CATAPULT
Connected Places

FREIGHT USER JOURNEY
Linking the North West to the rest of the world with the Liverpool City Region Freeport and the renaissance of its historic inland waterway assets in an age of energy transition and digitalisation.

MOVING ON THE MERSEY

INTEGRATED & SUSTAINABLE TRANSPORT ECOSYSTEM

JUNE 2022

LETS GET STARTED

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Produced by:

Royal HaskoningDHV
Enhancing Society Together

PROJECT INTRODUCTION

INTEGRATED & SUSTAINABLE TRANSPORT ECOSYSTEM ON THE MERSEY – PROJECT INTRODUCTION

The Integrated & Sustainable Transport Ecosystem on the Mersey is made up of a series of three user journeys which illustrate how with the changing policy and investment atmosphere, the time is ripe to re-explore the types of river centric user journeys (current or future) that could be unlocked through integration of marine transport with other modes of transport and the innovative use of existing and new technologies. These user journeys are developed and published by the Connected Places Catapult, in association with Royal HaskoningDHV and Mersey Maritime.

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MERSEY MARITIME

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THE USER JOURNEYS ARE BASED AROUND THREE DISTINCT POTENTIAL USER GROUPS:

Passengers

Tourists

Freight

The user journeys are informed by real-life challenges for current or future user groups and were selected together with a cross section of regional stakeholders consulted via a series of surveys, workshops and meetings to gather feedback on the developments planned within the region, links to ongoing technology developments and their views on the opportunities for solving locally relevant transport challenges.

While the user journey for each user group has been drafted as a separate case study, a key element is the interconnected and synergistic nature of journeys and how the deployment of new practices, infrastructure or technology on each area could help to unlock opportunities across the region.

The aim of these studies is to kick start further discussion and inspire collaboration, with local authorities, transport operators, investors, regulators and technology providers all working together to solve shared challenges with joined-up solutions, capturing opportunities to regenerate our transport ecosystem in the Liverpool City Region and beyond.

We would like to thank the stakeholders within the region for their contributions and discussions and hope you find the series both enjoyable and informative. We would also welcome you to reach out directly to us with your own ideas that link into the user journeys and the supportive ecosystem of technologies that will be needed.

User Group	Journey	Key Policy Links
Passenger	A connected river-based journey between Wirral Waters and working in Liverpool.	Build Back Better Net Zero Strategy Levelling Up
Tourist	Using the enclosed northern docks waterway as an attraction and sustainable transport asset for Liverpool, with a zero-emission passenger and cycle waterbus service.	Build Back Better Maritime 2050 Tourism Recovery Plan
Freight	Linking the North West to the rest of the world with the Liverpool City Region Freeport and the renaissance of its historic inland waterway assets in an age of energy transition and digitalisation.	Net Zero Strategy UK Freeports Maritime 2050

INTRODUCTION

The UK Freeport Model is an opportunity for the Liverpool City Region to showcase itself on the global stage. The region has a host of untapped marine assets that with the support of digital tools and clean transport could be reinvigorated, making the river and canals the artery of the region once again.

THE FREIGHT JOURNEY

Liverpool is a city built on its maritime heritage with the Port of Liverpool's infrastructure straddling the estuary providing deep water access to some of the world's largest container vessels on the northern banks, to the energy infrastructure of Tranmere and Stanlow and the historic 36-mile-long inland waterway connection to the heart of Manchester on the southern banks. The estuary and its inland connections are a gateway to the hinterland in both the Midlands and the North.

The Port of Liverpool handles a diverse array of cargo from containers transporting products ranging from tea to pharmaceuticals, agri-bulks through to steel. The port acts as a conduit for multiple supply chains such as manufacturing in the Midlands to aggregates enabling construction in the Northwest. Each year the port supports the trade of some ~32 million tonnes of cargo. One of the port city's unique maritime features is the historic feat of engineering, the Manchester Ship Canal. Which at its peak (1955) handled ~ 18.6m tonnes of cargo annually, exporting products produced in the industrial heartlands of Salford in Manchester. With the onset of containerisation and the growth in vessel sizes, the use of the canal as a conduit for exports fell into decline. Nowadays, the canal is used to support the transport of containers, dry bulks such as fertilisers and cement, forest products, scrap metal and occasionally large pieces of project cargo. Cargo volumes handled on the canal have fallen to a more modest level of ~8m tonnes annually, with estimates that this unique asset is currently only around 5% utilised.

