

Summary

Lord Tony Berkeley asked this paper's author, Bill Davidson, to prepare a submission for the Isles of Scilly Transport Board. As the Transport Board considers options for future ferry services the experience from elsewhere suggests that serious consideration should be given to a ro-ro based solution – even though there is little actual or potential demand for the routine carriage of cars. This paper sets out the main arguments and describes options.

Introduction

On many European ferry routes, the consideration of new vessels and their associated service characteristics only comes round every 25-30 years.

In the UK the vast majority of ferry services are in Scotland with a great many ferries supporting small and fragile island communities – as in the Isles of Scilly. In Scotland the vast majority of ferry services have been State subsidized since the 1960s and with government funding support there has been a steady progression of service vessel types as well as very substantial reductions in fares as a result of more recent SNP government policies. However, it has been unsubsidized private sector operators who have introduced two of the more significant service developments in the last 50 years – one of which was ro-ro.

This paper seeks to apply the Scottish experience to the Isles of Scilly services and to offer suggestions for the Transport Board members and the ISSG to consider.

Scottish ferry services: the historical context

Much of the Scottish ferry network is based on ferry services of 100-150 years ago originally established by the railway companies. This saw ferries operating from piers adjacent to railheads and in turn the flow of traffic resulted in the development of these railhead/ferry towns. Often piers were built in fissures where the underlying Scottish granite met the sea but for shallow drafted passenger dominant paddle steamers this was not an issue. Rather than build new terminals in deeper water many of the current services use relatively large ro-ro ferries with an unusually shallow draft continuing to operate from long established shallow draft piers close to town centres.

Through the 1960s the progressive shift of freight from rail to road and from coastal steamers to ferries saw an increase in demand for the carriage of freight on the ferries.

Loading and unloading a ferry by crane is known as lo-lo (lift-on, lift-off) – as with the current ISSG services.

Where cargo on wheels is driven or towed on and off a ferry this is referred to as ro-ro (roll-on, roll-off).

Replacement of lo-lo with ro-ro

On the West Coast of Scotland Clyde & Hebrides ferry services are operated by CalMac Ferries using a fleet of some 33 ferries. The last CalMac lo-lo vessel was replaced 20 years ago with the ro-ro MV Lochnevis serving the Small Isles of Rum, Eigg, Muck and Canna – combined population of about 150. More below on this route and the 'technology' used.

The Orkney archipelago has 20 inhabited islands served by a 9 vessel inter-island ferry service of 15 routes – operated by the local authority. The two remaining lo-lo vessels operate the north isles service and are the subject of a current plan to replace them. The replacement vessels are almost

certain to be ro-ro mainly for health & safety reasons. Hence, even the most northerly island of North Ronaldsay – population of 72 – will become a ro-ro service.

In the Shetland archipelago of 100 or so islands there are 16 that are inhabited. Inter-island ferry services are operated by the local authority who utilize a fleet of 11 vessels to serve 10 routes, with the eleventh route operated under contract by a private sector operator. Only one route – serving Fair Isle (population 65) - remains lo-lo and the current replacement proposal will see ro-ro being adopted on this route too, again largely for health & safety reasons.

A similar pattern of a shift from lo-lo to ro-ro can be seen in other countries such as Canada - with ro-ro ferries being introduced to serve ever smaller island and remote communities.

A variation to this generality is Norway where the long established and heavily subsidized 67 port coastal ferry trade (aka Hurtigruten) has developed the widespread use of side loading vessels. In this case cargo is palletized, loaded and unloaded from vessels through side doors which access side lifts to carry cargo between the loading point and the ships' holds below. Much of the cargo is fish related and this system has worked well for the Norwegians. Over the last 50 years or so as Norwegian passenger numbers fell the Hurtigruten has evolved into a well-appointed cruise passenger 'product' aimed at the foreign tourist market - carried on top of a side-lift cargo ship shifting goods to remote communities and refrigerated fish to market. The current Covid-19 related dearth of tourists has resulted in very significant cuts to the frequency of Hurtigruten freight services.

Main Benefits of Ro-Ro

Health & Safety

As has been noted health & safety has been a significant factor in deciding to replace lo-lo with ro-ro when a new ferry is being specified. As a crane based slung cargo handling method lo-lo is inherently a higher level of risk than a ro-ro wheel-based method of cargo handling. Even where the service track record shows no significant lo-lo accidents the view of health & safety professionals is that as a safer method of cargo handling ro-ro should be the preferred method if at all possible.

