

Port Traffic Analysis Including Modal Transport Splits

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Introduction

This Port Traffic Analysis report was commissioned by the British Ports Association (BPA) as part of their ongoing Port Connectivity Review to provide detailed information on modal splits and the wider freight journey. Seeking to gain a better understanding of how the ports ecosystem integrates with the transport network and logistics industry, this report provides information on a number of metrics, including the breakdown of freight leaving ports by transport mode. This report thus provides industry and Government with an updated picture of where investment would be best focused to ensure maximum efficiency of freight and trade flows.

Objectives and Methodology

- Port freight volume analysis by modes of transport in 2019 (pre-Covid & prior to significant Brexit issues)
- To provide evidence and analysis about inland/coastal transport modes to & from UK ports.
- To provide content that will help BPA to promote wider understanding of ports' scale and roles:
 - in the context of UK freight transport systems and the related capacity needs
 - potential benchmarking of the impact of Freeports
 - connectivity for passengers and for supply chains

The methodology:

1. Although some disruptions to 'normal' trade patterns occurred in 2019 because of Brexit developments at that time (e.g. stockpiling), the year was clear of pandemic-related disruptions and therefore does provide a good picture of regular trade and passenger volume patterns through UK ports and river terminals. 2019 is also the most recent full-year picture available with complete details of port commodity flows and destinations.
2. The source data include 2019 statistics published by DfT in August 2020 and November 2020, supplemented by Office for Rail and Road (ORR) statistics and various trade body data.

3. Tonnage data is supplemented by unit numbers where this helps to explain specific modes (e.g. cars and passenger traffic)

4. The areas of analysis for this study are:

- Overall port volumes in 2019 and the significance of liquid bulk trades
- Coastal shipping
- Irish Sea RoRo trade
- Rail freight perspectives including intermodal freight
- Passenger volumes through UK ports

UK port volumes summary - freight

To set the scene, the volume statistics for freight and shipping throughput at UK ports in 2019 (across all origins and destinations) are summarised in Table 1.

Table 1 - Volume data in 2019 at UK ports

	Tonnes (m)	Percent of tonnes	Units (m)	Percent of units	Ships (k)	Percent of Ships
Liquid Bulks	192.7	40.5%	-	-	15.0	12.8%
Dry Bulks	93.5	19.7%	-	-	34.6	29.5%
General Cargo	17.2	3.6%	-	-	-	-
RoRo freight	98.7	20.8%	7.96	34.2%	57.2	48.7%
RoRo Trade Cars	6.3	1.3%	3.73	16%		
RoRo passenger cars	-	-	5.54	23.8%		
Containers (LoLo)	67.0	14.1%	6.04	26.0%	8.7	7.4%
Cruise	-	-	-	-	1.9	1.6%
Totals	475.30	-	23.27	-	117.4	-