In 2021, the Liverpool City Region was awarded freeport status along with eight other locations around England. The Freeport encompasses key industrial sites and transport hubs from the Port of Liverpool and the Port of Garston to Port Salford located on the Ship Canal.

The UK Freeport model enables goods to be moved within the freeport zone and added value services to be undertaken with a range of special tax benefits in place to support businesses that import, process, manufacture, and re-export goods. Being a freeport also presents opportunities to innovate and trial new technologies by providing a range of regulatory benefits aimed at reducing barriers to research and development and innovation, making the Mersey region an ideal testbed location for nascent technologies. Clean growth is also at the heart of the UK Freeport model.

With this future context, the region is reaching a tipping point whereby long-standing plans such as Mersey Waters Enterprise Zone, Atlantic Gateway (Ocean Gateway) could be reinvigorated.

The freight user journey aims to fulfil the needs of the global exporters, enabling them to rapidly understand the transport options available to them and sustainably transport their goods to and around the freeport for added value services to be performed and ultimately to transport the finished products on to their end consumers.

To ensure that the future freight transport network fulfils these needs and local aspirations for decarbonisation and sustainable growth, the following concepts have been developed and pitched to local stakeholders:

1) Semi-autonomous Manchester Ship Canal freight barges (existing supply chains like grain, containers, wine) – powered by alternative fuels, using automation technology.
2) Freeport transport mode marketplace (aimed at deep-sea freight transiting within the freeport) – a communication platform enabling rapid cost and supply chain CO_2 comparison for multiple transport modes supported by secure bonded tracking for audit trail.

> There is a wealth of expertise within the Mersey region related to the design, build and operation of vessels. The technology to develop a green freight corridor between Liverpool and Manchester exists and there is appetite from local stakeholders to develop it. For the recent Clean Maritime Demonstration Competition ran by the Department for Transport, we have developed a novel methanol solution for decarbonising vessels, that is scalable to other vessel types and operational power profiles such as the proposed concept for the Manchester Ship Canal.

expleo

THE USER

The concept captured by the user journey offers a way of communicating the opportunities of the Freeport to a global market, providing a transparent and joined up view of the transport options available to get their product to market in a cost effective and low carbon manner.

This could be replicated across a host of other commodities to unlock the untapped capacity available to the region within its unique maritime assets.

THE USER CASE STUDY

To explore the potential offered by the freight user journey concept, a user profile has been generated. The user (commodity) we have selected to illustrate the potential for the freight journey is coffee. However, the same theory will apply to many other products that are shipped in containers or bulk and undergo additional processing steps in the in the UK (now or in the future).

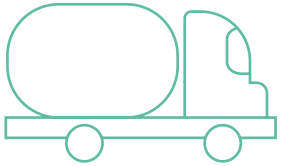
Almost 150,000 tonnes of coffee beans are imported annually through the Port of Liverpool. With roughly 27 tonnes of product per truck, which equates to around 5,500 truck movements from the Port of Liverpool each year.

Commodities like coffee are products that require special transport conditions due to their sensitivity to moisture and temperature. Typically, the green beans (beans that have been hulled in the country of export) are transported to the UK in sacks made of natural fabrics such as jute or sisal. The sacks, normally up to 60kg in weight, are then loaded into containers, which are usually ventilated and transported below deck in the large container vessels used to transport them from key export locations in South America, Africa and Asia.

There are many players or intermediaries involved in the supply chain of a product like coffee, from the growers who produce the coffee to the processors who remove the hulls, to the exporters who purchase different beans to sell on to international suppliers. The international suppliers (brokers) then sell on the product to roasters in the UK who typically process and package the beans and dispatch the product to shops, cafes or directly their end customers. Each of these parties has different needs and interests and therefore different requirements on the supply chain. For the purposes of the user journey, a user profile has been generated, to illustrate some of these key needs.