Cargo damage

A ro-ro based system will see cargo being handled less frequently and this will reduce the potential for cargo being damaged with all its associated inconvenience and costs. A ro-ro based trailer system – as described below – would see parcels, boxes, etc being loaded into trailers in Penzance and only unloaded at the final destination island. The removal of the handling onto and off Scillonian III and then the handling onto and off Lyonesse Lady reduces the occasions on which damage can occur particularly for off island cargo.

Efficiency

Similarly, a ro-ro based system will require considerably less labour to load, stow and unload cargo improving significantly the operating cost of cargo operations.

Ro-Ro vessel options

For many people ro-ro conjures up images of a Dover to Calais size of ferry. However, there are many different types and sizes of ro-ro vessel. A few – relevant for consideration for Scilly – are described below.



This CalMac ferry was specially designed to operate the service from Mallaig to the sparsely populated Small Isles of Rum, Muck Eigg and Canna. Given the distance and type of waters a Euro B is the class of vessel (like MV Lochnevis) needed to operate the mainland to Isles of Scilly service. This vessel has a conventional bow and was designed to load and unload all vehicles over a stern ramp only – i.e., the vessel is not ‘drive through’ like bigger ro-ro ferries. Designed to carry up to 190 passengers, 14 cars or one 44te artic or a combination of cars and freight this vessel is the only Euro B ro-ro in the CalMac fleet designed to operate from a normal concrete slipway as opposed to a linkspan – described further below. As a result, the vessel has a 27m stern ramp to allow the 2.7m draft vessel to remain afloat while operating from a slipway. Operating a distance from a slipway means the vessel relies on ‘alignment structures’ to keep it squared up to the slipway which is an interesting contrast to the SLV design described below.

As a Euro B vessel this ferry is able to operate across the Minch to the Outer Hebrides. While not quite the Western Approaches the weather encountered is significant and CalMac prides itself on their ability to keep services running if at all possible and safe to do so.

It is relevant to note that when ro-ro became available for travel to the Small Isles a system was put in place the effect of which is to prevent inappropriate cars travelling to the islands. Essentially other than islanders it tends to be only service engineers and travellers with mobility difficulties who get permits to take vehicles on the ferry. A benefit for the islands is that they can now receive deliveries and services (e.g., the Council refuse collection lorry) in the same way as other islands and mainland locations.

Canada: MV Veteran



This 80m vessel and its sister ship both delivered in 2015 operate services in Newfoundland. While only 80m long these vessels have a considerable capacity at 200 passengers and 50 cars or 190m lane metres of freight.

Note: in ro-ro ferries freight capacity is usually described in terms of lane metres. For guidance a standard road going artic trailer is 13.4m long and will typically carry a maximum of about 28te of cargo. So, the 190 lane metres of these vessels would accommodate in theory 14 artic trailers but in practice a bit less. Rarely is a ro-ro load made up of only artic trailers. A more typical load is a combination of different sized lorries, and vans.

While more or less the same length as Scillonian III the passenger capacity is less but the freight capacity very significantly more. Clearly within a hull size the two requirements can be blended.

Swath: MV Alfred



This type of vessel is based on a catamaran design with a shallow draft (2.8m) resulting in improved fuel efficiency compared to a conventional monohull ferry. The topic is controversial but some academic research suggests that passenger comfort can be a problem in this type of vessel as large waves will lift each hull in turn resulting a corkscrew type motion in heavy weather. MV Alfred operates across the Pentland Firth where there are very strong tides, currents and winds as the Atlantic Ocean is squeezed through the gap between Caithness and the Orkney Islands to reach the North Sea. Again – while not the Western Approaches – the seas regularly encountered are very significant.

Stern loading & unloading only but a wide deck area allowing most vehicles to turn on-board without reversing. At some 98 cars the MV Alfred is clearly too big for IoS but the design type can and has been scaled to a more appropriate size.

In comparison to a conventional monohull ro-ro this this style of vessel typically has both a very significantly lower capital cost and lower on-going running costs due to its fuel efficiency.

SLV: Mathew Flinders



This vessel is one of a series (15+) of various sizes (20m to 100m) which operate in Australia and the Pacific islands. They are designed as a Stern Loading Vessel (SLV) operating from a concrete slipway (or a beach) in a manner similar to a military style of Landing Craft. However, the design overcomes the main design problems with Landing Craft. Indeed, it is understood that the US military are close to adopting the design for their next series of beach landing vessels designed to carry multiple tanks, artillery, etc.

