Strategic Sea Crossings in the Highlands & Islands: Development Opportunities (2005- 2025)

Strategy

Final Report

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SUMMARY

KEY FACTS

Based on the data available to us, all the ferry services of the Highlands and Islands services conveyed the following total annual traffic levels in 2004:

- Passengers: 8,120,000.
- Cars: 2,119,000.
- CVs/Buses: 184,000, with a further 266,100 vehicle metres of freight.
- Vehicles: 280,000 on the Corran ferry service.

The total annual deficit funding for the services was £68,510,000 in 2004.

Table S.1 summarises information on the year of build for the vessels that are in public ownership.

TABLE S.1: Year of build of vessels

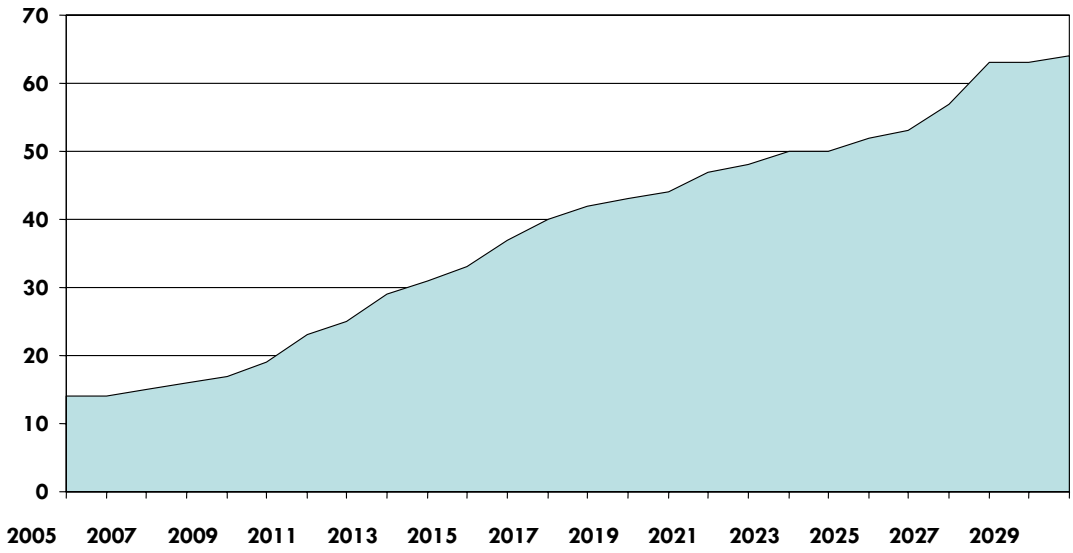
Built	Number of Vessels
2001-present	12
1996-2000	8
1991-1995	11
1986-1990	14
1981-1985	5
1976-1980	4
1971-1975	10
Total	**64**

It shows that of the 64 ships, 20 (31%) were built in the last decade. Of the 44 that are older than this, over half (25) were constructed between 1986 and 1995. In total, just over one in two ships is at least 15 years old, with 14 (22%) of an age beyond the normal life expectancy of 25 years. The mean and median vessel ages are similar at between 15 and 16 years.

Figure S.1 overleaf charts the cumulative vessel replacement requirements. This is based on nominal replacement dates, assuming an operating life of 25 years. The main points to note are:

- Vessel replacement is required in almost every single year up to 2030. In most years at least two vessels are due to be replaced.
- Over half (52%, or 33 ships) of the fleet requires to be replaced between now and 2015, with over one third (36%, or 23 ships) needing replacement by 2011.

Figure S.1: Cumulative vessel replacement profile



KEY FINDINGS

The key **issues and problems** affecting provision of services on the Strategic Sea Crossings (SSCs) are:

- Cost of services: The cost of providing CalMac and NorthLink services is high.
- Fares: High fares on some routes act as a disincentive to travel. The fare structure charged across the overall network seems to have little economic basis.
- Lack of frequency: Whilst incremental improvements have been made over the years, the frequency on some routes remains poor, sometimes less than daily.
- First and last service: Services are sometimes based around operational needs rather than those of the markets they serve.
- Passage times: On some of the longer routes, passage times are unnecessarily long.
- Winter timetabling: Communities benefit from increased summer schedules buoyed by tourism demand, but this then leaves deficiencies in services in the winter periods.
- Landfalls: The landfalls used often do not have an inherent logic, and there are sometimes two or more serving the same broad community.
- Integration with bus and rail: Several instances of mismatches were reported.

- Inter-island travel: Services are focused on mainland connections, and inter-island travel is often a by-product of these.

- Freight v. passenger needs: Combined freight and passenger services generally create conflict in preferences for sailing times between passengers and freight. At times where capacity is constrained, the two sectors compete for space.

- Livestock welfare and regulatory issues: An increasingly stringent regime is raising challenges on how to maintain shipments of livestock using current practices.

The key **constraints** holding back improvements to sea crossings are:

- Lack of strategic direction: There has been no strategy setting priorities and directions against which the network could be shaped. This includes vessels AND terminals.

- Lack of vision on economic potential: Some hold negative and outdated perceptions of the islands' potential when there is evidence for optimism.

- Geography and topography: Remoteness makes it a challenge to provide transport to the communities that live on the islands.

- Road networks: The quality of these sometimes constrains the ability to concentrate ferry services.

- Divided communities and vested interests: Within some islands, neighbouring communities are fighting for individual instead of collective agendas.

- Leadership can be unpopular: Local democracy is very close to the people in island communities, and it is difficult for political leaders to take up collective agendas.

- Change perceived as threat: A significant number of stakeholders are both dissatisfied with the network but fearful of any change.

The strategy is formed against the following **uncertainties**:

Future funding for ferries: Public sector support for the ferry network is at a record high, and the operating deficit is highly likely to grow in real terms. Continued investment will be required in new craft.

Future development of road network and fixed links: For some islands, the transport network is a serious constraint. For strategic short crossings, it may make sense to develop fixed links in the longer term. This requires significant funding.

Growth of air travel: It is unclear how far intra-regional services will develop in terms of increased frequency and reduced fares.

Future tender process: This represents a significant opportunity for change and encouragement of innovation in philosophy and service delivery.

OBJECTIVES

There are three fundamental **objectives** that the strategy must achieve:

1. Support economic development: The quality of services provision on the SSCs can make or break any of the islands' economies. Services must support business and industry, tourism and the service industries.

2. Support sustainable population and communities: A sustainable population is needed, in terms of non declining or growing numbers, and a balanced demographic profile. Services on the SSCs should address the core of this issue, and help to tackle barriers to social inclusion.

3. Promote integration with other transport modes, and with other policies: It is vital that the development of ferry services be pursued in the context of (and cross referenced with) national and regional strategies and policies for transport, and issues such as planning, housing, tourism, education, and health.

RECOMMENDATIONS

Recommendations on development opportunities have been developed at three levels to deliver these objectives:

- Institutional: These go to the heart of the network in terms of the philosophy behind it, and the way that services are delivered.
- Strategic: These are strategic recommendations that are the thrust of achieving a step change in the network in the medium to long term.
- Tactical: These are short term actions that pave the way to medium to long term goals.

INSTITUTIONAL RECOMMENDATIONS

1. Best value should be at the heart of the strategy. This requires a significant change in both the driving philosophy and the delivery policy. The philosophy behind funding should be more strategic. The emphasis should be on investing in upgrading infrastructure where practicable with a view to reducing whole life costs.

2. The future of the ferry network should have the socio-economic development of the islands at its core. It should be depoliticised, and the role of custom and practice in shaping the network must be reduced. A network designed on the basis of socio-economic facts and potential would:

- Target linkages to sub-regional powerhouses (e.g. Skye, Oban), and use their gravitas to leverage economic growth on the islands.
- Design services around the origin and destination of ALL classes of passenger traveller and the origin and destination of freight.

3. Future delivery of the ferry network must be strategically led and innovation friendly. Investment decisions must be made against the "big picture", not against incremental analysis. The market place should be encouraged to innovate and provide tailored solutions, and the tender framework in coming rounds should encourage this. The network should be based around the following principles:

- Balancing development of services on shorter crossings with freight and passenger origin and destinations.
- Concentration of faster higher frequency services between strategic landfalls, and the development of hubs that offer potential for leveraging added economic value.
- Development of the road network to feed into these, including fixed links on short strategic crossings.

4. An INDEPENDENT Strategic Enabler must develop the expertise and capacity to facilitate development of the future network. In the short term it can build knowledge and capability through tactical actions.

STRATEGIC RECOMMENDATIONS

At the strategic level, **best value** means delivering enhanced services with the same resources, and investing additional resources where the returns are greatest. The opportunities to do this include:

- Changing landfalls to obtain higher frequency / shorter crossings.
- Concentration over fewer landfalls to increase frequency.
- (related to these…) Improved vessel productivity.
- New pricing mechanisms.
- Basing vessels on islands to facilitate island centred timetabling including daily off-island commuting.
- Increasing the length of the sailing day.
- Enhancing sailing frequency during the CalMac winter timetable to reflect trends in the visitor market.

Further recommendations are framed against a background of **six key development opportunities** that concern innovation in the network:

- Strategic development and upgrading of the ports and terminals network.
- Strategic fixed links for short crossings.
- Alternative ownership models for ferry companies.
- Application of fast Ro-Pax craft.
- Application of a fast passenger only craft.
- Capture of land uplift value.

These six opportunities are not separate ideas. They should be thought of a set of inter-related rings. Taken as a package, the first five will make a profound impact on the economy and sustainability of communities in the Highlands & Islands. They enable application of the sixth opportunity, which concerns innovation in funding.

Excellent ports and terminals, designed to handle vessels generally available in the marketplace, would significantly improve the opportunities to deploy new vessels. The priority of ports and terminals and their role in sustainable strategy must be raised. The Strategic Enabler should develop a strategic approach to future infrastructure investment.

Elsewhere in the UK, ports and terminals are increasingly recognised as supporting a range of activities, including within their immediate hinterland, in terms of commercial and residential property, leisure and retail. There is much to learn from HIAL, which in recent years has invested considerably in the gateway element of its airports. It is also reviewing the wider economic potential of airport sites and surrounding land.

The Strategic Enabler should support development of **strategic fixed links**. Strategic fixed links make a wider contribution beyond replacing the ferry service to a single island. They can act as catalysts for improvements to other transport services in an area.

Several of the crossings may be candidates for comprehensive project appraisals to assess if replacement of ferry services with fixed links is feasible. Two simplified case studies of economic cost-benefit analysis suggest the following:

- The main challenge for economic justification of fixed links compared to ferry services with present traffic volumes is to develop low cost designs for fixed links.
- Traffic levels would, however, be likely to increase significantly above existing levels where the crossing is truly strategic. This issue will be critical in the analysis.
- A link on a strategic crossing should produce other benefits, e.g. the ability to concentrate two routes to one and achieve higher frequency and faster crossings to a wider community. Regional economic development and social benefits must be captured in the analysis.

There is potentially value to be gained by reviewing **models for operation and ownership of ferry companies**. The main options are public sector, private sector, public private partnership, and community ownership. These models deliver different pros and cons in different situations. These should be considered and developed for the long term, although in the short to medium term, a pilot project on community ownership might be reviewed.

The Strategic Enabler needs to build expertise in the application of fast ferries, and then to use this to influence development of the network with their application. Currently all CalMac ferry routes are served by conventional medium speed Ro-Pax ferries. In order to meet the desire for increased frequency of service, it may be possible on some routes to apply smaller **fast Ro-Pax craft** which would achieve the same or greater route capacity by making more return trips each day. Routes where a fast craft may be suitable will have the following characteristics:

- The route will be reasonably sheltered, and not too complex so that a high proportion of transit time can be spent at cruising speed.
- The route should not be too short to obtain benefits of speed, or too long if exposed to open seas.
- The fast ferry should ideally replace two (or more) conventional ferries or permit higher frequency where there is demand or social need for this.
- The traffic mix should support fast ferries, with alternatives for HGVs.

As with the Great Lakes or Alaska routes, it is likely that the specific requirements of a Ro-Pax fast ferry on a given route would benefit from a purpose designed vessel.

The Clyde area has a relatively high population level: 22,600 for Cowal and Bute combined. While landfalls for the existing ferry services are within Inverclyde, the main trip destination for local residents is the Glasgow area. **Fast direct passenger services** from Cowal and Bute would radically alter actual and perceived access to and from the Glasgow city region. A fast craft operation would produce economic benefits at both ends of the route, and the service would encourage tourism. In addition, the road links between Inverclyde and the city region are likely to become increasingly congested over the next 10-20 years making alternatives more attractive.

The nature of the route, along an urban river with semi open water at the downstream end, is similar to other urban rivers where riverbus services have been introduced. Several shipbuilders have developed vessels specifically for this type of service.

The vision is one of people being able to travel more frequently *and* quickly *and* conveniently on more appealing craft via attractive and interesting gateways. This will have a substantial impact on the value of land neighbouring terminals, and possibly even whole towns or islands. There is good potential for **land uplift capture** (LUC). Examples with potential for this include the Clyde Estuary and Oban.

LUC can be substantial. Research shows that on average in the UK a house will gain in value by 10% through better transport connectivity. This is an additional profit for the developer over and above planning gain and is created solely by the improved transport connectivity. Elsewhere, research on a new ferry terminal in Australia shows that a house within 800m of the terminal will increase in value by 10-20% on average, purely because of the new transport facility.

There are various options for raising funds from LUC, but the most proactive is voluntary contributions achieved through the "E-Rail methodology". This has been applied to 22 projects in the UK, Canada and Australia. It has been proven to work, it supports sustainable development, and the equity of transport benefiting from the wealth that it has created is compelling.

TACTICAL RECOMMENDATIONS

Strategic Enabler:

- An origin and destination study covering sea, air and fixed link for both passengers and freight.
- A study based around propensity to travel considering the impact of higher frequency / shorter crossings / lower fares and pricing strategies.
- An international benchmarking study of cost structures and best practice for ferry services.

Ports and terminals:

- Assess the adequacy of existing facilities to provide flexible infrastructure for vessels in the marketplace, and identify priorities for best value upgrading.
- Assess the wider economic potential to develop ports and terminals and leverage added value.

Fixed links:

- Develop design concepts and pre-feasibility studies for strategic fixed links.

Ferry company ownership models:

- Assess the extent to which existing ownership patterns and charging regimes constrain development and impact on fares.
- Study the merits of potential ownership models and develop a pilot project for community ownership.

Fast Ro-Pax services:

- Develop and maintain a database on fast ferries.
- Foster partnerships with innovative designers and constructors, and encourage development of financially viable and economically desirable design concepts for the SSCs.

Fast passenger only services

- A feasibility study of fast passenger services on the Clyde is required to examine potential demand, fare structures, routes, shore infrastructure costs, vessel costs, operating costs and timetabling.

Land uplift capture:

- Explore further the E-Rail approach through a pilot study and Stage 1 Report in one of the target areas.

Figure S.2 overleaf gives a graphic summary of the SSC Strategy.

Conditions

Issues and problems

- Cost of services is high
- Some high fares suppress travel
- Lack of frequency
- Non island-centric timetabling
- Some unnecessarily long passage times
- Inadequacies in winter timetabling
- Landfalls not optimised
- Some poor integration with bus & rail
- Poor provision for inter-island travel
- Freight v. passenger needs
- Livestock issues

Constraints

- Role of politics / custom & practice
- Lack of strategic direction
- Lack of vision on economic potential
- Geography and topography
- Some road networks poorly developed
- Divisive agendas & leadership issues
- Change perceived as threat

Uncertainties

- Future level of funding
- Development of fixed links & roads
- Growth of air travel
- Future tender process

Objectives

Support economic development:
The quality of services provision on the SSCs can make or break any of the islands' economies. Services must support business and industry, tourism and the service industries.

Support sustainable population and communities:
A sustainable population is needed, in terms of non-declining or growing numbers, and a balanced demographic profile. Services on the SSCs address the core of this issue, and help to tackle barriers to social inclusion.

Promote integration with other transport modes, and with other policies:
It is vital that the development of ferry services be pursued in the context of (and cross referenced with) national and regional strategies and policies for transport, and issues such as planning, housing, tourism, education, and health.

Opportunities

Institutional

- Funding driven by strategy
- Strategy led by socio economic goals
- Strategic delivery; innovation friendly
- Independent "Strategic Enabler"

Strategic

- Best value: enhanced services with same resources; target extra resources
- Upgrade ports and terminals network
- Strategic fixed links
- Ownership models, esp. community
- Application of fast Ro-Pax craft
- Application of fast passenger craft
- Capture land uplift values

Tactical

- Studies on O/D & propensity to travel
- Benchmark cost of services
- Ports & terminals review; upgrade plan
- Engineering studies for fixed links
- Community ferry company pilot project
- Fast ferry database
- Fast ferry design partnerships
- Feasibility study Clyde fast pax ferry
- Pilot study on land uplift capture

Figure S.2: Summary Strategy

1 INTRODUCTION

Fisher Associates was engaged by HITRANS to undertake a study on Strategic Sea Crossings (SSCs) in the Highlands & Islands. The objective of the study is to prepare a strategy that will help HITRANS to realise existing and emerging development opportunities to 2025. The Strategic Sea Crossings are:

- Shetland to the Scottish Mainland
- Orkney to the Scottish Mainland
- Argyll Islands
- Hebrides CalMac Network
- Clyde crossings serving Arran, Bute, Dunoon and Cumbrae

This report is not a shopping list of projects. It is more profound and addresses in a generic way the deep issues that determine how services on the sea crossings are provided now, and how to improve services in the medium to long term through institutional and strategic recommendations. It also offers immediate tactical initiatives that will start the voyage.

This report was researched and written in the first half of 2005, and is structured around the STAG pre-appraisal process which is summarised as:

- Analysis of present and future problems
- Objectives
- Options generation, sifting and development

Section 2 presents a summary of the key issues, constraints and uncertainties that the strategy must address. Four core institutional recommendations are made to address the underlying causes of the problems identified.

Section 3 identifies "STAG compliant" objectives that the strategy must achieve.

Section 4 discusses the key development opportunities that should be pursued. These cover a broad range of issues affecting the network, and form the basis of six strategic recommendations.

Section 5 maps the various recommendations and development opportunities onto the objectives and discusses priorities.

Section 6 presents a detailed review of the key issues for each group of SSCs.

A separate sister document presenting a factual Overview of Existing Ferry Networks is also available.

We acknowledge with thanks the significant support that the HITRANS partners have provided. We also acknowledge the kind support of numerous consultees who contributed to the research base of the study.

Fisher Associates is a management consultancy specialising in maritime and transport studies. Beckett Rankine Partnership, COWI, MRC McLean Hazel, and Reference Economic Consultants supported us on this study.

2 ISSUES

2.1 APPROACH

The identification of issues has been undertaken through:

- Consultation with stakeholders and ferry operators.
- The contents of the sister overview report produced earlier in the study.
- The consultants' previous research into the relevant ferry networks.
- Existing reports reviewed as part of this study.

Development opportunities were also discussed in our consultations with stakeholders, and the outcome of these discussions has been fed into the strategy.

The first part of this section presents a summary of the generic key issues against a background of constraints and uncertainties. The second part presents primary recommendations on strategic directions based upon these. A detailed review of key issues is given in Section 6.

2.2 SUMMARY OF ISSUES

2.2.1 INTRODUCTION

This section summarises the generic key issues, constraints and uncertainties that provide the backdrop for the strategy.

