

Research Bulletin 20/1 | Analysing HGV movements between NI and GB using mobile network data

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Summary

The Department commissioned Citi Logik¹ to analyse mobile network data (MND) to provide analysis of Heavy Goods Vehicle (HGV) movements between Northern Ireland and Great Britain including via the Republic of Ireland. Whilst the number of accompanied HGV crossings between NI and GB is relatively well understood, the ferry routes and the origins and destinations of the goods beyond the ferry ports are less well known. There were an estimated 50,000 accompanied HGV crossings in each direction between NI and GB over the course of the 3 month study period. The results show that 57% of HGV crossings between NI and GB go through Belfast; 22% go through Larne; and interestingly 20% go through the Republic of Ireland. This equates to an annual estimate of around HGV 80,000 crossings between NI and GB via ROI. Most ROI traffic goes through Dublin to Holyhead or Liverpool.

The analysis suggests that HGV travel from NI to destinations in GB is relatively well spread, with HGVs going to most parts of GB. For crossings from GB to NI there is a greater concentration of trips ending in the Belfast region compared to the rest of NI. The data shows GB origins are more local to the port areas with less spread throughout the mainland. This is indicative of drivers resting in the port areas before onward travel.

Introduction

This project was undertaken by the Department to inform discussions in relation to EU Exit and the NI Protocol. This paper outlines the number of accompanied HGV crossings between NI and GB, the proportion of HGVs using the ferry routes and the origin and destination of these HGVs. The Northern Ireland HGV project is based on a data collection period covering the second quarter of 2019 - April, May and June 2019. This period was selected because it was relatively neutral (i.e. not impacted by holiday periods) and there was published data from the Department for Transport (DfT) to validate the findings of the analysis.

The following sections provide an overview of the methodology and present the results of the analysis in terms of:

- Total HGV ferry crossings;
- Popularity of ferry routes; and
- Origin and destination of HGV journeys.

Methodological Overview

DfE commissioned Citi Logik to undertake this research using Vodafone mobile network data. Mobile network data is the core interaction between the mobile device (which is anonymised) and the core network and identifies the cell tower that the user's device is attached to and time of interactionⁱⁱ. Mobile network events are generated every time a mobile device communicates with the core network, e.g. on calls, texts and apps communicating. These events provide the location and movement data that were analysed by Citi Logik.

Citi Logik processed the data to identify motorised trips based on journey lengths and travel speed parameters. This enabled Citi Logik to develop a methodology for separating HGV trips from other motorised trips. The key assumption behind the HGV identification methodology is that the travel behaviour of devices belonging to HGV drivers should demonstrate certain common characteristics that are distinguishable from other road-based users (e.g. car, LGV etc.). This is a reasonable assumption to make since HGVs generally exhibit different travel patterns from other vehicles on major highways. This difference particularly pertains to speed, since HGVs are subject to speed restrictions on major highways and dual carriageways, and evidence suggests that the vast majority of HGVs abide by the specified restrictions. Additionally, the distance between trip origins and destinations is likely to be significantly greater for HGVs than for other vehicles. This, together with the device speeds, forms the principal criteria used to identify devices associated with vehicles making HGV trips.

The collected sample data only covered movements by the proportion of the population who use a single mobile operator. The resulting analytics were expanded to represent the full UK population using a methodology developed and approved by DfT.

After obtaining a dataset including all devices that had interacted with a cell in NI, Citi Logik identified ferry crossing journeys between NI and GB using five steps:

1. Isolating Crossing Devices: Identified in the dataset by any device interacting with both NI and GB. The criteria stated above for identifying devices associated with HGV trips was then applied to the dataset.
2. Isolating Crossing Journeys: Identified trips based on origin and destination points being in separate regions with direction of travel being allocated accordingly.
3. Identifying Ferry Crossings: Filtered set of crossing journeys to only those that activated a cell in the catchment area of one of the GB/NI ports.
4. Analysing Ferry Routes: Analysis of ferry routes to ensure trips corresponded with existing ferry routes.
5. Identifying HGVs: HGV algorithms applied to ferry trips in order to identify trips that appeared to be related to freight.

Total HGV crossings

There were an estimated 50,000 HGV accompanied crossings in each direction between NI and GB over the course of the 3 month travel period. This equates to about 400 to 600 crossings each day. Table 1 shows HGV journeys by route. The Belfast / Cairnryan route is the most popular for HGVs with 47% of trips using this route. The next most common route is Larne / Cairnryan with 22%. The data also suggests that 20% of the HGV accompanied crossings between NI and GB are going via the Republic of Ireland, with the primary route being through Holyhead.

