

# BPA PORT FUTURES:

## THE POTENTIAL IMPACT OF AUTONOMOUS AND ULTRA-LOW EMISSION HGVS ON THE BRITISH RORO PORT MARKET



# ABOUT

The Port Futures Programme was launched by the British Ports Association in 2018 to examine global emerging trends in the ports and shipping industries. This rolling programme of activity will address key issues for ports over the next 50 years, including technology, infrastructure and skills, as well as potential opportunities for and challenges to British ports that these issues present.

The British Ports Association (BPA) represents over 100 port members and over 80 associate members. Our port members own and operate over 350 ports, port facilities and terminals of all sizes across the UK, facilitating more than 80% of the UK's maritime trade, 95% of which is carried by sea.

MDS Transmodal (MDST) was established in 1983 and provides specialist research, consultancy and information services to the world's transport industry. The company owns and operates the Great Britain Freight Model (GBFM), which forms the freight module of the Department for Transport's current National Transport Model. Using this model MDST has produced forecasts and associated scenarios for the future of freight transport for the DfT, Network Rail, the National Infrastructure Commission and a variety of other public and private entities as well as a range of UK ports.



# INTRODUCTION

This paper has been produced by MDS Transmodal as a contribution to the British Ports Association's Port Futures Programme and sets out the results of modelling of the use of autonomous and ultra-low emission HGVs in the short sea RORO market between Great Britain and the European continental mainland and Ireland.

GBFM has a calibrated base case for 2015, which 'explains' the movement of freight by inland mode and port of entry and exit in terms of the door-to-door cost of moving international freight between Great Britain and the European continental mainland and Ireland, as well as 'explaining' domestic freight movements; the impact of future scenarios can then be modelled by changing the cost inputs to the model.

This paper provides the results of a '2050 Autonomy & Carbon Reduction Scenario' produced by MDS Transmodal using GBFM, which seeks to quantify the potential impact of autonomous and ultra-low emission trucks on roll-on roll-off (RORO) freight flows through British ports in 2050. The results for this scenario are compared with a more neutral '2050 Business as Usual (BAU) Scenario'.



# THE 2050 AUTONOMY AND CARBON REDUCTION SCENARIO

MDS Transmodal's 2050 Autonomy & Carbon Reduction Scenario assumes that UK Government policy would have led to a ban on the use of diesel HGVs in order to reduce emissions and that commercially viable ultra-low emission HGVs would be available by 2050. The HGVs that would be used for long distance movements for both short sea international and domestic freight transport would use electric propulsion using enhanced battery technology for longer trunk hauls by HGVs, involving battery re-charging or battery swapping.

The market, facilitated by changes to the regulatory framework, would have led to an increase in the efficiency of road freight transport for long distance freight movements. This would have been achieved through:

- The availability of autonomous HGVs that would be able to operate on the highway network without a driver and also be self-loading and unloading at RORO ports.
- The development of automated distribution centres, allowing more efficient storage of goods and synchronised cross-docking of freight between inbound and outbound vehicles.
- The availability of longer HGVs, therefore reducing the unit costs and increasing the efficiency of the use of highway capacity.





The Government would also have introduced infrastructure pricing, so that HGVs would be charged for their use of the network based on the distance travelled on different types of road and the time of day. This would have replaced the existing system of taxation on a fiscally neutral basis. Rail freight transport in the 2050 Autonomy & Carbon Reduction Scenario would also benefit from economies of scale provided by longer intermodal trains, full autonomy (i.e. driverless trains) and full electrification of rail freight services. The planning system would have facilitated the development of large rail and/or water-connected distribution parks located adjacent to major urban areas so that rail and waterborne freight services could compete more effectively with long distance road freight services.