The SSCs constitute a diverse group of routes serving different communities experiencing rather different economic fortunes. We must however see the wood and not just the trees. We have therefore addressed the SSCs as a whole to enable us to draw out some important conclusions and fundamental recommendations.

2.2.2 KEY ISSUES

Cost of services: The cost of providing the CalMac and NorthLink services is high, with an operating subsidy of over £50 million in the 2004-05 financial year. It is argued that this is not a "typical" year, however the future outlook is likely to be based around continuing cost escalation due to fuel prices trends, regulatory compliance issues, and demands for improved terms and conditions.

Fares: We expect users to grumble about fares, but there is perhaps some justifiable sentiment that fares on some routes are too high and act as a real disincentive to travel. The fares charged across the overall network seem to have little basis in economic principles, and are based more on custom and practice.

Lack of frequency: Whilst incremental improvements have been made over the years, the frequency on some routes remains poor – sometimes less than daily.

First and last service: Services are sometimes based around operational needs rather than those of the markets they serve. This can affect groups such as commuters who may not be able to access the mainland early enough or leave late enough, and school children who may not be able to get home in the evenings or at weekends.

Passage times: On some of the longer routes, passage times are perhaps unnecessarily long. It is interesting to contrast, for example, the capability of ferries on Northern Isles routes with those serving the Hebrides.

Winter timetabling: Communities benefit from increased summer schedules buoyed by tourism demand, but this then leaves deficiencies in services in the winter periods.

Landfalls: The landfalls used often do not have an inherent logic, and there are sometimes two or more serving the same broad community. There is little or no information on the origin and destinations of people and freight to inform this issue. This results in the butter being spread thinly across the network, resulting in poor frequencies, longer crossing times etc.

Integration with bus and rail: As a general comment, fragmentation of the transport system means that it is difficult to mesh modes together, and several instances of mismatches were reported.

Inter-island travel: Services are focused on mainland connections, and inter-island travel is often a byproduct of these.

Freight v. passenger needs: Combined freight and passenger services generally create conflict in preferences for sailing times between passengers and freight. At times where capacity is constrained, the two sectors compete for space.

Livestock welfare and regulatory issues: An increasingly stringent regime is raising challenges on how to maintain shipments of livestock using current practices.

2.2.3 CONSTRAINTS

Lack of strategic direction: There has been no strategy setting priorities and directions against which the network could be shaped. Although there is an appraisal process (STAG), lobbying for new routes becomes a case of who can "shout loudest", resulting in an apparent lack of equity.

Decisions with long term consequences (e.g. buying new vessels / starting new routes) have generally been based on incremental and operational factors. Within the STAG process, not all parties appear to understand or accept the importance of the "softer" issues, as opposed to the traditional cost-benefit approach to transport appraisal.

The absence of a strategy constrains investment in shore facilities. There is a perceived risk that ports presently used for services may see these withdrawn in future years.

Lack of vision on economic potential: Some hold negative and outdated perceptions of the islands' potential. The reasons for optimism include:

- The potential for broadband to substitute for physical presence in commerce.
- The islands' attractiveness in lifestyle terms.
- The maturity of package holidays, and the change and increasing sophistication in tourism markets such as eco-tourism, archaeology, heritage etc.
- The opportunity for renewable sources of energy.
- The potential for quality and niche products such as food and drink.

Geography and topography: It is self evident that remoteness and low density population on the islands makes it a challenge to provide transport to the communities that live on them, and to develop road links to appropriate landfalls.

Road networks: The quality of these sometimes constrains the ability to concentrate ferry services by increasing journey times to existing and potential ferry hubs.

Divided communities and vested interests: There are examples of tensions between island communities, and sometimes within individual island communities. Energies can become focused on individual instead of collective agendas. Vested interests outside the islands also exert influence that constrains island-centric development proposals.

Leadership can be unpopular: Local democracy is very close to the people in island communities, and it is difficult for political leaders to take up collective agendas when they represent specific island communities. The potential to develop and support a "radical" strategy aimed at an overall step change can therefore be constrained.

Change perceived as threat: It is fair to say that a significant number of stakeholders are both dissatisfied with the network and fearful of any change. This fear centres on past battles to gain / maintain / improve services, which people are concerned will be lost. In other words, it is better the devil you know than the devil you don't.

2.2.4 UNCERTAINTIES

Future funding for ferries: Public sector support for the ferry network is at a record high, as indeed is funding for Scottish transport in general. In the absence of any positive influence on demand due to (for example) marketing developments or pricing policy, the operating deficit is highly likely to grow in real terms even if fares are maintained in real terms. Continued investment will be required in new craft. In broad terms at least one vessel per year must be replaced.

Future development of road network and fixed links: On some islands, the road network is a serious constraint to economic development in general and improving overall ferry provision. For some crossings, it may make sense to develop fixed links in the longer term, and these will require significant funding.

A move towards shortening sea crossings implies more travel by road on the mainland, and this will impact on road investment needs. Travel by road may become more expensive through higher fuel costs and, in the case of freight, further regulations may be introduced regarding driver hours, etc. Some of these factors might, however, be offset if UK-wide road pricing was to make travel in rural areas cheaper.

Growth of air travel: It is unclear how far the intra-regional services will develop in terms of increased frequency and reduced fares. For services to destinations outside the region, the islands have yet to see any significant benefits from the "low cost revolution" beyond some reduced fares on full service operations. It is uncertain how far the islands will see the development of no frills services. This is compounded by the possibility of airfares rising to reflect both the environmental costs of air travel and longer term higher fuel costs.

Future tender process: It remains uncertain (June 2005) whether the CalMac network will be provided under a tender arrangement in the future. If it is, this represents a significant opportunity to encourage innovation in the provision of services, marketing, pricing, and vessel deployment over successive 6 year contracts.

Government may consider the opportunity to encourage innovation in tender responses, and avoid a tendency to produce specifications that largely reflect existing provision. While tendering a complete network has some obvious advantages (notably fleet coverage for relief and overhaul), it would make sense to maintain an open mind on this issue and review it in five years time in preparation for the second tender. As traffic grows, and vessel designs improve, it is major routes that offer the potential for new ways of meeting customer demand (novel types of craft, yield management, etc).

2.3 PRIMARY RECOMMENDATIONS

2.3.1 BEST VALUE

STAG is clear that strategy proposals should be robust under the impact of uncertainties. It would be unwise to base the strategy on a constantly expanding budget that continues the trend of the last 5 to 10 years. Our first recommendation is:

1) Best value should be at the heart of the strategy.

The two key questions are:

- How can more services be delivered with the same resources?
- Where are the opportunities to deliver high returns from modest increases in resources?

The network as a whole is very resistant to change for reasons discussed in the next section. However there may be opportunities to obtain better value from existing resources by:

- Changing landfalls to obtain higher frequency / shorter crossings.
- Concentration over fewer landfalls to increase frequency.
- (related to these…) Improved vessel productivity.
- New pricing mechanisms.

The main issues identified in consultation concerned facilitating off-island daily commuting, and the potential for island-based crew and island centred timetabling.

There are some routes where existing timetables could be altered to more fully meet the needs of island residents, and better support the objectives identified in Section 3. In particular, greater frequency and longer sailing days on some of the shorter west coast routes were highlighted. Reorientation of service timings to better meet needs of island communities should be considered, particularly with regard to off-island commuting on an all year basis.[1] Services that could reoriented in this fashion include:

- Ardrossan-Brodick
- Largs-Cumbrae
- Oban-Craignure
- Oban-Lismore
- Mallaig-Armadale

Consultation also highlighted a need for enhanced sailing frequency during the CalMac winter timetable to reflect trends in the visitor market. In part, this could be met through extending and regularising the present summer timetable.

2.3.2 A SOCIO-ECONOMIC APPROACH

Whilst the islands offer economic optimism for those with vision, it is clear that the economy of the Western Isles in particular is fragile. Even islands with stable or small growth in population have significant issues in terms of demographic balance.

Sea transport is a critical component in fostering balanced economic growth and population. This should be driving development of the strategic sea crossings. But a mixture of economic decline and population imbalance suggests that current efforts are not good enough. Why is this? There are currently two main philosophical drivers to the provision of the ferry network. These are:

- **Politics:** The Scottish Government has a significant role in providing ferry services, and this results in political agendas driving the operation and development of the network, rather than socio-economic fundamentals.

- **Custom and practice:** The types of vessels used, the ports served, and the fares charged are generally the way they are because they have always been that way, not because it is necessarily the best way to do it.

This should change. Our second recommendation is:

2) The future of the ferry network should have the socio-economic development of the islands at its core.

This means two things:

- Depoliticising both the philosophy behind providing the network and the way it is delivered.
- Higher level thinking and determined leadership in local communities to encourage debate and acceptance of changes resulting in overall improvements in services.

[1] This is in the context of a tight labour market in some mainland areas, due to existing population levels and structures, and presently low unemployment rates.

In practical terms, the important issues that would shape the network on the basis of socio-economic facts and potential would include:

- Understanding the impact of higher frequency / shorter crossings / lower fares and pricing strategies on the propensity to travel.
- Concentration of services to provide high frequency service and the development of hubs that offer potential for leveraging added economic value.
- Targeting linkages to sub-regional powerhouses (e.g. Skye, Oban) and using their attractiveness to leverage economic growth on the islands.
- Design services around the origin and destination of ALL classes of passenger traveller and the O / D of freight.
- Considering the national "freight off roads" agenda and the potential for development of coastal shipping services.

2.3.3 STRATEGICALLY LED DELIVERY

The provision and most importantly the development of the network are currently operationally led. Decisions are made on a marginal and incremental basis against a background of STAG appraisals. In the absence of any other influence (e.g. actual or the threat of competing services) this almost always leads to the conclusion of replacing vessels with something a bit bigger and hopefully a bit faster.

Significant change is needed in the philosophy behind delivering services on the SSC network. Our third recommendation is:

3) Future delivery of the ferry network must be strategically led and innovation-friendly.

This means three things:

- Not making investment decisions incrementally against an analytical framework that misses "the big picture".
- Encouraging tailored design and delivery concepts to emerge from the marketplace.
- Where appropriate, moulding the tender framework to encourage innovation in delivery of services, whether this is from the public sector, or in subsequent tender rounds from the public sector, private sector, island communities or combinations of these.

To be specific, delivery of the network in the future should be based around the following principles:

- Concentration of faster higher frequency services between strategic landfalls.
- Development of the road network to feed into these.
- Fixed links on short strategic crossings.

2.3.4 THE STRATEGIC ENABLER

These recommendations will not be easy to implement. As with all institutional change, such recommendations will take time to internalise into the stakeholders' way of doing business and users' expectations.

This does not mean that there is nothing to do now. Our fourth recommendation is:

4) An INDEPENDENT strategic body must develop the expertise and capacity to facilitate development of the future network.

This means that a body independent of the Scottish Executive or CalMac or NorthLink must develop knowledge, ideas and partnerships, and act as a fulcrum for the future development of the network.

There are several tactical projects that the Strategic Enabler should progress in the next one to two years to enable it to embark on this journey.

1 An **origin and destination study** covering sea, air and fixed link for both passengers and freight. This will allow the Strategic Enabler to develop its ideas from a position of facts rather than anecdote.

2 Undertake an **international benchmarking study** of cost structures and best practice for ferry services to establish how services provided within the network compare with public sector provision elsewhere as well as private sector and community models. This will enable HITRANS to gain a clearer perspective on what levels of service the communities could be receiving against different frames of reference.

3 Undertake a study based around **propensity to travel**. This should build on previous work such as the Western Isles Fares Study, and should include:

a. Assessment of demand elasticities.
b. Potential for yield management.
c. Impact of reduced crossing times.
d. Responses to fixed links (including an evaluation of the Skye Bridge and the Eriskay Causeway).

4 Foster **design partnerships** with the most innovative ferry designers and builders, to raise their awareness of the potential application of their products around the coast of Scotland, and encourage the development of workable innovative future design concepts.

3 OBJECTIVES

3.1 POINTS OF DEPARTURE

The strategy must be based upon the objectives it is trying to achieve. STAG advises that objectives should indicate desired change and its direction at the pre-appraisal stage, and that they should be developed in accordance with the following principles:

- Objectives will express the outcomes sought in the study area as opposed to any of the activities planned to achieve them.
- The formulation of objectives should take full account of a thorough investigation of the root causes underlying identified problems.
- The development process should be inclusive.
- If targets are associated with objectives they will be SMART.
- The objectives will reflect the core values of the planning proposal rather than established practice or what is easiest to measure.
- A regular dialogue will take place.
- They should be clear as to the geographic area of concern (the domain) and any existing priorities with which they must be consistent.
- Any existing resources in the form of previously established sets of objectives or data resulting from surveys or consultation exercises will be fully used in setting objectives.

We have recourse to the national objectives and those previously identified by HITRANS with respect to ferries. These are summarised overleaf.

We have developed objectives for the SSCs in accordance with STAG advice, and with particular emphasis on:

- Addressing the issues and the recommendations relating to underlying problems highlighted in Section 2.
- The output of a workshop held with the client group to discuss this topic.

National objectives	Existing HITRANS ferry objectives
• Environment (maximising the quality of the built and natural environment for enjoyment by all). • Safety (reducing the risk and incidence of accidents and improving the security of all transport users). • Economy (saving people's and businesses' time and money and facilitating desired economic development). • Integration (fitting the transport network together and ensuring a rational relationship between transport and land use and wider policy). • Accessibility (providing everyone (not just users but also non-users) with the means to travel to opportunities of all kinds).	• Discounted fares and reduced freight tariff. • Replacing vessels with faster/novel craft. • Fixed links to replace ferries and reconfiguring routes to provide shorter crossings. • Improving the quality of interchange facilities at ports. • Through ticketing and better information. • Improved frequency and convenience of schedules.

3.2 THE THREE OBJECTIVES

The fundamental objectives that the strategy must achieve are:

1. **Support economic development**
2. **Support sustainable population and communities**
3. **Promote integration with other transport modes, and with other policies**

The following sections explain these and suggest key sub objectives and proposals related to them. It must be remembered that these proposals apply over a long time scale. It would be sensible to revisit them in about 5 years time to assess their relevance at that time.

3.3 SUPPORT ECONOMIC DEVELOPMENT

The future of the islands depends on them having sustainable economies. The quality of provision on the SSCs is a key determinant of economic sustainability.

Three main sub objectives are proposed:

1.1 Facilitate business and industry, especially higher value added, to locate in the five areas.

- 1.1.a Encourage lower freight costs.
- 1.1.b Target day-trip accessibility to key economic centres.

1.2 Encourage increased tourism numbers thereby increasing local spend and supporting local businesses.

- 1.2.a Encourage lower fares.
- 1.2.b Encourage spread of tourism to all months of the year.
- 1.2.c Focus on and encourage niche markets e.g. outdoor pursuits, special breaks, impulse markets, events and charters, coach traffic where appropriate.
- 1.2.d Improve the accessibility of tourism infrastructure.

1.3 Support the service industries, including improving access to communities and their markets.

Specific proposals have been identified to support these:

- Replace short strategic crossings with fixed links.
- Separate freight and passenger services and landfalls where appropriate.
- Serve mainland markets nearer to the origin and destination where appropriate.
- Concentrate and develop passenger services with higher frequency on shorter crossings where appropriate.
- Focus on development of services to sub-regional power economies.
- Achieve and capture value added generated through concentration on hubs.
- Introduce yield management techniques and marginal cost pricing.
- Minimise costs and maximise revenues and vessel utilisation.

3.4 SUPPORT SUSTAINABLE POPULATION AND COMMUNITIES

A sustainable population (in terms of non-declining / growing numbers and a balanced demographic profile) is an economic necessity. This objective could thus be seen as a sub objective of "support economic development". There are however much broader social and environmental issues at stake here, and population deserves its own high level objective.

Improving accessibility and the broader built environment is at the core of this objective. The key supporting objectives are:

2.1 Retain and increase the population, and achieve a balanced demographic profile, maximising the economically active and retaining young people.

- 2.1.a Improve residents' quality of life by making the islands more accessible by sea.
- 2.1.b Increase air connectivity between the islands and the mainland key gateway airports.

2.2 Promote a community-centric open-minded approach to development of ferry services.

- 2.2.a Ground provision of services in the communities themselves.
- 2.2.b Ensure that "the big picture" is evident at community level.

2.3 Encourage social inclusion.

- 2.3.a Tackle barriers to inclusion by providing affordable access by sea to essential services, such as health and education, between islands and with the mainland.
- 2.3.b Promote inclusion among young people and children by offering better access to amenities and reducing "penalties" associated with accessing education.
- 2.3.c Improving accessibility to support opportunities for economic development and regeneration of communities.

Proposals to support these are:

- Provide for commuting on a daily basis to / from the key economic centres.
- Ensure ferry times are at "social" hours.
- Provide daily access to education services for all communities and where necessary ensure students can return home on a Friday for weekends.
- Understand origin and destination patterns for passengers and freight.
- Provide daily air services to the key economic centres.
- Champion innovation in tendering, provision, and development of ferry services.
- Work in close partnership with community bodies.

3.5 PROMOTE INTEGRATION

It is vital that the development of ferry services be pursued in the context of (and cross referenced with) national and regional strategies and policies for transport, and issues such as planning, housing, tourism, education, and health.

The case for integration is most obvious with respect to air transport, as this compliments movement of people by sea. Connectivity of travel by sea with buses and trains is the next most obvious. Less obvious is the need for parking and the potential application of car sharing schemes.

There is also a need to ensure that the strategy for SSCs and transport in general dovetails with other economic and spatial policies. For example, tourism will not develop if the industry does not provide beds and improve standards. Population cannot become sustainable if there are insufficient homes given trends to smaller households and the need for affordable housing. Flexibility in education delivery combined with scheduling of services may promote social inclusion. These are just examples.

The main sub objectives are:

3.1 Ensure the integration of transport policies with other national and regional policies and priorities.

3.2 Improve the integration and accessibility of inter-island and mainland transport services.

3.2.a Increase the availability and flexibility of transport ticketing, both virtually and physically.

3.2.b Ensure the integration of ferry services with road and rail services.

Proposals to support these are:

- Develop expertise and capacity in an INDEPENDENT Strategic Enabler of the future sea crossing network.
- Develop the road and air transport networks to be complimentary to and support the strategy for SSCs.
- Work in close partnership with other relevant transport bodies, and policy makers in other relevant disciplines.
- Be flexible in response to changing market and social conditions.

4 DEVELOPMENT OPPORTUNITIES

4.1 INTRODUCTION

An opportunity for development is an opportunity that presents the means to support the objectives. Achieving **best value** is a development opportunity, and specific comments are made on this in Section 2.3.1.

This section of the strategy concentrates on innovation in the network. There are six generic development opportunities to achieve this:

- Strategic development and upgrading of the ports and terminals network.
- Fixed links for strategic crossings.
- Alternative ownership models for ferry companies.
- Application of fast Ro-Pax craft.
- Application of a fast passenger only craft.
- Capture of land uplift value.

These are not separate ideas. They should be thought of a set of inter-related rings framed specifically in the context of:

- A broad socio-economic and community orientated philosophy, not driven by political and micro local issues.
- A strategically led delivery policy not based on individual and incremental STAG appraisals.
- An independent Strategic Enabler that will champion the strategy and the development opportunities.