Data sources: DfT port freight statistics and DfT Sea Passenger statistics

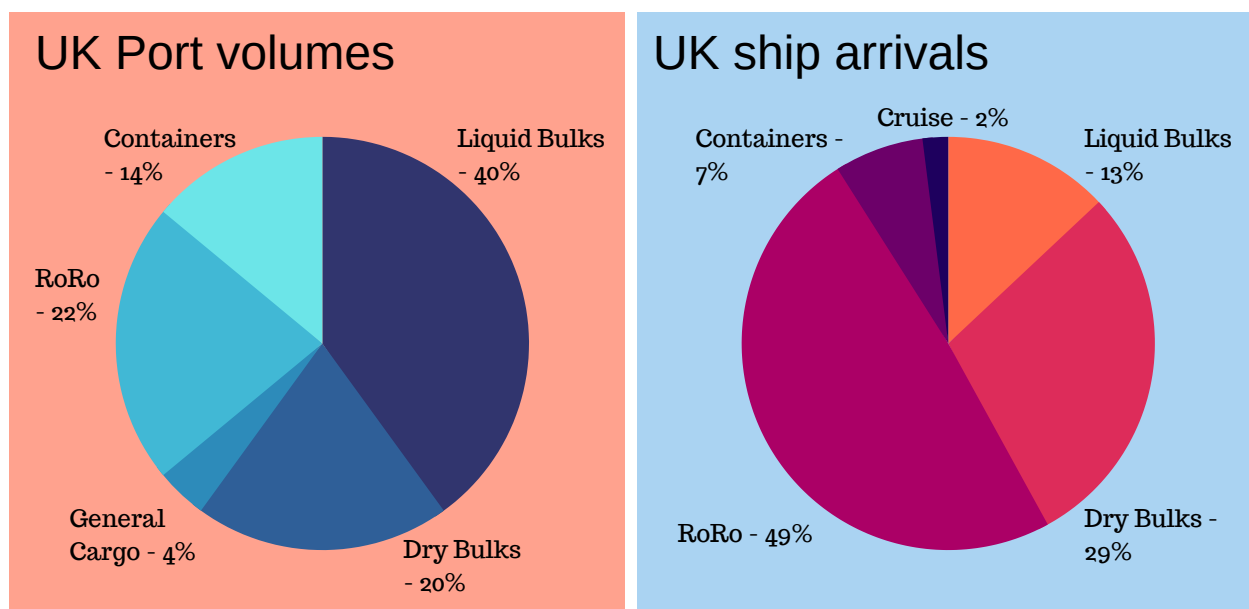
Notes

- The freight tonnages and units handled data are for the UK’s fifty-one ‘major’ ports.

- An additional 10.8m tonnes are handled at sixty other UK ports, but the details are not available by commodity sector.
- Excludes pipeline volumes and Channel Tunnel services

The two pie charts below compare the relative volumes of tonnage and ship arrivals:

Chart 1 - Total UK port volumes compared to ship arrivals, by commodity type



- Half of the vessels using UK ports are RoRo ships, and RoRo freight is the second largest segment of UK ports' throughput at 22% of total trade. The majority of RoRo freight haulage is by road. A small proportion is carried by rail, for example exported cars. Coastal RoRo trade is a significant part of the throughput and is analysed in further depth below.
- Container trade represents 14% of UK volume throughput but only 7% of ship arrivals. This is indicative of vessel sizes, in particular at the four UK deep sea ports. Intermodal freight is now the largest sector within the UK's rail freight network (surpassing the dominance of coal historically) and further analysis of rail is provided below.
- Liquid Bulks are the largest trade sector in tonnes but a significantly lower proportion of ship arrivals which is also due to the size of vessels, but also to the use of pipelines. UK ports provide the critical infrastructure and port services (including SHA duties) for safe and secure supplies of crude oil and oil products to the UK's six oil refineries.

- The UKPIA (ukpia.com) provides useful facts regarding liquid bulks in the petroleum sector. “Located along Britain's coast and estuaries, or with connections to deep-water navigation channels capable of taking large tankers, the UK's refining infrastructure is a critical component to the national energy landscape”

Terminals

The UK has 41 coastal and 20 inland storage terminals, often near major urban centres.

Pipelines

The UK is criss-crossed by a vast network of pipelines, owned either by individual companies or as joint ventures. An efficient and safe means of moving large volumes of refined products from refineries to storage terminals, pipelines transport over 30 million tonnes of fuels each year across the UK, equivalent to about one million road tanker journeys.

Sea

An alternative to pipelines for moving large volumes of product is by coastal tanker, which are generally small enough to navigate shallower waters and dock at coastal ports (further details below)

Rail

Rail connections at a number of UK refineries allow large quantities of refined products to be transported to rail-fed terminals across the country, enabling their distribution closer to areas of major consumption.