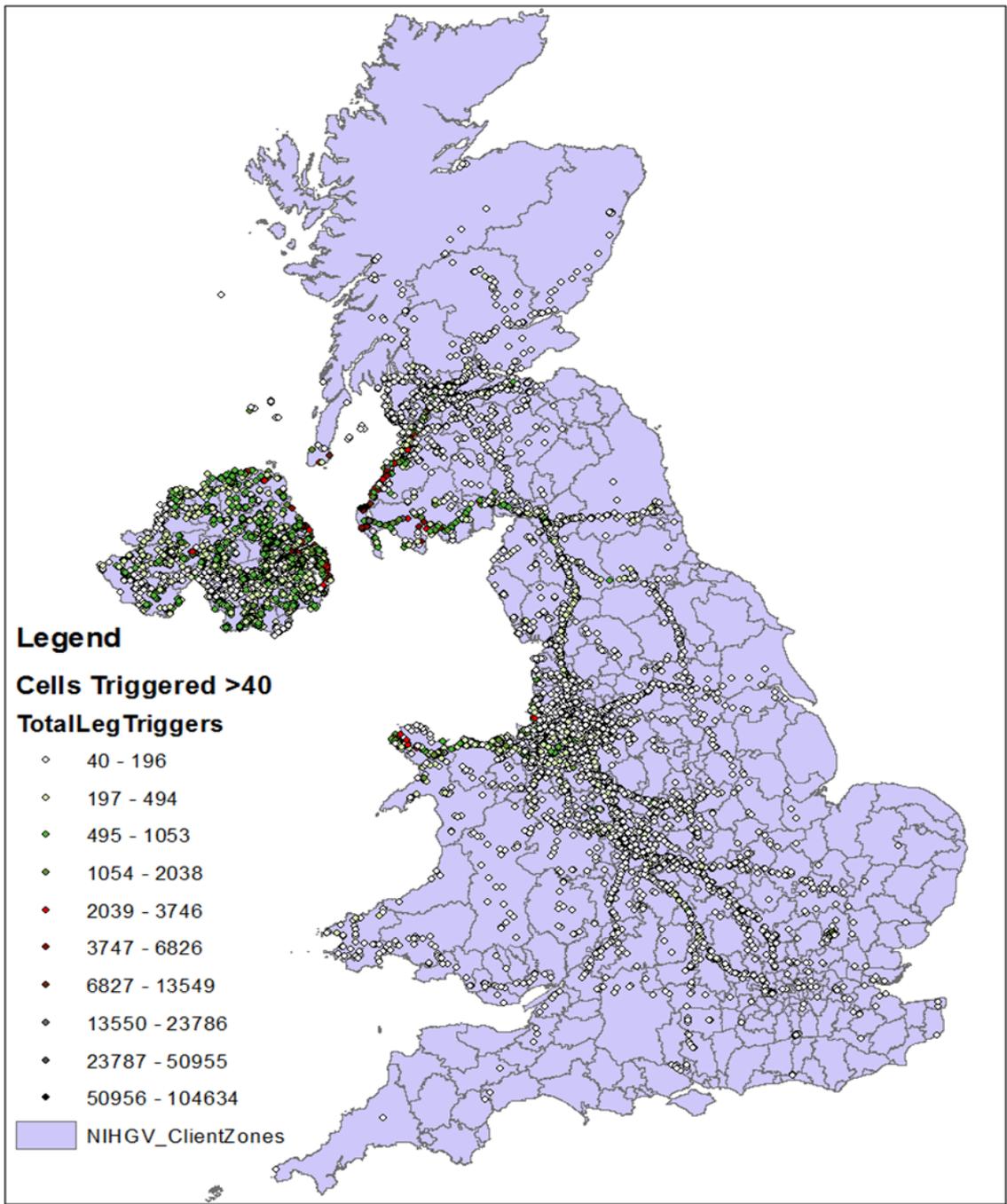
Table 1: Summary of HGV journeys by route during the study period

GB Port	NI/ROI Port	GB to NI Expanded HGV	NI to GB Expanded HGV	2 Way	Percentage
Cairnryan	Belfast	24,109	22,601	46,710	47%
Cairnryan	Larne	10,708	11,500	22,208	23%
Holyhead	ROI	7,592	5,558	13,150	13%
Liverpoolⁱⁱⁱ	Belfast	3,764	5,478	9,242	9%
Liverpool	ROI	2,147	2,983	5,129	5%
Fishguard	ROI	619	689	1,309	1%
Heysham	Warrenpoint	508	638	1,146	1%
Total		49,447	49,447	98,893	100% ^{iv}

Source: Northern Ireland HGV MND Project, 2020

Figure 1 shows how devices undertaking HGV crossings^v have interacted with the Vodafone mobile network. In GB the strategic road network (key routes and motorways) is clearly visible.