4.2 THE PORTS AND TERMINALS NETWORK

Ports and terminals are arguably the most strategic element of the SSC network. Whereas ships are readily tradable assets with a world market, ports and terminals are fixed infrastructure affected by numerous commercial and development constraints (notably environmental issues).

The priority of ports and terminals and their role in sustainable strategy must be raised. Ports and terminals should be developed with the ability to accommodate appropriate vessels. These would include those available now or anticipated in the marketplace in coming years, as well as vessel designs optimised for the Highlands & Islands context.

4.2.1 INFRASTRUCTURE CONSTRAINTS

On the west coast, the vessels that can be deployed on particular routes are restricted by the ports' characteristics, particularly with regard to vessel draft. This, in turn, limits the innovation that can be brought into the tendering process through bidders proposing alternative types of ships for use on the CalMac network. If this issue is not addressed innovation in ship design may be stifled, with service provision falling behind that found elsewhere.

The Strategic Enabler should develop a strategic approach to future infrastructure investment. This is lacking at present, reflecting the lack of a strategic direction to existing ferry service provision. In practical terms it should assess the adequacy of existing ports to provide flexible infrastructure for the vessels in the marketplace – particularly faster vessels.

Specifically, there is also the longer term issue of capacity at Aberdeen. We understand that the dimension of the port's existing berths limited the design of the current NorthLink vessels. If future vessel design is to be optimal then the issue of berth capacity will need to be reviewed, with appropriate capital investment, and/or an alternative landfall considered.

4.2.2 CHARGING AND OWNERSHIP

As with the ferry services, much existing provision appears based on custom and practice. The Baseline Review has shown that there is a wide range of ownership patterns, encompassing CalMac (whose ports will subsequently be owned by the VESCO), local authorities and Harbour Trusts. They have varying levels of resources to invest and, in some cases, limited vision as to the potential of the facilities, including new technologies such as automated mooring.

An assessment should be made of the extent to which existing ownership patterns and charging regimes constrain development and contribute to high fare levels. Based on these findings, ideas should be developed that support the strategy's core objectives.

4.2.3 ECONOMIC POTENTIAL OF PORTS

There has been a general tendency to view ports and terminals as simply transport infrastructure. However, elsewhere in the UK they are recognised as supporting a range of activities on site and within their immediate hinterland. Examples include commercial and residential property, leisure and retail.

Ports also have a wider function in terms of gateways to the islands and are the first impression that a visitor gains. As well as physical appearance, this includes integration with other transport modes. In recent years, HIAL has invested considerably in the gateway element of its airports. It is also reviewing the wider economic potential of airport sites and surrounding land. There is a need for a similar exercise to be conducted regarding Highlands and Islands ports.

These issues are worthy of further consideration, not least because the potential opportunities will be quite site specific. In some cases, this may relate to a cluster of facilities around the port, such as the development of the tea room/restaurant and shop at the new pier on Eigg. Such developments will help to get greater value for money and economic benefit from investment in shore facilities. It also reflects the general objective of having socio-economic development at the core of the ferry network.

4.3 STRATEGIC FIXED LINKS

A fixed link is the ultimate sea crossing in terms of convenience and flexibility. It is not practical, however, to use fixed links for all SSCs because they are too expensive. The strategy must therefore balance the fact that they are by and large highly desirable against their affordability.

Affordability will be maximised where a fixed link is strategic. Strategic fixed links make a wider contribution beyond replacing the ferry service to a single island. They can act as catalysts for improvements to other transport services in an area and for development of local economies. For example, the causeways to Berneray and Eriskay allowed improved inter-island ferry services to be offered, thus significantly enhancing connectivity throughout the Western Isles as a whole.

This section reviews three issues:

- Technical considerations.
- How likely are fixed links to be affordable?
- Locations where fixed links are likely to be most affordable, and next steps.

4.3.1 TECHNICAL CONSIDERATIONS

The type of link that gives the best solution in a given situation can only be established at pre-feasibility stage. The main options are causeway, bridge, tunnel, and combinations of these. In terms of capital costs, the following situations favour one or the other:

- Causeways: Likely to be the cheapest where wind and wave conditions are benign, and where water is relatively shallow, and there is no need for navigation.
- Bridges: Likely to be lower capital cost than tunnels where the water is relatively shallow and high clearance for navigation is not required.
- Tunnels: Costs depend on depth and soil and rock conditions. If tunnels can be constructed with simple techniques in hard rock without encountering geological faults, they can be cheaper than bridges.

Specific safety requirements can have a significant impact on construction costs, e.g. if special emergency lanes / exits are required for use in case of fire.

Operating and maintenance costs vary considerably for the same solution depending on specific design. If tunnels need to be equipped with ventilation systems and pumping systems to keep seawater out, operating and maintenance costs are generally higher than bridges. But simple tunnels without these facilities may be less costly to operate than bridges.

Assuming that different options offer the same level of functionality (e.g. the same capacity, no difference in downtime due to bad weather, etc.), and equal impacts on navigation and the environment, the financially optimal solution is the one with the lowest total costs over time (lifecycle costs). Engineering studies are required to assess this, including consideration of the following issues to establish suitability and relative costs:

- Shore to shore distance.
- Need for construction of approach roads.
- Water depth.
- Clearance and maximum span requirements (for bridges) to maintain navigation.
- Soil / rock conditions.
- Environmental impacts and abatement costs.
- Aesthetics / architectural / landscape requirements.
- Safety standards - especially for tunnels.
- Trade off between capital costs and operating costs.
- Potential to integrate other uses (e.g. energy) into the design.
- Capacity of the link (number of lanes) based upon anticipated demand.

4.3.2 AFFORDABILITY OF STRATEGIC FIXED LINKS

Fixed links are economically affordable where total accumulated benefits over time for the transport users, transport operators and the rest of the society, outweigh the costs of the fixed link to society. This is determined by cost-benefit analysis, which should assess:

- Benefits from transport user cost savings (time savings, out-of-pocket savings, no inconveniency cost related to travel planning).
- Benefits from induced traffic.
- Benefits from savings in ferry related costs.
- Valuation of benefits such as wider regional economic development impacts and social inclusion (as noted by STAG).
- Costs in terms of investment, operation and maintenance (including environmental mitigation costs).

Financial and institutional issues must also be addressed such as:

- The financing scheme (who pays what).
- Ownership and responsibility for construction and operation of the link.

It is not possible at this stage to assess the viability of strategic fixed links. This requires knowledge of the appropriate technical solutions and investment costs to at least a pre-feasibility level (noted earlier). It also requires modelling of economic outcomes to properly identify benefits such as:

- Will the local economy be stimulated?
- How much more transport demand will the fixed link generate?
- How will ferry routes be affected and what costs can be reduced or avoided?
- What is the value of all the economic gains?

The economic benefits of fixed links reflect, to an extent, the quality of existing ferry service provision. In the case of Eriskay, the fixed link represented a step change in transport provision compared with a continued ferry service. The very tidal nature of the waters meant that the island was cut off, during the daytime, for a considerable number of hours. In other cases, where a ferry service has a high frequency and low fares, the introduction of a fixed link will produce relatively low economic impacts.

We have attempted to "get a feel for" their viability by undertaking simplified cost-benefit analyses for two hypothetical examples of replacing ferry services with non tolled fixed links. The two examples are based approximately on the present traffic numbers and distances for the Sound of Harris (5km short distance example), and the Pentland Firth (15km long distance example). The detailed workings of these are presented in Appendix 1.

The case studies show that neither fixed link is economically viable based upon the assumptions made. Notably these included relatively conservative construction costs. Sensitivity analysis shows that the projects might be acceptable under the following conditions:

- 5km case study: traffic induced to 4 x existing levels, and construction costs reduced by 40%.
- 15km case study: traffic induced to 3 x existing levels, and construction costs reduced by 20%.

C*aution*: these case studies do not prove that strategic fixed crossings are unviable, but we can draw the following conclusions:

- Traffic levels would have to be much higher than in the examples to make such investments feasible. Traffic levels would, however, be likely to increase significantly above existing levels where the crossing is truly strategic. This and the value placed upon induced traffic are critical factors for the analysis of individual fixed links. Reductions in construction cost will lower the target volume of traffic required to breakeven.
- Construction cost is a critical factor. The main challenge for economic justification of fixed links is to develop low cost designs - which can only be demonstrated in an engineering study. For all types of fixed link, investment costs will vary substantially with the local conditions and requirements.
- Truly strategic fixed links will produce other benefits, e.g. the ability to concentrate two routes to one, and achieve higher frequency to a wider community. Modelling of the projects must capture wider economic impacts beyond simple user benefits.

4.3.3 RECOMMENDATIONS

Based on this discussion, and particularly the need to consider potential affordability, the strategic fixed links worthy of further investigation include:

- Pentland Firth: This could provide a significant stimulus to economic development in the north of Scotland and Orkney, as well as replace two existing ferry services.
- Sound of Harris and/or Sound of Barra: These would further enhance the impact of the Berneray and Eriskay causeways, permit greater geographic concentration of island ports offering mainland sailings, and allow potential replacement of two services with one fast ferry.
- Coll and Tiree: This would mean that the mainland ferry would no longer need to call at both islands, making the vessel used more productive in terms of sailing frequency.
- The Clyde Estuary: A fixed link network, for example linking the Cowal Peninsula and the south bank, and Bute and the peninsula, would provide significant economic stimulus to all geographic areas.

We do not preclude individual, non-strategic fixed links being introduced to some islands. However, the social and economic benefits would accrue only in relation to the island / area served, making the capital investment more difficult to justify.

The Strategic Enabler should promote development of strategic fixed links as a long term strategic goal. The case study overleaf illustrates how fixed links form the backbone of the transport strategy for Southeast Alaska, a region with similar characteristics to the west coast of Scotland.

The long term fixed link programme should be based on a systematic process for assessment including:

- Agreement on the strategic fixed links that warrant further investigation.
- Pre-feasibility assessments / surveys and modelling for selected locations.
- Preparation of a detailed feasibility programme for the strategic fixed links that are most likely to be affordable.
- Detailed feasibility studies of specific options for each location (full demand, economic, technical and environmental analyses).
- Preparation of a draft long term investment programme.

Case Study: Transportation plan for Southeast Alaska

Southeast Alaska has remarkable similarities to the west coast in terms of population, peripherality, and transport system challenges.

A new Southeast Alaska Transportation Plan was published in 2004. Described in characteristically American terms as "The Ultimate Plan – Development of the Essential Transportation and Utility Corridors", it identifies 34 essential transportation and utility corridors to be reserved and protected to meet future transportation needs. The ultimate highway development plan is to construct fixed links through all of these transportation corridors.

Retirement of older ferries operated by the Alaska Marine Highway System will occur as new ferries and roads are constructed. Following completion of highway links serving key towns, the primary roles of ferries in Southeast Alaska would be expanded operations of new fast vehicle ferries, shuttle ferry connections, and services to less populous communities that remain isolated from the land highway network.

The performance of a new fast ferry, the Fairweather, is being evaluated to determine whether these are the answer to replacing an aging fleet. Her introduction in late 2003 was described as "the most significant change in the Alaska Marine Highway's System's 40 year history." A second sister ship, the Chenega, was also put into service in 2005.

4.4 FERRY COMPANY MODELS

4.4.1 OPTIONS

The operation of a large network of ferry routes of greatly differing characteristics with vessels owned by a single company is unusual. More common is for larger companies to concentrate activities on routes requiring large ferries, leaving individuals or small companies with low overheads to operate shorter routes with smaller ferries.

The State owns CalMac, and CalMac owns 50% of NorthLink. The current ownership structure is therefore dominated by the **public sector**. The only other large scale public sector ferry company that we are aware of outside Scotland is the Alaska Marine Highway System. This operates 11 vessels including two new fast vehicle ferries.

Most ferry services are operated by the **private sector** using a combination of owned and chartered vessels, which enables flexibility and mitigates risks. The forthcoming retendering of the NorthLink network, and the likely tendering of the CalMac network, may encourage some private companies to enter the market.

There are pros and cons of these two models, and often the debate on their merits centres on ideology and fears rather than logic. This has given rise to the so-called third way of **public private partnership**. This may be defined as "a risk sharing relationship based upon a shared aspiration between the public sector and one or more partners to deliver a publicly agreed outcome". This seeks to harness what the two are best at e.g.:

- Public sector: security of supply and relatively low cost of capital.
- Private sector: efficiency and innovation.

There is a fourth model that has merit. This is **community** ownership and operation of ferry services to the community.

4.4.2 COMMUNITY MODEL

There are a number of examples of ferry companies operated by communities:

- Ferry services in Norway operated either by the local community or by very small local authorities. In the former case, the Florø kommune owns and runs the ferry to Svanøy, which appears to be a reasonably large vehicle carrying vessel.
- On Lundy island the ferry MS Oldenburg is operated by the Landmark Trust, which is a charity that owns much of the island. Details of their ship can be found at (www.lundyisland.co.uk).
- Transmacor (www.transmacor.pt) in the Azores is owned jointly by islanders and local government. They operate conventional monohulls and fast catamarans.
- The Isles of Scilly Steamship Company (ISSCo) (www.islesofscilly-travel.co.uk) owns and operates ferries deployed between the Isles of Scilly and the mainland, as well as some inter island services. A local Boatman's Association operates services to the off-islands.

Case Study: Community ownership in the Isles of Scilly

This is a group of over 100 islands 23 miles south west of Lands End. Six of the islands are inhabited with a combined population of around 2,000, a figure that can double during the tourist season.

The largest of the island group, St Mary's, is connected to the mainland by a multipurpose ferry, the Scillonian III, and a freight ferry, the Gry Maritha, as well as air services. The Isles of Scilly Steamship Company provides these.

Islanders formed the company in 1920 as a private limited company with share capital that was initially held entirely by islanders. The company now has 850 shareholders of which 30% to 50% currently live on the islands. The non-resident shareholders are generally ex residents.

The Board of Directors has to approve all share transfers. Until recently all the Directors were islanders but in recent years non-islanders have been bought in for special skills. Of the current 9 Directors 6 are resident in the islands.

ISSCo has a share capital of just over £1m and made a profit after taxation of £458,000 on a turnover of £7m in 2004. The turnover is split more or less equally between services by sea and services by air.

The company started services with a second-hand ship, which was replaced by a new build in 1956. The second new build replacement was constructed in 1977, and another replacement is planned. The Gry Maritha was purchased second-hand in the early 1990's. ISSCo receives a small government operating subsidy for its inter-island service, but none for the mainland link. Details of the vessels and services are provided in Appendix 2.

The ferry services linking the off-islands to St Mary's are co-ordinated by the St Mary's Boatman's Association. Association members operate 15 or more vessels, which are generally owned by individuals or family firms. These carry both passengers and small freight. The boats have traditionally been large open boats although recent grant-aided replacements are fully decked with enclosed passenger accommodation for 30 to 40 passengers.

4.4.3 APPLICATION OF COMMUNITY MODEL TO SSCS

In the short to medium term, a pilot project on community ownership might be progressed. It can be expected that this model would result in vessels being island-based. This would have a number of benefits:

- The use of island-based staff, thus creating local employment. This is the present practice of Western Ferries on their Cowal service.
- The ability to operate the first sailing of the day from, and the last sailing to, the island concerned. Based on our consultations, this would be more beneficial to island residents than the reverse pattern of sailings. It would offer longer hours on the mainland and open up potential for off-island commuting.

Given the complexity of operating larger vessels, it is possible that this could be piloted on one or two routes that use smaller vessels, e.g. Loch Class, with only limited crew numbers.

The vessel could be procured through charter or purchase and operated by a community trust/company. Such organisations are becoming increasingly common in the islands, whether through community based land buyouts or, more recently, the development of community-based energy companies, which aim to maximise the local benefits from renewable energy projects.

Alternatively such organisations could use the available funding to contract with a third party provider to deliver a specified service. This could either be a local company or one from further afield.

Clearly, issues would need to be resolved regarding overhaul/relief vessel cover and possible joint marketing/ticketing with other ferry operators. These are solvable e.g. by reciprocal arrangements amongst companies, or by holding a relief vessel in State ownership, and must not act as a barrier.

4.5 APPLICATION OF FAST RO-PAX CRAFT

4.5.1 OVERVIEW

Currently all CalMac ferry routes are served by conventional medium speed Ro-Pax ferries. Only one of CalMac's fleet has a service speed above 16.5 knots and most are significantly slower.

In order to meet the desire for increased frequency of service, it may be possible on some routes to substitute a conventional ferry with a smaller fast ferry that would achieve the same, or greater, route capacity by making more return trips each day.

What is a fast ferry? A widely accepted definition is a lightly built ferry with a service speed in excess of 25 knots (it is worth noting that the latest conventional ferries on the English Channel now have service speeds up to 29 knots).

The most widely used fast ferry hull form is currently the catamaran. This vessel type has a track record of providing fast and efficient services for both passengers and cars in comparable locations such as Alaska. These vessels have a shallow draft (<4m) and would be able to access many ports in the study area subject to clearance for propulsion jets. However, development of fast commercial craft is ongoing and there are many other types of hull form in various stages of development.

Research into fast ship design is focussed on improving speed, fuel efficiency, sea keeping ability and passenger comfort. Appendix C1 explains the current main marine vehicle development concepts. Many of these concepts are hybrids of several vehicle types that have been devised to combine their various benefits.

Future development will produce vessels that are more suitable than the current designs for exposed locations such as those on some Highlands & Islands routes.

Routes where a fast craft may be suitable will have the following general characteristics:

- The route will be reasonably sheltered from the prevailing wind direction as fast ferries may have limitations on sailing in rough water.
- The route should not be too complex so that a high proportion of transit time can be spent at cruising speed.
- The route traffic mix should support fast ferries, with alternatives for HGVs as only the largest fast ferries can accommodate these.
- The route should not be too short (to obtain benefits of speed), or too long if exposed to open seas. Too short a route will not allow a fast ferry to deliver significant time savings since passage time is a small proportion of overall block time. Too long a route may be stressful for passengers in adverse weather.
- To deliver major cost savings the fast ferry should ideally replace two (or more) conventional ferries.
- It should ideally fulfil a need for higher frequency where there is demand or social need for this.

4.5.2 APPLICATION TO THE SSCS

While all existing routes will be considered for either additional or replacement vessels in the future, prioritisation is needed with regard to short term assessment for fast ferry services.

Based on the broad criteria listed, seven routes have been identified as offering the most potential. Analysis was then undertaken to assess the priorities within these for further study. The results of this are summarised below in Table 4.1. The methodology and assumptions used is described in more detail in Appendix C2.

Table 4.1: Relative priority for fast Ro-Pax routes[2]

Route	Route length	Route complexity	Sea state	More sailings?	Fast ferry only?	Priority for study
Scrabster - Stromness	3	3	1	1	1	Low
Ullapool - Stornoway	3	3	1	2	1	Low
Uig - Tarbert	3	2	2	2	3	High
Uig - Lochmaddy	3	3	2	2	1	Low
Uig- Tarbert - Lochmaddy Comb	3	2	2	2	2	High
Kennacraig - Islay	3	1	3	3	2	Medium
Ardrossan - Brodick	1	2	3	2	1	Low
Oban - Craignure	1	2	3	2	2	Low

To summarise the analysis:

- Scrabster-Stromness: The length is such that the route could see an increase in the number of sailings, and the cargo mix is suitable for a solely fast ferry service, but it is across a very exposed route. While a solely fast ferry service might be viable, the sea state might cause a fast ferry service an unacceptably large number of delays.