Road

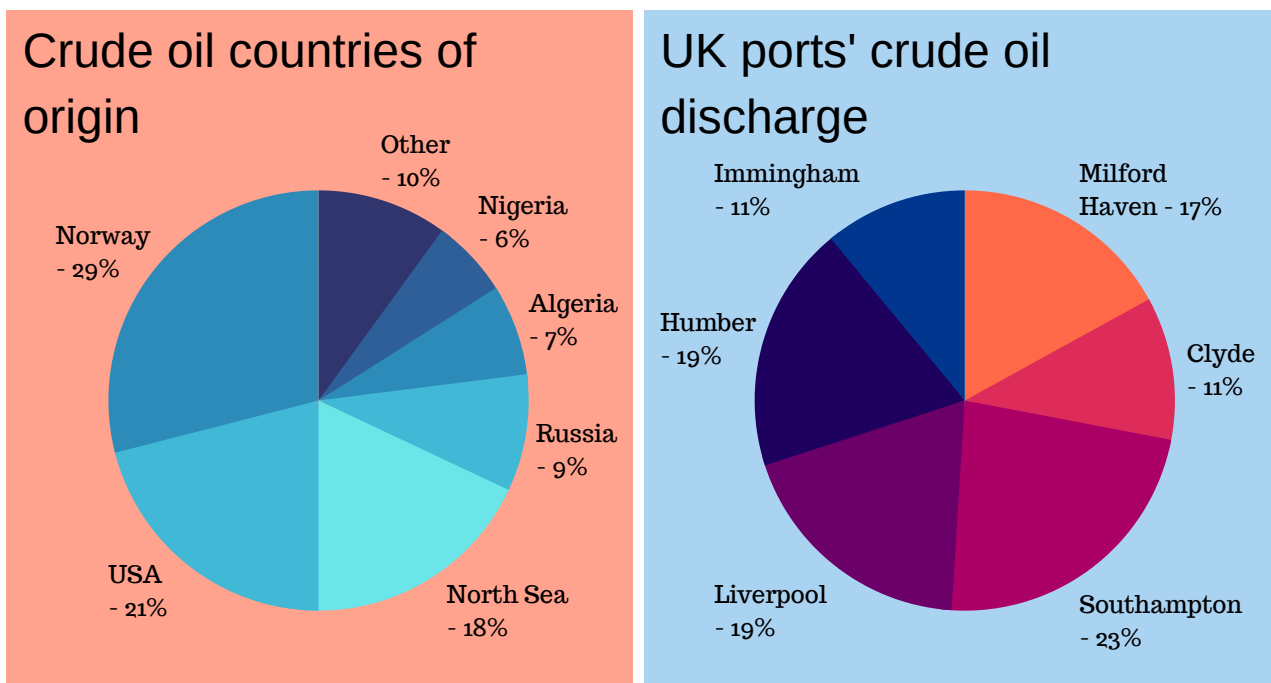
Road transport is the preferred method for the delivery of most products to the end user, be it an industrial customer or a filling station. The biggest tankers for fuels tend to be articulated lorries with capacity to carry around 40,000 litres with specialist tankers used to convey products such as bitumen, fuel oil and LPG.

- As stated by UKPIA, inward supplies of crude oil for the UK's six oil refining companies are very dependent on maritime transport and include North Sea oil extraction, part of which arrives by sea but also via

pipelines to Grangemouth (Petroineos refinery) and to Teesport, before onward shipping (more details below in the coastal shipping section).

- The origin/destination chart below shows UK North Sea crude oil is the third highest source of feedstock after Norway and USA, and also shows the six ports of discharge for crude oil. Imports of crude oil discharged at Clydeport are pumped across the Central Belt to the Petroineos refinery at Grangemouth.

Chart 2 - Comparison of Crude Oil imports by country and by port of discharge



UK coastal shipping of Bulks and Unit Loads

Road and rail transport are the major inland transport modes (plus a very small volume by waterways) but coastal shipping is also a major feature of UK freight and passenger flows and the following analysis sets out the position. Further analysis of domestic passenger traffic is in a later section.

In 2019, 92m tonnes UK port throughput was handled via domestic coastal shipping services, representing 20% of total port throughput. These cargo flows included:

- seaborne trade between two UK ports with no landside leg (e.g. crude oil)
- coastal trade as part of a longer supply chain (e.g. trucks using RoRo ferry services with Northern Ireland)
- one-port traffic for discharging sea-dredge aggregates
- one-port traffic providing support services to offshore energy platforms and windfarms.

The following tables explain and quantify the cargo types in more detail for domestic coastal shipping, of which Bulks (liquid and dry) were nearly 70% of volume by weight of goods.

Liquid Bulks Coastal Shipping

In 2019, the total volume of Liquid Bulks handled at UK ports was 192.7m tonnes of which 18% was transported by domestic coastal shipping services. The cargo breakdown was:

Table 2 - UK coastal shipping of Liquid Bulk products by commodity type and direction

Tonnes (m)	Crude Oil	Oil Products	LNG	Other LBs	All Liquid Bulks
Outward	8.1	7.0	0.4	1.3	16.8
Inward	9.0	7.2	0.5	0.6	17.3
Total for UK ports	17.1	14.2	0.9	1.9	34.1

- Two of the UK's major ports that receive crude oil (and gas) supplies from North Sea fields are at Grangemouth on the Forth Estuary and at Teesport on the River Tees. The supplies of crude oil arrive via sub-sea pipelines from North Sea extraction platforms and overland to these ports; the Forties pipeline to Grangemouth and the Ekofisk pipeline to Teesport. The volume of crude oil received at these ports via pipelines is not included in DfT port statistics.
- However, after receipt via pipeline, the onward shipping of crude oil is by sea from Grangemouth, primarily to international markets (13mt) but in 2019 0.5mt was transported by coastal shipping to UK users. A more

significant volume of crude oil (6.4mt) is shipped from Teesport's facilities by domestic coastal services, primarily to the UK oil refineries on the Humber Estuary (Phillips 66 and Total). A further 5mt is exported from Teesport to international export markets.

