challenging for a fixed link to be progressed within the lifetime of this study horizon, within the current policy context. The ferry assets in Orkney are, in most cases, in need of replacement in the short-term. Even if a commitment is made on a fixed link (and getting to this stage could take many years and involve significant investment), the process of obtaining consents, design and construction is lengthy and at least one further

cycle of ferry replacement would be required in the interim. The one potential exception to this is the proposed fixed link between Rousay and Egilsay, which is of a lesser scale than the other connections being investigated.

- 1.4.20 A frequent point also made to support fixed links is that they are less expensive in the long-run because they offset successive rounds of ferry / air replacement and the annual net operating costs associated with these services. Whilst this may be true in arithmetic cash terms, it is important to reiterate that fixed links have a very large upfront cost and thus there is a significant *opportunity cost* associated with them. This is in contrast to successive rounds of ferry & air replacement where the costs occur at various points in the future and are thus significantly discounted (see the next section).

Other Issues

- 1.4.21 The safety and environmental impact of any fixed link would require very detailed analysis. In addition, if a causeway or bridge was to be pursued, a review of the impact on existing sea lanes would also be required. Water depth and exposure in the Orkney archipelago would also make the construction of any fixed links more challenging than in other areas of Scotland.
- 1.4.22 Employment in the delivery of air and ferry services is important to a number of the islands and fixed links could impact negatively on this.
- 1.4.23 There would also be a need for some form of air / ferry contingency in the event of a fixed link being out of commission.
- 1.4.24 The above points clearly demonstrate the scale of the challenges that would be faced in pursuing a fixed link even if the appraisal shows that such a link would be positive to one or more of the isles. This is not to rule out fixed links in principle but to highlight the range of funding and timing issues which would have to be addressed in developing these proposals.

Progressing the Fixed Link Debate

- 1.4.25 This study takes a view on whether the four suggested fixed links should be pursued from a strictly appraisal perspective. However, the case for fixed links and their potentially transformative impact on the islands in question is one that goes beyond conventional appraisal.
- 1.4.26 There is therefore a wider question as to whether there should be a fixed links policy at a national level. This issue goes beyond the remit for this piece of work and is for the wider consideration of OIC and HITRANS.
- 1.4.27 In this context, there are periodic review processes which determine the Scottish Government's priorities for investing in transport projects across the country. The most recent of these was the Strategic Transport Projects Review³, published in 2008. This Review is scheduled for an update in the near future, in parallel with a review of the National Transport Strategy.

Cost Assumptions

- 1.4.28 In the analysis which follows, all costs quoted are in 2016 prices unless otherwise stated. No discounting has been applied unless stated. Single year costs have been used at this stage. This means that no assumptions have been made regarding the future trajectory of air and ferry costs, e.g. employee costs, fuel prices etc.

³ <http://www.transport.gov.scot/strategic-transport-projects-review>

- 1.4.29 A full 60 year discounted appraisal of all options will be developed in the subsequent OBC. This will also fully account for optimism bias which at this stage for infrastructure projects would be 44%. Ferry prices are not subject to optimism bias in STAG. Fixed link projects begin with an optimism bias figure of 66%. In the costings which follow, optimism bias is not included unless stated otherwise. The purpose of including costs at this stage is to provide a broad order of magnitude of the costs associated with each option.
- 1.4.30 Note that as the air services are currently provided via a tendered contract, detailed analysis of the costs associated with the air service are not available. This limits the extent to which the potential cost of providing additional flights can be quantified at this stage, although such costs will become available as a costed option within the current tendering process.
- 1.4.31 For the costing of revenue options, the following assumptions have been made:
- Fares revenue associated with additional sailings and sailing hours is 70% of average yield, i.e., it is not reasonable to assume that increasing sailings by 50% would increase fares revenue by 50%.
 - There is a 'new vessel effect' of 3% on carryings.
 - Where an option increases capacity on a route where there are known constraints, an uplift of 5% in carryings is assumed.
 - New vessels are assumed to have reduced annual costs for surveys and repairs.
 - New vessels are assumed to have harbour dues and stevedoring costs in line with the broad size of the vessel compared to the vessel it replaces.⁴
- 1.4.32 Note that specific assumptions are made regarding fuel consumption for new vessels, taken as a multiple of an existing vessel. No assumptions have been made with respect to alternative fuel types. It is assumed that this is an issue which would be fully addressed during the OBC stage on a given route or mini-network, in the context of the fleet-wide strategy for future propulsion options.

Harbour Drawings

- 1.4.33 For each ferry option developed for each island, an indicative drawing and commentary is provided on potentially necessary harbour works. The drawings **do not** consider investment required to maintain the current assets – any investment suggested is in relation to either rectifying known issues with current infrastructure or in terms of developing / scaling-up to alternative vessel sizes, vessel numbers, overnight positioning etc.
- 1.4.34 At this SBC stage, the harbour drawings are relatively generic and further detailed design work will be required at the OBC stage. The detailed design will be very much driven by vessel design / specification.
- 1.4.35 Detailed budget costings have not been fully considered at this stage. The indicative costs provided (which are an order of magnitude based on a series of listed assumptions), have been obtained using approximate rates based on our team's experience and information from similar developments within Orkney. These broad costs would also require further refinement at the OBC stage as the detailed design becomes clearer.
- 1.4.36 Fees related to design consultancy, surveys and possible required consents / licences have been included as 15% of the total construction costs. Optimism bias and contingency are not included in the costs.

⁴ There is a wider question as to whether Orkney Ferries berthing dues are in need of revision.

- 1.4.37 Following on from the provision of harbour drawings for each mini-network, a network-wide costing sheet is provided in Appendix F.

Fares

- 1.4.38 The current level of fares on the Orkney inter-island services, particularly for ferries, was cited by a number of island communities as a transport problem. The Council has previously carried out a tariff review and there are longer term considerations on what the future fares policy may be, particularly in light of the recent roll-out of Road Equivalent Tariff (RET) in the Clyde & Hebrides.
- 1.4.39 As fares are a policy issue, this study does not develop or appraise options for future fares policies.
- 1.4.40 There are only very limited carryings data currently available, which makes it challenging to identify the impact of a significant fares change on demand and capacity. The analysis in this report does, where practical, highlight routes / sailings where capacity is a problem and it can be reasonably assumed that any fares reduction on these routes would have to be accompanied by additional capacity and / or demand management measures.

Crewing Arrangements

- 1.4.41 The Routes & Services Methodology (RSM) defines three main operating day types:
- ‘Standard’ (11 hours 0700-1800);
 - ‘Extended’ (up to 14 hours, 0600-2000); and
 - ‘Extended+’ (More than 14 hours).
- 1.4.42 Using this terminology, the Orkney network at present operates on a ‘Standard’ day, with around 30 minutes of start-up and close-down at either end of the day, although an arrangement closer to ‘Extended’ is used at certain times of the year on certain routes.
- 1.4.43 A key issue here is the potential to extend the operating day beyond the hours which can be worked in a single shift. The options are perhaps as follows:
- Extend the operating day with the single crew on the current 2-weeks on, 2-weeks off basis. This would involve existing crew working a longer day up to a maximum of e.g. 14 hours Monday-Saturday, 7 hours Sunday giving a 91 hour week preserving the 77 hours of rest requirement.
 - On a given day, the core crew could continue to work a standard ‘11’ hour day and be supplemented with additional crew so that a ‘rolling’ roster is always available, whilst others take periods of rest. This arrangement is perhaps more workable on new vessels where there is suitable crew accommodation for rest periods.
 - It should be noted that such an arrangement is operationally feasible but would not be without its challenges given the need for more than one individual at each of the key grades (e.g. Master, Mate, Engineer etc), whether this is an entirely additional crew member or a crewman acting up.
 - The shift system could be changed to something akin to the Shetland model which operates on a 3-week rota: dayshift / backshift / week off. This would require a third crew per vessel.
 - An extended operating day could also be achieved on the Outer North Isles routes by staggering the start times of the vessels, especially in the case of a fourth vessel being available. For example, staggered start times of 06:30, 07:30, 08:30 and 11:30 could

create an operating day spanning 06:30 to 22:30, a 16 hour period. At present the three vessels start and end at similar times of the day.

- An extended operating day on the Outer North Isles or any future two vessel route could also be achieved by starting say two ferries early and having an extended middle of day break, essentially a split shift system.

1.4.44 In order to make the options appraisal manageable at this stage, we have assumed crewing (i.e. revenue options) of +20% and +50% additional crewing hours. The above discussion has touched on some of the complexities of delivering these options, but following discussion with the Council, it was agreed that these figures represent plausible increases in operating hours. The precise details of how crew would be recruited, rostered etc will be determined at a later date.

1.4.45 Many of the options discussed here imply additional crew to operate longer days / additional vessels across the network. In addition, there is at times a desire for crew to be island based (particularly in the Outer North Isles), thus overnighting in the isles. It is recognised that recruitment of suitably qualified crew is an ongoing problem for Orkney Ferries, and this is, or would be even more difficult on the islands. The current vessels do not have adequate crew accommodation for regular overnight use (although presumably new vessels could, albeit at a cost and impact on vessel design) and many harbours do not offer sufficient weather protection. Again, this latter point could be addressed through engineering solutions.

Back Office

1.4.46 Similar to the above point, a significant ramp up in services would have implications for the back office function, which may have to be scaled up to reflect the increased number of bookings etc, albeit the greater use of IT and on line booking should offset this to some extent. These potential costs have not been accounted for at this stage.

Approach to Environmental Appraisal

1.4.47 The appraisal of the inter-island transport options has followed an approach based on Scottish Transport Appraisal Guidance (STAG). The key stages of the approach involved:

- collation of environmental baseline information including on constraints and designations;
- preparation of environmental constraints plans using a GIS;
- analysis of options information (including infrastructure plans) prepared by the study team for each group of island services;
- environmental appraisal of the options;
- reporting of the appraisal;
- consultation with Orkney Islands Council, Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) and Historic Environment Scotland (HES) on the initial assessments; and
- updates of the appraisals taking account of consultation feedback.

1.4.48 The key environmental constraint and designation data have been primarily drawn from a desk-based review of publicly accessible data sets (e.g. from Scottish Natural Heritage, Historic Environment Scotland etc), from information provided by the local authority, Ordnance Survey mapping and reference to the Local Development Plan (LDP) and associated proposals maps. Information on the emissions profile of the existing fleet of ferries and aircraft was also compiled as part of the preparation of the study's environmental working paper⁵.

⁵ Environmental Working Paper (Task 1: Vessels and Aircraft). This note also included baseline information on emissions and fuel use and a review of relevant environmental legislation for ferries and aircraft

The key baseline datasets were then presented in the Appraisal Summary Tables (ASTs), which are included as an appendix for each island / mini-network.

- 1.4.49 A series of environmental constraints plans were also prepared using GIS to map the principal environmental designations and constraints. These plans were used to inform the appraisal of options through constraints analysis of the physical infrastructure proposed for airfields and ferry terminals with nearby constraints.
- 1.4.50 The appraisal of options was generally based on the Part 1 level of STAG appraisal, with some development of the detail where further information was available. Since a large number of options required appraisal, the environment team grouped options with similar characteristics and set out a series of assumptions for each group of options to allow for a consistent appraisal process. These assumptions typically related to vessel fuel efficiency, routes for ferry services, locations of harbour works etc.
- 1.4.51 The appraisal also took into account information provided by the team on the characteristics of existing and potential future ferries and aircraft, which was drawn from various technical reports prepared during the study by the marine and aviation specialists. The appraisal was undertaken for each of the environmental sub-criteria, taking account of baseline sensitivities and identifying a predicted impact level based on the seven point scale from STAG adopted for the study. The findings of the appraisal are recorded in the ASTs.
- 1.4.52 Consultation was undertaken by the project team on the draft set of transport options in July 2016 through a series of public exhibitions and through provision of information on options for comment by the statutory environmental consultees. Feedback received from these consultations was incorporated into the final reporting of the option appraisal.

Education

- 1.4.53 The provision of schooling in its current form is a critical issue for the isles and the air and ferry services play a key role in moving children and teachers around the islands to provide this service. The table below summarises the current arrangements by island as these issues are a key factor in the appraisal which follows.

Table 1.1: Summary of Education Arrangement by Island

Island	Primary	S1-S4	S5-S6
North Ronaldsay	On island Teacher flies in daily Mothballed when no pupils Pupil flies into mainland two days per week to attend St Andrews PS	Kirkwall Grammar School (KGS) – hostel (one pupil)	KGS hostel Monday AM to Friday PM Late arrival Monday AM – time made up at school Gap between school closing and Friday PM flight
Papa Westray	On island Resident teacher (expressive arts teacher flies in on a Wednesday)	Westray Junior High KGS on request (hostel) Travel via MV <i>Golden Mariana</i> to Westray daily	KGS hostel Monday AM to Friday PM Sunday PM flight also available but hostel does not open until 1900
Westray	On island Resident teachers	Westray Junior High KGS on request (hostel) Mix of resident and incoming teachers	KGS hostel Sunday PM and Friday PM ferries truncate the weekend on island
Eday	On island teacher (expressive arts teacher flies in on a Wednesday)	KGS – hostel S1-S2 – Monday AM flight S3-S4 – Sunday PM ferry truncates the weekend on island Both Friday PM ferry back	KGS hostel Sunday PM and Friday PM ferries truncate the weekend on island
Sanday	On island Resident teachers	Sanday Junior High KGS on request (hostel) Mix of resident and incoming teachers	KGS hostel Sunday PM and Friday PM ferries truncate the weekend on island
Stronsay	On island Resident teachers	Stronsay Junior High KGS on request (hostel) Mix of resident and incoming teachers	KGS hostel Sunday PM and Friday PM ferries truncate the weekend on island
Shapinsay	On island Resident teachers	KGS Travel daily on ferry AM and PM	KGS Travel daily on ferry AM and PM
Rousay	On island All teachers are mainland based and travel daily	KGS Travel daily on ferry AM and PM	KGS Travel daily on ferry AM and PM
Egilsay	School closed in 2010 One child attends Rousay, child escort required	KGS Travel daily on ferry via Rousay (<i>none at present</i>)	KGS Travel daily on ferry via Rousay (<i>one at present</i>)
Wyre	No school on island – Rousay used (<i>none at present</i>)	KGS Travel daily on ferry AM and PM via Rousay leading to long day	KGS Travel daily on ferry AM and PM via Rousay leading to long day
Hoy	On island – mix of island based and itinerant teachers	S1-S2 Junior High recently mothballed Split between daily travel to Stromness (via Moaness) / KGS (via Houton) and use of hostel	KGS Hostel through the week with inbound travel Monday AM and outbound travel Friday PM
Graemsay	No school on island – Stromness used, child Escort required	Travel daily to Stromness (<i>one at present</i>)	Travel daily to Stromness (<i>none at present</i>)
Flotta	On-island primary school mothballed Flotta primary age pupils attend Orphir Primary School.	Mix of daily travel and KGS hostel children Mon AM and Friday PM ferries	KGS hostel Mon AM and Friday PM ferries

Expressive arts staff travel out to the islands to provide music, art and PE once a week for both primary and secondary. For the small isles (Papay/Eday) one of these teachers goes out every third Wednesday when they get a whole day of the subject. North Ronaldsay pupils get expressive arts whilst at St Andrews PS.

1.4.54 The Council indicated that the numbers of pupils using the Kirkwall hostel accommodation has dropped markedly in recent years from 78 to 43 in term 2015/16.

- 1.4.55 A key issue in the isles is that there are a number of mainland based teachers who fly out to the isles-based Primary and Junior High Schools on a daily basis from Kirkwall in the morning, returning to Kirkwall in the afternoon. Seats for teachers making these journeys are prioritised and are not available to isles residents or other visitors to the isles. Some seats are also booked for schoolchildren coming into Kirkwall Monday AM and leaving Friday PM.
- 1.4.56 As an example, the figure below highlights (in boxes) those flights from the summer timetable where the effective capacity to the public is reduced due to the movement of teachers. The number of seats booked does vary by flight, but the graphic does give an indication of the scale of this issue.
- 1.4.57 For example, the first Monday flight from North Ronaldsay (red plane) via Eday (blue plane) to Kirkwall (black plane) has seats allocated for school children travelling into Kirkwall. Similarly, the second flight has restricted capacity between Kirkwall and Westray, then between Papa Westray and Kirkwall.

- 1.4.58 It can therefore be seen that around 60% of weekday term-time rotations from Kirkwall and back are affected at some stage during this rotation by a loss of capacity to the travelling public. Some of these flight legs are booked to 88% capacity reducing the seats available to the public to a single seat.

1.5 Consultation

- 1.5.1 The options developed were presented to the public at a series of island-based 'drop-in' public engagement sessions during week beginning 27 June 2016, as follows (the figures in brackets are the approximate attendance):

- Monday 27 June: Papa Westray (18), Westray (32), Rousay (incorporating Egilsay and Wyre where both Community Council representatives attended) (37);
- Tuesday 28 June: Sanday (56), Stronsay (53), Hoy (38), North Ronaldsay (10);
- Wednesday 29 June: Eday (27), Shapinsay (37); and
- Thursday 30 June: Flotta (8), Graemsay (12).

- 1.5.2 In each venue a series of bespoke island-specific display boards were exhibited and the public were able to view these at their leisure and discuss issues with the study team, Council Officers and Elected Members. The material outlined the purpose of the study, the current inter-island service, the problems identified and the options being considered.

- 1.5.3 The events were well attended, as noted above, with a good proportion of the population of each island attending. A *proforma* was available in hard copy which provided the opportunity for the public to comment on the material presented. The material and form was also available online for a period of three weeks following these events where people could view the slides and complete the *proforma*.

- 1.5.4 The *proforma* asked people to comment on:

- (i) any problems associated with the current inter-island air and ferry services – used to validate or otherwise the problems identified by the study and those highlighted at an earlier stage via Community Councils; and
- (ii) the options proposed for the future of inter-island air and ferry services, and the initial '*take forward*' / '*reject*' decision presented at the Exhibition – this information has fed into the '*public acceptability*' element of the appraisal.

- 1.5.5 They were then asked: '*If additional running air and / or ferry operating hours were to be made available, what would be the priorities to improve the service from your perspective?*' and asked to tick up to three of the following 'generic' options (air options for Outer North Isles only):

- Air: Departures at the same time each day
- Air: A daily service to / from Kirkwall for school children
- Air: Additional Sunday services
- Air: More direct rather than indirect services
- Air: More inter-island connections
- Air: More frequent services across the current operating day
- Air: Greater availability of seats for public
- Ferry: Departures at the same time each day
- Ferry: A daily service to / from Kirkwall for school children

- Ferry: Earlier first sailings from the island
- Ferry: An early evening (eg 20:00) sailing to the island
- Ferry: A late evening (eg 22:00) sailing to the island
- Ferry: Additional Sunday services
- Ferry: First sailing from the island
- Ferry: First sailing from the mainland
- Ferry: Longer operating period for Summer timetable
- Ferry: More direct rather than indirect services
- Ferry: More inter-island connections
- Ferry: More frequent services across the current operating day
- Ferry: Winter timetable run for whole winter period (ie no Refit timetable)
- Other

- 1.5.6 The purpose of this exercise was to identify firm priorities in terms of the future services for each individual island which will provide evidence to focus future use of resources. The results from this are outlined in the chapters which follow. Note that the results from this process encapsulate the improvements to connectivity people prioritise – there may be more than one way of delivering these improvements in terms of assets and timetables.
- 1.5.7 The completed *proformas* provide a wealth of views and qualitative and quantitative information. This information can be used in the ongoing appraisal of the options and eventual service planning, and has been provided in full to the Council

2 Vessels

2.1 Introduction

2.1.1 This chapter considers the future options for vessels in isolation from services and timetables. The purpose of this is to provide a 'building block' for the appraisal of options which follows and where services and timetables are considered in detail.

2.2 Vessel Replacement Strategy

2.2.1 A key part of the appraisal has therefore been an independent assessment of vessel options for each route / mini-network. The ferry service should provide an appropriate lifeline service for the majority of islands (with air fulfilling this role for others), and thus ensuring an appropriate vessel replacement strategy is fundamental to the economic wellbeing and long-term sustainability of these communities.

Vessel Berthing Systems

2.2.2 The Orkney internal ferries network operates off of a range of different berth types. It is worth setting these out in advance of considering potential vessel types.

Linkspans

2.2.3 The Outer North Isles (excluding North Ronaldsay and Papa Westray) and services between Houton – Lyness – Flotta operate from linkspans. With the exception of Kirkwall, all of the linkspans are single lane portal.

- The linkspans at Eday, Sanday, Stronsay and Westray (Rapness) are 28.7 metres long * 7.8m wide at the outer end.
- The linkspans at Houton, Flotta and Lyness are 27.1 metres long * 7.2 metres wide at the outer end (although Flotta is 8.2 metres wide).

2.2.4 The linkspans are controlled from the shore rather than the vessel.

2.2.5 The Outer North Isles (ONI) vessels (*MV Earl Sigurd*, *MV Earl Thorfinn* and *MV Varagen*) can use all linkspans in the ONI network and are thus interchangeable. The *MV Hoy Head* operates from the linkspans on the Houton–Lyness–Flotta route and can be relieved by the *MV Thorsvoe* (which can also operate on the ONI linkspans and also on hard ramp routes).

2.2.6 The Ports & Harbours Baseline Report noted that the linkspans currently function well, but they are also relatively old. The Outer North Isles (ONI) linkspans were constructed during the 1990s and the South Isles linkspans during the mid-1980s. They were designed in conjunction with the existing vessels and it is noted that some replacement / modification / refurbishment will inevitably be needed as and when new vessels are introduced.

2.2.7 The linkspans are controlled by hydraulic cylinders, which are used to adjust the ramp height. The ramp is suspended from a portal frame, which has led to site height clearance issues at extreme high tide in some terminals.

2.2.8 The main issue with all the South Isles linkspans is that the maximum loading for the structures is 40 tonnes, and thus below current maximum (44 tonnes) HGV road limit. This produces frequent issues with loads having to be referred to OIC Civil Engineering for consideration. For the ONI, anything above road limits is referred to OIC Civil Engineering for advice on whether to permit transport, or not. At this time, the 12.5 tonne axle limit at Kirkwall is therefore of little material influence when transporting road freight to the ONI due to the

more onerous restrictions at the destination end. However the maximum loading of the Kirkwall linkspan is relatively low and this may cause issues if the Outer Isles linkspans were to be upgraded.

- 2.2.9 It is likely that the existing shoreside infrastructure will be replaced / refurbished as part of any vessel replacement programme. As the ONI functions as a network, there may therefore be an opportunity for standardising the infrastructure on the 'Norwegian' system of automated locking type linkspans, which are used in Shetland. This should be considered at the OBC stage when finalising vessel / shoreside infrastructure designs but, in principle, it is a concept worthy of further investigation.

Hard Ramps

- 2.2.10 The Kirkwall – Shapinsay and Tingwall – Rousay / Egilsay / Wyre routes operate on a network of hard ramps, using a 1 in 8 fixed concrete ramp. Our initial research found these ramps to be in good condition, having been refurbished about five years ago and can generally operate at all tidal levels.

Lo-Lo and Passenger Terminals

- 2.2.11 The terminals at North Ronaldsay and Papa Westray are Lo-Lo, with a vessel mounted derrick used for loading and unloading cargo. The same is also true of the ports on the Stromness – Graemsay – Moaness route. Tidal block solutions have been considered (particularly for Graemsay) but have been rejected for a number of reasons.
- 2.2.12 There are foot passenger only facilities for services between Pierowall (Westray) and Papa Westray. This service runs to a timetable in summer and operates a school run / NHS charter in winter, although there is a desire from the community for Orkney Ferries to provide an all year round service.

Hull Forms

- 2.2.13 The current Orkney Ferries' fleet consists exclusively of monohull vessels, and the shoreside infrastructure has been developed around these vessels. Many of the terminals served by Orkney Ferries require a vessel with a relatively narrow beam (to fit the ramp or linkspan) and a shallow draft. There is however longer-term potential to migrate towards different vessel solutions, although it is likely that significant investment in shoreside infrastructure would be required.
- 2.2.14 Multi-hulled vessels have the advantage of reducing the water-plane area, therefore allowing a smaller power plant to achieve the same speed through the water as a mono-hulled vessel. The disadvantage is their sea-keeping qualities. Conventional multi-hulled vessels tend to operate well in beam seas, but tend to "plough in" in head or stern or quartering seas. When operating in head or stern seas, they are also very uncomfortable for passengers and cause motion sickness. Although conventional multi-hull vessels allow for greater deck space and are generally very stable (although very stiff in motion) they suffer from structural torsion stress in the raft between the two hulls. Nonetheless, conventional multi-hulled vessels are already proven to operate successfully in the Orkney environment, with the categorised waters of Scapa Flow being well-suited to these vessels, although our research suggests that they may be less appropriate in terms of seakeeping in the context of the Outer North Isles (although there remains some debate around this).
- 2.2.15 There is however an emerging multi-hulled vessel that delivers good sea keeping qualities - this is known as a small water plane area twin hull (SWATH). SWATH vessels have far better motion capabilities than catamarans and are estimated to consume around 10%-15% less fuel than an equivalent monohull. The twin hulls are generally closer together and there is less racking stress within the raft. The key drawbacks in the Orkney context is that SWATH

vessels are both generally wider beamed than monohulls and also have a deep draft (a particular problem in Orkney). The provision of a Ro-Ro vessel of this nature would also entail a significant step-up in size, which in turn would give rise to a need for significant investment in shoreside infrastructure and dredging. This is not a realistic option for Orkney and will not be considered further at this stage.

2.2.16 As this study is relatively strategic in nature, for simplicity, our analysis proceeds on the basis of the broadly 'like-for-like' replacement of the existing monohull vessels. However, the route-by-route case for alternative tonnage should be considered when developing detailed designs in the Outline and Final Business Cases.

Categorisation of Waters & Class of Vessel

2.2.17 There are four categories of waters designated by the UK Maritime & Coastguard Agency (MCA) are as follows:

- Category A: Narrow Rivers and canals where the depth of water is generally less than 1.5 metres.
- Category B: Wider rivers and canals where the depth of water is generally 1.5 metres or more and where the significant wave height could not be expected to exceed 0.6 metres at any time.
- Category C: Tidal rivers and estuaries and large, deep lakes and lochs where the significant wave height could not be expected to exceed 1.2 metres at any time.
- Category D: Tidal rivers and estuaries where the significant wave height could not be expected to exceed 2.0 metres at any time.

2.2.18 These categorisations apply specifically to the operation of Class IV, V and VI Passenger Ships and also determine which waters are not regarded as 'open sea' for the purposes of regulations made, or treated as made, under Section 85 of the UK Merchant Shipping Act 1995.

2.2.19 Ideally, and where financially appropriate, vessels should meet the same Class rules of construction instead of the present regime which has differences of classifications for different routes, weather or time of year. This causes management problems and is extremely limiting in operational terms. As a result, at present some vessels are largely confined to their present trading routes.

2.2.20 These restrictions may cover:

- Where the ship operates - a ship with a Class VI(A) certificate can operate no more than three miles from land.
- When a ship operates - a ship with a Class VI certificate cannot operate in winter or at night; the ship will not be a qualifying ship.
- The number of passengers which may be carried - a ship with a Class VI(A) certificate cannot carry more than 50 passengers.

2.2.21 Current ferries that have been issued with these certificates are only certified for navigation at sea if they are operating in accordance with the restrictions set out in their trading certificate.

2.2.22 More recently, EU class has come into force (although the MCA classification can still apply in domestic waters) and new builds should comply with the EU directive for the relevant class listed below:

2.2.23 EU Class A means a passenger ship engaged on domestic voyages other than voyages covered by Classes B, C and D

- EU Class B means a passenger ship engaged on domestic voyages in the course of which it is at no time more than 20 miles from the line of the coast, where shipwrecked persons can land, corresponding to the medium tide height.
- EU Class C means a passenger ship engaged on domestic voyages in sea areas where the probability of exceeding 2.5m significant wave height is smaller than 10% over a one-year period for all-year round operation, or over a specific restricted period of the year for operation exclusively in such period (e.g. summer period operation), in the course of which, it is at no time more than 15 miles from a place of refuge, nor more than 5 miles from the line of the coast, where shipwrecked persons can land, corresponding to the medium tide height.
- EU Class D means a passenger ship engaged on domestic voyages in sea areas where the probability of exceeding 1.5m significant wave height is smaller than 10% over a one-year period for all-year round operation, or over a specific restricted period of the year for operation exclusively in such period (e.g. summer period operation), in the course of which, it is at no time more than 6 miles from a place of refuge, nor more than 3 miles from the line of the coast, where shipwrecked persons can land.

Orkney Waters & Vessel Classification

2.2.24 The classification of waters in Orkney provides a relatively clean divide between the Outer North Isles and the Inner & South Isles, as is illustrated in the map below:



Figure 2.1: Orkney Islands – Categorisation of Waters

2.2.25 The figure above shows that:

- The Kirkwall – Shapinsay; Tingwall – Rousay / Egilsay / Wyre; Stromness – Graemsay – Moaness and Houton – Lyness – Flotta services all operate within categorised waters. These vessels would be MCA Class IV, V or VI / VIA or Euro C.
- The Outer North Isles are in waters defined as ‘open sea’. The fleet should be certified to Euro B (or MCA class IIA).

2.2.26 It should be noted that the winter restrictions of passenger numbers (between October and April) placed on Class VI/VIA vessels can be up to around 44% (MV *Graemsay*) and is in force whether it is rough or calm sea states.

Route Hierarchy

2.2.27 In terms of volume and scale, the Orkney inter-island ferries network can perhaps be thought of in four main tiers:

- Tier 1:
 - Kirkwall – Shapinsay; Tingwall – Rousay / Egilsay / Wyre; and Houton – Lyness – Flotta
 - Categorised waters Ro-Ro
- Tier 2:
 - Stromness – Graemsay – Moaness and Papa Westray - Westray
 - Categorised waters Lo-Lo / passenger only
- Tier 3:
 - Eday, Sanday, Stronsay and Westray
 - ‘Open sea’ Ro-Ro
- Tier 4:
 - North Ronaldsay and Papa Westray
 - ‘Open sea’ Lo-Lo

2.2.28 The current fleet therefore comprises of a range of different vessels, although with a degree of interchangeability within and between Tiers 1 & 2 and within Tier 3. The majority of the Orkney fleet have restricted categorisations (Class IV to VI / VIA) which place seasonal restrictions on passenger numbers and / or class of waters in which the vessel can operate.

2.2.29 In broad terms, when considering the future of the ferry network over the next 30 years, there are perhaps three main strategies which could be adopted:

- **Strategy 1:** Replace vessels on a piecemeal and minimum cost / specification basis with vessels which are sometimes bespoke to individual routes. This would maintain the restrictions associated with all of the current non-class IIA / EU B vessels (MV *Golden Mariana*, MV *Graemsay*, MV *Thorsvoe*, MV *Shapinsay*, MV *Eynhallow* and MV *Hoy Head*). Larger versions of the existing vessels could be commissioned to cater for any capacity restrictions.
- **Strategy 2:** Work towards a vessel replacement programme that offers broadly interchangeable vessel types with a Class IIA / EU B certification (unless this is clearly disproportionate, in which situation a bespoke vessel would be procured). With this strategy, the fleet of vessels would provide interchangeability between routes / crew etc and would also potentially give rise to scale economies in terms of the capital and ongoing revenue costs. However, this strategy could give rise to a degree of over-specification, with EU B vessels operating in categorised waters for much of the year.

- **Strategy 3:** Work towards an Outer North Isles and Inner & South Isles vessel replacement programme that offers interchangeable vessel types within each mini-network. The Outer North Isles fleet would be certified to Class IIA / EU B and the Inner & South Isles fleet would be certified to Class VI - VIA or EU C (unless in both cases this is clearly disproportionate, in which situation a bespoke vessel would be procured). Two fleets of easily exchangeable vessels would provide interchangeability between routes / crew etc and would also potentially give rise to scale economies in terms of the capital and ongoing revenue costs.
- 2.2.30 Strategy 1 would represent a lower cost option than Strategy 2 in the short-term (when taking into account additional stability criteria, sub-divisions etc associated with EU B vessels). Strategy 2 would provide a cheaper price associated with bulk purchase, save costs on maintenance, allow widespread substitution of vessels on different routes, allow crew training to be modular and generic, and enable similar scale and consistency benefits in terms of landside infrastructure. However, the cost of construction and operation of EU B / Class IIA vessels in the categorised waters of Scapa Flow would seem excessive.
- 2.2.31 Strategy 3 strikes something of a middle ground between the above. This approach would provide two mini-fleets of vessels, each proportionately designed for the waters in which they operate. With these fleets, there would be the scale economies associated with Strategy 2 without the step-change in cost which would arise from a network wide set of EU B / Class IIA vessels. The vessels review therefore recommends a move towards **Strategy 3** for the OIC network.

2.3 Vessel Characteristics – Key Assumptions

- 2.3.1 In light of the above analysis, a number of ‘generic’ vessel types have been considered here and it is helpful to consider this in the context of the defined ‘tiers’ above.
- Type 0 - Small / bespoke vessels for routes where a generic vessel type would be inappropriate and / or disproportionate.
 - Type 1a – Class VI / VIA or EU C, 30 metre length overall (LOA) double ended small *Loch Class* style vessel (12 pcu / maximum 96 passengers). This vessel would be a modern version of the late 1980s *Loch Class* vessels, the first of which was MV *Loch Striven*.
 - Type 1b – Class VI / VIA or EU C, 41 metre LOA double ended medium *Loch Class* style vessel (24 pcu / maximum 96 passengers). This vessel would be a modern equivalent of the MV *Loch Alainn*.
 - Type 1c – Class VI / VIA or EU C, 54 metre LOA double ended large *Loch Class* style vessel (36 pcu / 144 passengers). This vessel would be the equivalent of the MV *Loch Shira*.
 - Type 2a – Class IIA / Euro B, 45-50 metre LOA double ended Ro-Ro with enclosed bow (25 pcu / 144 passengers).
 - Type 2b - Class IIA / Euro B, 60-75 metre LOA double ended Ro-Ro with enclosed bow (35-50 pcu / 144 passengers).
- 2.3.2 It should be noted that the passenger numbers above are the assumed maximum and based on broadly equivalent vessels in the Shetland Islands. There would be flexibility with any new vessels to reduce the passenger certification to reduce crew at periods of low demand.
- 2.3.3 Note that it is assumed that a Type 2a / 2b vessel could be specified to continue Lo-Lo operations in North Ronaldsay and Papa Westray, although there would be a continuing requirement for a vessel based crane unless a shore based crane or RoRo solution were to be adopted. If this was not possible or practicable, a bespoke freight vessel would be required to provide this service.

- 2.3.4 The strategy would be to allocate either:
- bespoke or Type 1a-1c vessels to Tier 1 & 2 routes;
 - bespoke or Type 2a-2b vessels to Tier 3 & 4 routes; and
 - the one exception to this is the Lyness – Flotta – Houton route, where a Type 1c, Type 2a and Type 2b could all be appropriate.
- 2.3.5 The table below shows each route and its current vessel together with the ‘candidate’ vessels to be considered in the context of either a like-for-like replacement (LfL) or where greater capacity is required now or in the future (indicated as +50% although this need not be precisely +50%). As well as length overall (LOA) for the current vessels, fuel consumption (in litres per hour) is shown for reference.
- 2.3.6 For the sea going vessels on the ONI (Type 2a and 2b above), there are potentially two existing ‘models’ which could be considered, the current Shetland Islands Council B600 ferries *MV Daggri / Dagalien* and the CMAL vessels *MV Argyle / MV Bute*. The former vessels are 65m in length and carry 31 cars, with the latter being 72m in length with a car carrying capacity of 60. These vessels are of similar beam (14.3m / 15.3m) and draught (3.7m / 3m). The difference in car carrying capacity is that, in the latter case, the car deck extends across the width of the vessel allowing 5 lanes, whilst in the former case, there are three loading lanes with storage and other facilities along each length of the vessel. The approximate costs of these vessels were £6m in 2004 and £9m in 2006. So, for a given LOA, a *MV Argyle / Bute* vessel carries more cars but is potentially more expensive.
- 2.3.7 The current ONI vessels are 45m (the *Earls*) or 50m (*MV Varagen*) by 11m beam with a draft of around 3.1m. Car carrying capacity is 22 and 28 cars respectively using 3 fairly narrow loading lanes. Both of the above proposed vessels are somewhat beamier than the current OIC vessels.
- 2.3.8 *MV Daggri / Dagalien* and *MV Argyle / Bute* type vessels are ‘scalable’ in that longer or shorter vessels could be built. For example, general arrangements (GA) have been produced for a 45m (22 cars) and a 75m (50 cars) version of the *MV Daggri / Dagalien* whilst prices have been obtained for 45m (35 cars) and 60m (50 cars) versions of the *MV Argyle / Bute*. The specification of vessel type (between these two or indeed other vessel types) will be determined at the OBC stage.
- 2.3.9 To this end, accompanying harbour drawings have been developed to accommodate vessels up to (LOA * breadth * draft):
- 50m * 11m * 3.75m – these dimensions would accommodate a vessel which would provide broadly similar car carrying capacity to the current ONI vessels
 - 75m * 15m * 3.75m – these dimensions would accommodate any vessel up to the largest of the potential vessels considered here.
- 2.3.10 The draft harbour drawings are reported in each island / mini-network chapter. It should again be noted that these are relatively high level and are intended only to indicate the broad scale and cost of work from stepping up to different vessel types.

Table 2.1: Candidate Vessels

Route	Current Vessels					Candidate Vessels					
	Class EU / MCA	Tier	Current Vessel	LOA(m) /pcu	Fuel Cons (l/hr)	Small / Bespoke	TYPE 1a 30m c12 pcu	TYPE 1b 41m / c24 pcu	TYPE 1c 54m / c36 pcu	TYPE 2a 45m-50m c25 pcu	TYPE 2b 60m-75m c35-50 pcu
Outer North Isles – Ro-Ro	Class IIA/III	3	Earl Sigurd; Earl Thorfinn; Varagen	45/22; 45/22; 50/28	250 250 226	✗	✗	✗	✗	LfL	Larger
Outer North Isles – Lo-Lo	Class IIA/II	4	Earl Sigurd; Earl Thorfinn;	45/22; 45/22;	250 250	✓	✗	✗	✗	LfL	Larger
Papa Westray - Westray	Class VI/VIA	2	Golden Mariana	15/0	12	✓	Larger	✗	✗	✗	✗
Kirkwall – Shapinsay	Class IV	1	Shapinsay	35/12	63	✗	LfL	Larger	✗	✗	✗
Tingwall – Rousay / Egilsay / Wyre	Class VI/VIA	1	Eynhallow	29/10	55	✗	LfL	Larger	✗	✗	✗
Houton – Lyness – Flotta	Class IV	1	Hoy Head	53/24	105	✗	✗	LfL	Larger	LfL	Larger
Stromness – Graemsay – Moaness	Class IV/VI/VI A	2	Graemsay	21/2	52	✓	Larger	✗	✗	✗	✗

Note – it is assumed that, where practicable, vessels will be designed with the ability to retrofit ramp-based mezzanine decks.

2.3.11 In the chapters which follow, these vessel types are considered in the context of the options appraised for each island. Where a bespoke vessel is thought to be appropriate for the route, the outline specification of this vessel is discussed separately.

Capital Costs

2.3.12 The capital costs of the new vessels have been developed from a number of sources, as follows:

Table 2.2: Estimated Vessel Costs

Generic Vessel Type	Estimated Cost	Source
Type 1a	£4 million	Study estimate
Type 1b	£5 million	Study estimate
Type 1c	£6 million	Based on cost MV <i>Loch Shira</i>
Type 2a	£7 million	Remontowa Yard
Type 2b	£9.25 million - £15.5 million	Remontowa Yard

2.3.13 In addition to costs for the generic vessels, there are a range of costs available for bespoke vessels which could be appropriate to the routes in question.

Annual Operating Costs

2.3.14 The Type 1a to Type 2b vessels noted above are modelled on existing vessels ploughing Scottish waters. At this stage, we do not have accurate estimates of the potential fuel

consumption figures for these vessels. Notwithstanding the fact that lower carbon fuels (LNG for example) may be available, for the purposes of making an initial high level estimate of the annual operating costs associated with these vessels, we have assumed the following based on fuel consumption figures for similar vessels:

- Type 1a: Fuel consumption: 90 litres per hour
- Type 1b: Fuel consumption: 190 litres per hour
- Type 1c: Fuel consumption: 210 litres per hour
- Type 2a: Fuel consumption: 250 litres per hour
- Type 2b: Fuel consumption: 300 litres per hour
- Foot passenger vessel: 50 litres per hour

2.3.15 When estimating the annual operating costs in the chapters which follow, the following simplifying assumptions have been made:

- New vessels are assumed to be more efficient than the vessels they replace with lower maintenance and annual survey costs⁶.
- Fuel costs have been assumed to increase on a *pro-rata* basis with additional sailings.
- Where options involve existing crew working longer hours, these costs have been estimated based on current terms and conditions; where options involve e.g. a doubling of crew, it is assumed that crew costs are increased on a *pro rata* basis.
- 'Other' costs are assumed fixed.
- Harbour dues accrue in line with the size of the vessel, so a larger ferry will be liable for increased harbour dues.
- These assumptions can be updated but have been included to provide an initial indication of the annual operating / revenue costs associated with each broad option.

Crew & New Vessels

2.3.16 Vessels with a higher certification do require a corresponding increase in crew certification, which is based on the tonnage and classification for deck crew and power for engineers. There are therefore crew training costs when moving between vessel types. Crew will also require induction training on all new vessels, so there is a fixed cost in moving to any new tonnage.

2.3.17 New vessels may require a lower crew certification, so there may to be a reduction in total crew numbers and (in principle although the reality could be more complex) potential for redeployment onto other vessels or using surplus crew to assist in extending the operating. However it should be noted that at present, the vessels operate near the lower end of the inshore and seagoing criteria.

2.3.18 It is assumed that, when moving to a larger vessel, additional crew are required. It should be noted that this assumption is used to simplify costing but will not necessarily be the case in reality. Crew numbers are generally driven by the passenger certification of the vessel in relation to mustering and the deployment of life saving appliances and also how other emergency scenarios are managed. A well-designed vessel could maintain or reduce crew numbers.

⁶ It should be noted that, depending on the size solution for replacement tonnage, the new vessels may become of a size where larger shipyards with higher overheads are required than that accessibly by the current fleet. In this case, it may be desirable to design the vessels to require out of water bottom inspection only twice in five years as the per the recent harmonisation of survey regulations MSN 1751. This would increase capital costs but would reduce revenue costs and save on disruption.

Carriage of Dangerous Goods

2.3.19 The replacement vessels envisaged will not improve the carriage situation of International Maritime Dangerous Goods Code (IMDG) classed incompatible dangerous goods, which require separation and segregation greater than can be achieved by any of the proposed vessels. This will not change even if one or more bespoke freight vessels were introduced as the IMDG separation and segregation rules remain, although the quantities of individual products may be unrestricted. To carry a range of dangerous goods to service any island will still require a frequency of service which allows individual incompatible classes to be carried on entirely separate sailings. Therefore, dangerous goods capacity would remain an issue across all of the proposed replacement vessel types.

Future Fuels

2.3.20 In November 2015, Orkney Islands Council commissioned a team led by Aquatera (which included PBA) to carry out the Low Carbon Ferries Feasibility Study. This piece of research considered potential future fuel types for ferries in Orkney in the context of the environmental and cost aspects of current marine fuel and the abundance of energy sources available in the Orkney Islands.

2.3.21 As well as the identification of potential future low carbon fuel types, the study involved the development of a sophisticated model which would allow the costs of alternative fuels to be tested.

2.3.22 As this study is strategic in nature and covers an extended time period, it works on the assumption of the Do Minimum, which is continuing with the current fuel options. However, at the stage where the preferred option(s) is / are being identified (the Outline Business Case) and procured (the Final Business Case), there should be consideration of the most appropriate fuel type at that juncture. In particular, application of the model prepared by Aquatera should be central to this business planning and development process. In addition, we are aware of the activities of Surf and Turf⁷ in Eday where hydrogen is being produced using currently curtailed electricity generation, and local interest in the use of LNG, a fuel which is becoming widespread across new ship build contracts.

Continuing Lo-Lo Operation

2.3.23 In some cases, the continuation of Lo-Lo operations is an option – Graemsay, North Ronaldsay and Papa Westray. In these cases, there are potentially issues of compliance to DIPTAC⁸ requirements, and the technical challenges here are difficult and potentially expensive in terms of capital and revenue costs. These issues will be brought to the fore if and when new assets are brought onto the route, as the current practices for accessing the vessels, and the full range of facilities on the vessels, are only ‘acceptable’ due to the age of the current assets and exemptions gained on the basis of what it is reasonable to achieve with the assets available at the time. The key references here are Merchant Shipping Notice (MSN) 1789⁹ and Maritime Guidance Note (MGN) 306¹⁰.

2.3.24 A further issue is the limitation of carrying large cargo and heavy pieces by small Lo-Lo vessels. The current Vessel ONI ships have issues handling anything heavier than 10 tonnes. To maintain or improve on this requires a considerable amount of the vessel design to be built around the lifting capacity; then other areas and efficiencies become compromised.

⁷ <http://www.localenergyscotland.org/funding-resources/funding/local-energy-challenge-fund/capital-demonstration-projects/orkney-surf-n-turf/>

⁸ <https://www.gov.uk/government/organisations/disabled-persons-transport-advisory-committee>

⁹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/440185/1789.pdf

¹⁰ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/440083/306.pdf

- 2.3.25 These issues are important in any ongoing Lo-Lo operation and would have to be considered in the detailed design during the OBC / FBC stage.

2.4 Phasing & Cascade of Vessels

Vessel Mix

- 2.4.1 In order to keep the appraisal manageable, the multiple vessel replacement options we have developed generally consider the parallel replacement of the existing vessel(s) with an assumed ferry mix (e.g. two identical ferries or one small, one medium, one large etc). These assumptions help to ensure the appraisal is not over-complicated by considering numerous various options around the one theme – for example, with a three vessel solution, options could include 3 * like-for-like; 3 * smaller; 3* larger; 1 * small, 1* LfL, 1* large; 2 * small, 1 * large; retention of current two vessels and 1 * large; and so on. The vessel mix has a limited impact on the results of the appraisal (with the exception of cost) and it is thus practical to appraise the options based on an assumed vessel mix here.
- 2.4.2 Clearly, the OBC and latterly the FBC will need to consider these in-principle options in more detail (and at the time of commissioning).

Vessel Cascade

- 2.4.3 The options appraisal generally assumes that vessel replacement is only undertaken at the point of life expiry (unless otherwise stated). With limited and specified exceptions, we have not considered cascade options.
- 2.4.4 This is a further simplifying assumption and it may be that when it comes to developing the OBC and FBC, cascade within the OIC fleet or indeed from other areas of Scotland will be an option and should be considered at this stage.

Phasing of Vessels

- 2.4.5 All multiple vessel options also assume that two or three new vessels arrive on the route at the same time. This is again a simplifying assumption to support the appraisal. Feedback from our maritime partners suggests that it is generally cheaper to build vessels sequentially and phase them in gradually. This option would be considered in the OBC / FBC.

Relief Vessels

- 2.4.6 The issue of relief vessels is an important one in the Orkney context. In the Shetland Islands and the Clyde & Hebrides, there is generally sufficient spare capacity in terms of relief vessels and / or two vessel routes to provide broadly adequate short-term relief in the event of a breakdown and for scheduled maintenance.
- 2.4.7 The situation in Orkney is somewhat different, where one vessel is generally shared between two or more islands (Shapinsay being the exception) - this limits resilience. In the Inner & South Isles, the MV *Thorsvoe* can be brought into service and the fleet shuffled to cover the scheduled or unscheduled absence of the MV *Hoy Head*, MV *Shapinsay* and MV *Eynhallow*.¹¹ There is no relief cover in the Outer North Isles, with the network being reduced to two vessels during periods of scheduled and unscheduled maintenance (although the MV *Thorsvoe* may in the future be able to operate an ONI freight service). Indeed, the current refit timetable has repeatedly been cited as a problem by Outer North Isles communities.

¹¹ MV *Thorsvoe* can cover for can cover for MV *Hoy Head* and MV *Shapinsay*. If the MV *Eynhallow* is out of service, she is covered by the MV *Shapinsay*, with the MV *Thorsvoe* covering the MV *Shapinsay*.

- 2.4.8 Whilst it is unlikely that a level of funding could be obtained commensurate with maintaining a large pool of relief vessels, consideration should be given to retaining at least one of the current Inner & South Isles fleet and one of the Outer North Isles fleet as new tonnage is introduced. The issue of relief vessels is not otherwise considered further in detail in this study. This is an issue which will be considered further at OBC stage.
- 2.4.9 Although the MV *Golden Mariana* provides relief for Graemsay (supported by a chartered multi-cat when required), the MV *Kirkwall Bay* (a pilot boat) is actually used to relieve the MV *Golden Mariana*. It is worth noting that the MV *Kirkwall Bay* has limited passenger capacity, which can create a problem when she needs to relieve the MV *Golden Mariana*, particularly outwith the winter period. This problem is accentuated because the period of cover is extended because the passenger only MV *Golden Mariana* is used to provide cover for the Lo-Lo vessel MV *Graemsay*. The Papa Westray – Westray and Stromness – Graemsay – Moaness route therefore both experience reduced capacity during periods of scheduled and unscheduled maintenance. Ensuring a degree of interchangeability between these routes is an important consideration for future tonnage.
- 2.4.10 Note that the following chapters consider each mini-network in turn and this includes the reporting of the costs of operating each one. The costs associated with the MV *Thorsvoe* relief vessel do not feature in these chapters. However the cost of operating the MV *Thorsvoe* in 2015/16 was £253,832.

2.5 Assumptions and Packaging of Capital & Revenue Options

- 2.5.1 It should be noted that in setting out both the capital and revenue options, we have made a series of assumptions to ensure that the number of options presented and appraised is manageable. There are potential variations within options which would be considered at a more detailed operational planning stage (potentially as part of the OBC / FBC).
- 2.5.2 We have also presented a series of capital and revenue options for each island. In the analysis, we have married each capital option with each relevant revenue option to show the broad scale of costs. This format has been adopted for simplicity but it should be noted that, in most cases, the revenue options are not mutually exclusive and could be introduced together.

3 Air Infrastructure Options

3.1 Overview

- 3.1.1 The inter-island air service offers connections between the hub airport of Kirkwall and the Outer North Isles of Eday, North Ronaldsay, Papa Westray, Sanday, Stronsay and Westray. The air services are a key component of the inter-island transport network, particularly for North Ronaldsay and Papa Westray where they form the lifeline connection for those islands. Whilst ferry related options can generally be considered on a route-by-route basis, most of the air options have to be considered on a network basis.
- 3.1.2 There are four main issues which dictate the nature of the Orkney air service. These are:
- accountable management;
 - the aircraft used and potential alternatives to those currently used;
 - navigational aids to widen the operational envelope or improve reliability; and
 - the level of intensity of use of the current assets.
- 3.1.3 Each of these issues is considered in turn below. Where feedback has been provided by the current operator, Loganair, it is included within the relevant section.

3.2 Accountable Management

- 3.2.1 The Orkney Islands air service operates within a well-developed and robust accountable management system for its airfields. The aircraft and service are also currently operated by Loganair (under a Public Service Obligation (PSO) Contract with Orkney Islands Council), providing the management and operational scale economies from being nested within a larger company. Loganair is accountable for the air service whilst OIC is responsible for the airfields.

Rescue & Firefighting Services (RFFS)

- 3.2.2 Whilst Orkney does have a well-developed system of RFFS, there are some human resource concerns surrounding the operation. At present, the RFFS role on the islands is generally fulfilled on a part-time basis by island residents. However, this gives rise to a range of problems / risks, including:
- ageing of the workforce in line with the general demographics of the Outer Isles;
 - recruitment and retention of staff (pay rates being cited as an issue during the research);
 - training and maintenance of competencies and safety management systems;
 - resilience in the face of illness, holiday cover and retirement;
 - maintenance of fire tenders and drying of protective clothing; and
 - there is also known to be some resistance to Sunday working on certain islands.
- 3.2.3 RFFS cover in the Outer North Isles currently appears to be relatively secure, although the issues raised above will have to continue to be addressed on an ongoing basis to maintain system integrity.

Airfield Infrastructure

- 3.2.4 The airfields in the Outer North Isles have a similar airport terminal design, which consists of a combined watchroom, office, waiting area, unisex toilet and small garage for lockers and tools, but not large enough to house the fire tender.
- 3.2.5 The Council has recently completed the construction of an impressive new garage and terminal in North Ronaldsay, with the intention to roll this out across the six isles airfields.

3.3 Current and Potential Aircraft

Current Aircraft

- 3.3.1 The Britten Norman (BN) Islander was developed in the 1960s to replace the Dragon Rapide which had initially served the Northern Isles from as early as the 1930s. The Islander's simple and rugged manufacture makes for daily operation in and out of rough grass (although these runways are prone to flooding) and unprepared strips in all-weathers. Indeed, its twin-engined reliability and 30 knots cross-wind limit has seen the Islander operate regular scheduled services in the Scottish environment since the late sixties. With accommodation for up to 8-9 passengers plus a single pilot, the Islander can also be operated as a freighter carrying around 700kg of cargo.
- 3.3.2 There are currently two BN-2 Islanders operating in Orkney:

Table 3.1: Loganair Britten-Norman Islanders

Aircraft	Serial Nos	Engines	Model	Year of Build
G-BLDV BN2P	2179	260 HP AVCO Lycoming	BN-2A Islander-2B-26	1986
G-BPCA BN2P	2198	260 HP AVCO Lycoming	BN-2A Islander-2B-26	1988

- 3.3.3 In the summer, the current Outer North Isles schedule can be completed satisfactorily with one aircraft, so in essence the second aircraft is a reserve which allows aero-engineering and unscheduled withdrawals from service to avoid disruption. Both aircraft are however required to operate the winter timetable due to the shorter operating days. Loganair has achieved a high degree of compatibility with the two examples that it operates, each having the same engines and basically the same performance characteristics. It is presumed there is a high degree of component inter-changeability.

Risks Connected with Current Aircraft

- 3.3.4 If an aircraft is well maintained it can continue to operate for extended periods, especially as so many key components can be changed under maintenance. The limiting factors in relation to the current aircraft over the thirty year strategy period will therefore be more to do with:
- The base airframe, which is the key component that cannot be changed, can be subject to corrosion (the maritime environment being particularly prone to it) or metal fatigue especially as a result of multiple landings over its lifetime. Deep maintenance checks manage these risks, however as an aircraft gets older a surprise discovery of corrosion or fatigue (usually small micro cracks) becomes an increased possibility, and therefore it is pragmatic to assume that the current airframes may need to be retired during the next thirty years. The operator may well identify corrosion or metal fatigue in the airframe that is beyond economic repair, or the risk of such occurrences rises to the point where the operator dramatically increases their maintenance allowance or refuses to take on the risk. For the 2010 review by Mott MacDonald, Loganair were quoted as saying:

- *'the aircraft have a further ten years of service capability subject to no major anti-corrosion or structural issues being located during the routine annual checks and SB190 structural checks. Any discoveries of this nature could lead to a premature need to replace the aircraft given the likely costs of repairs. In the event of an Islander replacement becoming necessary, we would expect to replace the aircraft with newer Islander aircraft'.*
 - Loganair reported that, during a recent inspection, the schedule of issues requiring attention unexpectedly used up their potential profit for the year. Whilst very well maintained, it is likely that the BN2 Islanders will need to be replaced within the first half of the strategy period.
 - Withdrawal of manufacturer's support for the aircraft type or key components such as engines that the aircraft uses is considered a low risk outcome as the aircraft is still widely used around the world, which provides a strong demand to underpin commercial support. The company has produced in excess of 1,250 aircraft, making it Europe's most prolific aircraft manufacturer. The BN2 series of aircraft are currently in daily use with some 500 companies and organisations in over 120 countries. The same applies for spare parts and components.
 - Pilot shortage does not present such a risk from current perspectives. Many pilots value and enjoy what they term 'real flying' as opposed to the 'indicator monitoring' they perform in more sophisticated aircraft. Also certain pilots are attracted to the human scale and interaction that a small aircraft offers. Lifestyle pilots seem positively attracted to these services. Indeed one operator, which also uses other aircraft types, reported that there was a waiting list for their BN2 service.
 - Human resources may however offer some challenges in that aero engineers may not be attracted to maintain older equipment as time progresses. Attention may well need to be given to this risk to forestall future difficulties.
 - The availability of AvGas does present a risk looking forward, but with 250,000 engines requiring this fuel around the world and with the US Federal Aviation Administration pondering solutions, it appears that the risk is being attended to. That said, above inflation cost increases are a real possibility and costs associated with migration to a new comparable fuel source are also likely within the next thirty years.
- 3.3.5 Our research (see below) suggests that there would be significant costs in moving away from the current islander fleet in the short-term, with little in the way of corresponding benefits. Whilst there are longer-term risks associated with continuing with the current aircraft, these cannot be quantified at this stage, but with prudent review of these issues, it should be possible to replace the current aircraft or migrate to other air service solutions at the appropriate time. Other aircraft types are briefly considered in this document.
- 3.3.6 In summary, The Britten Norman Islanders currently used to serve the Outer North Isles are ideally suited to what is required of them (capacity issues aside). The risk of early challenges to the viability of the BN2 Islander is considered low. However, options for the replacement of the airframes will need to be seriously evaluated in the first ten years of the strategy period.

