BRITISH PORTS ASSOCIATION

‘I have a bridge to sell you’

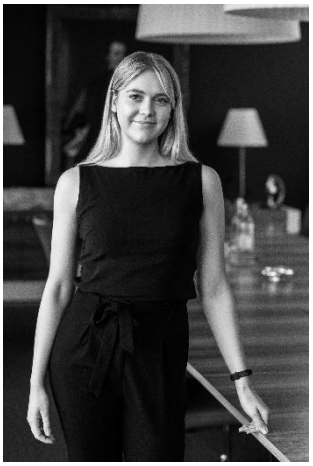
Making The Case for Port Connectivity

The British Ports Association

The British Ports Association (BPA) is the national association for ports, harbours and terminals, speaking for over 100 port authorities who own and operate over 400 ports, terminals and port facilities. We represent the interests of a diverse group of ports to all tiers of government.

Our membership accounts for 86% of all tonnage and handles 85% of all vessel arrivals. The BPA also represents all the UK's main energy gateways, 19 of the top 20 fishing ports and an extensive network of ports and harbours that facilitate over one million leisure craft and yachts.

Author



Phoebe Warneford-Thomson joined the Association in 2019, working within all policy areas to strengthen the BPA's positions. Phoebe's role includes data analysis and evidence gathering to both back up our lobbying asks as well as to support our membership.

She is particularly focussed on transport and freight issues, trade and port performance statistics as well as being the BPA's lead on the development of the UK government's flagship Freeports agenda. Alongside this, Phoebe is also the BPA's lead for Scottish ports and policy issues.

Contents

Executive Summary

A redundant and superfluous use of public money

- Research commissioned by the British Ports Association from a leading engineering firm estimates that a fixed link between Northern Ireland and Great Britain is likely to cost in the region of £20 billion. Such projects have a high likelihood of cost overruns of 80%+. This, combined with the cost of infrastructure upgrades on either side of the link, means that overall costs could exceed **£40 billion**, with a negligible return on investment expected. This sum is before continued operations and maintenance are considered.
- Experts concluded that the scale and challenge of the project are unprecedented and as a result costs would be unmanageable.
- The engineers' report, attached at Annex A, indicates that physical constraints, such as water depth and metocean conditions mean the option of a bridge is out of the question. However, the length and depth of water, dumped munitions and complex geology also mean a tunnel is a challenging and costly prospect.

Increased emissions

- The project would also pour water on the Government's green agenda, with the resulting modal shift from shipping to road (if the bridge was actually used by hauliers) would raise emissions by 133%. While the materials to even construct the link also come with staggering environmental costs.
- Efficiency of freight transport would also be poor if the link was established. There is no natural place for Brexit checks of goods to occur and journey times will increase, with HGV drivers having to take a break before or after transiting the link to avoid breaking the law on legal limits for driving time.

Ready-made alternative investment opportunities exist

- The British Ports Association (BPA) has presented the economic benefits of establishing a comprehensive port connectivity plan, with an anticipated 400% return on investment derived through cost savings for businesses, with a positive impact on emissions and the net-zero agenda.
- The Programme highlights key examples of work that should be undertaken to consider the matter of port connectivity, drawing on the work of the 2018 Port Connectivity Study and the BPA's own research.

Introduction

The Government's Union Connectivity Review is currently undertaking a feasibility study into a fixed-link between Great Britain and Northern Ireland. Previously dismissed as a white elephant, there has been growing concern over the seriousness of suggestions of such a project.

The BPA welcomes the Union Connectivity Review and any Ministerial interest in improving infrastructure links within and between the UK. UK ports invest £600m of private capital into infrastructure every year and depend on world-class hinterland connectivity to keep goods and passengers moving. As shown in this report, there are urgent investment priorities for the sector but a fixed link would be at best a distraction and at worst an black hole of spending that would divert public money away from highly-productive, highly valuable transport schemes.

The BPA has commissioned a leading engineering consultancy to assess the scale of this challenge and present an estimated cost for the project. Experts concluded that the scale and challenge of the project are unprecedented and as a result costs would be unmanageable.

Our engineering consultants recorded that a bridge would be an entirely unviable option. This is partly due to metocean conditions present in the Irish sea that would often shut the bridge. Also, few bridges in the world have ever been built at depths over 50m, yet Beaufort's Dyke, which the link must cross, has a depth of over 200m. Only a tunnel would have a shred of workability and even this would represent vast costs – to industry, the environment and the nation's purse.

Cost Breakdown

BPA research has found that existing estimates of the cost of construction of a fixed link to be £15-20bn are reasonable. However, this does not include annual costs of operations and maintenance, which means the project represents significant additional costs for years to come. Also, substantial investment would be needed in road and rail links on either side, further driving up cost. On the Scottish side alone, upgrades to the road network are expected to add a further £1bn to the project costs and upgrades to the rail network would be more expensive still.

Furthermore, there is major cost uncertainty due to untested approaches, meaning that the actual costs of the project are likely to well exceed this figure. Examining lessons learned from the Channel Tunnel project, we know that costs exceeded over 80% of original estimates. Experts, therefore, estimate that it would not be unexpected if the cost of this rose above £36bn, even before added costs of maintenance and invested needed for connectivity at either end.

The BPA estimates that the cost of transport upgrades on either side of the link, as well as the establishment of locations for border checks that do not disrupt the flow of goods, could exceed £4bn. Thus, to establish a fixed link between Northern Ireland and Great Britain, an investment of £40bn plus the ongoing cost of maintenance and upgrades each year is required. This sum represents over 10% of the UK's total budget deficit.

Project element	Estimated Cost Ranges
Construction costs	£15-20 billion
Likely cost overruns[1]	+80% (£16 billion)
Associated connecting infrastructure upgrades	£4 billion
Total final cost[2]	**£40 billion**

[1] Based on experiences with similar projects

[2] without the cost of operations, maintenance and upgrades to link and connected transport links factored in

Fixed Link: Barriers

The full report which evaluates the Government's proposals for a fixed-link, prepared by a leading engineering consultancy, can be found in Annex A attached at the end of this report. A summary of the key barriers is below.

Physical Constraints

The length of crossing and depth of water to be crossed underly the unfeasibility of this project.

Dumped munitions and explosives on the route, as well as busy shipping lanes, add significant complications to construction.

Geology and the metocean conditions also represent a barrier here, which would drive up costs significantly to overcome.

Environmental Considerations

The current planned route crosses numerous protected sites of conservation, as well as features of archaeological importance.

Commercial fisheries would be impacted through permanent loss of fish spawning and nursery grounds as a result of the construction of bridge foundations or a tunnel.

The fixed link would involve the use of considerable construction materials and the associated carbon footprint to even build it is enormous, as steel and concrete are both massively carbon-intensive to manufacture. For example, the Channel Tunnel has two tunnels lined with concrete rings approximately 7m in diameter and 0.35m thickness. If the same solution were employed for the proposed fixed link this would equate to approximately 600000m^3 of concrete just for the tunnel lining – production of this alone would produce 103,824,000kg of CO_2. This is the same CO_2 output as 22,570 cars produce over a year. This is more CO_2 than if the entire populations of both Edinburgh and Glasgow (1.08 million people) flew to a European destination– from the concrete used alone.

When built, the link could also drastically increase greenhouse gas emissions from transport, by encouraging the mode shift from shipping, the most carbon-efficient form of transport per kilometre, to road. Should modal shift from GB-NI ferries to road haulage via the fixed link occur, the UK would see a 133% rise in CO_2 emissions on this route.

Invest in Existing Infrastructure Links

In response to Government's proposals to divert significant funds towards a redundant transport project, the BPA has prepared a Comprehensive Port Connectivity Programme to set a productive plan for investment, at a mere fraction of the cost of the fixed-link.