- In 2019 coastal shipping of North Sea crude oil accounted for 40% of the feedstock used by the two Humber refineries.
- Feedstocks for the oil refineries on the Mersey (Essar at Stanlow) and at Southampton (Esso at Fawley) are largely sourced by international imports of crude oil, supplemented by a small amount of North Sea crude, primarily from Sullom Voe (1.2mt).
- Over 14mt of refined oil products are shipped to a large number of UK ports (UKPIA identifies 40 coastal locations) and around half of the outward coastal shipping tonnage of oil products is from Milford Haven, where Valero at Pembroke have their nearby refinery.

Dry Bulks Coastal Shipping

In 2019, the total volume of Dry Bulks handled at UK ports was 93.5m tonnes of which 29% were transported via domestic coastal shipping services.

Table 3 - Coastal shipping of Dry Bulk products by commodity type and direction

Tonnes (m)	Coal	Granite	Aggregates	Agri-bulks	Other DBs	All Dry Bulks
Outward	0.5	2.9	2.6	0.8	0.3	7.1
Inward	0.5	2.9	15.0	0.8	0.5	19.7
Total for UK ports	1.0	5.8	17.6	1.6	0.8	26.8

- The highest volume of coastal trade in Dry Bulks in 2019 was Aggregates (17.6mt). These are grouped under 'other dry bulks' in DfT stats and comprise sea dredge materials, classed as 'one-port' traffic. A proportion of this material (2.6mt) is subsequently shipped by coaster from the port of landing to another UK port where the sand/aggregates are used in manufacturing (e.g.cement) or for major construction projects. The major part of coastal freight in coal was the transshipment of Belfast's coal imports to the Kilroot power station jetty.

- Granite trade in 2019 comprised the ongoing shipping of the stone from Glensanda's quarry (2.9mt) to other UK ports (2.9mt). This represented 45% of Glensanda's total output volume (N.B. the port at Glensanda is the UK's largest exporter of dry bulks).
- Some modest volumes of agri-bulks are transported by sea, for example Barley from Shoreham Port to Montrose.

General cargo coastal shipping and port services

- In 2019, the total volume of General Cargo handled at UK ports was 17.2m tonnes of which 2.2mt (13%) was transported via domestic coastal shipping services.
- Within General Cargo operations, the principal coastal activities were services for the offshore energy sectors with 1.9mt of cargo throughput handled at Aberdeen, Peterhead and Great Yarmouth.
- A significant number of UK ports support offshore windfarm construction projects, provide long term O&M services and are involved with decommissioning projects in the oil & gas sectors. Ports such as Mostyn, Barrow, Dundee, Blyth, Hartlepool, Grimsby East, Lowestoft and Newhaven have performed key roles within these offshore sectors but are not captured in terms of tonnage throughput.

Unit Loads coastal shipping

- In 2019, the total volume of Unit Loads (RoRo and LoLo) handled at UK ports was 172m tonnes of which 17% was transported via domestic coastal shipping services.
- In the LoLo sector, coastal shipping of containers is limited despite the availability of grant funding to encourage greater use of waterborne freight. For shippers the underlying economics have been difficult to justify and perhaps limited by the readily available rail freight grants which compete for this type of trade. Some limited domestic LoLo services operate across the Irish Sea to Belfast and Warrenpoint but in 2019 the total volume of coastal LoLo trade only amounted to 300k units (3.2m tonnes).
- RoRo is the dominant sector for domestic coastal trades and amounts to 25% of all volume handled in the entire UK RoRo sector. Additionally, it is important to include the RoRo trade flows with the Republic of Ireland

within this picture and therefore this fuller picture is analysed in the next section.

Irish Sea RoRo trade

The trade flows between GB and the Island of Ireland at the time of writing is a hot topic. GB connections from west coast Scottish, English and Welsh ports to the island of Ireland are major generators of road traffic on both sides of the Irish Sea. The analysis below quantifies these volumes.