It is suggested that this type of vessel is a strong contender for the design of vessel to operate the inter-island freight services servicing the off islands. The Australian designers – who have some knowledge of Isles of Scilly – believe it is also a potential candidate for the mainland to IoS service vessel with a very competitive price as well as a proven design.

Where a conventional Landing Craft is designed to keep the propellers and rudders immersed and clear of the slipway the SLV is designed to land the stern onto a slipway or beach – while still protecting the stern gear.

Berthing Options

A ro-ro ferry (other than a landing craft or the SLV design) requires a suitable interface onto which the ship's ramp is landed for the traffic to be driven on and off. Of the main options three are described below. In each case the length of the structure is largely driven by the difference in tidal height (peak high water to lowest low) that needs to be accommodated. In an ideal installation all possible tidal conditions would be catered for. However, the engineering and associated costs of accommodating the tidal extremes needs to be weighed against the predictable timetable changes – and inconvenience - that would allow a simpler and cheaper structure to accommodate the vast majority of vessel berthings.

Floating linkspan – connecting to land at beach height

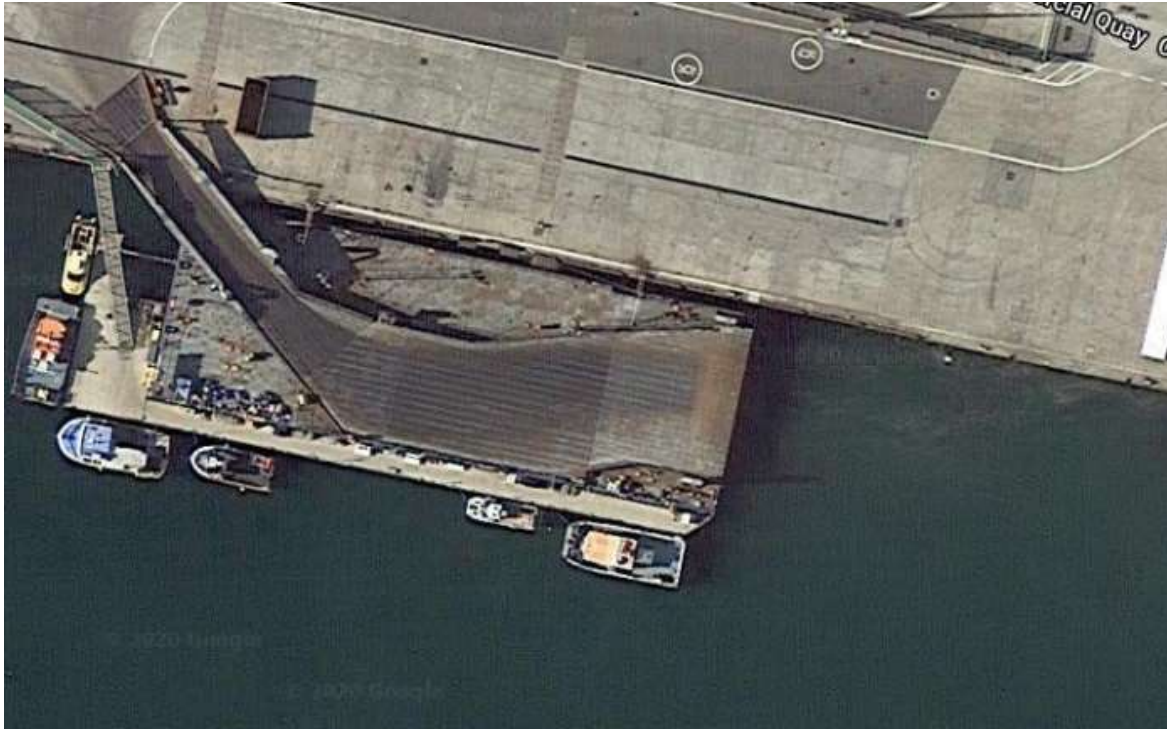


This design is similar to the hydraulic linkspan described below with the linkspan bridge hinged at the landward end. However, in this case instead of the seaward end being held up by hydraulic rams on a structure mounted on the seabed the seaward end is supported on a floating pontoon which rides up and down on the tide on tethers to pile type structures. Floating linkspans are also usually much cheaper.

In St Marys this design could support the simple transfer of loads for onward carriage to the off islands with both vessels moored at the pontoon and ro-ro loads being driven across the pontoon deck from one vessel to the other.

The main downside of this design is in periods of heavy weather where the pontoon can be moving as well as the ferry resulting in more challenging loading and unloading conditions. However, the extent of such movements will depend on the degree of shelter. Western Ferries on the Clyde have been using floating linkspans for over 40 years. They advise that the relative motion of the vessel and pontoon is rarely an issue.