The Department for Transport's 2018 Port Connectivity Study presented some key lessons to Government. This study was welcomed by the British Ports Association and Industry, though in many cases confirmed what the industry already knew. Despite this being a valuable contribution to Government's understanding of port connectivity, there has been no significant change to port connectivity or programme of investment announced since 2018.

The BPA has conducted an ongoing review of Port Connectivity Since the Summer of 2020; considering the foundations of what it means to be a connected port, from surface access, digital connectivity and other requirements, such as energy connectivity or provisions such as housing to support a skilled workforce. This publication considers the importance of surface connections and highlights what would constitute an effective comprehensive investment programme to secure the connectivity of UK ports, building on the work of the 2018 Port Connectivity Study. This programme re-focuses action on port connectivity and identifies where strong value for money investments can be made, to the benefit of UK PLC and thus the Government's finances.

Return on Investment

Investment in transport infrastructure has long been regarded as representing strong value for money, with well-planned schemes offering high potential returns on the initial investment.

This concept is well supported by literature and research, including the IMF, which estimated that an increase in public investment in infrastructure of 1% of GDP can lead to a 2.6% increase in GDP over four years.

Sir Rod Eddington's Transport Study, commissioned by HM Treasury and the Department for Transport in the 2000s also contributed to our knowledge of the true benefits of transport investment in the United Kingdom. Eddington reported that transport improvements that deliver time, cost and journey reliability savings, particularly for business and freight traffic, can significantly contribute to GDP through an increase in overall cost savings for business. One conclusion

drawn noted that a 5% reduction in travel time for all business travel on the road network in Great Britain could generate cost savings to business in the region of 0.2% GDP.

The Eddington report also concludes that while transport projects, in general, offer high potential returns on investment (as much as 4x), investment in surface access to ports had even stronger cost-benefit ratios, which was anywhere between 1:3 and 1:15.

So, a £10 billion investment could see £30-£150 billion returned to the Exchequer via derived benefits from cost savings for all types of businesses. With 95% of the UK's international trade arriving or leaving via a port, the speed and efficiency to which goods can be transported to their onward destinations – either for further processing, warehousing or to be sold to consumers - has an impact on all UK businesses and is fundamental to the health of the UK economy.

With reference to the Government's fixed-link, because there is little need or want for this work, we anticipate a negligible return on the vast investment needed. Meanwhile, we would expect to see at least 400% return on investment in a comprehensive port connectivity programme.

	Cost to Government	Return on Investment Seen by Exchequer
Fixed Link Proposals	Up to £40bn	Negligible
Comprehensive Transport Connectivity Programme	£10bn	£40bn

Sustainability

Not only does investment in surface access to ports drive efficiencies in the economy, meaning cost savings for businesses and ultimately more money collected by the Exchequer, port connectivity schemes and investment freight transport can also assist in achieving imperative sustainability targets.

Data from the Department for Transport indicates that HGVs account for around 17% of UK greenhouse gas emissions from road transport and around 21% of road transport NO_x emissions while making up just 5% of vehicle miles. A reduction in journey times is one of the most efficient ways to reduce the total emissions of HGVs, as well as other vehicles using these routes.

Furthermore, the majority of routes for road freight leaving ports must travel on local roads before reaching the major roads network and the strategic road network. There are numerous benefits to optimising local roads for this purpose. By allowing freight a swift and efficient journey out of the area, congestion will be minimised on the roads. This not only contributes to better public safety, but fewer traffic jams and bottlenecks will lead to significantly better air quality and an overall better living environment. Furthermore, by aiding port activity through these means, Government can enable ports to bring further investment into the area, creating jobs for local residents and leading to a positive cycle of benefits brought by ports to coastal communities around Britain.

Comprehensive Port Connectivity Programme

The Department for Transport's 2018 Port Connectivity Study assessed the connectivity needs of English ports and presented a welcome contribution to our understanding of the projects and upgrades required to strengthen transport connections and unlock growth in the economy. Hence, we have attached the regional case studies from the report as Annex B, as this forms a strong basis to build a comprehensive investment plan upon. However, the fundamental weakness of this report is that it considers English port connectivity in isolation – when a four nations approach is essential.

Looking at the matter of port connectivity from a UK wide perspective avoids baking in blind spots in our vision for connectivity upgrades where the strategic objectives of regions diverge in the minds of devolved and central governments. Planning to boost the connectivity of all ports also ensures a level playing field for ports across all four nations of the UK. As a result, the Government's Union Connectivity Review – bar its accompanying plans to assess a fixed link – will be a valuable exercise to address the gaps in connections between England and the devolved administrations. The Review has been largely welcomed and we look forward to the forthcoming publication of its final report this Summer.

To encourage the Government to look at port connectivity in detail across all administrations of the UK, the BPA has thus worked with ports to highlight examples of projects for 2021 that could also be included in a Comprehensive Port Connectivity Programme. While not an exhaustive list, Annex C provides examples of where investment is needed around the UK.

Annex A: Engineers Report GB-NI

1. Executive Summary

A potential fixed link between Scotland and Northern Ireland on the proposed route would have to overcome several key challenges:

- The length of the open water crossing.
- The depth of water to be crossed.
- The presence of dumped munitions and explosives on the proposed route.
- The busy shipping lanes and routes in the location of the proposed route.

Based on a comparison of capital costs of long subsea tunnels versus long sea crossing bridges, the most appropriate form of construction is likely to be a conventional bored tunnel.

The construction cost range currently being discussed in the media of £15bn to £20bn represents a reasonable estimate for the scheme. It should be noted that any scheme will include novel aspects to overcome the key challenges identified. The innovation required will inevitably bring cost uncertainty associated with untested approaches. In addition, in order to obtain benefit from the scheme a substantial investment would also be needed in road and rail links at either side of the proposed fixed link.

2. Proposed Fixed Link - Background

The feasibility of a fixed link between Northern Island and the British mainland is being considered as part of the Government's Union Connectivity Review. The interim report (published by Sir Peter Hendy in March 2021) provides no details on the fixed link beyond the fact that this aspect of the review is being

carried out as a discrete piece of work to be delivered in summer 2021.

A number of locations for the link have been discussed in the media, this report considers the route shown in Figure 1 below.