- Ullapool-Stornaway: The length is such that the route could see a significant improvement in the number of sailings, but the cargo mix is not suitable for a solely fast ferry service and the route is exposed to the north and west. Due to the route length, the sea state may mean that journeys could regularly be uncomfortable.

- Uig-Tarbert: The length is such that the route could see an increase in the number of sailings and the cargo mix is suitable for a solely fast ferry service. The sea state is not ideal, but is unlikely to cause unacceptable delays or discomfort to passengers.

- Uig-Lochmaddy: While similar to the Uig-Tarbert route, the cargo mix is unsuitable for a solely fast ferry service.

[2] 3 = most suitable; 1 = least suitable

- Uig-Tarbert-Lochmaddy Combined: It may be possible to combine the Uig routes using a fast ferry to serve all three destinations, in conjunction with a conventional ferry to cater for the HGV demand.

- Kennacraig-Islay: The length is such that the route could see an increase in the number of sailings, but the cargo mix may not be suitable for a solely fast ferry service. The likely sea state is highly suitable and should not cause unacceptable delays or discomfort to passengers. It is likely this route would need a conventional ferry service to cater for the HGV demand.

- Ardrossan-Brodick / Oban-Craignure: While the sea state is highly suitable and should not cause unacceptable delays or discomfort to passengers, the length is too short to see a significant increase in the number of sailings and the cargo mix is unsuitable for a solely fast ferry service.

The two limiting factors are therefore:

- The cargo mix: inability or poor ability of "normal" fast ferries to carry large vehicles means that conventional vessels may still be required carry the heaviest traffic, but on a less frequent service than is currently in place. This system is already in use on the Ullapool-Stornoway route, where a freight service transits overnight with the heaviest traffic. Separation of freight and passenger services is a desirable goal.

- Seakeeping and passenger comfort: This constraint will progressively be overcome with the development of new designs. The Strategic Enabler needs to work with designers to achieve this.

4.5.3 COMPARATIVE COSTS

Fast ferries travel at higher speeds than conventional ferries. This has two consequences:

- Faster transit times and higher frequency stimulate demand (i.e. traffic volumes rise), and also permit higher prices because the service is better.

- Fast ferries require significantly more fuel to operate, and this means higher fuel costs.

To illustrate this, we made a comparative analysis of fuel costs for *similar sized* monohull and catamaran vessels. Assuming that other operating costs remained equal, we assessed the level of uplift required to generate the same voyage margin.

The case study (see Appendix C3) shows that in the time taken for a single trip by a conventional ferry, the fast ferry will make two trips and use more than twice as much fuel. However, this will double the route's traffic capacity, as twice as many passengers and cars can be carried.

Assuming demand for services and prices remain at constant levels, the fast ferry is significantly less profitable to operate because its utilisation is half that of the conventional vessel. In broad terms, the fast ferry may only generate a positive margin (revenues in excess of the running costs) when the average utilisation exceeds 40%.

The analysis assessed the conditions that would be required for the fast ferry to make the same margin as the conventional vessel it replaces. These conditions are:

- A 25% increase in average prices, combined with
- A 50% increase in traffic volumes

In practice, many fast ferry services serve seasonal markets, and winter and shoulder services would typically reduce proportional to the traffic. This would reduce the uplift required to achieve the same margin.

To further illustrate comparative costs, Table 4.2 presents key facts for two vessels:

- Hebrides: one of CalMac's most recent ships.
- Chenega: a modern fast ferry operated by the Alaska Marine Highway System.[3]

Table 4.2: Conventional / fast ferry comparison

	Hebrides III	Chenega
Length	99m	71.75m
Beam	15.8m	18.0m
Draught	3.22m	2.65m
Deadweight	5506 tonnes	200 tonnes
Service Speed	16.5 kt	35.5 kt
Passengers	612	250
Cars	90	70
Crew	34	14
Cost	£15m (2000)	£20m (2004)[4]

Depending upon the utilisation of the Hebrides III, it is possible that the Chenega could offer similar capacity. There would be trade-offs on costs as follows:

- Chenega costs some 35% more, and would probably use more fuel even though the Hebrides III is about twice its capacity.
- But Chenega's crewing requirement is only a fraction (41%) of that for the conventional vessel.

[3] It is interesting to note that Chenega is capable of operating in sea state 6 (significant wave height 4.2 to 6.0m) which would make it suitable for service on a number of west coast services.

[4] Nigel Gee & Associates have also recently designed a 30 knot 20 car capacity Ro-Pax ferry for the Great Lakes. The vessel has been priced at £11.4m, but has not yet been built.

4.5.4 CONCLUSION

The route analysis and case studies give a feel for the application of fast ferries to the Highlands & Islands SSCs. The conclusions we make on fast Ro-Pax ferries are:

- Some routes offer favourable characteristics for their application.
- There are trade offs between capacity, capital costs and operating costs (fuel and crewing).
- Viability depends upon what they are replacing, in what circumstances, and the potential for demand to respond to better services.

Fast Ferries are a key potential component of an *overall strategy* that concentrates on economic stimulation through higher frequency, shorter crossings, concentration of routes, and associated investment in fixed links. The case study on the following page illustrates how fixed links combined with fast ferries have shaped the development of the Scandinavian transport network over the last 15 to 20 years.

A replacement fast ferry for each route would need be specified based on the capacity that it is replacing, the average and peak utilisations of this capacity, the potential for traffic growth due to better services, seasonal profiling, and the operational factors discussed in the previous sections. Such appraisals would therefore be significantly underpinned by other work recommended on origins and destinations, and propensity to travel.

As with the Great Lakes or Alaska routes, it is likely that the specific requirements for fast ferries in the Highlands & Islands would benefit from a purpose designed vessel. A number of designers and manufacturers would undoubtedly be keen to develop relationships with the Strategic Enabler on the grounds that there is, in principle, good opportunity for their products on the SSCs.

A database on fast ferries should be prepared and maintained, and manufacturers encouraged to develop financially viable and economically desirable design concepts for the SSCs. This could, for example, be accomplished in the form of a design competition.

Over the short to medium term, the Strategic Enabler needs to build expertise in the application of fast ferries, and then use its position to influence strategic development of the network with their inclusion.

Case Study: Development of fixed links and fast ferries in Scandinavia

The development of ferry services in Scandinavia had its golden era in the 1950s and 1960s, due to huge growth in car traffic. More recently, the network has developed under the influence of both fixed links and fast ferries.

Over the last 15 to 20 years, a number of ferry routes have been replaced with new bridges and tunnels. Combined with general improvements in the road network, these have allowed drivers to stay in their cars and drive around fjords. Although about 20 ferry associations still operate in mid Norway, the number has halved in this period as ferry services have become redundant. Examples include the construction of fixed links to the mainland from Hitra, Frøya and Fjellværøya in Norway. These made several ferry routes redundant.

In Denmark the Great Belt fixed link opened in 1998 between Nyborg and Korsør, replacing the largest Danish ferry routes for both road and rail transport. Before the opening of the link the average daily number of vehicles was about 8,000, but this volume has almost tripled under the influence of the fixed link. Part of this increase in traffic comes from other east-west ferry routes and domestic air routes, which have lost traffic. The two main ferry routes competing with the fixed link are now serviced by modern catamarans with maximum speeds of 45 knots (see below).

More modern vessels have been put into operation on many of the routes where fixed links have not (yet) been considered feasible. In Norway, vessels in scheduled service are found in three categories: traditional (service speed 10 - 15 knots), modern faster vessels (service speed 15 - 20 knots) and fast vessels (service speed above 20 knots). The number of fast vessels, primarily larger types, have increased significantly during the last 10 to 15 years, but the type of vessels used on specific routes continue to reflect the route characteristics.

Table 4.3 below illustrates characteristics of a variety of fast vessels, both Ro-Pax and passenger only, operating on Scandinavian routes.

Table 4.3: Examples of fast ferries on Scandinavian routes

Name	Country	Length (m)	Width (m)	Capac. Cars	Capac. Pax	Speed knots	Year
Mie Mols	Denmark, Kattegat	76	23	120	450	45	1996
Max Mols	Denmark, Kattegat	91	26	220	800	45	1998
Draupner	Norway, Bergen-Stavanger	42	12.5	No	358	38	1999
Vingtor	Norway, Bergen-Stavanger	40	10	No	279	36	1990
Dønna	Nordland, Norge	27	9	20 t	47	26.5	2003
Thorolf Kveldulfsøn	Nordland, Norge	29	8	8 t	100	30	1995

4.6 APPLICATION OF FAST PASSENGER ONLY CRAFT

An issue for use of fast ferries on the west coast has been the perceived need for multi-purpose vessels that can cater for both passengers and vehicles. This reflects the relatively limited market for passenger only services in many locations due, in part, to low population levels on many islands.

However, the Clyde area is somewhat different. It has a relatively high population level: for Cowal and Bute combined this is 22,600. As a consequence, their three main services (to Wemyss Bay, Gourock and McInroy's Point) convey over 2.6 million passengers per annum. Both locations are relatively close to the populous west central belt. Glasgow City alone has a population of 578,000: that is, over 11% of the total Scottish population.

While landfalls for the existing ferry services are within Inverclyde, the main trip destination for local residents is the Glasgow area. Fast direct passenger services between Cowal and Bute would radically alter actual and perceived access to and from the Glasgow city region. This would be through offering fast and direct connections, avoiding the present need for interchange between different modes (ferry / road and ferry / public transport).

A fast service's image is likely to appeal to those who presently would not consider using public transport to make trips between the two locations. In addition, the road links between Inverclyde and the city region are likely to become increasingly congested over the next 10-20 years making alternatives more attractive.

A fast craft operation would produce economic benefits at both ends of the route. First, the city region would have a greater number of residents in its labour market catchment. It would also ease pressure, to some extent, on housing and other resources by making Cowal and Bute attractive places to live for those working in the city region.

Cowal and Bute could benefit from an increased number of residents, with their associated expenditures within the local economy. There would also be increased opportunities for existing residents to commute to work in the city region, whether daily or less frequently. Cowal benefited from an increase in commuters during the 1990s, as people moved into the peninsula to buy housing stock that was disposed by the outgoing US military. This, and the physical regeneration of Rothesay, is indicative of the potential of both areas to be more economically vibrant than at present.

However, both locations continue to face demographic and economic challenges. Their combined populations fell by 5.2% between 1991 and 2001, compared to a slight increase in numbers within the Highlands and Islands as a whole. Unemployment rates have, in recent years, been above both the HIE and Scottish levels and are some of the highest among the region's Travel To Work Areas.

The service would also encourage tourism by:

- Stimulating the weather / impulse led day trip market to Cowal and Bute from the city region, through off-peak sailings.
- Generating additional demand for short breaks, particularly over the weekend.

The nature of the route, along an urban river with semi open water at the downstream end, is similar to other urban rivers where riverbus services have been introduced. Several shipbuilders have developed vessels specifically for this type of service; their principal characteristics are that they are moderately fast, with service speeds of circa 25 to 30 knots, are catamarans with long narrow hulls to produce minimum wash, and are generally single decked with low headroom for passing under bridges. Passenger capacities for this type of vessel vary from around 60 to 220. They can usually also carry bicycles.

For service on the Clyde a mid-range size of vessel with a passenger capacity of 120 to 150 is likely to be most suitable. Smaller vessels are less able to cope with the more open water in the lower reaches of the Clyde while larger vessels are more expensive to operate unless passenger load factors are high.

A suitable vessel could be of the type recently selected, but never implemented, by Clydefast; these were NQEA River Runner 150 Mark 3s. The two vessels selected by Clydefast have now entered service on the River Thames operating between Woolwich and Central London.

The principal characteristics of the River Runner 150 are:

- Length: 31.9m
- Beam: 7.8m
- Draught: 1.3m
- Deadweight: 13.15 t
- Passengers: Saloon: 114
External: 24
Total: 138
- Speed: 25 knots

The cost of these vessels new is circa £3.5m. Operational cost would be around £200,000 per annum with fuel costs, depending upon degree of usage, also being around £200,000.

On the Thames these vessels operate a commuter service morning and evening extending nearly 15 miles to the East of Central London. During the day they operate over a shorter route within Central London.

Route lengths on the Clyde would be comparable with the Thames, with the distance from central Glasgow to Gourock being approximately 25 miles. Journey times would depend upon the number of stops made and speed restrictions imposed by the navigational authority. Dialogue is needed to minimise these.

The number of vessels required would depend upon the length of the route proposed, the number of stops and the service intervals. However, two vessels are likely to be the minimum necessary to provide a credible service, although three or four would be preferable.

It is common to commence a service using second hand or chartered vessels particularly where the level of demand for the service is difficult to predict. There is always a selection of second hand vessels on the market although finding the correct ones can take time.

Vessels that are in plentiful supply would not necessarily be suitable for the Clyde either because they have deep draught (e.g. Russian hydrofoils) or because they have too much air draught (e.g. many twin decked catamarans). However, second hand vessels can be secured considerably cheaper than new vessels and a ten year old 200 passenger fast catamaran would typically cost in the region of £1m.

In order to determine the viability of fast passenger services on the Clyde, a feasibility study is required to examine potential demand, fare structures, routes, shore infrastructure costs, vessel costs, operating costs and timetabling. This could act to update previous research that has been carried out.

Importantly, it would also have to address the issues of:

- Access to existing shore infrastructure and financing of any modifications or new facilities that would be required.
- Whether operating subsidy would be available, as per most other public transport services in the area.
- Impacts on existing ferry service provision to Cowal and Bute.

4.7 LAND UPLIFT CAPTURE (LUC)

4.7.1 POTENTIAL FOR LUC

Taken as a package, the five opportunities that have been identified will make a significant, possibly even a profound, impact on the economy of the Highlands & Islands.

The vision is one of people being able to travel more frequently *and* quickly *and* conveniently on more appealing craft via attractive and interesting gateways. This can have a substantial impact on the value of land neighbouring terminals, and possibly even whole towns or islands.

We are of the opinion that there is an opportunity to capture uplift in land values to fund ferry services in the Clyde estuary and at Oban:

- If a fast ferry service was provided between Glasgow City Centre and Dunoon, Rothesay and possibly Millport, there is no doubt that land and property values would rise substantially in these towns. If some of this value can be captured, it will provide substantial funding for either capital or revenue support of the service. It may be that this will require a methodology that applies to all new developments in these towns and surrounding areas and this would have to be explored.
- The area around the terminal at Oban is also an opportunity to capture LUC. This could be part of a regeneration plan for the area increasing residential densities and creating mixed use sustainable communities. The combination of improved connectivity and waterside living is an attractive proposition given that Oban has the greatest number of ferry arrivals and departures in the network.

Land uplift is real. There is substantial research measuring the uplift in land and property values around transportation lines when the connectivity of these lines is improved. This applies to all fixed transportation facilities, e.g. busways, LRT, heavy rail, roads and terminals. Terminals include all modes - rail, road and ferry. This is not a new phenomenon:

- The Metropolitan line in London and the Canadian Pacific railway both used increased land values to fund their projects.
- More recently, the Oerstat regeneration project in Copenhagen funded 100 % of its LRT through land uplift capture (LUC).
- Research on a new ferry terminal in Australia shows that a house within 800 m of the terminal will increase in value by 10-20 % on average, purely because of the new transport facility.

The LUC can be substantial amounting to many millions of pounds. For example, the research shows that on average in the UK a house will gain in value by 10%. This is an additional profit for the developer over and above planning gain and is created solely by the improved transport connectivity. It is therefore fair and reasonable that the funders of the transport project receive a proportion of this extra profit.

4.7.2 CAPTURING LAND UPLIFT

There are various options for raising funds from property value uplifts:

A **Compulsory Purchase Order** (CPO) can be raised either by an individual or company in addition to the Local Authority. The grounds for promotion are fairly strict and the entire process is open to challenge by the public. It is very laborious, time consuming, and the grounds need to comply with CPO rules. It is our understanding that a CPO to secure planning gain is difficult to justify. However, an order to introduce a public transport facility would probably comply. It should be noted that CPO s only work for areas that are needed; you cannot CPO more than you need.

Section 106/75 agreements can be attached to planning consents and any financial contribution paid to the Local Authority or a third party as agreed. Traditionally these agreements have been entered into with Councils aiming to secure what is considered appropriate in planning gain terms. This method can only capture uplift where planning consents are granted and even then may not attract the maximum available. Section 106/75 Agreements are put in place at the time of planning consent, which may not be when the gains to be honoured have matured.

The Transport Provider becomes the land developer. The transport provider could buy up, or have transferred to it, land and buildings, hold them until the transport was in place and then sell for the best price. However, there are a number of problems associated with this strategy. For example, owners may be reluctant to sell and if they are properly advised, they will sell at the correct market value. The holding of vacant properties could be expensive and, require a team of professionals managing the estate. Lastly, there would be a need to take the risk of declining markets.

In the past Government has sometimes intervened and introduced a **tax on betterment and land gain**. These taxes have rarely succeeded. We understand the Government is examining this issue, which may include CPO powers in their long term strategy. In Eire, the Government introduced a tax system last year and it remains to be seen whether it will be successful. No land gain tax exists at present in the UK, although developers' profits and income are taxed and technically these could be channelled into transport. However, successive Chancellors have been reluctant to segregate funds in this way. These tax powers are not currently available.

Land transfer: If a Council transfers to the transport venture all its land which is directly linked to the transport system, then an opportunity arises to enjoy the proceeds from all planning gain without the risk associated with property development. The Council could sell the land at current market value and, once the line and stations were fixed, a development team would lodge a planning application to maximise the values achievable, selling the land to developers and builders at the most advantageous time and price.

Voluntary Contribution: This is the method E-Rail Ltd has developed and further details of the methodology follow.

4.7.3 THE E-RAIL MODEL

This mechanism captures land uplift and conforms to current rules and regulations, specifically with respect to procurement and the independence of planning. The methodology has been applied to 22 projects in the UK, Canada and Australia. The company that has done this is E-rail Ltd, based in Edinburgh and backed by the Bank of Scotland. It uses a two stage methodology:

Stage 1: Preliminary assessment of the land uplift capture (LUC) provides initial LUC valuation of sites and ranks them with respect to planning policy deliverability. The Stage 1 report identifies the maximum and expected sums that can be secured. It sets out the E-Rail methodology within the client's transport and planning framework, and explains how a Stage 2 appointment falls within EU&UK procurement and best value rules and regulations.

Stage 2: E-Rail approaches landowners and holders of interest in property, and enters into negotiations and agreements with them to deliver the contributions from LUC to a protected transport trust fund. Funds are released only when the transport project contract is placed. These agreements are independent of the Local Authority or the transport procurer and allow planning departments to act independently as they have no knowledge of agreements. These do not affect section 106/75 arrangements which councils wish to enter into, except they cannot recover a contribution for the specific transport project twice.

In practical terms, the typical method of application is:

- The Council/Sponsor enters into a 50:50 joint venture with E-Rail by establishing a company (JVCO) to raise the contributions from landowners/developers.
- JVCO appoints E-Rail through a management agreement, to negotiate on its behalf with relevant landowners/developers and raises the targeted funding.
- JVCO sets up a protected trust fund to receive the funds raised by E-Rail and, at the appropriate time, remit these as grants towards the construction of the designated transportation system.
- E-Rail undertakes fund-raising on behalf of the JVCO solely in return for an agreed percentage of funds raised. This is payable to E-Rail only when the developers pay over their contributions to the trust fund managed by JVCO.