Figure 1: Cells triggered by HGV crossing journeys



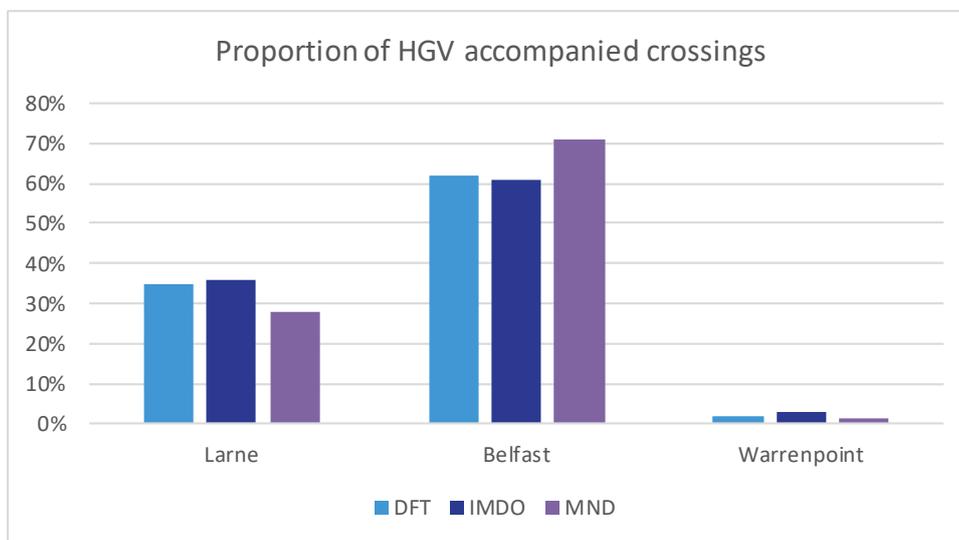
Source: Northern Ireland HGV MND Project, 2020

Benchmarking with published data

The MND results were benchmarked against two sources of official data: Department for Transport (UK) and the Irish Maritime Development Office 2020 statistics reporting on the number of accompanied freight vehicles. The IMDO data^{vi} provides inbound and outbound journeys for the following three NI ports: Larne, Belfast and Warrenpoint. Only HGV accompanied trips for the 3-month period were drawn from this data set. The IMDO

and DfT sources suggest there were about 43,000 HGV accompanied crossings in each direction over the period. This is close to the MND calculations of about 40,000 HGV crossings identified when removing movements via ROI. This good match between the estimated and actual data for total crossings is reassuring. Figure 2 shows the comparison of MND in this project with the official data sources for the three NI ports.

Figure 2: Comparison of HGV crossings using MND and official data sources

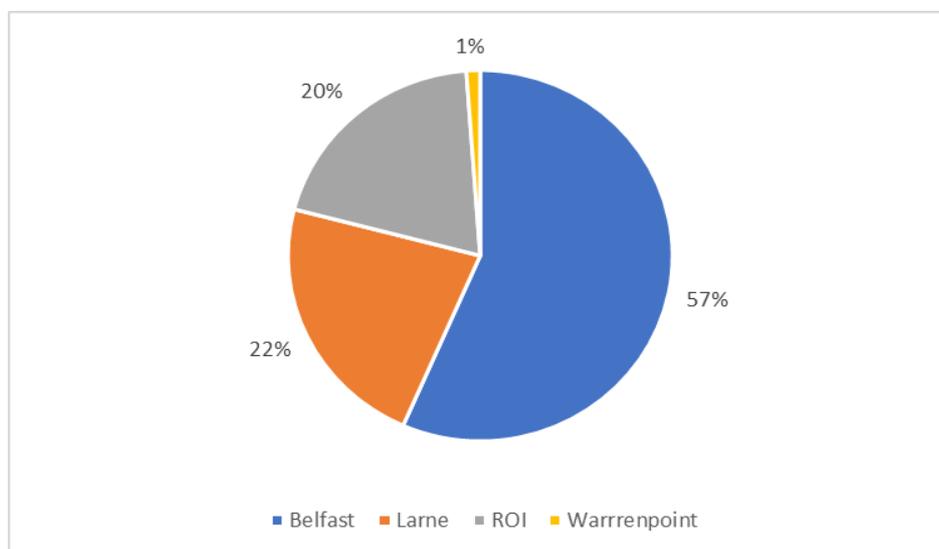


Source: Northern Ireland HGV MND Project, 2020

Popularity of ports

Figure 3 shows the most popular Northern Ireland port is Belfast with 57% of crossings, followed by Larne at 22%, Republic of Ireland at 20% and Warrenpoint with 1%.

Figure 3: Proportion of HGVs using Northern Ireland ports during the study period



Source: Northern Ireland HGV MND Project, 2020

Top destinations by origin port

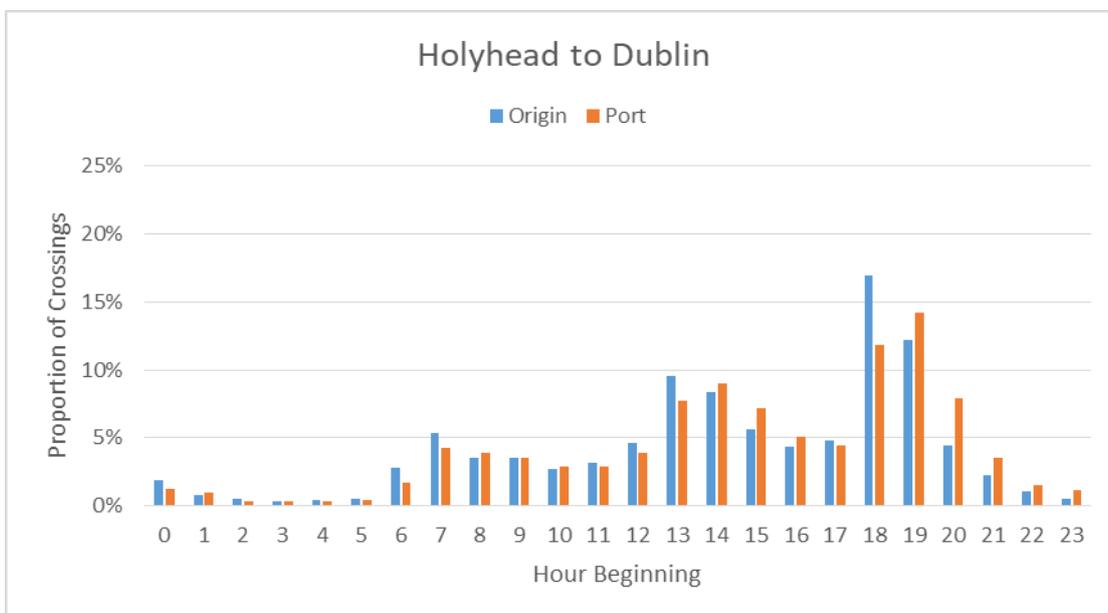
The most popular destinations for HGVs travelling from the ports of Belfast and Larne are Dumfries and Dunbartonshire. The most popular destinations for HGVs travelling from Cairnryan are North Down and Carrickfergus. The most popular destinations for HGVs travelling from Holyhead are Newry and Mourne and Fermanagh.