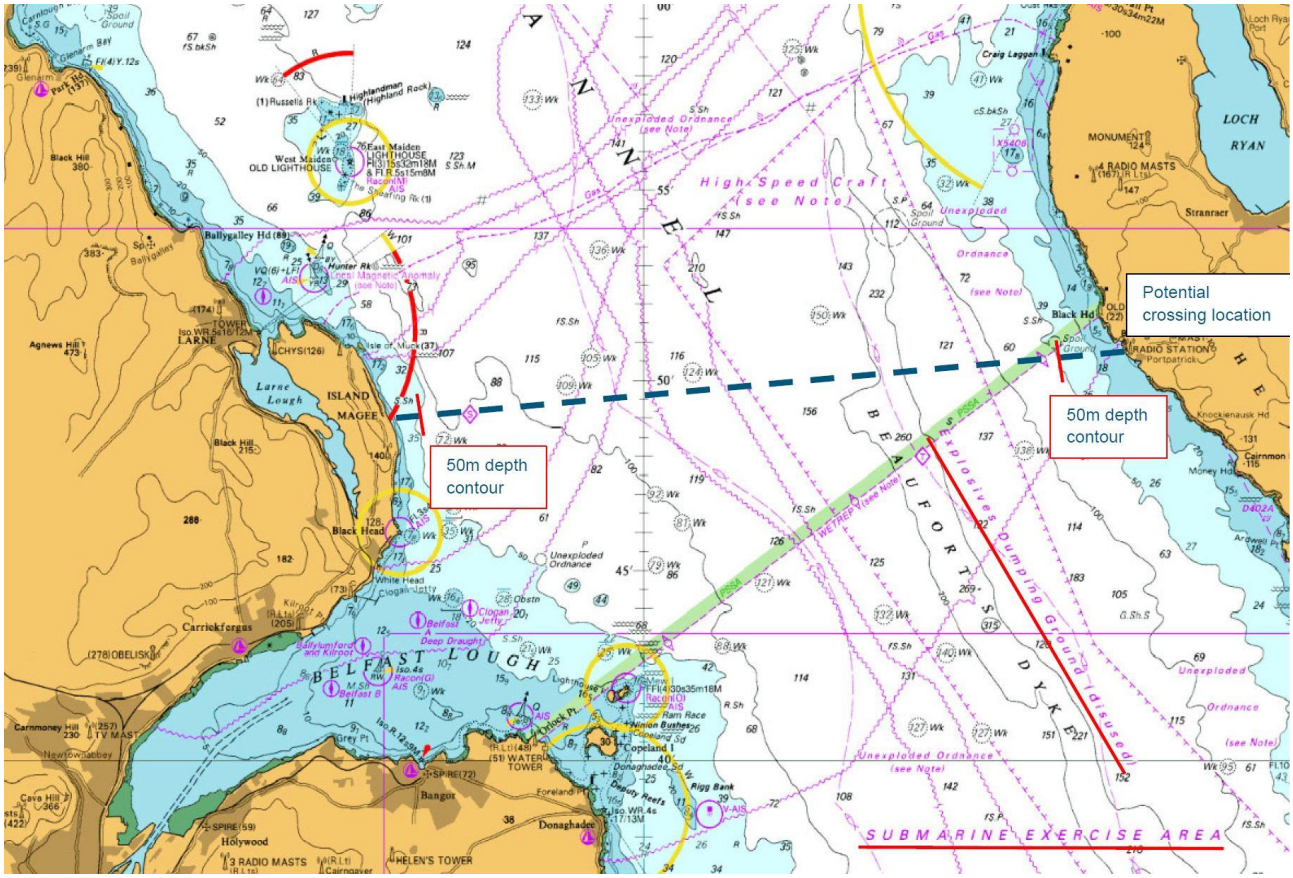


Figure 1 - Proposed location for Irish Sea fixed link - © Crown Copyright, 2021. All rights reserved. License No. EK001-700076. Not to be used for Navigation

3. Unique Challenges

3.1 Shipping Lanes

Just to the North of the proposed location, at the pinch point between the Peninsula of Kintyre and Rathlin Island, there is a designated shipping channel with a pair of 3km wide shipping lanes separated by a 3km wide traffic separation zone. These lanes are visible in Figure 2 and indicate the kind of provision for shipping that would be required for a fixed link. If a bridge solution were to be pursued, then the main span lengths would need to account for shipping entering the Irish Sea as well as shipping between Loch Ryan and Larne / Belfast.

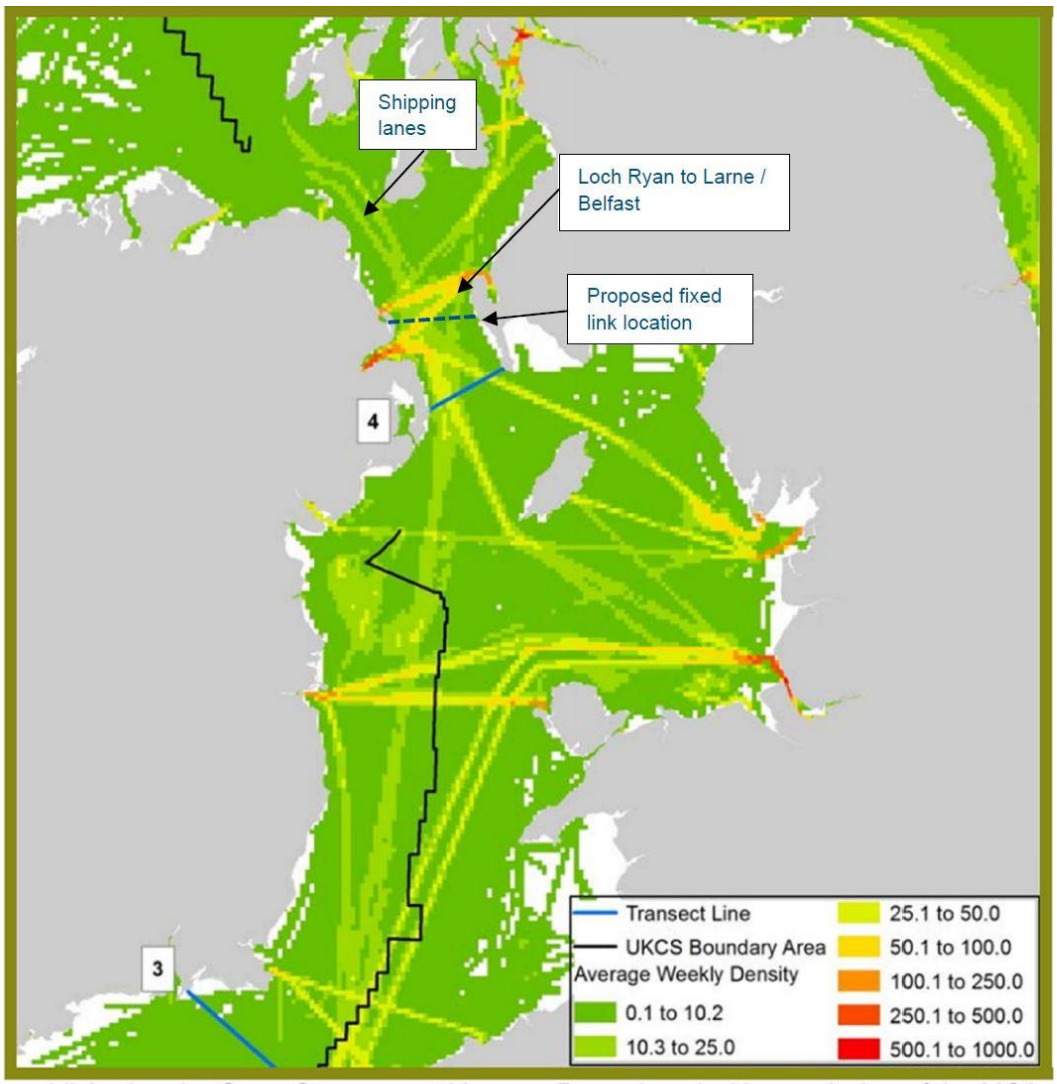


Figure 2 - Heat Map of Vessel Traffic – reproduced from the Marine Management Organisation report 'Mapping UK shipping density and routes from AIS'

If a bridge were to be constructed it would need two or more long spans across shipping lanes. The length of span required would be subject to navigational risk assessment but would need to be 300 to 400m indicatively.

In addition to the volume of surface vessels the area proposed for the crossing is also designated as a submarine training area (due to the presence of Beaufort's Dyke). The area has already been the subject of at least one near miss between a commercial surface vessel and a Royal Navy submarine[3]. Further navigational hazards, such as bridge support structures, would only exacerbate risks to navigation in this area.

3.2 Depth of Water

Approximately 87% of the total crossing length shown in Figure 1 is in water depths greater than 50m and more than 50% is in water depths greater than 100m. Where the proposed route crosses Beaufort's Dyke the depth of water exceeds 200m.

Conventional bridge foundations, such as caissons, are currently used in water depths up to approximately 50m. There are few, if any, examples of bridges being built across water greater than 50m in depth.

If a bridge option was selected, then a novel form of construction would be required for the bridge supports. For foundations in this depth of water the project would have to adapt technology from the offshore energy sector (refer to section 5.1.1) or use a completely new and untested approach (refer to sections 5.1.2 and 5.1.3).

The depth of water along the proposed route also poses problems for tunnels. The water pressure associated with depths in excess of 100m mean that careful planning is necessary to avoid problems with water ingress and flooding. This planning requires detailed information about the ground through which the tunnel will be constructed.