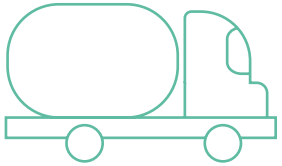
150,000

tonnes of coffee beans are imported annually through the Port of Liverpool



Equivalent to

~5,500



truck loads of coffee from the port each year

COFFEE JOURNEY

A large coffee roaster is seeking to reduce the transport carbon emissions for their supply chain by replacing road haulage and moving to rail or barge. They have a new factory adjacent to Port Salford to process coffee from Africa and South America, arriving bagged in containers from deep sea vessels. Most of the coffee is for domestic use, but some is processed into other products for re-export.

> **Our customers and investors demand transparency on supply chain emissions and our focus is to reduce these where possible, regardless of lowest cost transport options. Liverpool and the wider region can offer both deep sea shipping access and inland low-carbon transport options to support our coffee processing business.**

Above all, the coffee roaster is seeking a transport solution that will:

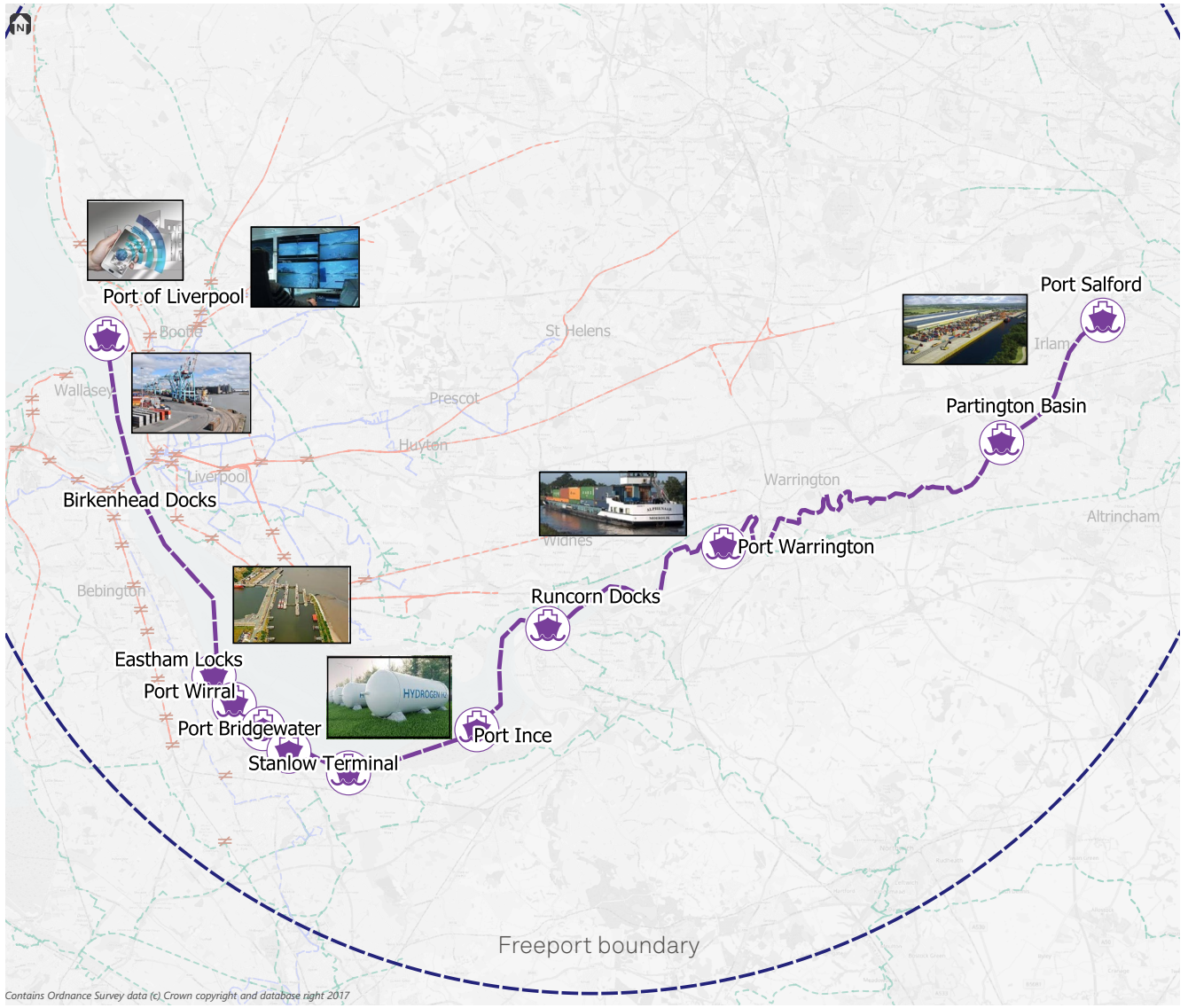
- Provide a reliable and predictable feed for their production lines.
- Offer a transparent and low carbon transport mode.
- Benefit from the tax savings through use of the Freeport for product processing.