Republic of Ireland

The data indicates that 20% (approximately 20,000 in the 3 month period) of the HGV accompanied crossings between NI and GB are going via the ROI, with Dublin - Holyhead being the primary route. This equates to an annual estimate of around HGV 80,000 crossings between NI and GB via ROI. To understand the Holyhead to ROI route usage for freight, the hourly distribution of HGV trips was analysed. Figures 4 and 5 show the distribution of Holyhead/Dublin crossings by the trip origin start time (true origin and port) for each direction.

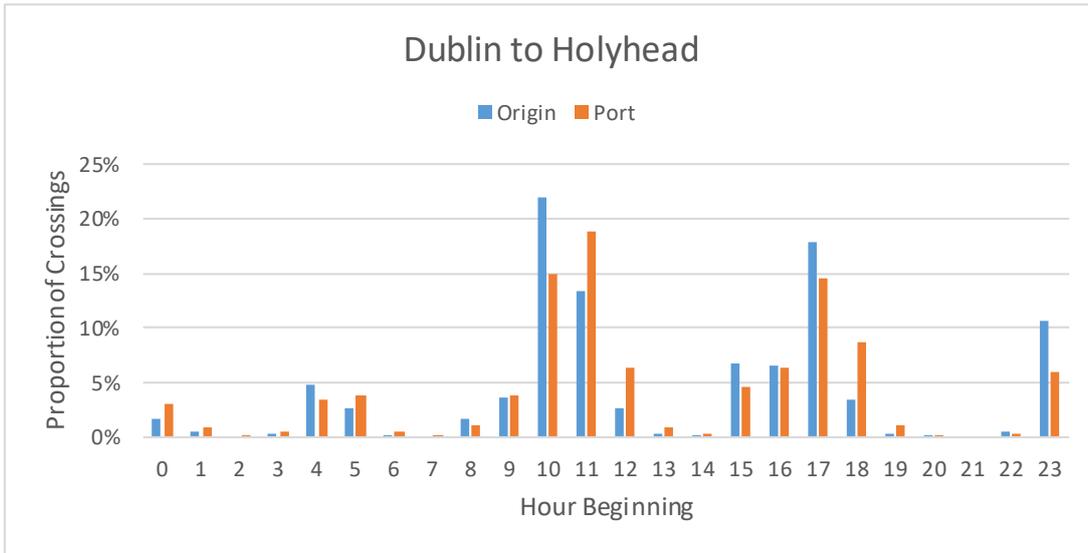
The distribution of origin trip time for HGV crossings align with the typical ferry crossing times assuming that the HGV would arrive 1 or 2 hours before the sailing. Typical crossing times are around 2am, 8am, 2pm and 9pm in both directions. The pattern is clearer for HGV crossings from Dublin to Holyhead. For HGVs originating in GB the origin times are more widely spread, but are still contained within bands at times preceding the crossing times. The most common sailings appear to be the 2pm and 9pm ferries, while the 2am ferry from Dublin also appears to be popular with about 10% of crossings using this service (while the ferry in the other direction at the same time shows very little use).

Figure 4: Proportion of Crossings per Hour for the Holyhead to Dublin Ferry by Trip Origin Departure Time and Port Arrival Time



Source: Northern Ireland HGV MND Project, 2020

Figure 5: Proportion of Crossings per Hour for the Dublin to Holyhead Ferry by Trip Origin Departure Time and Port Arrival Time