Site investigations in water depth such as those anticipated are possible, with drill ships being required to undertake the work. It is probable that initial phases

[3] *MAIB investigation report 13-2020: near miss between Stena Superfast VII & Royal Navy submarine*

will be required to characterise the seabed whilst later phases will need to focus on discrete areas of interest or complexity. Additional work will be required in

order to quantity the unexploded ordnance (UXO) risk discussed in section 3.4. This UXO risk will increase the cost of investigation, as will the use of offshore drilling plant/ equipment.

3.3 Length of crossing

The sea crossing from Port Patrick to Larne is approximately 38km. Whilst bridges have been built which exceed this length it does create problems for the safe operation of tunnels. The longest road tunnel in the world is currently the Laerdal Tunnel in Norway at 24.5km long. Long road tunnels require measures to guard against driver fatigue, allow emergency access and egress, provide fire safety, and to provide adequate air quality.

Longer traffic tunnels are typically for rail traffic only, the current record being held by the Gotthard Base Tunnel in Switzerland at 57km long.

The Channel Tunnel remains the longest subsea tunnel in the world, with 37.9km of its 50.45km length being under the channel.

If a tunnel were the preferred option it would most likely be rail only tunnel (for safety reasons) and would probably be the longest subsea tunnel in the world (depending on final alignment).

3.4 Unexploded Ordnance

Although there are not adequate records, it is now accepted by the UK government that around 2 million tonnes of munitions have been dumped into the Beaufort's Trench area of the Irish Sea between 1920 and 1976. The locations of the various munitions is not known with any accuracy, but it is known that a significant amount was 'short dumped' and actually lie outside the trench.

It is clear that the UXO risk is high and any proposed structure that would require a foundation in the sea bed (such as a bridge) or would disturb the surface of the sea bed (such as an immersed tube tunnel).

3.5 Metocean Conditions

The UK National Annex to Eurocode 1: Actions on Structures indicates that the basic design windspeed for the Irish sea is higher than anywhere in England and is only exceeded in Scotland to the North of Glasgow and Aberdeen.

A bridge structure can be designed to withstand the expected wind loading but additional measures, such as wind barriers or a sheltered traffic lane within the deck structure, are required in order to ensure that a bridge would remain safe for users in high winds. The high wind speeds and the frequency with which they occur also have a significant impact on construction cost. High winds result in downtime for construction operations which has an inevitable effect on construction costs.

Data from the Irish data buoy network shows that the record wave height[4] in the Irish Sea was recorded during hurricane Ophelia on the 16th of October 2017. A Significant Wave Height, Hs, of 6.64m was recorded at the M2 buoy which is the closest to the proposed route.

This wave height is greater than that which occurs at the proposed sites in Norway for floating bridges and the negatively buoyant variant of the Submerged Floating Tube Bridge (SFTB) described in section 5.1. It is likely that the wave height would increase the cost of these structural forms and make them unsuitable.

The depth averaged current for a mean spring tide across the proposed route is between 0.5 and 1.0m/s[5].

3.6 Geology

The British Geological Survey's GeoIndex Offshore[6] describes the bedrock along most of the proposed route as being mudstone and sandstone belonging to the Triassic rocks category. Faults are present at both the East and West ends of the proposed route.

There is insufficient information available during the drafting of this report to make a comparison between the geology of the Irish Sea Link route compared with the Channel Tunnel route in terms of tunnelling difficulty. The increased water pressure would make the tunnelling conditions more complex than those encountered for the channel tunnel.

---

[4] Foras Na Mara Marine Institute, Record individual wave measured in South East by M5 weather buoy during Ophelia | Marine Institute (02/06/2021)

[5] Hydrography of the Irish Sea, SEA6 Technical Report, M.J. Howarth

[6] https://mapapps2.bgs.ac.uk/geoindex_offshore/home.html (02/06/2021)

3.7 Environmental Considerations

This section outlines the key environmental constraints that would need to be considered when assessing the potential environmental impacts of the construction and operation of the proposed Irish sea link. For the purposes of this report, consideration has only been given to those constraints that are considered to pose a significant consenting risk to the proposed fixed link project.

3.7.1 Designated Sites for Nature Conservation

There are numerous offshore and onshore designated sites in the vicinity of the proposed fixed link which could be directly and indirectly impacted by the development of a fixed link. Sites that have been designated at an international, European and National level and which are in close proximity to the proposed route are listed below:

- Larne Lough Special Protection Area (SPA), Ramsar site, Site of Special Scientific Interest (SSSI);
- The Maidens SAC, SSSI;
- North Channel Special Area of Conservation (SAC);
- Red Bay SAC;
- Outer Ards SPA;
- Copeland Islands SPA;
- Belfast Lough Open Water SPA;
- Antrim Hills SPA;
- Luce Bay and Sands SAC; and,
- Loch of Inch and Tors Warren SPA, Ramsar site.

It should be noted that this list is by no means exhaustive and there would be other sites affected whose qualifying features are mobile, such are for marine mammals and birds. In addition, the seafloor will support habitats and species that do not form part of a designated site; however, will quality as non-

designated features or indeed are projected in their own right, under the relevant legislation.

3.7.2 Archaeology and Cultural Heritage

There are numerous features of archaeological importance that could be present along the proposed route of the crossing, both known and unknown. These include archaeological sites, submerged archaeological and paleoenvironmental landscapes, shipwrecks and aircraft.

3.7.3 Commercial Fisheries

Commercial fisheries could be impacted through the permanent loss of fish spawning and nursery grounds, should these be located within the footprint of the foundations, and through changes in coastal processes, as well as any exclusion areas around the bridge itself. During construction, exclusion areas would also apply, as well as fish stocks being impacted from any impact piling works, resulting in fish injury and death, and displacement. Displacement of fishing activity would cause an increase in fishing activity elsewhere in the Irish Sea, potentially exacerbating over exploitation.

3.7.4 Seascape, Landscape and Visual Receptors

There would be significant changes to the landscape/seascape character and views across the Irish Sea from coastal communities in Scotland and Northern Ireland, in addition to impacting on the Antrim Coast and Glens Area of Outstanding Natural Beauty.

3.7.5 Other Users

The proposed fixed link has the potential to affect numerous other users, including:

- Commercial fisheries (as described above);
- Sub-sea pipelines;
- Oil and gas exploration;
- Shipping; and,
- Tourism and recreation, such as wildlife tourism, and diving and water sports.

3.7.6 Human Health

The fixed link could impact human health from:

- Increased air and noise pollution from increased traffic flows;
- Disturbance and mobilisation of contaminants during any required ground excavations;
- Introduction of new contaminant sources; and,
- Adverse impacts on coastal communities.

3.7.7 Natural Resources

The construction of a fixed link would involve the use of considerable construction materials and the associated carbon footprint. As an indication, the channel tunnel has 2 running tunnels lined with concrete rings approximately 7m in diameter and 0.35m thickness. If the same solution were employed for the proposed fixed link this would equate to approximately 600 000m3 of concrete just for the tunnel lining.

4. Reference Projects

The list below provides references of similar long sea crossing projects already constructed as tunnels, bridges, or a combination of both. With the aspiration of having both road and rail, the maximum water depth and the length of the bridge, the project would have to use untested technology as described in the sections below with a potentially longer design programme and increased cost of construction compared to proven solutions.