The E-rail methodology obtains the participation of landowners / developers because they receive a proportion of the extra profit from transport without risk. It provides a method of sharing extra profits / uplift with them. It resolves the multi ownership issue because each Voluntary Contribution Agreement is confidential to each landowner/developer.

The Council/Sponsor has the discretion to raise the needed funds in this manner by the way in which JVCO is established and structured and by the terms upon which the monies are granted towards the building of the transport system. It should be noted that this can all be done without a JV being established, indeed the first two Stage 2 projects being carried out by E-rail have not used a JV. The choice is up to the client.

Government and regulatory bodies are positively inclined towards this strategy for three key reasons:

- It demonstrates that the local project "sponsor" is adopting a proactive approach to secure contributions towards the capital cost of the project.
- It indicates that local enterprise is prepared to plough back some of the financial benefits which will accrue to them from the project.
- It ensures that the transport system will be speedily completed and fully exploited within the community when finished.

The methodology has been audited by Counsel in both England and Scotland by E-rail and a Local Authority in Scotland.

This methodology has been proved to work, it supports sustainable development and the equity of transport benefiting from the wealth that it has created is compelling.

4.7.4 CONCLUSION

The E-Rail approach is worthy of further exploration, perhaps through a pilot study and Stage 1 Report in one of the target areas, i.e. the Clyde Estuary or Oban.

NB: E-Rail has evolved this methodology and is awaiting a patent both in the UK and North America. To the best of our knowledge the expertise and information base to apply this process is not available elsewhere.

5 MAPPING OBJECTIVES AND IDENTIFYING PRIORITIES

Based on the analysis undertaken, this section brings together the four key strands of the strategy:

- Objectives
- Primary (institutional) recommendations
- Development opportunities / Strategic recommendations
- Tactical recommendations

This section maps these onto each other, and also considers priorities in implementing the development opportunities.

5.1 MAPPING RECOMMENDATIONS ONTO OBJECTIVES

The strategy is multi-layered. As directed by STAG, it is designed to meet objectives by addressing the underlying causes of key issues in the light of constraints and uncertainties. Some of the underlying causes relate to institutional (soft) issues, attitudes, and the way that people and organisations interact and pursue their own agendas. The institutional recommendations therefore support the harder development opportunities that can physically be implemented to support better services. The development opportunities are themselves supported by tactical recommendations, which provide stepping stones.

Figure 5 overleaf shows how the various recommendations support the objectives by mapping them onto each other in a matrix form.

Figure 5: Mapping Recommendations to Objectives

	Objectives	Institutional Recommendations			
		Best value at the heart of strategy	Socio-economic development to be at core of the strategy	Delivery to be strategically led and innovation friendly	Independent strategic enabler
1.1	Facilitate business and industry, especially higher value added, to locate in the five areas.		Supports business & industry agenda	Concentration, faster, higher frequency	Championing recommendations
1.1.a	Encourage lower freight costs.	Greater opportunity to subsidise			
1.1.b	Target day-trip accessibility to key economic centres.				
1.2	Encourage increased tourism numbers thereby increasing local spend and supporting local businesses.		Supports tourism agenda	Concentration, faster, higher frequency	Championing recommendations
1.2.a	Encourage lower fares.	Greater opportunity to subsidise			
1.2.b	Encourage spread of tourism to all months of the year.	Get more services for the same money			
1.2.c	Focus on and encourage niche markets.				
1.2.d	Improve the accessibility of tourism infrastructure.	Get more services for the same money			
1.3	Support the service industries, including improving access to communities and their markets.	Get more services for the same money	Supports service industries	Concentration, faster, higher frequency	Championing recommendations
2.1	Retain and increase the population, and achieve a balanced demographic profile.		Supports sustainable employment	More convenient travel	Championing recommendations
2.1.a	Improve resident's quality of life by making the islands more accessible by sea.	Get more services for the same money			
2.1.b	Increase air connectivity between the islands and the mainland key gateway airports.				
2.2	Promote a community-centric open-minded approach to development of ferry services.		Challenges micro agendas	Encourage participation in services	Championing recommendations
2.2.a	Ground provision of services in the communities themselves.			Encourage participation in services	
2.2.b	Ensure that "the big picture" is evident at community level.				
2.3	Encourage social inclusion.			More convenient travel	Championing recommendations
2.3.a	Tackle barriers to inclusion by providing affordable access by sea to essential services.	Get more services for the same money			
2.3.b	Promote inclusion among young people and children.	Supports potential for lower fares			
2.3.c	Improve accessibility to support opportunities for economic development and regeneration of communities.	Get more services for the same money	Supports economic development		
3.1	Ensure the integration of transport policies with other national and regional policies and priorities.				Key body to develop integration agenda
3.2	Improve the integration and accessibility of inter-island and mainland transport services.			Greater potential to link	
3.2.a	Increase the availability and flexibility of transport ticketing, both virtually and physically.				
3.2.b	Ensure the integration of ferry services with road and rail services.			Greater potential to link	
					Origin & destination Study
				Tactical Recommendations	Study on propensity to travel
					Intl. benchmarking ferry services

Figure 5 (cont): Mapping Recommendations to Objectives

	Strategic Recommendations / Opportunities					
	Strategic development and upgrading of the ports and terminals network	**Application of strategic fixed links**	**Alternative ownership models**	**Fast Ro-Pax**	**Fast passenger only craft**	**Capture of land uplift value**
1.1		Improving accessibility, reducing cost		Higher frequency, faster trip		
1.1.a	Opening terminals to different vessel types					Captures value to support services
1.1.b					Higher frequency, faster trip	
1.2	Providing attractive gateways	Improving accessibility, reducing cost		Higher frequency, faster trip		
1.2.a	Opening terminals to different vessel types					Captures value to support services
1.2.b						
1.2.c					Higher frequency, faster trip	
1.2.d					Higher frequency, faster trip	
1.3	By linking terminals to service activity	Improving accessibility, reducing cost		Higher frequency, faster trip	Higher frequency, faster trip	
2.1		Improving attractiveness of island living	More responsive to community needs	Higher frequency, faster trip		
2.1.a			More responsive to community needs		Higher frequency, faster trip	
2.1.b						
2.2						
2.2.a			Potential for island-based services and crews			
2.2.b						
2.3		Improving attractiveness of island living	More responsive to community needs	Higher frequency, faster trip	Higher frequency, faster trip	
2.3.a						
2.3.b						
2.3.c	Leveraging economic devt. potential					
3.1	Planning and integrating facilities	Supports social justice/equity agenda	Supports community involvement/ownership agenda		Encourage modal switch from private transport	
3.2		Improve public transport access			Supports integration	
3.2.a						
3.2.b	Potential for public transport interchanges					
	Best value upgrading plan	Pre-feasibility studies strategic links	Investigate ownership & charging	Fast ferry database	Clyde feasibility study	E-Rail Stage 1 report on target area
	Economic development potential		Assess potential ownership models	Develop design partnerships		

5.2 PRIORITIES BY DEVELOPMENT OPPORTUNITY AND SSC GROUP

The SSC Strategy identifies six general development opportunities. HITRANS has requested that we suggest relative priorities between these. This is difficult because they are related, and sometimes specific to particular groups of SSCs. Table 5.1 below summarises where we think the priorities lie for each development opportunity mapped against each group of SSCs.

Table 5.1: Priorities by development opportunity

	Clyde crossings	Argyll Islands	Hebrides	Orkney	Shetland
Ports & Terminals		High	High	Medium	Medium
Fixed Links	Medium	Medium	High	Medium	
Ownership models		High	High		
Fast Ro-Pax		High	High		
Fast Pax	High				
LUC	High	Medium			

This analysis is interesting. It suggests that the greatest potential for the SSC Strategy to positively impact on the Highlands and Islands economy lies in the Hebrides, Argyll Islands, Clyde crossings, Orkney and Shetland in that order.

5.3 PRIORITIES BY DEVELOPMENT OPPORTUNITY AND LOCATIONS

This section summarises the geographic locations for application of development opportunities in more detail. Where specific examples are shown below these are not in any order of preference.

Best value

One of the core recommendations, best value highlights the potential for achieving more longer sailing days, and reorientation of service timings to more fully meet needs of island communities. Services that could reoriented in this fashion include:

- Ardrossan-Brodick
- Largs-Cumbrae
- Oban-Craignure
- Oban-Lismore
- Mallaig-Armadale

The ports and terminals network

To obtain maximum benefit from this development opportunity a strategic approach is required to concentrate initial effort. Prioritisation is therefore required on the basis of:

- Passenger throughput.
- Ports that are used by more than one service.
- Where improvements in capacity (which could include channel depth) at one port would permit use of more suitable vessels that also serve other ports/routes.

On this basis, potential examples for more detailed investigation would be:

- **Economic potential**: Brodick; Craignure; Oban; and Uig.
- **Infrastructure capacity**: Aberdeen; Lochboisdale; and others to be identified through a more detailed review.

Strategic fixed links for short crossings

The earlier analysis pointed to the following strategic links for further investigation:

- Pentland Firth.
- Sound of Harris.
- Sound of Barra.
- Coll and Tiree.
- The Clyde Estuary: Cowal - Renfrewshire and Bute - Cowal.

Ferry company ownership models

In terms of the possibilities for community ownership/operation, the best approach would be to test this through a pilot on routes that are relatively small scale and not complex, and where there is strong interest from the relevant communities. Without wishing to limit community initiative, possibilities could include:

- Some routes presently operated by Argyll & Bute Council and Highland Council.
- Barra-Eriskay.

Application of fast Ro-Pax craft

The earlier analysis identified seven routes for possible development, of which the most promising in the short to medium term are:

- Uig-Tarbert.
- Uig-Tarbert/Lochmaddy.
- Kennacraig-Islay.

Application of fast passenger only craft

Following the earlier analysis, this relates to services between the Clyde Estuary (Bute, Cowal and Cumbrae) and the Greater Glasgow area.

Land uplift capture – related to new developments

Following the earlier analysis, the possible pilot areas identified are:

- Clyde Estuary
- Oban

6 STRATEGIC SEA CROSSINGS: DETAILED REVIEW

6.1 SHETLAND TO MAINLAND

Freight is seen as a key issue for Shetland. This is in terms of rates, the origin and destination of traffic and service timings. Some consultees believe that there is potential to route freight services to Rosyth for ease of access to markets in the central belt and for connecting with the Superfast service to Zeebrugge. However, other consultees would resist such a development. In particular, some loads are apparently consolidated in the North East mainland before onward shipping. Overall, there is a need for more detailed information and research to fully understand the dynamics of the freight market: in particular in terms of origins and destinations.

As in Orkney, transportation of **livestock** is an important issue. However, changes in requirements are likely to occur in the medium term. This will reflect the subsidy regime placing less emphasis on animal production, and, possibly, greater processing of animals on Shetland.

Passenger travel appears to be less of an issue, although consultees believe that there is a need to ensure sufficient capacity for peak tourism demand, and that there is some scope for additional sailings in the summer months. In addition, air services are a more important component of passenger travel to/from Shetland than to other islands in the region. This reflects its relatively long distance from the mainland. This is particularly the case for island residents' travel. Air travel's importance will be strengthened if fares are reduced and services enhanced through an extended PSO air network.

It appears that demand is increasingly for travel to the central belt and beyond, rather than simply Aberdeen. This is reflected in the enhancement of air services between Shetland and Edinburgh in recent years.

Changing the mainland port for the ferry service would certainly be contentious, as there will be some continuing demand for travel to Aberdeen. This reflects the links that have developed over the years between the two locations and the ease of access to the city centre offered by the Port of Aberdeen, compared to, say, Rosyth's location vis à vis Edinburgh. Interests in Aberdeen would oppose any such change. However, we note that public sector financial support to the ferry service is for the benefit of the residents and economy of Shetland, rather than those of Aberdeen.

6.2 ORKNEY TO MAINLAND

One distinctive feature of services to Orkney is the relatively **high number of services and operators**. These encompass: NorthLink; Pentland Ferries; the seasonal John O'Groats passenger service; and the Streamline container service from Aberdeen. Some consultees believe that this produces a situation where neither the NorthLink nor Pentland Ferries service properly meets user requirements. This is because the NorthLink vessels are seen as over specified for the Pentland Firth crossing, while the other operator has the most appropriate route (short crossing) but not particularly good quality vessels in terms of passenger comfort, etc.

It can be argued that this situation has arisen because elements of the tender for the NorthLink service have not been properly specified for the Pentland Firth service: in terms of fares and, in particular, the optimum route, i.e. the shortest crossing. Consequently, some consultees believe that resources are spread too thinly and there is a need for consolidation to a smaller number of services to Orkney. This would have the advantage of securing greater stability/certainty of: service provision; and fare levels. Rationalisation could include cessation of the NorthLink service to Aberdeen and redeploying the resources it consumes on one shorter crossing from the north mainland, supporting a reduced crossing time and increased frequency.

Selection of the "best route" could be based on minimising crossing time - either through faster vessels and/or, in particular, operating the shortest crossing. Alternatively, a tunnel under the Pentland Firth would facilitate this in the longer term.

Freight is another key issue for Orkney, reflecting its relatively high level of exports of food and drink. There are conflicts in terms of sailing times on the NorthLink service across the Pentland Firth. Demand from the resident passenger markets is for an early arrival on the mainland. In contrast, some freight interests are seeking an early arrival at Stromness to get goods to customers as early as possible in the day.

Some consultees argued that this could be addressed by separating freight and private traffic. However, the container service and the NorthLink freight vessel out of Aberdeen already provide for non time sensitive freight, while some freight traffic would still opt to travel on the passenger service. Therefore, the volumes for additional dedicated freight capacity may, in fact, be limited.

Freight rates were also identified as an issue by consultees. Greater separation of freight may offer the opportunity for lower rates as well as improved service timings. However, as noted above, there is already a degree of freight separation, while the new NorthLink contract will offer subsidy for the transportation of freight as well as private traffic.

Related to freight is the issue of **livestock** transportation. Agriculture is a key element of the Orcadian economy. There is a need to support the export of live animals by meeting its specialist welfare requirements and maintaining freight rates that make production financially viable. These issues may, over time, help to lead to more processing of live animals on Orkney which should make exports easier to facilitate.

The **link with Shetland** is generally viewed as of much less importance than that to the mainland. Traffic volumes are low and some consultees believed that including Orkney and Shetland in the same service tender is sub-optimal, with some negative consequences, such as late arrival times in Kirkwall for Aberdeen sailings.

6.3 ARGYLL ISLANDS AND KINTYRE

The problems and needs facing users vary according to the types of routes: broadly, these can be divided between short crossing of under one hours and longer crossings that are over two hours in crossing time.

6.3.1 LONGER CROSSINGS

For the longer routes, **lack of frequency** is an evident problem. Some islands do not have a daily service even during the summer timetable. In the winter months frequency falls significantly to a point where some islands (notably Coll and Colonsay) have some of the poorest public transport provision in the United Kingdom. Unlike in Orkney and Shetland, most of the Argyll islands do not have air services. Thus they are totally reliant on ferry services to connect with the mainland.

In the winter timetable, Colonsay, Coll and Tiree each have three sailings per week. This means that a trip to the mainland involves an overnight stay of at least two nights with the time and cost that this implies. Tiree does have an air service but this is to Glasgow rather than Oban such that it only serves part of the market for travel to/from the island. Further, the frequency is only one return per day (with no services on a Sunday). Thus, again, a day trip to/from Tiree is not possible.

Lack of frequency serves to:

- Discourage travel, whether by residents or visitors.
- Combined with other factors, it can also hamper the ability to attract and retain key individuals, notably medical staff, on some islands. This appears to be a greater issue for healthcare provision than the services' impacts on movement of patients.
- Constrain the frequency of trips to the islands by public sector and other service providers.
- Where trips are made, incur significant time and cost penalties, the latter relating particularly to overnight stays.

In addition to this poor frequency of service, **sailing times** can be unsuitable. In the case of Coll and Tiree, sailings from the mainland depart at 0645 throughout the winter timetable, with vehicle check-in some 45 minutes before the vessel sails. Islay is one of the most populous islands served by CalMac, yet on most days during the winter the last sailing from the mainland is at 1250. It should be appreciated that a significant proportion of demand for travel to/from Islay is distant from the mainland landfall at Kennacraig. Therefore, those travelling to the island will be coming from further afield on the mainland. Again, vehicle check-in (30 minutes in this instance) increases overall journey times.

Frequency of service is also constrained by **vessel speed** and **crossing times**. The sailings are some of the longest in the CalMac network, yet the vessel speeds are below those of the ships operated to the Northern Isles. In addition, a "perceived problem" among users is that the vessels do not actually sail to their potential speed in order to reduce fuel consumption and costs.

Crossing times are also a function of sailing distance. The "shortest crossing" principle is generally not adopted, with, for example, sailings from Coll and Tiree being direct to Oban rather than to, say, a landfall on the north of Mull. However, consultees saw minimising the time spent at sea as a means of attracting additional tourists and benefiting livestock transportation.

In addition, service development is constrained by the **sharing of vessels** between different islands. Coll and Tiree share the same vessel, and also share it with Barra and South Uist. The vessel serving Colonsay is, in the main, the one used on the Oban-Craignure. Thus unless additional vessels can be brought in, as happens during part of the summer timetable, then increasing frequency to one island has to be at the expense of the service to another.

Lack of frequency also has a negative effect in terms of **integration of ferry services** with bus and rail connections. The fewer the number of services, the more difficult it is to make effective connections. This is a particular issue for those travelling onwards from mainland landfalls to more distant final destinations.

Inter-island travel is also a problem. The ferry services are configured for making trips to the mainland, and inter-island connections are often simply a by-product of this. In part, the private sector has begun to address this offering, for example, seasonal passenger only services from Colonsay to Mull, Islay and Jura. This reflects similar services elsewhere on the west coast, such as Lochaber and Skye.

6.3.2 SHORTER CROSSINGS

Two main problems are evident in relation to shorter crossings in the area. First, the **length of sailing day** in both summer and winter. The last sailings from the mainland are viewed as being too early. They certainly compare unfavourably with those on comparable routes in Shetland and those operated by ABC within their area. This is viewed as constraining both visitor day trips to the islands and islander's ability to access, in particular, opportunities for leisure and social activities.

It also relates to an **inability to commute daily** from some of the islands. Specific examples include Lismore and Mull into Oban. The first sailings from these two islands generally arrive into Oban after 0900. In the case of the Tobermory-Kilchoan service, the last sailing from Tobermory is 1630. In the case of Oban, some sectors of the local economy face labour shortages and widening the labour pool through allowing off-island commuting is one means of addressing this.

Fixed links are a possible solution to some of these issues. However, they may not be appropriate in all cases. Some communities may oppose them because they view them as changing those qualities of island status that they most value.

6.3.3 COMMON ISSUES

There are a number of common issues, in terms of **Problems and Needs**, across the area's services. First, is the **winter timetable**. In terms of frequency and times of last sailings it compares unfavourably with provision in the summer; and also with services provided by the local authority, which tend to have a quite similar timetable all year round. This acts to constrain residents' access to facilities and services on the mainland. This is in a context where most islands served have a population of fewer than 1,000. This limits the range of services provided which necessitates trips to the mainland.

The winter timetable also constrains tourism activity. Our consultations highlighted the changing nature of the tourism market, with activity increasingly moving towards an all year round basis. In the case of Mull, one consultee remarked that "February is now as busy as October", reflecting, in part, the growth of tourism among retirees whose holidaymaking is not constrained by work requirements. There is continued growth in impulse-led shorter breaks, distributed across the year, which requires sufficient capacity and frequency to realise its potential.