Source: Northern Ireland HGV MND Project, 2020

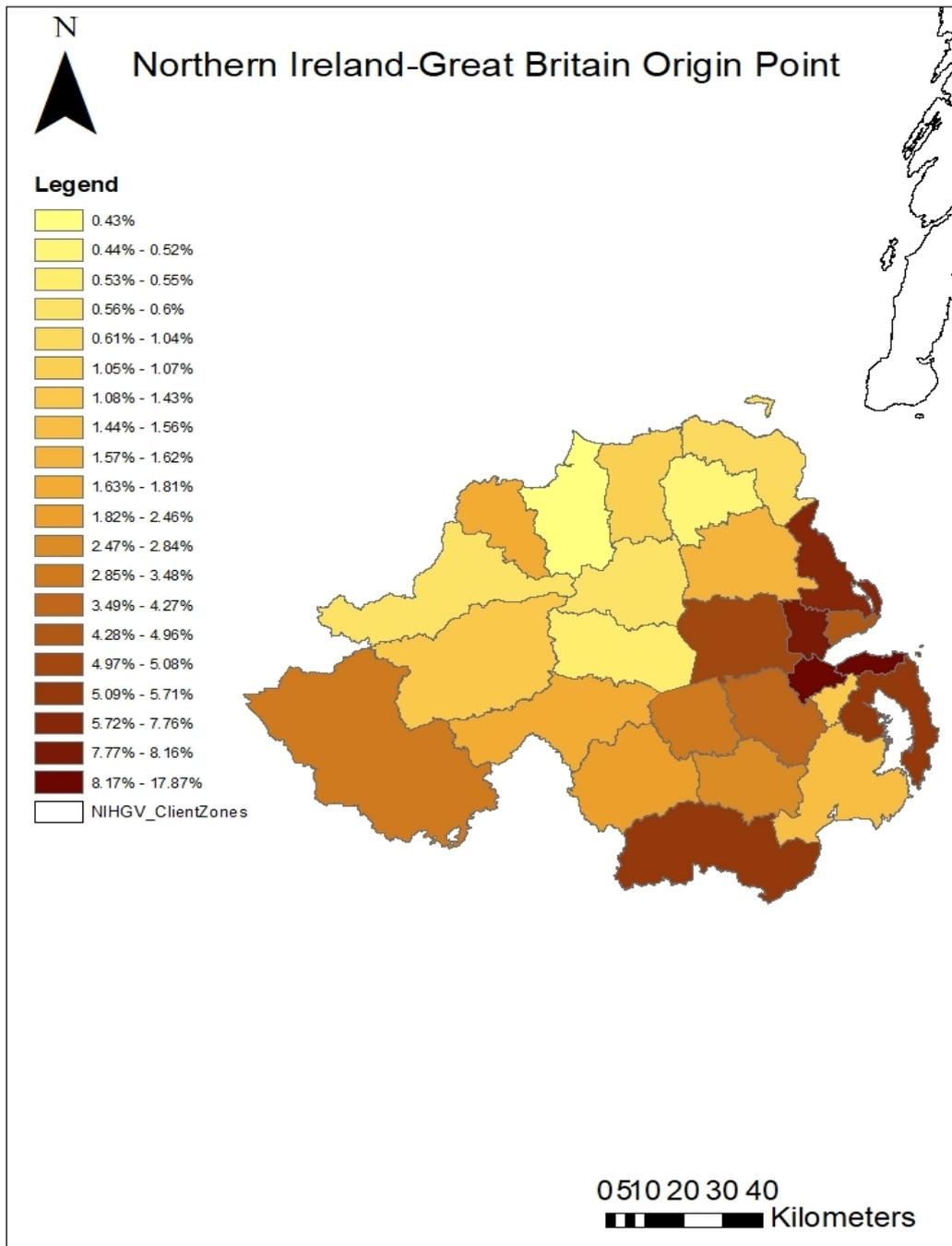
Origin and destination of HGV crossings

The origins and destinations of HGV crossings were assessed as part of the study and are discussed in the following sections.

NI Origins and Destinations

Figure 6 illustrates the origins of the HGVs travelling from NI to GB over this period. The analysis suggests that for HGVs crossing from NI to GB the origins are mostly concentrated in Belfast and surrounding regions.