Table 1 - Reference Projects

Name	Crossing	Length	Maximum Depth of Water	Form	Details
Channel Tunnel	English Channel	50.45km	50m (with 75m cover)	Rail tunnel: twin tube	Tunnel Boring Machine (TBM) through chalk marl. Longest subsea tunnel.
Rogfast Tunnel	Bokna Fjord	27km	352m (with 40m rock cover)	Road tunnel: twin tube 10.5m diameter.	Drill and blast construction with rock bolting and sprayed concrete tunnel lining. Will be the longest and deepest subsea road tunnel when complete.
Hong Kong – Zhuhai – Macau Bridge	Pearl River Estuary	55km	Up to 26m for the tunnel section but much of the viaduct was 5m	Bridge/Tunnel hybrid. Road only.	Approach viaducts, cable stay bridges, artificial island and a tunnel. The tunnel was an immersed tube form of construction. Longest sea-crossing bridge.
Oresund Crossing	Oresund Strait	11.9km	10m	Bridge/Tunnel hybrid carrying road and rail.	Approach viaducts, cable stay bridges, artificial island and a tunnel. The tunnel was an immersed tube form of construction.
Irish Sea Fixed Link	**Irish Sea**	**38km**	**240m**	**TBC**	**TBC**

5. Possible Solutions

This section reviews the potential construction methods for the crossing and highlight the challenges that each would present based on the local known conditions.

5.1 Bridge

Any bridge considered for the crossing would be reliant on a novel solution to support the deck, as to date no bridge has been built in this depth of water.

5.1.1 Deep Water Fixed Foundation

Deep water fixed foundations could make use of tried and tested techniques from the North Sea oil and gas sector such as tubular steel jacket structures or concrete 'Condeep' structures.

Jacket structures are used for water depths up to 300m. Typically the jacket is fabricated and transported to site in one piece by barge. The jacket is then launched from the barge and positioned on the seabed using buoyancy tanks to control the location. Once in position the jacket is secured to the seabed by installing piles through guides at the base of the legs.

Condeep structures are formed from a base of concrete tanks with support towers rising from them. These concrete structures are built in dry docks then towed to site and ballasted down into position where they function as gravity base structures. Condeep structures have also been used in water depths up to 300m.

These deep water foundations would be considerably more expensive than the conventional foundations used for either of the Hong Kong – Zhuhai – Macau Bridge or Oresund Crossing reference projects described in section 4 (due to the significantly deeper water in the Irish Sea). Fixed foundations would disturb the seabed which would give rise to risks associated with the UXO. The number of supports required for the 38km crossing would also represent a hazard to shipping, both during construction and subsequent operation.

5.1.2 Floating Bridge

A floating bridge could provide a solution which would be suitable for the depths of water on the proposed route. Floating bridges use pontoons to support the bridge piers. These pontoons can either form a chain which is moored to the shore at each end of the overall span, or each pontoon can be moored to the

seabed. A further development of the approach is for each pontoon to be secured with tensioned anchors (using technology borrowed from the Tension Leg Platform concept used in the oil and gas sector) in order to increase the stability of the pontoon. This approach is necessary for bridges with taller piers to support the deck.

For the Irish Sea crossing anchorages would be required per pontoon, rather than the end anchorage approach used for the floating bridge structures currently operating in Norway (such as the Nordhordland Bridge). This would introduce the same problems with disturbance of the seabed and hazards to shipping as the deep water fixed foundations but would probably offer a cheaper solution. The anchorage cables would probably represent a greater risk to submarine activity than the deep water fixed foundations as they would be harder to detect. As with fixed foundations, the number of supports required for the 38km crossing would also represent a hazard to shipping, both during construction and subsequent operation.

The floating bridge crossings (built to date and proposed) in Norway use discrete pontoons to support a low level roadway with a higher cable stayed span at one end with conventional foundations. An Irish Sea crossing would require an elevated roadway for the full length (to raise it above wave height and to provide passage for smaller vessels) as well as a number of larger cable stayed spans (for the passage of larger vessels).

5.1.3 Submerged Floating Tube Bridges

The E39 Coastal Highway route in Norway is also investigating the pioneering use of Submerged Floating Tube Bridges (SFTBs) as a solution for long crossings of deep water. SFTBs take the form of a watertight tube which is either negatively buoyant and suspended from pontoons, or positively buoyant and tethered to the seabed.

SFTBs need to be located at sufficient depth so as not to interfere with shipping but they remove the potential constraint on air draft posed by conventional bridges. Unlike a conventional bridge an SFTB is not prone to restrictions due to high winds, snow or ice. Where they are suspended from pontoons an SFTB solution is subject to wave and current loading. Where they are tethered to the seabed an SFTB solution is isolated from wave action but is still subject to current loading.

An SFTB could provide a solution which would be suitable for the depths of water on the proposed route. This solution would involve moorings to the seabed,

either for a positively buoyant tube or for a negatively buoyant tube supported from pontoons. This would introduce the same risks associated with disturbance

of the seabed as the other two options. An STFB would present less of a hazard to shipping (as the tubes could be suspended lower than the deepest vessel draft) but it would pose an increased hazard to submarine navigation and this would be unlikely to be feasible for the 38km length due to the safety issues involved.

As a part of Norway's 'Coastal Highway E39' project, several observational buoys were deployed and used to measure wave and wind records in Sulafjorden. The proposed crossing site in Sulafjorden reaches a Maximum Significant Wave Height, Hs, of 2.964 metres[7]. The greater wave heights in the Irish Sea would make a positively buoyant SFTB solution more attractive than a negatively buoyant solution as it would omit the need for pontoons on the surface. The wave heights may also pose a challenge to a floating bridge solution.

5.2 Tunnel

An immersed tube tunnel is unlikely to be a cost-effective solution in this depth of water. The Busan Geoje Crossing is currently the deepest immersed tube tunnel in the world at a depth of 48m. In addition, an immersed tube tunnel would require a substantial trench for installation which would cause significant disturbance of the seabed. The UXO risk on the proposed alignment would add significantly to the cost of this approach compared with other options.

A conventional bored tunnel is more likely to offer a cost-effective solution for the proposed route. A conventionally bored tunnel would not create a hazard to shipping and would avoid the risk associated with the disturbance of UXO. A conventional tunnel is also more suited to the depths of water present along the proposed route.

5.3 Hybrid

Based on some of the known constraints like water depth or driver safety in tunnel, a hybrid solution could present some benefit to alleviate the issue. Hybrid solutions are common, such as the Oresund Crossing or the Hong Kong – Zhuhai – Macau Bridge but are unlikely to be practical engineering solutions for the proposed Irish Sea crossing. With a hybrid approach part of the crossing is made

[7] Nergaard, B O, University of Bergen, Wave energy potential in the area of Sulafjorden and Breisundet (2020)

as a bridge and the remaining part as a tunnel. The transition from bridge to tunnel is typically made at an artificial island partway along the route. The proposed location for the Irish Sea crossing is such that the water quickly becomes too deep for the economic construction of an artificial island.

6. Cost and Risk

Table 2 - Reference Project Costs

Name	Cost (at time of construction)	Year Completed	Cost in 2020 Prices*	Total length	Cost in 2020 Prices*/km
Channel Tunnel	£4.65bn (an 80% cost overrun)	1994	£9.46bn	50.45km	£187.5M/km
Rogfast Tunnel	$1.9bn (est) £1.34bn**	2026 (est)	£1.34bn**	27km	£50M/km
Hong Kong – Zhuhai – Macau Bridge	$18.8 £13.27bn**	2018	£13.77bn**	55km	£250M/km
Oresund Crossing	€2.6bn £2.24bn***	2000	£3.86bn***	11.9km	£324M/km

*based on retail price index using the Bank of England inflation calculator: https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator
**based on June 2021 conversion of $1 = £0.71
***based on June 2021 conversion of €1 = £0.86

Whichever solution is considered, the Irish Sea crossing will break records and require an innovative approach to succeed. The technical risks can be managed as most of the potential solutions draw from existing technology. However, the project would stretch this technology to new levels, and this will make accurate cost estimation very difficult. The Channel Tunnel was a similarly challenging project which pushed the boundaries of what had previously been constructed and that saw a reported 80% cost overrun. Knowing that the current estimate of the project already lies between £15 - £20bn, a final construction cost of up to £36bn would not be unexpected. It is important to note that this cost represents the construction of the crossing only and that significant additional investment would be required in the road and rail connectivity at each end.