- In the following table, the units handled are in thousands and include all flows inwards and outwards between GB ports and the island of Ireland. On these routes, total RoRo freight volume at 1.93m units is 32% of all UK ports' RoRo freight traffic.

Table 4 - RoRo trade volumes on Irish Sea Service

	RoRo RoI (K)	RoRo NI (K)	Passenger cars (K)	Passengers (K)
Loch Ryan / Belfast	-	215	291	467
Cairnryan / Larne	-	195	123	1,304
Heysham / RoI / Warrenpoint / IoM	44	252	67	268
Liverpool / Belfast / IoM	-	259	181	557
Liverpool / Dublin	381	-	21	91
Holyhead / Dublin	481	-	472	1,886
Fishguard / Rosslare	40	-	82	235
Milford Haven / Rosslare	67	-	98	327
Total Units	1,013	921	1,335	5,315

- The number of passengers carried on routes across the Irish Sea is also split by port/service and highlights the significant volumes through the Welsh and Scottish ports. Further context about passenger traffic is included in the specific section below.
- A key takeaway from the table above is that over 3m trucks and cars used the Irish Sea RoRo services in 2019, and over 5m passengers were carried. For context and comparison, this represented around 25% of the annual number of Eurostar passengers in 2019.
- In 2020/2021 some Irish Sea RoRo volumes are diverting as a result of new direct shipping services that by-pass GB ports and offer direct connectivity for EU trade between Dublin, Rosslare and Cork to mainland European ports. The data analysed in this report is for 2019 and therefore pre-dates these new RoRo ferry service developments in 2020 and 2021.
- A further health warning is about empty running. A more granular breakdown of the data is available but outside of the scope of this overall picture.

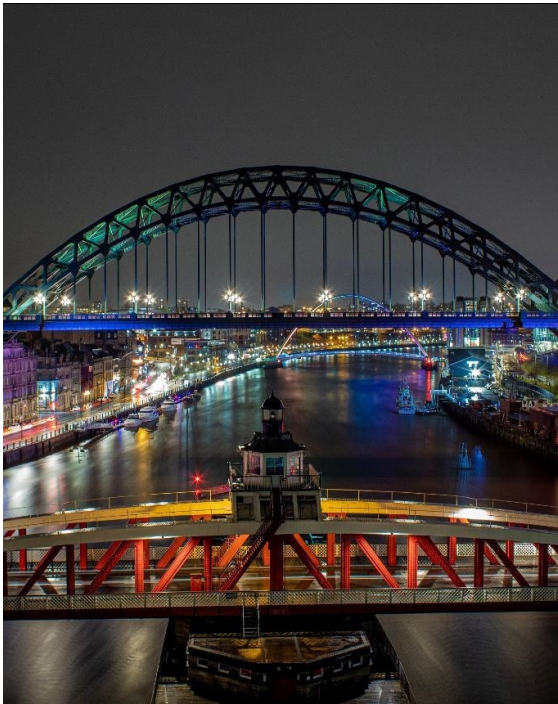
Rail freight transport at UK ports

Historically, rail transport underpinned port development, and indeed port ownership, because of the basic economics of transport and trade. In 2019 the number of UK ports with active rail freight services is significantly fewer than in the previous century, and their role has changed, in particular through the growth of intermodal container transport.



- In 1982/1983 the weight of coal carried on the GB rail network was 90.9mt and a further 54.7mt was carried in other commodities (primarily aggregates). The equivalent data in 2019/20 was 6.3mt of coal and 61.8mt in other commodities.
- The shift of course reflects changes in UK energy policies, including the switch to biomass, and the significant growth of intermodal transport of containers. It should also be emphasised that rail freight services operate between locations that are unrelated to ports, for example from quarries to inland construction hubs.

- The ports with active rail operations today are primarily the four deep sea container hubs, regional container handling ports such as Forth, Tilbury and Teesport and specialist operators such as Immingham for imports of iron ore and coal used in steel making, Tyne for biomass and Boston for transport of steel coils to Midlands' car plants. In total it is estimated that less than 15 UK ports have active rail freight operating services. New rail freight services are often announced with a great flourish as many boxes are ticked when rail miles are substituted for road miles.