The coffee roaster's key motivations for modal shift are:

- Fast, reliable transport.
- Cost effective transport to their processing location.
- Transparent and accessible information about multi-operator/multi-modal fare products.
- The sustainability benefits and reduced carbon footprint associated with its end-to-end supply chain.

USER JOURNEY REIMAGINED

To give the coffee roaster access to the full benefits of the Freeport, a new and innovative transport service is outlined in the 'freight user journey concept'. There are elements of the journey that could be developed in isolation as a pilot project or as first step in a roadmap towards the longer-term solution.



WHAT DOES THE REIMAGINED USER JOURNEY LOOK LIKE?

STEP 1 – The importer uses the Freeport Transport Mode Marketplace to compare deep sea freight and UK discharge port options to the factory within the Freeport. The platform enables the coffee roaster to rapidly compare the cost and CO_2 emissions associated with multiple transport modes, demonstrating the joined-up canal service from the Port of Liverpool to Port Salford, with fewer interchanges and reduced carbon footprint.

STEP 2 – The containers of coffee are loaded onto a semi-autonomous self-powered barge at Royal Seaforth Container Terminal (Terminal 1) within the Port of Liverpool. The containers are supported by secure bonded tracking for the purposes of HMRC audit trail within the Freeport.

STEP 3 – The barge's movement is monitored from the remote pilotage centre supported by 5G for communication. Anti-collision sensors and internet of things devices monitor the state of river conditions, weather and other vessel proximity conditions within the river. Mersey VTS maintain a navigational safety monitoring role to guide the barge control centre team on any issues.

STEP 4 – The barge's movement is timed to meet the tidal window (5 hours, twice daily) for access to the Manchester Ship Canal at Eastham where the lock gate is operated remotely from the control centre using the SCADA (supervisory control and data acquisition) system. The barge continues to transit along the canal and as a semi-autonomous vessel, the barge has a reduced bridge height which helps to minimise the impacts at some bridge locations.

STEP 5 – The containers of coffee are offloaded at the quayside facility in Port Salford for processing and packaging.

STEP 6 – On the return journey, the barge refuels taking advantage of the bunkering infrastructure available locally (near to Stanlow) that has been developed a result of the region's HyNet development using a swappable containerised battery or alternatively a solid oxide fuel cell system that could be bunkered using an e-fuel such as hydrogen, methanol or ammonia.

In this reimagined journey, the container of coffee destined for processing within the Freeport illustrates how historic assets like the Manchester Ship Canal coupled with the deep-sea access offered by the Port of Liverpool could be unlocked to offer a unique proposition to encourage global trade and growth by embracing the core pillars of the UK Freeport model (utilising digital tooling, automation and clean vessel propulsion options). The journey responds to the needs of the user by:

- Providing clear and comparable carbon impact for trade routing, to enable decision making on commodity routing to Liverpool Freeport, making use of the joined-up interchange for bonded transit of cargo.
- Offering a low carbon transport mode, which has the potential to remove thousands of truck movements per year, improving local air quality and impact on residents near to the Liverpool container terminals.
- Demonstrating the feasibility of alternative marine fuels, combined with automation, to create new opportunities for the Mersey region in skills, technology and innovative vessel design.