The depth of water and exposed location will also raise significant health and safety challenges whichever solution may be preferred.

The various issues set out in section 3.7 present risks to obtaining the necessary permissions for the construction of a fixed link. These issues impact on the viability of the project as well as introducing cost and programme risk.

7 Conclusions

A conventional bored rail only tunnel is likely to be the most cost effective and lowest risk solution to form a link on the proposed route. Based on a simple construction cost per km comparison with the Channel Tunnel would give a cost of £7.125bn. Whilst the subsea length of the proposed tunnel is very similar to the channel tunnel, the depth required is substantially greater. In addition, the Channel Tunnel was bored through chalk marl which is generally considered to be a preferable tunnelling medium to the mudstone and sandstone present on the proposed route. With these points in mind, the construction costs currently being discussed in the media of £15bn to £20bn represent a reasonable estimate for the scheme.

The £15bn to £20bn figure does not include the annual costs of operation and maintenance. Assuming a rail link the operational costs include traction power for the trains as well as lighting and ventilation of the tunnel. In addition to the maintenance costs associated with the usual railway systems and infrastructure there are additional costs associated with maintaining a tunnel. The structure itself will require regular inspection and maintenance, as will the: ventilation and lighting systems, drainage, fire safety equipment and communication and information systems.

The £15bn to £20bn figure does not include the cost of upgrading the infrastructure at each end of the proposed link (i.e. the cost of road and rail upgrades which would be required). Port Patrick is 10km from the closest road and rail links at Stranraer but these are relatively minor transport links. The closest major transport links of the M74 and the West Cost Main Line are over 100km away. Upgrade of the road network on the Scottish side of the link could be expected to add a further £1bn to the project costs and upgrade to the rail network could be expected to be more expensive still. Higher capacity road and rail links are closer on the Northern Irish side of the link, approximately 20km away in Belfast, but would still add substantially to the costs.

The cost represents a rail only link which would terminate in Northern Ireland rather than joining the wider Irish rail network due to the different gauge used on the Irish rail network.

Annex B: Port Connectivity Study 2018

Department for Transport - England's Port Connectivity: the current picture 9 regional case studies. Access here.

Annex C: BPA Port Connectivity Proposals

Aberdeenshire
Proposal 1 - Overview: • Delays on the A952/A90 south of Fraserburgh reduces the efficiency of moving freight to/from the port onto the AWPR. This problem relates to a number of aspects including the transport of fresh fish which is time sensitive for onward transport via the main transport hubs either for processing or export. Transfer of cargo and personnel for oil, gas and renewables industry. Fraserburgh is an OW O&M Port with Future aspirations to expand further in conjunction or as part of Scotwind next OW licencing round. Fish landings in UK are predicted rise with Brexit, this increasing the capacity of the fishing sector, its landings and processing onto the local highway network as there is no alternative mode. • New industrial land zones at the south of Fraserburgh with access issues. • Road safety risk on the A952, the main south bound artery to A90 trunk.
Desired works: • A project to dual the carriageway between Aberdeen and Ellon and to provide a bypass around Aberdeen is complete. The dual carriageway should be extended north of Ellon to Fraserburgh to remove congestion and delays on this stretch and alleviate accident blackspots. • Formation of a fifth spur at roundabout at south entrance to Fraserburgh.
Steps to be taken: Nestrans has commissioned a study to look at transport links between Aberdeen and Fraserburgh, investigating rail and road options.
Proposal 2 - Overview:

Main access to Aberdeen Harbour is constrained by busy roads. Increased vessel sizes associated with existing and new traffic flows requires longer and deeper berths.

Capacity constraints resulting in increased costs and risks for established oil and gas.

Desired works:

- Freight priority lanes in roads.
- Construction of additional berthing capacity at Nigg Bay.

Steps to be taken:

The port authority has been in discussion with the Local Authority to discuss these infrastructure needs. Construction has commenced on the Aberdeen Harbour. Expansion Project in Nigg Bay and is scheduled for completion in 2020.

Proposal 3 - Overview:

Delays on the A90 south of Peterhead reduces the efficiency of moving freight to/from the port. This particularly affects the transport of fresh fish which is time sensitive.

Large items of project cargo have difficulty accessing the Smith Quay / Merchants Quay berths at the port due to road width restrictions at the junction in Peterhead between Kirk St and Charlotte St.

Desired works:

A project to dual the carriageway between Aberdeen and Ellon and to provide a bypass around Aberdeen is underway. The dual carriageway should be extended north of Ellon to Peterhead to remove congestion and delays on this stretch.

The junction at Kirk St / Charlotte St in Peterhead should be realigned to facilitate larger vehicles making the turn.

Steps to be taken:

Nestrans has commissioned a study to look at transport links between Aberdeen and Peterhead, investigating rail and road options.

Angus

Overview:

Failure to improve road access to the port is restricting development of the potential of the port.

Desired works:

Improved road links to the port to and from the A90 Aberdeen / Dundee and the A92 Montrose / Dundee

Steps to be taken:

The port has continuing dialogue with Angus Council, Scottish Enterprise and Scottish Government.

Argyll and Bute

Overview:

Access to the port involves negotiating the very congested town centre and across a railway bridge.

Resilience issue - in the event of this bridge being considered inadequate for heavy traffic, there is no other access to the port.

No room for port expansion. Having gained access to the terminal, in the summer months at least, it is not unusual for vehicles arriving early for a sailing to be told to go away and come back later, as the place is choked with traffic. There is no HGV parking in Oban, and this often results in trucks orbiting the town's one way system, with obvious consequences.

Desired works:

Improvements to road system in the town and replace bridge. Also replace the railway tracks with more accessible tramline tracks which maintain the train line but would allow roads vehicles to drive over the tracks when the line is not in use. This would create more queueing space at the port terminal reliving pressure in the town centre."

Belfast

Overview:

The A75 from Gretna to Stranraer is of strategic significance to Belfast Harbour and its customers. Despite the route being used by over 400,000

freight vehicles each year, the majority of the road is of single-carriageway standard and the road is in very poor condition.

Desired works:

Due to the Scottish Government's perception that this is mostly used by English freight traffic, they have not been willing to upgrade this route to dual carriageway and this area does not fall under the UK Department for Transport's powers. The South West Scotland Transport Study originally considered this idea but ultimately discarded proposals. Though they did recommend the upgrading of the A75 as far as Dumfries. As it stands, no one seems to own the strategic overview of this road.

Steps to be taken:

After multiple sources flagged this road as a priority for review within the public consultation phase of the Union Connectivity Review, the Interim Report identified this stretch of road to be of interest to the aims of the Review. We await the final report to gauge what Sir Peter Hendy and his team identify as the solution.

County Down

Overview:

All Warrenpoint Port traffic (240,000 vehicle lorry movements) has to go through the bottle neck of Newry city centre before entering the main rod network (A1/N1 – Euro 1 route) for the region.

Desired works:

Creation of Newry Southern Relief Road that by pass Newry city centre and connects form manina1/N1 to A2 (road to port).

Steps to be taken:

DFI Roads have stated detailed feasibility study to bring project to "public inquiry" stage.

Estimated cost:

£80M

Dumfries and Galloway

Proposal 1 - Overview:

Poor road access to the ports of Cairnryan and Loch Ryan, particularly on the A75 and A77. The lack of dual carriageway on parts of these roads places limits on the traffic the ports can handle. The ports are in competition with Heysham, Fleetwood, Liverpool and Holyhead for Irish Sea traffic.

Desired works:

Dual carriageway extension on the A75 and A77 all the way to the ports.

Steps to be taken:

None so far.

Proposal 2 - Overview:

Operation Stack. Cairnryan area. Resilience issue.