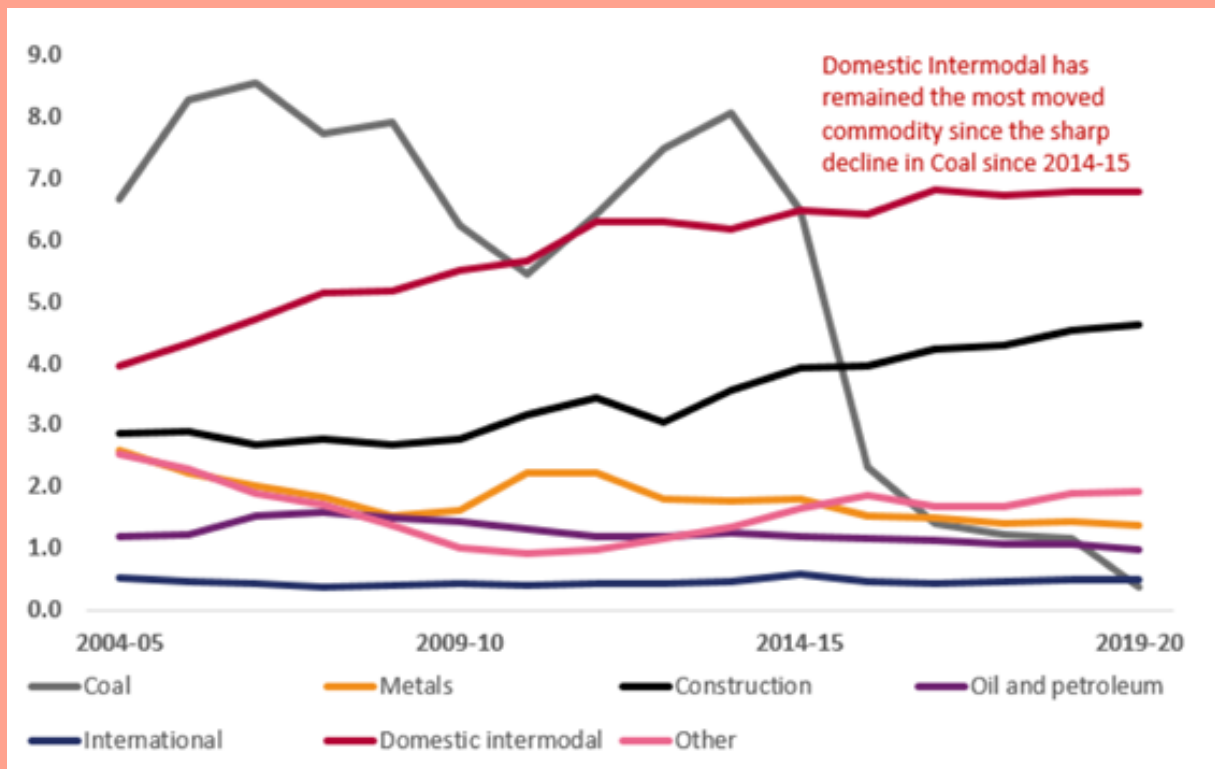


- Data about the services that operate are held by the train operating companies and shared at a high level through the Office of the Rail & Road Regulator. The chart below sourced from ORR shows the long term trends from 2004 in freight moved data, measured in net tonne kilometres, and shows the amount of freight which is moved on the railway network, taking into account the weight of the load and the distance carried.

- Intermodal freight is the now the largest user of rail freight services and also included are container train services from the inland depots, for example within the golden triangle, to Scotland's Central Belt. These services are in addition to 'maritime' port operations. International is Channel Tunnel services by scheduled rail (not the truck shuttle) and are limited. Construction materials are the second highest user, in particular for
- transport of aggregates from quarries to users. Other operations using rail freight include transport from car plants
- to the Port of Southampton for export and wood pellets (biomass).

Chart 3 - ORR analysis of rail freight trends 2004 to 2020

Rail freight moved by commodity (billion net tonne kilometres), Great Britain 2004-05 to 2019-20



- From the data, an approximation can be made about the amount of throughput that departs or arrives by rail into GB ports. It must be emphasised that there are number of key assumptions to be considered in allocating the 61.8m tonnes, excluding coal, for the ORR financial year 2019/2020.