These trends have also fed through to the coach market which, based on our consultations, appears to be enjoying something of a resurgence within Argyll. Again, major operators are moving to an all year round basis. However, inclusion of the islands is constrained by the winter timetable, which operates for a considerable part of the year.

Fares are another general issue. Consultees perceive passenger fares as being "reasonable", but this is not the case for cars and, in particular, freight charges on some of the longer routes. Residents and visitors perceive car charges as constraining travel. Freight rates are viewed as checking the development of industries, including reduced profitability. They are also seen as adding significantly to the cost of retail goods on the islands as well as making construction activities considerably more expensive than on the mainland.

As a consequence, little thought has been given to fare structures as opposed to fare levels. This relates to:

- The relative charges for different traffic types (i.e. passengers, cars and commercials).
- Structuring fares to benefit/incentivise travel by particular market segments, such as tourists.

It is also related to more active yield management with a greater range of fares to fill capacity outside periods of peak demand. The present approach was compared unfavourably by some consultees with the practices of rail and airline operators. This is in a context where the islands face growing competition for the "impulse-based short breaks" market from low cost air services in the central belt, a geographic area which remains a key market for the Argyll islands. This competition, our consultations suggest, is strongest outside the peak summer months.

In general, the approach to fares and timetabling has not been sensitive to the changing nature of tourism, despite visitors being a significant part of total demand for CalMac services. The company reported that 70% of its network's annual passenger demand falls within the five months of May-September, inclusive.

Tourism growth on some islands has meant that further increases in demand in the peak periods cannot be readily accommodated. Hence, public sector strategies are aimed at growing the market outside the peak, while increasing expenditure per head during it.

There are a number of **Constraints** that affect this group of SSCs.

First, **some communities are divided in their opinions** and unable to generate a clear view as to what is required. An example of this is the ongoing attempts to improve overall provision to Lismore, which is presently served by two different routes, for an island with a population of under 150. The consequence of this has been that the public sector has moved on to deal with other issues. Part of the problem is that there have been no general principles developed regarding the level of access required for each island to promote economic development. For example, should every island have a daily service, or be able to make a day trip in both directions on certain days of the week? What should be the last sailing time on both longer and shorter crossings?

Another significant constraint is the **pessimistic view of some parties** of the economic potential of the islands. In particular, this appears to be true of the ferry operator. There is a perception that there will always be limited demand for visitor travel to the islands, particularly outside the peak. Even if demand was evident then there is doubt that the infrastructure on the islands would raise its game in terms of quality, length of season, etc. These views, however, contrast with research findings for VisitScotland that point to a main growth area of outdoor, stress-busting activities and other activities related to the natural environment. The west coast islands, including those in Argyll, are well placed to serve this emerging market.

Further, there appears to be little belief in some quarters that reduced fares would produce a significant increase in demand. However, the evidence from the last 20 years on the CalMac network shows that where other barriers to access (such as improved frequency and greater capacity) have been reduced then demand has risen accordingly. One recent example has been improved frequency and capacity on the Islay service with the deployment of two vessels during part of the summer timetable. This is an interesting development as, hitherto, no routes of comparable length had been served by more than one vessel. This has been the operator's reaction to lack of frequency rather than the deployment of high speed craft, yet it still represents a highly significant change from past practice.

Increased demand traffic may emerge relatively quickly through simply increasing vessel capacity. Other types of service developments, such as reduced fares and later sailings, may take longer to stimulate significant new traffic, but this is a common factor in public transport provision. Further, some service changes, such as altering departure times to benefit freight, may produce little additional commercial vehicle traffic until the longer term.

In part, these issues reflect "conflict" between operational driven objectives and those relating to economic development.

The **geography and topography** of the islands served is also a constraint. A more tangible constraint is the complementary funding that would be required to upgrade roads to allow possible new service patterns. This would be required if "overland" routes were developed via Mull and Jura. The case is more supportable where the road infrastructure concerned would also serve a strategic function - e.g. on Mull improving road connections to the island's main settlement of Tobermory.

Another constraint is the layout of the Argyll islands, which are not, in any realistic sense, a "chain". The solutions adopted for intra-Western Isles transport, of fixed links and dedicated inter-island services, which also have significant potential to improve access to the mainland, cannot be readily adopted in Argyll.

There are also **vested interests** in retaining existing patterns of service that benefit particular locations. This relates, in particular to the number and location of ports. Islay, for example, continues to have two ports of call and any change to this would be contentious.

There has, arguably, been a lack of progress in developing ferry services to the Argyll islands. As a consequence some **"pet projects"** have been on the stocks for a number of years and it is difficult for those involved in them to accept that new or alternative solutions may now be the best way forward.

6.4 HEBRIDES CALMAC NETWORK

This section is initially divided between crossings serving the Western Isles, including the two inter-island services, and those in the Highland Council area. This is followed by a discussion of issues and constraints that are common to both geographic areas.

6.4.1 WESTERN ISLES

The issues on the mainland routes serving the Western Isles are similar to those discussed for the longer routes in Argyll and Kintyre. Two related problems are again, **length of crossing time** and **service frequency**. Despite considerable investment in the last 10-20 years crossing times have not reduced markedly. The Ullapool-Stornoway crossing time remains above 2½ hours, while that to Barra and South Uist are still, at best, around 5 hours. The total journey time is, again, lengthened by vehicle check-in times: 45 minutes on the Stornoway service and up to 45 minutes for sailings to Barra and South Uist. Similarly, crossing times on Uig-Tarbert/Lochmaddy have not changed significantly over the same period. Generally, the policy has been to introduce larger vessels on mainland services that do not sail at significantly faster speeds or more often than their predecessors.

As in Argyll, these issues partly reflect the speed of the vessels deployed, which is considerably below those on NorthLink services. There is also the "perceived problem" that some vessels do not operate to maximum design speed. This is in order to reduce fuel consumption. Perhaps as a consequence of lengthy journey times and poor frequency, recent interest has been expressed in using/reintroducing new landfalls such as Mallaig and Dunvegan (Skye).

Long crossing times are perceived to depress visitor demand. In the Western Isles the trend is towards greater numbers of visitors but their staying for a shorter time on the islands than before. Visitors want, therefore, to maximise time actually spent at their destination. Again, faster vessels were seen as being the solution to this, although times of arrival and departure (notably for Barra and South Uist service) were also seen as limiting visitor demand. As noted, visitors are now booking much closer to the time of travel. They therefore require flexibility through appropriate sailing frequency and timings. Enhanced frequency is required but must be provided at times when people want to travel.

In addition, minimising time at sea and overall transit time was seen as important for livestock exports. Consultees wished to see beasts get to their final destination as soon as possible and this was seen as requiring faster vessels and reduced vehicle check-in times. It should, however, be appreciated that the levels of livestock exports are less than from the Northern Isles. Further, as animal production becomes less important than environmental management, there will fewer beasts exported and less feed imported.

Frequency is also constrained by the **sharing of vessels**. Barra and South Uist share the same vessel with Coll and Tiree. On some sailings, and particularly in the winter, the vessel calls at both Barra and South Uist on the same trip from the mainland. This results in longer journey times, with an increase of around 1¾ hours for the island at the end of the "chain".

The Harris and North Uist services also share the same vessel. This restricts the maximum number of return sailings to either island to two per day in summer, with a lower frequency actually provided on most days. During the winter timetable sailing frequency is reduced such that Harris has less than one return sailing per day. A consequence of this is that sailing times back to the two islands are generally early afternoon in the winter, when, also, a day trip is not possible in either direction. In part this reflects the limited use of the vessel in the winter months with sailings ceasing no later than 1710 and even earlier on certain days. Consequently travellers to/from the islands incur additional time and expense in trip-making because of the large gaps in the timetable.

This raises the issue of the ability to provide an acceptable level of service if five island ports are to be used. Some consultees argued that the existing number and distribution of ports reflects the situation before improvements in both inter-island ferry services and road connections, accepting that more remains to be done in this regard.

In addition, the **present mainland and island ports do not offer the shortest available sea crossings**. This contributes to the constraints associated with crossing times and service frequency.

Another key issue is catering for the demands of various traffic types and, in particular, **freight**. The winter timetable for Barra and South Uist is seen as offering a poor service for commercial vehicles. This is terms of both sailing frequency (3 return sailings for most of the winter timetable) and also departure times from the islands. As a consequence, some freight traffic from the southern half of the Uists has gravitated to the Skye service.

Some have suggested a "tramp" service for some freight traffic, which could call at ports in the Uists and Barra before travelling to the mainland. However, this would only capture that portion of traffic that is not time sensitive. Island residents have grown to appreciate the benefits of something approaching a daily service for freight deliveries. The problem is that there are different requirements for different types of traffic within the generic "freight" grouping, especially within fisheries where weather conditions can make production unpredictable on a day to day basis.

In 2002, a dedicated, overnight freight service was introduced on the Ullapool-Stornoway run. This was seen as benefiting the freight market through offering:

- Better arrival times on both the mainland and the islands.
- (Slightly) reduced rates compared to the daytime sailings.

However, one of the main impacts was to release vehicle deck capacity on daytime sailings, with a consequently large uplift in car carryings through accommodating previously frustrated demand. The increase in demand was 36% between 2000 and 2004 at a time when air services to Stornoway improved significantly. Some consultees saw this as a predictable consequence of freeing up space for previously frustrated demand. They reported, however, that the ferry operator had not anticipated such an uplift. Again, this appears to reflect their pessimistic view of the islands' economic potential as discussed previously.

The dedicated freight service has, therefore, been widely welcomed. It should be appreciated that the Stornoway route provides significant revenues from commercial traffic and that CalMac had faced competition on the route from a freight operation. The challenge in replicating the model elsewhere in the Western Isles, and beyond, is relatively low demand and also the volatility of some key flows (particularly related to salmon farming) which may make provision of a dedicated service more difficult.

It is the importance of freight which has, in part, restricted thinking about fast craft conveying only passengers and cars as opposed to existing, multi-purpose vessels. It also reflects concerns about vessel reliability in bad weather and expensive fuel consumption levels.

Some of the major salmon farming companies based in the Western Isles have moved towards using their own freight boats to import feed and to export live salmon for processing on the mainland. This acts as a double-edged sword. It makes dedicated freight services from CalMac less financially viable. Yet it does help in that there is one less "problem" for the CalMac services to "solve" in that the salmon producers' own vessels can be flexed to meet their specific production requirements. (A similar position exists in Argyll with the movement of considerable amounts of timber by coastal vessels rather than ro-ro ferry services.) However, smaller independent companies and niche producers can be expected to continue to rely on the ferry services.

Inter-island services have developed significantly within the past decade and are generally accepted as having helped increase visitor activity and distribution throughout the Western Isles. However, user expectations have grown such that the Sound of Harris service is now viewed as restrictive. Operations are limited (by the MCA) to daylight hours such that during some of the winter timetable only two return sailings are possible. The waters plied also lead to a sailing time that, at one hour, some are now viewing as excessive. This compares with the much less frequent service with a crossing time of 1¾ hours that existed ten years ago. Further, there are presently no Sunday sailings

The Sound of Barra service is generally viewed as having been highly successful. However, even here the service provision is limited by the fact that the vessel deployed on the route is, at 8 knots, one of the slowest ships in the CalMac fleet. In addition, the service could make more of a contribution to mainland sailings by having its timetable integrated with arrivals/departures from Castlebay and Lochboisdale.

Some consultees viewed improving inter-island connections as a basis rationalising mainland service provision. For example, if fixed links were introduced across one or both Sounds then the number of mainland services could be reduced, with fewer ports of exit in the Western Isles than the present five. Thus the fixed links would make a wider strategic contribution beyond simply benefiting the communities in close proximity to them. Improved inter-island links would also increase the scale of markets for provision of goods and services, in a context of sparsely distributed population. From our consultations, it appears this effect is emerging in Skye & Lochalsh. The abolition of the tolls on the Bridge has led people on the mainland to travel to Skye to purchase goods and services.

Another issue that was highlighted in our consultations was an **underutilisation of the vessels**. This is particularly an issue during the winter timetable.

Overall, there is a feeling of **lack of innovation and flexibility** in the development of services. This was felt generally among consultees, but in particular it was felt that young people wanted frequent services to make life in the islands more attractive. This is a key group of people for many islands on the west coast, as their loss is one of the reasons underpinning their continuing population decline.

Some consultees contrasted recent developments in air services favourably with ferry provision. This was in terms of lower/a wider range of fares and, in the case of Lewis, Sunday flights. In particular, the cost of ferry travel is seen as depressing visitor demand, along with crossing times. Within Lewis at least, air travel is now being given greater consideration for off-island trips. However, available evidence suggests that the effect is to increase trip-making frequency rather than simply displace trips from surface travel.

Overall, a key issue for the Western Isles is the **ability of transport services to contribute more fully to economic development and population levels**. Improved links could address the problems associated with low and dispersed population and economic activity, through:

- Concentrating resources on a reduced number of mainland services.
- Increasing the size of local markets through improved inter-island connections.

6.4.2 HIGHLAND COUNCIL AREA

The main specific issue regarding services is **frequency of service**. On the Mallaig-Armadale service there is sharp decrease in frequency in the winter months. This means that travellers to/from south Skye have to make longer journeys made using the Skye Bridge. The frequency of service in the winter months and the timings of the summer service mean that it cannot be used for daily commuting in ether direction. It is thus a barrier to increasing economic integration between Skye and Lochaber, two small areas but ones that continue to grow in economic terms.

6.4.3 COMMON ISSUES

The main **Problems and Needs** common to both areas are:

- **Fare levels**. These are seen as, in particular: discouraging: visitor travel; and adding to the cost of lower value goods such as agricultural inputs and construction materials. In addition, the fare levels are inconsistent between routes and between traffic types. It should be appreciated, however, that this reflects the inconsistent application of the existing fares regime, rather than the regime itself. Mainland services from the Western Isles are, to a degree, substitutes for one another but there is presently no pricing strategy that reflects this and which could make more effective use of capacity.

- The **decrease in frequency in the winter timetable** fails to reflect the trends in the visitor market of increased activity in the shoulder months, one which is being actively promote by public sector organisations involved in tourism development. Many of the comments on tourism made previously apply equally to services in the Western Isles and Highland Council areas.

- A **lack of information on ultimate origins and destinations** for both private traffic and freight. This has led to a lack of informed decision-making about potential service changes.

- **Ferry services may become less important for the economy** as a whole relative to air services. The trend in public sector economic development effort is towards developing higher value added/knowledge sectors. These tend to generate relatively low freight movements and rely on air rather than transport for staff travel.

Regarding **Constraints,** the **geography and topography and the administrative history** of the Western Isles has meant that inter-island road connections remain poor in places. While this is being addressed it will require considerable investment to allow reconfiguration of the ferry services to a more effective basis.

There are **vested interests** regarding the number and location of ports in the Western Isles and north Skye, who wish to see no reduction of service to "their" port. This is exacerbated in a number of locations where the ferry service is by far the main economic contributor, with a lack of alternatives if the service was to be significantly reduced or withdrawn. There is still an expectation in some quarters that residents should not have to drive very far to/from their island port.

6.5 CLYDE CROSSINGS

One of the distinctive features of the Clyde crossings is the desire for, and economic potential of, **fast and easy access to the Glasgow city region**. Existing provision does not fully meet this given, first, that some landfalls on the mainland are distant from Glasgow. Where cars are used, congestion on road links such as the A78 is seen as likely to increase further in future years, again reducing the quality of access.

Second, the timings of the last sailings to the islands (Cowal being excepted given that the Western Ferries service runs until midnight) are such that travellers have to leave Glasgow quite early to return home. Consequently the area served by the Clyde crossings does not strongly benefit from proximity to Glasgow.

Consultees also perceive that existing timetables and fare levels **constrain the commuting potential** of the islands. This was contrasted unfavourably with the position in Cowal where the late running ferry service is seen as offering the opportunity to live on the peninsula but work elsewhere. The early last sailings also make the islands less attractive as places to live, given the limited ability to access social and leisure activities on the mainland during the evening

In the case of Arran, providing for commuting is more problematic. This is because of its relative distance from Glasgow and the sea distance between Brodick and Ardrossan. However, the timetable could possibly be configured to allow residents to commute to Glasgow on a number of days per week, while working at home at other times. Indeed, while Arran is includes in the Clyde SSC group for this study, its issues are more akin to those of Argyll and the Hebrides. Specifically:

- Limited frequency of service. This includes the winter timetable when the numbers of hours available for day trips are much fewer than in summer.
- Fare levels, particularly for freight.

In contrast, the issues for Bute and Cumbrae are focused (although not exclusively) on the adequacy of the timetable for off-island travel and the times of last sailings.

A distinguishing feature of the Clyde area as a whole is the **importance of weather/impulse-led day trips from the mainland**. This results in significant increases in traffic volumes during "good summers". However, demand is constrained by a quite simple pricing policy, which does not target specific market segments particularly effectively. In addition, it can lead to pressure on passenger capacity on routes such as Largs-Cumbrae, with provision generally geared to car-borne rather than foot passengers.

The Clyde area enjoys relative proximity to the large Central Belt passenger market. Yet it is not clear how far services, pricing and marketing reflect this, rather than one model being adopted for the CalMac network as a whole. This extends to the potential to exploit the growth in passenger traffic on no frills services into Glasgow Prestwick airport, as well as the growing number of visitors accessing Scotland through Glasgow International airport.

The main identified **Constraints** are ones of perception and attitudes:

- Among some local stakeholders, a **pessimism about the economic potential of the Clyde area** and its ability to benefit from economic growth in and around Glasgow.

- **Change perceived as threat**. For example, the perceived threat that the main ferry service to Bute would be significantly reduced if a fixed link was constructed at the north end of the island.

- **Vested interests** simply wishing to maintain the pattern of existing landfalls, which may be outside the Highlands & Islands.

APPENDIX A: FIXED LINK ASSESSMENT

This appendix presents simplified cost-benefit analyses for two hypothetical - but realistic - examples of replacing ferry services with non-tolled fixed links. The two examples are based approximately on the present traffic numbers and distances for Pentland Firth (long distance example) and Sound of Harris (short distance).

Example A – 15km fixed link: The fixed link (width 16 m, 2-3 lanes + emergency lanes) replaces an existing major ferry service on a 15 km long crossing. The constant annual traffic level is 300,000 passengers, 100,000 cars and 200,000 m freight before a fixed link is constructed; the link is assumed to increase all kinds of traffic with 50% compared to continued ferry service.

The replaced ferry service is carried out with a vessel doing 3 round trips per day (all days of the week) and with a service speed of 19.3 Knots. The "model" is a vessel like Hamnavoe with a replacement cost of GBP 30.1 million.

Example B – 5km fixed link: The fixed link (width 12 m, 2 lanes + emergency lane) replaces an existing minor ferry service on a 5 km long crossing. The constant annual traffic level is 50,000 passengers, 20,000 cars before a fixed link is constructed; the link is assumed to increase all kinds of traffic with 50% compared to continued ferry service.

The replaced ferry service is carried out with a vessel doing 4 round trips 4 days of the week and 3 round trips 3 days a week and with a service speed of 10.5 Knots. The "model" is a vessel as Loch Portain with a replacement cost of GBP 5.2 million.

The simplified economic analysis compares the investments in fixed links with continued ferry services (based on investments in ferries corresponding to the replacement costs) over a 60 year period with constant traffic and reinvestment costs in a new similar ferry after every 25 years.