An incident occurred during December 2014 when the berth at Stena's terminal was damaged stopping its service and subsequently bad weather closed the P&O terminal. The port of Heysham had already closed earlier, so the combination of high end year volumes, additional traffic due Heysham being closed meant that local road quickly became clogged causing significant disruption to local residents and there was also no adequate facilities for hauliers trying to cross to Northern Ireland. This resulted in lorries parked in dangerous locations and also made it difficult to pull traffic forward for loading in an orderly manner once port facilities were opened.

Desired works:

An area is required in the event of port closures due to technical or weather problems over a protracted period for freight vehicles to park that is safe and does not congest the local area.

Steps to be taken:

Discussions are in progress and an advanced stage with the local council and P&O / Stena to utilise an airfield about 5 miles from the port in the event of port closure and the necessity to implement "Stack". Never-the –less the facility is not yet operational.

Hampshire

Proposal 1 - Overview:

Requirement for increased capacity of the A326 to support port development and other infrastructure projects in the area.

Estimates suggest that the net additional economic benefit of regeneration which is dependent on an upgrade of the A326 amounts to £860m, which comprises of £294m of a one-off benefit associate with land value uplift from additional housing developments and £566m in additional GVA. There could be up to 6,700 additional full-time equivalent (FTE) jobs (excluding construction) in New Forest, Southampton and the rest of the UK economy. Source EBIS for Hampshire County Council (2019) A326 Waterside Infrastructure Scheme Economic Development and Regeneration Related Economic Benefits.

Desired works:

Increased capacity of the A326 between Totton and Dibden Purlieu to facilitate growth and investment.

Steps to be taken:

Project recognised in TFSE Transport Strategy and being advanced by Hampshire County Council.

Proposal 2 - Overview:

Portsmouth International Port (incl Portico Terminal) is well connected by road (direct access to M275) however it does not currently benefit from rail connectivity. The closest rail freight terminal to Portsmouth and/or its port is either Eastleigh or the Port of Southampton. However, back in 2008, a substantial amount of money (£250K) was spent by way of a Freight Facility Grant on the creation of a container loading pad at the Fratton Goods Siding, located immediately adjacent to Fratton Station on the mainline from Portsmouth to London. Fratton Station is essentially in the middle of the Portsmouth Island and ideal for distribution to/from anywhere in the city (including the Port). However there are gauge challenges from this site and also the overall site (given over to the goods siding) is simply not big enough to accommodate a rail freight terminal.

Desired works:

In order to make best use of the site PIP have suggested to Network Rail (via the DfT) that we work together to put together a 'land assembly' proposition to local freehold owners in order to increase size of facility (see attached, Phase A and Phase B). Any further improvements to the site will also need to include the burying of a critical High Voltage supply (for the operation of passenger trains) that also restricts the operation of the site.

Steps to be taken:

Prior to CV19 lockdown, a kick off meeting was held with Network Rail and the Dft regarding this project and PCC (Portsmouth City Council) are currently pulling together a land ownership plan. Following the agreement of an MOU between Dft, NR and PIP, feasibility studies will then have to be carried out.

Estimated cost:

Estimated Capex for Phase A - £10M

Highlands

Proposal 1 - Overview:

Public transport connectivity to and from the Port of Cromarty Firth is poor. This limits the options for workers, especially those with limited mobility or without driver's licences. It also hinders the cruise passengers who visit and creates an over-reliance on coaches which are often brought from the central belt due to the numbers we need.

Desired works:

Upgrades to the North rail link to provide hourly trains between Inverness and Invergordon.

Steps to be taken:

Awaiting final sanction from the Transport Minister (Scottish Government) and a date for the upgrades to begin.

Proposal 2 - Overview:

Significant stretches of the A890 and the A896, which provide the principle access route to Kishorn Port from Inverness and the east, are single track road. This combined with the significant increase in traffic associated with

the North Coast 500 touring route can have an impact on port logistics, especially during the summer months.

Desired works:

Upgrade single track sections of road to two-way traffic routes.

Steps to be taken:

The Highland Council has prepared a design and secured planning permission for the upgrading of part of the single track section of the A890 road between Balnacra and the Lair railway bridge but this has still to be implemented.

Design, consenting, funding and implementation is required for all remaining single track sections of the A890 and on the A896.

Proposal 3 - Overview:

Traffic congestion at peak times on the A893 Ullapool Harbour approach road due to tourism and ferry volumes increasing year on year. Recognised and documented as a safety issue by Transport Scotland in January 2016.

Desired works:

Complete realignment of the 400m A893 to incorporate the existing seaward footpath in the roadway and create a new walkway over the revetment/sea wall.

Steps to be taken:

Working with the local community and Transport Scotland to develop the concept and deliver the walkway and road widening as funding becomes available.

Estimated cost:

Walkway and road improvements £2.9M.

Proposal 4 - Overview:

Scrabster Harbour experiences poor road access to the port via the A9, particularly Berriedale Braes. The steep gradient and hairpin bend at the

Braes is a very challenging road alignment, especially for HGVs and other long vehicles.

Desired works:

Removal of hairpin bend and improve road alignment. These works would improve journey times and road safety by removing the need for vehicles to slow down or stop to negotiate the bend.

Steps to be taken:

Following inception and design workshops and public consultation, draft road orders for the Berriedale upgrade were published in December 2014 but there is no current commitment to undertake the works.

Proposal 5 - Overview:

For the Port of Inverness, cirect access to the A9 is currently only possible via the Longman Interchange in a southerly direction. Traffic heading north has to firstly head south to A96 intersection before turning north.

Desired works:

Upgrade of Longman Interchange to full grade separated status.

Steps to be taken:

As a result of the Inverness City Region Deal, proposals for this improvement are being brought forward and a preferred option has been decided upon. Port has engaged with Council consultants during public consultation process to ensure that the requirement for abnormal loads can be accommodated by these proposals. Discussions are still on-going as the process evolves.

It is important to ensure that this improvement is not delayed as a result of the COVID-19 pandemic. It is currently planned to proceed in 2/3 years' time dependent upon whether a PLI is required.

Humber

Overview:

Trans-Pennine Freight Capacity and Capability **-** There are currently insufficient train paths available to run regular freight trains across the Pennines.

The requirements need to meet the market - an hourly efficient freight path would be required in each direction.

Asset utilisation requirements: Capacity to run two trains per day in each direction with one set of assets from the west coast ports/ inland terminals to the east coast ports/ inland terminals i.e. 12-hour cycle per train round trip.

Congestion in Manchester – passenger and freight aspirations clash in Manchester and a strategy for a North West Strategic Freight Terminal should be considered that reduces the amount of freight through Manchester or gives additional capacity for freight trains.

Desired works:

Gauge

The route is not currently Gauge Cleared for W10/12 freight Trains. High cube containers can only be carried on the Trans Pennine Route on specialist wagons. The gauge clearance needs to be delivered to give flexibility and efficiency of the FOCS wagon assets.

Electrification

The Trans-Pennine route requires electrification to deliver the most cost, carbon and time efficient service to the customers, consideration should be given to continuing any electrification schemes to service all ports and inland terminals.

Kent

Overview:

There are two routes strategic routes to the Port of Dover – M20/A20 and M2/A2. M20/A20 is a mix of three-lane motorway and dual carriageway. Although the M2/A2 is at least dual carriageway, increasing to four lanes around Medway, there is a five-mile stretch into Dover that is single carriageway (see map below).

Currently around 40% of Dover's traffic uses M2/A2 and this could increase to 50% with the construction of the Lower Thames Crossing. On a day-to-day operational basis this route therefore has minimal resilience as it reaches Dover and any incidents or delays immediately impact both port

and local traffic flows with no ability to bypass the queue. Looking at times when there has been an incident on the M20 and traffic has diverted across to the M2/A2, port traffic volumes on this routes have increased to 70%.