Commodity/Service	Billion net tonne per km
Intermodal	1.64
Construction	1.16
Metals	0.36
Oils	0.23
International	0.11
Other (e.g. biomass)	0.49

The proportion of volume by commodity type and their relationship to actual tonnage hauled:

- Estimates of rail freight for intermodal, metals and oils have been calculated in proportion to the above figures. It is clearly understood that the distances hauled will vary within each commodity and between them. However, it does provide a useful approach to calculate estimated rail freight volumes.
 - Split of intermodal traffic between maritime and inland moves at 70/30. Applying this formula gives estimated use of rail freight for container transport at 17.8m tonnes, which is equivalent to 22% of international trade volumes in containers. Expressed another way, this implies that around 1 in 5 laden containers moved by rail. (Note this excludes empty boxes which are 50% of export trade and are not included in port volumes measured by weight of goods).
 - A more accurate estimate of rail freight traffic in the 'other' category uses data for iron ore imports at Immingham and the estimated volume of biomass wood pellet imports for Drax and Lynemouth (Liverpool, Immingham and Tyne).
 - For this analysis it has been assumed that 100% of construction materials moved by rail are inland moves only. As noted earlier, sea dredge aggregates do form a significant part of UK coastal traffic and some of this material may be moved by rail.
- **The output from using these assumptions gives an estimated volume of rail freight at 47m tonnes, 10% of UK port volumes.**

Sea passenger data

The total number of passengers using UK ports and river terminals in 2019 was 62.3m. For comparison, the number of passengers carried on Eurostar was 21.5m (in addition, Le Shuttle carried 2.65m passenger vehicles in 2019). The composition is shown in the table and charts below.

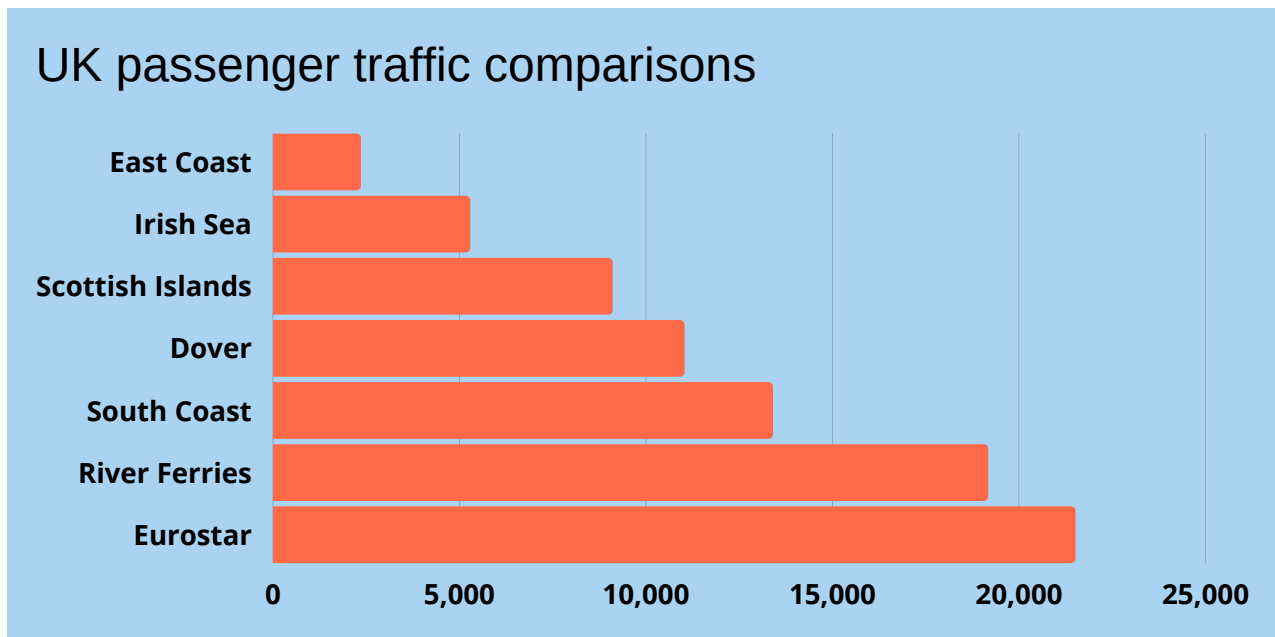
Table 5 - Numbers of sea passengers through UK ports

In millions	Irish Sea	South Coast	Dover	East Coast	Scottish Islands	All river ferries	Other ferry services
Domestic	2.6	8.9	-	-	9.1	19.2	2.2
International	2.7	4.5	11.0	2.3	-	-	-
All passengers	5.3	13.4	11.0	2.3	9.1	19.2	2.3
Percent split	8.4%	21.4%	17.6%	3.7%	14.5%	30.6%	3.7%