Aircraft Ownership

- 3.3.7 The one major difference with the Orkney internal network when compared to Shetland is that the aircraft are not owned by the Council, rather they are provided by the operator through the PSO.
- 3.3.8 Currently OIC prepare a PSO ITT that must respect the conditions and the requirements set out in Articles 16-18 of the EU Air Services Regulation 1008/2008. Transport Scotland does help ensure compliance which requires that the intention is justified by a prior socio-economic study, and OIC must comply with certain tender processes aimed to ensure the competition is transparent, fair and non-discriminatory and this includes the ITT being published in the

Official Journal of the European Union (OJEU) and sufficient time being provided for the tender process (at least six months). The contract can be awarded for as long as four years, but usually has a six month notification clause for withdrawal (from either party). If the contract is significantly changed midway through then it should be fully retendered. Therefore new features / innovations can more prudently be presented as trials, which can be dropped or extended dependent upon frontline experience without retendering.

- 3.3.9 PSOs are widely used across Europe but the arrangement does give rise to risks surrounding the ability of operators to justify renewing aircraft (which are long-term assets and commitments) for the reward of short-term (typically four year) contracts. This could in the long-term lead to the situation where the operator rather than the customer no longer accepts the responsibility for providing capacity. Partly in response to this eventuality, both Shetland Islands Council and Transport Scotland have directly acquired new modern assets of older aircraft types. The contract specification for the tendered services stipulates the use of the aircraft and also allows operators to offer operational and maintenance contracts only, which does facilitate competition.
- 3.3.10 The approach to the procurement of inter-island transport services generally is not within the scope of this study, although it is being considered in a parallel piece of work. Nonetheless, the risks surrounding the ownership of the assets and the case for operator investment are important to bear in mind in the context of this study.

Potential Alternative Aircraft

- 3.3.11 This section considers potential alternative aircraft assessed as part of the study.

Cessna 208, Caravan 1 - Single Engine Turbine Operations in Orkney

- 3.3.12 In November 2015, the European Aviation Safety Agency (EASA) recommended approving commercial single engine turbine (SET) operations and once this is passed by the European Parliament will become EU law (anticipated to be before the end of 2016).
- 3.3.13 This type of aircraft will still require operators to develop and have an approved safety and operational case for such services, which in any specific time limited and pressurised tender process is very difficult / impossible.
- 3.3.14 Legislation permitting, SET commercial flights are expected to be adopted, according to Cessna, throughout Europe by the end of 2016. Within this, it is likely that something like a 15 minute risk period per flight could be accepted so the aircraft can cross open water. The new provisions in all likelihood will expect operators to be able to glide and navigate to safe landing areas (aerodromes or simple fields of sufficient size without obstacles) in the event of an engine failure. It should be possible to devise a compliant route in Orkney, but agreement with the CAA would be involved. It would still require an in-depth risk assessment of operating a single engine aircraft. Insurance premiums for such operations are another unknown.
- 3.3.15 The Cessna 208 does require slightly longer runways than the BN2 Islander but this would not be an issue on Orkney's Outer North Isles main runways. However, the aircraft does have lower cross wind limits because of its design (20kts as opposed to the Islander's 30kts) which would be a significant drawback in the Orkney environment despite the fact that most airfields do have cross runways which could be offered.
- 3.3.16 The aircraft type uses jet fuel which is currently cheaper than AvGas, but the increased fuel consumption of a turbine will nullify any potential savings.
- 3.3.17 A significant drawback to operating a turbine engined aircraft on the Orkney inter-island service is the very short sector times. Turbine engines suffer fatigue related to the number of cycles (starts and shutdowns) they perform rather than in relation to the total time they are

running, which is the case with the piston engine used by the Islander. However, the Cessna 208 is a popular parachute jumping platform and they do perform well in the typically short missions (10-15 minutes several times each hour) and high cycles that this entails. Engine overhaul costs for turbine engines are said to be around five to six times those of piston engines. This problem is mitigated somewhat by the use of propeller brakes, which allow the turbines to stay powered whilst the propeller is stationary. The turbine would still need to be shut down whilst refuelling though and the cyclical costs would still be significantly higher than a piston engine in an equivalent power range.

- 3.3.18 More modern avionics and aircraft systems (generators, hydraulic pumps, controls etc) tend to be more sophisticated and hence more expensive than piston engine technology. Maintenance costs can therefore be expected to be significantly more than a piston BN2.
- 3.3.19 Although EASA has established that these aircraft have demonstrably higher engine reliability than some currently operated twins, there is still the potential for consumer resistance to such a development. If these aircraft were to be introduced, a prior information dissemination and familiarity type campaign would seem prudent.
- 3.3.20 Cost is also a significant consideration. A standard Cessna 208 has a 9 passenger capacity although certificated versions up to 14 seats exist. A version of the 208 is also available with increased baggage capacity in a belly pannier. A new C208 costs in the region of \$2.5m, and 10 year old models still cost around \$2m.
- 3.3.21 The current operator Loganair has noted that it would be willing to consider SET in future but that there would be a number of significant challenges in introducing such an aircraft in the Orkney context – it is not an immediate prospect.



- 3.3.22 Whilst no alternative aircraft currently offers a transformative replacement to the BN2 Islander without some accompanying drawbacks (be they operational or cost based), SET seems quite a possible future evolution, when the BN2 Islander truly is no longer available / operational.

DHC-6 Twin Otter

- 3.3.23 The Scottish Government has recently acquired two new DHC-6 Twin Otters, which could feasibly permit some form of standardisation across the Scottish network. The aircraft has good STOL¹² performance and is now being manufactured again by Viking of Vancouver (albeit largely unchanged from an early design) and can carry 19 passengers. The DHC-6 Twin Otter is a Canadian 19-passenger aircraft and was developed by De Havilland of Canada. Over 600 were made before production ended in 1988 and in 2006 Viking Air announced its intention to offer a series 400 Twin Otter. In the following year they announced

¹² Short take-off and landing

that, with 27 orders and options in hand, they would be restarting production. Their first new aircraft was delivered in July 2010.

3.3.24 The current operator, Loganair made the following observations:

- Though the DHC-6 Twin Otter is billed as a STOL aircraft and does indeed have very good performance, in order to operate to Commercial Air Transport standards, many of Orkney's airfields would need lengthening and possible widening. Most Outer North Isles airfields would require an estimated runway extension of around 100-150 metres (exact dimensions would be subject to a very detailed analysis) plus other infrastructure improvements such as RFFS CAT3 cover (applicable at all operating locations). In this context, it is important to note that when Orkney Islands Council acquired the land for the current runways, they purchased little more than the required length for BN2 operations. As a result, land ownership and acquisition questions would reemerge if the operation migrated to a larger aircraft.
- Presuming the home base of the inter-island service remained as Kirkwall, the hangar would be large enough to accommodate the Twin Otter.
- The drawbacks associated with turbine engines discussed previously apply to the DHC-6.
- The systems which accompany turbine installations, generators, hydraulic pumps, controls etc are also more sophisticated and hence expensive than piston engine technology. The maintenance costs of a turbine Islander are estimated at least twice that of a piston BN2. Jet fuel is cheaper than gasoline, but the increased fuel consumption of a turbine cancels out those savings.
- The airframe is very expensive to purchase either used or new (a 1979 model still commands over \$2.5m and a new version [Viking DHC-6-400] costs around \$7.3m plus delivery charges etc). It is also an expensive airframe to maintain with costs estimated to be around 3-4 times that of a BN2. The direct operating costs are obviously proportionately higher.
- A further direct operating cost would probably be that for the second pilot. The aircraft is certified as a single pilot aircraft, but both current UK operators (Loganair and Isles of Scilly Skybus) operate them with two pilots for sound reasons. Multi-crew operation may well be held to be preferable, the present pilots could potentially be dual rated on the BN2 and the DHC-6 or solely on the DHC-6. However, there would inevitably be a need to recruit additional pilots.
- A mixed solution with a Twin Otter and BN2 Islander might be one way to increase capacity, but it would not be very cost effective as pilots and engineers would either need to be dual rated or separate workforces and back-up aircraft and separate spares would add to the lack of economies of scale.

The TecNam P2012 Traveller



- 3.3.25 The Italian designed TecNam P2012 Traveller concept aircraft illustrates what a next generation BN2 Islander aircraft might look like. The aim was to design a modern 11-seat aircraft with state-of-the-art equipment, using latest technologies to reduce costs, including simple and easy to access airframe & systems.
- 3.3.26 This is the sort of aircraft innovation that Scottish air service operators should closely monitor.

Seaplanes

- 3.3.27 In parts of the USA (Alaska in particular) and Canada the seaplane continues in use as a regular mode of transport. Scotland ostensibly is equally suitable for seaplanes with 120 populated islands and over 30,000 freshwater lochs.
- 3.3.28 One Scottish operator, Loch Lomond Seaplanes (LLS), operates two amphibians, a Cessna Caravan and a Cessna 208, on charter and sightseeing flights around the west coast. They are thought to be investigating expanding their services elsewhere in the British Isles, and there are equivalent initiatives in Ireland, Croatia and Greece. However LLS withdrew from scheduled passenger flying because of the potential costs imposed by EU denied boarding compensation strictures, combined with its relatively low operational reliability. They now restrict their offer to chartering and sightseeing flights.
- 3.3.29 Canada's Harbour Air operates the world's largest all-seaplane fleet with over 50 aircraft. The route network is extensive and the primary route connects Vancouver with Victoria on Vancouver Island, a distance of approximately 50nm. Two of the world's largest seaplane operators are in the Maldives, Maldivian Air Taxi and Trans Maldivian, which both offer connecting flights from the International Airport at Male to more than 40 resort islands.
- 3.3.30 The in-flight performance of a seaplane is impacted by the additional weight and drag of the floats. The seaplane will be slower than the regular landplane increasing journey times by approximately 10%. The aircraft's carrying capacity would also be reduced.
- 3.3.31 With regard to landing areas, there are few suitable inland lochs that can be used on many islands and sheltered anchorages in the Orkney context can still experience rough water and strong winds. Assuming some of the runways were retained because of no acceptable water sites on certain islands then an amphibian version, as opposed to float version, with both floats and wheels would be required which has a heavier weight penalty yet again.
- 3.3.32 The costs of maintaining an amphibian (airworthiness and infrastructure) together with the crosswind limitations on even extended / resurfaced Outer North Isles strips capable of taking that configuration make it impractical in the Orkney environment.

Rotary Solutions

- 3.3.33 The PSO for the air services to the three Aran Islands in Southern Ireland requires a total subsidy of nearly €2m to run the flights as well as the three aerodromes on the Aran Islands and the Connemara Regional Airport in Indreabhán (Inverin). Aer Arann Islands (the islander and airport operator) employs approximately 38 full-time and two part-time staff, to run these services. A new contract was recently tendered by the Irish Department of the Arts Heritage and the Gaeltacht in 2014 with a 30% discount cap imposed on current spending intentions, apparently at €900,000 per annum for the air service component on its own.
- 3.3.34 Rather surprisingly the tender was awarded to a rotary company (Executive Helicopters). They proposed offering a twin engine helicopter with 8 plus passenger capacity (the type is currently confidential because of an award review currently underway). Executive Helicopters claimed that the proposed helicopters for the routes would have a greater passenger capacity than the existing Aer Arann Islander aircraft and would have similar luggage/cargo capacity and can fly in a greater range and variety of weather conditions. They noted that the new helicopter service would provide a reliable, faster, more efficient service to Galway city under the terms of the public service tender.
- 3.3.35 Helicopters are the air transport of choice to other Irish offshore islands such as the Tory Island service¹³ off the Donegal coast, and Executive Helicopters has been operating helicopters in the west of Ireland for almost 20 years '*without any problems whatsoever*'.
- 3.3.36 Helicopters are also better placed to deal with deleterious situations such as rapidly deteriorating weather, as they have the option to either slow down or land, whereas the fixed wing aeroplane has to seek a suitable diversion airfield. It was noted that safety statistics demonstrate that helicopters are every bit as safe as fixed wing aircraft.
- 3.3.37 However, there was a considerable backlash to the proposed award. Such was the outcry that the tender award was postponed and a one year standstill and review was instituted, which is still currently underway.
- 3.3.38 The Isles of Scilly also enjoyed a 45 year air link with Penzance provided by British International Helicopters until October 2012. In 2014 local MP Andrew George and Graham Cole, the chairman of AgustaWestland, the Anglo-Italian helicopter company with a production facility in Yeovil '*jointly expressed*' their optimism over a potential re-establishment of the helicopter service. AgustaWestland previously said it would offer the first of its AW 189 helicopter (carrying up to 19 passengers) off the production line at a cheap rate to encourage someone to set up a commercial service to Scilly.
- 3.3.39 There is also a rotary PSO to Værøy in the Lofoten Islands in Norway, which is the most isolated island in the peninsular chain. The service flew over 9,000 passengers in 2014.
- 3.3.40 These developments raise several instructive aspects for the Orkney inter-island transport environment. A rotary solution might be competitive when the total cost of maintaining airfields, rather than helipads is considered, although helicopters cost considerably more per hour to fly than the BN2 islander. As with single-engined aircraft, there would likely be significant public concern about the risks of rotary solutions, particularly in light of recent high profile accidents in the North Sea.

Summary

- 3.3.41 This research has confirmed that the BN2 Islander remains the most appropriate aircraft to operate the Orkney inter-island service, and indeed Loganair has indicated that it would likely replace the current aircraft with newer Islanders when they reach life expiry. It would at present be impractical and very costly to move away from these aircraft and the benefit stream

¹³ Run by the Local Health Board but also taking members of the public in winter months using a helicopter from Irish Helicopters (part of the PDG Group with its HQ in Inverness)

is likely to be very low. The study is therefore ruling out any move towards a larger aircraft at this stage.

- 3.3.42 The above sections have set out some potential alternative aircraft which could be considered in the longer-term, potentially when aircraft replacement needs to be considered around one third of the way through the strategy period. However, it is likely that, by this time, technology will have moved on again and the issue should be revisited then.

3.4 Navigational Aids & Runway Enhancements

- 3.4.1 The current Orkney inter-island services operate on the basis of Visual Flight Rules (VFR), which constrains the operation to the hours of daylight (with the exception of North Ronaldsay which has runway lighting). The current operation is well adapted to this operational environment and offers both high frequency and good reliability. However, the VFR arrangements do nonetheless limit the length of the operating day, a particular issue in Orkney during winter when hours of daylight are limited. This compounds the issue of a short operating day on the internal ferry network.

- 3.4.2 Navigational aids, including the Global Navigation Satellite System (GNSS) and runway lighting offer the potential to extend the length of the operating day. The viability of each of these navigational aids is considered below.

Global Navigation Satellite System

- 3.4.3 GNSS antennas on aircraft can pick up signals generated from a constellation of satellites and uses the difference in the time of travel of radiowaves from four satellites to fix the position of the receiver and get an accurate value for time. Based on classical mechanics, the principles underlying GNSS are simple, but the system is formidably complex in practice, the main problem being timing errors. It is impossible to put a single figure on the accuracy of GPS as it depends on several ever-changing factors, many of which affect the ionosphere, the biggest single source of error. Current systems have a way of alerting users that GNSS is underperforming for any reason.

- 3.4.4 The potential is that GNSS can be used to supplement visual navigation (VFR), IFR¹⁴ and night time navigation. This would be without the need for ground based navigational aids which are expensive to install and maintain.

Recent Scottish Experience

- 3.4.5 Highlands & Islands Airports Limited (HIAL) recently received a 70% grant to undertake GNSS approvals for three of its airfields. This has required a safety case and operational procedure to be developed for each airfield and CAA approval for the submission. HIAL used Cyrrus to manage the project and actually used Hebridean Airways' BN2 Islanders to undertake much of the 'field' calibration work. Barra, Tiree and Campbeltown are either currently approved or nearing approval.

- The approval delivers managed approaches to 200 feet at strips of 500 metres (since 2012) and this reduces the pilot's decision height considerably in IFR conditions.
- The Garmin database coding¹⁵, flight validation and CAA approvals cost between £12k and £20k depending on the location. The timeline for database coding and flight validation is approximately three months. The consultancy, design, hazard identification & safety cases cost approximately between £24k and £38k with a delivery timeline around 4-6 months. The timeline for CAA Approvals is elastic and has varied from 18 months to more than 24 months mainly because of resource issues within the CAA.

¹⁴ Instrument Flight Rules

¹⁵ Garmin charges are going up significantly and they only give quotations when the designs are finalised

- One needs to allow approximately six months from CAA approval to allow NATS AIS¹⁶ to assess the work required to meet one of their AIRAC¹⁷ cycles, and for the charts to be published in the Aeronautical Information Publication.
- The cost of the GNSS unit for a BN2 aircraft is approximately £10k and Hebridean Airways has it installed on both of their west coast aircraft. It was established that the onboard equipment needs revalidated each year at an approximate cost of £750.

3.4.6 HIAL has now been successful in receiving further EU funding to roll out GNSS approvals to all of their airfields. Hebridean Airways now has four years of experience using the equipment, although few of the airfields they operate into have approved approaches.

Summary

3.4.7 Overall, it can be concluded that GNSS provides the prospect of permitting IFR flying in the Orkney environment, which could improve despatch reliability and additionally supplement current VFR flying from a safety perspective. Further feasibility studies will be required, but a source of some experience already exists within Scotland.

3.4.8 However, the current operator, Loganair noted it would be difficult to achieve Instrument Flight Rules (IFR) flights to the Outer North Isles without significant investment in in the airport / runway infrastructure. Whilst GNSS is seen to be a helpful option, there would be many other considerations, not least the lack of accurate meteorological observations to assess landing conditions.

3.4.9 Any decision to install GNSS would require a variation in the PSO contract.

Runway Lighting

3.4.10 Runway lighting offers improved decision heights for pilots in poor visibility or in night-time conditions. However wiring up a runway can be expensive.

- Airfield Ground Lighting (AGL) is a challenging environment in which shocks, vibrations and great changes in temperature (frost or intense heat from the sun and surrounding tarmac) can have a negative impact on the equipment. Currently, the main provision for AGL is still in the form of incandescent lamps using a filament. These suffer from a number of weaknesses, in particular a relatively short average life as filaments are burnt out after 1,000 to 2,000 hours. Another weakness of incandescent lights is their poor spectral emission.
- Precision Approach Path Indicator (PAPI) lights help pilots acquire and maintain the correct vertical approach to an airfield. PAPIs are generally located beside the runway approximately 300 meters beyond the landing threshold of the runway.
- HIAL has been undertaking trials with Battery Operated LED runway lights and even PAPI lights. LED Lights have a much longer service life; lower power consumption; low maintenance and higher luminosity with good temperature and vibration tolerance, and they have battery operated options that only need re-charged every fortnight or so.

3.4.11 At Campbeltown, they are using a company called CALKIT. Prices vary inevitably because of specifications such as red white lighting mixes and number of units required, bearing in mind that Campbeltown's runway is one of the longest in Scotland. A Manual Controlled CALKIT LED with 54 White 125cd & 6 Red & 6 Green is coming in at just over £42,000, whilst a radio controlled CALKIT LED with charging unit & desktop charger is just over £58,000. Delivery costs are another significant factor with our correspondent suggesting that arranging one's own dedicated low loader is more cost effective.

¹⁶ National Air Traffic Services Aeronautical Information Service

¹⁷ Aeronautical information regulation and control

North Ronaldsay Experience

- 3.4.12 Orkney Islands Council has installed PAPI lighting on North Ronaldsay, which allows night time landing. In theory, this helps the whole system as in winter the rest of the programme can be completed in daylight, leaving the Kirkwall – North Ronaldsay – Kirkwall shuttle to finish off the day. However, the CAA imposes different and more restrictive performance limitations on night-time VFR flying. This has the effect that often flights that could be undertaken in current daytime conditions will be out of limits in the forthcoming night-time conditions. Hence the pilot recommends bringing forward the flight. It should be noted that winter night time conditions are also more affected by snow, ice, and frost, so it is not just a procedural policy issue. Even if the conditions at both airfields permit take-off and landing, the conditions on transit can often lead to a flight being brought forward.
- 3.4.13 The standard procedure is that if the weather looks like it will be above limits (which are lowered during night-time as opposed to daytime VFR flying) then the service is brought forward (to 1400 for 10 weeks in 'mid-winter' and 1600 for other winter weeks). Unfortunately, in winter this is a very frequent occurrence, with an estimate of around 70% of these flights being brought forward in 2015-16.¹⁸ The high level of disruption to this flight has reduced the overall benefit which it offers to the North Ronaldsay community, as there is much reduced certainty of being able to use these flights.
- 3.4.14 Whilst more detailed investigation into the potential for runway lighting is required, the North Ronaldsay experience suggests that the benefits overall are relatively limited for the cost outlay.
- 3.4.15 Loganair cautioned that proliferating lighting throughout the Outer North Isles airfields may raise expectations beyond the ability of the system to deliver. Lighting cannot therefore be seen as a panacea to accomplish more flying without some operational implications.

Asphalting of Landing Strips

- 3.4.16 As part of the overall network review, the study considered the potential benefits of upgrading current gravel runways to asphalt. However, discussions with OIC have established that there is no great advantage to be had in asphalting of landing strips. The current gravel surface has good, and possibly superior, frictional traction for the BN2 Islander when compared with an asphalt surface. Drainage to reduce standing water is also thereby enhanced. Based on the above, longer runways would likely be required, whilst a more sophisticated de-icing option would also be required.
- 3.4.17 The surfaces do require de-mossing, weeding and other surface maintenance such as rolling from time-to-time, but this is an occasional, and not an expensive or too onerous, a process. In addition, there is little prospect of snow clearing or de-icing being undertaken at Outer North Isles airfields and there is little cost benefit to be achieved by asphalting the landing strips.
- 3.4.18 Another request that is occasionally proffered from an operator perspective is for a gravelled cross runway as this would supposedly add to the reliability of flights into airfields in difficult wind conditions. However, it has been estimated that it would cost £460,000 to achieve this for each airfield and it is unclear what improvements in reliability this investment would deliver. It was noted that over a previous winter (2014/2015), which was a particularly wet season, the grass strips were declared closed because of flooding, and the impact on reliability was in fact slight. There were only five flight cancellations that would otherwise have gone ahead if the grass surfaces had been usable.

¹⁸ OIITS Aviation Baseline Report (Northpoint Aviation, 2016), pp. 43-44.

3.5 Use of Existing Assets & Resources

- 3.5.1 The appraisal of options for the Outer North Isles (see Chapter 4) considers options in relation to increasing the intensity of the current air service. This final section prefaces that analysis by considering the use of existing assets and resources and the ability to scale up the operation through the provision of additional aircraft and crew.

Crew and Aircraft Usage

- 3.5.2 The inter-island air service is run very intensively, with the research undertaken in the Outer North Isles STAG Part 1 Appraisal identifying no additional flying hours available within the current operating envelope.
- 3.5.3 There are two aircraft and three full-time pilots based on Orkney mainland. With some assistance from senior management pilots (estimated as 0.5 FTE pilot), Loganair provides year round cover, holiday cover and an acceptable level of fast response sickness cover. It was noted that management pilots are more expensive than Orkney-based pilots and, if there was to be any increase in crewing, it would very quickly become more cost-effective to recruit one or more local pilots rather than stretch external support resources.
- 3.5.4 The Orkney operation accomplishes around 1,400 hours each year. Loganair is prepared to schedule its two aircraft to run concurrently, which permits this quantum of operating hours. The Orkney air crew are, in very broad terms, accomplishing around 400 flight hours per year, which is towards the maximum end of what is permitted under the Flight Times Limitations Scheme. The above, combined with research undertaken in the earlier study, suggests that the Orkney timetable could not be increased within the current daytime flying schedule without additional crew and aircraft.

Additional Aircraft

- 3.5.5 In the short-term, our research suggests that the only means of enhancing the timetable and total capacity would be to add a third Britten-Norman Islander to the fleet (alternative aircraft being part of a longer-term consideration). The provision of an additional Islander could then ensure two aircraft are always in service and, for over half the year (assuming suitable crewing), three aircraft could be in frontline service, offering a transformational change in island connectivity in terms of e.g. regular morning & evening flights to each island, a reduction in shared flights etc. Note that it would be prudent to apportion time for unscheduled or extended scheduled maintenance in the timetable.
- 3.5.6 The capital cost of a new BN2 Islander would be in the region of \$1.2m new or \$600k second hand. There is significant second hand availability of these aircraft for purchase or lease. The capital costs of an additional Islander would therefore be relatively low. Given the contracting model in Orkney, it is likely that a third aircraft could be secured through the PSO process, with the winning operator leasing the plane for the period of the contract and passing the cost back to the contracting authority.
- 3.5.7 In terms of operating costs, direct operating costs escalate on a linear basis in line with activity, but fixed operating costs such as hangar rentals, the pilot, engineer and ground staff salaries account for the majority of the running costs of the air service. A third aircraft could likely be added to the fleet with no increase in maintenance and hangar costs, an increase in the number of pilots and a small increase in ground staff costs. Estimates for such an upgrade were developed in 2010 and were put at £600k per annum, which included the aircraft and the extra operational costs connected with significant increased usage (almost doubling). This figure did not include meeting the additional costs and logistics of operating Council airfields more intensively.

- 3.5.8 In terms of pilot numbers, the requirement would depend on the total number of additional flying hours to be operated by a third aircraft. On the assumption that flying hours are increased from 1,400 hours per annum to 2,000 hours per annum, there would be a need for 5 - 5.5 pilots, up from the existing 3.5 pilots.
- 3.5.9 Our research further considered the possibility of operating four or more BN2 Islanders. Whilst the incremental cost of scaling up the air operation is less than the equivalent cost of scaling up the ferry operation, this option is rejected at this stage. The next chapter sets out the respective air & ferry markets in the Outer North Isles and establishes that ferry rather than air is the lifeline mode for Eday, Sanday, Stronsay and Westray (air being the lifeline mode for North Ronaldsay and Papa Westray). Three aircraft could comfortably deliver the air travel needs of the market and any additional aircraft would be disproportionate in the near term. The contract cycle of the PSO contract specification process would provide the means to monitor the potential for a further increase in the size of the fleet over time.

Development of New Airfields

- 3.5.10 The study considered the potential development of new airfields, including the reinstatement of the air strip in Hoy. However, the proximity of the Inner & South Isles to Orkney mainland and the relative air and ferry based travel times suggested that such an option would be disproportionate, and thus new airfields were not considered further.

3.6 The 2017 PSO Tender

- 3.6.1 The Orkney inter-island air tender is due to be re-let in 2017 and the options set out above could potentially be incorporated within it, either at the outset of the tender or as a priced option / variation of contract. Given the above analysis, the only likely substantive change in the lifetime of the next PSO contract would be the addition of a third aircraft, although GNSS could later be installed as a variation of contract if it proved to be viable in the Orkney environment, learning from experience elsewhere in Scotland.
- 3.6.2 It is outwith the scope of this study to define the next PSO tender and in any case it would be the responsibility of bidders to set out their proposed approach in the tender. Nonetheless, it is worth setting out some of the potential options which could be included in the tender if a third aircraft was brought into the fleet – these could include:
- The operation of three aircraft in the winter months, offering a denser timetable. In summer, the service would be scaled back to two aircraft, with each plane going through its necessary checks when daylight hours are longer.
 - The summer operating day could be extended if the necessary pilot flying hours were available.
 - The third aircraft could offer a timetable which 'shadows' the current flights constrained by education use, or could run an alternative timetable focussed on island residents.
 - Defining one aircraft as an 'education / public services priority' service to clarify the role of these flights. The public could potentially use any spare capacity on a stand-by basis.
 - North Ronaldsay and Papa Westray could benefit from three rotations per day all year round (morning, afternoon and evening), given that their lifeline mode is air (see Chapter 4). Ideally, these flights would be direct
 - Eday could be given a level of air connectivity equivalent with Sanday, Stronsay and Westray.
 - The number of indirect flights could be reduced.
 - The timetable could aim to achieve at least a start of day / middle of day / end of day rotation for each island 6-days per week, dropping to two rotations on a Sunday.

- Consideration could be given to daytime connections to Wick airport, providing an alternative means of accessing the Scottish mainland.

3.7 Summary

- 3.7.1 This chapter has set out the potential infrastructure options / investment in relation to the Orkney inter-island air service. As the service is wholly concentrated in the Outer North Isles and has clear interaction with ferry service provision, the appraisal of air options is included in the Outer North Isles chapter (Chapter 4).

4 Outer North Isles

4.1 Capital Investment Timeframe

- The current Outer North Isles vessels are nearing the end of their operational life – the MV *Earl Sigurd* and MV *Earl Thorfinn* were built in 1989 and so are approaching 30 years old, whilst the MV *Varagen* is also a relatively elderly vessel, having being built in 1988. Whilst well maintained, there is an increasingly urgent need for their replacement with more modern tonnage. The passenger only vessel which operates between Westray and Papa Westray, the MV *Golden Mariana*, is 43 years old and is also in relatively urgent need of replacement. An immediate replacement programme is therefore required.
- Chapter 3 noted that the current aircraft remain fit-for-purpose but that consideration will have to be given to their replacement midway through the study period at the latest. There are also a series of air related options which could potentially expand the current operating envelope.
- Capacity was identified as a key problem in the Outer North Isles. On the ferry services, Westray and Sanday are the islands which most frequently experience capacity problems, whilst Stronsay and Eday experience occasional capacity issues. The refit timetable in particular causes a significant reduction in direct connections and greater capacity issues. The air services are also very capacity constrained, both by the limited number of seats and the use of the aircraft to deliver public and other services (e.g. education).
- The marine infrastructure is also ageing and in need of replacement at a number of locations on the network. In addition, at many ports, the existing infrastructure can only just accommodate the current vessels and thus any increase in vessel size would necessitate harbour works to support this. Only Sanday and Stronsay allow for year round overnight berthing, with Westray used in the summer only. Eday, Papa Westray and North Ronaldsay cannot be used for overnight berthing.
- The crew are on the whole mainland based. The vessels are single crewed at any given time, with each crew working on a two-week on, two-week off basis. The crew accommodation on the current vessels is below the waterline – the dispensation provided by the MCA allows the crew to overnight on the vessels a maximum of two nights per week, so the majority of crew are not based on the vessels.

4.1.1 For each island / island group, the following package of documents are included in an appendix:

- Appraisal Summary Tables (ASTs);
- indicative harbour drawings, providing high level illustrations of the shoreside investment required to support each option; and
- environmental constraints maps.

4.1.2 The above material for Outer North Isles is included in Appendix A.

4.2 Identified Problems by Island

4.2.1 A range of 18 potential transport problems was considered for each island. The tables below show the subset of problems which were identified together with a rating of the severity of the problem (x, xx or xxx). Where there is a '✓' shown in the rating column, this means that the study has not identified this aspect of connectivity as a problem.

4.2.2 The following transport problems in relation to the Outer North Isles were identified in the Pre-Appraisal Report and verified through subsequent community feedback. Where the community has identified a problem which we have not, their contribution is noted in red text.

Table 4.1: North Ronaldsay Transport Problems

	Service Characteristics	Rating	North Ronaldsay: Why is this a problem or not?																																																																								
1	Overall Journey Time to Kirkwall	✓	Whilst the direct ferry service from North Ronaldsay to Kirkwall takes around 160 minutes, the air service is defined as the lifeline mode. The direct flight time is 18 minutes and indirect flight time 25 minutes (although most flights are direct). There is a half hourly bus from Kirkwall airport, with a journey time of around 10-15 minutes.																																																																								
2	First sailing / flight	✓	The first flight from North Ronaldsay generally departs at 0758 in summer and winter (0823 on a winter Monday), facilitating a working day on Orkney mainland.																																																																								
3	Last sailing / flight	✗	<p>The last departure in summer is 17:30, providing a near full day in the mainland. The last departure from Kirkwall in the winter is 17:00, which is facilitated by the runway lighting on North Ronaldsay.</p> <p>However, our research suggests that in 2015-16, almost 70% of the 17:00 flights to North Ronaldsay were brought forward to 16:00 or 14:00 as a result of anticipated visibility issues at North Ronaldsay, a situation which worsened in 2015/16.¹⁹ This can lead to significant disruption and uncertainty for those working on or visiting the mainland and vice versa.</p>																																																																								
4	Time on mainland	✓	<p>North Ronaldsay residents have the most time on the mainland out of all of the Outer North Isles given the flight times. Some islanders would like to see an additional 'middle of the day' flight in winter, so as to be able to undertake a half day rather than a full day on the mainland in the winter months.</p> <p>The time on mainland can be negatively affected by the last flight being brought forward to 16:00 or 14:00 during the winter – 1 to 3 hours on the mainland are lost on each day that the flight is brought forward.</p> <p>The hours ashore by timetable by mode are summarised in the table below and values are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th></th> <th colspan="8">North Ronaldsay-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Ferry - Winter</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Ferry - Refit</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Air - Summer</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>5</td> <td>6</td> <td>57</td> </tr> <tr> <td>Air - Winter</td> <td>8</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>5</td> <td>0</td> <td>48</td> </tr> <tr> <td>Air - Refit</td> <td>8</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>7</td> <td>0</td> <td>51</td> </tr> </tbody> </table> <p>The Refit timetable provides additional time on the mainland on a Saturday.</p>		North Ronaldsay-Time on Mainland									Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	0	0	0	0	0	0	0	0	Ferry - Winter	0	0	0	0	0	0	0	0	Ferry - Refit	0	0	0	0	0	0	0	0	Air - Summer	9	9	9	9	9	5	6	57	Air - Winter	8	9	9	9	9	5	0	48	Air - Refit	8	9	9	9	9	7	0	51
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5	Time in Kirkwall	✓	See point 4 – the hours in Kirkwall are very similar to the time on the mainland, although the interchange and time on the bus (for those using public transport) has to be taken into account.																																																																								
6	Time on island	✓	<p>As with time on mainland, it has been suggested that an additional 'middle of the day' flight would be of value for those only undertaking a half day of work on the island.</p> <p>The time on the island is reduced in the winter if the final North Ronaldsay rotation of the day is brought forward to a 14:00 or 16:00 departure from Kirkwall.</p> <p>The hours on island by timetable by mode are summarised in the table below and values are rounded up or down to the nearest whole hour:</p>																																																																								

¹⁹ In 2015, the flight was brought forward to 1600 between 26/10/15 – 10/11/15 and 19/01/16 – 14/02/16 and to 1400 between 11/11/15 and 18/01/16.

Service Characteristics	Rating	North Ronaldsay: Why is this a problem or not?								
		North Ronaldsay-Time on Island								
		Mo	Tu	We	Th	Fr	Sa	Su	Total	
		Ferry - Summer	0	0	0	0	0	0	0	0
		Ferry - Winter	0	0	0	0	0	0	0	0
		Ferry - Refit	0	0	0	0	0	0	0	0
		Air - Summer	10	10	10	10	10	6	7	63
		Air - Winter	9	10	10	10	10	6	0	53
		Air - Refit	9	10	10	10	10	8	0	55
		The services therefore provide more time on the island than time on the mainland.								
7	Frequency / Sailings per day / Timetable gaps	✘	<p>North Ronaldsay has the highest frequency air service of any Scottish island.</p> <p>However, the ferry only operates twice a week in summer and once a week in winter (although Orkney Ferries supplement the winter service with a chartered air freight service once per week, which transports perishables, chilled & frozen food and other emergency supplies and additional flights are chartered if sailings are disrupted).</p> <p>Furthermore, the highly constrained ferry berth in the island means that, in winter in particular, it can be several weeks between ferry calls. Whilst personal accessibility is maintained by the air service, the supply chain of the island can be negatively affected.</p> <p>A further issue is that the timetables have to align with the tides so sailings do not depart / arrive at the same time every day / week.</p>							
8	Capacity	✘	<p>The air service is limited to eight passengers which, in the absence of a reliable ferry service, places a hard constraint on the number of people who can travel to and from the island at any given time. However, it should be noted that the population of North Ronaldsay is low, and the 8-9 seats on the plane generally meet the island's needs at present (although there are occasion, particularly in the summer, where securing a seat on the plane can be challenging).</p> <p>Whilst the majority of North Ronaldsay's flights are direct, a handful are shared (via Eday or Papa Westray), which can impose a further limitation on capacity.</p> <p><i>Ad hoc</i> flights are operated to support special events in North Ronaldsay.</p>							
9	Reliability (weather / mechanical)	✘✘	<p>The ferry service is unreliable due to weather – the berth is exposed to swell and is tidally constrained, leading to sustained service outages, particularly during the winter months.</p> <p>The air service, which is the lifeline mode, is generally very reliable and can operate in most weather conditions (fog being the main problem). However, the last rotation of the day during winter is frequently brought forward to 14:00 or 16:00 as visibility restrictions prevent night landings.</p>							
10	Comfort	✘	<p>The ferry is lightly used by passengers so the facilities are broadly appropriate for the length of the crossing, if somewhat dated. The plane is also broadly appropriate given the short flight times, although the RSM survey picked up various complaints about the aircraft being cold during the winter months.</p>							
11	Physical access	✘✘✘	<p>Physical access to transport services is a problem in North Ronaldsay, particularly in light of the ageing population. Access to the ferry for the disabled can be challenging, whilst feedback from the NHS suggests an air passenger is only permitted on the plane if they can self-evacuate the aircraft.</p>							
12	Integration with PT (local bus)	✓	<p>The ferry travels into the heart of Kirkwall, whilst there is a relatively frequent bus service to and from Kirkwall Airport.</p>							
13	Integration with PT (strategic)	✘✘	<p>North Ronaldsay residents cannot connect with the first NorthLink or Pentland Ferries services (although they can get the 11:50 departure from St Margaret's Hope and the 11:00 NorthLink service from Stromness, which operates during the peak timetable). Residents also cannot catch the first flights to Aberdeen or Edinburgh, although they can make the first flights to Glasgow and Sumburgh. The first Inverness flight could possibly be connected with on Tuesday through Friday, although the timing is tight.</p> <p>They can however access the late night NorthLink sailings to Aberdeen and Lerwick on the</p>							

	Service Characteristics	Rating	North Ronaldsay: Why is this a problem or not?
			<p>days which this service operates via Kirkwall.</p> <p>The last flight to North Ronaldsay is generally before the last inbound flights and ferries to Orkney from the Scottish mainland and Shetland.</p> <p>Current strategic transport connectivity makes it difficult to undertake a day return to the Scottish mainland, leading to costly overnight stays.</p>
14	Crossing / flight time	✓	See point 1.
15	Onboard facilities	✗	The air service is appropriate to the journey length. Facilities on the ferry are dated but adequate and appropriate to a lifeline service, although of a lesser standard than found in other parts of Scotland.
16	Weekday / weekend service variation	✗✗	The Sunday flight from North Ronaldsay also calls at Sanday and Stronsay on request, so capacity on this flight is likely to be a problem.
17	Landside infrastructure issues	✗✗✗	<p>The ferry berth at North Ronaldsay is challenging to operate to and from. The berth is exposed, tidally constrained and the pier is marginally too short for the ONI vessels. North Ronaldsay is also a Lo-Lo port, which can make carrying anything other than passengers or small pieces of freight problematic. The constrained nature of this port means that the island can go extended periods without a ferry call.</p> <p>North Ronaldsay is the only airfield in the ONI network with precision runway lighting and a hardened cross-runway, but this has been of only limited effectiveness in supporting flying during the hours of darkness due to visibility and cloud base constraints.</p>
18	Landside human resources	✗✗✗	<p>Orkney Islands Council has successfully managed Rescue & Fire Fighting Services at its airfields but this will always be an ongoing challenge, particularly with an ageing population in North Ronaldsay.</p> <p>The ageing population also presents a challenge in terms of sustaining the ferry service. The difficult berthing conditions mean that able-bodied and fit linesmen are required to secure the vessel, which is likely to become an increasingly challenging requirement in the future.</p>

Table 4.2: Papa Westray Transport Problems

	Service Characteristics	Rating	Papa Westray: Why is this a problem or not?
1	Overall Journey Time to Kirkwall	✓	Whilst the direct ferry service from Papa Westray to Kirkwall takes around 105 minutes, the air service is defined as the lifeline mode. The direct flight time is 16 minutes and indirect flight time 23 minutes. There is a half hourly bus from Kirkwall airport, with a journey time of around 10-15 minutes.
2	First sailing / flight	✓	Papa Westray's flight schedule does not permit commuting to full time employment on Orkney mainland. However, the first flight does generally arrive in Kirkwall between 09:00 and 09:30 (although there are some later arrivals in the summer, typically 10:12), which is a reasonable start time for conducting personal business.
3	Last sailing / flight	✓	The last flight to Papa Westray typically arrives at 15:21 in winter and at 16:51 in summer, although with some daily variations.
4	Time on mainland	✓	The time ashore by timetable by mode is summarised in the table below and values are rounded up or down to the nearest whole hour:

	Service Characteristics	Rating	Papa Westray: Why is this a problem or not?																																																																								
			<table border="1"> <thead> <tr> <th colspan="9">Papa Westray-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Ferry - Winter</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Ferry - Refit</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Air - Summer</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>7</td> <td>5</td> <td>43</td> </tr> <tr> <td>Air - Winter</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>0</td> <td>35</td> </tr> <tr> <td>Air - Refit</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>4</td> <td>0</td> <td>33</td> </tr> </tbody> </table>	Papa Westray-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	0	0	0	0	0	0	0	0	Ferry - Winter	0	0	0	0	0	0	0	0	Ferry - Refit	0	0	0	0	0	0	0	0	Air - Summer	6	6	6	6	6	7	5	43	Air - Winter	6	6	6	6	6	6	0	35	Air - Refit	6	6	6	6	6	4	0	33
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5	Time in Kirkwall	✓	See point 4 – the hours in Kirkwall are similar, although the interchange time on the bus (for public transport users) has to be taken into account.																																																																								
6	Time on island	✓	<p>The hours on island by timetable by mode is summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Papa Westray-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Ferry - Winter</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Ferry - Refit</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Air - Summer</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>8</td> <td>6</td> <td>48</td> </tr> <tr> <td>Air - Winter</td> <td>7</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>7</td> <td>0</td> <td>39</td> </tr> <tr> <td>Air - Refit</td> <td>7</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>5</td> <td>0</td> <td>37</td> </tr> </tbody> </table> <p>The services therefore provide more time on the island than time on the mainland.</p>	Papa Westray-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	0	0	0	0	0	0	0	0	Ferry - Winter	0	0	0	0	0	0	0	0	Ferry - Refit	0	0	0	0	0	0	0	0	Air - Summer	7	7	7	7	7	8	6	48	Air - Winter	7	6	6	6	6	7	0	39	Air - Refit	7	6	6	6	6	5	0	37
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Air - Refit	7	6	6	6	6	5	0	37																																																																			
7	Frequency / Sailings per day / Timetable gaps	✓	<p>Whilst the ferry service is limited, the air service provides 3 services a day Monday to Thursday during the summer (two on other days), which typically reduces to two flights a day during winter. This is sufficient for carrying out personal business on the mainland. In addition, where there is a middle of the day flight in the summer, it permits a half day visit to the mainland.</p> <p>In the summer months, Papa Westray residents also have access to Westray (and in turn sailings from Westray to Kirkwall) using the Papa Westray – Pierowall passenger ferry service.</p>																																																																								
8	Capacity	xx	<p>The air service is limited to eight passengers which, in the absence of a reliable ferry service, places a hard constraint on the number of people who can travel to and from the island at any given time.</p> <p>The majority of Papa Westray's flights are shared with Westray on the inbound or outbound leg, which further limits capacity. <i>Ad hoc</i> flights are operated to support special events in Papa Westray.</p>																																																																								
9	Reliability (weather / mechanical)	xx	Whilst the berth at Papa Westray is better than that at North Ronaldsay, it is still somewhat exposed and prone to weather related disruption. However, the air service is generally reliable and, in the summer, the ferry connection via Westray provides an alternative to the Lo-Lo service.																																																																								
10	Comfort	x	The Lo-Lo ferry is lightly used so the facilities are broadly appropriate for the length of the crossing, if somewhat dated. The plane is also broadly appropriate. The MV <i>Golden Mariana</i> which links Papa Westray and Westray is an old vessel and in need of replacement.																																																																								
11	Physical access	xxx	Physical access is a problem in Papa Westray. Access to the passenger vessel, the MV <i>Golden Mariana</i> , is particularly challenging, whilst feedback from the NHS suggests an air passenger is only permitted on the plane if they can self-evacuate the aircraft.																																																																								
12	Integration with	✓	The ferry travels into the heart of Kirkwall, whilst there is also a relatively frequent bus service																																																																								

	Service Characteristics	Rating	Papa Westray: Why is this a problem or not?
	PT (local bus)		to and from Kirkwall Airport. The seasonal foot passenger ferry to Westray travels to one of the more populous areas of the island and there are public bus services on the island that specifically connect with Rapness, where the ferry to Kirkwall departs.
13	Integration with PT (strategic)	xxx	Papa Westray's strategic transport integration is limited. It is not possible to catch either the first NorthLink or Pentland Ferries departures, although the 11:50 Pentland departure and the 11:00 NorthLink service from Stromness, which operates during the peak timetable, are accessible. Papa Westray residents cannot catch the first flights to Aberdeen, Edinburgh or Inverness, although they can catch the first flights to Glasgow and Sumburgh. They can however access the late night NorthLink sailings to Aberdeen and Lerwick on the days which this service operates via Kirkwall. The evening ferry and air arrivals to Orkney from the Scottish mainland arrive too late for onward connections to Papa Westray. Trips to the Scottish mainland therefore require at least one off-island overnight stay.
14	Crossing / flight time	✓	See point 1.
15	Onboard facilities	x	The air service is appropriate to the journey length. Facilities on the ferry are dated but adequate and appropriate to a lifeline service, although of a lesser standard than found in other parts of Scotland.
16	Weekday / weekend service variation	xx	The Sunday flight from Papa Westray also travels via Westray so capacity on this flight is likely to be an issue.
17	Landside infrastructure issues	xx	The Lo-Lo berth at Papa Westray is relatively exposed and access to the vessel is poor, with only a narrow gangway provided.
18	Landside human resources	✓	Whilst Papa Westray will face the same longer term challenges as other islands in terms of maintaining Rescue & Fire Fighting Services and linesmen for the ferry, there is no suggestion of an immediate problem surrounding such provision.

Table 4.3: Westray Transport Problems

	Service Characteristics	Rating	Westray: Why is this a problem or not?
1	Overall Journey Time to Kirkwall	x	The journey by ferry from Westray takes 85 minutes which is deemed to be acceptable, although marginally longer than journey times for equivalent distances in other parts of Scotland. However, the direct flight from Westray takes only 16 minutes, whilst the indirect flight via Papa Westray takes 23 minutes.
2	First sailing / flight	x	The ferry is the lifeline mode for the island, particularly given that Westray is the most freight intensive island in the network. The first ferry does not depart the island until 09:00, which means that the first arrival into Kirkwall is not until 10:25. This can limit interaction with the mainland and can lead to problems for businesses, e.g. late arrival into the marts.
3	Last sailing / flight	✓	The last ferry generally departs at 16:20 and the last flight at 15:00 (winter) and 16:30 (summer). There are minor variations by day in summer and winter. However, it should be noted that the long layover for school children on a Friday is seen as a problem, truncating an already short weekend.
4	Time on mainland	✓	The hours ashore by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:

Service Characteristics	Rating	Westray: Why is this a problem or not?																																																																									
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Air - Refit	6	6	6	6	6	4	0	33																																																																			
5	Time in Kirkwall	✓	See point 4 above.																																																																								
6	Time on island	✓	<p>The time on island is generally felt to be adequate. The hours on island by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Westray-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>7</td> <td>6</td> <td>9</td> <td>9</td> <td>10</td> <td>9</td> <td>7</td> <td>58</td> </tr> <tr> <td>Ferry - Winter</td> <td>9</td> <td>9</td> <td>9</td> <td>6</td> <td>9</td> <td>9</td> <td>0</td> <td>55</td> </tr> <tr> <td>Ferry - Refit</td> <td>9</td> <td>9</td> <td>9</td> <td>6</td> <td>9</td> <td>0</td> <td>0</td> <td>43</td> </tr> <tr> <td>Air - Summer</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>0</td> <td>0</td> <td>36</td> </tr> <tr> <td>Air - Winter</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>0</td> <td>0</td> <td>33</td> </tr> <tr> <td>Air - Refit</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>5</td> <td>0</td> <td>38</td> </tr> </tbody> </table> <p>The transport connections to Westray therefore provide more time on the island than time on the mainland, whilst it is also possible to make a day return trip to Westray on a summer Sunday. Additional air services on a Saturday replace the ferries during refit.</p>	Westray-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	7	6	9	9	10	9	7	58	Ferry - Winter	9	9	9	6	9	9	0	55	Ferry - Refit	9	9	9	6	9	0	0	43	Air - Summer	7	7	7	7	7	0	0	36	Air - Winter	7	7	7	7	7	0	0	33	Air - Refit	7	7	7	7	7	5	0	38
Westray-Time on Island																																																																											
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Air - Refit	7	7	7	7	7	5	0	38																																																																			
7	Frequency / Sailings per day / Timetable gaps	xx	Westray is the most populous and freight intensive island on the network, requiring relatively frequent connections. During the summer timetable, there is a regular 'middle boat' from the island which does not run during the winter. This can lead to capacity constraints on this busy route (see below).																																																																								
8	Capacity	xxx	<p>The capacity data provided by Orkney Ferries suggests that capacity constraints are a significant factor on Westray sailings to the extent that they are constraining the growth of the island economy.</p> <p>As the island generates significant volumes of freight, a small number of commercial vehicles can quickly lead to deadweight constraints on the vessel whilst vehicle deck space remains available. Data from Orkney Ferries shows that the Westray route, despite generally being direct (i.e. not shared), generates the largest number of standbys. The gap between sailings further amplifies this problem – bookings are essential on busy sailings, which can make discretionary travel a challenge at times.</p> <p>The air service is also capacity constrained, particularly because most flights are shared with Papa Westray, where the air service is the lifeline mode. Booking of itinerant teachers also reduces the amount of available capacity for the community.</p> <p><i>The community consultation response reiterated that capacity, particularly on the ferry, is a major problem which is constraining the economy of Westray.</i></p>																																																																								
9	Reliability (weather /	x	There are no major reliability issues on this route but the consultation and data suggests that mechanical problems with the vessels are becoming more frequent as they get older.																																																																								

	Service Characteristics	Rating	Westray: Why is this a problem or not?
	mechanical)		
10	Comfort	✘	The facilities on the ferry are broadly appropriate for the length of the crossing, if somewhat dated. The plane is also broadly appropriate.
11	Physical access	✘✘	Physical access is a problem. The MV <i>Varagen</i> has disabled facilities but the two <i>Earls</i> are more limited in this respect. Feedback from the NHS suggests an air passenger is only permitted on the plane if they can self-evacuate the aircraft.
12	Integration with PT (local bus)	✓	The ferry travels into the heart of Kirkwall, whilst there is a relatively frequent bus service to and from Kirkwall Airport. There is also a bus service which meets the arrival/departure of the ferry in Westray.
13	Integration with PT (strategic)	✘✘	<p>Westray's strategic transport integration is limited and best accessed via the air service. It is not possible to catch either the first NorthLink or Pentland Ferries departures, although the 11:50 Pentland departure is accessible. Westray residents cannot catch the first flights to Aberdeen, Edinburgh or Inverness, although they can catch the first flights to Glasgow and Sumburgh. They can however access the late night NorthLink sailings to Aberdeen and Lerwick on the days which this service operates via Kirkwall. The evening ferry and air arrivals to Orkney from the Scottish mainland arrive too late for onward connections to Westray. Trips to the Scottish mainland therefore require at least one off-island overnight stay.</p> <p>Freight integration is also limited given that a Westray haulier could not have goods on the Scottish mainland (Caithness) until almost 13:00.</p> <p><i>The community consultation response noted that the timings of connections from Westray make it very challenging to connect with the peak timetable 1100 departure from Stromness (to the extent that residents generally do not try). The strategic air connectivity is seen to be poor.</i></p>
14	Crossing / flight time	✘	See point 1
15	Onboard facilities	✘	The air service is appropriate to the journey length. Facilities on the ferry are dated but adequate and appropriate to a lifeline service, although of a lesser standard than found elsewhere in Scotland.
16	Weekday / weekend service variation	✘✘	<p>The weekday and Saturday timetables are relatively similar (although there is no middle of the day sailing on a summer Saturday when such a sailing operates on all weekdays).</p> <p>It is not possible to make a meaningful day return trip to the mainland or the island on a Sunday during the winter. A day return trip can be made to the island but not the mainland by ferry on a summer Sunday.</p> <p>Combining air and ferry services on a summer Sunday does allow for a very short afternoon trip to the mainland, although there would be cost / ticket interchangeability issues. Day return services by air are available on all weekdays.</p>
17	Landside infrastructure issues	✓	Landside infrastructure in Westray is broadly fit for purpose but the ferry can lie over in the island only in calm conditions hence not during the winter months.
18	Landside human resources	✓	As a more populous island, Westray manages the challenges of landside human resources appropriately.