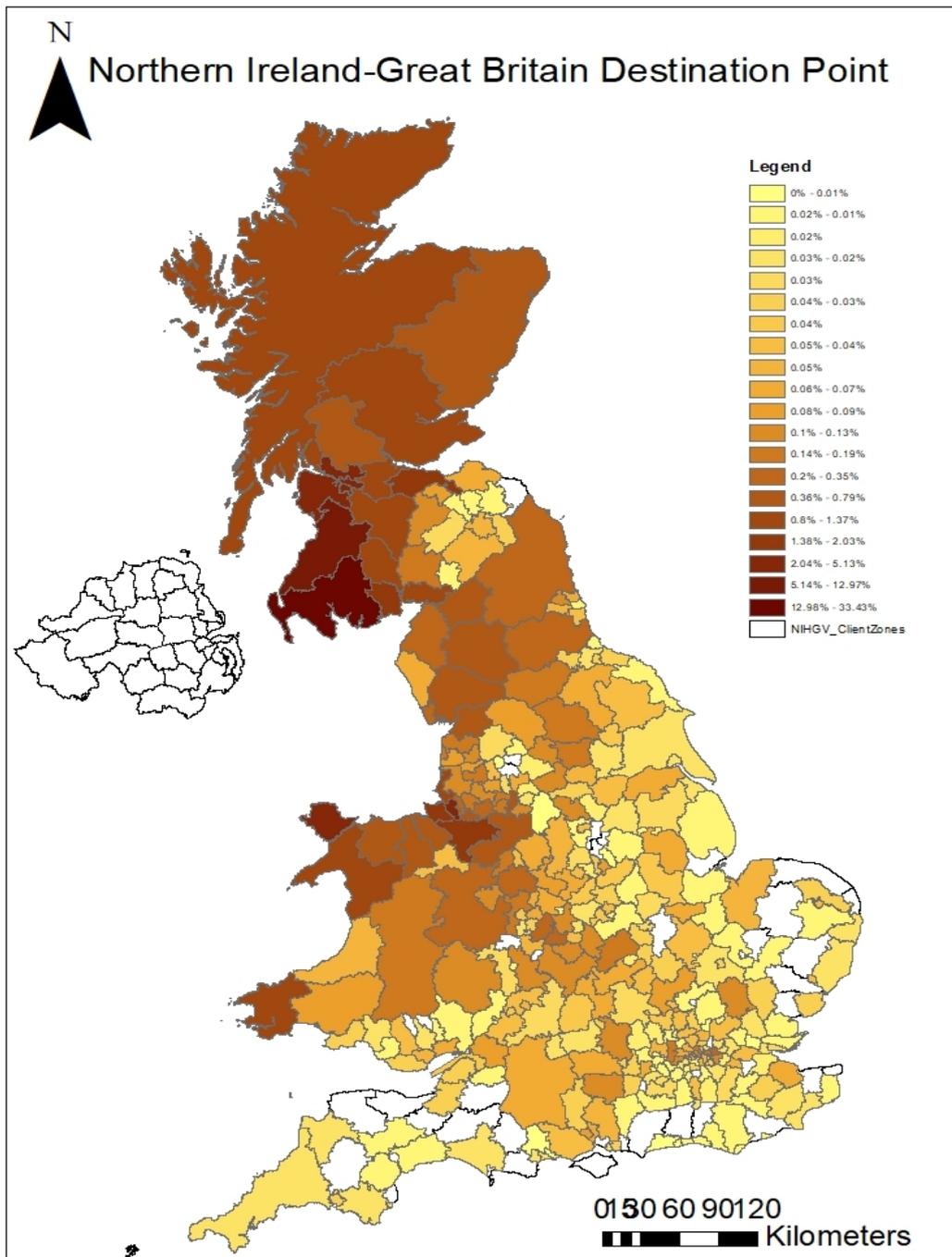
Figure 6: Origin zones for HGV crossings NI to GB



Source: Northern Ireland HGV MND Project, 2020

Figure 7 illustrates the destinations of the HGVs travelling from NI to GB over this period. The analysis suggests that for HGVs crossing from NI to GB the destinations are spread through the whole of mainland GB. Travel behaviour suggests that after a period of rest on the ferry the drivers undertake long distance trips into mainland GB.

Figure 7: Destination zones for HGV crossings NI to GB



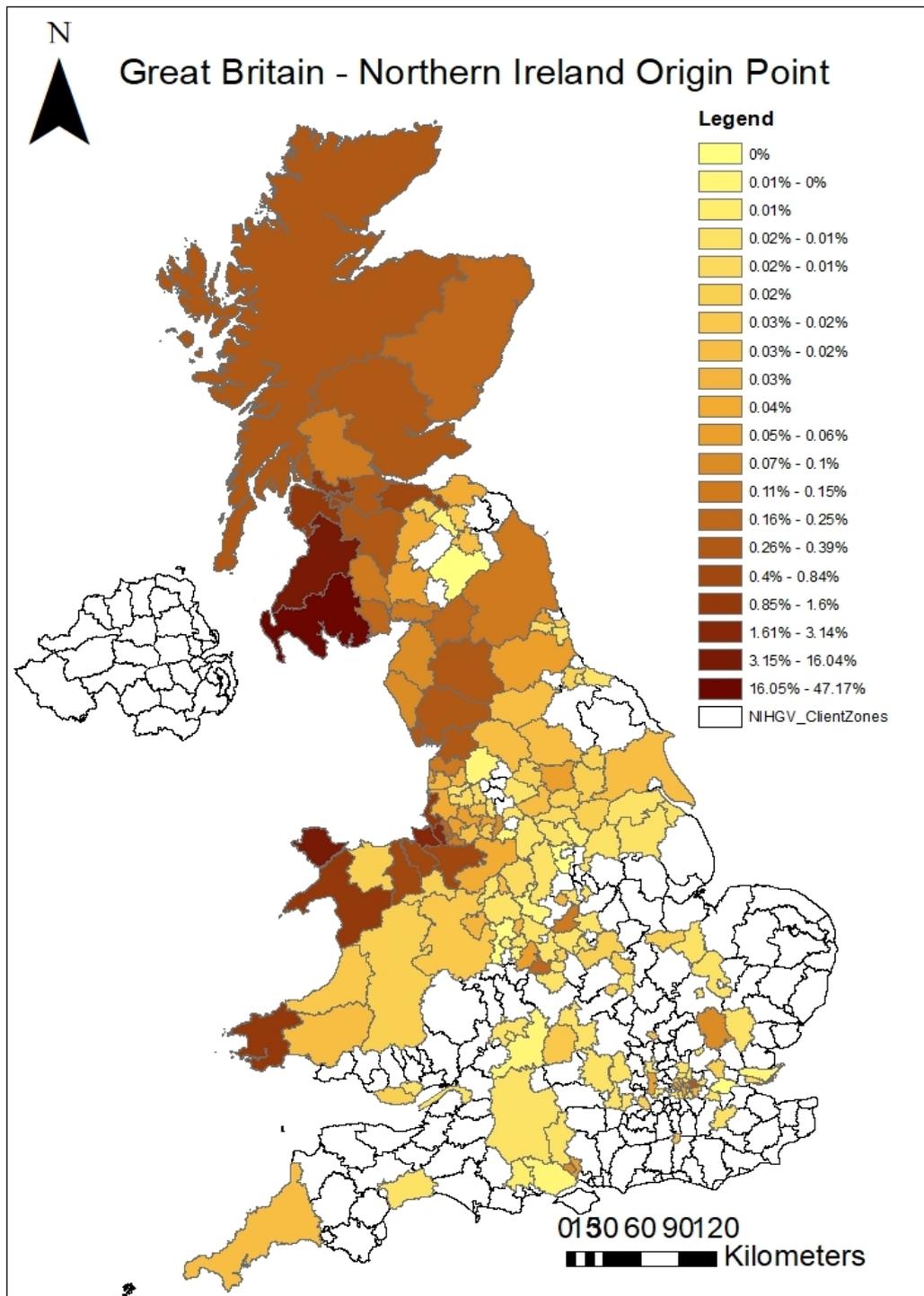
Source: Northern Ireland HGV MND Project, 2020