Floating linkspan to work from an existing pier



This design is recommended for consideration at St Mary's and probably also Penzance.

The above floating linkspan is known as Eurolink and is installed in Aberdeen Harbour. Here the floating linkspan allows a ro-ro ferry to berth alongside a conventional pier with the pontoon carrying all the weight of the linkspan bridge which allows vehicles to transit easily down from the quayside height above the waterline to the ferry cargo deck height above the waterline.

For comparison a couple other design types are described below..

Hydraulic linkspan



This is a commonly used interface but probably the most expensive option. Essentially it is a bridge structure hinged at the landward end with the seaward end raised or lowered by hydraulic rams or cables. The required height above the waterline will vary with the load in the ferry. Also, the rams raise or lower the seaward end according to the rise and fall of the tide. Where there is a large tidal range then the linkspan bridge will be long and consequently the hydraulic rams have to lift and hold a heavy bridge structure as well as carry the weight of all vehicles on the linkspan bridge. Overall the structure becomes large, heavy and expensive. However, the structure is fixed to dry land as well as the seabed and does not move with the wind and waves thereby reducing a source of potential difficulties for loading and unloading vehicles in heavy weather.

Short linkspan with vessel buoyancy



This design is used in Shetland for the internal ferries. With a small ($\sim 1.5\text{m}$) tidal range there is no need for a lengthy linkspan bridge to accommodate a large tidal range. As a consequence, the linkspan bridge structure is relatively short and the design is such that on mooring the ferry slides under the linkspan bridge so that the ferry's own buoyancy is used to carry the weight of the vehicles passing over the linkspan bridge onto and off the ferry.

Carriage of freight etc to/from the off islands

For the Isles of Scilly the carriage of freight to and from the off islands as well as to St Marys is an important consideration.

The suggested use of a floating linkspan would facilitate the simple movement (on wheels) of cargo from the mainland ferry to the off islands ferry with the two vessels berthed on the pontoon at right angles to each other.

At the off islands it is suggested that loading & unloading of freight is done via a concrete slipway – a functional solution at relatively modest cost.

Concrete slipway



This is a typical CalMac ferry terminal featuring a 1:8 concrete slipway with imbedded metal bars on which the ferry ramp lands creating a metal-on-metal contact to reduce wear damage on the ferry ramp in heavy weather when the ramp can move on the slipway as the ferry moves in a swell.

This picture also illustrates one style of alignment structure to allow the ferry to remain square on to the slipway.

The civil engineering involved in a slipway is fairly straightforward and relatively low cost in comparison to a hydraulic linkspan.

In theory this type of setup could be implemented in St Mary's relatively easily and cheaply in the area of the current slipway used for project cargoes. For the off islands if a SLV design of vessel were used it is probable that there would be little need for alignment structures but suitable locations and assessments will be needed to confirm.

19 Carriage of luggage and small volume freight



It is suggested that airport style luggage trolleys are used for the carriage of luggage, camping equipment, dive equipment etc. In such a system the travelling passengers are required to load and

unload their bags etc to/from the trolleys. This is the system which was very successfully implemented by NorthLink Ferries for services to Orkney and Shetland.

Carriage of palletised and heavier freight

Palletised freight and big bag bulk freight can also be accommodated on similar flatbed trolleys as is done with air freight carried in containers. For long items such as timber or roof trusses ‘trombone’ type trailers can facilitate easy handling.

Tow Tractors



While small in size this type of airport style tow tractors has a significant capacity. At airports a train of many, many trolleys with a high overall weight are quite common.

Available in different sizes and powered by batteries or diesel capacities of 15 – 30 tonnes are readily available as new and used standard equipment.

Conclusion

The specification for a new ferry comes around rarely. As has been done in Scotland, Canada and elsewhere the opportunity of new vessels has been used to move forward the service offering and in particular replace lo-lo services with ro-ro services mainly for the health & safety reasons but also to gain the efficiency and damage reduction advantages.

About the author: Bill Davidson was a management consultant and corporate financier. With KPMG he created and financed the new-start ferry company, NorthLink Ferries. He was appointed as its first CEO and served for 10 years to 2012. NorthLink continues to operate the lifeline ferry services to the Orkney & Shetland Islands and is currently managed by Serco. Bill spent 15 years working with CalMac Ferries and David MacBrayne as a consultant and then as a director. In retirement Bill has provided ferry related consultancy advice for a number of projects in Scotland, England and overseas.