Table 4.4: Sanday Transport Problems

	Service Characteristics	Rating	Sanday: Why is this a problem or not?
1	Overall Journey Time to Kirkwall	✘✘	<p>The direct journey time from Sanday to Kirkwall is 85 minutes, which is deemed to be acceptable, although marginally longer than journey times for equivalent distances in other parts of Scotland. However, indirect connections via Stronsay (+55 minutes, Saturday only) and Eday (+20 minutes) add significantly to journey times. This is a particularly key issue during the refit timetable when the majority of services are indirect, shared with both Eday and Stronsay.</p> <p>The flight times are seen to be reasonable at 14 minutes direct and 22 minutes indirect.</p>

	Service Characteristics	Rating	Sanday: Why is this a problem or not?																																																																								
2	First sailing / flight	xx	<p>The first ferry departure does not typically allow Sanday residents to get to Kirkwall until mid-morning (except on summer Mondays and Wednesdays), whilst the variation in this departure time over the week would present a challenge for any user unfamiliar with the timetable.</p> <p>The first flight from Sanday also departs later than from North Ronaldsay, although it does still permit a mainland arrival pre-09:30 on most days of the week, summer and winter.</p>																																																																								
3	Last sailing / flight	x	<p>The last ferry generally departs at 15:20 in the winter and 16:40 in the summer. The last weekday flight in summer is typically 15:44, leaving slightly earlier in the winter.</p> <p>However, it should be noted that the long layover for school children on a Friday is seen as a Problem, truncating an already short weekend.</p>																																																																								
4	Time on mainland	xx	<p>The hours ashore by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Sanday-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>7</td> <td>6</td> <td>8</td> <td>4</td> <td>3</td> <td>6</td> <td>0</td> <td>34</td> </tr> <tr> <td>Ferry - Winter</td> <td>5</td> <td>4</td> <td>5</td> <td>5</td> <td>4</td> <td>4</td> <td>0</td> <td>26</td> </tr> <tr> <td>Ferry - Refit</td> <td>4</td> <td>4</td> <td>4</td> <td>5</td> <td>3</td> <td>0</td> <td>0</td> <td>19</td> </tr> <tr> <td>Air - Summer</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>0</td> <td>0</td> <td>31</td> </tr> <tr> <td>Air - Winter</td> <td>5</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>0</td> <td>0</td> <td>30</td> </tr> <tr> <td>Air - Refit</td> <td>5</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>4</td> <td>0</td> <td>34</td> </tr> </tbody> </table> <p>It is therefore not possible to make a day trip to the mainland from Sanday on a Sunday. Additional air services on a Saturday replace the ferries during refit.</p>	Sanday-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	7	6	8	4	3	6	0	34	Ferry - Winter	5	4	5	5	4	4	0	26	Ferry - Refit	4	4	4	5	3	0	0	19	Air - Summer	6	6	6	6	6	0	0	31	Air - Winter	5	6	6	6	6	0	0	30	Air - Refit	5	6	6	6	6	4	0	34
Sanday-Time on Mainland																																																																											
	Mo	Tu	We	Th	Fr	Sa	Su	Total																																																																			
Ferry - Summer	7	6	8	4	3	6	0	34																																																																			
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Air - Summer	6	6	6	6	6	0	0	31																																																																			
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Air - Refit	5	6	6	6	6	4	0	34																																																																			
5	Time in Kirkwall	xx	See point 4 above.																																																																								
6	Time on island	✓	<p>The time on island is generally felt to be adequate. The hours on island by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Sanday-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>6</td> <td>0</td> <td>6</td> <td>8</td> <td>6</td> <td>9</td> <td>7</td> <td>42</td> </tr> <tr> <td>Ferry - Winter</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>7</td> <td>9</td> <td>0</td> <td>47</td> </tr> <tr> <td>Ferry - Refit</td> <td>8</td> <td>9</td> <td>8</td> <td>9</td> <td>6</td> <td>0</td> <td>0</td> <td>40</td> </tr> <tr> <td>Air - Summer</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>0</td> <td>0</td> <td>34</td> </tr> <tr> <td>Air - Winter</td> <td>6</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>0</td> <td>0</td> <td>33</td> </tr> <tr> <td>Air - Refit</td> <td>6</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>5</td> <td>0</td> <td>38</td> </tr> </tbody> </table> <p>The transport connections to Sanday therefore provide more time on the island than time on the mainland, whilst it is also possible to make a day return trip to Sanday on a summer Sunday. Additional air services on a Saturday replace the ferries during refit.</p>	Sanday-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	6	0	6	8	6	9	7	42	Ferry - Winter	8	8	8	8	7	9	0	47	Ferry - Refit	8	9	8	9	6	0	0	40	Air - Summer	7	7	7	7	7	0	0	34	Air - Winter	6	7	7	7	7	0	0	33	Air - Refit	6	7	7	7	7	5	0	38
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Ferry - Summer	6	0	6	8	6	9	7	42																																																																			
Ferry - Winter	8	8	8	8	7	9	0	47																																																																			
Ferry - Refit	8	9	8	9	6	0	0	40																																																																			
Air - Summer	7	7	7	7	7	0	0	34																																																																			
Air - Winter	6	7	7	7	7	0	0	33																																																																			
Air - Refit	6	7	7	7	7	5	0	38																																																																			
7	Frequency / Sailings per day / Timetable gaps	xx	<p>Sanday is the second most populous and freight intensive island in the ONI, requiring relatively frequent connections. The frequency of the service is seen to be broadly appropriate but connections can be lost to capacity issues (see below).</p> <p>The frequency of direct connections during the refit timetable is significantly reduced. This is a major challenge for the island as both frequency and capacity are reduced.</p>																																																																								
8	Capacity	xxx	<p>The capacity data provided by Orkney Ferries suggest that ferry capacity constraints, although not as severe as on Westray, are a significant factor on Sanday, to the extent that they are constraining the growth of the island economy. Sanday's vessel is often shared with other islands, which reduces the effective capacity on any given sailing. As the island is amongst</p>																																																																								

	Service Characteristics	Rating	Sanday: Why is this a problem or not?
			<p>the larger freight generators on the network, a small number of commercial vehicles can quickly lead to deadweight constraints on the vessel, when vehicle deck space is still available. Data from Orkney Ferries shows that the Sanday route generates the third largest number of standbys. The gap between sailings and frequent indirect connections via Eday and occasionally Stronsay further amplifies this problem – bookings are essential on busy sailings, making discretionary travel a challenge at times.</p> <p>The air service is also highly capacity constrained, particularly the first flight out from and last flight back to Kirkwall. This is because the Sanday / Stronsay route is the most itinerant teacher intensive route on the network, with some flights being almost fully utilised by teachers.</p>
9	Reliability (weather / mechanical)	✘	There are no major reliability issues on this route but the consultation and data suggests that mechanical problems with the vessels are becoming more frequent as they get older.
10	Comfort	✘	The facilities on the ferry are broadly appropriate for the length of the crossing, if somewhat dated. The plane is also broadly appropriate.
11	Physical access	✘✘	Physical access is a problem. The MV <i>Varagen</i> has disabled facilities but the two <i>Earls</i> , which are generally operated on this route, are more limited in this respect. Feedback from the NHS suggests an air passenger is only permitted on the plane if they can self-evacuate the aircraft.
12	Integration with PT (local bus)	✓	<p>The ferry travels into the heart of Kirkwall, whilst there is a relatively frequent bus service to and from Kirkwall Airport.</p> <p>Sanday also has a public bus service on the island to connect with the arrival / departure of the ferries.</p>
13	Integration with PT (strategic)	✘✘✘	<p>Sanday's strategic transport integration is limited and best accessed via the inter-island air service. It is not possible to catch either the first NorthLink or Pentland Ferries departures, although the 11:50 Pentland departure is generally accessible. The 11:00 NorthLink departure from Stromness, which operates during the peak timetable, is also accessible. Freight integration is limited given that, on most days, a Sanday haulier could not have goods on the Scottish mainland (Caithness) until almost 13:00 (and it is also worth noting that making the 11:50 Pentland departure from St Margaret's Hope is not guaranteed on all days given arrival times into Kirkwall).</p> <p>Sanday residents cannot catch the first flights to Aberdeen, Edinburgh or Inverness, although they can catch the first flights to Glasgow and Sumburgh. They can however access the late night NorthLink sailings to Aberdeen and Lerwick on the days which this service operates via Kirkwall.</p> <p>The evening ferry and air arrivals to Orkney from the Scottish mainland arrive too late for onward connections to Sanday. Trips to the Scottish mainland therefore require at least one off-island overnight stay.</p>
14	Crossing / flight time	✘	See point 1
15	Onboard facilities	✘	The air service is appropriate to the journey length. Facilities on the ferry are dated but adequate and appropriate to a lifeline service, although of a lesser standard than found in other parts of Scotland.
16	Weekday / weekend service variation	✘✘	The weekday and Saturday timetables are relatively similar, although it is not possible to make a meaningful day return trip to the mainland or the island on a winter Sunday. A day return to the island on a Sunday is possible during the summer timetable but a day return to the mainland is still not possible.
17	Landside infrastructure issues	✓	Landside infrastructure in Sanday is broadly fit for purpose and the ferry can lie over in the island in calm conditions.
18	Landside human resources	✓	As a more populous island, Sanday manages the challenges of landside human resources appropriately.

Table 4.5: Stronsay Transport Problems

	Service Characteristics	Rating	Stronsay: Why is this a problem or not?
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	Service Characteristics	Rating	Stronsay: Why is this a problem or not?																																																																						
1	Overall Journey Time to Kirkwall	xx	<p>The direct journey time from Stronsay to Kirkwall is timetabled as 95 minutes. This is a relatively long journey time, caused principally by the current position of the ferry terminal on the north-east of the island. On other routes, the terminal is located in a way that generally achieves the shortest crossing distance / time to Kirkwall. This is, uniquely, not the case for Stronsay. The extended journey times impact both on this island and the wider Outer North Isles network. Indirect connections via Eday (+30 minutes) also add significantly to journey times. This is a particularly key issue during the refit timetable when the majority of services are shared with both Sanday and Eday.</p> <p>The difficult approach to the harbour at Stronsay has an impact on keeping to timetabled times.</p> <p>The flight times are seen to be reasonable at 11 minutes direct and 25 minutes indirect.</p>																																																																						
2	First sailing / flight	xx	<p>The first ferry departure does not typically allow Stronsay residents to get to Kirkwall until mid-morning (except on winter Wednesdays and Fridays & summer Fridays when the vessel overnights in the island and departs early in the morning), whilst the variation in this departure time over the week would present a challenge for any user unfamiliar with the timetable.</p> <p>The first flight from Stronsay also typically departs later than from North Ronaldsay, Papa Westray and Westray.</p>																																																																						
3	Last sailing / flight	✓	<p>During the summer and winter, the last ferry to Stronsay generally departs at 16:00 on weekdays (15:00 on a winter Monday & Friday), with the last flight generally departing Kirkwall at 15:30 in summer and 15:10 in winter.</p> <p>However, it should be noted that the long layover for school children on a Friday is seen as a Problem, truncating an already short weekend.</p>																																																																						
4	Time on mainland	xx	<p>The length of time on the mainland can be extended by taking the first flight to the mainland and last ferry back to the island, although this has ticket interchangeability and cost issues.</p> <p>The hours ashore by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="7">Stronsay-Time on Mainland</th> <th rowspan="2">Total</th> </tr> <tr> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>6</td> <td>6</td> <td>5</td> <td>5</td> <td>6</td> <td>5</td> <td>0</td> <td>33</td> </tr> <tr> <td>Ferry - Winter</td> <td>4</td> <td>5</td> <td>5</td> <td>5</td> <td>6</td> <td>4</td> <td>0</td> <td>31</td> </tr> <tr> <td>Ferry - Refit</td> <td>4</td> <td>4</td> <td>4</td> <td>0</td> <td>6</td> <td>0</td> <td>0</td> <td>18</td> </tr> <tr> <td>Air - Summer</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>0</td> <td>0</td> <td>31</td> </tr> <tr> <td>Air - Winter</td> <td>5</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>0</td> <td>0</td> <td>30</td> </tr> <tr> <td>Air - Refit</td> <td>5</td> <td>6</td> <td>6</td> <td>6</td> <td>6</td> <td>4</td> <td>0</td> <td>34</td> </tr> </tbody> </table> <p>It is therefore not possible to make a day trip to the mainland from Stronsay on a Sunday. Additional air services on a Saturday replace the ferries during refit.</p> <p><i>The community consultation response noted that time available on the mainland is a major problem for Stronsay residents, particularly during refit period. It was further noted that too short a period on mainland is provided on winter Saturdays.</i></p>		Stronsay-Time on Mainland							Total	Mo	Tu	We	Th	Fr	Sa	Su	Ferry - Summer	6	6	5	5	6	5	0	33	Ferry - Winter	4	5	5	5	6	4	0	31	Ferry - Refit	4	4	4	0	6	0	0	18	Air - Summer	6	6	6	6	6	0	0	31	Air - Winter	5	6	6	6	6	0	0	30	Air - Refit	5	6	6	6	6	4	0	34
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Ferry - Summer	6	6	5	5	6	5	0	33																																																																	
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5	Time in Kirkwall	xx	See point 4 above.																																																																						
6	Time on island	✓	The time on island is generally felt to be adequate. The hours on island by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:																																																																						

	Service Characteristics	Rating	Stronsay: Why is this a problem or not?								
			Stronsay-Time on Island								
			Mo	Tu	We	Th	Fr	Sa	Su	Total	
			Ferry - Summer	7	9	10	0	0	9	7	41
			Ferry - Winter	9	0	0	0	0	8	0	23
			Ferry - Refit	10	7	9	0	0	0	0	26
			Air - Summer	7	7	7	7	7	0	0	36
			Air - Winter	6	7	7	7	7	0	0	34
			Air - Refit	6	7	7	7	7	5	0	38
			<p>The transport connections to Stronsay therefore provide more time on the island than time on the mainland, and it is possible to make a day trip to Stronsay on a summer Sunday. Additional air services on a Saturday replace the ferries during refit. Day trips to Stronsay by ferry cannot be made on Thursdays (there is an early morning departure to Stronsay but no day return) and Fridays in summer and Tuesday to Friday in winter.</p>								
7	Frequency / Sailings per day / Timetable gaps	✓	<p>The frequency of this service is seen to be broadly appropriate, although the turnaround time for the island haulier on the mainland is relatively tight on most days.</p> <p><i>The community consultation response noted that this is seen as a moderate to severe problem, particularly during the winter timetable. The response noted that the island requires more frequent connections over the piece.</i></p>								
8	Capacity	✖✖	<p>The ferry capacity issues on Stronsay are not as marked as those experienced in Sanday and Westray, although capacity problems do still emerge from time to time, particularly on indirect sailings via Eday. The air service is however highly capacity constrained, particularly the first flight out from and last flight back to Kirkwall. This is because the Stronsay / Sanday route is the most itinerant teacher intensive route on the network, with some flights being almost fully utilised by teachers.</p> <p><i>The community consultation response noted that capacity should be seen as a 'major' rather than a 'moderate' problem, particularly during the refit timetable, where Stronsay is linked with both Eday and Sanday. This is seen to be particularly detrimental for the haulier, who can struggle to get vehicles away. It was also noted that aircraft capacity is particularly problematic, with itinerant teachers taking up much of the available capacity on the air service.</i></p>								
9	Reliability (weather / mechanical)	✖	<p>There are no major reliability issues on this route but the consultation and data suggests that mechanical problems with the vessels are becoming more frequent as they get older.</p> <p><i>The community consultation response noted that reliability is a moderate rather than minor problem. It was noted that the ageing vessels are becoming less reliable.</i></p>								
10	Comfort	✖	<p>The facilities on the ferry are broadly appropriate for the length of the crossing, if somewhat dated. The plane is also broadly appropriate.</p>								
11	Physical access	✖✖	<p>Physical access is a problem. The MV <i>Varagen</i> has disabled facilities but the two <i>Earls</i>, which are the usual vessels on this route, are more limited in this respect.</p> <p>Feedback from the NHS suggests an air passenger is only permitted on the plane if they can self-evacuate the aircraft.</p>								
12	Integration with PT (local bus)	✓	<p>The ferry travels into the heart of Kirkwall, whilst there is a relatively frequent bus service (for public transport users) to and from Kirkwall Airport.</p> <p><i>The community consultation response noted that this aspect of connectivity should be seen as a problem. It was noted that the airport bus does not always wait for plane arrivals and that the airport bus shelter is in a very exposed position, especially when the weather is bad (although it should be noted that there is a bus every 30 minutes and that passengers can wait in the terminal, which is only 30 yards away). It was noted that, if passengers are sheltering in the main airport building and not in the bus shelter, the bus does not stop and drives on without waiting to see if there are any passengers.</i></p>								
13	Integration with PT (strategic)	✖✖✖	<p>Stronsay's strategic transport integration is limited and best accessed via the air service. It is not possible to catch either the first NorthLink or Pentland Ferries departures, although the 11:50 Pentland Ferries departure is accessible (although for those taking the ferry, they would</p>								

	Service Characteristics	Rating	Stronsay: Why is this a problem or not?
			likely need a car on certain days to make this connection). The 11:00 NorthLink departure from Stromness, which operates during peak season, can be accessed by Stronsay residents using the air service (Tuesday – Friday) and the ferry on a Friday (and potentially on other weekdays but the connection times are tight). Stronsay residents cannot catch the first flights to Aberdeen, Edinburgh or Inverness, although they can catch the first flights to Glasgow and Sumburgh. They can however access the late night NorthLink sailings to Aberdeen and Lerwick on the days which this service operates via Kirkwall. The evening ferry and air arrivals to Orkney from the Scottish mainland arrive too late for onward connections to Stronsay. Trips to the Scottish mainland therefore require at least one off-island overnight stay.
14	Crossing / flight time	✘	See point 1 <i>The community consultation response noted that the ferry crossing times are a moderate to major problem, particularly on indirect sailings / during refit timetable.</i>
15	Onboard facilities	✘	The air service is appropriate to the journey length. Facilities on the ferry are dated but adequate and appropriate to a lifeline service, although of a lesser standard than found in other parts of Scotland. <i>The community consultation response noted that the onboard café on the MV Varagen is not open for long enough on longer crossings.</i>
16	Weekday / weekend service variation	✘✘	The weekday and Saturday timetables are relatively similar, although it is not possible to make a meaningful day return trip to the mainland or the island on a winter Sunday. A day return to the island on a Sunday is possible during the summer timetable but a day return to the mainland is still not possible. Connections to the island drop off significantly in winter. <i>The community consultation response identified the current weekend service provision as a major problem for the island.</i>
17	Landside infrastructure issues	✘✘	The location of Stronsay pier in the north east of the island adds to journey times.
18	Landside human resources	✓	With a relatively small population, managing the long-term human resource needs of the air and ferry services will present a challenge. However, there have been no specific problems in Stronsay identified in the baselining. <i>The community consultation response noted that there is no difficulty recruiting ferry workers but that there are increasing problems in recruiting airfield staff.</i>

Table 4.6: Eday Transport Problems

	Service Characteristics	Rating	Eday: Why is this a problem or not?
1	Overall Journey Time to Kirkwall	✘	The direct journey time from Eday to Kirkwall is 75 minutes, which is deemed to be acceptable, although marginally longer than journey times for equivalent distances in other parts of Scotland. Whilst the majority of connections are direct, indirect connections via Sanday (+40 minutes) and Stronsay (+65 minutes) add very significantly to journey times. This is a particular issue during refit period, particularly given Eday's lack of a meaningful air service. Journey times to and from Eday can be significantly extended in poor weather, when the vessel transits via Eday Sound. <i>The community consultation response noted that inter-island travel is also important for Eday. The haulage needs of the island are served from Stronsay, whilst there is an aspiration for children to be able to attend Sanday Junior High School.</i>
2	First sailing / flight	✘✘	The first sailing from Eday does not depart until after 09:00 except on a winter Wednesday and Friday and a summer Friday, which means that the first arrival into Kirkwall is not until mid-morning. This can limit interaction with the mainland and can lead to problems for businesses, e.g. late arrival into the marts. With the exception of a Tuesday and Friday, no sailings depart Eday before 10:00 on weekdays during the refit timetable.

	Service Characteristics	Rating	Eday: Why is this a problem or not?																																																																								
			The lack of a Monday morning ferry to allow children to get to KGS for the start of the school week is seen as a major problem amongst the community (driven principally by the lack of a Junior High in Eday). Their view is that the children having to leave the island on a Sunday night for school is undermining the long-term sustainability of the island community (although note that this is a broadly common issue across the Outer North Isles).																																																																								
3	Last sailing / flight	✘	The last sailing time is seen to be broadly acceptable, although the long layover for schoolchildren on a Friday is seen as a problem, truncating an already short weekend.																																																																								
4	Time on mainland	✘✘✘	<p>Eday has the least amount of time on Orkney mainland of all of the islands within the archipelago. As the small number of flights from the island is predominantly for use by school children, the ferry is the dominant mode of travel for Eday residents.</p> <p>A day return to Eday by air is only available on a Wednesday and the time varies between term-time and school holidays.</p> <p>The hours ashore by timetable by mode are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Eday-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>6</td> <td>6</td> <td>5</td> <td>5</td> <td>6</td> <td>5</td> <td>0</td> <td>33</td> </tr> <tr> <td>Ferry - Winter</td> <td>4</td> <td>4</td> <td>5</td> <td>5</td> <td>6</td> <td>4</td> <td>0</td> <td>29</td> </tr> <tr> <td>Ferry - Refit</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>6</td> <td>0</td> <td>0</td> <td>22</td> </tr> <tr> <td>Air - Summer</td> <td>0</td> <td>0</td> <td>6</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>6</td> </tr> <tr> <td>Air - Winter</td> <td>0</td> <td>0</td> <td>5</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>5</td> </tr> <tr> <td>Air - Refit</td> <td>0</td> <td>0</td> <td>7</td> <td>0</td> <td>0</td> <td>7</td> <td>0</td> <td>14</td> </tr> </tbody> </table> <p>Notes: - Wednesday Air Winter & Refit, 5 hours October to mid-January and 6 hours mid-January to March - Wednesday Air Summer, 9 hours during school holidays - Saturday flights replace Saturday ferries during refit. A day trip to the mainland cannot be made on a Sunday.</p>	Eday-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	6	6	5	5	6	5	0	33	Ferry - Winter	4	4	5	5	6	4	0	29	Ferry - Refit	4	4	4	4	6	0	0	22	Air - Summer	0	0	6	0	0	0	0	6	Air - Winter	0	0	5	0	0	0	0	5	Air - Refit	0	0	7	0	0	7	0	14
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7	Frequency /	✘✘✘	When considering combined air and ferry connectivity, Eday is the most poorly served island																																																																								

	Service Characteristics	Rating	Eday: Why is this a problem or not?
	Sailings per day / Timetable gaps		<p>in the Orkney archipelago. With only 16 connections per week (summer timetable), the island lags the other Outer North Isles and the Inner and South Isles where the direct and indirect crossing times are much shorter.</p> <p>Eday's low service frequency significantly disadvantages the island <i>vis a vis</i> other islands. In particular, Eday only gets one return flight per week (on a Wednesday, with the Monday service established for use by school children and shared with North Ronaldsay). An additional return air service is provided on a Saturday during the refit period.</p> <p><i>The community consultation response cited that the once per week air service to Eday is a major problem for the island. The lack of air connections severely limits the benefits of having air connectivity.</i></p>
8	Capacity	xx	<p>The ferry capacity issues on Eday are not as marked as those experienced in Sanday and Westray, although capacity problems do still emerge from time to time, particularly on indirect sailings to / from Eday (especially when services are shared with Sanday). The (term time only) Monday AM air connection to Kirkwall is severely capacity restricted as the flight starts from North Ronaldsay and any remaining seats are only made available to Eday residents at 1500 on the Sunday before the flight.</p>
9	Reliability (weather / mechanical)	x	<p>There are no major reliability issues on this route but the consultation and data suggests that mechanical problems with the vessels are becoming more frequent as they get older. Journey times to and from Eday can be significantly extended in poor weather when the vessel transits via Eday Sound.</p> <p><i>The community consultation response noted that reliability and punctuality are both problems, particularly during refit timetable.</i></p>
10	Comfort	x	<p>The facilities on the ferry are broadly appropriate for the length of the crossing, if somewhat dated.</p>
11	Physical access	xx	<p>Physical access is a problem. The MV <i>Varagen</i> has disabled facilities but the two <i>Earls</i> are more limited in this respect.</p> <p><i>The community consultation response noted that the MV Varagen can be used on the morning outbound leg with one of the Earls being used on the afternoon return (or vice versa) meaning that appropriate disabled facilities are only available in one direction.</i></p> <p><i>It was further noted that the waiting room at Eday is a long walk from the linkspan and that the vessels have a number of awkward / dangerous steps, stiff doors etc. It was explained that these can present difficulties for passengers with even slight mobility concerns or indeed pregnant women. An example in relation to one of the Earls was given, whereby it was explained that pregnant woman cannot sit at a table in the café.</i></p> <p><i>It was further noted that the seats for people who cannot get up or down the stairs are at the entrance to the staff quarters, which can be a busy and draughty corridor. There is also no play area for young children, which is seen as a problem given the length of crossings.</i></p>
12	Integration with PT (local bus)	✓	<p>The ferry travels into the heart of Kirkwall, whilst there is a relatively frequent bus service to and from Kirkwall Airport. A one day per week public bus service operates on the island to connect with the arrival / departure of the ferry.</p>
13	Integration with PT (strategic)	xxx	<p>Eday's strategic transport integration is limited. It is not possible to catch either the first NorthLink or Pentland Ferries departures, although the 11:50 Pentland departure is accessible (although for those taking the ferry, they would likely need a car on certain days to make this connection). The 11:00 NorthLink departure from Stromness, which operates during the peak timetable, can be accessed from Eday by air on a Wednesday and ferry on a Friday (and potentially on a Monday, although the connection time would be very tight).</p> <p>Eday residents cannot catch the first flights to Aberdeen, Edinburgh or Inverness, although they can catch the first flights to Glasgow and Sumburgh. They can however access the late night NorthLink sailings to Aberdeen and Lerwick on the days which this service operates via Kirkwall. The evening ferry and air arrivals to Orkney from the Scottish mainland arrive too late for onward connections to Eday.</p> <p>Trips to the Scottish mainland therefore require at least one off-island overnight stay.</p>
14	Crossing / flight time	x	See point 1
15	Onboard facilities	x	The air service is appropriate to the journey length. Facilities on the ferry are dated but

	Service Characteristics	Rating	Eday: Why is this a problem or not?
			adequate and appropriate to a lifeline service, although of a lesser standard than found in other parts of Scotland.
16	Weekday / weekend service variation	xx	The weekday and Saturday timetables are relatively similar, although it is not possible to make a meaningful day return trip to the mainland or the island on a Sunday. <i>The community consultation response highlighted the severity of this problem for Eday. It was noted that, during winter, it is not possible to make a meaningful day trip to Kirkwall on a Saturday given the length of the crossing in each direction.</i>
17	Landside infrastructure issues	✓	The landside infrastructure is seen to be broadly fit for purpose. <i>The community consultation response noted that the landside infrastructure is not for fit purpose, particularly given the recent structural issues which emerged in early 2016. It is also noted that there are inadequate waiting facilities at Eday and nowhere to stand at the linkspan in bad weather.</i>
18	Landside human resources	✓	With a relatively small population, managing the long-term human resource needs of the ferry (and to a lesser extent air) services will present a challenge. However, there have been no specific problems in Eday identified in the baselining.

4.3 Overview – Vessels, Connectivity & Options

4.3.1 Analysis of the ONI air and ferry networks has demonstrated that the service currently provided falls short of the benchmark defined by Transport Scotland (in the Routes & Services Methodology) and is out of step with other comparable islands across Scotland. The basis of this shortfall is that three vessels are being used to serve six islands.

4.3.2 Whilst the existing communities have no doubt adapted to the current level of connectivity to some extent, the nature of these connections may be acting as a constraint on the development of the ONI, and in particular the potential for in-migration to the isles.

4.3.3 The STAG process and the Routes & Services Methodology (RSM)²⁰ provide two means to determine what the ‘appropriate’ level of connectivity should be. In general these would imply a significant increase in the service and resources required to deliver them.

4.3.4 This section explores some of the issues surrounding the current operation of the ONI network. The ferry network is operated by three vessels in three distinct phases: summer, winter and annual refit.

- Westray – RoRo served directly from Kirkwall;
- Papa Westray – LoLo service generally shared with North Ronaldsay or Westray;
- North Ronaldsay – LoLo served directly or shared with Papa Westray;
- Eday – RoRo served in combination with Stronsay and / or Sanday;
- Sanday – RoRo generally served directly or in combination with Eday; and
- Stronsay – RoRo generally served directly or in combination with Eday.

4.3.5 There are a large number of variables which determine the nature of the ONI network including:

- number of vessels;
- number of aircraft;

²⁰ The RSM is a six-step process which defines a ‘model’ level of service for an island in terms of the number of days on which there is a connection, the number of connections per day and the length of the operating day. The process involves comparing the model service with the current service and identifying options to address any under or over provision.

- location of harbours;
- shift patterns / operating hours;
- LoLo / RoRo;
- number of islands; and
- location of vessel overnight.

4.3.6 In this section the issues surrounding connectivity, number of vessels and crewing models are explored to provide context for the appraisal which follows.

Transport Planning Objectives

4.3.7 To recap, the Transport Planning Objectives for the overall study are as follows, together with the key problems for the Outer North Isles.

TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island and Orkney mainland.

- Deadweight restrictions, aircraft seating restrictions due to the size of the aircraft and the block booking of seats for education / Council use, and ferry car deck carrying capacity restricting car-based travel

TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.

- There are many occasions across the year when this objective is not being met
- Even in summer there is no Sunday connectivity by ferry, whilst other islands, e.g. Sanday and Westray, have days of the week when this objective is not met – in the main due to the scheduling required for the North Ronaldsay run.

TPO 3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.

- The time between connections varies widely across the day and overall frequency is below the RSM specified level.

TPO 4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.

- The current timetable is irregular across the day, week and between summer / winter / refit
- There is also a mixture of direct and indirect connections to / from Kirkwall
- The nature of the service differs markedly across the year with a major reduction during refit when only two vessels are in operation, the result being many more indirect connections

TPO 5: Where practicable and realistic, islanders should be provided with links to strategic onward connections without the need for an overnight stay on Orkney mainland.

- This objective is widely not met at present, meaning an overnight stay on Orkney mainland will be required before and / or after off-Orkney trips.

4.3.8 The key to making progress towards meeting these objectives is **additional Outer North Isles connections**.

The Role of Air Services

- 4.3.9 In addition to providing passenger transport for residents and visitors, the air service is essential for the provision of education, health and other Council services to the ONI. The air network also facilitates services which are critical to the islands, banking and veterinary services for example. It is estimated that 60% of current air carryings across the network are accounted for in this way with half of all carryings being teacher and pupil movements. Teacher movements are generally out from Kirkwall in the morning returning in the afternoon / early evening. Pupil movements are principally Monday and Friday into and out of Kirkwall respectively, where the children stay in the Council hostel or with family. Between Monday and Friday during school term, around two thirds of all flight rotations from Kirkwall have legs where capacity is reduced due to the prioritised movements of teachers and schoolchildren.
- 4.3.10 Westray, Sanday and Stronsay have junior high schools. For these schools, each day, teachers fly out from, and return to Kirkwall and these movements make up the bulk of the seats used for education purposes. As there are no junior high schools in North Ronaldsay, Papa Westray and Eday, children are flown / ferried into Kirkwall Sunday / Monday - Friday. Papa Westray S1-S4s attend Westray Junior High. S5-S6 children from islands where there is a junior high use ferries to / from Kirkwall typically Sunday PM / Friday PM. Only from North Ronaldsay, Papa Westray and Eday (S1 & S2 Monday morning only) do schoolchildren currently use the air services.
- 4.3.11 For Eday, Sanday, Stronsay and Westray, the air service accounts for only 8% of all passenger journeys, and around 60% of these journeys will be accounted for by education / health / Council use. Further evidence is provided by the surveys undertaken to inform the RSM process where, in all four islands, over 90% of respondents stated that they have never or rarely (less often than once a month) used the air service. The equivalent figure for the ferry services was only 10-15%. It can also be argued that Stronsay / Sanday / Westray and possibly Eday are too populous for an air-based link to be regarded as a genuine 'connection' given the very low capacity of the aircraft, even more so when the flight rotation is shared with another island and the seats available to a given island will be reduced. Only ferries can provide the means to transport the volumes of people associated with these larger islands and the movement of vehicles and goods required to maintain the islands' supply chain.
- 4.3.12 For the purposes of this exercise, we assume that as **the ferry provides the lifeline link for Eday, Sanday, Stronsay and Westray**, the RSM remains a valid tool as a guide in defining the appropriate service, with the air service supporting this lifeline service with a key role in the delivery of public services and an alternative much quicker but low volume means of accessing the mainland.
- 4.3.13 In contrast, for North Ronaldsay and Papa Westray, the air service accounts for nearly 95% of all passenger movements, a reflection of the relative travel times and frequencies. Also for islands like these with much lower population levels, an air service can accommodate a more meaningful proportion of the population and can therefore be regarded as a more genuine 'connection'. **In the case of North Ronaldsay and Papa Westray the air service is therefore regarded as the lifeline link** for passenger travel, whilst it is recognised that (less frequent) sea-based connections are required for the movement of goods.
- 4.3.14 Given the difference in lifeline mode, it may be worth considering these two mini-networks on a separate basis.

Routes and Services Methodology

- 4.3.15 In addition to the issues surrounding these objectives, the RSM application has also identified a significant shortfall in the current level of service, suggesting a model service of **3-5 sailings** per day over a **14 hour operating day** for Eday, Sanday, Stronsay & Westray. The RSM is

less appropriate for North Ronaldsay and Papa Westray as the air service provides the lifeline mode.

- 4.3.16 It should be noted that the main determinant of sailings per day in the RSM is crossing time as this dictates the number of crossings which can be achieved in a given number of hours. The primary reason for the ONI falling short of the RSM specification is the fact that three vessels are shared around six islands meaning that the frequency for any given route is diminished when the vessel is serving another island.

Eday / Sanday / Stronsay / Westray: What level of ferry connectivity is currently provided?

- 4.3.17 Some 3-5 sailings per day would suggest a minimum of 21 connections to Kirkwall (2-way) across the week (or 20 if the connections drop to two on a Sunday). The table below shows the current number of ferry connections per week.

Table 4.7: ONI Ferry Connectivity by Season

Ferry Connections to Kirkwall / week		Summer	Winter	Refit
Eday	<i>Direct [%]</i>	9 [60%]	7 [54%]	7 [54]
	<i>Indirect / shared</i>	6	6	6
	Total	15	13	13
Sanday	<i>Direct [%]</i>	10 [71%]	10 [71%]	3 [21%]
	<i>Indirect / shared</i>	4	4	11
	Total	14	14	14
Stronsay	<i>Direct [%]</i>	9 [64%]	7 [58%]	6 [46%]
	<i>Indirect / shared</i>	5	5	7
	Total	14	12	13
Westray	<i>Direct [%]</i>	16 [94%]	15 [100%]	12 [100%]
	<i>Indirect / shared</i>	1	0	0
	Total	17	15	12
Overall	<i>Direct [%]</i>	44 [73%]	39 [72%]	28 [54%]
	<i>Indirect / shared</i>	16	15	24
	Total	60	54	52

- 4.3.18 The following points emerge from this:

- On this basis, there is a significant shortfall in the number of ferry connections provided at all times of year – none of the islands reach a figure of 20 connections per week at any time across the year.
- There are many indirect connections which increase journey times and can impose capacity restrictions.

- During refit, although absolute levels of connectivity are similar to winter, the proportion of direct connections drops from 72% to 46% indicating an extensive reduction in service and significant increase in journey times.

Eday / Sanday / Stronsay / Westray: Length of the operating day (first departure to last arrival)

Table 4.8: ONI Ferry Operating Day by Season

Length of Operating Day by vessel		Summer (hh:mm)	Winter (hh:mm)	Refit (hh:mm)
Vessel 1	<i>Weekday Ave.</i>	12:08	11:26	11:59
	<i>Saturday</i>	12:50	12:35	4:20
	<i>Sunday</i>	11:50	3:20	4:20
	Total weekly hours	85:20	73:05	68:35
Vessel 2	<i>Weekday Ave.</i>	11:39	12:00	12:11
	<i>Saturday</i>	12:00	12:00	9:00
	<i>Sunday</i>	11:40	3:00	3:05
	Total weekly hours	81:55	75:00	73:00
Vessel 3	<i>Weekday Ave.</i>	10:50	10:47	0
	<i>Saturday</i>	12:00	0	0
	<i>Sunday</i>	11:55	3:20	0
	Total weekly hours	78:05	57:15	0
All vessels	Total weekly hours	245:20	205:20	141:35

Note that start-up / close down time is not included in the above figures.

4.3.19 The following points emerge from this:

- At no point across the year is a 14 hour operating day provided.
- These services are provided on the basis of a single crew operating day / week on each vessel. Current crewing arrangements are 2-weeks on / 2-weeks off plus 3 weeks annual leave, and the contract is based on an annual number of hours. It is assumed that the above operating hours is a reflection of these contacted hours.
- The refit figure represents a 31% reduction on winter weekly operating hours and a 42% reduction on summer weekly operating hours.

Precedent

4.3.20 By way of wide context, it is also worth considering precedent when scoping out what the ferry service should look like.

- Across the Clyde & Hebridean Ferry Services (CHFS) network, where small islands are served, there is no real precedent of a significant winter reduction in services or prolonged refit timetable eg:
 - Raasay (population 161): 10 departures per day from Raasay in summer and winter. Heavily curtailed Sunday service.
 - Lismore (population 192): 4 departures per day from Lismore summer and winter (plus the Argyll & Bute Council foot passenger ferry). Heavily curtailed Sunday service.
 - Gigha (population 163): 9-10 core sailings per day in summer and winter. Curtailed Sunday service.
- Typical operating days on these routes are 12-14 hours
- All of these islands therefore have smaller populations than e.g. Westray / Sanday / Stronsay
- Small Isles – services do reduce in winter
 - Rum, Eigg and Muck reduce to 4 departures per week in winter, Canna to 3.
 - No air service to compensate.
 - Indeed these islands do not get a 7-day service even in summer.
 - The Small Isles populations are Rum (22), Eigg (83), Canna (12), Muck (27).
 - These islands are more analogous to North Ronaldsay and Papa Westray than the other four ONI.

4.3.21 Shetland Islands Council provides higher levels of service. A comparable island to Sanday / Westray is perhaps Unst (population 632). The Unst service has an Operating day circa 0600-2300 (17 hours) and the short crossing means that there are many departures across the day (28-29). All of the main Shetland routes are operated on this basis. Weekend services are reduced from these levels though, typically dropping to a single vessel service.

4.3.22 All islands have their own particular circumstances and requirement, so what service would be appropriate for the ONI? What is the high level 'model' service?

Model Service for Eday / Sanday / Stronsay / Westray

4.3.23 Taking all of the above into account, it is proposed that the model service for Eday / Sanday / Stronsay / Westray is:

- 3-5 sailings per day (Mon-Sat)
 - Westray and Sanday have the highest populations and carryings and may merit 3-4 rotations per day, e.g. 4 each day, or 3 one day, 4 the next; or 3.5 each day if the ferry could overnight in the islands²¹.
 - Stronsay is some way behind in terms of population and carryings so may merit 3 or 3.5 alternating.
 - Eday has a much lower population so could receive the minimum of 3, although its geographic proximity to Kirkwall could suggest that a level of connectivity similar to Stronsay would be more appropriate.
- substantively the same timetable in summer and winter;
- substantively the same timetable Monday to Saturday;

²¹ It is noted that at present the MCA grant a dispensation for vessels to overnight in the isles two nights per week – reflecting the inadequate crew accommodation. Some harbours not suitable for this at present.

- a refit timetable with minimal differences from the winter timetable;
- reduced Sunday service;
- 12-14 hour operating day;
- potentially later / request sailings on Fridays and Saturdays; and
- potentially early / request sailings on weekdays.

Papa Westray and North Ronaldsay

- 4.3.24 Application of the RSM is not well suited to Papa Westray and North Ronaldsay. Papa Westray and North Ronaldsay are well served by air with approximately 20 flights to Kirkwall in summer (3 rotations per day) and 15 flights in winter / refit, although some flights are shared which impacts on available capacity. Flights provide 7-day connectivity to Kirkwall in the summer and 6-day access during winter and refit, and cater for the overwhelming majority of passenger movements (95%+). Air is therefore the lifeline mode and the low population levels generally mean that those who need to travel can travel by air. Additional flights could ease the capacity restrictions which do exist, particularly in the case of Papa Westray e.g. at the times of year when the Papa Westray - Westray flight is popular with tourists.
- 4.3.25 So given that air provides the main passenger lifeline service, what are the requirements of the ferry service?
- 4.3.26 Both islands have only 1-2 Lo-Lo connections per week depending on the season. Passenger carryings are very low. North Ronaldsay's connections are also tidally constrained so the timetable is irregular and weather conditions at both locations make both connections unreliable (particularly at North Ronaldsay during the winter).
- 4.3.27 Community consultation did not reveal high levels of discontent with the number of connections by sea per week to these islands and presumably island supply chains have developed around these connections (although additional connections would be welcomed).
- 4.3.28 As a parallel, the Small Isles each receive a minimum of 3-4 ferry calls per week across the year, and there is no air service. It may therefore be appropriate here to plan for:
- 2 rotations per week from Orkney mainland to each island, e.g. on alternate days; or
 - 3-4 rotations a week serving both islands across the year
 - Bespoke freight flights when required
 - Given the very low passenger carryings, there may be merit in considering running these sailings in 'freight' mode with e.g. a maximum of 12 passengers and reduced crewing levels. However it is noted that when this 'freight only' rotation is preceded by or succeeded by a 'standard' run on a given day, then the full crew would be required, which may present rostering / logistical difficulties.
- 4.3.29 Providing these links at present takes substantial time which could be used to serve the more populous islands as follows:
- In summer:
 - Tuesday – approx. 7 hours
 - Friday – approx. 1.5 hours (Westray - Papa Westray loop) plus 9 hours = 10.5 hours
 - so approx. **17.5 hours** in total
 - In winter:
 - Friday or Saturday: return to North Ronaldsay, so approx. 6-6.5 hrs;

- Tuesday: approx. 1.5 hours (Westray - Papa Westray loop);
- Friday: 4.0 hours (Papa Westray)
- so approx. **12 hours** in total
- In Refit:
 - 4hr:15m (Friday Papa Westray) &
 - 9 hours (Saturday North Ronaldsay)
 - so approx. **13hr15m** in total.

How can this be achieved?

- 4.3.30 At present, OIC has three vessels capable of regularly serving the ONI. As there is no relief vessel available, when a vessel goes for refit, the current timetable cannot be maintained as the service operates with two vessels. There are no obvious precedents around the Scottish network where the timetable is compromised to this extent when the normal operating vessel(s) are on annual refit.
- 4.3.31 As such the current asset inventory cannot deliver the 'model' service. Under the scenario where a relief vessel is available, the refit timetable issue is resolved, i.e. the winter timetable would run during this period. **The question then is, can a three-vessel scenario deliver the other elements of the service required for the ONI year round, or is a fourth permanent vessel required?**

Rotations Analysis

- 4.3.32 As noted previously, for all four 'inner' islands, the RSM suggests that there should be 3-5 sailings per day. Although a 'sailing' is not defined by the RSM, given the relatively short crossing times and the close ties between the islands and Kirkwall, we could assume this to mean: *a connection which facilitates time on the mainland and the ability to return on the same day.*
- 4.3.33 It is helpful to think of this in terms of 'rotations' where a rotation is a voyage out from Kirkwall to one or more islands and back to Kirkwall. Basing the vessel in the island would maximise the time available on the mainland and *vice versa* but at present a combination of the vessels used (crew accommodation) and the lack of year-round sheltered berths means that the vessels are predominantly Kirkwall based.
- 4.3.34 So for example, for Westray, if the vessel is **Kirkwall based**:
- **0.5 rotation:**
 - Kirkwall-Westray
 - Provides a one-way link in one direction only.
 - No day return possible.
 - **1 rotation:**
 - Kirkwall–Westray–Kirkwall
 - Provides a 1-way connection in both directions.
 - Requires an overnight stay on Orkney mainland.
 - Requires an overnight stay in Westray unless the vessel ties up in Westray for a meaningful period of time.

- **1.5 rotations:**
 - Kirkwall–Westray-Kirkwall-Westray
 - Vessel starts and finishes the day in different positions.
 - Requires an overnight stay in Westray unless the vessel ties up in Westray for a meaningful period of time.
 - Requires an overnight stay on Orkney mainland unless the vessel ties up in Kirkwall for a meaningful period of time.
- **2 rotations:**
 - Kirkwall–Westray–Kirkwall-Westray-Kirkwall
 - Provides meaningful time in Westray.
 - Provides time in Kirkwall only if the vessel ties up for a meaningful period.
- **2.5 rotations:**
 - Kirkwall-Westray-Kirkwall-Westray-Kirkwall-Westray
 - Vessel starts and finishes the day in different positions.
 - Provides meaningful time in Westray.
 - Provides meaningful time in Kirkwall.
- **3 rotations:**
 - Kirkwall–Westray–Kirkwall-Westray-Kirkwall-Westray-Kirkwall
 - Provides extended time in Westray and meaningful time in Kirkwall.
 - In this case, the base harbour of the vessel is less important and only affects timing of the first arrival / last departure of the day.
- **3.5 rotations:**
 - Kirkwall–Westray–Kirkwall-Westray-Kirkwall-Westray-Kirkwall-Westray
 - Vessel starts and finishes the day in different positions.
 - Provides extended time in Westray and Kirkwall.

4.3.35 Most of these permutations can be observed at present across the ONI network.

4.3.36 The tables below show the number of rotations per day serving each island from Kirkwall (where the vessels usually start / end the day) for the three different operating timetables, e.g. on an Eday summer Sunday: Kirkwall–Eday-Kirkwall (1) plus Kirkwall-Eday (0.5) = 1.5 rotations. These figures include the impact of running to North Ronaldsay and Papa Westray.

Table 4.9: Ferry Rotations Per Day From Kirkwall

Summer	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Tot
Eday	2.5*	2	3	2.5	2.5*	2	1.5	16
Sunday	2.5	1.5	2.5	2	2	2	1.5	14
Stronsay	2.5	2	3	1.5	1.5	2	1.5	14
Westray	2.5	2	3	3	3	2	1.5	17
total	10	7.5	11.5	9	9	8	6	61

* starts from Stronsay
Tuesday and Friday affected by North Ronaldsay / Papa Westray
red – starts from island

Winter	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Tot
Eday	2	2	2.5*	1.5	1.5*	2	1	12.5
Sanday	2	2	3	2	2	2	1	14
Stronsay	2	1.5	2.5	1.5	1.5	2	1	12
Westray	2	2	3	3	2	2	1	15
total	8	7.5	11	8	7	8	4	53.5

* starts from Stronsay
Friday and Saturday affected by North Ronaldsay / Papa Westray
red – starts from island

Refit	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Tot
Eday	3	2	2	1.5	2.5	1	1	13
Sanday	3	3	3	2	2	1	1	15
Stronsay	2	3	3	1.5	1.5	1	1	13
Westray	2	2	2	2	2	1	1	12
total	10	10	10	7	7.5	4	4	53

Friday and Saturday affected by North Ronaldsay / Papa Westray
red – starts from island

4.3.37 These tables suggest that the minimum of three rotations per day per island is not achieved even on days when there is no North Ronaldsay / Papa Westray calls with the current mix of dedicated / shared services and length of operating day.

4.3.38 The number of hours currently used to provide this level of connectivity is set out in the table below.

Table 4.10: ONI Timetabled Operating Hours per week (excluding start and end of day)

Season [weeks]	Ferry 1 hh:mm	Ferry 2 hh:mm	Ferry 3 hh:mm	Per Week hh:mm	Per Week excluding North Ron and Papa Westray hh:mm	Total excluding North Ron and Papa Westray hh:mm
Summer [20]	85:20	81:55	68:35	235:50	217:20	4,346:40
Winter [23]	73:05	75:00	73:00	221:05	209:05	4,809:55
Refit [9]	68:35	73:00	0	141:35	128:20	1,155:00
Annual	4,004:50	4,020:20	3,073:40			10,310:35

4.3.39 At its simplest therefore, in the summer a 235:50 hour timetabled week is providing a total of 61 rotations from Kirkwall to Eday / Sanday / Stronsay / Westray per week. These rotations are a mix of single and double-island rotations. However, around 18.5 hours per week is used

to serve North Ronaldsay and Papa Westray, so these 61 rotations are actually provided in 217:20 hours.

4.3.40 The tables below set out three illustrative scenarios for the number of rotations per day based on the above discussions.

Table 4.11: ONI Timetable Scenarios

Timetable Scenario 1 RSM Min Year Round	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Tot
Eday	3	3	3	3	3	3	2	20
Sanday	3	3	3	3	3	3	2	20
Stronsay	3	3	3	3	3	3	2	20
Westray	3	3	3	3	3	3	2	20
Total	12	12	12	12	12	12	8	80

Timetable Scenario 2 RSM Mid Year Round	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Tot
Eday	3	3	3	3	3	3	2	20
Sanday	3.5*	3.5*	3.5*	3.5*	3.5*	3.5*	2	23
Stronsay	3	3	3	3	3	3	2	20
Westray	3.5*	3.5*	3.5*	3.5*	3.5*	3.5*	2	23
Total	13	13	13	13	13	13	8	86

Timetable Scenario 3 RSM High Year Round	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Tot
Eday	3	3	3	3	3	3	2	21
Sanday	4	4	4	4	4	4	2	26
Stronsay	3.5*	3.5*	3.5*	3.5*	3.5*	3.5*	2	23
Westray	4	4	4	4	4	4	2	26
Total	15.5	14.5	14.5	14.5	14.5	14.5	8	96

* Assumes vessel can overnight at Sanday / Stronsay / Westray

4.3.41 What level and mix of resource would be required to provide this?

4.3.42 Assuming that the service would continue to be provided on a similar mix of single and double-island rotations with vessels of similar operating speeds, the table below provides an estimate, on a *pro rata* basis, of the annual running hours required to provide Scenario 1, 2 and 3 connectivity above.

Table 4.12: ONI Implied Running Hours Requirement

	Annual Running / Crewing Hours (hh:mm)	% change from present day
Present Day (excluding PW and NR)	10,310:35	
No Refit timetable (winter timetable for full winter period)	11,037:20	7%
Summer timetable year round	11,301:20	10%
Scenario 1 year round	14,821:25	44%
Scenario 2 year round	15,933:02	55%
Scenario 3 year round	17,785:42	72%

4.3.43 The tables below provide an indication of how these additional hours could be provided in a 3 or 4 vessel scenario. Additional running hours can clearly be achieved through either an additional vessel or via additional crew hours and hence a longer operating day / week / year. Vessel speeds are assumed to be the same as current.

4.3.44 Two crew scenarios are considered – one where rotating crew provided for a 1.2²² crew day operation and one where e.g. a 12 hour day shift / 6 hour back shift arrangement (as operates in Shetland) provides for a 1.5 crew day. The illustrative resulting increase in available running hours is shown in the bottom row of each table.

Table 4.13: ONI – Crew & Vessel Scenarios

		Crews per Operating Day 20% Scenario							
Vessel	Present Day	Supply Scenario A1	Supply Scenario A2	Supply Scenario A3	Supply Scenario A4	Supply Scenario A5	Supply Scenario A6	Supply Scenario A7	Supply Scenario A8
1	1	1.2	1.2	1.2	1	1.2	1.2	1.2	1.2
2	1	1	1.2	1.2	1	1	1.2	1.2	1.2
3	1	1	1	1.2	1	1	1	1.2	1.2
4	-	-	-	-	1	1	1	1	1.2
Additional hours provided		7%	13%	20%	33%	40%	47%	53%	60%

²² The option of supplementary daily crew was discussed in detail with Orkney Ferries – it is possible to deliver such a model although it would not be without its logistical challenges.

Crews per Operating Day 50% Scenario									
Vessel	Present Day	Supply Scenario B1	Supply Scenario B2	Supply Scenario B3	Supply Scenario B4	Supply Scenario B5	Supply Scenario B6	Supply Scenario B7	Supply Scenario B8
1	1	1.5	1.5	1.5	1	1.5	1.5	1.5	1.5
2	1	1	1.5	1.5	1	1	1.5	1.5	1.5
3	1	1	1	1.5	1	1	1	1.5	1.5
4	0	0	0	0	1	1	1	1	1.5
Additional hours provided		17%	33%	50%	33%	50%	67%	83%	100%

4.3.45 So to meet e.g. Timetable Scenario 1 (3 rotations per week for all four islands), 44% additional hours could be achieved (see Table 4.12):

- with 3-vessels: Supply Scenarios B3
- with 4-vessels: Supply Scenarios A6-A8 & B5-B8

4.3.46 The maximum 3-vessel scenario (Supply Scenario B3) could therefore conceivably provide the required hours with an additional 50% running hours. However in this case:

- if the current running hours required to serve North Ronaldsay and Papa Westray were added to the total, these hours could not be met with this resource;
- this would also imply a 17-18 hour operating day, which is in excess of that required by the RSM;
- spreading these connections across such a long day with three vessels may mean that people are less likely to have connections available at key times;
- additional calls to North Ronaldsay / Papa Westray would not be possible and there would be very limited flexibility in terms of acting on weather / tidal windows; and
- Timetable Scenario 2 or Scenario 3 could not be provided with 3 vessels.

4.3.47 **This high level analysis suggests that even the minimum RSM requirements and transport planning objectives for the Outer North Isles cannot be met with three vessels on the basis of the number of connections, the length of the implied operating day and issues surrounding relief vessels.**

4.3.48 It is noted however that within the current operating hours, there are periods of extended down time. Whilst some of this time will be required for breaks and scheduled maintenance, the underlying issue may be that four rotations per day from Kirkwall cannot be achieved within a single crewing day at present, whereas three rotations can be achieved with relative ease (e.g. summer Thursday Westray service). If the working day was extended by a modest amount, this current down time could be used in a further rotation without necessarily extending out the working day by the full amount implied by an additional rotation. Alternatively, it would be possible to have one longer day followed by one shorter day. A detailed analysis of timetabling and crew rostering would be required to determine this.

4.3.49 Alternatively, were the vessels able to lie out in the islands all year round, a 3.5 rotation system could be used where the vessel spends alternate nights e.g. at Kirkwall then Westray.

- 4.3.50 It is also noted that the ONI vessels run with a crew of 9/10. If newer, more efficient vessels were used, this number could be reduced and the crew deployed elsewhere in additional vessels or across the operating day.

Benefits of a four-vessel solution

- 4.3.51 A four-vessel solution would bring a much greater level of flexibility in serving the four inner islands and North Ronaldsay / Papa Westray. The vessels could be crewed / operated in a range of ways and be tailored to the precise requirements of the ONI as they evolve over time. This configuration could ultimately provide a doubling of the current ONI operating hours, which would provide a high degree of futureproofing and would be scalable in terms of crewing / running hours.
- 4.3.52 A fourth vessel would mean that on days when North Ronaldsay / Papa Westray are served, there would still be three vessels to serve Eday / Sanday / Stronsay / Westray. Were Papa Westray to be linked to Westray by a new RoRo service, the discontinuation of the Papa Westray call would free up the vessel to undertake further runs to Eday / Sanday / Stronsay / Westray.
- 4.3.53 The three 'core' vessels could be used to serve Eday / Sanday / Stronsay / Westray, with a focus on Westray and Sanday as the two highest volume routes. In addition to serving North Ronaldsay and Papa Westray (potentially in freight mode), the fourth vessel could provide additional sailings to the other islands with a timetable perhaps shaped around specific events such as regular mart days etc.
- 4.3.54 A fourth vessel would also dramatically reduce the impact of refit as the fourth vessel could step in whilst also providing cover for North Ronaldsay and potentially Papa Westray (although there would be a requirement for a crane on this vessel). This is a major issue as the impact of the current winter refit timetable is one of the key issues impacting on the Outer North Isles.
- 4.3.55 **In summary a fourth vessel (allied to appropriate crewing) would reduce sailing times (by providing more direct connections), provide significant additional capacity and provide the ability to increase frequency and the length of the operating day.**

4.4 Appraisal of Capital Options

- 4.4.1 The appraisal of capital options for the Outer North Isles is a challenging process as the exercise covers six islands and three modes (air, ferry and road / fixed link) as well wider infrastructure improvements which do not in their own right increase connectivity but could contribute to other options (e.g. new overnight berths, new harbour locations, aircraft navigational aids etc). With this in mind, the appraisal has been broken down into a series of steps.

Capital Appraisal – Step 1: Fixed Links

- 4.4.2 There are a clearly a large number of permutations and combinations of infrastructure options, all of which could be thought of as being **components** of an **overall service offering** for the ONI. Step 1 in developing the ONI appraisal is therefore to determine the number of islands to be served by **ferry services**, which will be determined by the **case for fixed links**. The ferry service has fixed infrastructure costs and a different number of vessels would be required to serve different numbers / combinations of islands. The adoption of one or more fixed links would materially impact the design of the ferry and air services.
- 4.4.3 There are three potential scenarios in terms of the ferry / fixed link mix:
- 6-island scenario – present day arrangements.

- 5-island scenario (Westray linked to Papa Westray, or Westray linked to Eday).
 - Reduces the number of harbours / airfields by one.
- 4-island scenario (Westray linked to Papa Westray and Westray linked to Eday).
 - Reduces the number of harbours / airfields by two.