Finally, the 2050 Autonomy & Carbon Reduction Scenario assumes that the UK would have left the European Union (EU), but a reasonably close economic relationship would be retained up to 2050; by comparison, the 2050 Business as Usual Scenario assumes the UK would have retained the full economic benefits of being an EU member. Both scenarios assume that the same short sea routes are available as today to link Great Britain with the continental mainland and Ireland and that the same ports as today are connected with inter-modal rail freight services. There were no capacity constraints included in the two scenarios to limit demand by short sea route, port or on rail or highways links.





# IMPACT ON THE SHORT SEA INTERNATIONAL FREIGHT MARKET

What would the impact of such an automated and ultra-low emission freight transport system as described in the 2050 Autonomy & Carbon Reduction Scenario - primarily designed to reduce emissions and increase the efficiency of road freight - have on the short sea international freight market between Great Britain and the Continental mainland and Ireland?

## **The current short sea international freight market:**

Ports are of crucial importance to the UK's freight transport system and in facilitating the UK's trade with Ireland and the European continental mainland. About 90% of this trade is handled currently as roll-on roll-off (RORO) cargo transported in road trailers on ferries or on the Eurotunnel Freight Shuttle through the Channel Tunnel. This RoRo freight traffic can be categorised as being either:

- Accompanied HGVs: where a tractor unit, accompanied by a driver, hauls the trailer on a door-to-door trip involving a ferry or Eurotunnel freight shuttle crossing;
- Unaccompanied trailers: where only the trailer is transported on a RORO ferry, but is delivered to the port of departure and collected from the port of arrival by a tractor unit with driver; or
- Shipborne port-to-port trailers: where containers are transported on special low height trailers on a RORO ferry. As the containers can often be double-stacked, this can reduce the unit costs for the transport of containers. Again, the containers are only transported port-to-port and so have to be delivered to and collected from the ports by HGVs.

As well as RORO freight, cargo can also be transported to and from Great Britain by container ships in the form of containerised load-on load-off (LOLO) cargo and by intermodal rail freight services through the Channel Tunnel. Again, in both cases, the cargo is transported unaccompanied.



# THE RESULTS BY TRAFFIC TYPE

The overall size of the market increases from about 10 million units in 2015 to approximately 19 million units in the 2050 BAU Scenario and 18 million units in the 2050 Autonomy & Carbon Reduction Scenario. The lower traffic volumes in the 2050 Autonomy & Carbon Reduction Scenario reflect the assumed lower level of integration of the UK economy with that of the EU following the UK's departure from the EU.

**Table 1: Modelled short sea unitload traffic by mode of appearance at ports**

Million units

	2015	2050 Business as Usual	2050 Carbon Reduction
Accompanied HGV	5.4	4.6	14.4
Unaccompanied trailer	2.4	7.2	1.8
Shipborne port to port trailer	0.8	2.2	1.1
Lolo	1.1	4.4	0.8
Channel Tunnel through rail intermodal	0.0	0.7	0.0
Total	9.6	19.1	18.1

Source: MDS Transmodal GB Freight Model

In the 2050 BAU Scenario increasing road haulage costs for diesel-powered and driver accompanied HGVs leads to a switch towards the unaccompanied modes; while the unaccompanied modes secured 44% of the short sea unitload market in 2015, its share would increase to 76% in the 2050 BAU Scenario.

However, the assumed introduction of autonomous HGVs in the 2050 Autonomy & Carbon Reduction Scenario would lead to the accompanied RORO mode securing a significantly higher modal share; while this mode of appearance accounts for some 56% of the market in 2015 it would secure an 80% share in the 2050 Autonomy & Carbon Reduction Scenario compared to only 24% in the 2050 Business as Usual Scenario.

This is mainly due to the reduction in the fixed costs of road haulage following the deployment of autonomous vehicles, as drivers would not be required for the automated loading and unloading of trucks and driver time would not be required during the crossings. The accompanied HGV traffic type would become, in effect, 'driverless accompanied', with some form of traction but no driver being required.