The following elements are considered:

- Travel time savings and reduced inconvenience costs (due to frequency restrictions). Assumptions are 1 hour saved travelling for each passenger/vehicle + 0.5 hour reduced inconvenience cost. The value of saved travel time is assumed to be GBP 11 per hour on average for passengers and cars based on recent British values, and an assumption of 1/3 business traffic and 2/3 commuting/other travel purposes. The value for freight is assumed to be GBP 4/hour/metre.
- Avoided ferry costs (replacement, crew, maintenance, fuel & lubricants). Assumptions are based on recently build vessels in Europe.
- Avoided port related costs. It is assumed that user paid dues (assumed present Cal Mac vessel dues) correspond to the actual costs for handling vessels and traffic in the ports.
- The costs of constructing and operating fixed links. The variation in construction costs under different conditions is illustrated in the Table A.1 overleaf. It includes examples of construction costs for causeways, bridges and tunnels. Even though the functionalities and ways of calculating costs are not fully consistent in the examples they illustrate the range of costs and solutions adapted in specific projects.

Table A.1: Construction costs for road fixed links (updated to 2005 price level)					
Fixed link	**Type**	**Built**	**Total costs (M£)**	**Length (m)**	**Cost/m (1000£/m)**
Scalpay	bridge	1998	8.8	300	29
Vatersay	causeway	1990	5.6	250	22
Berneray	causeway	1999	7.6	900	8
Eriskay	causeway	2001	9.6	1600	6
Øravik-Hov, Faroe islands	tunnel	2005	11.7	2450	5

- The analysis uses costs based on European experience for standard major bridges (GBP 1900 m2 or GBP 22,800/m for 12 m width). This corresponds to an average investment cost for bridges under fairly good conditions. It is in the higher quartile for costs shown above.
- The annual operating and maintenance costs are assumed to 0.5% of construction costs; these costs may in practise vary but the variation between e.g. different tunnels may be larger than between average bridges and tunnels depending on the specific design

Using these assumptions, we have illustrated the results (Tables A.2 and A.3) - stated as Economic Internal Rate of Return – with sensitivity analyses of changing the assumptions of traffic levels and fixed link investment costs compared to the "base case" assumptions listed above. In the sensitivity analyses "traffic level" refers to a scale factor multiplied with the base case traffic level after the fixed link is constructed (traffic before the fixed link + 50% newly generated traffic).

In British guidelines for infrastructure investment appraisals a minimum internal rate of return of 3.5% is normally required to accept a project. The calculated internal rates of return are presented below.

Table A.2: Example A - 15km fixed link			
Traffic level	**Fixed link investment cost level**		
	Base Case	25% Cap-ex Reduction	50% Cap-ex Reduction
Base Case	< 0%	2.0%	4.6%
Traffic Doubled	3.0%	4.9%	8.5%
Traffic x 3	5.0%	7.4%	12.2%
Traffic x 5	8.7%	12.1%	19.4%

In the base case, an increase in traffic of 360% (instead of the 50% assumed) is required for the investment to meet a target IRR of 3.5% (break even). Sensitivity analysis shows that the project might be acceptable if a pre-feasibility study showed that induced traffic was 200% of existing and costs reduced by 20%.

Table A.3: Example B - 5km fixed link			
Traffic level	**Fixed link investment cost level**		
	Base Case	25% Cap-ex Reduction	50% Cap-ex Reduction
Base Case	< 0%	< 0%	2.0%
Traffic Doubled	< 0%	2.1%	4.7%
Traffic x 3	2.1%	3.9%	7.0%
Traffic x 5	4.7%	6.9%	11.3%

In the base case, an increase in traffic of 815% (instead of the 50% assumed) is required for the investment to meet a target IRR of 3.5% (break even).

Sensitivity analysis shows that the project might be acceptable if a pre-feasibility study showed that induced traffic was 300% of existing and costs reduced by 40%.

The IRR calculations do not give concrete guidelines for specific projects, but they show how the economic feasibility depends on traffic levels and the investment costs. The situation for a specific fixed link project might be very different from the general and simplified assumptions used in the examples.

Between 1/3 and 1/2 of the total economic benefits associated with a fixed link may come from avoiding costs of ferry services, whereas the remaining benefits derive from traffic user benefits.

A major financial impact of replacing ferry services with user payments, with fixed links without user payments (tolls), is of course that the users not only obtain benefits in the form of reduced travel time and all time access, but also reductions in out of pocket travel costs as they will not longer pay ferry fares. The economic analyses above do not distinguish between distribution of costs and benefits between traffic users and the society in general, but the financial consequences for public budgets may be significant.

APPENDIX B: SERVICES TO THE ISLES OF SCILLY

B1: VESSELS AND SERVICES

ISSCo operate 4 vessels:

1 Scillonian III

Length 68m
Beam 11.9m
Draught 2.9m
GRT 1,255
Dwt 262
Passenger capacity 600
The ship has a small forward hold that is unloaded using ships own crane
Service Speed 14 knots

Built in 1977 for ISSCo at a cost of £2m; major refit in 1999 cost just under £2m.

Scillonian III's 2005 timetable for Penzance to St Mary's is:

Table B.1: Scillonian III timetable

							Depart Penzance	Depart St Mary's
21 March – 9 April	M		W		F	S	0915	1630
11 April – 21 May	M	T	W	T	F	S	0915	1630
23 May – 4 June	M	T	W	T	F	S	0915	1630
						S	0630 & 1345	0945 & 1700
6 June – 9 July	M	T	W	T	F	S	0915	1630
11 July – 16 July	M	T		T	F	S	0915	1630
			W				0800	1630
18 July – 3 Sept	M	T		T	F		0915	1630
			W				0800	1630
						S	1100	1500
27 August only						S	0630 & 1345	0945 & 1700
5 Sept – 22 Oct	M	T	W	T	F	S	0915	1630
24 Oct – 5 Nov	M		W		F	S	0915	1630
SUNDAY SAILINGS								
7 and 14 August							0915	1630
21 August							0800	1630

The route length is approximately 36 miles, which takes approximately 2 hours 40 minutes. Sightseeing trips around the outer islands are also operated during the bird watching season. ISSCo carried 139,200 single trip passengers in 2004; of these half were carried by air and half by Scillonian III.

2 Gry Maritha

Length 42.3m
Beam 9.7m
Draught 2.9m
GRT circa 800
Passenger Capacity 12
Service Speed 11 knots

Built 1981 for supplying remote communities in the Norwegian fjords. Purchased by ISSCo in 1989.

Carries fuel in transportable fuel tanks and can also carry 20' containers and general cargo that is unloaded using ship's own crane.

Timetable – 3 return trips per week from Penzance to St Mary's. Only carries passengers in winter when Scillonian III is laid up.

14,000 tonnes of freight were carried mostly by the Gry Maritha although some, predominantly perishable, cargo is carried by the Scillonian III.

3 Lyonesse Lady

Length 15m

Capacity 8 to 10 euro pallets of cargo. Equipped with Hiab crane.

Built in 2003 for ISSCo. Used for supplying the off islands from St Mary's.

4 Swift Lady

8.4m RIB. Used to supplement Lyonesse Lady in supplying the off islands.

B2: REPLACEMENT OF SCILLONIAN III

The Scillonian III is currently in good condition and is expected to remain in service until at least 2009 however the company will eventually need to replace her and would like improved speed and comfort from their next ship.

The Council of the Isles of Scilly in partnership with ISSCo., the Duchy of Cornwall and Penwith District Council have commissioned a study to review the Islands transport infrastructure. This study, which is not yet complete, has included examination of options for replacement ferries the options considered include:

- No passenger vessel, freight only (passengers by air)
- Separate passenger and freight vessels (standard speed)
- Separate passenger and freight vessels (fast speed)
- Combined passenger and freight vessel

A fast ferry service could carry the passenger carrying demand and would have the advantage of a reduced journey time of around 1 hour and the ability to operate with a low draft. However it was decided such a ferry could not depart with a significant wave height of over 1 to 1.5 metres. Weather statistics indicated that these wave heights would be exceeded frequently and the ferry would have a down time of approximately 47% in the summer months. This percentage was considered too high for a viable service and therefore the fast speed options are not being pursued.

The options that are being considered are either separate vessels or a combined vessel travelling at faster but standard speeds. Features being sought include:

- A passenger service speed in normal sea conditions of 20 knots reducing the journey time on the water to 2 hours
- Improved comfort
- Improved freight and passenger handling to reduce time spent on vessels in port

The identified option vessels are summarised in Table B.2.

Table B.2: Options to replace Scillonian III

Vessel	Length (metres)	Beam (m)	Draft (m)	Speed (knots)	Approx. Cost
Passenger	70	12	3.1	20	£17.0m
Freight	43	10	2.9	14	£11.0m
Combined	80	14	3.4	20	£21.0m

These costs would be difficult for the company to fund so EU Objective 1 grant assistance is being investigated. However there are considerable difficulties in obtaining state funding for vessels that operate in competition with other privately operated services such as the helicopter service to the islands. ISSCo believe that will be a better chance of obtaining grant aid for the port infrastructure improvements necessary to accommodate the next generation of vessel(s).

APPENDIX C: FAST RO-PAX

This appendix deals specifically with several requests for more information made in comments on version 1 of the Draft Final Report.

C1: TYPES OF FAST MARINE CRAFT

The last 25 years have witnessed a rapid development of Fast (and Advanced) Marine Vessels for various applications. Up to the 1970s the design of fast marine vessels appeared to be of interest only to navy authorities, but most recent developments have been driven mainly by commercial applications. In the last two decades considerable efforts have been expended, worldwide, to develop new types of fast passenger and cargo ships and to increase the modal share of waterborne transportation.

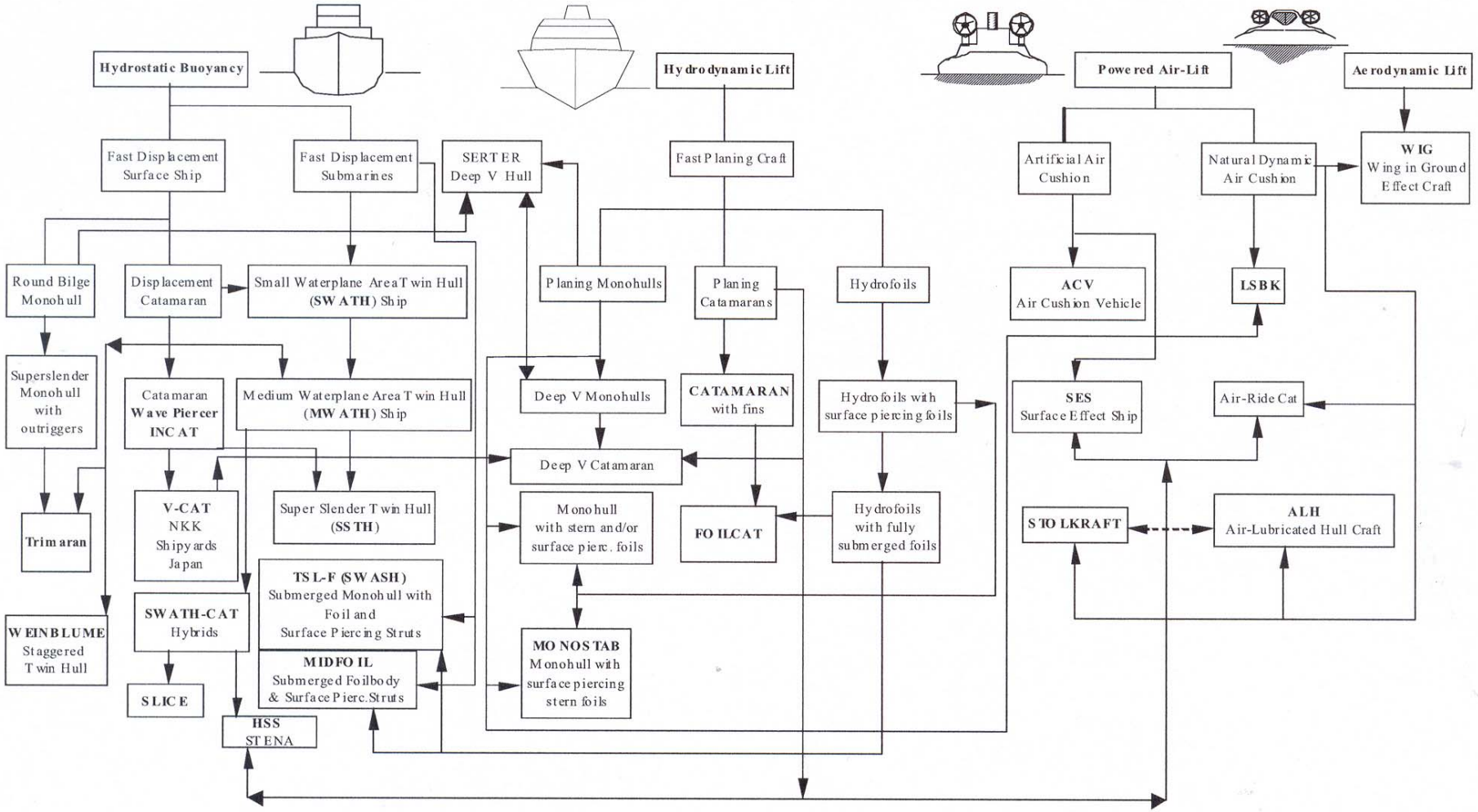
The competitiveness of any transportation system, including Short Sea Shipping, depends upon the price and quality of the offered services. The main factors characterising the quality of transportation services are transportation time, safety, comfort and economy. It is these four factors that have been the driving force behind innovation in design.

The diagram (see following page) shows innovative ship designs currently under development or already implemented in practice. The chart is based on the four main physical concepts leading to the force balancing the weight of the ship:

- Hydrostatic buoyancy force
- Hydrodynamic lift force
- Aerostatic powered air-lift force
- Aerodynamic lift force

The outlined basic concepts and the derivatives thereof are in columns according to origin of the principal physical concept balancing the ship's weight during service operation, and in rows according to the degree of their development and deviation from the original main concept. Historically technological developments have generally taken place from the left upper corner ('Archimedean Principle') towards the right and downwards.

From the feasibility point of view, all the outlined concepts have at least some of the required technical and economic characteristics for practical fast sea transportation. However caution is necessary when selecting a candidate AMV concept as a variety of technical and economic aspects need to be considered such as: calm water performance (resistance and propulsion); wave-wash impact on shore; seakeeping; manoeuvring; payload capacity; flexibility of overall and of machinery/propulsion arrangements; energy emissions; noise and vibration levels; building and operational cost; links to port facilities. **A close collaboration between researchers, designers, builders, operators and port authorities is generally required to ensure the successful implementation of an AMV on a particular route.**



ADVANCED MARINE VEHICLES

Development of Basic Types and Hybrids

(after A. Papanikolaou)

Explanation of acronyms and description of craft

ACV: Air Cushion Vehicle – Hovercraft, excellent calm water and acceptable seakeeping (limiting wave height), limited payload capacity.

ALH: Air Lubricated Hull, various concepts and patents, see type STOLKRAFT.

Deep V: ships with Deep V sections of semi-displacement type acc. To E. Serter (USA) or of more planing type, excellent calm water and payload characteristics, acceptable to good seakeeping, various concepts AQUASTRADA (RODRIQUEZ, Italy), PEGASUS (FINCANTIERI, Italy), MESTRAL (BAZAN, Spain), CORSAIR (LEROUX & LOTZ, France).

FOILCAT: Twin hull (catamaran) hydrofoil craft of KVAERNER (Norway), likewise MITSUBISHI (Japan), excellent seakeeping (but limiting wave height) and calm water characteristics, limited payload.

Low Wash Catamaran (LWC): Twin hull superslender semi-displacement catamaran with low wave-wash signature of FBM Marine Ltd (United Kingdom), employed for river and closed harbour traffic.

LSBK: LaengsStufen-Bodenkanalboot-Konzept, Optimised air-lubricated twin hull with stepped planing demihulls, separated by tunnel, aerodynamically generated cushion, patented in Germany.

MIDFOIL: Submerged Foil-body and surface piercing twin struts of NAVATEK-LOCKHEED (USA).

MONSTAB: Semi-planing monohull with fully submerged stern fins of RODRIQUEZ (Italy).

MWATH: Medium Waterplane Area Twin Hull Ship, as type SWATH, however with larger waterplane area, increased payload capacity, worse seakeeping.

SES: Surface Effect Ships, Air Cushion Catamaran Ship, similar to ACV type concept, however improved seakeeping and payload characteristics.

SLICE: Staggered quadruple demihulls with twin struts on each side, acc. To NAVATEK-LOCKHEED (USA), currently tested as prototype.

SSTH: Superslender Twin Hull: Semi-displacement with very slender long demihulls of IHI Shipyard (Japan), similar to type WAVEPIERCER.

STOLKRAFT: Optimised air-lubricated V-section shape catamaran, with central body, reduced frictional resistance characteristics, limited payload, questionable seakeeping in open seas, patented by STOLKRAFT (Australia).

SSM: Superslender Monohull: excellent calm water and payload characteristics, non-validated seakeeping and structural design, EUROEXPRESS of KVAERNER-MASA Yards (Finland).

SSMO: Superslender Monohull with Outriggers: Long monohull with two small outriggers in the rear part acc. To KVAERNER-MASA (Finland), excellent calm water performance and payload characteristics, good seakeeping in head seas.

SWATH Hybrids: SWATH type bow section part and planning catamaran astern section (STENAs HSS, Finland, AUSTAL hybrids, Australia), derived from original type SWATH & MWATH.

SWATH: Small Waterplane Area Twin Hull Ship, synonym to SSC (Semi-Submerged Catamaran acc. to MITSUI Ltd), ships with excellent seakeeping characteristics, especially in short period seas, reduced payload capacity, appreciable calm water performance.

TRICAT: Twin Hull semi-displacement catamaran with middle body above static water level. FBM Marine Ltd (United Kingdom).

TRIMARAN: Long monohull with small outriggers at the centre, proposed by Prof. D Andrews – UCL London (United Kingdom), currently tested as large prototype by the UK Royal Navy (TRITON), similarities to the Superslender Monohull with outriggers concept of KVAERNER-MASA, however apparently with different calm water, seakeeping and payload characteristics.

TSL-F – SWASH: Techno-Superliner Foil version, submerged monohull with foils and surface piercing struts, shipyard consortium (Japan).

V-CAT: Semi-displacement catamaran with V section shaped demihulls of NKK shipyard (Japan), similar to WAVEPIERCER.

WAVEPIERCER: Semi-displacement catamaran of INCAT Ltd (Australia), good seakeeping characteristics in long period waves, good calm water performance and payload characteristics.

WEINBLUME: Displacement catamaran with staggered demihulls, IFS Hamburg – Prof. H Soeding (German), very good wave resistance characteristics, acceptable seakeeping and payload, named in honour of late Prof. Weinblum.

WFK: Wave Forming Keel High Speed Catamaran Craft, employment of stepped planing demihulls, like type LSBK, but additionally introduction of air to the planing surfaces to form lubricating film of micro-bubbles or sea foam with the effect of reduction of frictional resistance, patented by A Jones (USA).

WIG: Wing in Ground Effect Craft, various concepts and patents, passenger and cargo carrying, excellent calm water performance, limited operational wave height, most prominent prototypes are the Ecranoplans of the former USSR.