4.4.4 The first step of this process therefore involves the appraisal of the suggested fixed links.

Fixed Link Options

- 4.4.5 In advance of considering the fixed link options, it is essential to note that the technical work to support fixed links in the Orkney context is not particularly well developed. In 2004, a Ferry Replacement Study was undertaken which discussed the idea of constructing several shorter inter-island tunnels, particularly between the Mainland and Shapinsay. In the mid-2000s a feasibility study for a fixed link between Orkney mainland and Shapinsay was commissioned and all subsequent studies on fixed links have built on this.
- 4.4.6 The *Orkney Isles Interconnectivity Study STAG 1 Report* considered fixed links but eliminated them from being taken forward for further study on the basis of cost, stating "*it seems very unlikely that a case for tunnels can be made in the short to medium term.*"
- 4.4.7 The issue was again revisited by OIC Project No: 100020, which produced a report entitled *Shapinsay Tunnel and Westray to Eday Fixed Links with Tidal Power Generation - Preliminary Study* in which a number of fixed link options were considered. The OIC Engineering Services Department independently provided cost estimate calculations produced during the study in support of parts of the report.
- 4.4.8 The report is the only engineering consideration of fixed links other than the Mainland Shapinsay report of 2006, and it provides a useful summary of the location, relative exposure, tidal currents, and fixed link type and dimensions of the crossings, which are used in the analysis below. The report concluded with a brief and objective discussion of construction options for each link and their likely costs.
- 4.4.9 As the title suggests, this was only ever intended to be a preliminary study. There are no extant archive engineering drawings of any scheme from which the quantities used to build up prices can be matched, which is a particular issue when it comes to verifying the accuracy of quantities used for pricing causeways. Some of the build-up is based on pro-rata comparison with recently constructed structures (low span bridges were costed based on Hatston Pier for example). The pragmatic methodology adopted to derive the costs is usual practice in lieu of detailed information, and the results stand as credible rough estimates. H.M. Treasury optimism biases were not applied to the cost estimates, and for planning and financing purposes, these would need to be considered.
- 4.4.10 The fixed link options in relation to the Outer North Isles identified in this study are set out below.

Option CO1: Construct a fixed link between Papa Westray and Westray

- This fixed link would run between Holland in Papa Westray and Aikerness on Westray across Papa Sound.
- The link would have open exposure to the north with a short fetch to the south, with the tides estimated to run at 2-3 knots. The crossing is 1,900 metres long with a minimum sea bed level of -5.5 metres Chart Datum. Approximately 900 metres of the seabed is above Chart Datum.
- Three potential options were considered (with estimated costs in 2015 prices brackets):

- 1) Causeway only (£88.7m basic cost, £147.2m when adjusted for optimism bias). This cost only covers the basic structure cost;
- 2) Causeway + short span bridge / tidal fence (£51.6m, £85.7m when adjusted for optimism bias). This cost only covers the basic structure cost; and
- 3) Short span bridge / tidal fence; (£38.7m, £64.2m when adjusted for optimism bias). This cost only covers the basic structure cost.
- The ferry service between Westray – Pierowall and Papa Westray - Kirkwall would be discontinued. It is assumed that the air services would continue as currently.

Option CO2: Construct a fixed link between Westray and Eday

- This fixed link would run from Westray via the Holm of Faray and then Faray to Eday.
 - The key characteristics of the connections are as follows:
 - The link between Westray and Holm of Faray would run from Weather Ness in Westray across Weatherness Sound. The route would have open exposure to the north-east although less exposure from the south-west, with the tide estimated to run at 3-4 knots. The link would be 600 metres long with a minimum seabed level of -6.0 metres Chart Datum
 - The link between Holm of Faray to Faray would run across the Lavey Sound. Exposure from east and west would be reduced, with the tide estimated to run at 3-4 knots. The link would be 400 metres long with a minimum seabed level of -5.0 metres Chart Datum.
 - The link between Faray and Eday would run between the Point of Scaraber to Fers Ness. Exposure from east and west would be reduced, with the tide estimated to run at 3-4 knots. The link would be 1,000 metres long with a minimum seabed level of -14.0 metres Chart Datum.
 - Four potential options were considered (with estimated costs in 2015 prices brackets):
 - 1) Causeways only (£205.8m basic cost, £341.7m when adjusted for optimism bias);
 - 2) Causeways plus tunnels - Westray via Holm of Farray via Farray (causeway) + Farray to Eday (tunnel) (£93.6m basic cost, £155.4m when adjusted for optimism bias);
 - 3) Short and long-span bridges - Westray via Holm of Farray via Farray + Farray to Eday (£49.2m basic cost, £81.7m when adjusted for optimism bias);
 - 4) Short span bridge and basic tidal fence Westray via Holm of Farray via Farray + Farray to Eday (£38.7m basic cost, £64.2m when adjusted for optimism bias). This cost only covers the basic structure cost.
 - It is assumed that the Westray – Kirkwall service would be discontinued.
 - Eday ferry terminal would be relocated from the east to the west of the island to the sheltered location of Sealskerry Bay, with Westray and Eday residents sharing one dedicated ferry.
 - If this option was built in parallel to a Papa Westray – Westray fixed link, the Papa Westray – Kirkwall and Papa Westray – Pierowall ferry services would be discontinued. It is assumed that air services would continue as at present.
- 4.4.11 The following sections contain the appraisal of each fixed link option against the study objectives and STAG criteria. The analysis does not differentiate between fixed links options (e.g. causeways, bridges etc) except in terms of affordability and technical feasibility.

Appraisal against Objectives

Table 4.14: Outer North Isles Fixed Links – Appraisal against Objectives

	Option CO1 – Construct a fixed link between Papa Westray & Westray	Option CO2 – Construct a fixed link between Westray & Eday
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓✓
<i>TPO2a: Where an island has a ‘commutable’ combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	N/A	N/A
<i>TPO 2b: Where an island does not have a ‘commutable’ combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	✓✓	✓✓
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	✓	✓✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	✓	✓✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-

4.4.12 The provision of a fixed link between Papa Westray and Westray (**Option CO1**) could offer very minor capacity benefits as it would remove the timetabled call at Papa Westray and release around 3-6 operating hours per week for deployment elsewhere. However, the Westray service already experiences peak capacity issues and there is a possibility that this could be exacerbated by Papa Westray traffic switching to that route. For capacity benefits to be realised, consideration would have to be given to using the released operating hours to enhance the Westray–Kirkwall service. The fixed link would also provide enhanced access to the Ro-Ro ferry services from Westray and would relieve the capacity pressures on the Papa Westray air service.

4.4.13 The provision of a fixed link from Westray to Eday (**Option CO2**) would have moderate capacity benefits, particularly if allied to a Papa Westray – Westray fixed link. This link would remove the need for a Ro-Ro ferry service from Westray (and Papa Westray if a fixed link was taken forward for that island) releasing a substantial number of operating hours per week. If Papa Westray did not benefit from a fixed link, it is likely that a different ferry solution would be required for the island. The released hours would be used to provide a shuttle service between Eday and Kirkwall, providing an overall increase in capacity.

4.4.14 The fixed link from Papa Westray (**Option CO1**) would enhance the ferry based connections of that island to Kirkwall via Westray. This would provide additional connections to Kirkwall, allow Papa Westray residents to more easily take the car and would relieve capacity constraints on the air service. The Westray–Eday link (**Option CO2**) would enhance connectivity for both islands (and potentially Papa Westray) to Orkney mainland by providing an enhanced ferry service to Kirkwall. This would particularly be the case if the vessel sailing patterns could be offset to extend the operating day.

4.4.15 The released operating hours under both options could support a more regular timetable throughout the week, contributing to TPO4.

Appraisal against STAG Criteria

Table 4.15: Outer North Isles Fixed Links – Appraisal against STAG Criteria

	Option CO1 – Construct a fixed link between Papa Westray & Westray	Option CO2 – Construct a fixed link between Westray & Eday
Environment	xxx	xxx
Safety	-	-
Economy	✓	✓✓
Integration	✓	✓
Accessibility & Social Inclusion	✓	✓✓
Established Policy Directives	✓	✓✓
Technical Feasibility	<i>There has been very little technical feasibility work undertaken. If this option were to be progressed, extensive ground and marine investigation work would be required.</i>	<i>There has been very little technical feasibility work undertaken. If this option were to be progressed, extensive ground and marine investigation work would be required.</i>
Operational Feasibility	<i>This option would remove the need for the current foot passenger ferry between Papa Westray and Westray. The Papa Westray Lo-Lo service to Kirkwall would be discontinued and the hours redistributed elsewhere. It is likely that these hours would have to be focussed on the Westray–Kirkwall route given that that route already experiences capacity issues and would have to additionally accommodate Papa Westray traffic (although absolute additional traffic volumes are likely to be small).</i>	<i>This option would remove the need for the Westray–Kirkwall ferry, the highest volume route on the Outer North Isles network. The hours would be redeployed elsewhere although the majority of these hours would have to be assigned to an Eday – Kirkwall shuttle to accommodate the combined Westray and Eday traffic. If this option were to be pursued, it would be prudent to consider the relocation of the Eday ferry terminal to the west of the island. The sea lane through the Westray Firth (to the west of Eday and east of Westray) would potentially be blocked off, which would inhibit the diversionary route to the other Outer North Isles.</i>
Affordability	<i>This would be a very high cost option – whilst there remains considerable cost uncertainty, high level costs suggest a range of £39m - £89m in unadjusted 2015 prices depending on the option chosen. When optimism bias is applied, the cost range would be £64m - £147m. There would also be significant ongoing maintenance costs.</i>	<i>This would be a very high cost option – whilst there remains considerable cost uncertainty, high level costs suggest a range of £39m - £206m in unadjusted 2015 prices depending on the option chosen. When optimism bias is applied, the cost range would be £64m - £342m. There would also be significant ongoing maintenance costs.</i>
Public Acceptability	<i>There was no obvious groundswell of opinion in favour of a Fixed Link amongst those who attended the Papa Westray drop in session. Of the comments received, a small number explicitly stated they did not want a fixed link whilst a small number could see the merit in this in the long term. Supplementary survey work carried out by Papa Westray Community Council (PWCC) found strong opposition to any fixed link proposal.</i>	<i>There was no obvious groundswell of opinion in favour of a Fixed Link amongst those who attended the Westray drop in session. Of the comments received, there was one strong advocate of fixed links and no explicit statements against the proposition.</i>

4.4.16 The key points from above appraisal against the STAG criteria are:

- The environmental impact of both proposed fixed links is likely to be highly negative, as they would be major civil engineering projects in a relatively unspoiled and undeveloped area. The Papa Westray – Westray link (**Option CO1**) would have potential for significant effects from permanent development of new infrastructure. This option could

also generate increased traffic movements on Westray and Papa Westray. Potential effects on the Papa Westray Marine Protection Area would need to be confirmed with further survey and more specific design information. The Westray – Eday link (**Option CO2**) would have potential for significant negative effects from permanent development of new infrastructure. This option could generate increased traffic movements on Westray and Eday, whilst there is potential for significant effects on the Faray and Holm of Faray Special Area of Conservation.

- The construction of a fixed link between Papa Westray – Westray (**Option CO1**) would have minor economic and accessibility benefits for both islands through enhancing the access between them. This is particularly the case for Papa Westray, which would have access to the larger range of services and employment on Westray. That said, there is a risk that it could also undermine the continuation of local services on Papa Westray, the school and on-island health provision for example.
- A fixed link between Westray and Eday (**Option CO2**) could also have moderate economic and accessibility benefits. As well as integrating the economies of the two islands, journey times to Kirkwall would for the best part be reduced for Westray residents, whilst there would be Transport Economic Efficiency (TEE) benefits associated with an enhanced ferry service frequency for both Westray and Eday residents. There would also be wider / Economic Activity & Location Impacts (EALI) benefits for both islands in terms of residents, tourism, locally traded services and externally traded services. Eday children could also attend Westray Junior High, removing the need for S1-S4 children to be residential at Kirkwall Grammar School (although this is not Council policy). As with Option CO1, there is a potential negative impact on Eday whereby local services could be rationalised and concentrated in the larger island of Westray.
- Transport integration would be improved with both fixed links, as they would improve connections between islands and, particularly in Papa Westray’s case, reduce the challenges of accessing Kirkwall by ferry. However, fixed links do imply the need for use of the car or the provision of a public transport connection to the new hub ferry terminals (i.e. Rapness in Westray under Option CO1 and the current or new port in Eday under Option CO2).
- It is essential to note that there is considerable technical uncertainty over the proposed fixed links, with a significant amount of further technical feasibility work required to inform a detailed appraisal. In addition, given the prolonged elapsed time in progressing a fixed link, a ferry solution would be required in the intervening period.
- The progression of fixed links would have operational benefits in terms of the ferry service as it would reduce the Outer North Isles network to five or four islands depending if one or both of the links were progressed. It should however be noted that Option CO2 could close off the sea lane through the Westray Firth, which is an important diversionary route for the other Outer North Isles in periods of inclement weather.
- The fixed link options are very expensive in terms of up front capital cost, an issue amplified by the considerable lack of cost certainty and unmitigated optimism bias associated with these options currently.

Rationale for Selection / Rejection

4.4.17 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 4.16: Outcome of Appraisal, Outer North Isles Fixed Links

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Option CO1: Construct a fixed link between Papa	✗	This option is rejected from further consideration given the very high costs for very limited benefits. In addition, the technical and funding uncertainty, as well

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Westray and Westray		<p>as the elapsed time before this option could be realised, means that it will not be considered further in the appraisal. This elapsed time would mean that if taken forward, this option would not be in place until the tail end of the strategy period, meaning that an interim solution would be required. There is very limited public support for this option.</p> <p>Should a nationally funded programme of fixed links emerge in future, the proposal could be revisited at this stage.</p>
Option CO2: Construct a fixed link between Westray and Eday	✗	<p>This option is rejected from further consideration given the very high costs for very limited benefits. In addition, the technical and funding uncertainty, as well as the elapsed time before this option could be realised, means that it will not be considered further in the appraisal. This elapsed time would mean that if taken forward, this option would not be in place until the tail end of the strategy period, meaning that an interim solution would be required.</p> <p>Should a nationally funded programme of fixed links emerge in future, the proposal could be revisited at this stage.</p>

4.4.18 As the Westray-Eday fixed link option is ruled out at this stage, the potential relocation of Eday harbour to a site on the west of the island is not considered in this appraisal, as this measure has no merit without the fixed link.

Capital Appraisal – Step 2: North Ronaldsay & Papa Westray

4.4.19 The exclusion of the fixed link options from further consideration determines the need for all six islands to be served by ferries and / or air. The travel market in Outer North Isles varies between islands:

- the large majority of passengers (86%-96%) from the four islands closer to Kirkwall (Eday, Sanday, Stronsay, Westray) travel by **ferry** (largely because these islands are comparatively well-served by ferries). The ferry can therefore be considered to be the **lifeline mode** for these islands. The air service supports both public service delivery and personal travel; and
- the large majority of passengers (92%-93%) from the two islands further from Kirkwall (Papa Westray and North Ronaldsay) travel by **air** (again, largely because these two islands are principally served by air). The air service can therefore be considered to be the **lifeline mode** for these islands. The ferry service is principally for the conveyance of freight and maintaining the supply chain.

4.4.20 Whilst the personal travel needs of North Ronaldsay and Papa Westray are almost exclusively delivered by the air service, the ongoing need for one of the *Earls* to meet the freight needs of the islands has implications for the Eday, Sanday, Stronsay and Westray in terms of lost operating hours.

4.4.21 Whilst it is indisputable that both North Ronaldsay and Papa Westray require continued ferry provision to meet freight and occasional passenger need, it has to be acknowledged that their service is fundamentally different from that currently offered to the other four islands. The appraisal of harbour infrastructure options for these islands therefore provides Step 2 of the capital options appraisal.

4.4.22 The following ferry options were identified for North Ronaldsay and Papa Westray:

Option CO3: Convert North Ronaldsay to a Ro-Ro port

- This option would involve the conversion of the exposed Lo-Lo berth at North Ronaldsay to a sheltered fully operational Ro-Ro berth capable of handling regular and reliable calls

by a Ro-Ro vessel. This would also allow the vessel to overnight in North Ronaldsay if required. This option would involve the construction of a 300 metre breakwater to provide shelter for southerly quadrant incoming waves. The provision of a new 80 metre long berthing structure would be supported against the breakwater. This would be supplemented by the provision of a new linkspan and dredging to provide a fully operational berth.²³

- An alternative option would involve the development of a more sheltered Lo-Lo berth. A hard ramp (potentially tidally constrained) could be included as part of this option. This berth would not be suitable for lying overnight.²⁴
- Any increase in the number of calls per week would require additional vessel / crew hours over and above those offered in the current timetable.
- There may be a compensating reduction in air services as a result of increased ferry provision.
- A change to Ro-Ro would fundamentally change the freight handling arrangements (and in all likelihood fares) for North Ronaldsay. A (presumably island based) haulier would be required to provide the new service.
- The high level cost of the fully operational RoRo berth option would be **£14m**. The alternative option of providing a sheltered Lo-Lo berth (potentially with a hard ramp) would cost around **£7m-£9m**.

Option CO4: Convert Papa Westray to a Ro-Ro port

- This option would involve the conversion of the exposed Lo-Lo berth at Papa Westray to a fully operational Ro-Ro berth capable of handling regular and reliable calls from Kirkwall by a Ro-Ro vessel together with providing a safe overnight berth. This would involve the extension of the existing jetty by approximately 40 metres. In addition a breakwater could be constructed to provide shelter from southerly waves (not costed here).²⁵
- Any increase in the number of calls per week would require additional vessel / crew hours over and above those offered in the current timetable.
- There may be a compensating reduction in air services as a result of increased ferry provision.
- An alternative option would be to provide a hard ramp berth for a smaller vessel to run between Papa Westray and Westray.²⁶
- Any change to Ro-Ro would fundamentally change the freight handling arrangements (and likely freight costs) for Papa Westray. A (presumably island based) haulier would be required to provide the new service either direct to Kirkwall or via Westray.
- The high level cost of the Kirkwall ferry Ro-Ro berth would be **£3.8m**. The provision of a breakwater would add **£2.5m** to this cost. The provision of a hard ramp berth would be lower at around **£3.0m** and there would be no requirement for a breakwater.

²³ See Appendix A - North Ronaldsay Harbour Drawing, Box 4, Harbour Improvements Option

²⁴ See Appendix A - North Ronaldsay Harbour Drawing, Box 3, Like-for-Like Option

²⁵ See Appendix A – Papa Westray Harbour Drawing, Box 4, Overnight Berth & Ro-Ro Option

²⁶ See Appendix A – Papa Westray Harbour Drawing, Box 3, Like-for-Like Option (II)

Appraisal against Objectives

Table 4.17: Outer North Isles, North Ronaldsay & Papa Westray – Appraisal against Objectives

	Option CO3 – Convert North Ronaldsay to a Ro-Ro port	Option CO4 – Convert Papa Westray to a Ro-Ro port
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	N/A	N/A
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	-	-
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	✓	✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	✓	✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-

4.4.23 As the air service is the dominant mode of travel for North Ronaldsay and Papa Westray residents, the provision of Ro-Ro berths in each island would only make a very limited contribution to the objectives. This would generally be associated with improving the reliability of the service, reducing the turnaround times associated with Lo-Lo operations and providing a safer operational environment. The frequency and overall connectivity could potentially be increased if the current berthing constraints are addressed, but this would be dependent on the provision of additional crewing hours if there was to be no net detriment to the service elsewhere.

Appraisal against STAG Criteria

Table 4.18: Outer North Isles, North Ronaldsay & Papa Westray – Appraisal against STAG Criteria

	Option CO3 – Convert North Ronaldsay to a Ro-Ro port	Option CO4 – Convert Papa Westray to a Ro-Ro port
Environment	xx	xx
Safety	✓	✓
Economy	✓	✓
Integration	✓	✓
Accessibility & Social Inclusion	✓	✓
Established Policy Directives	✓	✓
<i>Technical Feasibility</i>	<i>The conversion of North Ronaldsay to Ro-Ro is technically feasible although the environment for construction would be very challenging.</i>	<i>The conversion of Papa Westray to Ro-Ro is technically feasible although the environment for construction would be challenging.</i>
<i>Operational Feasibility</i>	<i>This option would remove the need for</i>	<i>This option would remove the need for a</i>

	Option CO3 – Convert North Ronaldsay to a Ro-Ro port	Option CO4 – Convert Papa Westray to a Ro-Ro port
	<i>a crane on the vessel and Lo-Lo operations at North Ronaldsay. New arrangements for handling island haulage would have to be implemented. The new overnight berth option could potentially accommodate a higher service frequency. However, additional assets / crew would be required if no other island was to be disadvantaged. There would be no issue with an enhanced Lo-Lo operation.</i>	<i>crane on the vessel and Lo-Lo operations at Papa Westray. New arrangements for handling island haulage would have to be implemented. The new berth could potentially accommodate a higher service frequency. However, additional assets / crew would be required if no other island was to be disadvantaged. There would be no issue with an enhanced Lo-Lo operation.</i>
Affordability	<i>£14m – fully operational Ro-Ro berth including safe overnight berth £7-£9m – more sheltered Lo-Lo operation (with optional hard ramp)</i>	<i>£3.8m (plus breakwater at £2.5m) fully operational Ro-Ro berth including safe overnight berth £3m – more sheltered Lo-Lo operation</i>
Public Acceptability	<i>Of those who attended the drop in session, of greater interest was a more reliable Lo-Lo service together with enhanced air services. Whilst there was no opposition to the concept of RoRo, there was a recognition that other options are perhaps more realistic and deliverable.</i>	<i>Research carried out by PWCC found support for a Kirkwall ferry Ro-Ro service providing it could provide a reliable service. It also found very little support for a Westray-Papa Westray Ro-Ro if this meant the loss of the Kirkwall ferry calls.</i>

4.4.24 The key points from above appraisal against the STAG criteria are:

- The environmental impact of converting both North Ronaldsay and Papa Westray to Ro-Ro would be a moderate negative. Both berths would require, at the minimum, an extension to the berthing structure and the inclusion of a linkspan or hard ramp. Ro-Ro at both ports could also include a breakwater and there would be a need for land reclamation at North Ronaldsay.
- There would be minor safety benefits associated with each option, as it would remove the need for challenging Lo-Lo operations, particularly at North Ronaldsay where the ageing population means securing able-bodied linesmen is likely to become increasingly challenging. The provision of a breakwater would enhance the safety benefits, particularly at North Ronaldsay where the vessel overhangs the very exposed berth.
- The economic, integration and accessibility benefits are likely to be relatively limited given that the bulk of personal travel is undertaken by air. There would be benefits associated with enhanced reliability and the ability to more easily take a car on and off of each island. A more significant scale of benefits could be realised if the service frequency was enhanced off the back of the harbour improvements. However, this would require either an increase in the number of assets and or crew.
- Whilst the options are technically feasible and would provide operational and reliability benefits, they are also very high cost.

Rationale for Selection / Rejection

4.4.25 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 4.19: Outcome of Appraisal, Outer North Isles, North Ronaldsay & Papa Westray

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Option CO3 – Convert North Ronaldsay to a Ro-Ro port	✗ (Ro-Ro) ✓ (enhanced Lo-Lo)	<p>The personal travel market in North Ronaldsay is predominantly and generally adequately delivered by the air service.</p> <p>Whilst the provision of a fully operational Ro-Ro berth would enhance the reliability of the service (and the number of connections if additional revenue funding was provided), the cost and impacts of delivering the necessary improvements significantly outweighs the benefits. There may need to be reductions in the number of air connections if the ferry service is scaled up.</p> <p>Modest harbour improvements could potentially be made to improve the safety and reliability of berthing at North Ronaldsay, although even these would be very challenging to implement. However the option of constructing a more sheltered Lo-Lo berth which could provide a more reliable and safer berth should be explored further.</p> <p>Overall, additional air services would be a more cost efficient way of delivering improved connectivity to North Ronaldsay.</p>
Option CO4 – Convert Papa Westray to a Ro-Ro port	✗ (Ro-Ro) ✓ (enhanced Lo-Lo)	<p>The personal travel market in Papa Westray is predominantly and generally adequately delivered by the air service and the foot passenger service to Westray.</p> <p>Whilst the provision of Ro-Ro facilities could, particularly with a breakwater, enhance the reliability of the service by providing a fully operational berth (and the number of connections if additional revenue funding was provided), the cost and impacts of delivering the necessary improvements significantly outweighs the benefits.</p> <p>There may also need to be reductions in the number of air connections if the ferry service is scaled up.</p> <p>Modest harbour improvements could potentially be made to improve the safety and reliability of berthing at Papa Westray, although even these would be challenging to implement. However the option of constructing a more sheltered Lo-Lo berth which could provide a more reliable and safer berth should be explored further and over the piece.</p> <p>Additional air services would be a more cost efficient way of delivering improved connectivity to Papa Westray.</p>

Capital Appraisal – Step 3: Ferry and Air Capital Options

4.4.26 The outputs of Steps 1 and 2 of the appraisal excluded the consideration of fixed links or the conversion of North Ronaldsay and Papa Westray to full Ro-Ro ferry terminals. This decision making process therefore dictates that the ultimate solution for the Outer North Isles involves the ongoing provision of ferry & air services to all six islands, with North Ronaldsay and Papa Westray continuing with a Lo-Lo and air-based service. The third step therefore is to appraise the remaining ferry and air service options.

4.4.27 A series of capital options has been developed based on a six-island service requirement. For ease of presentation, these options are split into a series of sub-headings before being brought together in a summary at the end of this section. The sub-headings are:

- Ro-Ro / Lo-Lo vessels;
- Ro-Ro / Lo-Lo harbours;
- passenger only vessels; and
- air options.

Ro-Ro / Lo-Lo Vessels

4.4.28 In advance of setting out the options in relation to Ro-Ro vessels, it is worth briefly summarising the harbour works which would be associated at each of the other ONI berths

with each generic vessel type, avoiding repetition in the text. The harbour options are set out in the table below:

Table 4.20: Required Harbour Infrastructure Improvements with Type 2a and Type 2b Vessels

Harbour	Type 2a	Type 2b
Kirkwall	<p>No major upgrades required. Recommend provision of a dedicated parking & waiting area at a cost of £100k.</p> <p><i>See Appendix A - Kirkwall Harbour Drawing, Box 2, Like-for-Like Option</i></p>	<p>No major upgrades required. Recommend provision of a dedicated parking & waiting area at a cost of £180k.</p> <p><i>See Appendix A - Kirkwall Harbour Drawing, Box 3, Larger Vessel Option</i></p>
Eday	<p>It is recommended that a dedicated parking and waiting area is provided. It is anticipated that this would cost £100k.</p> <p>Waiting room and toilets are aging and in need of replacement.</p> <p><i>See Appendix A - Eday Harbour Drawing, Box 2, Like-for-Like Option</i></p>	<p>If scaling-up to provide facilities for a larger vessel, it is recommended that the berth is designed for overnight berthing. This would involve extending the pier by approximately 20 metres or the provision of a dolphin. The linkspan would be upgraded as required to provide adequate vessel fit and dedicated parking & waiting area should be provided. It is anticipated that this would cost £2.5m.</p> <p><i>See Appendix A - Eday Harbour Drawing, Box 3, Like-for-Like Option & Overnight Berth</i></p>
Sanday	<p>No terminal upgrades would be required at Sanday although the assets would need to be replaced on life expiry. The vessel can currently safely overnight in Sanday.</p> <p><i>See Appendix A - Sanday Harbour Drawing, Box 2, Like-for-Like Option</i></p>	<p>The linkspan would be upgraded as required to provide adequate vessel fit and parking & waiting areas would be required. It is anticipated that this would cost £1.2m. The vessel can currently safely overnight in Sanday.</p> <p><i>See Appendix A – Sanday Harbour Drawing, Box 3, Larger Vessel Option</i></p>
Stronsay	<p>The dredged depth should be increased if a fully tide range operational berth is required. This would include dredging the access channel and providing a manoeuvring area for the vessel to turn (dredged to -3.5m CD). It is also recommended that a dedicated parking / waiting area is provided. It is anticipated that this would cost £2.0m.</p> <p><i>See Appendix A - Stronsay Harbour Drawing, Box 2, Like-for-Like Option</i></p>	<p>The linkspan would be upgraded as required to provide adequate vessel fit. It is recommended to extend the existing jetty by circa 20m to provide additional shelter, and parking & waiting areas would be required.</p> <p>The dredged depth should be increased if a fully tide range operational berth is required. This would include dredging the access channel and providing a manoeuvring area for the vessel to turn (dredged to -3.5m CD).</p> <p>It is anticipated that this would cost £3.2m</p> <p><i>See Appendix A – Stronsay Harbour Drawing, Box 3, Larger Vessel Option</i></p>
Westray	<p>No terminal upgrades would be required at Westray although the assets would need to be replaced on life expiry.</p> <p><i>See Appendix A - Westray Harbour Drawing, Box 2, Like-for-Like Option</i></p>	<p>The linkspan would be upgraded as required to provide adequate vessel fit. A pier extension of approximately 80m would be required to provide adequate shelter. Detailed development would be required as expensive rock blasting may be required and it is not certain that with an 80m extension to the pier as to whether a vessel could safely manoeuvre into the berth in all weather conditions. A parking & waiting area would be required. It is anticipated that this would cost £3.1m. These works would also provide a safe year round overnight berth.</p> <p><i>See Appendix A – Westray Harbour Drawing, Box 3, Larger Vessel Option</i></p>

Option CO5a: Replace the current fleet with three vessels

- The new vessels would be Type 2a, Type 2b or a mix of the two. This option would therefore cost in the range of £21m (60m vessels) to £27.75m-£46.5m (75m vessels) depending on which vessel specification is selected (see Table 2.2).
- The harbour works required would be dependent on the vessel mix chosen and would reflect those set out in in the table above. The estimated cost of the harbour works would be £2.2m (Type 2a) to £10.2m (Type 2b). In addition, a Type 2b vessel would likely require harbour works at Papa Westray and North Ronaldsay as laid out above.
- Two of the vessels would require a crane unless a shore based crane was taken forward.
- The current single crew operation is assumed.

Option CO5b: Supplement Option CO5a with a freight vessel

- Option CO5a would be supplemented by a freight only vessel equipped with a crane. The vessel would be equivalent to e.g. the Shetland ferry MV *Filla* and would cost £4.1m.
- The freight vessel would be used primarily to serve North Ronaldsay and Papa Westray. The three Ro-Pax vessels would focus on Eday, Sanday, Stronsay and Westray.
- The freight vessel could provide supplementary freight services to other islands at peak times (e.g. Westray on a Monday morning), releasing deck space for cars.
- If a freight vessel was procured, only one of the Ro-Pax fleet would need to have a crane if the current Lo-Lo islands did not have a shore-based crane.
- The acquisition of a vessel equivalent to the MV *Filla* would allow passenger and Ro-Ro vehicle capacity to be 'switched-on' allowing the vessel to act as a fourth Ro-Pax where required and as a supplementary Ro-Pax during refit timetable.
- The current single crew operation is assumed.
- This option would not require any additional harbour works over and above option CO5a. The total capital cost in 2016 prices would therefore be **£4.1m**.

Option CO6a: Replace the current fleet with four vessels

- The new vessels would be Type 2a, Type 2b or a mix of the two. This option would therefore cost in the range of £28m (60m vessels) to £37m-£62m (75m vessels) (see Table 2.2).
- The harbour works required would be dependent on the vessel mix chosen and would reflect those set out in in the table above. The estimated cost of the harbour works would be £2.2m (Type 2a) to £10.2m (Type 2b). In addition, a Type 2b vessel would likely require harbour works at Papa Westray and North Ronaldsay as laid out above.
- The current single crew operation is assumed.

Option CO6b: Supplement Option CO6a with a freight vessel

- This option would be equivalent to Option CO5b. The only difference with a four vessel solution is that Eday, Sanday, Stronsay and Westray would each have a dedicated vessel outwith refit period.
- If a freight vessel was procured, only one of the Ro-Pax fleet would need to have a crane if the current Lo-Lo islands did not have a shore-based crane.
- The current single crew operation is assumed.
- This option would not require any additional harbour works over and above option CO6a. The total capital cost in 2016 prices would therefore be **£4.1m**.

Option CO7: Convert the Papa Westray to Pierowall route to Ro-Ro

- This option would involve the conversion of the current foot passenger route between Papa Westray and Pierowall to Ro-Ro.
- The route would be operated by a small bespoke Ro-Ro (landing craft style) or a Type 1a vessel, with the current Papa Westray–Kirkwall Lo-Lo service discontinued. A slipway would be required at either end of the crossing. A Type 1a vessel is estimated to cost **£4m**, although a very small landing craft style vessel would be significantly cheaper.
- This would change the service from a summer only timetabled service to a year round service. There would be a requirement for new crew, providing local employment opportunities as the crew would have to be Westray / Papa Westray based.
- Air services would not be impacted.
- As noted previously, the cost of providing a hard ramp berth in Papa Westray would be **£3m**²⁷ whilst the cost of providing a hard ramp based solution at Pierowall would be **£1.6m**²⁸. Further detailed development work would be required to ensure that there is sufficient depth for a ferry to berth onto the hard ramp at all states of the tide. There is a lower cost option for a very small landing craft style vessel which could be accommodated within the existing harbour at Pierowall.

Appraisal against Objectives

Table 4.21: Outer North Isles, Ro-Ro / Lo-Lo Options – Appraisal against Objectives

	Option CO5a – Replace the current fleet with three vessels	Option CO5b – Supplement Option CO5a with a freight vessels	Option CO6a – Replace the current fleet with four vessels	Option CO6b – Supplement Option CO6a with a freight vessels	Option CO7 – Convert Papa Westray – Pierowall to Ro-Ro
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓✓	✓✓	✓✓✓	✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	N/A	N/A	N/A	N/A	N/A
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	xx	x	✓✓	✓✓✓	-
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	✓	✓✓	✓✓✓	-
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	xx	x	✓	✓✓	-

²⁷ See Appendix A – Papa Westray Drawing, Box 4, Like-for-Like (II) Option.

²⁸ See Appendix A – Westray (Rapness) Drawing, Boxes 2&3, Small Scale Low Capacity Ro-Ro (I) and (II) Options.

	Option CO5a – Replace the current fleet with three vessels	Option CO5b – Supplement Option CO5a with a freight vessels	Option CO6a – Replace the current fleet with four vessels	Option CO6b – Supplement Option CO6a with a freight vessels	Option CO7 – Convert Papa Westray – Pierowall to Ro-Ro
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-	-	-	-

- 4.4.29 The different vessel options provide incremental capacity benefits. The adoption of three modern vessels (**Option CO5a**) would offer a capacity benefit through addressing the deadweight constraints which currently impact on the ONI fleet. The extent of the benefit would of course depend on the vessel mix chosen, with three Type 2b vessels providing a significant step up in capacity compared to three Type 2a vessels. A key drawback with any three vessel solution however is that, with a mixed ONI & Inner & South Isles fleet, the ONI would be reduced to two vessels during refit timetable, which gives rise to significant capacity disbenefits for the islands. Indeed, it has already been demonstrated that a service based on three vessels cannot provide the level of connectivity required.
- 4.4.30 Supplementing the three vessel solution with a freighter (**Option CO5b**) provides a moderate capacity benefit. The principal benefit of the freighter is that it effectively removes North Ronaldsay and Papa Westray from the timetable operated by the Ro-Pax vessels. The additional connections which can then be offered by the Ro-Pax vessels can enhance capacity through increased frequency. In addition, the freight vessel would only need to make a limited number of calls at North Ronaldsay and Papa Westray each week (1-3 calls per week) and can be used to provide supplementary freight capacity on other parts of the ONI network (Monday morning departures from Westray for example), supplementing car deck availability. .
- 4.4.31 **Option CO6a** would also offer a moderate benefit in terms of capacity, allowing the six islands to be served by four rather than three vessels. The provision of four Ro-Pax vessels and a supplementary freight vessel would be transformative for the Outer North Isles, in that it would offer dedicated vessels for Eday, Sanday, Stronsay and Westray and a shared vessel for North Ronaldsay and Papa Westray. The capacity benefits of the freighter set out in Option CO5b also apply to Option CO6b.
- 4.4.32 The provision of a Ro-Ro service between Papa Westray and Pierowall (**Option CO7**) would make a minor positive contribution towards capacity, as it would allow Papa Westray residents to take their vehicles to Westray and onwards to the mainland on most if not all days of the week.
- 4.4.33 The three vessel solution (**Option CO5a**) does not deliver the minimum four hours on the mainland six days a week year round. The need to serve North Ronaldsay and Papa Westray as well as the move to a two vessel solution during the refit timetable means that this option records a moderate negative. Supplementing the three vessels with a freighter (**Option CO5b**) may also fail to deliver the requisite time on the mainland given the capacity restrictions implied by freight only operation. The four vessel solution (**Option CO6a**) does make a moderate contribution in this regard, although refit timetable remains an issue. Supplementing a four vessel solution with a freighter (**Option CO6b**) makes a major contribution to this objective, with the freighter supporting the Ro-Pax vessels during refit. However, fully realising the requirements of the objective would require an additional crew / a longer operating day.
- 4.4.34 In terms of frequency, a three vessel solution (**Option CO5a**) would offer no change on the current situation. A freighter (**Option CO5b**) would offer a slight increment in frequency, both

through allowing three Ro-Pax vessels to concentrate on Eday, Sanday, Stronsay and Westray and also through providing additional freight only connections on other days of the week. A four vessel solution (**Option CO6a**) would offer a moderate positive in this respect, whilst supplementing these four vessels with a freighter (**Option CO6b**) would offer a significant step-change in frequency.

4.4.35 The three vessel solution (**Option CO5a**) would offer no improvement on the current irregular timetable, with the exception that new vessels could lie out more than two nights per week. A freighter (**Option CO5b**) would assist to some extent but the timetable would still be irregular. A four vessel solution (**Option CO6a**) and the addition of a freighter (**Option CO6b**) would make incremental positive improvements to the regularity of the timetable.

4.4.36 None of the options would make any contribution towards strategic connectivity without the operating day being extended.

Appraisal against STAG Criteria

Table 4.22: Outer North Isles, Ro-Ro / Lo-Lo Options – Appraisal against Objectives

	Option CO5a – Replace the current fleet with three vessels	Option CO5b – Supplement Option CO5a with a freight vessel	Option CO6a – Replace the current fleet with four vessels	Option CO6b – Supplement Option CO6a with a freight vessel	Option CO7 – Convert Papa Westray – Pierowall to Ro-Ro
Environment	✓	-	✗	✗✗	✗
Safety	✓	✓	✓	✓	✗
Economy	✗	✓	✓✓	✓✓✓	✓
Integration	✗	✓	✓✓	✓✓	✓
Accessibility & Social Inclusion	✗	✓	✓✓	✓✓✓	✓✓
Established Policy Directives	✗	✓	✓✓	✓✓	✓
Technical Feasibility	Harbour works would be required, the scale of which would be dependent on the vessel mix chosen.	Harbour works would be required, the scale of which would be dependent on the vessel mix chosen.	Harbour works would be required, the scale of which would be dependent on the vessel mix chosen.	Harbour works would be required, the scale of which would be dependent on the vessel mix chosen.	The provision of hard ramp slipways would be required at both Papa Westray & Pierowall.
Operational Feasibility	Crew induction training required.	Crew induction training required. Additional crew would be required to operate the freighter. The freight vessel could be used to provide additional freight connections over the week and could also run as a Ro-Pax during refit timetable.	Crew induction training required. Additional crew would be required to operate the fourth Ro-Pax.	Crew induction training required. Additional crew would be required to operate the fourth Ro-Pax and the freighter. The freight vessel could be used to provide additional freight connections over the week and could also run as a Ro-Pax during refit timetable.	Crew induction training required. Existing crew would need to be trained / certified for Ro-Ro operations. It is assumed that the existing Lo-Lo service from Papa Westray would be discontinued – this would put capacity pressure on the Westray – Kirkwall route.
Affordability	Depends on vessel mix and associated harbour works.	Incremental cost of £4.1m	Depends on vessel mix and associated harbour works.	Incremental cost of £4.1m	Vessel and harbour works of £8.6m, although this would be a

	Option CO5a – Replace the current fleet with three vessels	Option CO5b – Supplement Option CO5a with a freight vessel	Option CO6a – Replace the current fleet with four vessels	Option CO6b – Supplement Option CO6a with a freight vessel	Option CO7 – Convert Papa Westray – Pierowall to Ro-Ro
					<i>much lower cost with a smaller vessel.</i>
Public Acceptability	<i>As this option would provide little scope to provide additional connections and would not resolve the winter refit issue, this option is not likely to be acceptable.</i>	<i>Some support for this option and it may be acceptable depending on the detail of the timetabled services which would emerge.</i>	<i>Strong support for a four vessel solution. Would be acceptable to the public.</i>	<i>Less comment was received concerning this option but, whilst acceptable, most felt that a four vessel solution would be appropriate.</i>	<i>Research carried out by PWCC found very little support for a Westray-Papa Westray Ro-Ro if this meant the loss of the Kirkwall ferry calls.</i>

4.4.37 The key points from the above appraisal against the STAG criteria are:

- From an environmental perspective, the like-for-like replacement of the current fleet (**Option CO5a**) would record a minor benefit, as it would replace ageing tonnage with new vessels that operate on more efficient engines (and potentially an alternative fuel source). This environmental benefit would decline with each incremental vessel, as total global emissions would increase. The conversion of Papa Westray – Pierowall (**Option CO7**) would have a minor negative environmental impact as it would involve the construction of new slipways the conversion of a passenger only route to Ro-Ro (the route would therefore operate with a higher emissions vessel and additional vehicle kilometres would also be generated).
- The three and four vessel options (**Options CO5a – CO6b**) would provide a minor safety benefit. The new vessels would meet all modern legislation, in particularly having no passenger accommodation below the waterline. This would also increase overnighting opportunities on the islands. The conversion of Papa Westray – Pierowall (**Option CO7**) would have a very minor negative safety impact as it would generate additional vehicle kilometres.
- The like-for-like replacement of the current fleet (**Option CO5a**) would return a negative against the Economy and Accessibility & Social Inclusion criteria. It is clear from all of the research undertaken to date that a three vessel solution cannot provide the required year round connectivity and capacity for the Outer North Isles, with the refit timetable being particularly problematic. With capacity issues already prevalent across the network (particularly for Sanday and Westray), it is likely that this option would constrain the economies of the Outer North Isles in the years ahead. In contrast, the addition of a freighter to the three vessel solution (**Option CO5b**) would offer minor economic and accessibility benefits. As the freighter would effectively withdraw North Ronaldsay and Papa Westray from the roster of the three Ro-Pax vessels, the number of connections which could be delivered by these vessels would increase. The freighter could also provide additional freight connections across the ONI over the week and be flexibly used as a fourth Ro-Pax when required. This would give rise to TEE benefits from increased frequency / capacity and would provide wider benefits in terms of residents, locally traded services and tourism. It would also support the manufacturing facilities on Westray as well as the critical agricultural sector across the ONI.
- A four vessel solution (**Option CO6a**) would offer broadly equivalent benefits to three Ro-Pax vessels plus a freighter. The additional benefit of this option is that it would offer four Ro-Pax vessels in operation at all times but clearly this would come at a higher cost than the 3+1 option. Supplementing the four vessels with a freighter (**Option CO6b**) would be transformative for the isles – Eday, Sanday, Stronsay and Westray would in effect have

dedicated vessels, whilst North Ronaldsay and Papa Westray would share a freighter (which in itself could be used to provide additional capacity across the week). This option would ensure that there are never less than four vessels operating the ONI network and would allow three rotations from each of the Ro-Ro islands daily. This could also potentially allow a shuffling of air services to enhance support to Papa Westray and North Ronaldsay. The types of benefits under both options CO6a and CO6b would be equivalent to the Option CO5b, but would just be on a larger scale.

- The conversion of Papa Westray – Pierowall to Ro-Ro (**Option CO7**) would have minor economic benefits and moderate accessibility benefits for Papa Westray. A Ro-Ro service would enhance accessibility for freight and passengers to / from Kirkwall via Westray, whilst also allowing island residents to access the wider range of services on the larger island. The only potential disbenefit is that it could lead to a greater concentration of services in Westray.
- The three vessel solution (**Option CO5a**) would make a negative contribution in terms of policy integration / fit with established directives, as it would leave the ONI some way short of the RSM levels of service.
- All of the options are technically deliverable, although clearly the scale of harbour works increases with vessel size. From an operational perspective, each vessel increment may require additional crew, so there could be a recruitment issue.
- In broad terms, the cost (capital and revenue) will increase with each vessel increment (although the number of connections that can be made and hence the benefits also increase). The four vessels plus freighter solution (**Option CO6b**) will in all likelihood have the highest cost, but it would move the ONI towards a level connectivity equivalent with that offered in the Clyde & Hebrides and Shetland, where the majority of islands operate with at least one dedicated vessel.

Rationale for Selection / Rejection

4.4.38 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 4.23: Outcome of Appraisal, Outer North Isles, Ro-Ro / Lo-Lo Options

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Option CO5a – Replace the current fleet with three vessels	✗	The current number of assets cannot meet the needs of the ONI communities in terms of frequency, length of operating day or capacity, and fall short of the RSM. This issue is heightened during the refit timetable, which reduces the service to two vessels. This option is therefore discounted from further consideration.
Option CO5b – Supplement Option CO5a with a freighter	✓	A four vessel solution, coupled with potentially extended operating days would provide a future-proofed solution for the ONI. This basic conclusion would apply regardless of other potential changes on the network such as new overnight berths, harbour relocations, ro-ro conversions etc. The issue is the appropriate vessel and crewing mix. This option would provide a cheaper fourth vessel with more limited functionality which may be sufficient depending on further analysis.
Option CO6a – Replace the current fleet with four vessels	✓	A four vessel solution, coupled with potentially extended operating days would provide a future-proofed solution for the ONI. This basic conclusion would apply regardless of other potential changes on the network such as new overnight berths, harbour relocations, ro-ro conversions etc. The issue is the appropriate vessel and crewing mix. This option would provide four Ro-Ro ferries which would provide maximum operational capacity and flexibility.
Option CO6b – Supplement Option CO6a with a freighter	✗	A four vessel solution could meet the frequency, length of operating day & capacity needs of the ONI. A five vessel solution would be disproportionate.
Option CO7 – Convert	✓	This option is retained for further consideration. The provision of a Ro-Ro

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Papa Westray – Pierowall to Ro-Ro.		<p>connection would give rise to economic and accessibility benefits for Papa Westray, and to some extent Westray. The Papa Westray – Kirkwall freight service could be withdrawn and the small number of hours saved reallocated to providing an enhanced service elsewhere.</p> <p>The impact of this option on the three / four vessel solution options outlined above has to be considered.</p> <p>This option should not be linked to any reduction in air services to Papa Westray.</p>

Ro-Ro / Lo-Lo Harbours

Option CO8a: Develop an overnight berth at Eday.

- This option would involve the development of a year round overnight berth at Eday. This would allow for the vessel to overnight on the island and the first service to be outbound to Kirkwall on some or all days of the week.
- Overnight accommodation would be required on the vessels.
- It is assumed that the required harbour works would be commensurate with the scale of investment required to scale up to a Type 2b vessel – see Table 4.20.²⁹

Option CO8b: Develop an overnight berth at Westray

- This option would involve the development of a year round overnight berth at Westray. This would allow for the vessel to overnight on the island year round and the first service to be outbound to Kirkwall on some or all days of the week.
- Overnight accommodation would be required on the vessels.
- It is assumed that the required harbour works would be commensurate with the scale of investment required to scale up to a Type 2b vessel – see Table 4.20.³⁰

Option CO9: Develop a new harbour in the west of Stronsay

- The current harbour at Whitehall on Stronsay is in the north of the island, leading to extended journey times from Kirkwall and lengthy diversions on indirect services to / from Sanday and Eday. The development of a new harbour would bring the rotation time for Stronsay into line with Sanday and Westray, saving around 25 minutes per rotation. This would therefore also bring timetabling benefits which could improve timetable regularity.
- There are two possible locations for a new harbour:
 - Huip Sound East (near Stronsay Airport): This location will require shelter from north-westerly waves. The shallow area will require dredging to provide the required depth for a Type 2a and Type 2b ferry. This berth would be near to the existing ferry routes to Eday and Sanday, although it would require a new access road.
 - Linga Sound West: This location will require shelter from south-westerly waves. The shallow area will require dredging to provide required depth for like for like and larger vessels. It is near existing ferry routes to Eday and Sanday and will require new road access. Further development work is needed.

²⁹ See Appendix A – Eday Drawing, Box 3, Larger Vessel & Overnight Berth Option

³⁰ See Appendix A – Westray Drawing, Box 3, Larger Vessel Option

- The conceptual nature of this proposal prevents any firm cost estimate at this stage – further development work would therefore be required, however as an entirely new facility, the costs associated are likely to be substantial.³¹

Appraisal against Objectives

Table 4.24: Outer North Isles, Ro-Ro / Lo-Lo Harbours Options – Appraisal against Objectives

	Option CO8a – Develop a new overnight berth at Eday	Option CO8b – Develop a new overnight berth at Westray	Option CO9 – Develop a new harbour in the west of Stronsay
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓	✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	N/A	N/A	N/A
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	✓	✓	✓
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	-	✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	✓	✓	-
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	✓	✓	-

4.4.39 The provision of new overnight berths in Eday (**Option CO8a**) and Westray (**Option CO8b**) would provide a minor contribution to a number of the objectives. The ability to commence the service from on the island would allow a more appropriate matching of supply and demand for the ferry service – on some days, the main demand may be inbound to Kirkwall (e.g. Monday morning from Westray), on other days outbound from Kirkwall. Tenable year round overnight berths in the isles and on the mainland would support a more flexible service, a consistent timetable, enhanced time on mainland on given days and potentially earlier departures which would connect with onward travel opportunities (e.g. the 1100 NorthLink departure from Stromness in peak season).

4.4.40 The development of a new harbour in the west of Stronsay (**Option CO9**) would reduce the steaming time to and from Stronsay, releasing around 7 hours per week within the summer timetable. The redeployment of these hours would make a contribution to enhancing frequency and thus capacity and potentially time on Orkney mainland.

³¹ See Appendix A –Stronsay Drawing, Box 4, Relocation of Stronsay Harbour Drawing

The Appraisal against STAG Criteria

Table 4.25: Outer North Isles, Ro-Ro / Lo-Lo Harbours Options – Appraisal against Objectives

	Option CO8a – Develop a new overnight berth at Eday	Option CO8b – Develop a new overnight berth at Westray	Option CO9 – Develop a new harbour in the west of Stronsay
Environment	x	x	xx
Safety	-	-	-
Economy	✓	✓	✓
Integration	✓	✓	x
Accessibility & Social Inclusion	✓	✓	-
Established Policy Directives	✓	✓	✓
Technical Feasibility	<i>This would involve extending the pier by approximately 20 metres and the provision of a dolphin.</i>	<i>A pier extension of approximately 80m would be required to provide adequate shelter. Detailed development would be required as expensive rock blasting may be required and it is not certain that with an 80m extension to the pier as to whether a vessel could safely manoeuvre into the berth in all weather conditions</i>	<i>There are two potential locations for a new harbour in Stronsay. Detailed technical investigation and costing of both sites would be required to establish feasibility.</i>
Operational Feasibility	<i>The ferry could lie overnight at Eday and the timetable would need to be reworked to reflect this.</i>	<i>The ferry could lie overnight at Westray and the timetable would need to be reworked to reflect this.</i>	<i>There would be 7 hours of savings in the timetable each week which could be used to enhance existing Stronsay services or redeployed elsewhere.</i>
Affordability	<i>It is anticipated that that an overnight berth would be realised if the harbour works commensurate with a Type 2b vessel were undertaken - £2.5m.</i>	<i>It is estimated that this would cost £4.1m.</i>	<i>Likely to be significant as this would be an entirely new site</i>
Public Acceptability	<i>An earlier first sailing of the day depart from Eday was a key priority for residents. As an enabling measure for this, it can be assumed that there would be strong support for this measure.</i>	<i>Having the first sailing of the day depart from Westray was a key priority for residents. As an enabling measure for this, it can be assumed that there would be strong support for this measure.</i>	<i>Moving the Stronsay harbour was rejected by the community in a 'referendum' a number of years ago. Opinion was again split on this issue although more comments in favour of a move were received than in opposition.</i>

4.4.41 The key points from above appraisal against the STAG criteria are:

- From an environmental perspective, the two overnight berths (**Options CO8a and Option CO8b**) would likely record a minor environmental negative, although the impacts are likely to be relatively limited in the long-term. The development of a new harbour in Stronsay (**Option CO9**) would have moderate negative environmental impacts as it would involve an entirely new facility plus access roads and would result in increased vehicle

kilometres as the harbour would be outwith the main settlement (although if the ‘saved’ operating hours were not redeployed, there would be a reduction in ferry emissions).

- There would be minor Economy and Accessibility & Social Inclusion benefits for Eday and Westray from the provision of overnight berths on each island (**Options CO8a and CO8b**). The provision of such berths would mean that Eday, Sanday, Stronsay and Westray could all accommodate a vessel overnight. If married with new tonnage (the current tonnage can only lie out two nights per week), there would be considerably increased flexibility in the operation of the network. This flexibility would allow the needs of the community to have a more integral role in setting the timetable, with itinerant benefits.
- The provision of a new harbour in Stronsay (**Option CO9**) would have minor economic benefits associated with reduced journey times, although these would be offset to some extent by the drive time to the port and dependency on car-based access, which would worsen integration.

Rationale for Selection / Rejection

4.4.42 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 4.26: Outcome of Appraisal, Outer North Isles, Ro-Ro / Lo-Lo Harbours Options

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Option CO8a – Develop a new overnight berth at Eday	✓	The provision of a new overnight berth in Eday would enhance the flexibility of the service and allow for a better matching of supply and demand. This option should be considered as part of any vessel replacement programme.
Option CO8b - Develop a new overnight berth at Westray	✓	The provision of a new overnight berth in Westray would enhance the flexibility of the service and allow for a better matching of supply and demand. This option should be considered as part of any vessel replacement programme.
Option CO9 – Develop a new harbour in the west of Stronsay.	✓	This option is retained and will be revisited after the public engagement meetings.

Passenger Only Vessels

Option CO10: Replace the MV *Golden Mariana* with a like-for-like passenger only vessel

- This option would involve the replacement of the current MV *Golden Mariana* with a like-for-like passenger only vessel. It is estimated that this would cost around £500k.
- No major harbour works would be required.
- This option is mutually exclusive with Option CO7.
- A sub-option of this would be to run the current service on a permanent year round timetabled basis. At present the service runs to a timetable in summer and operates as a school run / NHS charter in winter.
- The cost of this option in 2016 prices would be **£500k**.

Option CO11: Operate a passenger only service between Eday and Sanday

- This option would involve the operation of a passenger only vessel between Eday and Sanday. The vessel would be a small medium-speed passenger only catamaran similar to the MV *Flotta Lass* and would cost in the region of **£1.0m**.

- Minor harbour works would be required at both ports.
- The option would principally be intended to allow Eday children to attend Sanday Junior High on a daily basis.

Appraisal against Objectives

Table 4.27: Outer North Isles, Passenger Only Vessel Options – Appraisal against Objectives

	Option CO10 – Replace MV <i>Golden Mariana</i> on a like-for-like basis	Option CO11 – Operate a passenger only service between Eday and Sanday
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	-	✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	✓
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	-	-
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	-
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-

4.4.43 The replacement of the MV *Golden Mariana* on a like-for-like basis (**Option CO10**) is in effect the 'Do Minimum' for the current Papa Westray – Westray service and would thus not contribute materially to the objectives.

4.4.44 The provision of a passenger only vessel between Eday and Sanday (**Option CO11**) would offer minor capacity and scheduling benefits, although these would be for services between the islands rather than island-mainland connections. This connection would also allow S1-S4 children to commute daily to Sanday Junior High School, and thus records a minor benefit in this respect.