GB Origins and destinations

Figure 8 illustrates the origins of HGVs travelling from GB to NI over this period. The analysis suggests that for HGV crossings from GB into NI, the origins are more localised to the port areas with less spread throughout the mainland.

This is indicative of drivers resting in the port areas before travel either due to driving time restrictions or simply having to wait for the next ferry. Due to this waiting period, the MND data will cut the trip off after 30 minutes of inactivity (known as the dwell time^{vii}) therefore it is more likely that HGVs traveling to NI will have an origin at the GB port.

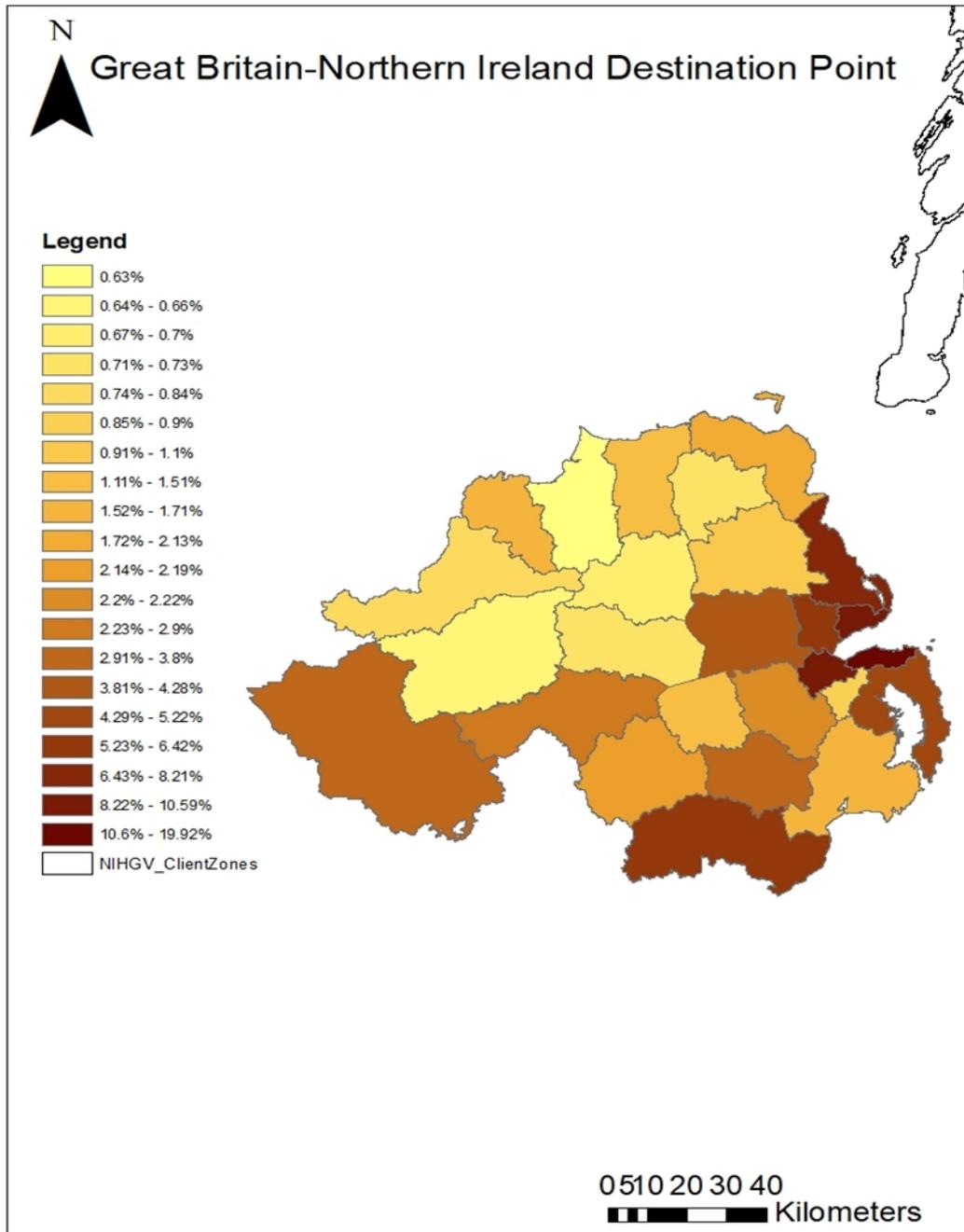
Figure 8: Origin zones for HGV crossings GB to NI