SEAFAR – INDUSTRY EXAMPLE

SEAFAR NV is a company in Belgium which offers a technology-based ship management solution that supports the automation of barges used for freight. Their package makes use of a remote shore control centre providing a monitoring service for unmanned craft. They have made use of Septentrio's AsteRx-U dual antenna, multi-frequency, multi-constellation receiver to provide sub-meter positioning for vessel monitoring and control. Other sensor data including LiDAR, radar and cameras is used for obstacle identification and classification, which is coupled with artificial intelligence to enable machine learning. The company now has ten vessels using the remote ship management in Belgium, including a containership, water trucks (used for aggregates) and a patrol boat.

NEXT STEPS

Making the freight journey a reality requires a global mindset, collaboration and tangible demonstrator projects to provide customers with confidence to encourage a critical mass of cargo.

CHALLENGES, OPPORTUNITIES AND NEXT STEPS

The user journey for coffee is just one example of a commodity that is currently handled by the Port of Liverpool; the new Freeport will open opportunities for new products, processing and trading relationships, particularly from locations outside of countries where the UK has established free trade deals. The Freeport will also open opportunities for developing industry around new growth sectors, for example those linked to the energy transition like offshore renewables, carbon capture and storage and vessel manufacturing, linking to the work of local ship operators and ship design and building skills at the likes of Bibby Marine, Expleo and Cammell Laird as well at the ongoing offshore renewables developments like Burbo Bank and the Mona and Morgan development, in addition to the HyNet Plans.

The Freeport Transport Mode Marketplace is an estimation and tracking tool that joins up the global transport threads coming into Liverpool to tap into those opportunities, presenting a cohesive and integrated picture of local inland transport to the rest of the world. Thinking beyond the Liverpool City Region and extent of the Freeport, at COP 26, 22 countries signed the Clydebank Declaration which pledged to establish at least six green maritime corridors between two or more ports, decarbonised from end to end for landside infrastructure and vessels by mid-2025. This marketplace initiative could link into one of those corridors for the Port of Liverpool, perhaps with our neighbours across the Atlantic.

From a technical standpoint this component of the user journey is relatively straightforward with a cloud-hosted platform to gather transport pricing (and carbon costs) and present a Liverpool-centric inland transport estimation model for international shippers. The more complex technical aspect of this solution is to track shipments being handled, with a secure bonded audit trail within the system; this can be achieved using similar methods to existing Port Community Systems linked to HMRC's CHIEF, then supported by Radio Frequency Identification (RFID) container seals and Global Positioning System (GPS) /geo-fence tracking of transport modes (barges in this case). The UK already has a bonded warehouse system, with a natural extension along a Freeport transport corridor. The greater challenge with this component of the user journey is related to the complexity of the stakeholder community involved in order to realise the solution. This creates a number of potential challenges, linked to market failures such as incomplete property rights (where the benefits of the solution are public goods or no market exists for natural resources like air quality or reduced congestion on the road) these types of market failures typically require government action to resolve either through subsidies (funding), taxation or regulation. This initiative could potentially be linked to upcoming funding packages such as The Clean Maritime Demonstration Round 2, recently launched by the UK Shipping Office for Reducing Emissions (UK SHORE). Collaboration, transparency and data sharing are also critical to this solution. The region already has promising foundations in place with the stakeholder relationships established through initiatives like the Maritime Knowledge Hub, but to drive these types of solutions forward, requires commitment from all parties to work towards a shared vision, openness to sharing data based upon common standards, and strong leadership. For this journey, this leadership role would logically sit with the Combined Authority as part of the Liverpool City Region Freeport working closely with Peel Ports, HMRC and major shipping lines.

Coffee was used as an example of a product that requires additional processing here in the UK as this creates opportunities for local jobs. However, to realise the full benefits of the Freeport there are likely to be other products with higher potential for re-export, which could link to other local developments such as the Marine, Energy and Automotive Park. Critical mass is an important part of creating a viable inland waterway solution and further work is needed to identify potential first movers to develop the business case. During COP 26, a number of organisations including Amazon and IKEA showed a clear appetite for increasing the level of ambition of the IMO's international shipping targets from a 50% reduction in carbon emissions by 2050, to achieving zero-emission by 2050, with aiming to have zero by 2040. These types of organisations could be the sorts of first movers to kick-start a green inland shipping corridor in the region.