Appraisal against STAG Criteria

Table 4.28: Outer North Isles, Passenger Only Vessel Options – Appraisal against Objectives

	Option CO10 – Replace MV <i>Golden Mariana</i> on a like-for-like basis	Option CO11 – Operate a passenger only service between Eday and Sanday
Environment	-	✗
Safety	-	-
Economy	-	-
Integration	-	✗

	Option CO10 – Replace MV <i>Golden Mariana</i> on a like-for-like basis	Option CO11 – Operate a passenger only service between Eday and Sanday
Accessibility & Social Inclusion	✓	✓✓
Established Policy Directives	✓	✗
<i>Technical Feasibility</i>	<i>There are no technical feasibility issues associated with this option.</i>	<i>Minor harbour and access works would be required at Eday and Sanday.</i>
<i>Operational Feasibility</i>	<i>Crew induction training would be required</i>	<i>A new crew would be required</i>
Affordability	<i>Vessel estimated at around £500k</i>	<i>Estimated at around £1m plus operating costs</i>
Public Acceptability	<i>In addition to its ongoing role, there was strong support for the expansion of this service to a year round timetabled service.</i>	<i>There is support for this proposal, or at least a link of some sort particularly from those with school age children.</i>

4.4.45 The key points from above appraisal against the STAG criteria are:

- The provision of an additional vessel operating between Eday and Sanday (**Option CO11**) would have minor environmental disbenefits due to increased emissions.
- The provision of a new vessel to replace the 1973 built MV *Golden Mariana* (**Option CO10**) would likely provide very minor economic benefits for Papa Westray. The provision of a passenger only vessel between Eday and Sanday would improve the overall accessibility of Eday, but the most notable benefit is that it would allow S1-S4 school children to return to the island each evening, likely making it a more attractive place for those with families to live.
- The provision of a service between Eday and Sanday (**Option CO11**) principally for the use of school children would represent a minor negative in terms of policy integration as Council policy is that children should attend the school in Kirkwall.
- The cost of a new vessel and the harbours works for an Eday – Sanday passenger only vessel (**Option CO11**) is relatively low in the context of the network as a whole. However, they are moderate to high when considered in the context of the likely limited use of this service.

Rationale for Selection / Rejection

4.4.46 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 4.29: Outcome of Appraisal, Outer North Isles, Passenger Only Vessel Options

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Option CO10 – Replace the MV <i>Golden Mariana</i> on a like-for-like basis	✓	This option is retained as the Do Minimum for the Papa Westray – Pierowall route. It should be noted that if Option CO7 (convert Papa Westray – Pierowall to Ro-Ro) is pursued, this option would be rejected from further consideration by default.
Option CO11 – Operate a passenger only service between Sanday and	✗	This option is rejected from further consideration as it is a relatively high cost option for the number of people that it would serve. A link between Sanday and Eday could more meaningfully and affordably be offered by an enhanced

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Eday		air service.

Air Options

Option CO12 (Do Minimum): Maintain and continue with the current BN2 Islanders over the strategy period / until life expiry.

- This would involve continuing with the current Britten-Norman Islanders over the length of the strategy period.
- If it becomes clear during this period that one or both of the aircraft is nearing the end of its operational life (likely within the first 10-15 years of the strategy), replacement BN2 Islanders (or another appropriate aircraft at that time) should be sought through the tendering process.

Option CO13: Supplement the current aircraft with an additional BN2 Islander.

- An additional BN2 Islander would be leased or purchased and added to the fleet. The timetable would be expanded to take account of this additional capacity.
- It is likely that the current crew complement would need to increase from 3.5 to 4.5 or 5 crew.

Option CO14: Install lighting on all island airstrips.

- This option would involve the installation of runway lighting at Eday, Papa Westray, Sanday, Stronsay and Westray.
- Further investigation into the type of lighting to be used is required – it is assumed for the purpose of this analysis that Precision Path Approach Indicator (PAPI) lights would be installed.

Option CO15: Install GNSS on the current BN2 Islanders.

- This option would involve the installation of GNSS and supporting equipment on the current fleet of BN2 Islanders. GNSS-based approaches would be developed and implemented.

Appraisal against Objectives

Table 4.30: Outer North Isles, Air Capital Options – Appraisal against Objectives

	Option CO12 – Maintain and continue with the current BN2 Islanders over the strategy period / until life expiry	Option CO13 – Supplement the current aircraft with an additional BN2 Islander	Option CO14 – Install lighting on all island airstrips	Option CO15 – Install GNSS on the current BN2 Islanders
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✗	✓✓✓	✓	✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	N/A	N/A	N/A	N/A

	Option CO12 – Maintain and continue with the current BN2 Islanders over the strategy period / until life expiry	Option CO13 – Supplement the current aircraft with an additional BN2 Islander	Option CO14 – Install lighting on all island airstrips	Option CO15 – Install GNSS on the current BN2 Islanders
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	-	✓✓	✓	✓
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	✓✓	✓	✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	✓✓	✓	✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	✓	✓	✓

4.4.47 The key points from the above table are summarised below:

- Continuing with the current aircraft (**Option CO12**) would have a minor negative impact against the capacity objective (TPO1) as there are demonstrated capacity constraints across the network, principally associated with the movement of schoolchildren and itinerant teachers. There would be no impact in terms of any of the other objectives.
- The addition of a third aircraft to the fleet (**Option CO13**) would make a significant contribution to the objectives. It would likely permit two aircraft to be in frontline service at all times, providing a significant increase in capacity, frequency and time on mainland. The addition of a third aircraft would also allow a degree of parity in the service of different islands, providing Eday with an enhanced service for example. Perhaps most importantly, it would address the current capacity issues, by allowing one of the aircraft to cover the needs of the education service. The additional aircraft could also provide additional operating hours that could be deployed at the weekend, enhancing the air connectivity at a time of the week when ferry connectivity is more limited.
- The provision of runway lighting (**Option CO14**) and GNSS (**Option CO15**) could potentially extend the reliability and operating envelope of the air service, for example permitting continued flying in less clement weather or allowing night landing. This would make a positive contribution to a number of criteria including capacity, frequency and time on mainland. However, the generation of positive impacts would be dependent on the timetabled change in service being reliably delivered.

Appraisal against STAG Criteria

Table 4.31: Outer North Isles, Air Capital Options – Appraisal against STAG Criteria

	Option CO12 – Maintain and continue with the current BN2 Islanders over the strategy period / until life expiry	Option CO13 – Supplement the current aircraft with an additional BN2 Islander	Option CO14 – Install lighting on all island airstrips	Option CO15 – Install GNSS on the current BN2 Islanders
Environment	-	✘	-	-
Safety	-	✘	✘	✓
Economy	✘	✓✓✓	✓	✓
Integration	-	✓✓	✓	✓
Accessibility & Social Inclusion	✘	✓✓✓	✓	✓
Established Policy Directives	-	✓✓✓	✓	✓
Feasibility				
Technical Feasibility	<i>There would be no technical issues associated with this option assuming that no major issues emerge with the aircraft. The aircraft would be replaced by appropriate aircraft at life expiry.</i>	<i>There would be no technical issues associated with this option.</i>	<i>There would be no technical issues associated with this option beyond initial set-up</i>	<i>There would be no technical issues associated with this option beyond initial set-up (explained in Chapter 3) providing the technology is proven in current trials in Scotland.</i>
Operational Feasibility	<i>There would be no operational issues associated with this option assuming that suitable levels of operational resources are provided.</i>	<i>At least 1-1.5 additional pilots would be required.</i>	<i>The tolerances for landing in darkness are significantly reduced, so lighting alone cannot be seen as a panacea for night time flying. The experience of runway lighting Orkney has, so far, been poor.</i>	<i>Pilot and ground staff training would be required. The current operator has raised concerns about the applicability and safety of GNSS in the Orkney context, explaining that a wider range of factors would have an impact on whether this technology could be deployed.</i>
Affordability	<i>There would be no affordability issues associated with this option</i>	<i>Study undertaken in 2010 suggested that third aircraft could be operated for an additional £600k (excluding airfield costs).</i>	<i>This option would cost around £250k in total (estimated at £50k per airfield)</i>	<i>This option would cost around £100k for the two aircraft</i>
Public Acceptability	<i>This option may be acceptable but would not address the current issues surrounding the air service. There was very little evidence of a desire for larger aircraft however and it was widely recognised that the Islander is the most appropriate aircraft for the role.</i>	<i>This option would be highly acceptable. Widespread support for a third aircraft.</i>	<i>This option was presented as being Rejected at the ONI Public Exhibitions. No dissent from this position was received and it can therefore be assumed that continuing without runway lighting would be acceptable.</i>	<i>This option was presented as being Rejected at the ONI Public Exhibitions (pending Argyll & Bute trials), albeit with a watching brief on emerging applications elsewhere. No dissent from this position was received and it can therefore be assumed that this is a</i>

	Option CO12 – Maintain and continue with the current BN2 Islanders over the strategy period / until life expiry	Option CO13 – Supplement the current aircraft with an additional BN2 Islander	Option CO14 – Install lighting on all island airstrips	Option CO15 – Install GNSS on the current BN2 Islanders
				<i>reasonable basis on which to deal with this issue.</i>

4.4.48 The key points from the above appraisal against the STAG criteria are:

- The continuation of the current operation (**Option CO12**) would have a minor negative impact in terms of economy and accessibility given current capacity constraints.
- From a safety perspective, the addition of a third aircraft (**Option CO13**) would record a minor negative due to the increased flying hours and therefore risk (albeit such a risk is very minor). The lighting of airstrips (**Option CO14**) could also have a negative safety impact. Whilst this option would extend the operating day, aircraft would be flown visually during the hours of darkness, which has a higher risk than daytime flying.
- The installation of GNSS (**Option CO15**) would have a minor safety benefit in that it would reduce an element of the risk associated with visual approaches particularly in poor weather. That said, the current operator has pointed out that other issues such as accurate meteorological data would be required before GNSS would be considered.
- The addition of a third aircraft (**Option CO13**) would have a major positive benefit in terms of economy and accessibility & social inclusion. This option would address the current capacity constraints associated with public service delivery and would thus increase the number of effective connections for islanders. An additional aircraft would also assist in reducing the number of indirect connections and could be used to increase the number of connections in places which are currently less well service. There would be a series of TEE benefits associated with enhanced frequency and reduced journey times (through less indirect connections), whilst wider / EALI benefits would emerge in terms of residents, tourists and locally traded services.
- The enhanced air service would also make a significant contribution to improving both community and comparative accessibility. Island residents would be better able to access key personal services, business opportunities and onward travel connections, whilst travel to the island would become less problematic. From an integration perspective, this option would clearly support policy integration in terms promoting the economic development of the isles.
- This option is technically deliverable and would be relatively low cost when compared to the ferry options being considered.
- The installation of runway lighting (**Option CO14**) and GNSS (**Option CO15**) would give rise to similar types of benefits (assuming the number of connections was scaled up), although the benefits would be of a lesser magnitude than those associated with a three aircraft service.
- Runway lighting (**Option CO14**) has not been without its operational difficulties in the Orkney context and it is likely that it would be less beneficial on its own than GNSS, which on the whole appears more reliable (although again largely untested in this environment).

Rationale for Selection / Rejection

4.4.49 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 4.32: Outcome of Appraisal, Outer North Isles, Passenger Only Vessel Options

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Rationale for Selection / Rejection
Option CO12 – Maintain and continue with the current BN2 Islanders over the strategy period / until life expiry	✓	This option has been retained for further consideration as the Do Minimum. The current air service generally meets the needs of the islands well. However, the capacity constraints, generally associated with public service delivery, do suggest that continuing with this option will not maximise the potential benefits of the air service or contribute towards the study objectives.
Option CO13 – Supplement the current aircraft with an additional BN2 Islander	✓	This option should be taken forward as it would address the majority of the current capacity issues with the air service and permit frequency enhancements / less indirect connections. Far greater flexibility would be provided and the service could be developed to meet specific peaks with relative ease, for example the additional rotations 'shadowing' current rotations which are used for education purposes.
Option CO14 – Install lighting on all island airstrips	✗	The experience of runway lighting in Orkney coupled with the restrictions applied to the service in night VFR mean that this option is excluded from further consideration. It could be considered further if GNSS were to be developed in the Orkney context.
Option CO15 – Install GNSS on the current BN2 Islanders	✓	GNSS presents a significant opportunity to extend the operating day. However, it should be noted that the operator concerns about safety and implementability in the Orkney environment would need to be addressed in advance of progressing this option.

4.5 Annual Operating Cost Estimates

4.5.1 In 2015-16, the revenue costs and income associated with operating the Outer North Isles ferry services (*MV Varagen*, *MV Earl Sigurd* and *MV Earl Thorfinn*) was as follows:

Table 4.33: ONI Operating Costs 2015-16

Costs and Income	2015-16
Employee costs	£2,928,618
Fuel	£667,850
Survey & Repairs	£1,068,672
Harbour Dues & Stevedoring	£495,396
Other costs	£720,540
Total costs	£5,881,076
<i>Fares</i>	£536,032
<i>Freight</i>	£755,583
<i>Other</i>	£106,169
Total Income	£1,397,784
Net Operating Position	-£4,483,292

4.5.2 In addition to the above, OIC spends around **£1.4m** per annum on the Loganair inter-island air contract and on running and maintaining airfields.

4.5.3 The chart below provides an estimate of the level of annual operating costs to provide ONI ferry services for different vessel and crewing permutations, reflecting the previous discussions. The figures on the horizontal axis are the net total figures when fares³² and other income are subtracted from total costs.

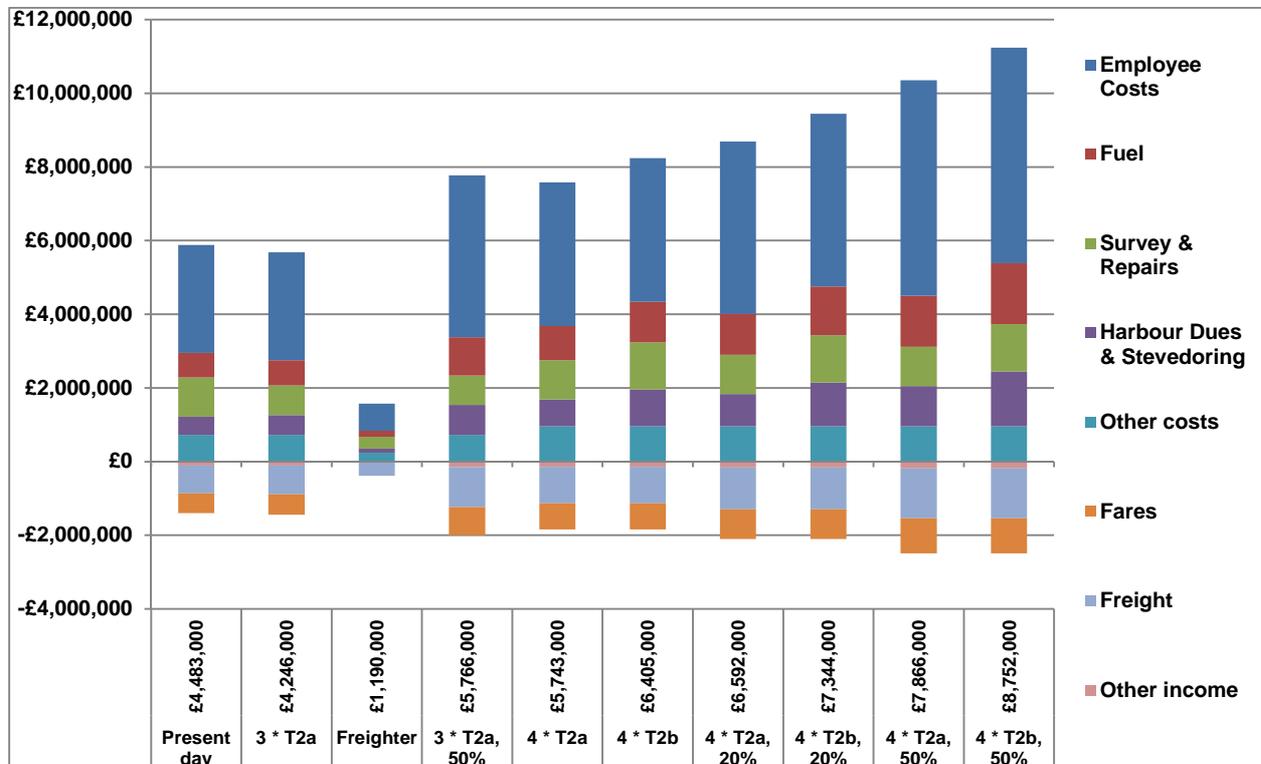


Figure 4.1: Estimated Annual Operating Costs of Appraised Options

- Present Day: costs as per 2015/16 of **£4.5m**.
- **3 * Type 2a** ferries, current crew hours: small saving in surveys / repairs and additional fares income (new vessel effect) leads to an overall reduction in costs to **£4.2m**.
- Freighter: these are the estimated costs of a freighter on a stand-alone business of approximately **£1.9m**.
- **3 * Type 2a** ferries, crew hours +50%: increase crew, fuel costs and harbour dues, offset by additional fares revenue gives an annual figure of **£5.8m**.
- **4 * Type 2a** ferries: 4 vessels running the same crewing pattern as at present produces similar outcome to three ferries running with +50% hours with reduced crew costs cancelled out by increased 'survey & repairs' and 'other costs' also giving a total figure of **£5.7m**.
- **4 * Type 2b** ferries: 4 vessels running the same crewing pattern as at present sees fuel, maintenance and harbour dues increase relative to 4 * Type 2a ferries giving a total figure of **£6.4m**.
- **4 * Type 2a** ferries each running with +20% crew hours: additional employee, fuel and harbour dues raises the cost to **£6.6m**.
- **4 * Type 2b** ferries each running with +20% crew hours: additional costs associated with the larger vessel increase costs to **£7.3m**.

³² Note – If Road Equivalent Tariff (RET) fares were introduced on the Orkney inter-island network, this would reduce the fare income received.

- 4 * **Type 2a** ferries each running with +50% crew hours: additional employee, fuel and harbour dues raises the cost to **£7.9m**
- 4 * **Type 2b** ferries each running with +50% crew hours: additional costs associated with the larger vessel increase costs to **£8.8m**.

4.5.4 These costs are intended to provide an indication of the quantum of change from the present day implied by increasing the number of vessels and operating hours to serve the ONI. These costs will be further refined at OBC stage as more details of the vessels and their associated costs, their crewing requirements and the details of the required timetabled running hours become available.

4.6 Public Consultation – Prioritisation

4.6.1 Chapter 1 described the Public Engagement undertaken in June 2016. A key part of this was the identification of priorities for enhancements to services in the event of additional resources being available. The public were provided with a list of potential enhancements and invited to tick the three that they would prioritise.

4.6.2 The number of completed questionnaires was:

- Eday: 13
- N Ron: 7
- Papa Westray: 13
- Sanday: 38
- Stronsay: 53
- Westray: 22

4.6.3 The figures below show the percentage of respondents who ticked each option. Note that these columns do not sum to 100% as the question allowed three responses.

Eday

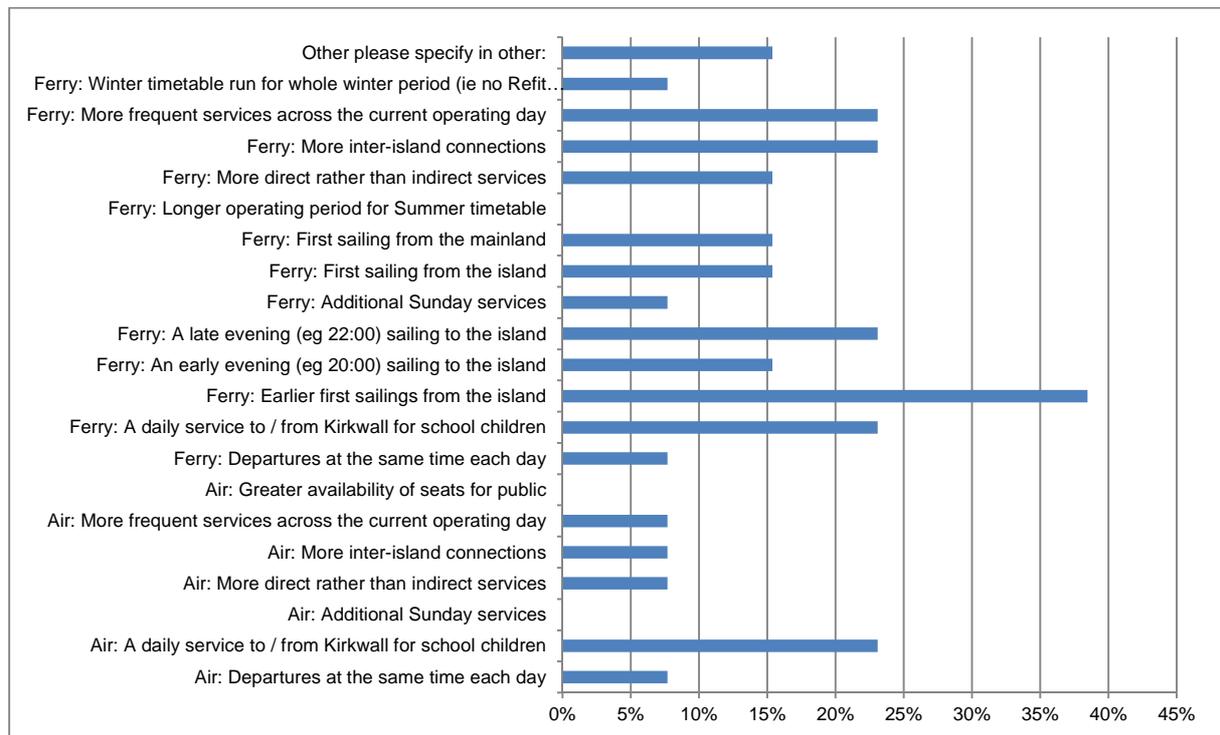


Figure 4.2: Eday – Prioritisation of Enhancements

Other comments included:

- A daily service to neighbouring island with Junior High School so children can return home each evening.
- It doesn't matter how it is provided, but each isle should have a working day available on the mainland and a working day available on the isle - this is what will support the isles to be sustainable. At present it is very difficult to get a worker out to the isle, e.g. a vet or electrician due to the very limited timetable.

4.6.4 A particular issue for Eday is that this is the only island with children in the age group where all S1-S4 pupils have to use the hostel in Kirkwall for the KGS. This is a particular issue for S1-S2 as these children will be far younger than the large majority of hostel children, who are primarily S5-S6. This issue was cited as a major barrier to sustaining the island as families with children approaching this age have moved to locations where S1-S4 pupils can return home on a daily basis. An option to address this would be to provide a daily link to a neighbouring island's Junior High School e.g. Sanday, similar to current arrangements for Papa Westray. Note that other islands would be in this position but do not have resident schoolchildren of an age who would be affected.

4.6.5 Other than this, the selection of 'earlier first sailing', more frequent sailings and later evening sailings perhaps reflect the relative proximity of Eday to Kirkwall compared to the other ONI. This perhaps brings a higher anticipation of daily commuting to Kirkwall which is not currently possible.

Table 4.34: Eday – Collated Comments

Eday – Comments	Number of times Cited
Can't commute	5
Links to onward transport	3

Eday – Comments	Number of times Cited
Fixed link good	2
Fixed link bad	2

North Ronaldsay

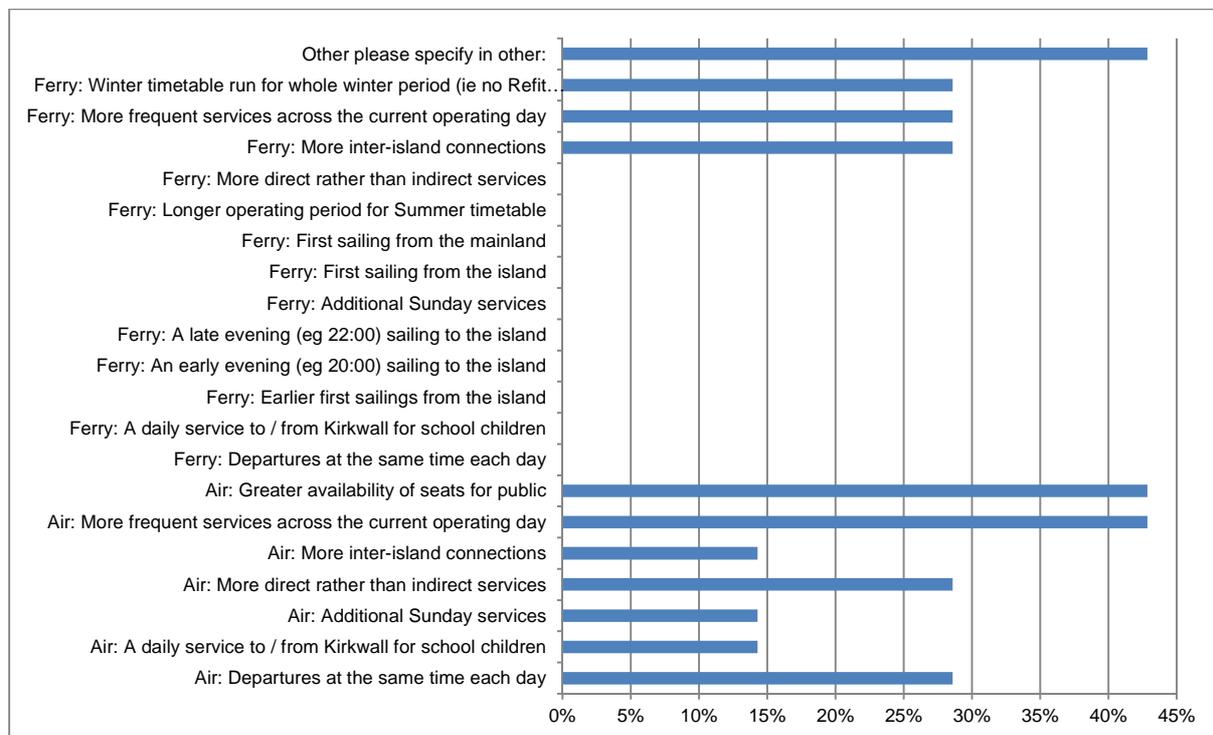


Figure 4.3: North Ronaldsay – Prioritisation of Enhancements

Other comments included:

- Go back to previous timetable (for night flying)
- Fixed/scheduled twice a week service to NR Trips to/from Kirkwall too short
- A three times a day air service is the minimum aspiration for North Ronaldsay.
- Three times a week would be the absolute minimum for the summer ferry service (passenger and freight) to a reliable terminal, preferably with inter island connections. Daily would be ideal especially to mitigate the frequent fogging out of the air service.
- Fare harmonisation across all services to allow equivalence in travel costs for North Ronaldsay residents which currently suffer substantially higher costs than those with access to Ro-Ro daily return services.

4.6.6 Flights are the main focus of the North Ronaldsay responses: more flights and bespoke flights were cited most often by North Ronaldsay residents. The late departure of the Monday AM flight from North Ronaldsay is a problem as pupils miss the start of the school day.

4.6.7 Of the ferry options, a higher frequency was cited most and there is some interest in inter-island connections, presumably to Sanday.

4.6.8 There were comments surrounding the need to provide more frequent and reliable ferries and also address the reliability surrounding the current late flight in the winter.

Table 4.35: North Ronaldsay – Collated Comments

North Ronaldsay – Comments	Number of times Cited
Unreliable flights with last minute cancellations	5
Get rid or dark flying	3
School children missing school due to timetable	3
Lack of capacity sea and air	2
Onward transport connections	2

Papa Westray

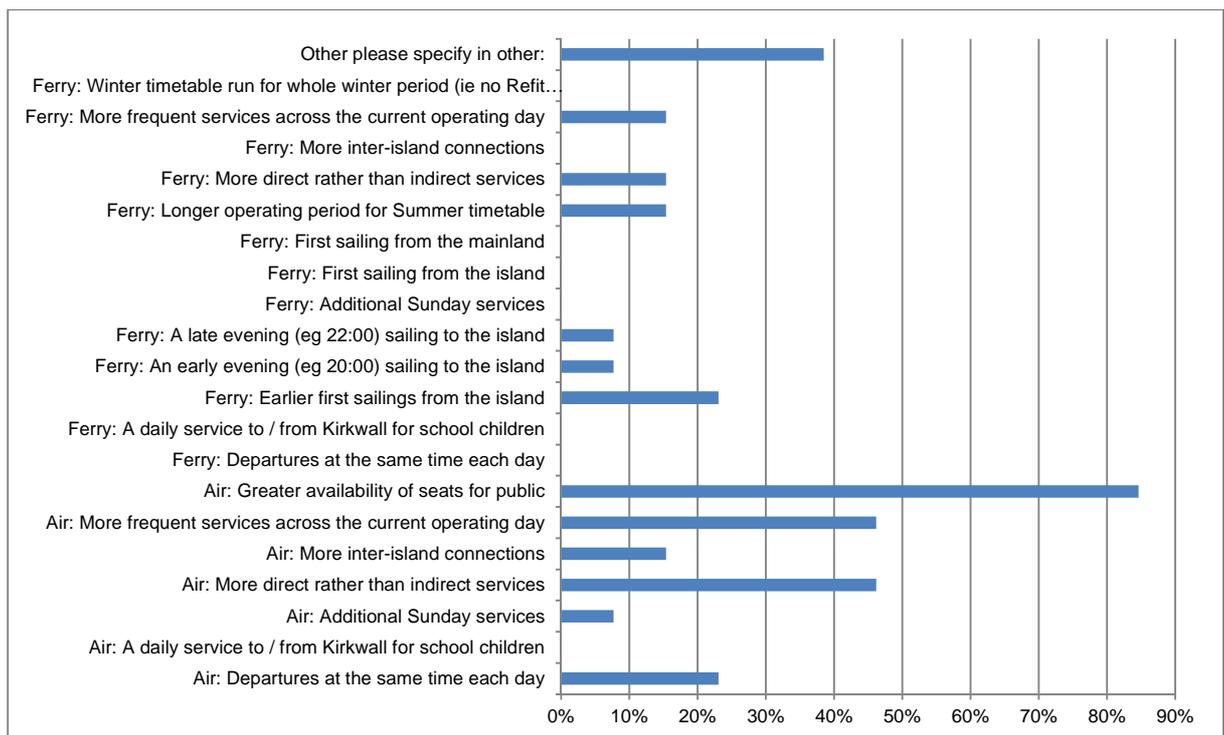


Figure 4.4: Papa Westray – Prioritisation of Enhancements

Other comments included:

- Improved accessibility for less able bodied demographic is required – population is ageing so more people will be affected in future.
- Hard ramp to Westray or fixed link.
- Year round passenger ferry to/from Westray (2)
- Freight costs are too expensive.
- Better integration with external services.

4.6.9 Nearly 2/3 of all the priorities from Papa Westray residents related to air options. The number of air connections and capacity issues surrounding flights shared with other islands and teachers were the main issues. 85% of respondents stated that 'greater availability of seats for public; was their main priority.

Table 4.36: Papa Westray – Collated Comments

Papa Westray – Comments	Number of times Cited
Capacity on plane	11
Onward transport links	8
Issue on ferries for those with mobility issues	5
No to fixed link	4
3rd plane needed	3
Freight costs	3
No scheduled Westray ferry in winter	2

Sanday

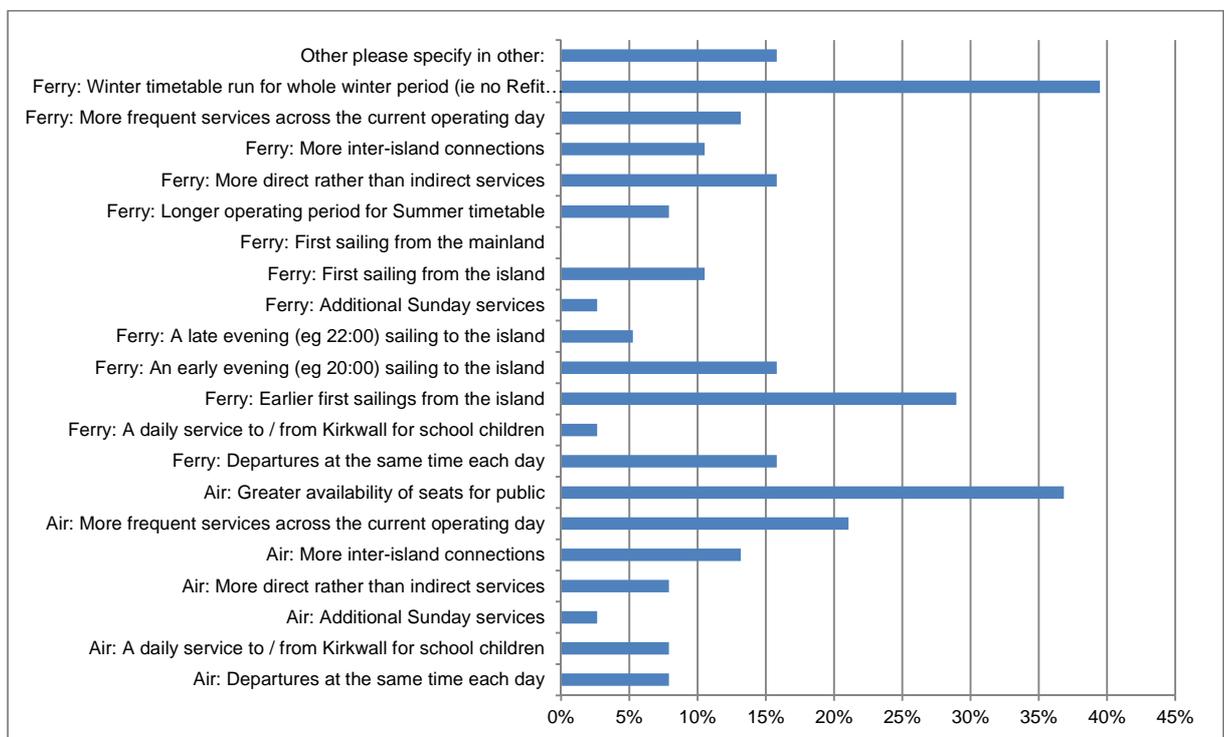


Figure 4.5: Sanday – Prioritisation of Enhancements

Other comments included:

- A year round Saturday boat that doesn't go via Stronsay and has at least 5 hours in town.
- More frequent sailings to and from the island coupled with a longer day, assisting those who are commuting for work or travelling to or from beyond Orkney. i.e. early morning out from Sanday, late morning out from Sanday, mid-afternoon back to Sanday, evening back Sanday).
- Winter Summer ferry from Sanday on a Sunday to Kirkwall.
- Regular timings on all ferries.
- More passenger vehicle spaces.
- A ferry from Sanday to Kirkwall and return each day on a commuting timetable. However if it started from the island then more people would have the opportunity to work in Kirkwall and it may encourage people to move to Sanday and take up employment opportunities with Orkney Ferries.
- A dedicated 'school' plane which could take teachers to Sanday and another commuting plane.
- A daily service for everyone would be welcome, to allow daily commuting to school, college and work.

4.6.10 Nearly 40% of Sanday residents prioritised the removal of the refit ferry timetable. Second to this greater public availability of seats on Sanday flights (referring to teachers) followed by an earlier first sailing off of the island. Issue listed under 'other' included:

Table 4.37: Sanday – Collated Comments

Sanday – Comments	Number of times Cited
Teachers taking up plane seats	17
Refit timetable impossible	12
Onward transport connections	10
New boats needed	10
Commuting impossible	6
Capacity for vehicles on ferry	5
Books of tickets too pricey	4
Fares too high	3
Ferry to stay overnight on Sanday	2

Stronsay

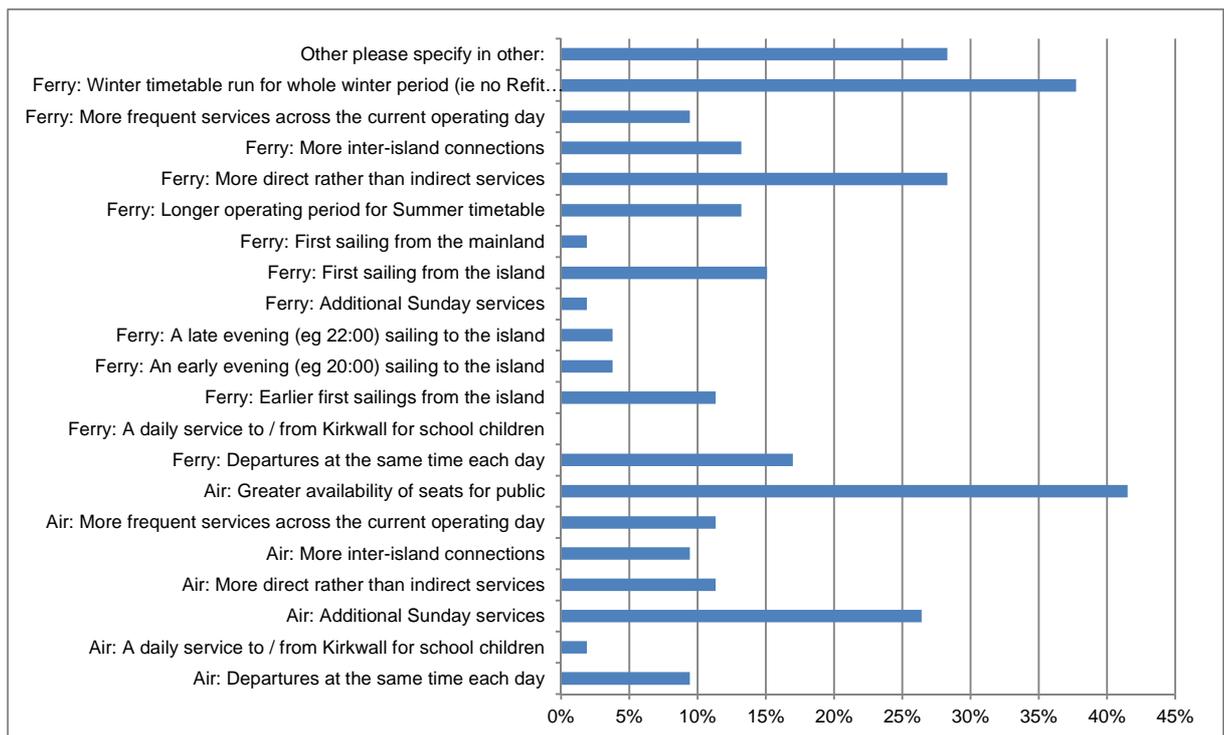


Figure 4.6: Stronsay – Prioritisation of Enhancements

Other comments included:

- Longer summer time table.
- Not one boat for three islands ever.
- Move the Stronsay ferry terminal to the west side (3).
- Ferry - Later sailing to island 1800.
- Air - Extended hours for plane. More equality across the islands.
- Ferry to stick to published timetable.
- Later ferry for harvest and appointments.

- *Earlier ferry on a Friday to get school children home.*
- *Better options for commuting workers.*
- *Consistent timetable and reliable service.*
- *Better access for people with mobility problems. .*
- *Coordinate air and ferry services better across the day to offer a wider range of travel times.*
- *The return ferry from Kirkwall should not be at 2000 or 2200 though not opposed to one at 2200) but rather at 17.30 to 17.45 and take no longer than 1 hour 20 minutes direct.*

4.6.11 Similar to Sanday, the main priority for Stronsay residents was the greater availability of seats on Stronsay flights and the refit ferry timetable. The next most important issue was to increase the number of direct sailings to Kirkwall. There was also a higher demand here for more Sunday flights from Stronsay.

Table 4.38: Stronsay – Collated Comments

Stronsay – Comments	Number of times Cited
Move harbour to other side of Island	20
Lack of seats on plane	20
Journey length too long	18
Not keeping to ferry timetable	16
Access to Kirkwall on Sundays	14
Refit timetable an issue	13
New ferries needed	9
Don't move harbour	9
Not enough time in Kirkwall	7
Extra ferries and plane good	7
Mobility access on ferry	5
Online booking system	4
Difficulty in contacting Kirkwall airport	3
Harbour not fit for purpose	2
Island based ferries	2
No direct flights	2
Onward connections	2

Westray

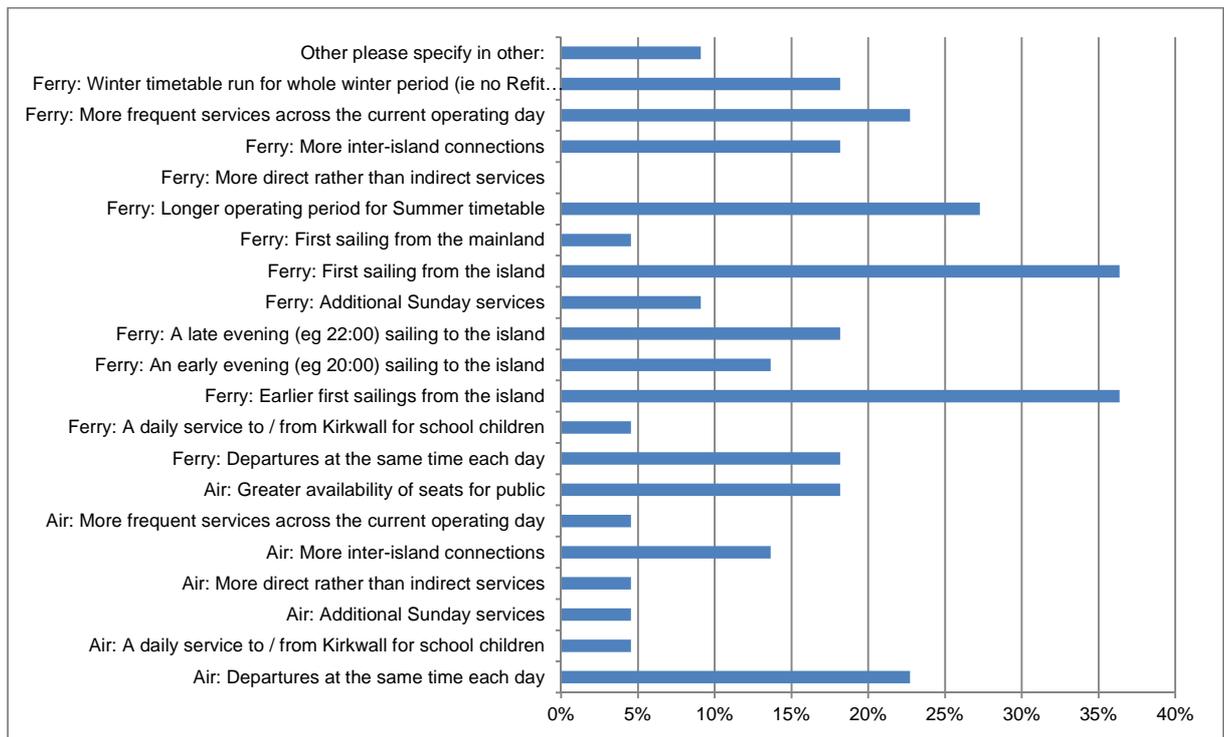


Figure 4.7: Westray – Prioritisation of Enhancements

Other comments included:

- There should be a smaller passenger only vessel so people can go to sports & events in Kirkwall and still get home late in the evening.
- Possibility of return flights on Saturday.
- More frequent services over a longer operating day.

4.6.12 The most frequently selected options amongst Westray residents were earlier ferries / first ferry to leave from Westray, i.e. for the ferry to be based on Westray. Third was a longer operating period for the summer timetable. Over 75% of all selections made by Westray residents related to the ferry service and many also prioritised a higher service frequency across the day. These selections are mainly a reflection for better commuting links and also greater capacity on a route where lack of capacity can be an issue.

Table 4.39: Westray – Collated Comments

Westray – Comments	Number of times Cited
Cost of travel	10
New boats	8
Capacity on plane	6
Boats sticking to timetables	5
Lack of onward links	5
Capacity on ferry (cars)	4
Disabled access on boats	4
Length of journey	4
Booking system needed	4

Westray – Comments	Number of times Cited
Can't commute	3
Reliability	3
Visibility on current boats	3
Ferry to berth on island	2
Timetable	2

5 Flotta and Hoy

5.1 Capital Investment Timeframe

- The Houton – Lyness – Flotta route is currently served by the MV *Hoy Head*, a double-ended Ro-Ro vessel which carries a Class IV certificate. The vessel is 22 years old but is amongst the newest in the Orkney Ferries fleet. The vessel was lengthened to 53 metres in 2013 and re-engined, with new thrusters and control systems. Original power generation, supply systems and one bow thruster remain and these types have been out of production for some time. Some of the ballast tanks are showing their age. Based on a 30 year lifespan, the MV *Hoy Head* would be replaced in 2024.
- There are a number of issues with the MV *Hoy Head* that may prompt replacement in advance of this. Firstly, passenger accommodation is below the waterline which presents some problems in terms of physical accessibility and is not in keeping with the regulations for modern vessels. Secondly, and notwithstanding her recent lengthening, she has vehicle deck capacity limitations at peak times which materially affect the route.
- The Houton – Lyness – Flotta route is unusual in the context of the Inner & South Isles in that it is the only one of the routes which works off linkspans rather than hard ramp.
- The linkspans and accompanying infrastructure on the route were introduced in the 1980s and a programme of replacement / refurbishment would be required as part of any vessels related investment.
- The crew are based on South Walls, with the vessel overnighing in Longhope. There is a morning and evening ‘dead-leg’ to / from either Lyness or Flotta. This removes around 40 minutes per day from the operational timetable. The service is operated by a single crew on a two-week on, two-week off basis.

5.1.1 The ASTs, harbour drawings and environmental constraints maps for the Houton – Lyness – Flotta route can be found in Appendix B.

5.2 Identified Problems

5.2.1 The following transport problems in relation to Houton – Lyness – Flotta route were identified in the Pre-Appraisal Report and verified through subsequent community feedback. Where the community has identified a problem which we had not, their contribution is noted in red text.

Table 5.1: Houton – Lyness - Flotta Transport Problems

	Service Characteristics	Rating	Hoy & Flotta: Why is this a problem or not?
1	Overall Journey Time to Kirkwall / Stromness	✓	The crossing time between Lyness / Flotta and the mainland is relatively short, although indirect crossings can add to the journey time. There are connecting bus services from Houton to Kirkwall and Stromness offering a relatively quick journey time overall.
2	First sailing / flight	✓	The first sailing departs Lyness and Flotta at either 06:50 or 07:10. This departure allows residents of both islands to commute to work and education on the mainland.
3	Last sailing / flight	✗✗	<p>The last departure from Houton is 17:30. Combined with the early first sailing, this permits a full working day on Orkney mainland (although only just as connections from Kirkwall or Stromness have to be made to Houton, with sufficient contingency built-in)</p> <p>The time of the last departure does not allow Hoy or Flotta residents to undertake evening social activities on Orkney mainland or connect with the last flights / ferries from the Scottish mainland (see below). It also curtails the length of day tourism visits to Hoy, given that the Moaness – Graemsay - Stromness route has a similar operating day.</p> <p>The length of the operating day is also less than that identified in the RSM model service provision.</p>

	Service Characteristics	Rating	Hoy & Flotta: Why is this a problem or not?																																				
			Flotta residents have access to the Talisman launch (the MV <i>Flotta Lass</i>) and can access the mainland outwith the core hours. However, this study is focussed only on future service provision from the perspective of Orkney Ferries.																																				
4	Time on mainland	✘	<p>Hoy and Flotta residents have amongst the longest amount of time on the Orkney mainland. The hours ashore by timetable are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Flotta-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>7</td> <td>8</td> <td>64</td> </tr> <tr> <td>Ferry - Winter</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>7</td> <td>0</td> <td>55</td> </tr> </tbody> </table> <p><i>Note the lack of a Sunday connection in winter.</i></p>	Flotta-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	10	10	10	10	10	7	8	64	Ferry - Winter	10	10	10	10	10	7	0	55
Flotta-Time on Mainland																																							
	Mo	Tu	We	Th	Fr	Sa	Su	Total																															
Ferry - Summer	10	10	10	10	10	7	8	64																															
Ferry - Winter	10	10	10	10	10	7	0	55																															
5	Time in Kirkwall / Stromness	✘	See point 4. It should be noted that the time in Kirkwall & Stromness is slightly reduced by the need to connect from Houton.																																				
6	Time on island	✔	<p>Time on the island is amongst the highest in the archipelago. The relatively frequent service also permits flexibility in the duration of on-island visits, minimising dead time for businesses or those on employers' business.</p> <p>The hours on island by timetable are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Flotta-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>4</td> <td>7</td> <td>47</td> </tr> <tr> <td>Ferry - Winter</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>7</td> <td>4</td> <td>0</td> <td>41</td> </tr> </tbody> </table> <p><i>Note the lack of a Sunday connection in winter.</i></p>	Flotta-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	7	7	7	7	7	4	7	47	Ferry - Winter	7	7	7	7	7	4	0	41
Flotta-Time on Island																																							
	Mo	Tu	We	Th	Fr	Sa	Su	Total																															
Ferry - Summer	7	7	7	7	7	4	7	47																															
Ferry - Winter	7	7	7	7	7	4	0	41																															
7	Frequency / Sailings per day / Timetable gaps	✔	With 4-6 rotations Monday – Friday (summer and winter), this route has a relatively high service frequency.																																				
8	Capacity	✘✘✘	<p>Car deck capacity and deadweight limitations were alleviated to some extent by the lengthening of the MV <i>Hoy Head</i> in 2013, although car deck capacity does remain a problem on peak sailings.</p> <p>Carryings data from Orkney Ferries suggests that the 09:10 & 16:40 sailings ex-Lyness and 10:15 & 17:30 ex-Houton are the most frequently capacity constrained sailings, highlighting the commuter and day visitor nature of the route.</p> <p>Furthermore, the data suggests that, despite its frequency, the Houton – Lyness – Flotta route records the second highest number of standbys after Westray, suggesting an element of unmet demand.</p> <p>This situation could worsen in the relatively near future if any of the opportunities being pursued for the Lyness Enterprise Area are realised.</p>																																				
9	Reliability (weather / mechanical)	✔	There are no major reliability problems on this route, although it is noted that there have been a handful of mechanical breakdowns in recent months.																																				
10	Comfort	✘	Whilst only a short crossing, the consultation suggested that the passenger accommodation being below the waterline detracts from the scenic journey to Hoy which tourists enjoy.																																				
11	Physical access	✘	Whilst the passenger accommodation is below the water line, physical access is seen to be better than on most older vessels.																																				
12	Integration with PT (local bus)	✔	Bus services to Kirkwall and Stromness connect with the ferry at Houton. The bus will wait up to 15 minutes for the late arrival of the ferry.																																				
13	Integration with PT (strategic)	✘✘	Users of the Lyness – Flotta – Houton route cannot catch the first flights to Aberdeen, Edinburgh and Inverness, although they can catch the first Glasgow and Sumburgh flights. Residents also cannot catch the first NorthLink or Pentland Ferries departures, although they																																				

	Service Characteristics	Rating	Hoy & Flotta: Why is this a problem or not?
			<p>can catch the 11:50 Pentland Ferries departure. The 11:00 NorthLink service from Stromness, which operates during peak timetable, can also be accessed.</p> <p>Evening integration is poorer – the last ferries of the evening from the Scottish mainland coupled with the flights from Aberdeen, Edinburgh and Inverness arrive after the last departure of the ferry to Lyness and Flotta.</p> <p>Trips to the Scottish mainland therefore require at least one off-island overnight stay.</p>
14	Crossing / flight time	✓	The crossing time between Lyness / Flotta and the mainland is relatively short.
15	Onboard facilities	✓	The onboard facilities are considered to be appropriate for the length of the crossing.
16	Weekday / weekend service variation	✘✘✘	<p>The Saturday service offers around half the number of connections that are available on a typical weekday. This level of connectivity is relatively low given the popularity of Hoy amongst tourists and day-trippers.</p> <p>There is a good summer Sunday service. However, the lack of a winter Sunday sailing (due to crewing hours) acts as a significant constraint on the islands. As well as curtailing the ability to undertake day trips to the mainland for personal business, it suppresses any inbound travel (particularly tourism).</p> <p>Moreover, if an island resident plans on travelling to the Scottish mainland on a Sunday, they will have to stay on Orkney mainland on the Saturday evening, at significant cost to themselves.</p>
17	Landside infrastructure issues	✘	Landside infrastructure in Lyness & Flotta is broadly fit for purpose. However, there is an ongoing debate as to whether the MV <i>Hoy Head</i> should berth overnight at Lyness (which would require harbour works) rather than at Longhope. The overnighting of the vessel at Longhope leads to an element of ‘dead-legging’ in the morning and evening, which takes up crewing hours and reduces the number of connections to the mainland. In addition, the vessel was recently damaged in a storm at its overnight berth.
18	Landside human resources	✓	Hoy & Flotta manage the challenges of landside human resources appropriately.

5.3 Appraisal of Capital Options

5.3.1 As indicated in the vessels chapter, the Lyness – Flotta – Houton route could continue to operate off of linkspans, but a hard ramp solution would also be workable. The preferred option would be determined at OBC stage, so both approaches are retained for consideration in this chapter.

Capital Options

5.3.2 The following capital options were identified for Lyness – Flotta - Houton:

Option CO1 (Do Minimum): Replace the MV *Hoy Head* on a like-for-like basis

- There are two potential like-for-like options for this route. If the route is to continue to work off linkspans, the existing vessel could be replaced by a *Type 2a* vessel, with a hard ramp solution using a *Type 1b* vessel. The respective costs are **£7m** for the Type 2a and **£5m** for a Type 1b vessel.
- The required harbour works for a Type 2a vessel (ie linkspan) are:
 - Houton: No terminal upgrades required, except the replacement of the infrastructure on life expiry.³³

³³ See Appendix B – Houton Drawing, Box 2, Like-for-Like Option

- Lyness: No terminal upgrades required, except the replacement of the infrastructure on life expiry.³⁴
- Flotta: No terminal upgrades required, except the replacement of the infrastructure on life expiry.³⁵
- The required harbour works for a Type 1b vessel (ie hard ramp) are:
 - Houton: The conversion of this port to hard ramp would involve the construction of a new berth to the east of the current berth. The facility would include an 80m berthing platform (berthing piles, dolphins etc) as well as a slipway of 130m located next to the existing pier. Road access will be required although land ownership may be an issue if progressing this option. It is estimated that this would cost **£2.4m**.³⁶
 - Lyness: A new hard ramp and berthing platform would be provided to the north of West Pier, together with facilities and parking. This is estimated to cost **£2.9m**.³⁷
 - Flotta: The conversion of this port to hard ramp would involve the construction of a new berth to the south of the existing berth. The investment required would include the provision of approximately 80m of berthing platform (berthing piles, dolphins etc). There would be a slipway located next to the existing pier and an access road would be required. Facilities, i.e. parking, waiting room etc could be provided in the adjacent area. It is estimated that this would cost **£3.3m**.³⁸
- The total harbour infrastructure cost of this option would range from **£7.0m** (linkspan solution, plus replacement of infrastructure on life expiry) to **£13.6m** (hard ramp solution) depending on shore infrastructure solution pursued.

Option CO2: Replace MV *Hoy Head* with one larger vessel

- There are two potential like-for-like options for this route. If the route is to continue to work off linkspans, the existing vessel could be replaced by a Type 2b vessel (£9.25m-£15.5m depending on the vessel), with a hard ramp solution using a Type 1c vessel (**£6m**).
- The required harbour works for a Type 2b (linkspan) vessel are:
 - Houton: The current berth would need to be expanded by 30 metres or a mooring dolphin inserted. A linkspan upgrade would be required to provide adequate vessel fit. It is estimated that this would cost **£2.6m**.³⁹
 - Lyness: It is recommended to displace the linkspan backwards and upgrade to provide an appropriate vessel fit. There would be no other terminal upgrades required, except the replacement of the infrastructure on life expiry. It is estimated that this would cost **£2.0m** including re-fendering.⁴⁰

³⁴ See Appendix B – Lyness Drawing, Box 2, Like-for-Like Option.

³⁵ See Appendix B – Flotta Drawing, Box 2, Like-for-Like Option.

³⁶ See Appendix B – Houton Drawing, Box 4, Hard Ramp Option.

³⁷ See Appendix B – Lyness Drawing, Box 4, Overnight Berth & Hard Ramp.

³⁸ See Appendix B – Flotta Drawing, Box 4, Hard Ramp Option.