# THE RESULTS BY PORT REGION

The current accompanied HGV traffic type in the short sea market is often associated with the turn-up-and-go services that are available across the Strait of Dover between Dover and Calais/Dunkirk and via the Eurotunnel Freight Shuttle. However, the modelling suggests that the potential new 'driverless accompanied' RORO traffic type would increase its market share significantly in the 2050 Autonomy & Carbon Reduction Scenario across the geographic scope of the market and not just on the Dover Straits (included in the 'Thames and Kent' port region below).

**Table 2: Modelled short sea unitload traffic by port grouping**

Million units

	2015	Business as Usual 2050	Carbon Reduction 2050
Thames and Kent	5.1	6.2	5.0
Humber	1.3	3.3	4.6
Lancashire and Cumbria	0.9	3.3	2.9
Haven	0.8	2.1	1.0
Sussex, Hampshire & South West	0.3	1.3	2.7
North East	0.3	0.9	1.0
West and North Wales	0.5	0.5	0.4
Scotland West Coast	0.4	0.6	0.4
Channel Tunnel	0.1	0.7	0.1
intermodal rail			
Scotland East Coast	0.0	0.3	0.0
Total	9.6	19.1	18.0

Source: MDS Transmodal GB Freight Model





The modelling suggests that the introduction of measures to reduce carbon emissions and the introduction of autonomous HGVs would lead to a switch of traffic to the North Sea RORO ports such as those on the Humber (26% market share in the 2050 Autonomy & Carbon Reduction Scenario compared to only 17% in the 2050 BAU Scenario) and to Western Channel ports (15% market share in the 2050 Autonomy & Carbon Reduction Scenario compared to only 5% in the 2050 BAU Scenario).

Many of the movements by the accompanied RORO traffic type in the 2050 Autonomy & Carbon Reduction Scenario would be with some form of tractor unit, but without the need for a driver. This means that the door-to-door economics of the 'driverless accompanied' RORO traffic type of the future would be much closer commercially to the economics of unaccompanied RORO traffic. This has potentially very significant implications for RORO ports of the future as it implies they would need to cater for more unaccompanied RORO vessels, but would not need to provide the same level of stevedoring resources as at present to load and discharge them as the ferries would be effectively self-loading.

The switch of traffic to a 'driverless accompanied' traffic type would also mean that RORO ports would need to provide more land close to RORO berths for the marshalling of HGVs prior to loading, but less land would be required for the storage of unaccompanied trailers. The impacts on particular ports would vary according to their existing mix of traffic between accompanied and unaccompanied RORO and their geographic location.