The autonomous freight barge aspect of the user journey has the potential to act as a demonstrator project for both low-carbon and autonomous technology aspects and could help to progress decarbonisation within some of the 'hard to abate' sectors (maritime transport is currently omitted from the city's Net Zero pledge). In its initial phase a pilot project could be limited to the more controlled space of the Manchester Ship Canal, where there are relatively low levels of traffic. In order to demonstrate the potential for the technology it could be used to support one of the existing commodities already being transported on the canal such as grain or other bulk cargoes, acting as a showcase for other commodities and minimising other high capital expenditure on high-cost container handling equipment like cranes and the civil infrastructure needed to support it. Connectivity is an important aspect to manage semi-autonomous vessels, both in terms of reliability and bandwidth capacity to ensure control is timely and robust. In the pre-digital built environment of the Manchester Ship Canal, this is likely to require a 5G radio network, to minimise capital costs. 5G is an enabling technology which could support a host of other uses cases along the corridor of the Manchester Ship Canal, enabling autonomous vessels for survey and asset inspection purposes like the FITZROY, linking into the autonomous infrastructure such as the lock gates, bridges and sluices, as well as enabling a host of Internet of Things (IoT) devices for monitoring environmental conditions with video cameras, or sensors to check water quality.

Connectivity is an important aspect to manage semi-autonomous vessels, both in reliability and bandwidth capacity to ensure control is timely and robust.

There are technical challenges associated with the navigational aspects along the Manchester Ship Canal linked to existing water depths, air draft restrictions (bridges), beam restrictions (locks) and the amount of wash created from passing vessels that cannot be neglected.

With road transportation becoming electrified and one of the major benefits of using waterborne transportation being its environmental benefits relative to road transportation, clean power is an essential component to futureproof this inland waterway transportation system. There are a number of power and propulsion technologies in development that are suited to small inland container vessels, using swappable containerised battery or modular hydrogen fuel cell solutions similar to the concepts being used in Europe such as ZES and MAAS. Again, regulation is a key uncertainty for vessel operators particularly given the safety considerations associated with alternative fuels such as hydrogen and this would also need to be explored in further detail as part of a feasibility study for the pilot project.

In summary, a revived river and canal-centric freight transport system that is able to effectively communicate the benefits of the Freeport to global partners enables further benefits and tangential growth opportunities for the Mersey region by:

- Demonstrating innovative use of vessel technology and alternative fuels for export of skills and knowledge.
- Reducing air quality and congestion impacts in Liverpool by encouraging modal shift and reducing truck movements from the Port of Liverpool to zero-emission waterborne transport modes.
- Opening up underused areas of industrial sites along the Manchester Ship Canal, helping to accelerate plans such as Atlantic Gateway.
- Contributing to the Liverpool City Region's targets for net-zero and action to address the climate emergency.

NEXT STEPS

1) Market study to assess identify potential first movers and build business case to present a focus on particular cargo types or inland processing facilities.

2) Feasibility study for the autonomous container vessel design, infrastructure access and alternative power solution, with cost estimations. Building on the local expertise offered by the likes of Bibby Marine, Expleo and Cammell Laird.

3) Design for the Freeport transport marketplace app and digital toolkit, to promote and attract trade to the Port of Liverpool and the inland transport options, linking into existing big data freight initiatives being progressed by the University of Liverpool.

4) Regulatory consideration and navigational risk assessment for approval of low-crew semi-autonomous vessel operations in UK, including safety considerations for alternative fuel options.

STAKEHOLDERS ENGAGED DURING THIS PROJECT

CRUISE LIVERPOOL

DENHOLM GLOBAL LOGISTICS

Everton 1878 NIL SATIS NISI OPTIMUM

(expleo)

ISLE OF MAN STEAM PACKET COMPANY

Hilton LIVERPOOL CITY CENTRE

Lancaster University

LIVERPOOL CITY REGION COMBINED AUTHORITY

METRO MAYOR LIVERPOOL CITY REGION

LIVERPOOL JOHN MOORES UNIVERSITY

LiverpoolJohn LennonAirport Faster. Easier. Friendlier.

Merseyrail

Peel L&P REALISING POSSIBILITY

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