³⁹ See Appendix B – Houton Drawing, Box 3, Larger Vessel Option.

⁴⁰ See Appendix B – Lyness Drawing, Box 3, Larger Vessel Option.

- Flotta: The vessel would overhang the existing jetty and it is recommended to extend the berth circa 25 metres if it was being strengthened. A linkspan upgrade would be required to provide adequate vessel fit. It is estimated that this would cost **£2.2m**.⁴¹
- The investment required to convert the three ports to hard ramp would be as per Option CO1.
- The total cost of this option would range from **£14.6m** (hard ramp) to **£16m-£22m** (linkspan).

Option CO3: Replace MV *Hoy Head* with two like-for-like vessels

- This option would involve deploying either two Type 1b vessels or two Type 2a vessels depending on whether the route operates off of linkspan or hard ramp.
- For costing purposes, it is assumed that the two vessels would work on the basis of a 'day boat' and 'shift boat' (as is the practice in Shetland). The day boat would operate a shuttle service between Lyness and Houton, operating from around 0630-1830. The shift boat would operate the current timetable, which would be extended to around 2300.
- The harbour works would be as per option CO1.
- The two vessel solution could work from existing overnight berths but this would add an element of 'dead-legging' into the operation. One vessel could lie overnight at Longhope, with the other on stand-by at Houton. An alternative and more efficient solution would be the provision of new overnight berthing at Lyness. The existing West Pier may be suitable for a new overnight berth at Lyness for like-for-like and larger vessels. However the pier could be extended to provide additional shelter, although further assessment is required to establish any strengthening works and mooring equipment needed.
- The total capital cost of this option would range from **£14.0m** for Type 2a vessels (with infrastructure to be replaced at life expiry) to **£18.6m** for two Type 1b vessels plus conversion to hard ramp operations.

Option CO4: Supplement Options CO1 or CO2 with a passenger only vessel between Lyness and Houton

- This option would involve a like-for-like replacement for the MV *Hoy Head* supplemented by a small medium-speed passenger only catamaran. This vessel would cost in the region of £1m and may require minimal harbour works including berthing pontoons and a gangway / steps. This would operate in addition to the current Moaness-Graemsay-Hoy service.
- It is assumed that the passenger vessel would operate a Lyness – Houton shuttle (given that Flotta residents have access to the MV *Flotta Lass*) which would run through to 2300 in the evening). It could alternatively operate to Stromness. As such there is a degree of flexibility within this option as to the optimal deployment of an additional passenger only vessel in Scapa Flow but this option represents the principle at this stage.
- The incremental capital cost of this option would be around **£1m** plus any minor harbour works.

Option CO5: Provide a new overnight berth at Lyness

- This option includes the provision of a new overnight berth at Lyness. For the purpose of appraisal, the option assumes a one vessel solution. However, the option could be

⁴¹ See Appendix B – Flotta Drawing, Box 3, Larger Vessel Option.

expanded to two berths where two vessels are proposed. The vessel would lie over at Lyness rather than Longhope and the time savings redistributed through the timetable.⁴²

- As well as the benefits in terms of time savings, a new safe overnight berth is seen to be essential for the MV *Hoy Head*, given recent damage sustained by the vessel during periods of inclement weather at Longhope.
- The existing West Pier may be suitable for a new overnight berth at Lyness for like-for-like and larger vessels. However the pier could be extended to provide additional shelter, although further assessment is required to establish any strengthening works, mooring equipment needed and associated costs.

Option CO6: Supplement Option CO3 with a new harbour in mid Hoy

- This option includes the provision of a new harbour in mid-Hoy. The current service to Lyness would be discontinued.
- The option would only be taken forward with Option CO3, a two vessel solution, and assumes at least two overnight berths are provided. The timetable would be similar to that suggested in Option CO3.
- The conceptual nature of this proposal prevents any cost estimate at this stage – further development work would therefore be required, however as an entirely new facility, the costs associated are likely to be substantial, not least because the location would be challenging and would require significant landside access infrastructure and road construction.

Appraisal of Capital Options

5.3.3 The following sections contain the appraisal of each capital option against the study objectives and the STAG criteria.

Appraisal against Objectives

Table 5.2: Lyness – Flotta – Houton Capital Options – Appraisal against Objectives

	Option CO1 (Do Min) – Replace MV <i>Hoy Head</i> like-for-like	Option CO2 – Replace MV <i>Hoy Head</i> with one larger vessel	Option CO3 – Replace MV <i>Hoy Head</i> with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a new overnight berth at Lyness	Option CO6 – Provide a new harbour in mid Hoy
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	xx	✓✓	✓✓✓	✓	✓	✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	✓	✓✓✓	✓✓	-	✓
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half</i>	N/A	N/A	N/A	N/A	N/A	N/A

⁴² See Appendix B – Lyness Drawing, Box 4, Overnight Berth & Hard Ramp.

	Option CO1 (Do Min) – Replace MV Hoy Head like-for-like	Option CO2 – Replace MV Hoy Head with one larger vessel	Option CO3 – Replace MV Hoy Head with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a new overnight berth at Lyness	Option CO6 – Provide a new harbour in mid Hoy
<i>day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>						
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	-	✓✓✓	✓✓	✓	✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	-	✓✓	✓	✓✓	✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-	✓✓	✓✓	-	-

5.3.4 The key points from the above table are:

- As a like-for-like replacement, the Do Minimum (**Option CO1**) would have no materially positive impact when compared against the objectives. However, given that this route is already demonstrating vehicle capacity problems, the provision of a like-for-like vessel in terms of capacity would have a moderate negative impact in that it would not address current capacity issues and would also fail to future proof the route against growth, a key consideration given the planned expansion of the Lyness Enterprise Area.
- The provision of two like-for-like vessels (**Option CO3**) would result in the largest overall improvement in terms of capacity. The provision of one larger vessel (**Option CO2**) would address the majority of the short-term capacity issues although there would be only limited scope for expansion and peak capacity issues could re-emerge over the strategy period. A passenger only ferry (**Option CO4**) would supplement the capacity of Options CO1 and CO2, providing a very minor benefit in terms of passenger capacity (although this option would have no additional impact in terms of vehicle capacity, the key constraint on the route).
- In terms of TPO2, Hoy and Flotta already both have a commutable service to the mainland. However, the ability to commute can be negatively impacted by capacity constraints on the ferry, particularly during peak season to and from Hoy. The provision of one larger ferry (**Option CO2**) would record a minor benefit in this respect but a two vessel solution would clearly enhance the ability to commute through addressing capacity issues and providing a higher frequency (see below). **Option CO3** would be more significant in this respect as it would expand opportunities to commute to work using the car, although the high quality public transport connections from Houton makes the provision of a supplementary passenger vessel (**Option CO4**) a moderately beneficial solution.
- In terms of frequency (TPO3) the one vessel solutions (**Options CO1 & CO2**) in isolation would not offer any improvement on the current service frequency. **Option CO3** (two like-for-like vessels) would result in significant and potentially transformative frequency enhancements with a potential doubling of the current timetable to Hoy and an extended operating day for both Hoy and Flotta. This option would also support TPO4 by removing the variation between the weekday and weekend timetable for both islands (i.e.

addressing the limited Sunday frequency). **Option CO4** (supplementing a one vessel solution with a passenger only vessel) would enhance the frequency of services to Hoy but only for foot passengers

- A new overnight berth at Lyness (**Option CO5**) could result in minor frequency and connectivity enhancements owing to the removal of the Longhope dead-legging at either end of the day. This would release around six hours in the timetable per week, which could be used to provide either additional sailings during the week or a limited Sunday service.
- Supplementing a two-vessel solution with a new harbour in mid-Hoy (**Option CO6**) would provide frequency, capacity and connectivity benefits over and above those provided as a consequence of a reduced sailing time between Hoy and Houton and the removal of the Longhope dead-legging. However, landside travel time on Hoy would likely increase due to the need to travel to/from the new harbour which is located further away from the main population centre on the island.
- A two vessel solution (**Options CO3 & CO4**) would enhance strategic connectivity (TPO 5) by offering an extended operating day. This would allow Hoy and Flotta residents to return to their respective islands when arriving on either the last inbound flights or ferries to Orkney. The timetables with these options could also be worked-up to allow an early morning departure to Houton for connection with the first flights from Kirkwall (although this would have negative implications elsewhere in the timetable).

Appraisal against STAG Criteria

Table 5.3: Lyness – Flotta – Houton Capital Options – Appraisal against STAG Criteria

	Option CO1 (Do Min) – Replace MV Hoy Head like-for-like	Option CO2 – Replace MV Hoy Head with one larger vessel	Option CO3 – Replace MV Hoy Head with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a new overnight berth at Lyness	Option CO6 – Provide a new harbour in mid-Hoy
Environment	✓	✓	✗	✗	✗	✗✗
Safety	✓	✓	✗	✗	✓	-
Economy	✗	✓	✓✓	✓	✓	✓
Integration	-	-	✓✓✓	✓	✓	✗✗
Accessibility & Social Inclusion	✗	✓	✓✓✓	✓✓	✓	✓
Established Policy Directives	-	✓	✓✓✓	✓	✓	✗✗
Technical Feasibility	Harbour works required for hard ramp solutions. Hard ramp solution may have land ownership issues	Harbour works required for hard ramp & linkspan solutions. Hard ramp solution may have land ownership issues	Harbour works required for hard ramp solutions. Hard ramp solution may have land ownership issues	No issues assuming suitable vessel is used	Work on West Pier may be required.	Technically unproven as this proposal is at conceptual stage
Operational Feasibility	Crew induction training would be required	Crew induction training would be required	Requirement for additional crew & crew induction training. Second	Requirement for additional crew & crew induction training.	The Longhope based crew would need to make their way to Lyness.	The Longhope based crew would need to make their way to the new harbour.

	Option CO1 (Do Min) – Replace MV Hoy Head like-for-like	Option CO2 – Replace MV Hoy Head with one larger vessel	Option CO3 – Replace MV Hoy Head with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a new overnight berth at Lyness	Option CO6 – Provide a new harbour in mid-Hoy
			overnight berth required.			
Affordability	Linkspan: £7m plus asset replacement at life expiry Hard ramp: £13.6m	Linkspan: £16m-£22m Hard ramp: £14.6m	Linkspan: £14m plus asset replacement at life expiry Hard ramp: £18.6m	£1m incremental cost plus any ancillary harbour works	No known costs at this stage although work on West Pier possible	No known costs at this stage – likely to be significant
Public Acceptability	Likely to be acceptable only if combined with revenue options to extend the operating day	Would be acceptable particularly so only if combined with revenue options to extend the operating day	Likely to be acceptable if combined with revenue options to extend the operating day	Likely to be acceptable only if it provided an extended the operating day	No specific comments received	No specific comments received although those in the south of the island would see their journey distances increase

5.3.5 The key points from above appraisal against the STAG criteria are:

- From an environmental perspective, it is assumed that any new vessel will be more fuel efficient and indeed there are opportunities to consider alternative propulsion systems. With this in mind, the one vessel solutions (**Options CO1 & CO2**) provide a minor environmental benefit, although a two Ro-Ro solution (**Option CO3**) would record a minor disbenefit given the step-change in sailing hours. The same would also be true of the addition of a passenger-only vessel (**Option CO4**), although the emissions associated with this vessel are likely to be very small. The provision of a new harbour in Mid-Hoy (**Option CO6**) would have negative environmental impacts in the short-term based on the marine infrastructure work and the development of a currently undeveloped area. However, provided the works are implemented sensitively, taking account of environmental constraints, they are considered unlikely to be significant in the longer-term
- All three replacement vessel options (**Options CO1 – CO3**) would have a minor positive safety impact. These benefits would stem from the replacement of the current MV *Hoy Head*, which has accommodation below the water line, with a vessel of a modern design. It should however be noted that the increased frequency associated with two vessel options would generate additional sailing hours and, in all likelihood, additional vehicle kilometres (except **Option CO4**), and thus record a minor negative in terms of safety. The provision of a new overnight berth at Lyness (**Option CO5**) would also record a minor safety benefit as it would ensure a fit-for-purpose overnight berthing location.
- From an economy perspective, a like-for-like vessel (**Option CO1**) would have a negative impact as it would perpetuate capacity issues on the route and constrain the growth of the Hoy economy in particular. The provision of one new larger vessel (**Option CO2**) would have minor positive impacts as it would reduce the capacity constraint affecting the route. A two vessel solution (**Option CO3**) would offer moderate TEE benefits (associated with enhanced frequency and reduced waiting times on the Lyness - Houton route during the day and evening enhancements across both islands) and major wider / EALI benefits, particularly for Hoy which would see a transformative change in access. Supplementing the single vessel solutions with a passenger only vessel (**Option CO4**) would lead to only minor TEE benefits and moderate wider / EALI benefits as the capacity and frequency improvements would largely be limited to the passenger element. The

provision of an overnight berth at Lyness (**Option CO5**) would generate minor economic benefits through increasing the number of connections over the week, potentially alleviating the gap in the Sunday timetable for this route.

- From an integration perspective, a two vessel solution (**Option CO3**) would contribute most positively to integration, with the higher frequency and longer operating day (more in keeping with the requirements of the RSM) resulting in enhanced transport integration with strategic connections and potentially leading to inward migration and positive changes in land-use. In contrast, a new harbour at mid-Hoy (**Option CO6**) would represent a major negative in terms of transport and land use integration and would be in conflict with established policy directives, with the relocation of the harbour potentially undermining the growth of the Enterprise Zone at Lyness.
- All of the new vessel options would give rise to accessibility and social inclusion benefits as a consequence of improved disabled access, with **Options CO3 to CO5** additionally providing improvements in community accessibility owing to both / either enhanced frequency and a longer operating day.

5.4 Appraisal of Revenue Options

5.4.1 This section sets out the potential revenue options for the Houton – Lyness – Flotta route. The length of the operating day and variations in the weekday & weekend service provision were identified as significant problems at the Pre-Appraisal stage of the study. In addition, the current timetable does not allow for connections with the first morning outbound or last evening inbound connections from / to Orkney, which has a significant negative impact on Hoy and Flotta. These problems are reflected in the RSM results for Hoy and Flotta which found that the islands are substantially under-provided in terms of the number of crossings per day and marginally under-provided in terms of the length of the operating day.

5.4.2 This section therefore considers a series of revenue funding options, principally focussed on crew increments, which extend the current operating envelope on the route, allowing for longer sailing days and / or enhanced weekend provision.

5.4.3 The following revenue options were identified for the Houton – Lyness – Flotta route:

Do Minimum

- Continue with the current level of revenue funding.

Option RO1: Provide 20% additional crew

- This option is based on the addition of 20% more crewing hours. This can only be delivered with additional crew (i.e. recruitment).
- The additional time could either be used to provide an earlier first sailing or a later last sailing seven days a week or used to ensure a full Sunday service on the winter timetable.

Option RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system

- The Orkney crew currently work ‘two weeks on, two weeks off’ with three weeks leave. The working day is around 12 hours.
- This option would involve migrating to the Shetland-style shift system, which involves one week of 12 hour dayshifts, one week of 6 hour backshifts and a week-off. This provides an average working week of 42 hours, with the backshift crew on standby through the night and leave cover built in.

- This three crew⁴³ operation (an increase of one full crew on the current Orkney model) provides a 16-18 hour operating day, with scope to be flexible (e.g. weekends).

Appraisal of Revenue Options

Appraisal against Objectives

5.4.4 The following sections contain the appraisal of each revenue option against the study objectives and the STAG criteria.

Table 5.4: Houton – Lyness – Flotta Revenue Options – Appraisal against Objectives

	Option RO1 – 20% Additional Crew	Option RO2 – Adopt dayshift / backshift single vessel shift system
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	✓	✓✓✓
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	✓	✓✓✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	✓✓	✓✓✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	✓	✓✓✓

5.4.5 The key points from the above table are:

- A 20% crewing increment (**Option RO1**) would make a minor contribution across the objectives, although it should be noted that the extent of the benefit to each objective would depend on how the extra hours were deployed. The obvious improvement which could be made would be to ensure a consistent year round Sunday timetable. However, the extra hours could equally be deployed to provide a slightly earlier first sailing or later last sailing. Any increase in the number of sailings will have a capacity benefit, particularly so if those improvements are concentrated at peak times.
- The adoption of the proposed shift system (**Option RO2**) would make a substantial contribution to the objectives. Firstly, it would immediately address the issues of the weekday / weekend service differentiation, providing a consistent week-round timetable. In addition, the extended operating day would potentially allow for connections with morning flights and the evening inbound flights and ferries from the Scottish mainland. It would also extend the potential working day, allowing island residents to take jobs on the Orkney mainland that are not typical 9-5 posts. Capacity and frequency would of course also be enhanced.

⁴³ The crews consist of 3 Masters, 3 Engineers, 4 Mates (3 can act up as Masters) and 4 Deckhands (two can act up to Mate and one to Engineer)

Appraisal against STAG Criteria

Table 5.5: Houton-Lyness–Flotta Revenue Options – Appraisal against STAG Criteria

	Option RO1 – 20% Additional Crew	Option RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system
Environment	-	x
Safety	-	x
Economy	✓	✓✓
Integration	✓	✓✓✓
Accessibility & Social Inclusion	✓	✓✓✓
Established Policy Directives	✓✓	✓✓✓
<i>Technical Feasibility</i>	<i>There are no technical feasibility issues associated with this option.</i>	<i>There are no technical feasibility issues associated with this option.</i>
<i>Operational Feasibility</i>	<i>As the vessel is island-based, recruiting the necessary additional crew could be challenging. Additional senior crew would be required given their lower degree of interchangeability. Organising effective rosters could also be a challenge.</i>	<i>As the vessel is island-based, recruiting a full additional crew could be challenging. There would also likely be a need to amend contracts of employment which could present a challenge.</i>
Affordability	<i>Low – small crewing increment and fuel cost.</i>	<i>High – full additional crew (plus holiday cover) with a likely requirement for a shift allowance and / or unsociable hours pay. Significant increase in fuel costs.</i>
Public Acceptability	<i>Would be acceptable if this could provide the evening and winter Sunday sailings desired by residents.</i>	<i>This option would be highly acceptable to the public.</i>

5.4.6 The key points from above appraisal against the STAG criteria are:

- **Option RO1** (a 20% increment in crew) would provide minor economic and accessibility benefits. The scale of these benefits under this option would depend on what aspect of the service the extra crewing hours were used to enhance. If it were the winter Sunday service, this option would make a positive contribution towards policy integration by reducing the disparity with the RSM.
- The adoption of **Option RO2** would make a significant contribution to the STAG criteria. An extended operating day would make a positive contribution in terms of the Economy criterion. As well providing minor TEE benefits associated with increased frequency, there would be substantial wider / EALI benefits for Hoy in particular. Firstly, the longer operating day could encourage the in-migration of working age families to both islands as it would make them genuinely commutable (with earlier first and later last sailings) whilst also removing the significant cost barrier associated with accessing the Scottish mainland. In addition, Hoy has a very attractive tourism product which is currently constrained by the length of the operating day and capacity shortages) – this option would address both of these issues and support the development of tourism in Hoy (and also in Flotta to some extent).

- Option RO2 would also support a wide range of policies and would do much to address the RSM related service shortfall. There would be very minor disbenefits in terms of the Environment and Safety caused in both cases by additional sailings and vehicle kilometres.
- Whilst the adoption of the shift system offers significant benefits, it would be relatively expensive in comparison to Option RO1, whilst there could be operational issues surrounding crew recruitment and contracts.

5.5 Annual Operating Cost Estimates

5.5.1 In 2015/16, the revenue costs and income associated with operating the Lyness – Flotta - Houton ferry service (MV *Hoy Head*) were as follows:

Table 5.6: Lyness – Flotta – Houton Operating Costs 2015-16

Costs and Income	2015-16
Employee costs	450,667
Fuel	137,181
Survey & Repairs	292,384
Harbour Dues & Stevedoring	93,222
Other costs	53,353
Total costs	£1,026,808
<i>Fares</i>	<i>£223,171</i>
<i>Freight</i>	<i>£353,182</i>
<i>Other</i>	<i>£23,481</i>
Total Income	£599,834
Net Operating Position	-£426,974

5.5.2 The total net revenue cost of any service option is a combination of characteristics of the asset(s) used, the timetable operated and the fares income generated. The current Lyness – Flotta - Houton service costs around **£427k** per annum (net) to operate. The main vessel and revenue options are recapped below.

Table 5.7 Summary of Houton – Lyness - Flotta Options

Capital Options	Revenue Options
CO1 : 1 * Type 1b (CO1a) <u>OR</u> Type 2a (CO1b) vessel	Do Min: Current Revenue Funding
CO2: 1 * Type 1c (CO2a) <u>OR</u> Type 2b vessel (CO2b)	RO1: 20% additional crew
CO3: 2 * Type 1b (CO3a) <u>OR</u> Type 2a (CO3b) vessels	RO2: Option RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system

Capital Options	Revenue Options
CO4: Supplement Options CO1 or CO2 with a passenger only vessel between Lyness and Houton	

5.5.3 An estimate of the annual net revenue budget costs associated with the main permutations of vessels (Capital – ‘Ca’) and timetables (Revenue – ‘Rev’) outlined above is shown in the chart below. The figures shown are the estimated net annual revenue costs associated with each option.

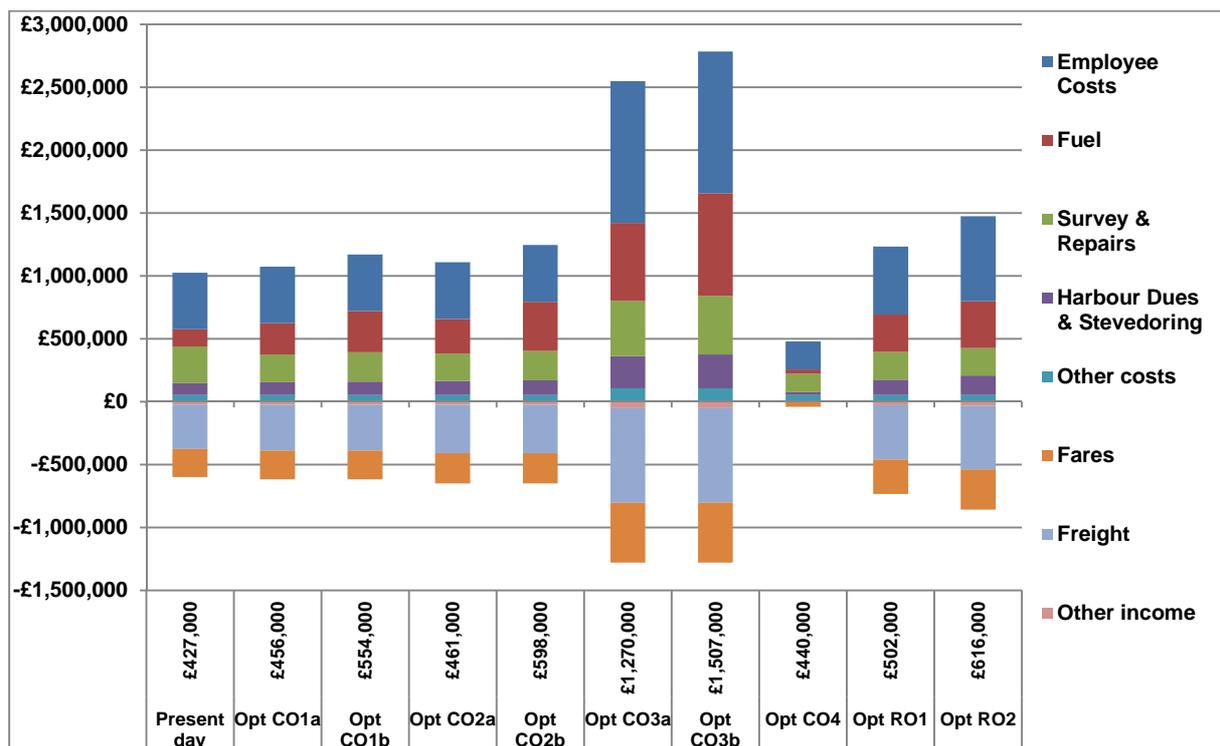


Figure 5.1: Lyness – Flotta – Houton Annual Operating Costs of Appraised Options

- Present Day: costs as per 2015/16 of **£427k**.
- The single vessel options (CO1a & CO1b, and CO2a & CO2b) see costs increase up to around **£600k** with higher fuel costs and harbour dues etc.
- The 2-vessel options, CO3a & CO3b see net costs increase to **£1.3m** and **£1.5m** respectively. These costs would reduce if the vessels were run less intensively than assumed here.
- The revenue options RO1 and RO2 see increases in fuel, employee and harbour dues in line with the increase in operating hours bringing net costs up to **£500k** and **£616k** respectively.
- Note that the costs for RO1 and RO2 are based on Capital Option CO1a for illustrative purposes.

5.6 Public Consultation – Prioritisation

5.6.1 Chapter 1 described the Public Engagement undertaken in June 2016. A key part of this was the identification of priorities for enhancements to services in the event of additional resources

being available. The public were provided with a list of potential enhancements and invited to tick the three that they would prioritise.

5.6.2 The number of completed questionnaires was:

- Flotta: 9
- Hoy: 4

5.6.3 The figures below show the percentage of respondents who ticked each option. Note that these columns do not sum to 100% as the question allowed three responses.

Flotta

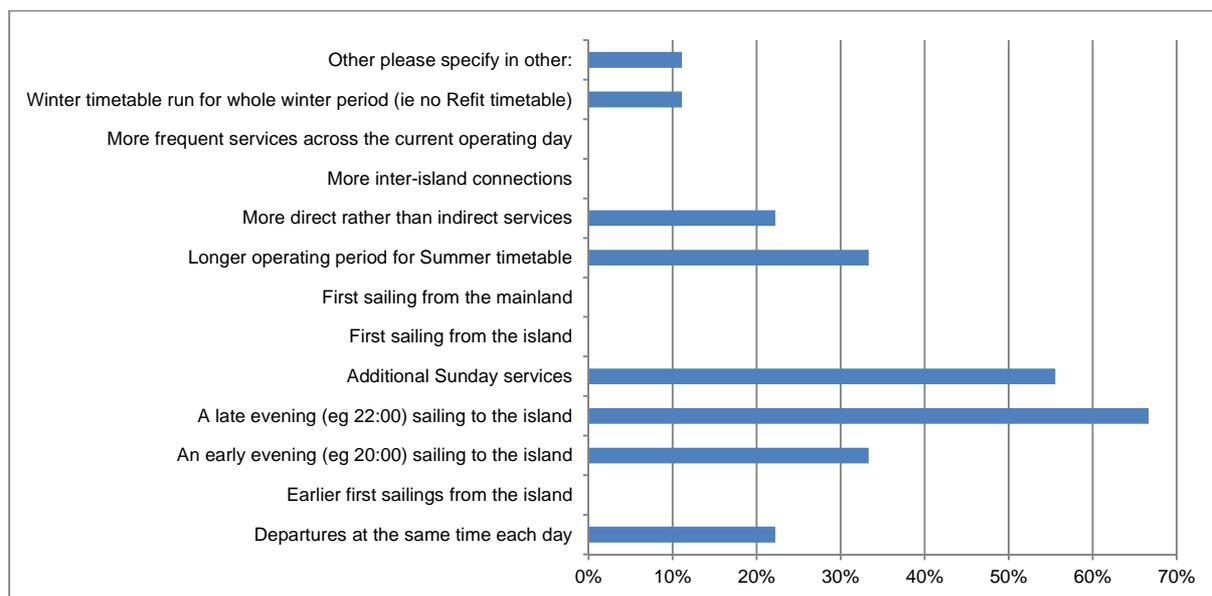


Figure 5.2: Flotta – Prioritisation of Enhancements

Other comments included:

- *No need for change*

5.6.4 The key improvements identified by Flotta residents were services later into the evening and also Sunday services. The fact that a number of Flotta services run indirect is also noted as an area for service improvement.

Table 5.8: Flotta – Other Comments

Flotta – Comments	Number of times Cited
Ferry based Houton or Lyness	2
Sunday Sailings	2
Additional boat	2

Hoy

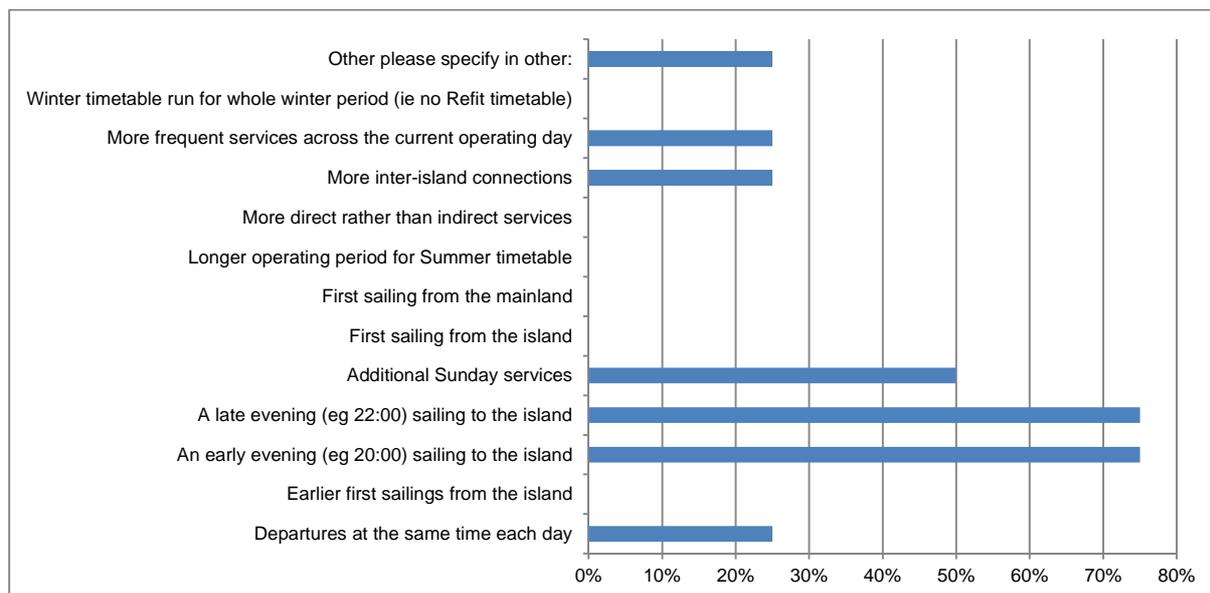


Figure 5.3: Hoy – Prioritisation of Enhancements

5.6.6 Other comments included:

- Later Saturday Service

5.6.7 There were a very low number of responses from Hoy given the size of the population. Those who did respond noted evenings and Sundays were the priority for service improvements.

Table 5.9: Hoy – Other Comments

Hoy – Comments	Number of times Cited
Sunday ferry	2
More evening ferries	2

5.7 Rationale for Selection / Rejection

5.7.1 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 5.10: Outcome of Appraisal, Houton – Lyness - Flotta

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Ration for Selection / Rejection
Option CO1 (Do Minimum): Replace the MV <i>Hoy Head</i> on a like-for-like basis	✗	The capacity issues identified on the route would not be resolved with one vessel of similar carrying capacity. The vessels are fully utilised during the peak periods therefore there is no possibility of providing additional services when most required.
Option CO2: Replace MV <i>Hoy Head</i> with one larger vessel	✓	One larger vessel would provide additional capacity and this option should be considered further. There remains a question as to whether such a vessel could meet the long-term capacity needs of the route. This would depend on detailed analysis of demand in the Outline Business Case. Further data collection may be required to achieve this.
Option CO3: Replace MV <i>Hoy Head</i> with two like-for-like	✓	Two vessels would provide significant additional capacity and this option should be considered further. An alternative would be 1 * TYPE 1b / 2a

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Ration for Selection / Rejection
vessels		vessels and 1 * TYPE 1c / 2b vessels. This would depend on detailed analysis of demand and the harbour implications would also have to be considered (including overnight berthing arrangements).
Option CO4: Supplement Option CO2 with a passenger only vessel between Lyness and Houton	✓	This option offers a potential extension of the operating day to / from Hoy (and Flotta if required) for a relatively low cost. Whilst it does not support vehicle-based access, the overall increase in connectivity offered means that this option should be considered further.
Option CO5: Provide a new overnight berth at Lyness	✓	The dead-legging to Longhope costs around 40 minutes per day, or around four and three quarter hours per week. These hours could be better deployed in supporting a denser timetable. The vessel has also been damaged recently when lying at Longhope. The option of an overnight berth at Lyness should therefore be considered further.
Option CO6: Supplement Option CO3 with a new harbour in mid-Hoy	✗	The costs of this option are likely high in the context of the limited benefits offered by it. There is also no obvious site for such a harbour. The main drawback of this option is that any move out of Lyness could materially affect the development aspirations associated with its Enterprise Area status.
Option RO1: Provide 20% additional crew	✓	This would be a relatively low cost means of expanding the operating envelope of the current service.
Option RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system	✓	Whilst this would be a high cost service enhancement, it would transform access to Hoy and Flotta, making both islands more attractive places to live, work and do business.

6 Graemsay and Hoy

6.1 Capital Investment Timeframe

- The current vessel on the Moaness – Graemsay – Stromness route, the MV *Graemsay*, is a small combi Lo-Lo / Ro-Ro vessel capable of accommodating two cars (less than two tonnes). Built in 1996, her career has been dedicated to the triangular route between Stromness, North Hoy and the island which she is named after. The vessel is primarily used for passengers and limited Lo-Lo. The vessel carries MCA Class VI certification in summer and VIA in winter. The MV *Graemsay* is 20 years old and based on a 30 year lifespan, the vessel would be replaced in 2026.
- The limitation of load for the vessel is i) the crane capacity, and ii) the set criteria (by the Class Society and National Authority) that when a vessel such as the MV *Graemsay* lifts a load on the beam it should not heel more than 7°. In practice, there is not a deadweight capacity restriction as such, as it is the crane and / or vessel design which restricts freight capacity, due to the relatively small size of the vessel. The carrying capacity is however 12 tonnes in passenger mode.
- Whilst the MV *Graemsay* has a stern ramp, none of the ports to which she currently operates have the facility to use this, and hence rely on her crane to lift freight and livestock on board. The vessel was lengthened from 16 metres to 21 metres in 2009 and re-engined in 2015. The re-power in 2015 renewed the propulsion machinery and generator in their entirety and this, coupled with the excellent overall condition of the vessel, should bode well for the vessel being in a condition to operate through to 2026 or beyond.
- The ferry terminals on this route are challenging to operate to / from and it is envisaged that any new capital investment on this route would require an element of upgrade. At Moaness, the vessel's belting gets above deck at the highest tides, whilst there is not enough water depth at the lowest tides. Graemsay is also tidally restricted, whilst access to the vessel at all three of the harbours could be improved.
- The MV *Graemsay* overnights in Stromness and operates with a single mainland crew working on a two-week on, two-week off rota.

6.1.1 The ASTs, harbour drawings and environmental constraints maps for the Moaness – Graemsay - Stromness route can be found in Appendix C.

6.2 Identified Problems

6.2.1 The following transport problems in relation to the Moaness - Graemsay – Stromness route were identified in the Pre-Appraisal Report and verified through subsequent community feedback. Where the community has identified a problem which we had not, their contribution is noted in red text.

Table 6.1: Moaness - Graemsay – Stromness Transport Problems

	Service Characteristics	Rating	Graemsay & Hoy: Why is this a problem or not?
1	Overall Journey Time to Kirkwall / Stromness	✓	The overall journey time between Moaness & Graemsay and Stromness is very short. The ferry berths in the heart of Stromness.
2	First sailing / flight	✗	The first sailing departs Moaness at 08:10 and Graemsay at 07:45 Monday – Friday. This departure allows residents of both islands to commute to work and education on the mainland. Following consultation, community feedback suggested that the first sailing is not early enough

	Service Characteristics	Rating	Graemsay & Hoy: Why is this a problem or not?																																				
			resulting in e.g. pupils arriving late at secondary school																																				
3	Last sailing / flight	xx	The last departure from Stromness departs at 1745. Combined with the early first sailing, this permits a full working day on Orkney mainland. However, the time of the last departure does not allow Graemsay or Hoy residents to undertake evening social activities on Orkney mainland or connect with the last flights / ferries from the Scottish mainland (see below). It also curtails the length of day tourism visits to Hoy, given that the Lyness route has a similar operating day. The only exception to this is on a Friday evening when there is a 21:30 departure from Stromness.																																				
4	Time on mainland	x	Hoy and Graemsay residents have amongst the longest amount of time on the Orkney mainland. A 7-day service is provided year round. The hours ashore by timetable are summarised in the table below and are rounded up or down to the nearest whole hour: <table border="1"> <thead> <tr> <th colspan="9">Hoy (Moaness)-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>13</td> <td>8</td> <td>8</td> <td>65</td> </tr> <tr> <td>Ferry - Winter</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>13</td> <td>6</td> <td>6</td> <td>62</td> </tr> </tbody> </table>	Hoy (Moaness)-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	9	9	9	9	13	8	8	65	Ferry - Winter	9	9	9	9	13	6	6	62
Hoy (Moaness)-Time on Mainland																																							
	Mo	Tu	We	Th	Fr	Sa	Su	Total																															
Ferry - Summer	9	9	9	9	13	8	8	65																															
Ferry - Winter	9	9	9	9	13	6	6	62																															
5	Time in Kirkwall / Stromness	x	See point 4																																				
6	Time on island	✓	Time on the island is amongst the highest in the archipelago. A 7-day service is provided year round. The relatively frequent service also permits flexibility in the duration of on-island visits, minimising dead time for businesses or those on employers' business (whilst the Lyness route provides an alternative means of getting on and off of Hoy). The hours on island by timetable are summarised in the table below and are rounded up or down to the nearest whole hour: <table border="1"> <thead> <tr> <th colspan="9">Hoy (Moaness)-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>14</td> <td>9</td> <td>9</td> <td>73</td> </tr> <tr> <td>Ferry - Winter</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>14</td> <td>7</td> <td>7</td> <td>69</td> </tr> </tbody> </table>	Hoy (Moaness)-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	10	10	10	10	14	9	9	73	Ferry - Winter	10	10	10	10	14	7	7	69
Hoy (Moaness)-Time on Island																																							
	Mo	Tu	We	Th	Fr	Sa	Su	Total																															
Ferry - Summer	10	10	10	10	14	9	9	73																															
Ferry - Winter	10	10	10	10	14	7	7	69																															
7	Frequency / Sailings per day / Timetable gaps	✓	With four rotations Monday – Friday (summer and winter) plus an additional freight sailing on Tuesdays, Wednesdays and Fridays and a late evening service on a Friday, this route has a relatively high service frequency.																																				
8	Capacity	x	Capacity is not an issue in terms of total demand. However, the MV <i>Graemsay</i> is a Lo-Lo vessel and can only carry a maximum of two small cars. This weight limitation presents a significant constraint on the Moaness – Graemsay – Stromness service, although multi-cats are chartered for heavy-lifts as required.																																				
9	Reliability (weather / mechanical)	xxx	Reliability on this route is relatively poor. Tidal constraints at Graemsay frequently lead to the service being rescheduled, whilst the piers at both Graemsay and Moaness are challenging to berth at and exposed to the weather.																																				
10	Comfort	✓	The levels of comfort on the vessel are seen to be appropriate for the length of crossing.																																				
11	Physical access	xxx	The lack of Ro-Ro facilities and the challenging berths make disabled access to the ferry very poor.																																				
12	Integration with PT (local bus)	✓	The ferry travels into the heart of Stromness. The X1 public bus service operates on a largely hourly basis to provide onward connections to Kirkwall.																																				
13	Integration with PT (strategic)	xx	The Moaness – Graemsay – Stromness route does not allow Graemsay and Hoy residents to catch the first flights to Aberdeen, Edinburgh and Inverness, although they can catch the first Glasgow and Sumburgh flights. Residents also cannot catch the first NorthLink or Pentland Ferries departures, although they can catch the 1150 Pentland Ferries departure. The 1100 NorthLink service from Stromness, which operates during peak timetable, can also be accessed. Evening integration is poorer – the last ferries of the evening from the Scottish mainland coupled with the flights from Aberdeen, Edinburgh and Inverness arrive after the last departure																																				

	Service Characteristics	Rating	Graemsay & Hoy: Why is this a problem or not?
			of the ferry to Graemsay and Moaness. Trips to the Scottish mainland therefore require at least one off-island overnight stay (except on a Friday when there is a late evening sailing).
14	Crossing / flight time	✓	See point 1 above
15	Onboard facilities	✓	The onboard facilities are considered to be appropriate for the length of the crossing.
16	Weekday / weekend service variation	✗	Whilst there are fewer weekend than weekday services, the two rotations which operate on a Saturday and Sunday allow for a meaningful day return to be made to both the island and mainland. However, one issue worth noting is that the ferry frequency on a Sunday, combined with the lack of a winter Sunday sailing between Lyness and the mainland may curtail Hoy's crucial tourism industry outwith the summer timetable period.
17	Landside infrastructure issues	✗✗✗	As previously noted, tidal constraints at Graemsay frequently lead to the service being rescheduled, whilst the piers at both Graemsay and Moaness are challenging to berth at and exposed to the weather.
18	Landside human resources	✓	There were no issues in relation to landside human resources picked up through the consultation. The relatively low population of Graemsay and ongoing need for Lo-Lo facilities could present a long-term challenge in terms of meeting the landside needs of the service.

6.3 Appraisal of Capital Options

Capital Options

6.3.1 The following capital options were identified for Moaness–Graemsay–Stromness:

Option CO1 (Do Minimum): Replace MV *Graemsay* with a like-for-like Lo-Lo vessel

- The MV *Graemsay* would be replaced by a bespoke like-for-like combi Lo-Lo / Ro-Ro vessel. This vessel would be able to carry a maximum of 73 passengers and 2 PCUs (12 tonnes in passenger mode, 23 tonnes in freight mode) and would carry a Class VI / VIA certificate. It is estimated that this would cost in the region of £1.5m-£2m.
- There would be no significant harbour works associated with this option.⁴⁴
- The total cost of this option would therefore be **£1.5m-£2.0m**

Option CO2: Replace MV *Graemsay* with a larger capacity Lo-Lo vessel

- The MV *Graemsay* would be replaced by a larger bespoke combi Lo-Lo / Ro-Ro vessel. In the Shetland Inter-Island Study, a like-for-like replacement for the 25 metre ferry MV *Snolda*, which operates to Papa Stour is being considered. A vessel of this scale could carry six PCUs and 115 tonnes of freight and would be a reasonable step up in carrying capacity for Graemsay. A new vessel of this nature is estimated to cost around £3m.
- There would be no significant harbour works associated with this option.⁴⁵
- The total cost of this option would be around **£3.0m**.

Option CO3: Replace MV *Graemsay* with a larger capacity Ro-Ro vessel

⁴⁴ See Appendix C – Moaness, Graemsay & Stromness Drawings, Box 1, Like-for-Like Options.

⁴⁵ See Appendix C – Moaness, Graemsay & Stromness Drawings, Box 1, Like-for-Like Options.

- This option involves converting this route to Ro-Ro using a hard ramp solution. A ‘block’ system, effectively a linkspan which can only be used at certain states of the tide, has been considered in detail for Graemsay in recent years. However this option has now been rejected by the local community and OIC is not considering this further. There are deemed to be two potential solutions to this:
 - The replacement of the MV *Graemsay* with a catamaran of approximately 20-25 metre length and 6 metre beam. This vessel would be capable of carrying 50 passengers and 5 PCUs. Whilst capacity would be less than with a Type 1a, this vessel would be shorter and require fewer remedial harbour works and is estimated to cost **£3.0m**.
 - The replacement of the MV *Graemsay* with a Type 1a vessel, which would have full roll through capability. However, this vessel would require significant harbour works at Graemsay and Moaness as well as a new berthing location at Stromness. It is estimated to cost **£4.0m**.
- The following harbour works would be required:
 - Graemsay: construction of an approximately 100m solid quay to the north of the existing pier which would provide additional shelter, supplemented by a hard ramp although further assessment is required to establish optimal ramp length, according to vessel ramp characteristics. The existing pier would require to be marginally extended to provide shelter from the south. There would also be a need for land reclamation for ramp access and an additional parking / waiting area. The estimated cost for these works is **£4.3m**.⁴⁶
 - Moaness: provision of a solid quay of approximately 90m and extension of the existing quay to provide additional shelter supplemented by a hard ramp although further assessment is required to establish optimal ramp length, according to vessel ramp characteristics. The existing pier would be marginally extended to provide additional shelter. Extended parking and waiting area required. The estimated cost for these works is **£4.6m**.⁴⁷ There may be further significant costs associated with rock dredging or to avoid this, placing the berth further from the shore.⁴⁸
 - Stromness: provision of a hard ramp and berthing platform of approximately 70 metres to the north of the marina - further assessment is required to establish optimal ramp length, according to vessel ramp characteristics. Dredging may be required to provide access at all tidal levels. The estimated cost for these works is **£2.6m**.⁴⁹
- The total cost of this option would therefore be around **£14.5m-£15.5m**.

Option CO4: Lengthen the Moaness Pier

- The quay at Moaness is curved in plan and of solid construction with the berth located on the northern side and has limited fendering. The maximum available berthing length is 20 metres and the water is 1-2 metres below CD. The vessel’s belting gets above deck at highest tides and there is not enough water depth at the lowest tides.
- An extension to Moaness Pier of 12 metres and an additional height of 1.5 metres has been suggested to remedy this – the extension would reduce the restrictions on serving the pier and increase safety. This option could either be progressed in its own right or as part of the solution with Options CO1 and CO2 (it is assumed that, under Option CO3, conversion to Ro-Ro, bespoke harbour improvements would be undertaken).

⁴⁶ See Appendix C – Stromness Drawing, Box 2, Hard Ramp Ro-Ro Option.

⁴⁷ See Appendix C – Moaness Drawing, Box 2, Hard Ramp Ro-Ro Option.

⁴⁸ It should be noted that, given the constraints at Moaness Pier, a variant of this option would be to have a hard ramp on Graemsay only, with any Hoy-based vehicular traffic routed through Houton – Lyness.

⁴⁹ It should be noted that, given the constraints at Moaness Pier, a variant of this option would be to have a hard ramp on Graemsay only, with any Hoy-based vehicular traffic routed through Houton – Lyness.

- A very high level total cost of this option would be around **£1m-£2m**, although further detailed design would be required to provide additional certainty in relation to these costs.

Appraisal of Capital Options

6.3.2 The following sections contain the appraisal of each capital option against the study objectives and the STAG criteria.

Appraisal against Objectives

Table 6.2: Moaness - Graemsay - Stromness Capital Options – Appraisal against Objectives

	Option CO1 - (Do Min) – Replace MV Graemsay with a like-for-like combi Lo-Lo / Ro-Ro vessel	Option CO2 – Replace MV Graemsay with a larger capacity combi Lo-Lo / Ro-Ro vessel	Option CO3 – Replace MV Graemsay with a larger capacity Ro-Ro vessel	Option CO4 – Lengthen Moaness Pier
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	-	✓✓✓	✓✓✓	-
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	✓	✓	✓
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	N/A	N/A	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	-	✓	-
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	-	-	-
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-	-	-

6.3.3 The key points from the above table are:

- One of the key operational problems identified on the Moaness – Graemsay – Stromness route was in relation to the deadweight capacity of the ferry (and occasional passenger capacity issues). The provision of a higher capacity Lo-Lo (**Option CO2**) or a Ro-Ro (**Option CO3**) would therefore have major capacity benefits, particularly for Graemsay where the bulk of the freight is likely to originate from.
- The other major operational issue identified on this route was the reliability issues associated with berthing at Moaness and Graemsay. The adoption of a new vessel solution (**Options CO2 and CO3**) with accompanying harbour works (**Option CO3**) would therefore likely provide a minor benefit in terms of the ability to commute to Stromness

through improving the reliability of the service. The extension of the pier at Moaness (**Option CO4**) would offer a similar benefit through improving the reliability of the service using the current vessel or a like-for-like replacement.

- The current Moaness – Graemsay – Stromness route is Lo-Lo only, which can lead to extended turnaround times associated with loading cargo onto and off of the vessel. At present, this does not present a scheduling problem as the timetable is relatively relaxed. Nonetheless, conversion of the route to Ro-Ro (**Option CO3**) could potentially provide a minor benefit in allowing the service to be run more frequently if the need arose.

Appraisal against STAG Criteria

Table 6.3: Moaness - Graemsay - Stromness Capital Options – Appraisal against STAG Criteria

	Option 1 - (Do Min) – Replace MV Graemsay with a like-for-like Lo-Lo vessel	Option 2 – Replace MV Graemsay with a larger capacity Lo-Lo vessel	Option 3 – Replace MV Graemsay with a larger capacity Ro-Ro vessel	Option 4 – Lengthen the Moaness Pier
Environment	✓	✓	✗	✗
Safety	-	-	✓✓	✓✓
Economy	-	✓	✓✓	✓
Integration	-	✓	✓	✓
Accessibility & Social Inclusion	✓	✓	✓✓	✓
Established Policy Directives	✓	✓	✓✓	✓
Technical Feasibility	No issues	No Issues	Further assessment would be required to establish optimal ramp length according to vessel's ramp characteristics. Pier extensions / rock dredging may be required. Note the Graemsay block solution is not considered appropriate and would not be considered further in the OBC.	This option is technically feasible
Operational Feasibility	Crew induction training would be required.	Crew induction training would be required.	Crew induction training would be required. Ro-Ro operations would be tidally constrained.	There would be no operational issues associated with this option.
Affordability	£1.5m-£2m	£3m	£14.5m-£15.5m	£1m-£2m but further detailed development work required.
Public Acceptability	Likely to be acceptable	Likely to be acceptable	There was little discernible desire for a Ro-Ro service in Graemsay amongst those who attended the Public Exhibition	No specific comments received on this proposal

6.3.4 The key points from above appraisal against the STAG criteria are:

- From an environmental perspective, it is anticipated that any new vessel (**Options CO1 – CO3**) would offer a minor benefit in terms of reduced emissions, although the Ro-Ro option (**Option CO3**) could lead to very marginally increased vehicle kilometres. **Option CO3**, the creation of Ro-Ro terminals, could have minor negative environmental impacts. The extension of Moaness Pier (**Option CO4**) would likely have minor negative environmental impacts during construction.
- The MV *Graemsay* is a relatively restricted vessel – as well as being weight constrained, she is limited to two tonnes on a side-lift and has limited indoor passenger accommodation. A larger Lo-Lo vessel (**Option CO2**) would alleviate these issues to some extent (although not wholly given the proposed scale of the vessel), providing minor safety benefits. A Ro-Ro (**Option CO3**) solution would remove the safety risks associated with Lo-Lo operations on narrow and exposed piers, providing moderate safety benefits. The extension of Moaness pier (**Option CO4**) would also provide a moderate safety benefit through reducing the risks associated with serving this challenging pier, particularly at spring tides.
- From the perspective of the economy and accessibility criteria, the provision of a Ro-Ro service (**Option CO4**) would have the most notable benefit. A Ro-Ro vessel would provide car-based access to / from Graemsay and, more importantly, would allow plant and other equipment to access the island without the need for multi-cat hire. Such a vessel would also remove the capacity constraints on the route. A larger Lo-Lo vessel (**Option CO2**) would offer minor economy benefits through lessening the current capacity constraints on the service. The reliability benefits offered by a lengthened Moaness pier (**Option CO4**) would also have a positive economic impact on Graemsay and indeed North Hoy.
- From an affordability perspective, a like-for-like replacement (**Option CO1**) would clearly be the lowest cost option as it would not require major harbour works and a comparatively small vessel replacement cost. However, this option would maintain the current constraints on the service. Moving to a Ro-Ro solution (**Option CO3**) would be the most expensive option but would offer the greatest overall benefit, particularly for Graemsay.

6.4 Appraisal of Revenue Options

- 6.4.1 This section sets out the potential revenue options for the Moaness – Graemsay – Stromness route. The length of the operating day was identified as a significant problem on this route at the Pre-Appraisal stage of the study. In addition, the current timetable does not allow for connections with the first morning outbound or last evening inbound connections from / to Orkney (except on a Friday evening), which has a significant negative impact. These problems are reflected in the RSM results for Hoy and Graemsay which found that the islands are under-provided in terms of the length of the operating day and the number of connections per day.
- 6.4.2 This section therefore considers a series of revenue funding options, principally focussed on crew increments, which extend the current operating envelope on the route, allowing for longer sailing days and / or enhanced weekend provision.
- 6.4.3 The following revenue options were identified for the Moaness – Graemsay – Stromness route:

Do Minimum

- Continue with the current level of revenue funding.

Option RO1: Maximise service intensity within current operating hours

- The current timetable includes periods where the vessel ties up for periods of the day. This option would involve running the vessel continuously during its current operating hours, excluding meal breaks etc.
- It should be noted that if the late Friday evening service was to be offered on other nights of the week, additional crew would be required. It is also worth noting that the current structure of the timetable, whilst relatively slack, does not provide the crew with much in the way of formal rest periods, so there are only very limited opportunities to increase the number of sailings with the existing crew.

Option RO2: Provide 20% additional crew

- It is estimated that the current single crew on the MV *Graemsay* achieve 4,178 hours per annum, which equates to an average working week of 80 hours. A 20% increment in crew would therefore provide around 16 extra crew hours per week. This equates to just over two and a quarter extra hours per day.
- The additional time could either be used to provide additional sailings during the week or a denser weekend timetable.
- This option can only be delivered with additional crew (i.e. recruitment).
- This additional time could also be used to provide the earlier AM departure required for *Graemsay* if this cannot be achieved under RO1.

Option RO3: Adopt dayshift / backshift (Shetland model) single vessel shift system

- The Orkney crew currently work ‘two weeks on, two weeks off’ with three weeks leave. The working day is around 12 hours.
- This option would involve migrating to the Shetland-style shift system, which involves one week of 12 hour dayshifts, one week of 6 hour backshifts and a week-off. This provides an average working week of 42 hours, with the backshift crew on standby through the night and leave cover built in.
- This three crew⁵⁰ operation (an increase of one crew on the current Orkney model) provides a 16 hour operating day, with scope to increase further where required (e.g. weekends).

Appraisal of Revenue Options

Appraisal against Objectives

6.4.4 The following sections contain the appraisal of each revenue option against the study objectives and the STAG criteria.

Table 6.4: Moaness - Graemsay - Stromness Revenue Options – Appraisal against Objectives

	Option RO1 – Maximise Operating Intensity	Option RO2 – 20% Additional Crew	Option RO3 – dayshift / backshift single vessel shift system
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the</i>	✓	✓	✓✓

⁵⁰ The crews consist of 3 Masters, 3 Engineers, 4 Mates (3 can act up as Masters) and 4 Deckhands (two can act up to Mate and one to Engineer)

	Option RO1 – Maximise Operating Intensity	Option RO2 – 20% Additional Crew	Option RO3 – dayshift / backshift single vessel shift system
<i>island(s) and Orkney Mainland</i>			
<i>TPO2a: Where an island has a ‘commutable’ combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	✓	✓✓✓
<i>TPO 2b: Where an island does not have a ‘commutable’ combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	N/A	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	✓	✓	✓✓✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	✓✓	✓✓✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	✓	✓✓✓

6.4.5 The key points from the above table are:

- The addition of an extra return sailing per day or a denser weekend timetable **Option RO1** (maximising the operating intensity) would result in minor improvements in capacity and frequency. An enhanced weekend timetable would offer particular benefits in this respect as it would support the important tourism industry in Hoy.
- A 20% crewing increment (**Option RO2**) would make a minor contribution across the objectives, although it should be noted that the extent of the benefit to each objective would depend on how the extra hours were deployed. The obvious improvement which could be made would be to provide a denser weekend timetable, with more and potentially later connections on a Saturday and Sunday. However, the extra hours could equally be deployed to provide a slightly later last sailing from Stromness, supplementing the connectivity offered by the Lyness – Flotta - Houton route. Any increase in the number of sailings will have a capacity benefit, particularly so if those improvements are concentrated at peak times.
- The adoption of the Shetland-style shift system (**Option RO3**) would make a substantial contribution to the objectives. Firstly, it would immediately address the issues of the weekday / weekend service variation, providing a consistent week-round timetable. In addition, the extended operating day would potentially allow for connections with morning flights and the evening inbound flights and ferries from the Scottish mainland. It would also extend the potential working day, allowing island residents to take jobs on Orkney mainland that are not typical 9-5 posts. Capacity and frequency would of course also be enhanced.