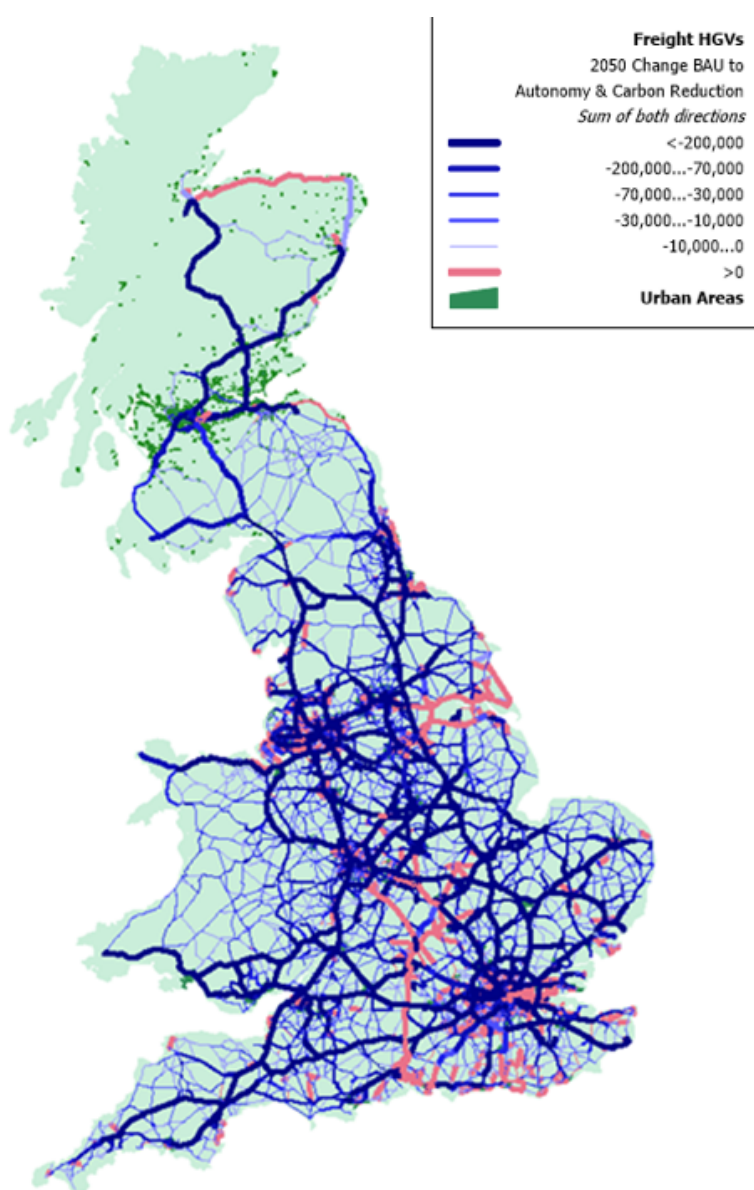


# GEOGRAPHIC IMPLICATIONS

The geographic implications of this potential switch of market share to the 'driverless accompanied' RORO traffic type become clearer from the attached map, which shows the change between the two 2050 scenarios in the traffic on the British highways network (in terms of annual HGVs in both directions on each link) for both domestic traffic and international traffic that has passed through ports or via the Channel Tunnel.

## HGVs flows - absolute change in 2050 Autonomy & Carbon Reduction Scenario vs 2050 BAU Scenario

Source: MDS Transmodal



The impact of the 2050 Autonomy & Carbon Reduction Scenario is to reduce the overall number of HGVs on the road network on many links. This reduction in HGV flows is partly due to an increase in intermodal rail freight services to and from rail-connected distribution parks as a result of the greater clustering of warehouses on rail-connected distribution parks. There are, however, some increases in HGVs flows in and around the major conurbations and to and from some ports with short sea RORO links that offer longer distance services to the continental mainland and Ireland. These increases in traffic are due, in part, to 'driverless accompanied' RORO traffic being transported on RORO services that provide direct links between North Sea, Western Channel and North West ports to the Continent and Ireland.

The switch to the 'driverless accompanied' RORO traffic type would therefore lead to a reduction in the HGV kilometres required on the highways network and to more cargo being transported directly between its origin or destination region in Great Britain and the Continent or Ireland.



# CONCLUSION

There remain significant technical, regulatory and economic barriers to the full-scale deployment of autonomous and ultra-low emission HGVs on the British highways network by 2050. However, given the policy imperative of reducing emissions and the market-based need to increase the efficiency of road freight transport - particularly given rising HGV driver costs - there will be a significant future focus on overcoming these obstacles.

This paper sought to consider the impact of the existence of the required technology on the economics of the short sea international freight market in 2050 and shows how it would lead to 'driverless accompanied' RORO traffic becoming dominant in the market, but with RORO traffic being less concentrated on some routes.

As a greater proportion of RORO cargo would be self-loading and unloading, land side resources at British RORO ports of the future would need to be focused to a greater extent on marshalling traffic prior to loading and to a lesser extent on stevedoring and the storage of unaccompanied trailers. Such developments would lead to Britain's short sea transport chains becoming both more efficient economically and more sustainable environmentally."



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