Source data is DfT sea passenger statistics

- Irish Sea range is from Milford Haven to Loch Ryan. The domestic services include those operating to the Isle of Man from Liverpool and Heysham.
- South coast range is from Newhaven to Plymouth and includes passengers using the Isle of Wight ferries and services to the Channel Islands. International includes cruise at Southampton.
- The number of passengers at Dover includes cruise but is primarily RoRo.
- East coast range is from Forth to Harwich. Most of the passenger volume was Tyne, Hull and Harwich.
- The mode of transport used by passengers for travel to and from these port groups will include car, coach and by rail. No detailed analytics are available.
- A detailed breakdown of the river ferry volume is not available but it will include the numbers of passengers using services on the Thames, Mersey, Solent etc and on commuter/leisure journeys. The figure is included for completeness in the table above and in the chart below as it provides another benchmark for comparison purposes.
- **The overall conclusion is that ports and river terminals handled over 60m passengers annually which is almost three times greater than the number of passengers carried on the Eurostar service in 2019.**

Chart 4 - Comparison of passenger traffic at UK ports, by regional groupings



Conclusions

- In 2019 UK ports throughput of maritime freight was 475m tonnes
 - Coastal shipping accounted for 20% (92m tonnes).
 - Rail freight handled an estimated 10% of port throughput (47m tonnes).
 - Road haulage was the primary mode accounting for around 70% of UK ports' throughput (336m tonnes).
- In 2019 ports and river terminals handled over 60m passengers annually which is almost three times greater than the number of passengers carried on the Eurostar service.
 - 31% on river ferries.
 - Port of Dover handled around 18% of passengers.
 - Other South coast ports handled an additional 21% of passengers, including cruise.
 - 14.5% of passengers travelled on routes between the Scottish Islands.
 - The number of passengers on all Irish Sea routes was around 8% of the total.

- Broader messages from the analysis include:
 - The number of ports engaged in critical oil-related supply chains and in renewable offshore energy markets that are not captured by regular data on tonnage/unit load traffic.
 - The scale of UK coastal shipping remains significant at 20% of UK ports' total throughput.
 - RoRo services with the island of Ireland accounted for almost a third of total UK freight in this mode.
- This report provides freight volume analysis by modes of transport during a clean, full calendar year (2019). This will serve as a potential benchmark for comparison with the impacts of disruptions to supply chains and travel in 2020/2021 arising from Covid-19 and from Brexit. Beyond 2021, benchmarking from 2019 base year may also be possible for measuring changes to trade flows arising from the proposed introduction of Freeport operations.

About Us



PCLP are a Liverpool-based boutique advisory firm who bring a detailed knowledge of the way in which ports are operated and configured, with strategic insights from market analysis and the competitive landscape for new business development opportunities. PCLP's advisory experience includes commercial due diligence work and business planning for port owners, operators and their teams in UK and global markets, most recently in Ireland and Turkey.

Stephen Taylor is the co-founder of PCLP in partnership with Budha Majumdar. He has worked in logistics, international trade and business management at four multinational companies, a Public Private Partnership and in management consultancy. Stephen's roles in industry included responsibilities for general management, business strategy development, capex project delivery, supply chain systems and international trade development. Stephen also produces the BPA's Statistical Dashboard, a monthly rundown of key statistics and indicators of the economy and port performance provided to members of the Association.







































**British
Ports
Association**



The British Ports Association is a national membership body for ports. We represent the interests of operators that handle 86% of all UK port traffic, to Westminster and devolved Governments, and other national and international bodies. We are an inclusive and progressive association, open to all and committed to supporting Government to deliver a policy framework that enables ports to thrive. As our membership comprises many ports, terminal operators and port facilities, all of varying size, location and nature, the Association is able to draw upon a wide range of experience and knowledge to represent its members' interests.

Appendix

The purpose of the table below is to summarise the primary modes of freight transport used by companies operating in these markets.

	Road	Rail	Pipe	Coastal	Waterway
Bulks					
Crude Oil					
Oil Products					
Natural gas/LNG/LPG					
Other liquids in bulk					
Ores					
Coal					
Agricultural products					
Other dry bulks					
Semi-Bulks					
Forestry products					
Steel products					
Project cargoes					
Unit Loads: Non-bulks					
RoRo Freight					
RoRo Trade Cars					
RoRo Passengers & Cars	 				
Containers (LoLo)	