Appraisal against STAG Criteria

Table 6.5: Moaness-Graemsay-Stromness Revenue Options – Appraisal against STAG Criteria

	Option RO1 – Maximise Operating Intensity	Option RO2 – 20% Additional Crew	Option RO3 – dayshift / backshift single vessel shift system
Environment	-	-	✘
Safety	-	-	✘
Economy	✓	✓	✓✓
Integration	✓	✓	✓✓✓
Accessibility & Social Inclusion	✓	✓	✓✓✓
Established Policy Directives	✓	✓✓	✓✓✓
Technical Feasibility	<i>There are no technical feasibility issues associated with this option.</i>	<i>There are no technical feasibility issues associated with this option.</i>	<i>There are no technical feasibility issues associated with this option.</i>
Operational Feasibility	<i>There are no operational feasibility issues associated with this option.</i>	<i>Additional senior crew would be required given their lower degree of interchangeability.</i>	<i>There are no operational feasibility issues associated with this option.</i>
Affordability	<i>Very Low – small additional fuel costs only.</i>	<i>Low – small crewing increment and fuel cost.</i>	<i>High – full additional crew (plus holiday cover) with a likely requirement for a shift allowance and / or unsociable hours pay. Significant increase in fuel costs.</i>
Public Acceptability	<i>Increased service frequency within the current operating day does not appear to be the priority for Graemsay therefore this option is likely to generate little in the way of benefits for the island.</i>	<i>Would be acceptable if this can provide the desired longer day and the earlier first arrival in Stromness from Graemsay in particular.</i>	<i>Acceptable although some residents may feel that the resulting timetable is excessive.</i>

6.4.6 The key points from above appraisal against the STAG criteria are:

- **Option RO1** (maximising the current operating intensity) would provide minor economic and accessibility benefits at relatively low cost – this benefit would be most significant if the additional hours were concentrated at the weekend or in providing a later last sailing Monday - Thursday. **Option RO2** (a 20% increment in crew) would also provide minor economic and accessibility benefits, particularly when introduced in addition to Option RO1. The scale of the benefits under this option would depend on what aspect of the service the extra crewing hours were used to enhance.
- The adoption of **Option RO3** would make a significant contribution to the STAG criteria. An extended operating day would make a positive contribution in terms of the Economy criteria. As well providing minor TEE benefits associated with increased frequency, there would be substantial wider / EALI benefits for Graemsay and Hoy, particularly if coordinated with any improvements on the Lyness – Flotta – Houton route. Firstly, the longer operating day could encourage the in-migration of working age families, particularly given connections to the main employment centres of Kirkwall and Stromness, a key issue for Graemsay in particular, where the population is relatively small. The later last sailings would enhance the commutability of the islands for those not in ‘typical’ 9-5 employment and, crucially, would support the development of the Hoy tourism economy. The extended operating day would also remove the significant cost barrier associated with accessing the Scottish mainland. Option RO3 would also support a wide range of policies and would do much to address the RSM related service shortfall.

There would be very minor disbenefits in terms of the Environment and Safety criteria caused in both cases by additional sailings and vehicle kilometres.

- Whilst the adoption of the shift-based crewing model offers significant benefits, it would be relatively expensive in comparison to Options RO1 and RO2, whilst there could be operational issues surrounding crew recruitment and contracts. This is a particularly pertinent point on this route, where any improvement to frequency or extension of the operating day would need to be coordinated with changes on the Lyness – Flotta - Houton route.

6.5 Annual Operating Cost Estimates

- 6.5.1 The revenue costs and income associated with operating the Moaness – Graemsay – Hoy ferry service in 2015/16 were as follows:

Table 6.6: Moaness - Graemsay - Stromness Operating Costs 2015-16

Costs and Income	2015-16
Employee costs	£192,611
Fuel	£34,481
Survey & Repairs	£135,340
Harbour Dues & Stevedoring	£5,679
Other costs	£38,345
Total costs	£406,456
<i>Fares</i>	<i>£65,575</i>
<i>Freight</i>	<i>£4,341</i>
<i>Other</i>	<i>£4,807</i>
Total Income	£74,723
Net Operating Position	-£331,733

- 6.5.2 The total net revenue cost of any service option is a combination of characteristics of the asset(s) used, the timetable operated and the fares income generated. The current Moaness – Graemsay - Stromness service costs around **£332k** per annum (net) to operate. The main options are recapped below.

Table 6.7: Summary of Moaness - Graemsay - Stromness Options

Capital Options	Revenue Options
CO1: Like-for-like Lo-Lo vessel	Do Min: Current Revenue Funding
CO2: Larger capacity Lo-Lo vessel	RO1: Maximise operating intensity of current crew
CO3: Larger capacity Ro-Ro vessel	RO2: 20% additional crew
CO4: Lengthen Moaness Pier	RO3 – dayshift / backshift single vessel shift

Capital Options	Revenue Options
	system

6.5.3 An estimate of the annual net revenue budget costs associated with the main permutations of vessels (Capital – ‘Ca’) and timetables (Revenue – ‘Rev’) outlined above is shown in the chart below. The figures shown are the estimated net annual revenue costs associated with each option.

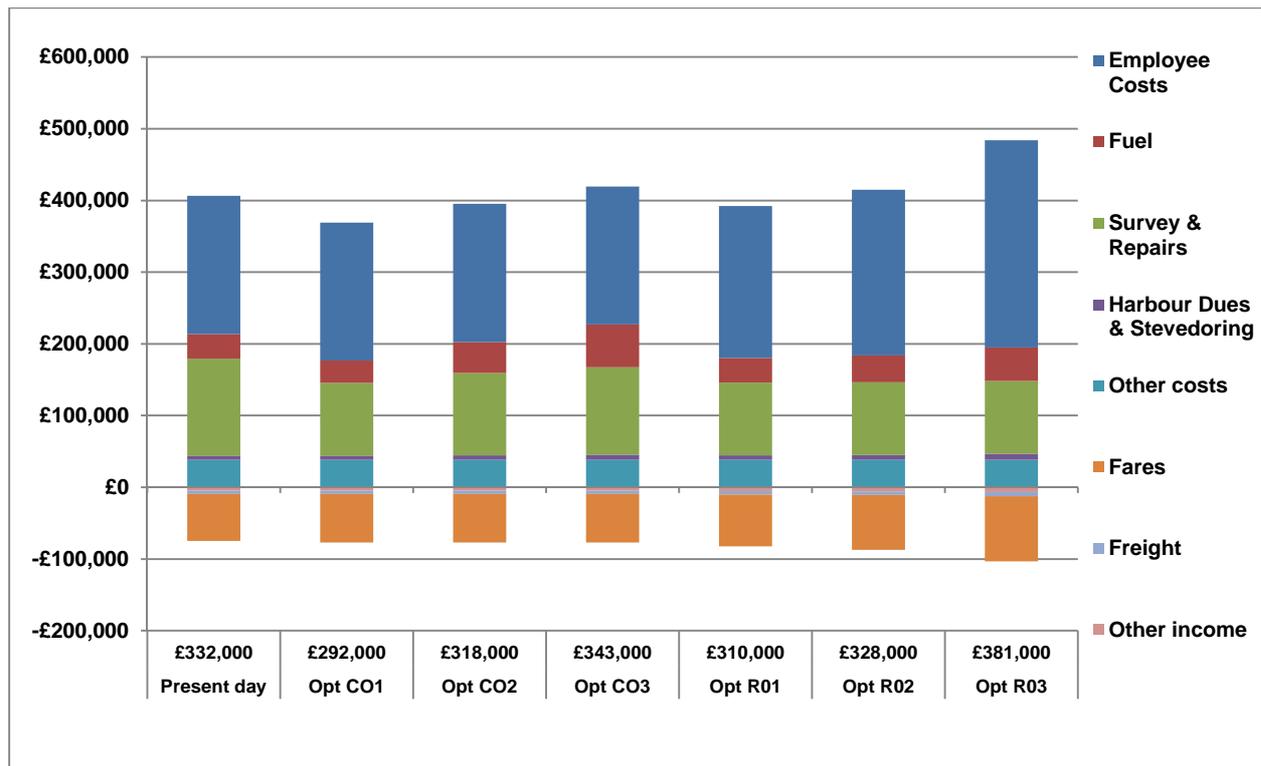


Figure 6.1 Moaness - Graemsay - Stromness Annual Revenue Cost Estimates

- Present Day: costs as per 2015/16 of **£332k**.
- Single vessel options, CO1-CO3, see costs reduce initially to £292k and £318k (assumed that newer vessels are cheaper to run) then increase to **£343k** with a larger RoRo.
- Note that the costs for RO1, RO2 and RO3 are based on Capital Option CO1 for illustrative purposes and all these see a proportionate increase in costs relative to CO1.

6.6 Public Consultation – Prioritisation

6.6.1 Chapter 1 described the Public Engagement undertaken in June 2016. A key part of this was the identification of priorities for enhancements to services in the event of additional resources being available. The public were provided with a list of potential enhancements and invited to tick the three that they would prioritise.

6.6.2 The number of completed questionnaires was:

- Graemsay: 5

6.6.3 The figures below show the percentage of respondents who ticked each option. Note that these columns do not sum to 100% as the question allowed three responses.

Graemsay

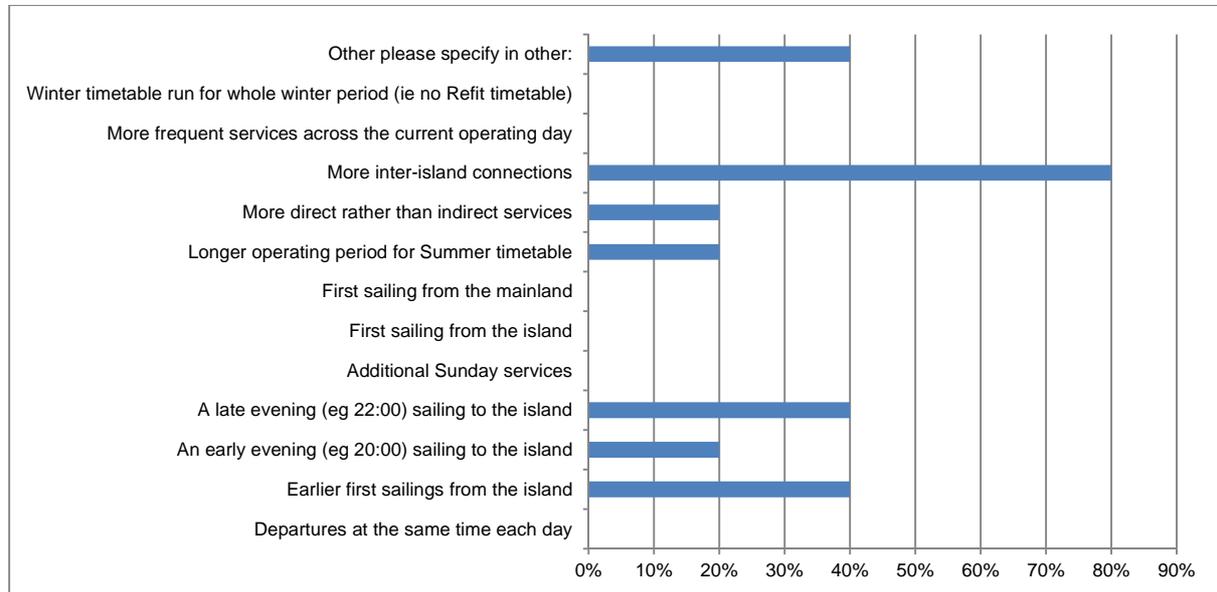


Figure 6.2: Graemsay – Prioritisation of Enhancements

Other comments included:

- Ability to visit Hoy – currently need to travel via Stromness with time / cost implications.
- As it takes the boat the same length of time to go to Hoy via the South side of Graemsay as it does via the North, it would be ideal if the boat called at Graemsay both ways – perhaps introduce a flag system or similar so they only call in if there is somebody wanting to travel.
- Later services in the evening, but don't think they need to be every evening, and I would be happy if this was an "on request" service.
- 17:45 sailing changed to 18:00 in order for commuting back from work.
- 1745 sailing moved to 1800.
- No need for change.

6.6.4 'More inter-island connections' was the most commonly cited service improvement from Graemsay. This concerns connections between Graemsay and Hoy with a number of residents highlighting the poor connectivity between the islands despite their proximity. The wish was to be able to spend more time in Hoy. Later evening and earlier morning sailings were also requested.

Table 6.8: Graemsay – Other Comments

Graemsay – Comments	Number of times Cited
Timings for commuting	5
Onwards travel	3
Time on mainland	2
Later ferry	2

6.7 Rationale for Selection / Rejection

6.7.1 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 6.9: Outcome of Appraisal, Moaness – Graemsay - Stromness

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Ration for Selection / Rejection
Option CO1: Replace MV <i>Graemsay</i> with a like-for-like Lo-Lo vessel	✗	The current weight limitations on the MV <i>Graemsay</i> impose relatively significant constraints on Graemsay and, to a lesser extent, North Hoy.
Option CO2: Replace MV <i>Graemsay</i> with a larger Lo-Lo vessel	✓	This option would alleviate the weight constraints associated with the current vessel whilst offering an increase in overall capacity.
Option CO3: Replace MV <i>Graemsay</i> with a larger Ro-Ro vessel	✓	This option could be genuinely transformational for Graemsay and also North Hoy, providing relatively easy vehicular access to both islands.
Option CO4: Lengthen Moaness Pier	✓	This option should be taken forward for further consideration as it would support improvements in reliability, a key evidenced problem with the existing service.
Option RO1: Maximise operating intensity of current crew	✓	This is a low cost option which could marginally increase the number of connections over the length of the current operating day.
Option RO2: Provide 20% additional crew	✓	This would be a relatively low cost means of expanding the operating envelope of the current service.
Option RO3: Adopt dayshift / backshift (Shetland model) single vessel shift system	✗	Whilst this would transform access to Graemsay and Moaness, the crewing resource required to operate this level of service would seem disproportionate to the population served and the catchment, particularly if there are improvements between Houton and Lyness. The majority of issues affecting this route could be addressed with Option RO2.

7 Rousay, Egilsay and Wyre

7.1 Capital Investment Timeframe

- The Rousay / Egilsay / Wyre vessel, the MV *Eynhallow*, is 29 years old and in need of replacement in the short-term. Whilst she has served the community well over many years, she has a relatively limited capacity and is particularly constrained in terms of her deadweight (56 tonnes).
- The Rousay / Egilsay / Wyre ferry operates off of a system of 1 in 8 hard ramps, which were refurbished in 2010 and 2011. It is assumed that further refurbishment / upgrades would be included as part of any new vessel solution.
- The MV *Eynhallow* overnights in Rousay and operates with a single island-based crew working on a two-week on, two-week off rota. The current crew are operating near to their maximum legally permitted hours.

7.1.1 The ASTs, harbour drawings and environmental constraints maps for the Tingwall – Rousay / Egilsay / Wyre route can be found in Appendix D.

7.2 Identified Problems

7.2.1 The following transport problems in relation to the Rousay / Egilsay / Wyre route were identified in the Pre-Appraisal Report and verified through subsequent community feedback. Where the community has identified a problem which we had not, their contribution is noted in red text.

Table 7.1: Rousay - Egilsay - Wyre Transport Problems

	Service Characteristics	Rating	Rousay / Egilsay / Wyre: Why is this a problem or not?
1	Overall Journey Time to Kirkwall / Stromness	✓	<p>The overall crossing time between Rousay / Egilsay / Wyre and the mainland is relatively short. However, there are a large number of different combinations of indirect connections on this route, which can give rise to extended journey times to Tingwall, particularly for Egilsay and Wyre. For example, some journeys from Egilsay to Tingwall can take up to 70 minutes. The longer 'round-trip' journeys also tie up a significant amount of operating time for a very small number of boardings.</p> <p>There is a connecting bus service from Tingwall to Kirkwall offering a relatively quick journey time overall.</p> <p><i>The community consultation response highlighted the extended journey times for those travelling to the mainland via another island, a particular issue for Egilsay and Wyre.</i></p>
2	First sailing / flight	✗	<p>The first sailings to the mainland depart Egilsay 07:10, Wyre 07:30 and Rousay 07:45. This timetable supports commuting and travel to KGS & Stromness Academy, with a pre-09:00 arrival into both Kirkwall and Stromness.</p> <p><i>The community consultation response noted that there are a number of island residents employed in shift work jobs, and thus the standard ferry timetable does not work well for them. This is seen to be inhibiting employment opportunities in all three islands in the parish. The current timetable therefore suits 9-5 workers only, not shift workers. In addition pupils currently miss the start of the school day.</i></p>
3	Last sailing / flight	✗✗	<p>The last departure from the mainland is 18:05. Combined with the early first sailing, this permits a full working day on Orkney mainland. However, the time of the last departure does not allow Rousay / Egilsay / Wyre residents to undertake evening social activities on Orkney mainland or connect with the last flights / ferries from the Scottish mainland (see below).</p> <p><i>As with the first sailing, the community consultation response noted that the timing of the last sailing does not suit those on shift work, whilst the departure of the last connecting bus from Kirkwall at 17:10 is seen a problem. It was explained that a number of islanders keep a car at</i></p>

	Service Characteristics	Rating	Rousay / Egilsay / Wyre: Why is this a problem or not?																																																																																																												
			<i>Tingwall, as well as an on-island car to get around both this issue and the cost of taking a vehicle on the ferry.</i>																																																																																																												
4	Time on mainland	✘	<p>Rousay / Egilsay / Wyre residents have amongst the longest amount of time on Orkney mainland. The hours ashore by timetable are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Rousay-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>8</td> <td>67</td> </tr> <tr> <td>Ferry - Winter</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>0</td> <td>60</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="9">Egilsay-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>6</td> <td>65</td> </tr> <tr> <td>Ferry - Winter</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>0</td> <td>60</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="9">Wyre-Time on Mainland</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>6</td> <td>65</td> </tr> <tr> <td>Ferry - Winter</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>0</td> <td>60</td> </tr> </tbody> </table> <p>Note the absence of Sunday sailings in the winter.</p>	Rousay-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	10	10	10	10	10	10	8	67	Ferry - Winter	10	10	10	10	10	10	0	60	Egilsay-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	10	10	10	10	10	10	6	65	Ferry - Winter	10	10	10	10	10	10	0	60	Wyre-Time on Mainland										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	10	10	10	10	10	10	6	65	Ferry - Winter	10	10	10	10	10	10	0	60
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5	Time in Kirkwall / Stromness	✘	See point 4. It should be noted that time in Kirkwall and Stromness is reduced by the need for bus transfer from Tingwall.																																																																																																												
6	Time on island	✔	<p>Time on the islands is also amongst the highest in the archipelago. The frequent service also permits flexibility in the duration of on-island visits, minimising dead time for businesses or those on employers' business.</p> <p>The hours on island by timetable are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Rousay-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>8</td> <td>6</td> <td>59</td> </tr> <tr> <td>Ferry - Winter</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>9</td> <td>8</td> <td>0</td> <td>52</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="9">Egilsay-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>4</td> <td>3</td> <td>45</td> </tr> <tr> <td>Ferry - Winter</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>4</td> <td>0</td> <td>42</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="9">Wyre-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>3</td> <td>53</td> </tr> <tr> <td>Ferry - Winter</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>0</td> <td>49</td> </tr> </tbody> </table> <p>Note the absence of Sunday sailings in the winter.</p>	Rousay-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	9	9	9	9	9	8	6	59	Ferry - Winter	9	9	9	9	9	8	0	52	Egilsay-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	8	8	8	8	8	4	3	45	Ferry - Winter	8	8	8	8	8	4	0	42	Wyre-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	8	8	8	8	8	8	3	53	Ferry - Winter	8	8	8	8	8	8	0	49
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7	Frequency / Sailings per day /	✔	With up to six connections to Tingwall on a typical day (summer & winter) from Rousay, the island has a relatively high service frequency. Egilsay and Wyre have a lower service																																																																																																												

	Service Characteristics	Rating	Rousay / Egilsay / Wyre: Why is this a problem or not?
	Timetable gaps		frequency and more indirect connections. It should be noted that all three islands have a level of service below the RSM standard. The lack of a winter Sunday sailing is a key issue.
8	Capacity	✘	<p>The sample carryings data provided suggests that there are occasional sailings where vehicle deck capacity issues emerge, particularly at the start at the end of the day. However, capacity constrained sailings appear to be relatively infrequent. It should also be noted that the MV <i>Eynhallow</i> is very constrained in terms of deadweight (56 tonnes), which means a sailing can be capacity constrained even if there is space available on the car deck.</p> <p><i>In addition to existing capacity issues, it was noted in the community consultation response that there are significant development plans in place for the Egilsay Reserve, which could increase the demand for vehicle and passenger use of the ferry.</i></p>
9	Reliability (weather / mechanical)	✓	<p>There are no major reliability problems on this route. The only minor issues that have emerged during the baselining is that when the MV <i>Shapinsay</i> is relieving on the Rousay / Egilsay / Wyre route, she can be slightly short on power when travelling against the tide to Egilsay. This can lead to slightly extended journey times.</p> <p><i>The community consultation response noted that the 'bookable' crossings to Egilsay & Wyre can create severe problems on occasion if the booked boat is missed due to a late plane or another unavoidable delay. More generally, island residents raised concerns about the lack of flexibility in deployment and operations. The community consultation response also noted that, when the MV Eynhallow is being relieved by the MV Shapinsay, the latter vessel can have problems getting into Egilsay & Wyre in certain conditions, with a number of landings aborted or cancelled during the refit period. It is also noted that the MV Eynhallow can have issues accessing Egilsay pier at low tide and in south-easterly winds.</i></p>
10	Comfort	✓	The levels of comfort on the vessel are seen to be appropriate for the length of crossing.
11	Physical access	✘	<p>Disabled access to the passenger lounge on the ferry is not step free.</p> <p><i>The community consultation response noted that disabled access on the MV Shapinsay is poor, which presents a challenge during refit period. The need to reverse onto the vessel is also a negative for some.</i></p>
12	Integration with PT (local bus)	✓	The connecting bus services at Tingwall are timed to meet the ferry in both directions. The bus will wait for up to 15 minutes for the late arrival of any ferry.
13	Integration with PT (strategic)	✘✘	<p>Rousay / Egilsay / Wyre residents cannot catch the first flights to Aberdeen, Edinburgh or Inverness, although they can catch the first Glasgow and Sumburgh flights. Residents also cannot catch the first NorthLink or Pentland Ferries departures, although they can catch the 11:50 Pentland Ferries departure and 11:00 NorthLink departure from Stromness, which operates during peak timetable.</p> <p>Evening integration is poorer – the last ferries of the evening from the Scottish mainland coupled with the flights from Aberdeen, Edinburgh and Inverness arrive after the last departure of the ferry to Rousay / Egilsay / Wyre. Trips to the Scottish mainland therefore require at least one off-island overnight stay.</p> <p><i>The community consultation response highlighted the absence of the 'middle sailing' on Stromness – Scrabster for much of the year and the problems associated with onward transport integration. The response also highlighted the critical importance of connections to Aberdeen, as this is key for access to health care. The inability to make a day-trip to Aberdeen is cited as a key problem, as it gives rise to significant costs for islanders. Connection with the NorthLink ferry service to Aberdeen is particularly important for those who have a medical condition which means that they are unable to fly – the long wait on Orkney mainland between the last arrival of the R/E/W ferry in to Tingwall and the arrival of the NorthLink vessel into Hatston is seen to be less than ideal.</i></p>
14	Crossing / flight time	✓	The crossing time between Rousay / Egilsay / Wyre and the mainland is relatively short, although indirect crossings can add to the journey time.
15	Onboard facilities	✓	The onboard facilities are considered to be appropriate for the length of the crossing.
16	Weekday / weekend service variation	✘✘✘	The weekday and Saturday timetables are broadly similar, although Egilsay loses one connection on a Saturday afternoon. The summer Sunday timetable also provides reasonable connectivity. However, the lack of a winter Sunday sailing (due to crewing hours) acts as a significant constraint on the islands, curtailing the ability to undertake day trips to the mainland for personal business. Moreover, if an island resident plans on travelling to the Scottish mainland on a Sunday, they will have to stay on Orkney mainland on the Saturday evening, at significant cost to themselves. If they are travelling on the Monday morning ferry from Stromness, residents have to stay on the mainland for two nights at significant cost to

	Service Characteristics	Rating	Rousay / Egilsay / Wyre: Why is this a problem or not?
			themselves. The same also applies for those returning to Orkney on the last Scrabster – Stromness sailing on a Saturday evening.
17	Landside infrastructure issues	✓	The service to Rousay / Egilsay / Wyre is operated using a hard ramp vessel which is not particularly intensive in terms of infrastructure.
18	Landside human resources	✓	The service to Rousay / Egilsay / Wyre is operated using a hard ramp vessel which is not particularly intensive in terms of landside human resources. It is also worth noting that the duty crew on the MV <i>Eynhallow</i> are on call out during the night for emergencies.

7.3 Appraisal of Capital Options

Capital Options

7.3.1 The following capital options were identified for the Tingwall – Rousay / Egilsay / Wyre route:

Option CO1 (Do Minimum): Replace the MV *Eynhallow* on a like-for-like basis

- The MV *Eynhallow* would be replaced by a Type 1a vessel, which would cost in the region of **£4m**.
- The necessary harbour improvements to accommodate a Type 1a vessel are set out below:
 - Tingwall: The width of the existing hard ramp should be increased to 14 metres to facilitate berthing. This would cost approximately **£400k**.⁵¹
 - Rousay: No harbour work required.⁵²
 - Egilsay: No harbour work required, although provision of a dedicated parking and waiting area would be beneficial. This would cost around **£100k**.⁵³
 - Wyre: No harbour work required, although provision of a dedicated parking and waiting area would be beneficial. This would cost around **£100k**.⁵⁴
- The total cost of this option in would therefore be **£4.6m**.

Option CO2: Replace the MV *Eynhallow* with one larger vessel

- The MV *Eynhallow* would be replaced by a Type 1b vessel, which would cost in the region of **£5m**.
- The necessary harbour work would be:
 - Tingwall: The width of the existing hard ramp should be increased to 14 metres to facilitate berthing and a jetty extension could be considered to provide additional shelter during final vessel approach. This would cost around **£2.0m**.⁵⁵

⁵¹ See Appendix D – Tingwall Drawing, Box 2, Like-for-Like Option

⁵² See Appendix D – Rousay Drawing, Box 2, Like-for-Like Option

⁵³ See Appendix D – Egilsay Drawing, Box 2, Like-for-Like Option

⁵⁴ See Appendix D – Wyre Drawing, Box 2, Like-for-Like Option

⁵⁵ See Appendix D – Tingwall Drawing, Box 3, Larger Vessel Option

- Rousay: It is recommended to increase hard ramp width to facilitate vessel operations. Existing quay could be extended to provide shelter for south westerly waves. This would cost around **£2.4m**.⁵⁶
- Egilsay: Demolition of jetty head to allow vessel access. Further assessment needed to establish necessary strengthening works. Recommended to provide a dedicated parking/waiting area. This would cost around **£1.9m**.⁵⁷
- Wyre: Extension of hard ramp (increase width) to facilitate vessel operations. If required, partial demolition of existing jetty head to facilitate vessel access could be undertaken (note however that the cross jetty at the end of the pier may still be required for a longer vessel to provide some shelter on the ramp). Recommended to provide a dedicated parking/waiting area. This would cost around **£2.0m**.⁵⁸
- At Wyre and Egilsay, scaling up to a larger vessel would potentially require the demolition of the jetty head. This would need to be considered in detail as these structures may be key structural components, and without these, significant remedial work would be required.
- The total cost of this option in 2016 prices would therefore be **£13.3m**.

Option CO3: Replace the MV *Eynhallow* with two like-for-like vessels

- The MV *Eynhallow* would be replaced by two Type 1a vessels, which would cost in the region of **£8m**.
- The harbour works would be as per Option CO1.
- For costing purposes, it is assumed that the two vessels would work on the 'Shetland model of a 'day boat' and 'shift boat'. The day boat would operate a shuttle service between Rousay and Tingwall, operating from around 0630-1830. The shift boat would operate the current timetable, which would be extended to around 2300. Additional bus services would be required at Tingwall.
- The required harbour works would be as per Option CO1. An additional overnight berth would be required. The day boat would need to use the secondary overnight berth as the shift boat would still be operating into Rousay.
- The total cost of this option would be around **£8.6m** plus any additional costs associated with a second overnight berth. Kirkwall could be an alternative for overnighting and this could create a Kirkwall-Rousay link at the start and end of the day.

Option CO4: Supplement a single vessel solution with a passenger only vessel

- This option would supplement Option CO1 or Option CO2. There are various potential service permutations but, for the purpose of this analysis, we have assumed that the Ro-Ro vessel would operate via Egilsay and Wyre on the first and last sailings of the day and directly between Rousay and Tingwall for the rest of the day. The passenger only vessel would connect Egilsay and Wyre to Rousay and / or Tingwall.
- We have also assumed that the passenger only vessel would operate through to 2300, providing additional connections to Tingwall or Kirkwall. If these connections were to Tingwall, additional bus services would be required, which would infer an additional cost to the Council as this is a contracted service.
- The passenger only vessel would be a small medium-speed passenger only catamaran similar to the MV *Flotta Lass*. This vessel would cost in the region of £1m and may require minimal harbour works including berthing pontoons and a gangway / steps. An

⁵⁶ See Appendix D – Rousay Drawing, Box 3, Larger Vessel Option.

⁵⁷ See Appendix D – Egilsay Drawing, Box 3, Larger Vessel Option.

⁵⁸ See Appendix D – Wyre Drawing, Box 3, Larger Vessel Option.

alternative could be a passenger coded workboat such as that operated by Groat's Charters from Shapinsay.

- The total cost of this option would be around **£1m**.

Option CO5: Provide a Fixed Link between Rousay and Egilsay

- This option would involve the construction of a fixed link between Rousay and Egilsay. There has been very little work done on this concept to date and there is not currently a preferred option. Options include a causeway or short span bridge with a tidal fence. The likely alignment would be across the Sound of Longataing to Holm of Sockness and then across Howie Sound to Egilsay.
- This option would remove the need for a ferry connection to Egilsay. It is therefore likely that it would be difficult to justify anything other than a one vessel solution for the remaining Tingwall – Rousay / Wyre portion of the route.
- No detailed research (including terrestrial and marine survey and ground investigation work) on the proposed fixed link has been undertaken and thus the cost estimates available are indicative rather than robust. Donaldson Associates estimate that the causeway would cost £42.1m (£69.8m when adjusted for optimism bias) in 2015 prices. The short span bridge with tidal fence is estimated at £18.2m (£30.2m when adjusted for optimism bias) in 2015 prices.
- The costs of the fixed link would be in addition to those of the one vessel options (Options CO1 or CO2).

Appraisal of Capital Options

7.3.2 The following sections contain the appraisal of each capital option against the study objectives and the STAG criteria.

Appraisal against Objectives

Table 7.2: Tingwall – Rousay / Egilsay / Wyre Capital Options – Appraisal against Objectives

	Option CO1 - (Do Min) – Replace MV Eynhallow on a like-for-like basis	Option CO2 – Replace MV Eynhallow with one larger vessel	Option CO3 – Replace MV Eynhallow with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a fixed link between Rousay and Egilsay
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓✓	✓✓✓	✓✓	✓✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	✓	✓✓✓	✓	✓✓
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	N/A	N/A	N/A	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by</i>	-	-	✓✓✓	✓✓	✓✓

	Option CO1 - (Do Min) – Replace MV <i>Eynhallow</i> on a like-for-like basis	Option CO2 – Replace MV <i>Eynhallow</i> with one larger vessel	Option CO3 – Replace MV <i>Eynhallow</i> with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a fixed link between Rousay and Egilsay
<i>maximising the number of island connections across the operating day.</i>					
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	-	✓✓✓	✓	✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	-	✓✓✓	✓✓	-

7.3.3 The key points from the above table are:

- The evidence collected as part of the baselining analysis suggests that there are vehicle and deadweight capacity issues on the Tingwall – Rousay / Egilsay / Wyre service. Overall, the provision of two like-for-like vessels (**Option CO3**) would provide the joint largest capacity benefits, with an effective doubling of the vehicle and passenger capacity and a two vessel solution allowing for the operation of additional sailings during the AM and PM peaks. One larger vessel, on the scale of a Type 1b, (**Option CO2**) would contribute substantially to the capacity issue given the 10 PCU / 56 tonne limitation on the MV *Eynhallow*. It would also offer the same PCU capacity as two Type 1a vessels.
- A like-for-like replacement (**Option CO1**) would increase the deadweight threshold but would otherwise do little in terms of capacity. A passenger only ferry (**Option CO4**) would supplement the benefits offered by Option CO1 or Option CO2 at peak times by increasing the passenger capacity. It would also allow the Ro-Ro vessel to be concentrated on the main Rousay – Tingwall route during the day, although there would be a disbenefit for Egilsay and Wyre from only having a passenger vessel during the day. Finally, a fixed link (**Option CO5**) would remove Egilsay from the current route and allow the time for that call to be reallocated to the main Rousay – Tingwall route.
- In terms of commuting, Rousay, Egilsay and Wyre already have a commutable service to the mainland, although this is restricted to '9-5' workers and the time of the first sailing means that pupils are late for school. However, the ability to commute can be negatively impacted by capacity constraints on the ferry, particularly during peak times. The provision of two like-for-like vessels (**Option CO3**) would contribute most to addressing this impediment, enabling the provision of additional AM and PM peak sailings, whilst also significantly extending the operating day. Replacing the MV *Eynhallow* with one larger vessel (**Option CO2**) would also support commuting through removing peak capacity constraints. A passenger only ferry (**Option CO4**) would supplement the benefits offered by Option CO2 by offering enhanced connectivity in the AM and PM peak periods and a longer operating day, albeit the later connections would be passenger only.
- In terms of frequency (TPO3), **Option CO3** (two like-for-like vessels) would result in significant frequency enhancements with an additional 8-9 sailings to Rousay and an extended operating day for all three islands. This option would also support TPO4 by removing the variation between the weekday and weekend timetable for both islands. **Option CO4** (a passenger only vessel) when combined with CO1 or CO2, would enhance the frequency of services over the length of the operating day, providing more Rousay – Tingwall Ro-Ro connections and additional connections for Egilsay and Wyre (albeit fewer Ro-Ro connections). The passenger only vessel could also allow for a longer operating day and evening connections to / from Kirkwall. The provision of a fixed link (**Option CO5**) would remove the need to provide the lengthy ferry connection to

Egilsay and therefore enable an enhanced frequency of service between Rousay / Wyre – Tingwall. The removal of the Egilsay leg would also allow for an earlier first arrival in Tingwall and later last departure, which would extend the operating day.

- The two vessel solutions (**Option CO3 and CO4**) would enhance access to strategic connections by extending the operating day at both ends. Option CO4 would however only provide evening connections for passengers.

Appraisal against STAG Criteria

Table 7.3: Tingwall–Rousay/Egilsay/Wyre Capital Options – Appraisal against STAG Criteria

	Option CO1 - (Do Min) – Replace MV Eynhallow on a like-for-like basis	Option CO2 – Replace MV Eynhallow with one larger vessel	Option CO3 – Replace MV Eynhallow with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a fixed link between Rousay and Egilsay
Environment	✓	✓	✗	✗	✗✗
Safety	✓	✓	✗	✗	✗
Economy	✓	✓	✓✓✓	✓✓	✓
Integration	-	-	✓✓✓	✓	✓
Accessibility & Social Inclusion	✓	✓	✓✓✓	✓✓	✓✓
Established Policy Directives	✓	✓	✓✓✓	✓	✓
Technical Feasibility	<i>This option is technically feasible.</i>	<i>This option is technically feasible, although a vessel of this size could find it challenging to access Egilsay and Wyre.</i>	<i>This option is technically feasible. A second overnight berth for the day boat would be required.</i>	<i>This option is technically feasible.</i>	<i>There would be a need for terrestrial & marine ground investigation and significant further research / costing.</i>
Operational Feasibility	<i>Crew induction training would be required.</i>	<i>Crew induction training would be required.</i>	<i>Requirement for additional crew & crew induction training. Second overnight berth required.</i>	<i>Requirement for additional crew & crew induction training. Second overnight berth required. If evening services were to/from Tingwall, additional bus connections would be required.</i>	<i>The remaining vessel would serve Rousay and Wyre only.</i>
Affordability	£4.6m	£13.3m	<i>£8.6m – plus any costs associated with overnight berthing of the second vessel</i>	<i>Incremental cost of around £1m plus any minor ancillary harbour works</i>	<i>The causeway option is estimated to cost £42.1m (£69.8m including Optimism Bias) The short span bridge / tidal fence is estimated to cost £18.2m (£30.2m including optimism bias)</i>
Public Acceptability	<i>This option is not</i>	<i>Acceptable and</i>	<i>Would be highly</i>	<i>No specific</i>	<i>This option was</i>

	Option CO1 - (Do Min) – Replace MV <i>Eynhallow</i> on a like-for-like basis	Option CO2 – Replace MV <i>Eynhallow</i> with one larger vessel	Option CO3 – Replace MV <i>Eynhallow</i> with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Provide a fixed link between Rousay and Egilsay
	<i>likely to be acceptable as many view the current vessel as too small.</i>	<i>desirable</i>	<i>acceptable</i>	<i>comments on this proposal were received but there was interest in a passenger vessel providing a link to Kirkwall.</i>	<i>presented at the exhibition as being ruled out in the appraisal and this appeared to be accepted. Those was some interest in a fixed link option between Rousay and Orkney mainland.</i>

7.3.4 The key points from above appraisal against the STAG criteria are:

- From an environmental perspective, the replacement of the MV *Eynhallow* with a like-for-like vessel or one larger vessel (**Options CO1 and CO2**) would likely have a minor positive environmental benefit through the adoption of more modern and fuel efficient technology (particularly if alternative fuel types were adopted). Moving to a two vessel solution (**Options CO3 and CO4**) would have a very minor negative environmental impact. This is particularly true of the two Ro-Ro option, which would generate additional sailing hours and potentially additional vehicle kilometres through unlocking capacity constraints and enhancing frequency. The Egilsay – Rousay fixed link (**Option CO5**) would have a moderate disbenefit in terms of the environmental implications of construction work, although assuming the work was carried out sensitively, the impacts could be largely mitigated. More detailed design would be required to fully scope the likely environmental impact.
- All of the vessel related options (**Options CO1-CO4**) would represent a very minor enhancement to safety as they would replace the ageing MV *Eynhallow* and remove the need for reversing onto and off of the vessel. The two Ro-Ro solution (**Option CO3**) would however give rise to a very minor negative in terms of safety as it would likely generate additional vehicle kilometres through increasing frequency and addressing current capacity constraints. In addition, both two vessel options (**Options CO3 & CO4**) would significantly increase total vessel running hours, marginally increasing the statistical probability of a marine accident. Similarly, the provision of a fixed link (**Option CO5**) would lead to a very small increase in car trips, which would lead to a statistically marginally higher accident rate. However, this risk is deemed to be very minor overall.
- A like-for-like replacement (**Option CO1**) would offer a minor economy benefit through the provision of a more modern and fit-for-purpose vessel. This benefit would be further enhanced by the provision of a larger vessel (**Option CO2**) as a result of the enhanced capacity provided. The provision of two like-for-like vessels (**Option CO3**) would represent a major positive in terms of the economy criterion. There would be TEE benefits associated with the higher frequency and the addressing of capacity constraints, whilst there would also be wider EALI benefits for residents, tourists and locally traded services. The extension of the operating day and significant frequency enhancements would also make the three islands (particularly Rousay) commutable for a wider range of jobs (i.e. those with working hours outside 9-5) and would also enhance strategic connectivity.
- Supplementing the single vessel solutions with a passenger vessel (**Option CO4**) would lead to moderate TEE benefits and moderate wider / EALI benefits through enhancing the overall frequency, particularly for Ro-Ro connections between Rousay and Tingwall (note also there may be economic disbenefits for Egilsay and Wyre, where the additional

frequency may be offset by the reduction in Ro-Ro connections), and the length of the operating day. The benefits would be similar to a two Ro-Ro solution, although of a lesser scale. Finally, a fixed link (**Option CO5**) would offer significant benefits to Egilsay residents by providing twenty-four hour connections to facilities on Rousay and access to any enhanced ferry services through Rousay.

- In terms of transport integration, a two vessel solution (**Option CO3**) would have a significant positive impact resulting in improved links to strategic transport connections and supporting the islands' Development Plan. As a result of the requirement for Egilsay and Wyre residents to interchange at Rousay on indirect services, **Option CO4** would have a negative impact on transport integration. However, there may be benefits in terms of transport and land-use integration, with the enhanced frequency of service making the islands a more attractive place to live. The fixed link (**Option CO5**) would have significant transport and land-use integration benefits for Egilsay.
- All of the vessel options would lead to accessibility and social inclusion benefits as a result of physical accessibility improvements brought about by the replacement of the current vessel. The two vessel solutions (**Options CO3 and CO4**) would significantly enhance accessibility and social inclusion through increasing the number of connections across the day (particularly given the longer operating day), with **Option CO3** clearly offering the largest benefit given the increase in Ro-Ro connections and the longer operating day. The provision of a fixed link (**Option CO5**) would provide a transformative change in accessibility and social inclusion for Egilsay residents, allowing them to much more fully benefit from the economic and social opportunities offered by Rousay (and to a lesser extent Orkney mainland).
- All of the options would support wider policy, including the islands' development plan which sets out a vision of a larger and more demographically balanced population; a vibrant economy with a range of job opportunities and an enhanced tourism market. A two Ro-Ro solution (**Option CO3**) with a longer operating day would provide the most significant benefit and could assist in delivering the RSM defined service.
- The fixed link (**Option CO5**) is at a relatively early stage of development and would require further terrestrial and marine ground investigations. There would be a wide range of additional technical issues which would need to be considered with this option.
- From an operational feasibility point of view, the two vessel solutions (**Option CO3 and CO4**) would require both additional crew and a second overnight berth (although this would be less onerous in terms of a passenger vessel).
- From an affordability perspective, the lowest cost option would be a like-for-like replacement of the MV *Eynhallow* (**Option CO1**). However, this does not offer the scale of benefits provided by migrating to one larger vessel (**Option CO2**) or a two vessel solution (**Options CO3 and CO4**). The two Ro-Ro solution (**Option CO3**) would be relatively high cost given the capital & revenue costs of a second vessel and the proposed extended operating day. The fixed link (**Option CO5**) scores poorly in terms of affordability, particularly given the cost uncertainties surrounding it.

7.4 Appraisal of Revenue Options

7.4.1 The following revenue options were identified for the Tingwall – Rousay / Egilsay / Wyre:

- **Do Minimum**
 - Continue with the current level of revenue funding
- **Option RO1: Provide 20% additional crew**
 - This option can only be delivered with additional crew (i.e. recruitment).

- The additional time could either be used to provide an earlier first sailing or a later last sailing seven days a week or used to ensure a full Sunday service in the winter timetable.
- **Option RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system**
 - The Orkney crew currently work ‘two weeks on, two weeks off’ with three weeks leave. The working day is around 12 hours.
 - This option would involve migrating to the Shetland-style shift system, which involves one week of 12 hour dayshifts, one week of 6 hour backshifts and a week-off. This provides an average working week of 42 hours, with the backshift crew on standby through the night and leave cover built in.
 - This three crew⁵⁹operation (an increase of one crew on the current Orkney model) provides a 16 hour operating day, with scope to increase further where required (e.g. weekends).

Appraisal of Revenue Options

Appraisal against Objectives

7.4.2 The following sections contain the appraisal of each revenue option against the study objectives and the STAG criteria.

Table 7.4: Tingwall – Rousay / Egilsay / Wyre Revenue Options – Appraisal against Objectives

	Option RO1 – 20% Additional Crew	Option RO2 – dayshift / backshift single vessel shift system
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓✓
<i>TPO2a: Where an island has a ‘commutable’ combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	✓	✓✓✓
<i>TPO 2b: Where an island does not have a ‘commutable’ combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	✓	✓✓✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	✓✓	✓✓✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	✓	✓✓✓

7.4.3 The key points from the above table are:

- A 20% crewing increment (**Option RO1**) would make a minor contribution across the objectives, although it should be noted that the extent of the benefit to each objective

⁵⁹ The crews consist of 3 Masters, 3 Engineers, 4 Mates (3 can act up as Masters) and 4 Deckhands (two can act up to Mate and one to Engineer)

would depend on how the extra hours were deployed. The obvious improvement which could be made would be to ensure a consistent year round Sunday timetable. However, the extra hours could equally be deployed to provide an earlier first sailing and / or later last sailing. Any increase in the number of sailings will have a capacity benefit, particularly so if those improvements are concentrated at peak times.

- The adoption of the dayshift / backshift system (**Option RO2**) would make a substantial contribution to the objectives. Firstly, it would immediately address the issues of the weekday / weekend service differentiation, providing a consistent week-round timetable. In addition, the extended operating day would potentially allow for connections with morning flights and the evening inbound flights and ferries from the Scottish mainland. It would also extend the potential working day, allowing island residents to take jobs on the Orkney mainland that are not typical 9-5 posts. Capacity and frequency would of course also be enhanced.

Appraisal against STAG Criteria

Table 7.5: Tingwall-Rousay / Egilsay / Wyre Revenue Options – Appraisal against STAG Criteria

	Option RO1 – 20% Additional Crew	Option RO2 – dayshift / backshift single vessel shift system
Environment	-	x
Safety	-	x
Economy	✓	✓✓
Integration	✓	✓✓✓
Accessibility & Social Inclusion	✓	✓✓✓
Established Policy Directives	✓✓	✓✓✓
<i>Technical Feasibility</i>	<i>There are no technical feasibility issues associated with this option.</i>	<i>There are no technical feasibility issues associated with this option.</i>
<i>Operational Feasibility</i>	<i>As the vessel is island-based, recruiting the necessary crew could be challenging. In particular, additional senior crew would be required given their lower degree of interchangeability.</i>	<i>As the vessel is island-based, recruiting the necessary crew could be challenging. There would also likely be a need to amend contracts of employment which could present a challenge.</i>
Affordability	<i>Low – small crewing increment and fuel cost.</i>	<i>High – full additional crew (plus holiday cover) with a likely requirement for a shift allowance and / or unsociable hours pay. Significant increase in fuel costs.</i>
Public Acceptability	<i>Would be acceptable if this can provide the desired longer day and Sunday hours. For example the current operating day means that pupils are routinely late for school.</i>	<i>Acceptable and desirable as this arrangement would provide sufficient hours to address the timetabling problems which have been identified.</i>

7.4.4 The key points from above appraisal against the STAG criteria are:

- **Option RO1** (a 20% increment in crew) would provide minor economic and accessibility benefits. The scale of these benefits under this option would depend on what aspect of the service the extra crewing hours were used to enhance. If it were the winter Sunday service, this option would make a positive contribution towards policy integration by reducing the disparity with the RSM.

- The adoption of **Option RO2** would make a significant contribution to the STAG criteria. An extended operating day would make a positive contribution in terms of the Economy criterion. As well providing minor TEE benefits associated with increased frequency, there would be substantial wider / EALI benefits for Rousay in particular. Firstly, the longer operating day could encourage the in-migration of working age families to all three islands as it would make them genuinely commutable (with earlier first and later last sailings) whilst also removing the significant cost barrier associated with accessing the Scottish mainland. Option RO2 would also support a wide range of policies and would do much to address the RSM related service shortfall. There would be very minor disbenefits in terms of the Environment and Safety caused in both cases by additional sailings and vehicle kilometres.
- Whilst the adoption of the shift-based crewing model offers significant benefits, it would be relatively expensive in comparison to the 20% increment, whilst there could be operational issues surrounding crew recruitment and contracts.

7.5 Annual Operating Cost Estimates

- 7.5.1 The revenue costs and income associated with operating the Tingwall – Rousay / Egilsay / Wyre ferry service in 2015/16 were as follows:

Table 7.6: Tingwall – Rousay / Egilsay / Wyre Operating Costs 2015/16

Costs and Income	2015-16
Employee costs	£377,119
Fuel	£57,886
Survey & Repairs	£248,798
Harbour Dues & Stevedoring	£52,028
Other costs	£26,093
Total costs	£761,924
<i>Fares</i>	£130,821
<i>Freight</i>	£155,523
<i>Other</i>	£26,380
Total Income	£312,724
Net Operating Position	-£449,200

- 7.5.2 The total net revenue cost of any service option is a combination of the characteristics of the asset(s) used, the timetable operated and the fares income generated. The current Tingwall – Rousay / Egilsay / Wyre service costs around **£450k** per annum (net) to operate. The main vessel and revenue options are recapped below.

Table 7.7 Summary of Tingwall - Rousay - Egilsay - Wyre Options

Capital Options	Revenue Options
CO1 :1 * Type 1a vessel	Do Min: Current revenue funding

Capital Options	Revenue Options
CO2: 1 * Type 1b vessel	RO1: 20% additional crew
CO3: 2 * Type 1a vessels	RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system
CO4: Supplement Options CO1 or CO2 with a passenger only vessel.	

7.5.3 An estimate of the annual net revenue budget costs associated with the main permutations of vessels (Capital – ‘Ca’) and timetables (Revenue – ‘Rev’) outlined above is shown in the chart below. The figures shown are the estimated net annual revenue costs associated with each option.

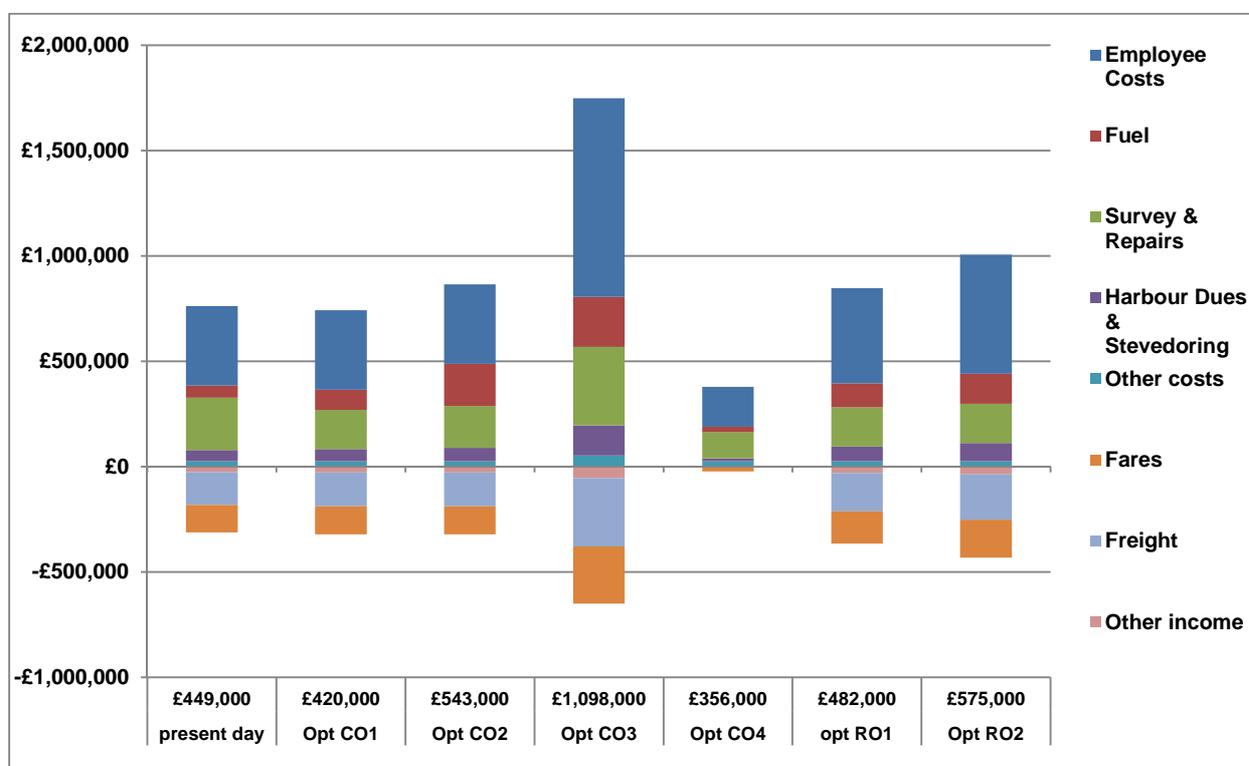


Figure 7.1 Tingwall - Rousay / Egilsay / Wyre Annual Operating Costs of Appraised Options

- Present Day: costs as per 2015/16 of **£449k**.
- Single vessel options, CO1 & CO2, costs rise incrementally to **£543k**, with the higher fuel costs assumed for a Type 1b vessel being a key factor.
- The 2-vessel option CO3 represents a major step up in employees and surveys & repairs meaning that costs rise to **£1,098k**. These costs would reduce if the vessels were run less intensively than assumed here.
- The revenue options rise to a cost of **£575k**.
- Note that the costs for RO1 and RO2 are based on Capital Option CO1 for illustrative purposes.

7.6 Public Consultation – Prioritisation

7.6.1 Chapter 1 described the Public Engagement undertaken in June 2016. A key part of this was the identification of priorities for enhancements to services in the event of additional resources being available. The public were provided with a list of potential enhancements and invited to tick the three that they would prioritise.

7.6.2 The number of completed questionnaires was:

- Rousay / Egilsay / Wyre: 23

7.6.3 The figures below show the percentage of respondents who ticked each option. Note that these columns do not sum to 100% as the question allowed three responses.

Rousay / Egilsay / Wyre

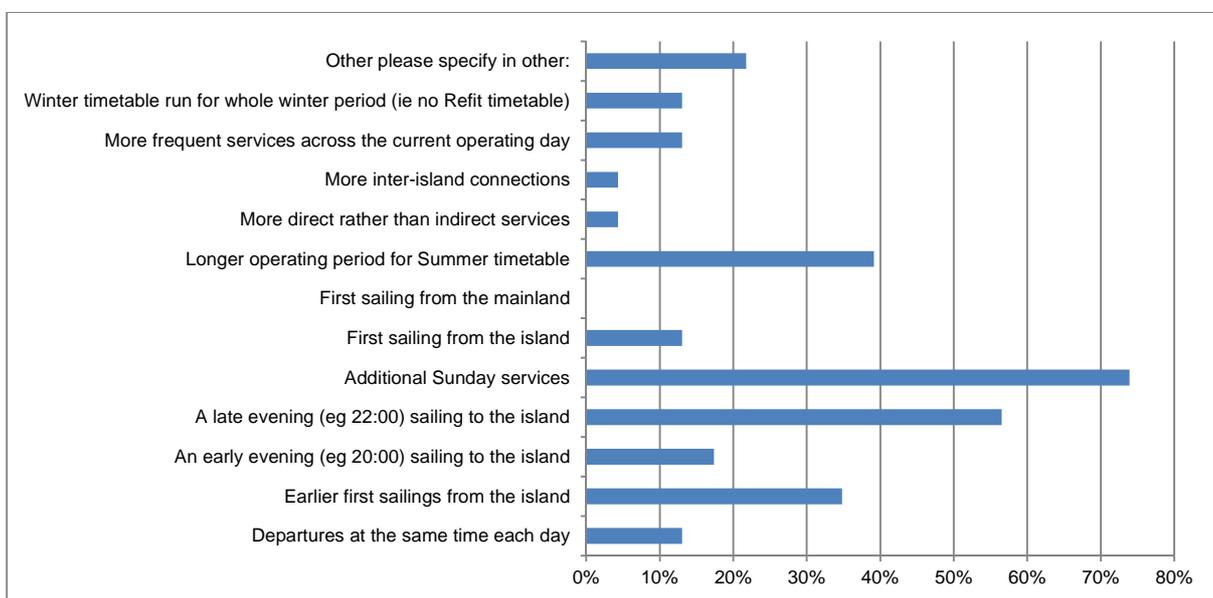


Figure 7.2: Rousay / Egilsay / Wyre – Prioritisation of Enhancements

Other comments included:

- Fixed link to the mainland.
- Additional passenger ferry - possibility of going to Kirkwall.
- Longer operating period (16 hour crew shift).
- 2 x Direct Kirkwall Runs per day. First and Last boat. Encourage working commuters to stay on the island and work in the town.