Source: Northern Ireland HGV MND Project, 2020

Figure 9 illustrates the destinations of the HGVs travelling from GB to NI over this period. The analysis suggests that for HGVs crossing from GB to NI, whilst the destinations are most prevalent in Belfast and surrounding regions, there is also spread to other parts of the country.

Figure 9: Destination zones for HGV crossings GB to NI



Source: Northern Ireland HGV MND Project, 2020

Limitations/constraints of data

It is important to note that in a study of this nature there will be some constraints and limitations on the data and the subsequent analysis. First, only full HGV units (tractor and trailer) have been observed as part of the study. Secondly, there was potentially some HGV traffic travelling to Larne that was allocated to Belfast due to how the destination data was recorded (close proximity of ports). Evidence of this is reflected in Figure 2 that shows MND with a higher proportion of traffic at Belfast port compared to the official statistics. Finally, for HGV crossings from GB into NI, the GB origins are more local to the port areas with less spread throughout the mainland. This is indicative of drivers resting in the port areas before onward travel. As part of the MND trip methodology the data will cut the trip off after 30 minutes of inactivity therefore it is more likely that HGVs travelling to NI will show an origin at the GB port, compared to the actual origin if the HGV arrives well in advance of the sailing time.

Conclusions

The data collected for this report was compared with official data and there was a good match between the estimated and actual data. MND in this project estimated 40,000 HGV accompanied journeys directly between NI and GB over the study period compared to official data of about 43,000 journeys. A key finding was the proportion of GB/NI HGV travel through the Republic of Ireland (20% of total crossings). This equates to an annual estimate of around 80,000 HGV crossings between NI and GB via ROI, with most trips going through Dublin. The most common sailings via from Dublin appear to be the 2pm and 9pm ferries, while the 2am ferry also appears to be popular. The report's findings suggest that HGV travel from NI to destinations in GB is relatively well spread. For crossings from GB to NI, whilst there is a concentration of destinations in the Belfast region, there is also a reasonable spread throughout the country.

Total HGV crossings

The analysis suggests that about 400 to 600 HGV crossings occur every day in each direction with a total of 50,000 HGV crossings observed over the 3 month period. Analysis shows that the Belfast / Cairnryan route is the most popular (47%) for HGVs with the next most popular route Larne / Cairnryan (22%). For the 20% of crossings going via the Republic of Ireland, the Holyhead / Dublin route is the most common route.

Popularity of ports

The analysis suggests that the most popular port is Belfast with 57% of crossings, followed by Larne at 22%, Republic of Ireland at 20% and Warrenpoint with 1%.

The origin and destination of HGV crossings

The analysis suggests that for HGV crossings from NI to GB the destinations are spread through the whole of mainland GB. Travel behaviour suggests that after a period of rest on the ferry the drivers undertake long distance trips into GB. For HGV crossings from GB into NI, the GB origins are more local to the port areas. This is indicative of drivers resting in the port areas before travel either due to driving time restrictions or simply having to wait for the next ferry. Due to this waiting period, the MND data will cut the trip off after 30 minutes of inactivity therefore it is more likely that HGVs travelling to NI will have an origin at the GB port. Those patterns are not as visible in NI as driving distances are much smaller.

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For further information or queries please contact john.mcgettrick@economy-ni.gov.uk

ⁱ Citi Logik is a technology company, which uses mobile network operator data to provide insight into the way people move on foot, in a vehicle or by train. Further details can be found here.

ⁱⁱ The analysis did not use any personal data and only contains data that has been both anonymised and aggregated to ensure customer privacy.

ⁱⁱⁱ Liverpool refers collectively to Liverpool, Bootle and Birkenhead.

^{iv} Totals have been normalised for ease of comparison. Total percentage may not be 100% due to rounding.

^v HGV crossings are defined as HGV accompanied journeys that have been made between NI and GB.

^{vi} Link for Logistics UK: Keeping Northern Ireland and Great Britain Trading can be found at:
<https://logistics.org.uk/CMSPages/GetFile.aspx?quid=7e9a7975-c2eb-47cd-81aa-b3ebba663d41&lang=en-GB>

^{vii} For trip definition purposes, 'dwell time' refers to the time during which events for a particular mobile device are registered by the same cell. If such dwell time for a certain mobile device exceeds a minimum time threshold (30 minutes) then its user experiences a 'dwell' and is deemed to be 'static'.