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C2: COMPARATIVE ROUTE ANALYSIS

This section explains the methodology and assumptions used to prepare the route analysis for the seven routes described in Section 4.5.2.

Baseline route information and statistics were taken from the Overview of Existing Ferry Networks (Table C.1).

Table C.1: Route data

Route	Length (km)	Duration (mins)	Summer Weekly Sailings	Winter Weekly Sailings	Nominal Fetch (km)	People	Cars	Coaches and CVs
Scrabster - Stromness	47	90	19	19	1000	142884	40205	6335.5
Ullapool - Stornoway	84	160	15	10	1000	188945	48524	12381
Uig - Tarbert	44	105	10	3	500	69911	21725	1090
Uig - Lochmaddy	50	105	11	9	500	82136	27788	5171
Kennacraig - Islay	47	140	26	19	100	148047	47438	7617
Ardrossan - Brodick	21	55	35	24	50	716631	125819	10869
Oban - Craignure	17	45	41	21	50	653313	115916	9009

Existing vessel data was sourced from www.calmac.co.uk and www.shipsofcalmac.co.uk. Data on a replacement fast ferry used information sourced from www.afaiships.com. See Table C.2.

Table C.2: Vessel data

Vessel	GWT	Draft	Length	Cruise (kts)	Cruise (km/h)	People	Cars
Hamnavoe	8940	4.4	112	19	35	630	98
Isle of Lewis	6753	4.19	101.25	18	33	680	123
Hebrides 3	5506	3.22	99	16.5	31	612	110
Hebrides 3	5506	3.22	99	16.5	31	612	110
Hebridean Isles	3040	3.11	85.15	15	28	507	110
Caledonian Isles	5521	3.2	94	15	28	1000	110
Isle of Mull	4719	3.19	90.3	15	28	1000	80
Afai 60M Car Ferry	**14400**[5]	**2.1**	**59**	**40**	**74**	**438**	**52**

[5] Installed engine power

The average speeds of the current vessels on the routes are between 20-32 km/h, which is between 73-95% of the specified cruising speed (see Table C.3). This difference is due to the time required for manoeuvring at the berths at either end of the route between departure and arrival, and the complexity of the route. Longer, more direct routes will have higher percentages.

Table C.3: Speed and capacity existing vessels

Route	Average Speed (km/h)	% Cruising Speed	Summer Sailing Time (hrs/wk)	Winter Sailing Time (hrs/wk)	Trips (yr)	Pax Capacity (yr)	Car Capacity (yr)
Scrabster - Stromness	31	89%	57	57	1976	1244880	193648
Ullapool - Stornoway	32	95%	80	53	1300	884000	159900
Uig - Tarbert	25	82%	35	11	676	413712	74360
Uig - Lochmaddy	29	94%	39	32	1040	636480	114400
Kennacraig - Islay	20	73%	121	89	2340	1186380	257400
Ardrossan - Brodick	23	83%	64	44	3068	3068000	337480
Oban - Craignure	23	82%	62	32	3224	3224000	257920

We then calculated the utilisation of vessels on these routes (see Table C.4). It is notable that the average utilisations appear quite low. This might be expected considering the seasonal nature of demand.

Table C.4: Utilisation existing vessels

Route	Passengers	Cars	Coaches and CVs
Scrabster - Stromness	11%	25%	20%
Ullapool - Stornoway	21%	35%	60%
Uig - Tarbert	17%	34%	10%
Uig - Lochmaddy	13%	28%	31%
Kennacraig - Islay	12%	22%	20%
Ardrossan - Brodick	23%	44%	22%
Oban - Craignure	20%	56%	17%

We considered the potential to replace existing mono-hull vessels with a twin hull fast ferry. This vessel has a much higher cruising speed than the existing vessels, but a lower passenger, car and commercial vehicle capacity.

The fast ferry's expected performance in terms of sailing speeds, times and capacity were calculated, assuming the same manoeuvring factors. The figures indicated that based on the same operational time at sea, a fast ferry could provide 59% to 140% more sailings (see Table C.5).

Table C.5: Speed and capacity fast ferry						
Using 60M Fast Ferry	Cruise speed (km/h)	Cruise (kts)	Trip Duration (mins)	Summer Weekly Sailings	Winter Weekly Sailings	Potential increase in service nos
Scrabster - Stromness	60	32	53	32	32	68%
Ullapool - Stornoway	80	43	67	36	24	140%
Uig - Tarbert	60	32	53	19	5	85%
Uig - Lochmaddy	60	32	53	21	17	90%
Kennacraig - Islay	60	32	65	56	41	116%
Ardrossan - Brodick	45	24	34	56	38	59%
Oban - Craignure	45	24	28	66	34	61%

Assuming that the increased number of services available with a fast ferry are utilised, and that demand stays constant, the fast ferry's expected average occupancy for each type of traffic (passengers, cars, commercial vehicles) was assessed (see Table C.6). Allowing for peaks in traffic the maximum allowable average utilisation is 70%, and the final column indicates whether a solely fast ferry service might be suitable for each route.

Table C.6: Utilization fast ferry				
Route	Passengers	Cars	Coaches and CVs[6]	Are occupancies acceptable?[7]
Scrabster - Stromness	10%	23%	95%	No
Ullapool - Stornoway	14%	30%	198%	No
Uig - Tarbert	13%	33%	44%	Yes
Uig - Lochmaddy	9%	27%	131%	No
Kennacraig - Islay	7%	18%	76%	Maybe
Ardrossan - Brodick	33%	50%	111%	No
Oban - Craignure	29%	43%	87%	Maybe

On several routes, the volumes of commercial vehicles and passenger coaches is such that the fast ferry used in the assessment would be unable to provide sufficient capacity for the existing traffic. However, average occupancies for passenger and car movements were less than 50% on all routes, indicating that the number of services could be reduced without creating a shortage of capacity.

[6] The data that drives this includes HGVs, which cannot in practice be transported by the fast ferry used in this example. This column illustrates that fast ferries are less appropriate for routes with a high proportion of coaches and commercial vehicles.

[7] Acceptable for providing a fast ferry service only. Occupancies below 70% are considered to be acceptable, and occupancies above 90% are unacceptable

The logistical suitability of providing additional or alternative services using fast ferries on each route has been assessed using the following key factors:

- Route Length: routes should not be too short or too long if exposed to heavy seas
- Route Complexity: higher proportion of transit time spent at cruising speed
- Nominal Fetch: open water in prevailing wind and weather direction
- Potential increase the number of service: more services in the same sailing time?
- Fast Ferry only: would the traffic mix suit only a fast ferry service?

Based on some of the key indicators generated in the analysis, the overall suitability of fast ferries to each route is summarised in Table C.7.

Table C.7: Route suitability matrix

	Route Length	Route Complexity	Nominal Fetch (km)	Potential increase in service nos	Fast Ferry Only?
Scrabster - Stromness	47	0.89	1000	68%	No
Ullapool - Stornoway	84	0.95	1000	140%	No
Uig - Tarbert	44	0.82	500	85%	Yes
Uig - Lochmaddy	50	0.94	500	90%	No
Kennacraig - Islay	47	0.73	100	116%	Maybe
Ardrossan - Brodick	21	0.83	50	59%	No
Oban - Craignure	17	0.82	50	61%	Maybe
Suitability:	High Suitability		Moderate Suitability		Low Suitability

C3: FUEL COST COMPARISON FOR CONVENTIONAL AND FAST FERRY

This section presents a comparative analysis of fuel costs for a conventional monohull with a catamaran operating on the same route with the same pricing structure. Both vessels have approximately equal capacities for passengers and cars. Commercial vehicles have not been included.

Diesel engine fuel consumption is approximately 0.24 litre per hour per kw, of operational time.

One of CalMac's modern 250 passenger, 40 car monohull ferries will typically have an installed power of around 6,000 kw to travel at a service speed of 14 knots. Such a vessel will consume around 1,440 litres per hour of fuel and would travel 14 nautical miles in that period. At the approximate cost of 35p/litre the cost of fuel would be £504.00 per hour of operation.

A typical fast catamaran of similar capacity to this CalMac monohull is the 73.4m vessel designed by Nigel Gee & Associates for Alaska Marine Highways see data sheet). These vessels carry 250 passengers and 40-50 cars (depending on car size). The catamaran has installed power of 14,400 kw giving a service speed of 35 knots up to Sea State 6 (above which it has to slow down). The catamaran consumes 3,456 litres per hour and travels 35 knots in that period. The fuel cost is therefore £1,209.60 per hour.

A case study has been used to calculate the benefits of utilising a fast ferry service in comparison to a conventional monohull service. This assumes a 60 km (one way) trip for both of these vessels, a passenger fare of £14, a car fare of £70 and that both vessels cruise for all but 2km of each trip when they are manoeuvring on and off the berths. Manoeuvring is assumed to use 33% of the fuel consumption rate of cruising. Trip durations are calculated on the basis that the main proportion of the trip is completed at cruise speed with an additional 30 minute period for berthing, unloading and loading. The fast ferry is therefore able to undertake two trips compared to the monohull's one trip.

It is assumed both vessels require a staff of 10 persons and the average cost of each is £40 per hour. The fixed staff costs are therefore assumed to be £240 per hour for either vessel.

The load factor for passengers and cars is assumed to be 80% for the monohull. A fast ferry would be undertaking two trips in comparison to one trip for the monohull, and in the absence of an increase in demand, its load factor would therefore be 40% on the two trips.

In reality, improved frequency and a considerably shorter voyage would stimulate demand and / or allow a premium to be charged. Assessments of demand on individual routes using assumptions on propensity to travel are required to properly investigate the response of demand to improved supply.

The case study illustrates this by showing a comparison where the margin on the fast ferry is equivalent to the margin on the monohull, and the increase in traffic and increase in revenue required to achieve this.

Data sheet

The catamaran would require a 25.6% increase in fares, combined with an increase in load factor from 40% to 60% to make the same margin per trip as the monohull. In broad terms fares must increase by a quarter and traffic volumes by a half.

Under these circumstances, Table C.8 summarises the costs and revenues for the comparison.

Table C.8: Fuel cost comparison

Vessel Type	60km route	Fixed Costs	Total Fuel Cost	Gross Revenue	Margin per Trip
Monohull	1 trip	£1,160	£1,429	£5,040	£2,451
Catamaran	2 trips	£1,160	£3,430	£9,491	£2,451

The analysis would be more complicated in reality. On the one hand, an equivalent fast catamaran would typically have a capital cost of 30 to 40% higher than the conventional monohull. On the other hand, an equivalent monohull could not carry the 50% uplift in passengers assumed in the case study, and would have to be bigger.

Should a fast catamaran be able to replace two existing ferries, for example in coordination with development of a fixed link, the cost equation would change, and the pool of traffic would immediately be larger as the two routes were aggregated.

The comparison is sensitive to fuel price changes, but this has a relatively modest impact. An additional 25% in the cost of fuel requires an increase in fares by 27.4% compared to 25.6% to balance the conditions of the case study.

Engine overhaul is expensive for ferry operations with the most significant cost being lost revenues due to down time during maintenance periods. The operating time between overhauls for diesel engines is approximately 10,000 hours at which time there is usually a 1 to 2 month out of service required. Based on 12 hours of engine operation per day a vessel will require a major engine overhaul once every 2 years.

Sensitivity analysis with regard to load factors and pricing is provided on the following page.

It is a complex problem to make a proper analysis. Whether a fast ferry can generate benefits compared to a conventional monohull on a given route is therefore dependent upon a number of factors the principal ones being:

- The average load factor: higher load factors favour fast craft.
- Fuel cost: higher fuel costs penalise fast craft.
- Sea state: fast craft can only deliver benefits when they are able to operate at their service speed so exposed routes favour conventional craft.
- Fare structures: will passengers on the route pay a premium for a faster crossing?
- Route length: for a fast craft to deliver benefits the route needs to be sufficiently long for the faster vessel to deliver a significant time saving and thereby make more trips.

	Premise		Straight Comparison			Price for Faster Route			Fuel Price rises 25%		
	Time Period (hrs)		2.9	2.9		2.9	2.9		2.9	2.9	
Route	Trip Distance (km)		60	60		60	60		60	60	
	Trip Distance (nm)		32	32		32	32		32	32	
	% Trip @ Cruise Speed		97%	97%		97%	97%		97%	97%	
	% Trip @ Slow Speed		3%	3%		3%	3%		3%	3%	
Vessel	Type		Monohull	Catamaran		Monohull	Catamaran		Monohull	Catamaran	
	Cruise Speed (kts)		14	35		14	35		14	35	
	Cruise Speed (km/h)		26	65		26	65		26	65	
	Cruise Consumption (l/hr)		1440	3456		1440	3456		1440	3456	
	Slow Consumption (l/hr)		480	1152		480	1152		480	1152	
	Car Capacity		40	40		40	40		40	40	
	Passenger Capacity		250	250		250	250		250	250	
	Power		6000	14400		6000	14400		6000	14400	
	KW/kt		429	411		429	411		429	411	
	Cruise Duration		144	58		144	58		144	58	
	Berthing and Turnaround Duration		30	30		30	30		30	30	
	Total Trip Duration in hrs		2.9	1.5		2.9	1.5		2.9	1.5	
Price	Fuel - per litre		£ 0.35	£ 0.35		£ 0.35	£ 0.35	Premium	£ 0.44	£ 0.44	Premium
	Car - One Way		£ 70.00	£ 70.00		£ 70.00	£ 87.89	25.6%	£ 70.00	£ 89.21	27.4%
	Passenger - One Way		£ 14.00	£ 14.00		£ 14.00	£ 17.58		£ 14.00	£ 17.84	
Results	No Trips in Time Period		1.0	2.0		1.0	2.0		1.0	2.0	
	No of Trips to Provide		1.0	2.0		1.0	2.0		1.0	2.0	
	Fuel Cost (per hour)		£ 504.00	£ 1,209.60		£ 504.00	£ 1,209.60		£ 630.00	£ 1,512.00	
	Fuel Cost (per time period)		£ 1,429.12	£ 3,429.89		£ 1,429.12	£ 3,429.89		£ 1,786.40	£ 4,287.36	
	Staffing Costs		£ 1,160.00	£ 1,160.00		£ 1,160.00	£ 1,160.00		£ 1,160.00	£ 1,160.00	
	Gross Revenue (per time period)	Load Factor									
		100%	£ 6,300.00	£ 12,600.00		£ 6,300.00	£ 15,819.41		£ 6,300.00	£ 16,057.60	
		90%	£ 5,670.00	£ 11,340.00		£ 5,670.00	£ 14,237.47		£ 5,670.00	£ 14,451.84	
		80%	£ 5,040.00	£ 10,080.00		£ 5,040.00	£ 12,655.53		£ 5,040.00	£ 12,846.08	
		70%	£ 4,410.00	£ 8,820.00		£ 4,410.00	£ 11,073.59		£ 4,410.00	£ 11,240.32	
		60%	£ 3,780.00	£ 7,560.00		£ 3,780.00	£ 9,491.65		£ 3,780.00	£ 9,634.56	
		50%	£ 3,150.00	£ 6,300.00		£ 3,150.00	£ 7,909.71		£ 3,150.00	£ 8,028.80	
		40%	£ 2,520.00	£ 5,040.00		£ 2,520.00	£ 6,327.77		£ 2,520.00	£ 6,423.04	
		30%	£ 1,890.00	£ 3,780.00		£ 1,890.00	£ 4,745.82		£ 1,890.00	£ 4,817.28	
		20%	£ 1,260.00	£ 2,520.00		£ 1,260.00	£ 3,163.88		£ 1,260.00	£ 3,211.52	
		10%	£ 630.00	£ 1,260.00		£ 630.00	£ 1,581.94		£ 630.00	£ 1,605.76	
		5%	£ 315.00	£ 630.00		£ 315.00	£ 790.97		£ 315.00	£ 802.88	
		1%	£ 63.00	£ 126.00		£ 63.00	£ 158.19		£ 63.00	£ 160.58	
	Margin (per time period)	Load Factor			Dual Service			Dual Service			Dual Service
		100%	£3,710.88	£8,010.11	£11,720.99	£3,710.88	£11,229.53	£14,940.41	£3,353.60	£10,610.24	£13,963.84
		90%	£3,080.88	£6,750.11	£9,830.99	£3,080.88	£9,647.58	£12,728.46	£2,723.60	£9,004.48	£11,728.08
		80%	£2,450.88	£5,490.11	£7,940.99	£2,450.88	£8,065.64	£10,516.52	£2,093.60	£7,398.72	£9,492.32
		70%	£1,820.88	£4,230.11	£6,050.99	£1,820.88	£6,483.70	£8,304.58	£1,463.60	£5,792.96	£7,256.56
		60%	£1,190.88	£2,970.11	£4,160.99	£1,190.88	£4,901.76	£6,092.64	£833.60	£4,187.20	£5,020.80
		50%	£560.88	£1,710.11	£2,270.99	£560.88	£3,319.82	£3,880.70	£203.60	£2,581.44	£2,785.04
		40%	-£69.12	£450.11	£380.99	-£69.12	£1,737.88	£1,668.76	-£426.40	£975.68	£549.28
		30%	-£699.12	-£809.89	-£1,509.01	-£699.12	£155.94	-£543.18	-£1,056.40	-£630.08	-£1,686.48
		20%	-£1,329.12	-£2,069.89	-£3,399.01	-£1,329.12	-£1,426.01	-£2,755.13	-£1,686.40	-£2,235.84	-£3,922.24
		10%	-£1,959.12	-£3,329.89	-£5,289.01	-£1,959.12	-£3,007.95	-£4,967.07	-£2,316.40	-£3,841.60	-£6,158.00
		5%	-£2,274.12	-£3,959.89	-£6,234.01	-£2,274.12	-£3,798.92	-£6,073.04	-£2,631.40	-£4,644.48	-£7,275.88
		1%	-£2,526.12	-£4,463.89	-£6,990.01	-£2,526.12	-£4,431.69	-£6,957.81	-£2,883.40	-£5,286.78	-£8,170.18
	Margin/Trip	Load Factor									
		100%	£3,710.88	£4,005.06		£3,710.88	£5,614.76		£3,353.60	£5,305.12	
		90%	£3,080.88	£3,375.06		£3,080.88	£4,823.79		£2,723.60	£4,502.24	
	Limited number of passengers	80%	£2,450.88	£2,745.06		£2,450.88	£4,032.82		£2,093.60	£3,699.36	
	Fast ferry margin is 91% less than	70%	£1,820.88	£2,115.06		£1,820.88	£3,241.85		£1,463.60	£2,896.48	
	conventional ferry margin	60%	£1,190.88	£1,485.06		£1,190.88	£2,450.88		£833.60	£2,093.60	
		50%	£560.88	£855.06		£560.88	£1,659.91		£203.60	£1,290.72	
		40%	-£69.12	£225.06		-£69.12	£868.94		-£426.40	£487.84	
		30%	-£699.12	-£404.94		-£699.12	£77.97		-£1,056.40	-£315.04	
		20%	-£1,329.12	-£1,034.94		-£1,329.12	-£713.00		-£1,686.40	-£1,117.92	
		10%	-£1,959.12	-£1,664.94		-£1,959.12	-£1,503.97		-£2,316.40	-£1,920.80	
		5%	-£2,274.12	-£1,979.94		-£2,274.12	-£1,899.46		-£2,631.40	-£2,322.24	
		1%	-£2,526.12	-£2,231.94		-£2,526.12	-£2,215.85		-£2,883.40	-£2,643.39	

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