Desired works:

Dualling of this final stretch of the A2 would significant increase resilience for port traffic, both in terms of additional capacity but also in terms of enabling local traffic to keep flowing if port traffic is queueing. Furthermore, the Port operates (via Kent Police and Highways England) the Dover TAP system on the A20 that allows freight to be held outside of Dover town on the inside coast-bound lane of the A20 between Folkestone and Dover at peak freight times so that it does not gridlock the town. This has proved very successful. Dualling the A2 would provide a second TAP opportunity able to provide a possible 25 miles of additional TAP capacity for freight, enabling the Port to better manage freight flows between the two routes. Finally, the dualling would ensure that one of the key benefits of the Lower Thames Crossing in improving strategic flows around London are not compromised by creating a bigger bottleneck at Dover as a result of increased traffic on the M2/A2.

Steps to be taken:

The A2 Dover Access Scheme has been identified by Highways England as a RIS 3 pipeline scheme and by Transport for the South East. HE is currently conducting a Stage 0 study on the scheme.

London

Overview:

Congestion and further freight capacity required.

Desired works:

- Improvements to rail freight transiting London / the North London line - delivery of the Ripple Lane Yard marshalling area in East London.
- More rail paths for freight along the Essex Thameside corridor, cross country and up the East, West and Midland mainlines, and through the Channel Tunnel.
- Delivery of the Lower Thames Crossing and Silvertown Tunnel projects ASAP, with direct connectivity to the former through.
- The Tilbury Link Road (a candidate scheme in RIS2 for delivery in RIS3) is supported by DPWLG and the PLA.

Lothian

Proposal 1 - Overview:

Ongoing lack of investment in main arterial route connections of M8 motorway and further enhancement to M9 motorway junctions.

Consideration to be given to appropriate flood defences for the upper Forth to protect the Port and Grangemouth.

Desired works:

Upgrade of the A801 Avon Gorge to provide an improved HGV connection between the M8 and M9 motorways.

Flood defences to be installed at appropriate parts on the upper Forth and Grangemouth, including the Grange Burn and River Carron.

Steps to be taken:

Both Falkirk and West Lothian Councils have completed all design and technical evaluations of the A801 upgrade, including the necessary land purchases.

Flood defence options for the Grangemouth area are currently being developed by Falkirk Council in conjunction with a number of partners.

Proposal 2 - Overview:

Congested and inefficient road connections to the Port.
Desired works: Improved road connections via the East to the Port.
Steps to take: Limited, with some initial masterplanning undertaken in preparation for NRIP.

Northumberland & Newcastle
Proposal 1 - Overview: Given the levelling up agenda and Scotland / midlands access, there are not enough paths on the ECML for freight.
Desired works: Timetabling needs to cater for the levelling up agenda at the EMCL, effectively doubling paths.
Steps to be taken: The DfT, through NWR need to assess the route flexibility and net value of the sheer amount of passenger paths through Newcastle to cater for north to south green freight transition.
Proposal 2 - Overview: Passengers accessing cruise terminal through Newcastle.
Desired works: New Metro stop at the international Passenger Terminal to enable the safe transit of passengers. There are no direct links to Newcastle or to ECML on the north side of Tyne.
Steps to be taken: Feasibility study to look at connecting roro and passengers to the port.
Proposal 3 - Overview: Road requirement for the road connections from South Shields to the A19 to accommodate wide loads sufficient to transport the growing wind turbine sector loads at the port.

Desired works:

Potential upgrading of the local road network – the A194.

Steps to be taken:

Link in to North and South Tyneside council to outline planning and infrastructure requirements.

Pembrokeshire

Overview:

1. Unreliable and congested road route to and from the Port of Milford Haven due to congestion on M4 (Brynglas and Port Talbot), A48, A40 and A477 (roundabouts and some single carriageway sections)

2. Constraints on the rail network for freight and passenger traffic to and from the Port. General requirement to safeguard freight paths for future opportunities.

Desired works:

1. A477, A40 from St Clears to Carmarthen and A48 from Carmarthen to M4: Grade separated junctions at roundabouts and on A477 additional climbing/overtaking lanes and short bypasses at Broadmoor and Llanteg.

M4: Alternative solution to the current congestion around Newport now WG has cancelled the proposed diversion. These works would ease congestion for all road users including those travelling to and from the Port.

2. Freight: Relaxation of restrictions on freight trains through the Severn Tunnel. Passengers: Increased passenger train frequency, rolling stock quality, station upgrading, improved journey times and connectivity.

Steps to be taken:

1. Roads identified are part of the TEN-T network. Milford Haven is listed as a Core TEN-T port. M4 is recognised as a bottleneck and a constraint on growth. Some A477 improvements have already been undertaken but more are required. Roundabouts west of the M4 are particular bottlenecks, particularly during peak season

2. Freight: Informal discussions with Network Rail. Passengers: Discussions with network Rail, Transport for Wales and Local Authority.

Proposal being advanced with 4theregion to work up proposals. Port is funding a brief study to kick start the process.

Anticipated extra capacity:

1. Concern is over reduction in delays but given the improvements in the road network from Rosslare towards Dublin improvements in this corridor could relieve some of the stress on the already improved A55 to Holyhead.

2. Removal of freight restrictions would improve capacity and viability of rail freight.

Perth and Kinross

Overview:

Failure to improve road access to the harbour is restricting development of the potential of the port.

Desired works:

Improved road links to and from the harbour to and from Edinburgh Road and Junction 10 of the M90 (steep hill and sharp bend). New access road required from harbour to Edinburgh Road / M90. Currently there is no access from the Southbound M90 or access to the Northbound M90 at Junction 10 requiring harbour traffic to go through the congested City Centre.

Steps to be taken:

Limited steps taken with some high-level route planning for new access road.

Shetland

Overview:

Freight ro/ro linkspan at Lerwick Harbour is from 1977 (38 years old) and narrow and a constraint on the size and configuration of ro-freight vessels that can use it.

Desired works:

Replacement of the linkspan with a wider linkspan to suit the next generation of ro-freight vessels, anticipated 2024. Also a modern linkspan requires one operator (compared to two with the current infrastructure) therefore saving operational costs.

Steps to be taken:

£2.95 million (2015 prices and not including optimism bias).

West Sussex

Overview:

Shoreham Port is close to good quality road links from the north (M25 is 35 miles and 40 minutes away) but connections east and west along the coast are poor (35 miles in one hour at best). West - bypasses at Worthing and Arundel have been mooted for decades but never executed. East – dual carriageway runs out after 15 miles at Lewes at links to other trunk roads are all through town centres.

The final 3 miles to the Port is also through narrow, congested, suburban roads with many schools and homes directly facing onto the carriageway [Argus News Article 2nd Sept 2020].

Desired works:

1. Significant upgrade of the A27 coastal road at key points in Worthing [Worthing & Lancing Improvements], Arundel [Arundel Bypass], and east of Lewes [East of Lewes].

2. Construction of new link road from Port to A27 or significant upgrade of existing route.

Steps to be taken:

All trunk road schemes have been in various Highways England programmes over several decades but have never actually come to fruition.

Link road scheme would require feasibility study – not currently part of any plans to Port's knowledge. A study by the local authority in 2013 [Adur Transport Study] was only looking at minor junction improvements.

Anticipated extra capacity:

Journey times could be reduced considerably to the east and west, or Port's zone of influence considerably increased.

Local link road would have the potential to improve safety, quality of life and air pollution in urban setting between coast and A270.

Western Isles

Overview:

Linkspan resilience on main passenger and freight route onto the islands. The freight/reserve link span at No. 1 Pier in Stornoway is more than 40 years old, and can only be used in emergencies. Should there be issues with the 20 year old linkspan at No. 3 Pier, there would be no other linkspan in the Outer Hebrides where the new Loch Seaforth ferry could berth.

Desired works:

Replacement linkspan.

Steps to be taken:

Issue raised at meetings with Transport Scotland's ferries and ports teams and other representatives.