7.6.4 The top priority for Rousay residents was Sunday services, a reflection of the absence of Sunday connections in the winter timetable. A longer operating day incorporating earlier first sailings and later evening services were the other most frequently cited improvements. Amongst the 'Other' suggestions were direct links to Kirkwall at certain times of the day.

Table 7.8: Rousay / Egilsay / Wyre – Other Comments

Rousay – Comments	Number of times Cited
No Sunday sailing in winter	16
Evening/Early ferry for commuting and schools	15

Rousay – Comments	Number of times Cited
Cost	9
Ferry too small	8
Onward transport links	7
Fixed link a good idea	3
Multi ticket books too expensive	3
More crew	2

7.7 Rationale for Selection / Rejection

7.7.1 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 7.9: Outcome of Appraisal, Tingwall – Rousay / Egilsay / Wyre

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Ration for Selection / Rejection
Option CO1 (Do Minimum): Replace the MV <i>Eynhallow</i> on a like-for-like basis	✗	The capacity issues identified on the route would not be resolved with one vessel of similar carrying capacity. The vessel is fully utilised during the peak periods and there is therefore no possibility of providing additional or more regular services when most required.
Option CO2: Replace MV <i>Eynhallow</i> with one larger vessel	✓	One larger vessel would provide additional capacity and this option should be considered further. This option may not be able to deliver an RSM compliant solution however.
Option CO3: Replace MV <i>Eynhallow</i> with two like-for-like vessels	✓	Two like-for-like vessels would provide significant additional capacity and connectivity and this option should be considered further. An alternative would be 1 * TYPE 1a vessel and 1 * TYPE 1b vessel. This would depend on detailed analysis of demand and the harbour implications would also have to be considered (including overnight berthing arrangements).
Option CO4: Supplement Options CO2 with a passenger only vessel	✓	This option offers a potential extension of the operating day to / from Rousay / Egilsay / Wyre. Whilst it does not support vehicle-based access, the overall increase in connectivity offered means that this option should be considered further.
Option CO5: Provide a fixed link between Egilsay and Rousay	✗	The technical uncertainty and high costs associated with providing a connection of this nature to a very small community means that it should not be considered further. The scale of cost and works would be disproportionate to the identified problems. Should a nationally funded programme of fixed links emerge in future, the proposal could be revisited at this stage.
Option RO1: Provide 20% additional crew	✓	This would be a relatively low cost means of expanding the operating envelope of the current service. The scope for this option to move towards an RSM compliant solution needs further investigation.
Option RO2: Adopt dayshift / backshift (Shetland model) single vessel shift system	✓	Whilst this would be a high cost service enhancement, it would transform access to Rousay / Egilsay / Wyre, making the islands more attractive places to live, work and do business. This option would likely facilitate an RSM compliant solution.

8 Shapinsay

8.1 Capital Investment Timeframe

- The Shapinsay – Kirkwall route is currently served by the MV *Shapinsay*, a single ended Ro-Ro vessel which carries a Class IV certificate. The MV *Shapinsay* is 28 years old but she was lengthened by 6.8m, and re-engined, with new propellers rudders and control system in 2011. Based on a thirty-year lifespan, the vessel would be scheduled for replacement in 2018, but her recent life extension works suggest that she could operate through to 2021 and beyond with further modest investment.
- The Shapinsay ferry operates off of a system of 1 in 8 hard ramps, which were refurbished in 2010 and 2011. It is assumed that further refurbishment / upgrades would be included as part of any new vessel solution.
- The MV *Shapinsay* overnights on the island which she is named after and operates with a single island-based crew working on a two-week on, two-week off rota.

8.1.1 The ASTs, harbour drawings and environmental constraints maps for the Shapinsay route can be found in Appendix E.

8.2 Identified Problems

8.2.1 The following transport problems in relation to Shapinsay were identified in the Pre-Appraisal Report and verified through subsequent community feedback. Where the community has identified a problem which we had not, their contribution is noted in red text.

Table 8.1: Shapinsay Transport Problems

	Service Characteristics	Rating	Shapinsay: Why is this a problem or not?																																				
1	Overall Journey Time to Kirkwall	✓	The crossing time from Shapinsay is 25 minutes. The vessel berths in the heart of Kirkwall.																																				
2	First sailing / flight	✓	The first sailing departs Shapinsay at 0730 Monday – Friday. This departure allows Shapinsay residents to commute and work full time on the mainland.																																				
3	Last sailing / flight	✖✖	<p>The last departure from Kirkwall sails at 1730. Combined with the early first sailing, this permits a full working day on Orkney mainland. However, the time of the last departure does not allow Shapinsay residents to undertake evening social activities on Orkney mainland or connect with the last flights / ferries from the Scottish mainland (see below).</p> <p>It should also be noted that the community use the proceeds from their community wind turbine to charter additional passenger-only sailings from a private operator in the evening. Whilst our review is only concerned with Orkney Ferries' provision, it does highlight the community demand for these services.</p>																																				
4	Time on mainland	✖	<p>The hours ashore by timetable are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th></th> <th colspan="7">Shapinsay-Time on Mainland</th> <th></th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>69</td> </tr> <tr> <td>Ferry - Winter</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>8</td> <td>3</td> <td>59</td> </tr> </tbody> </table> <p>The vessel overnights in Shapinsay so time on the mainland is greater than time on the island. Connectivity to the mainland is provided 7 days a week.</p>		Shapinsay-Time on Mainland									Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	10	10	10	10	10	10	10	69	Ferry - Winter	10	10	10	10	10	8	3	59
	Shapinsay-Time on Mainland																																						
	Mo	Tu	We	Th	Fr	Sa	Su	Total																															
Ferry - Summer	10	10	10	10	10	10	10	69																															
Ferry - Winter	10	10	10	10	10	8	3	59																															
5	Time in Kirkwall	✖	See point 4																																				

	Service Characteristics	Rating	Shapinsay: Why is this a problem or not?																																				
6	Time on island	✓	<p>The hours on island by timetable are summarised in the table below and are rounded up or down to the nearest whole hour:</p> <table border="1"> <thead> <tr> <th colspan="9">Shapinsay-Time on Island</th> </tr> <tr> <th></th> <th>Mo</th> <th>Tu</th> <th>We</th> <th>Th</th> <th>Fr</th> <th>Sa</th> <th>Su</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Ferry - Summer</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>9</td> <td>9</td> <td>58</td> </tr> <tr> <td>Ferry - Winter</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>7</td> <td>2</td> <td>49</td> </tr> </tbody> </table> <p>Connectivity to Shapinsay is provided 7 days a week.</p>	Shapinsay-Time on Island										Mo	Tu	We	Th	Fr	Sa	Su	Total	Ferry - Summer	8	8	8	8	8	9	9	58	Ferry - Winter	8	8	8	8	8	7	2	49
Shapinsay-Time on Island																																							
	Mo	Tu	We	Th	Fr	Sa	Su	Total																															
Ferry - Summer	8	8	8	8	8	9	9	58																															
Ferry - Winter	8	8	8	8	8	7	2	49																															
7	Frequency / Sailings per day / Timetable gaps	✓	With six direct return crossings Monday – Friday (summer and winter), Shapinsay has a relatively high service frequency.																																				
8	Capacity	✓	Orkney Ferries has noted that passenger capacity can be an issue on peak summer sailings, but this is believed to be a relatively minor problem overall.																																				
9	Reliability (weather / mechanical)	✓	There are no major reliability problems on this route.																																				
10	Comfort	✓	The levels of comfort on the vessel are seen to be appropriate for the length of crossing.																																				
11	Physical access	✗	<p>Disabled access to the passenger lounge on the ferry is not step free. Overall amenity for disabled passengers is poor, with the disabled seating next to the toilets on the car deck.</p> <p><i>The community consultation response also noted that an increasing number of foot passengers are travelling on the ferry with dogs, which involves them standing on the car deck (which is clearly less than ideal).</i></p>																																				
12	Integration with PT (local bus)	✓	The ferry travels into the heart of Kirkwall.																																				
13	Integration with PT (strategic)	✗✗	<p>Shapinsay residents cannot catch the first flights to Aberdeen and Edinburgh, although they could possibly make the first Inverness flight and can catch the first Glasgow and Sumburgh flights. Residents also cannot catch the first NorthLink or Pentland Ferries departures, although they can catch the 11:50 Pentland Ferries departure. The 11:00 NorthLink service from Stromness, which operates during peak timetable, can also be accessed.</p> <p>Evening integration is poorer – the last ferries of the evening from the Scottish mainland coupled with the flights from Aberdeen, Edinburgh and Inverness all arrive after the last departure of the ferry to Shapinsay.</p> <p>Trips to the Scottish mainland therefore require at least one off-island overnight stay.</p>																																				
14	Crossing / flight time	✓	See point 1 above																																				
15	Onboard facilities	✓	The onboard facilities are considered to be appropriate for the length of the crossing.																																				
16	Weekday / weekend service variation	✗	<p>The Saturday service is broadly similar to the weekday service, with only one return sailing less (the 0730 departure from Shapinsay) in the winter timetable and the same number of sailings in the summer timetable.</p> <p>There is only one less sailing on a Sunday compared to a weekday in the summer. However, limitations on crewing hours mean that winter Sunday rotations reduce to two, although this still allows a brief return trip to Orkney mainland (around 3 to 3.5 hours).</p>																																				
17	Landside infrastructure issues	✓	The service to Shapinsay is operated using a hard ramp vessel which is not particularly intensive in terms of infrastructure.																																				
18	Landside human resources	✓	The service to Shapinsay is operated using a hard ramp vessel which is not particularly intensive in terms of landside human resources.																																				

8.3 Appraisal of Capital Options

Capital Options

8.3.1 The following capital options were identified for Shapinsay::

Option CO1 (Do Minimum): Replace MV *Shapinsay* on a like-for-like basis

- The MV *Shapinsay* would be replaced by a Type 1a vessel, which would cost in the region of £4.0m.
- There would be no significant harbour works at either Shapinsay or Kirkwall.⁶⁰
- The total cost of this option would therefore be **£4.0m**.

Option CO2: Replace MV *Shapinsay* with one larger vessel

- The MV *Shapinsay* would be replaced by a Type 1b vessel, which would cost in the region of £5m.
- The hard ramps at both Shapinsay and Kirkwall would need to be marginally widened at a cost of £600k each. In addition, the existing jetty at Shapinsay could be extended and wave screens inserted to provide additional shelter (not costed at present).⁶¹
- The total cost of this option would therefore be **£6.2m**.

Option CO3: Replace MV *Shapinsay* with two like-for-like vessels

- The MV *Shapinsay* would be replaced by two Type 1a vessels, which would cost in the region of £8m.
- The harbour works would be as per Option CO1.
- For costing purposes, it is assumed that the two vessels would work on the 'Shetland model' of a 'day boat' and a 'shift boat'. The day boat would operate between 0600-1800. The shift boat would operate the current timetable, which would be extended to around 2300. It is assumed the second vessel would berth overnight in Kirkwall.
- The total cost of this option would be around **£8.0m**.

Option CO4: Provide a passenger only vessel

- This option would supplement Option CO1 or Option CO2. The passenger vessel would operate an offset timetable from the Ro-Ro, doubling the number of connections across the day and extending services into the evening to around 2300.
- The passenger only vessel would be a small medium-speed passenger only catamaran similar to the MV *Flotta Lass* (or alternatively a workboat coded passenger vessel similar to that operated privately from Shapinsay at present). This vessel would cost in the region of £1m and may require minimal harbour works including berthing pontoons and a gangway / steps.
- It is noted that there is currently a private sector operator offering passenger services from Shapinsay. This service is subsidised by the Shapinsay Development Trust.
- The total cost of this option would be around **£1m**.

Option CO5: Construct a fixed link between Shapinsay and Orkney mainland

⁶⁰ See Appendix E – Kirkwall Hard Ramp & Shapinsay Drawings, Box 2, Like-for-Like Option.

⁶¹ See Appendix E – Kirkwall Hard Ramp & Shapinsay Drawings, Box 3, Larger Vessel Option.

- The current preferred alignment of a fixed link would run from Helliar Holm in Shapinsay to Head of Work on the mainland.
- The Helliar Holm to Shapinsay causeway would have open exposure to the south-east, with the tides estimated to run at 3-4 knots. The crossing would consist of a 2,450 metre tunnel and an 860 metre causeway.
- It is estimated that the link would cost **£102m** in 2015 prices, although the application of optimism bias would increase this to **£170m**.
- The ferry service between Shapinsay–Kirkwall would be discontinued. It would be possible to hub ferry services for the Outer North Isles through Shapinsay, although this option was ruled out in the previous Outer North Isles STAG Part 1 and is not considered further.

Appraisal of Capital Options

8.3.2 The following sections contain the appraisal of each capital option against the study objectives and the STAG criteria.

Appraisal against Objectives

Table 8.2: Shapinsay Capital Options – Appraisal against Objectives

	Option CO1 - (Do Min) – Replace MV Shapinsay on a like-for-like basis	Option CO2 – Replace MV Shapinsay with one larger vessel	Option CO3 – Replace MV Shapinsay with two like- for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Construct a fixed link between Shapinsay & Orkney Mainland
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	-	✓	✓✓	✓	✓✓✓
<i>TPO2a: Where an island has a 'commutable' combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	-	✓✓✓	✓✓	✓✓✓
<i>TPO 2b: Where an island does not have a 'commutable' combined ferry or air / drive / public transport / walk time to a main employment centre, the scheduled connections should permit at least a half day (e.g. 4 hours) in Kirkwall or Stromness 7-days a week, all year round.</i>	N/A	N/A	N/A	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	-	-	✓✓✓	✓✓	✓✓✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	-	✓✓✓	✓✓	✓✓✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic</i>	-	-	✓✓	✓	✓✓✓

	Option CO1 - (Do Min) – Replace MV <i>Shapinsay</i> on a like-for-like basis	Option CO2 – Replace MV <i>Shapinsay</i> with one larger vessel	Option CO3 – Replace MV <i>Shapinsay</i> with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Construct a fixed link between Shapinsay & Orkney Mainland
<i>onward transport connections without the need for an overnight stay on Orkney mainland.</i>					

8.3.3 The key points from the above table are:

- Whilst the community consultation has suggested that passenger capacity can be an issue on peak summer sailings, this is not reflected in the available carryings data. However, while capacity does not appear to be a major problem currently, any capacity improvement will provide for future growth on the route. Overall, a two vessel solution (**Options CO3 and CO4**) provides the greatest improvement in terms of capacity, with Option CO3 in particular enabling both a potential doubling of the Ro-Ro service frequency during the day and an extended operating day (the passenger only vessel offering the latter only).
- A two Ro-Ro solution (**Option CO3**) operating on a ‘Shetland crewing model’ would also provide the greatest benefits in terms of commuting with the provision of two vessels enabling the operation of an additional AM and PM peak service as well as additional services throughout the day and into the evening. Supplementing a single vessel option with a passenger only vessel (**Option CO4**) would also lead to improvements in terms of commuting through doubling the service frequency and extending the length of the operating day. As the *Shapinsay* services travel to the heart of Kirkwall, the absence of a second vehicle ferry would have less of an impact than on equivalent routes, Rousay / Egilsay / Wyre for example.
- In terms of connectivity (TPO3), the two vessel options (**Option CO3 and Option CO4**) would result in a doubling of service frequency during the day. In addition, both options would also significantly extend the operating day, providing additional evening sailings and thereby improving links to strategic transport connections (TPO5).
- Both two vessel solutions would also reduce timetable variation (TPO4) through the provision of an enhanced winter Sunday service with the benefits for Option CO4 limited to the passenger element. Both options would also offer a consistent service across all seven days.
- The provision of a fixed link between Shapinsay and Kirkwall (**Option CO5**) would make a major contribution to the objectives. A fixed connection between the island and Orkney mainland would allow twenty-four hour access to employment and services on the mainland, as well to strategic transport connections.

Appraisal against STAG Criteria

Table 8.3: Shapinsay Capital Options – Appraisal against STAG Criteria

	Option CO1 - (Do Min) – Replace MV <i>Shapinsay</i> on a like-for-like basis	Option CO2 – Replace MV <i>Shapinsay</i> with one larger vessel	Option CO3 – Replace MV <i>Shapinsay</i> with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Construct a fixed link between Shapinsay & Orkney Mainland
Environment	✓	✓	✗	✗	✗✗✗

	Option CO1 - (Do Min) – Replace MV Shapinsay on a like-for-like basis	Option CO2 – Replace MV Shapinsay with one larger vessel	Option CO3 – Replace MV Shapinsay with two like-for-like vessels	Option CO4 – Provide a passenger only vessel	Option CO5 – Construct a fixed link between Shapinsay & Orkney Mainland
Safety	✓	✓	✗	✗	✗
Economy	✓	✓	✓✓	✓	✓✓✓
Integration	✓	✓	✓✓	✓	✓✓
Accessibility & Social Inclusion	✓	✓	✓✓	✓✓	✓✓✓
Established Policy Directives	✓	✓	✓✓	✓	✓✓
Technical Feasibility	<i>This option is technically feasible.</i>	<i>This option is technically feasible.</i>	<i>This option is technically feasible.</i>	<i>This option is technically feasible.</i>	<i>There would be a need for terrestrial & marine ground investigation and significant further research / costing.</i>
Operational Feasibility	<i>Crew induction training would be required.</i>	<i>Crew induction training would be required.</i>	<i>Requirement for additional crew & crew induction training. Second overnight berth would be in Kirkwall and the crew mainland based.</i>	<i>Requirement for additional crew & crew induction training.</i>	<i>The current Kirkwall – Shapinsay service would be discontinued.</i>
Affordability	<i>£4m for replacement vessel</i>	<i>£6.2m - £5m for replacement vessel and £1.2m for harbour works</i>	<i>£8.0m for two replacement vessels</i>	<i>£1m plus any minor ancillary harbour works</i>	<i>It is estimated that the link would cost £102m in 2015 prices, although the application of optimism bias would increase this to £170m</i>
Public Acceptability	<i>Acceptable if a modern drive-through vessel and combined with revenue options.</i>	<i>Acceptable and desirable</i>	<i>The priority for Shapinsay residents is length of operating day rather than frequency. Some residents commented that 20+ sailings per day would be unnecessary.</i>	<i>No specific comments in favour or against this option but potentially acceptable if providing an evening service.</i>	<i>This option was presented at the Exhibition as being ruled out in the appraisal and this appeared to be accepted. Those who commented on this option generally opposed the idea.</i>

8.3.4 The key points from above appraisal against the STAG criteria are:

- From an environmental perspective, the replacement of the MV *Shapinsay* with a like-for-like or larger vessel (**Options CO1 and CO2**) would likely have a minor positive environmental benefit through the adoption of more modern and fuel efficient technology (particularly if alternative fuel types were adopted). Moving to a two vessel solution (**Options CO3 and CO4**) would have a very minor negative environmental impact through increasing the number of sailings. The scale of construction of a fixed link (**Option CO5**) would likely lead to major environmental disbenefits as well as additional induced traffic, although this is likely to be small in absolute terms.

- All of the Ro-Ro vessel related options (**Options CO1-CO3**) would represent an enhancement to safety as they would replace the ageing MV *Shapinsay* and remove the requirement for passengers to reverse onto the vessel. Whilst moving to a two vessel solution (**Option CO3 and Option CO4**) would statistically increase the possibility of marine accidents (due to more ferry journeys being undertaken) and is likely to lead to additional vehicle kilometres (for Option CCO3), this risk is deemed to be relatively minor overall. Similarly, the provision of a fixed link (**Option CO5**) would lead to a very small increase in car trips which would lead to a statistically marginally higher accident rate. However, this risk is deemed to be very minor overall.
- In terms of the economy criterion, the provision of two like-for-like vessels (**Option CO3**) and a passenger only vessel (**Option CO4**) would provide significant positive changes in access with frequency improvements during the day and evening enhancements resulting in TEE benefits and wider / EALI benefits for residents, tourists and locally traded services. The enhanced access may also make the island a more attractive place to live, resulting in inward migration. These benefits would be significantly amplified with a fixed link (**Option CO5**), although there is some possibility of consolidation of key services off-island, which would be negative for *Shapinsay*.
- A like-for-like replacement (**Option CO1**) or one larger vessel (**Option CO2**) would offer minor economy benefits through the provision of a more modern and fit-for-purpose vessel and, in the case of the latter, a higher capacity. Where Option CO1 or CO2 is combined with a passenger vessel (**Option CO4**) there would also be frequency enhancements with resultant economic benefits for the island, although these benefits would accrue to passengers only.
- In terms of transport integration, **Option CO3** would have a significant positive impact resulting in improved links to local and strategic transport connections, whilst it could also promote in-migration / land-use development on *Shapinsay*. The same could also be said of **Option CO4** although the benefits would be less than with Option CO3 given that the service would cater for passengers only.
- All of the vessel options would lead to accessibility and social inclusion benefits as a result of physical accessibility improvements brought about by the replacement of the current vessel. The two vessel solutions (**Option CO3 and Option CO4**) would provide community accessibility benefits through improvements in service frequency with Option CO3 offering the largest overall benefit of the vessel options given the longer operating day and two Ro-Ro vessel mix. All of the options would support wider policy with **Option CO3** providing the largest overall benefit.
- Across the piece, a fixed link (**Option CO5**) would make the most significant contribution to the STAG criteria of Economy, Integration and Accessibility & Social Inclusion. However, there is significant technical uncertainty surrounding this option and it is by some distance the most expensive option.
- There are no technical feasibility issues associated with any of the options. From an operational perspective, the two vessel solutions (**Option CO3 and Option CO4**) would require additional crew (particularly **Option CO3**). It is likely that the one of the two vessels would overnight in Kirkwall and the crew would be mainland based.
- From an affordability perspective, the lowest cost option would be a like-for-like replacement for the MV *Shapinsay* (**Option CO1**). As there are no identified capacity issues on the route, it is anticipated that this option would meet the needs of the community, although clearly scaling up to a larger vessel (**Option CO2**) or a two vessel solution (**Options CO3 and CO4**) would offer more significant benefits, albeit for a higher cost.

8.4 Appraisal of Revenue Options

8.4.1 The following revenue options were identified for Shapinsay:

Do Minimum

- Continue with the current level of revenue funding.

Option RO1: Maximise service intensity within current operating hours

- The current timetable includes periods where the vessel ties up for periods of the day. This option would involve running the vessel continuously during its current operating hours, excluding meal breaks etc. This approach would provide 1-2 additional daily rotations and it is assumed in this option that the current operating day cannot be extended.

Option RO2: Provide 20% additional crew

- This option is based on the addition of 20% more crewing hours. The 20% figure is intended to illustrate the potential impact of a small increase in crew resources on the route.
- The additional time could either be used to provide an earlier first sailing and a later last sailing seven days a week or used to ensure a full year round Sunday service. In this way the current PM charter time could be brought into the standard timetable.
- This can only be delivered with additional crew (i.e. recruitment).

Option RO3: Adopt dayshift / backshift (Shetland model) single vessel shift system

- The Orkney crew currently work 'two weeks on, two weeks off' with three weeks leave. The working day is around 12 hours.
- This option would involve migrating to the dayshift / backshift system, which involves one week of 12 hour dayshifts, one week of 6 hour backshifts and a week-off. This provides an average working week of 42 hours, with the backshift crew on standby through the night and leave cover built in.
- This three crew⁶² operation (an increase of one crew on the current Orkney model) provides a 16 hour operating day, with scope to increase further where required (e.g. weekends).

Appraisal of Revenue Options

Appraisal against Objectives

8.4.2 The following sections contain the appraisal of each revenue option against the study objectives and the STAG criteria.

⁶² The crews consist of 3 Masters, 3 Engineers, 4 Mates (3 can act up as Masters) and 4 Deckhands (two can act up to Mate and one to Engineer)

Table 8.4: Shapinsay Revenue Options – Appraisal against Objectives

	Option RO1 – Maximise Operating Intensity	Option RO2 – 20% Additional Crew	Option RO2 – dayshift / backshift single vessel shift system
<i>TPO 1: The capacity of the services should not act as a constraint to regular and essential personal, vehicular and freight travel between the island(s) and Orkney Mainland</i>	✓	✓	✓✓
<i>TPO2a: Where an island has a ‘commutable’ combined ferry or drive / public transport / walk time to a main employment centre (e.g. 80 minutes), the connections provided should reliably facilitate commuting</i>	-	✓	✓✓✓
<i>TPO2b: Where an island does not have a ‘commutable’ combined ferry or air / drive / public transport / walk time to a main employment centre, the connections provided should reliably permit at least a half day a week (e.g. 4 hours) in Kirkwall 7 days a week</i>	N/A	N/A	N/A
<i>TPO3: The scheduled time between connections should be minimised to increase flexibility for passengers and freight by maximising the number of island connections across the operating day.</i>	✓	✓	✓✓✓
<i>TPO4: The level of connectivity provided should minimise the variation within and between weekdays, evenings, Saturdays and Sundays.</i>	-	✓✓	✓✓✓
<i>TPO5: Where practicable, islanders should be provided with links to strategic onward transport connections without the need for an overnight stay on Orkney mainland.</i>	-	✓	✓✓✓

8.4.3 The key points from the above table are:

- The addition of an extra return sailing per day **Option RO1** (maximising the operating intensity) would enable the delivery of one additional daily return crossing between Shapinsay and Kirkwall and would therefore result in minor improvements in capacity and frequency.
- A 20% crewing increment (**Option RO2**) would make a minor contribution across the objectives, although it should be noted that the extent of the benefit to each objective would depend on how the extra hours were deployed. The obvious improvement which could be made would be to ensure a consistent year round Sunday timetable. However, the extra hours could equally be deployed to provide a slightly earlier first sailing or later last sailing. Any increase in the number of sailings will have a capacity benefit, particularly so if those improvements are concentrated at peak times.
- The adoption of the dayshift / backshift crewing model (**Option RO3**) would make a substantial contribution to the objectives. Firstly, it would immediately address the issues of the weekday / weekend service variation, providing a consistent week-round timetable. In addition, the extended operating day would potentially allow for connections with morning outbound flights and the evening inbound flights and ferries from the Scottish mainland. It would also extend the potential working day, allowing island residents to take jobs on Orkney mainland that are not typical 9-5 posts. Capacity and frequency would of course also be enhanced.

Appraisal against STAG Criteria

Table 8.5: Shapinsay Revenue Options – Appraisal against STAG Criteria

	Option RO1 – Maximise Operating Intensity	Option RO2 – 20% Additional Crew	Option RO3 – dayshift / backshift single vessel shift system
Environment	-	-	×
Safety	-	-	×
Economy	✓	✓	✓✓
Integration	✓	✓	✓✓✓
Accessibility & Social Inclusion	✓	✓	✓✓✓
Established Policy Directives	✓	✓✓	✓✓✓
Technical Feasibility	<i>There are no technical feasibility issues associated with this option.</i>	<i>There are no technical feasibility issues associated with this option.</i>	<i>There are no technical feasibility issues associated with this option.</i>
Operational Feasibility	<i>Turnaround times on existing services would need to be quicker.</i>	<i>As the vessel is island-based, recruiting the necessary crew could be challenging. Additional senior crew would be required given their lower degree of interchangeability.</i>	<i>As the vessel is island-based, recruiting the necessary crew could be challenging. There would also likely be a need to amend contracts of employment, which could present a challenge.</i>
Affordability	<i>Very Low – small additional fuel costs only.</i>	<i>Low – small crewing increment and fuel cost.</i>	<i>High – full additional crew (plus holiday cover) with a likely requirement for a shift allowance and / or unsociable hours pay. Significant increase in fuel costs.</i>
Public Acceptability	<i>This is not likely to be acceptable as it only intensifies services within the current operating day.</i>	<i>Would be acceptable if this can provide the desired longer day.</i>	<i>Acceptable although some residents may feel that the resulting timetable is excessive.</i>

8.4.4 The key points from above appraisal against the STAG criteria are:

- **Option RO1** (maximising the current operating intensity) would provide minor economic and accessibility benefits at relatively low cost. **Option RO2** (a 20% increment in crew) would also provide minor economic and accessibility benefits, although of a slightly greater magnitude than Option RO1. The scale of these benefits under this option would depend on what aspect of the service the extra crewing hours were used to enhance. If it were the winter Sunday service, this option would make a positive contribution towards policy integration by reducing the disparity with the RSM.
- The adoption of **Option RO3** would make a significant contribution to the STAG criteria. An extended operating day would make a positive contribution in terms of the Economy criterion. As well as providing minor TEE benefits associated with increased frequency, there would be substantial wider / EALI benefits for Shapinsay. Firstly, the longer operating day could encourage the in-migration of working age families, particularly given connections to the main employment centre of Kirkwall. The earlier and later first and last sailings would enhance the commutability of the islands for those not in 'typical' 9-5 employment. The extended operating day would also remove the significant cost barrier

associated with accessing the Scottish mainland. Option RO3 would also support a wide range of policies and would do much to address the RSM related service shortfall. There would be very minor disbenefits in terms of the Environment and Safety caused in both cases by additional sailings and vehicle kilometres.

- Whilst the adoption of the Shetland crewing model offers significant benefits, it would be relatively expensive in comparison to Options RO1 and RO2, whilst there could be operational issues surrounding crew recruitment and contracts.

8.5 Annual Operating Cost Estimates

- 8.5.1 The revenue costs and income associated with operating the Kirkwall – Shapinsay ferry service in 2015/16 were as follows:

Table 8.6: Shapinsay Operating Costs 2015-16

Costs and Income	2015-16
Employee costs	£370,329
Fuel	£53,229
Survey & Repairs	£163,411
Harbour Dues & Stevedoring	£26,037
Other costs	£40,946
Total costs	£653,952
<i>Fares</i>	<i>£139,722</i>
<i>Freight</i>	<i>£133,673</i>
<i>Other</i>	<i>£16,331</i>
Total Income	£289,726
Net Operating Position	-£364,225

- 8.5.2 The total net revenue cost of any service option is a combination of characteristics of the asset(s) used, the timetable operated and the fares income generated. The current Shapinsay service costs around **£365k** per annum (net) to operate. The main options are recapped below.

Table 8.7: Summary of Shapinsay Options

Capital Options	Revenue Options
CO1: 1 * Type 1a vessel	Do Min: Current revenue funding
CO2: 1 * Type 1b vessel	RO1: Maximise operating intensity of current crew
CO3: 2 * Type 1a vessel	RO2: 20% additional crew
CO4: Supplement Options CO1 or CO2 with a	RO3: Adopt dayshift / backshift (Shetland model)

Capital Options	Revenue Options
passenger only vessel	single vessel shift system
CO5: Construct a fixed link between Shapinsay & Orkney mainland	

8.5.3 An estimate of the annual net revenue budget costs associated with the main permutations of vessels (Capital – ‘Ca’) and timetables (Revenue – ‘Rev’) outlined above is shown in the chart below. The figures shown are the estimated net annual revenue costs associated with each option.

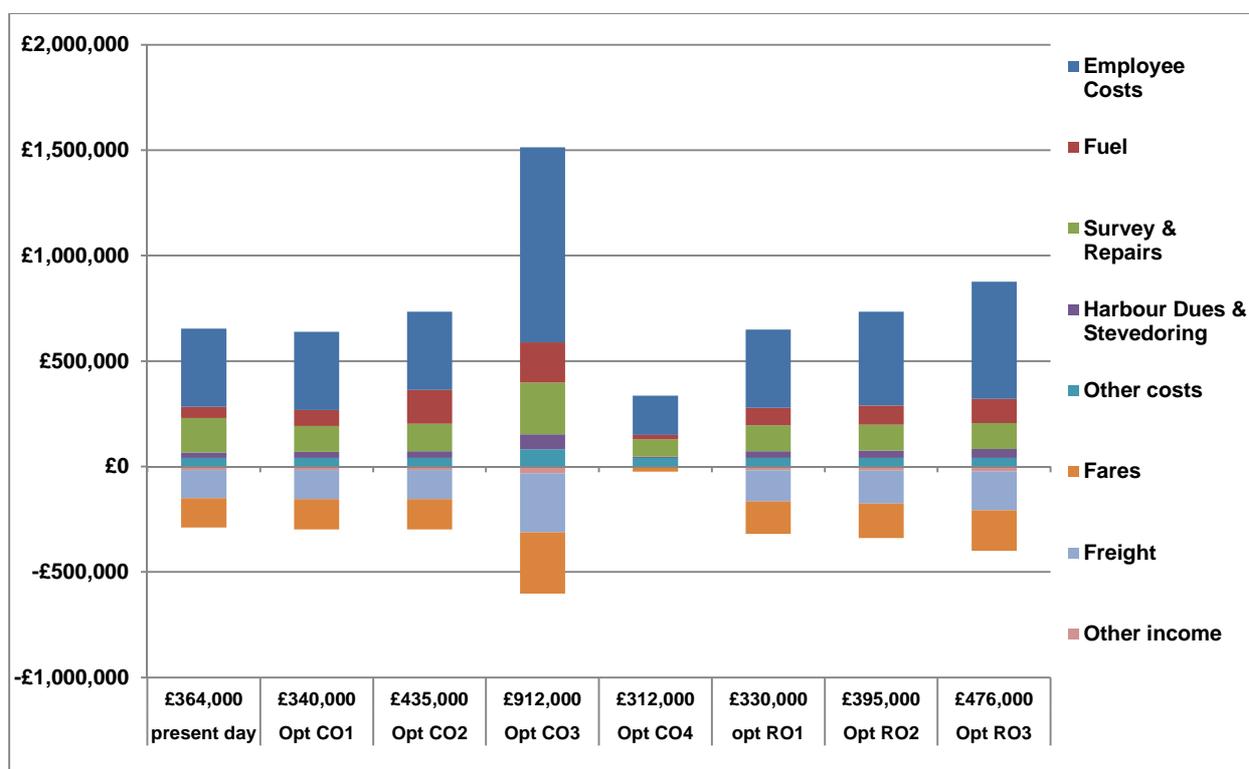


Figure 8.1 Shapinsay Estimated Annual Operating Costs of Appraised Options

- Present Day: costs as per 2015/16 of **£346k**.
- Single vessel options, CO1 & CO2, see costs rise incrementally to **£435k**, with the higher fuel costs assumed for a Type 1b vessel being a key factor.
- The 2-vessel option, CO3 sees net costs increase to **£912k** with increases in employees and vessel costs. These costs would reduce if the vessels were run less intensively than assumed here.
- The three revenue options RO1-3 see incremental increases in employee and other variable costs in proportion to the additional running hours.
- Note that the costs for RO1, RO2 and RO3 are based on Capital Option CO1 for illustrative purposes.

8.6 Public Consultation – Prioritisation

8.6.1 Chapter 1 described the Public Engagement undertaken in June 2016. A key part of this was the identification of priorities for enhancements to services in the event of additional resources being available. The public were provided with a list of potential enhancements and invited to tick the three that they would prioritise.

8.6.2 The number of completed questionnaires was:

- Shapinsay: 15

8.6.3 The figures below show the percentage of respondents who ticked each option. Note that these columns do not sum to 100% as the question allowed three responses.

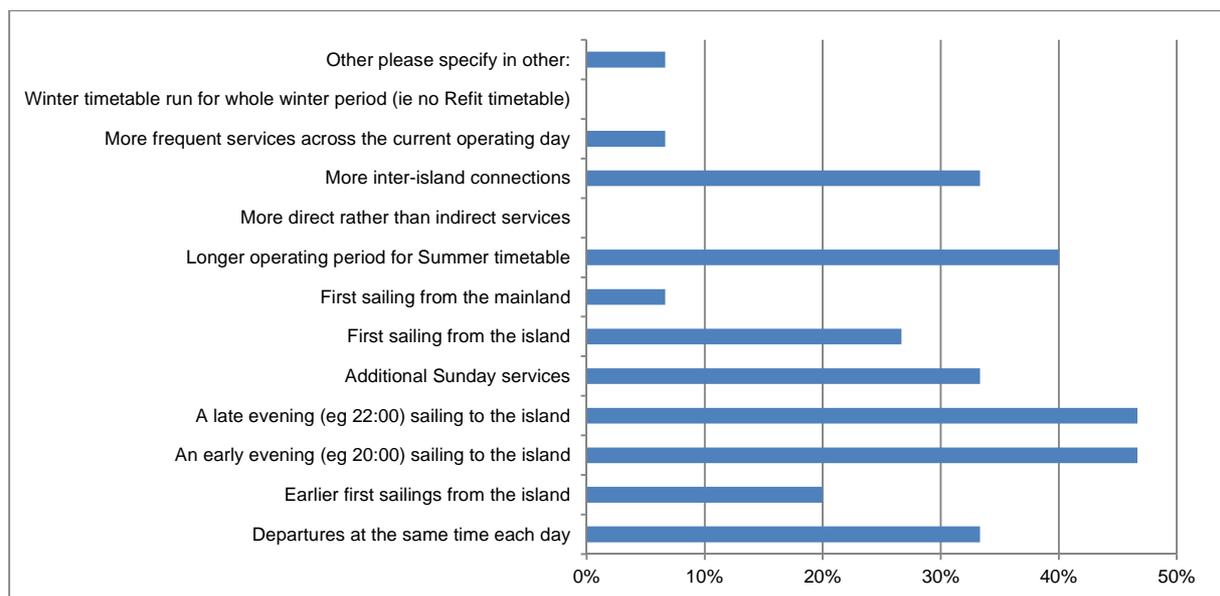


Figure 8.2: Shapinsay – Prioritisation of Enhancements

Other comments included:

- A desire for drive through capability.
- Everything is fine the way it is no change needed in my opinion.
- Better connectivity with other islands and mainland Scotland

8.6.4 The main priorities for Shapinsay residents are later evening sailings and a longer running of the summer timetable followed by additional Sunday services. It is notable that the longer operating day and evening sailings are prioritised over enhanced frequency across the day. This would support a continuing single-vessel solution.

Table 8.8: Shapinsay – Other Comments

Shapinsay – Comments	Number of times Cited
Onward transport links	9
Evening Sailings	9
New ferries	6
Disabled access/compartments	6
Sunday Sailings in Winter	4

Shapinsay – Comments	Number of times Cited
Double ended boat needed	3
Do not want fixed link	3
Reversing on ferry	2
20 sailings an overkill	2
Thorsvoe has no windows	2

8.7 Rationale for Selection / Rejection

8.7.1 The table below summarises the options together with our initial recommendation as to whether the option should be taken forward for more detailed appraisal.

Table 8.9: Outcome of Appraisal, Shapinsay

Capital & Revenue Options	Take Forward (✓) / Reject (✗)	Ration for Selection / Rejection
Option CO1 (Do Minimum): Replace the MV <i>Shapinsay</i> on a like-for-like basis	✓	A like-for-like replacement vessel would provide sufficient capacity based on current carryings and this option should be considered further. Any capacity issues could potentially be addressed via the revenue options RO1-RO3.
Option CO2: Replace MV <i>Shapinsay</i> with one larger vessel	✓	One larger vessel would provide additional capacity and this option should be considered further. Detailed carryings analysis will be required to determine whether a larger capacity vessel is merited relative to the cost differential.
Option CO3: Replace MV <i>Shapinsay</i> with two like-for-like vessels	✗	Based on the identified problems, two like-for-like vessels would appear a disproportionate solution.
Option CO4: Supplement Options CO1 or CO2 with a passenger only vessel	✓	This option offers a potential extension of the frequency of services to / from Shapinsay at relatively low cost, whilst it would also address the occasional summer passenger capacity issues identified. Whilst it does not support vehicle-based access, the overall increase in connectivity straight into Kirkwall offered means that this option should be considered further.
Option CO5: Construct a fixed link between Shapinsay & Orkney Mainland	✗	This option is rejected from further consideration given the very high cost in comparison to the other options. In addition, the technical and funding uncertainty, as well as the elapsed time before this option could be realised, means that it will not be considered further in the appraisal. This elapsed time would mean that, if taken forward, this option would not be in place until the tail end of the strategy period, meaning that an interim solution would be required. Should a nationally funded programme of fixed links emerge in the future, the proposal could be revisited at this stage.
Option RO1: Maximise operating intensity of current crew	✓	This is a low cost option which could marginally increase the number of connections over the length of the current operating day for very little additional cost.
Option RO2: Provide 20% additional crew	✓	This would be a relatively low cost means of expanding the operating envelope of the current service.
Option RO3: Adopt dayshift / backshift (Shetland model) single vessel shift system	✓	Whilst this would be a high cost service enhancement, it would transform access to Shapinsay across the day, making the island a more attractive place to live, work and do business. The additional costs of this option over RO2 will have to be analysed in the context of the RSM guidance in particular.

9 Financial Summary

9.1 Introduction

- 9.1.1 This Chapter brings together the key financial information associated with the remaining options, ie the options which it is proposed are taken forward to Outline Business Case stage. The options which are not recommended to be taken forward are not included in the following tables. At OBC stage, the costs and benefits associated with each option would be developed in more detail and quantified, and a preferred option would be identified.
- 9.1.2 It should therefore be recognised that these are initial high level cost estimates commensurate with the SBC stage of the process. They should be regarded as indicative of the broad orders of magnitude of the options relative to one another with a view to determining which options are taken forward to the next stage.
- 9.1.3 Outturn costs would be dependent on exact vessel specifications, procurement and financing strategies, implications on crewing and crew terms and conditions, fuel prices, and more detailed evaluation of the scope of harbour and ship to shore infrastructure works required to accommodate the preferred vessel design.
- 9.1.4 Note that any OBC would also have to take cognisance of any changes to fares policy which may emerge in the short or medium term.

9.2 Outer North Isles

Summary of Cost Estimates

Table 9.1: Summary of Ferry Options Costs – Outer North Isles

Option	Capital			Annual Revenue Costs		
	Vessel	Harbour	Total	Current shift pattern	RO1 +20%	RO2 +50%
Present Day				£4.5m		
CO5* 3 * 'Type 2a' Vessels & Freighter	£25.1m	£2.2m	£27.3m	£6.1m		
CO5* 3 * 'Type 2b' Vessels & Freighter	£41.2m	£10.2m	£51.4m	£6.4m		
CO6* 4 * 'Type 2a' Vessels	£28.0m	£2.2m	£30.2m	£5.7m	£6.6m	£7.9m
CO6* 4 * 'Type 2b' Vessels	£49.5m	£10.2m	£59.7m	£6.0m	£7.3m	£8.8m
CO3 Enhanced LoLo berth at North Ronaldsay		£8.0m	£8.0m			
CO4 Enhanced LoLo berth at		£3.0m	£3.0m			

Option	Capital			Annual Revenue Costs		
	Vessel	Harbour	Total	Current shift pattern	RO1 +20%	RO2 +50%
Papa Westray						
CO8 Eday – year round overnight berth	-	£2.5m	£2.5m			
CO8 Westray – year round overnight berth	-	£3.1m	£3.1m			
CO9 Stronsay harbour relocation	-		**			

* costs are provided for 3 or 4 Type 2a or Type 2b vessels. These figures therefore reflect an upper and lower bound as the outcome could be a mix of Type 2a and Type 2b vessels

** costs unavailable at stage due to conceptual nature of proposal

9.2.1 It can therefore be seen that there is a very wide range of costs associated with the different ONI options. Capital spend could range from in the region of £30m to £80m depending on the vessels and associated harbour works.

9.2.2 Annual revenue spending could also increase from the current £4.5m to around £9m.

9.2.3 These costs exclude the costs associated with running a fourth islander aircraft. These (largely operational) costs would be covered within the context of the air service contract and there would be limited capital spend required to accommodate this aircraft.

Priorities

9.2.4 The ONI service has been demonstrated to fall short of the RSM and Transport Planning Objectives in a number of ways. Whilst the air service provides additional connectivity, these connections are highly constrained in terms of capacity and cannot be regarded as a substitute for a ferry connection. The three vessels are nearly 30 years old and fall well short of modern accessibility standards and the single crew shift pattern does not permit the number of connections or length of operating day required. The two-vessel winter refit timetable also substantially diminishes the service.

9.2.5 Therefore both a capital and revenue solution is required for the ONI in the short term, or at the very least a programme of investment is required to begin in the short term. The scale of the ONI routes is far larger than the other Orkney routes and this is reflected in the scale of the figures outlined above.

Key Issues for OBC / Selection of Preferred Option

9.2.6 Some of the key issues to be addressed at OBC stage would be:

- Having determined that a three vessel solution will not meet the objectives set, the issue is what is the optimum vessel mix which futureproofs the ONI service for the next 30 years. This will involve:
 - Early analysis of whether the fourth vessel could be a freighter or whether a RoRo vessel is required to provide the level of connectivity required

- Detailed analysis of carryings by type (cars, commercial vehicles, freight) including recordings of when cars / commercial vehicles are unable to board due to capacity constraints
- Development of detailed timetable options, on the basis of: (i) the additional vessel / single crew and (ii) options whereby the operating day of some or all vessels is extended beyond a single crew (see below).
- These timetable options should be developed around a number of principles or objectives to bound in the very large number of potential permutations and provide consistency and transparency across the islands. These principles / objectives would be developed from the analysis undertaken here.
- Feasibility of crewing arrangements to accommodate a longer operating days across the ONI
- More detailed consideration of how / if the LoLo berths at North Ronaldsay and Papa Westray can be made more reliable short of conversion to full RoRo
- More detailed vessel design and harbour analysis
- Arrangements for the resilience of service during refit
- Arrangements for the carriage of dangerous goods
- Quantify the cost and benefits of relocating Stronsay harbour
- Consideration of DIPTAC related requirements for passenger access at continuing LoLo terminals potentially at Papa Westray and North Ronaldsay
- Specification of LoLo loading / unloading arrangements which would meet the needs of Papa Westray and North Ronaldsay
- Determine the most effective deployment of a forth Islander aircraft
- Implications of any changes to fares policy

9.3 Flotta and Hoy

Summary of Cost Estimates

Table 9.2: Summary of Options Costs – Flotta and Hoy

Option	Capital			Annual Revenue Costs			
	Vessel	Harbour	Total	Current timetable	RO1	RO2	Implied timetable
Present Day				£427k			
CO2 1 * Larger 'Type 2b' Vessel Linkspan Solution	£12.4m	£6.8m	£19.2m	£589k	£658k	£808k	
CO2 1 * Larger 'Type 1c' Vessel Hard Ramp Solution	£6.0m	£8.6m	£14.6m	£461k	£508k	£623k	
CO3 2 * LFL 'Type 2a' Vessels Linkspan Solution	£14.0m	*	£14.0m				£1,507k

Option	Capital			Annual Revenue Costs			
	Vessel	Harbour	Total	Current timetable	RO1	RO2	Implied timetable
CO3 2 * Larger 'Type 1b' Vessels, Hard Ramp Solution	£10.0m	£8.6m	£18.6m				£1,270k
CO4 Supplementary Passenger vessel	£1.0m	**	£1.0m				
CO4 Lyness Overnight Berth	-	***	***				

* the replacement of existing linkspans at life expiry has not been costed here as the focus has been on service enhancements. These costs would be covered under ongoing maintenance / asset replacement programmes

** minor costs not estimated here

*** not possible to cost at this stage as would be dependent condition survey on existing pier and the resultant option taken forward

9.3.1 For the Flotta / Hoy routes, the capital spend is estimated at between £14m and £20m. Annual revenue costs are estimated to range between £450k and £1,500k.

Priorities

9.3.2 The MV *Hoy Head* is potentially due for replacement in 2024. The more pressing issue for this route is therefore the requirement for additional revenue funding to extend the operating day and provide year-round seven day sailing. The additional sailings which would be provided would also assist in addressing the capacity issues on the current vessel.

Key Issues for OBC / Selection of Preferred Option

9.3.3 Some of the key issues to be addressed at OBC stage would be:

- Feasibility of crewing arrangements to accommodate a longer operating day and year-round seven day sailings
- Hard ramp or Linkspan operation when the MV *Hoy Head* is replaced
- More detailed analysis of demand and carryings:
 - Can the MV *Hoy Head* meet all demand for another decade with additional sailings?
 - If / when replaced, would a single larger vessel accommodate demand, or
 - Does a two-vessel solution provide a more effective medium term option?
- Detailed feasibility of potential overnight berth at Lyness
- More detailed vessel design and harbour analysis
- Options for the role of passenger vessel and how this could best be deployed across Scapa Flow - how this could best be deployed and what would the costs and benefits be?
- Assessment of integrated options for both Moaness and Lyness routes
- Implications of any changes to fares policy

9.4 Graemsay and Hoy

Summary of Cost Estimates

Table 9.3: Summary of Options Costs – Graemsay and Hoy

Option	Capital			Annual Revenue Costs		
	Vessel	Harbour	Total	Current timetable	RO1 Intensify	RO2 +20%
Present Day				£332k		
CO2 1 * Larger LoLo	£1.75m	£0m	£1.75m	£318k	£338k	£357k
CO3 1 * Larger RoRo – small cat or 'Type 1a'	£3.0m	£11.5m	£15.0m	£343k	£364k	£385k
CO4 Moaness Pier extension	-	£1.5m	£1.5m	-	-	-

9.4.1 For the Graemsay / Hoy routes, the capital spend is estimated at between £2m and £15m. Annual revenue costs are estimated to range between £320k and £390k.

Priorities

9.4.2 The MV *Graemsay* should be able to operate until at least 2025 and this coupled with the lack of public appetite amongst current residents for a RoRo solution, would suggest that the priority for Graemsay would be extending the operating day at both ends to improve access to the services provided in Stromness.

Key Issues for OBC / Selection of Preferred Option

- Consider timetabling to provide greater connectivity between Graemsay and Moaness, allowing Graemsay residents to more easily spend time in Hoy
- Consideration of DIPTAC related requirements for passenger access at LoLo terminals
- Specification of LoLo vessel which would meet the needs of Graemsay and Hoy in terms of loading arrangements and carrying capacity
- Options for the role of passenger vessel and how this could best be deployed across Scapa Flow - how this could best be deployed and what would the costs and benefits be?
- More detailed vessel design and harbour analysis
- Assessment of integrated options for both Moaness and Lyness routes
- Fuller assessment of the costs and benefits of extending Moaness pier
- Fuller assessment of whether ongoing LoLo operation can sustain the Graemsay community
- Feasibility of crewing arrangements to accommodate a longer operating day and year-round seven day sailings
- Implications of any changes to fares policy

9.5 Rousay, Egilsay and Wyre

Summary of Cost Estimates

Table 9.4: Summary of Options Costs – Rousay, Egilsay & Wyre

Option	Capital			Annual Revenue Costs			
	Vessel	Harbour	Total	Current timetable	RO1 +20%	RO2 18hr	Implied timetable
Present Day				£449k			
CO2 1 * Larger 'Type 1b' Vessel	£5.0m	£8.3m	£13.3m	£543k	£623k	£743k	
CO3 2 * LFL 'Type 1a' Vessels	£8.0m	£0.6m	£8.6m				£1,098
CO4 Supplementary Passenger vessel	£1.0m	*	£1.0m				

* minor costs not estimated here

9.5.1 For the Rousay / Egilsay / Wyre routes, the capital spend is estimated at between £9m and £13m. Annual revenue costs are estimated to range between £550k and £1,100k.

9.5.2 Crewing costs for a passenger only vessel are not known at this stage although it is assumed they would not differ significant from the relatively small Ro-Ro vessel MV *Eynhallow*.

Priorities

9.5.3 The MV *Eynhallow* is due for replacement in the short term. There is also a pressing need for additional revenue resource to accommodate year-round seven day sailings and a longer operating day at both ends of the day.

9.5.4 A capital and revenue solution is therefore required in the short term.

Key Issues for OBC / Selection of Preferred Option

- Scaling up to a larger 'Type 1b' vessel has significant implications for harbour infrastructure. Given that there are three islands to be served, would 2 * 'Type 1a' vessels provide a more effective solution?
- More detailed vessel design and harbour analysis
- Feasibility of crewing arrangements to accommodate a longer operating day and year-round seven day sailings
- Integration of Wyre and Egilsay calls into the timetable
- Options for the role of passenger vessel - how this could best be deployed and what would the costs and benefits be?
- Implications of any changes to fares policy

9.6 Shapinsay

Summary of Cost Estimates

Table 9.5: Summary of Options Costs – Shapinsay

Option	Capital			Annual Revenue Costs			
	Vessel	Harbour	Total	Current timetable	RO1 intensify	RO2 +20%	RO3 18hr
Present Day				£346k			
CO1 1 * LFL 'Type 1a' Vessel	£4.0m	£0	£4.0m	£340k	£330k	£395k	£476k
CO2 1 * Larger 'Type 1b' Vessel	£5.0m	£1.2m	£6.2m	£543k	£527k	£631k	£760k
CO4 Supplementary Passenger vessel	£1.0m	*	£1.0m				

9.6.1 For the Shapinsay routes, the capital spend is estimated at between £4m and £6.5m. Annual revenue costs are estimated to range between £350k and £760k.

Priorities

9.6.2 The MV *Shapinsay* could remain in service for at least another five years with modest improvement. The priority here therefore is to adopt revenue measures to increase the length of the operating day throughout the week.

Key Issues for OBC / Selection of Preferred Option

- Feasibility of crewing arrangements to accommodate a longer operating day
- Detailed analysis of carryings to determine whether a higher capacity vessel is required in the medium term to accommodate demand at peak periods of the day or whether a like for like replacement would be sufficient
- More detailed vessel design and harbour analysis
- Options for the role of passenger vessel - how this could best be deployed and what would the costs and benefits be?
- Implications of any changes to fares policy

List of Abbreviations

The following abbreviations are used within this report and the accompanying Appraisal Summary Tables:

AGL – Aircraft Ground Lighting
AIRAC – Aeronautical Information Regulation and Control
AvGas – Aviation Gasoline
BN – Britten Norman
CAA – Civil Aviation Authority
CHFS – Clyde & Hebridean Ferry Services
DIPTAC – Disabled Persons Transport Advisory Committee
EALI – Economic Activity and Location Impacts
EASA – European Aviation Safety Agency
FBC – Final Business Case
FTE – Full-Time Equivalent
GDL – Garden and Designed Landscape
GIS – Geographic Information Systems
GCR – Geological Conservation Review
GNSS – Global Navigation Satellite System
HES – Historic Environment Scotland
HIAL – Highlands & Islands Airports Limited
HRA – Habitats Risk Assessment
IFR – Instrument Flight Rules
IMDG – International Dangerous Goods Code
ITT – Invitation to Tender
LDP – Local Development Plan
Lo-Lo – Lift-on, lift-off
KGS – Kirkwall Grammar School
LfL – Like-for-like
LNG – Liquefied Natural Gas
LOA – Length Overall
MCA – Maritime & Coastguard Agency
MGN – Maritime Guidance Note
MPA – Marine Protected Area
MSN – Merchant Shipping Notice
NATS AIS – National Air Traffic Aeronautical Information Service
NNR – National Nature Reserve
NSA – National Scenic Area

OBC – Outline Business Case
OF – Orkney Ferries
OIC – Orkney Islands Council
OIITS – Orkney Inter-Island Transport Study
OJEU – Official Journal of the European Union
ONI – Outer North Isles
PAPI – Precision Path Approach Indicator
PCU – Passenger Car Unit
PSO – Public Service Obligation
RFFS – Rescue & Fire Fighting Services
RET – Road Equivalent Tariff
Ro-Pax – Passenger carrying Ro-Ro vessel
Ro-Ro – Roll-on, roll-off
RSM – Routes & Services Methodology
SAC – Special Area of Conservation
SBC – Strategic Business Case
SEPA – Scottish Environment Protection Agency
SET – Single-Engine Turbine
SM – Scheduled Monument
SNH – Scottish Natural Heritage
SPA – Special Protection Area
SSSI – Site of Special Scientific Interest
STAG – Scottish Transport Appraisal Guidance
STOL – Short take-off / landing
SWATH – Small water plane area twin hull
TEE – Transport Economic Efficiency
TPO – Transport Planning Objective
VFR – Visual Flight Rules
WHS – World Heritage Site