Smart Ports Use Case

Virtual Pre-Gate for Dynamic Management of Ferry Freight Export Traffic

Insight into future UK ro-ro port management

Smarter UK Ports - Project Introduction

Smarter UK Ports is a series of five use case for the use of technology in Smarter and Greener ports in the UK, developed and published by the Connected Places Catapult, in association with Royal HaskoningDHV UK.

The use cases are based on real-life challenges within many ports across the UK, co-created with five port authorities to give local context and relevance on how innovative technologies can be implemented to improve their business function, resilience, environmental impact and operational performance.

The five topics were selected together with the partner ports to give context and achievable, nearer-term initiatives that support the delivery of key Maritime 2050 themes. As challenges that exist at ports throughout the UK, these use cases present opportunities for collaboration and knowledge exchange to deploy and scale these potential solutions to realise wider sector impacts.

Meant as a snapshot of relevant challenges to port operators, these studies aim to inspire further discussion and collaboration, with clear next steps to make use of technology that delivers Smarter and Greener Ports

All of the Smart Port Use Cases in this series engage a range of existing or evolving technologies to bring improved digitalisation and business change into the multi-stakeholder environment that UK ports operate within.

We would like to thank our partner port authorities 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 challenges and initiatives on our journey to Smarter and Greener UK Ports.

Henry Tse, Director of New Mobility Technologies, Connected Places Catapult

Topic	Supporting Port	Maritime 2050 Links
Connected Supply Chain – Virtual Pre-Gate for Ferry Operations	Portsmouth International Port	Trade Technology Environment
Automated Asset Inspection & Shared Port Insight	Shoreham Port	Infrastructure People
Green Energy – Shore Power for Wind-Farm Service Operation Vessels	Port of Tyne Authority	Environment Trade Infrastructure
Climate Resilient River Operations in London by Predictive Level Digital Twin	Port of London Authority	Environment Trade Security & Resilience
Operational Resilience – Monitoring of Marine Assets in Remote Locations	Milford Haven Port Authority	Infrastructure Security & Resilience

1

The Challenge

The port is challenged by limited foresight or control of export freight arrivals and acts as a scheduling buffer and a hub for manual administrative processes; this will become more difficult in 2021.

In Portsmouth, ferry freight of accompanied trucks and unaccompanied trailers arrives at the port in a short and sometimes unpredictable time window, causing peak-time yard and gate access challenges, with limited ability to actively manage the arriving traffic. Lack of data sharing between the port, ferry operator and regulatory authorities will cause additional challenges for the port after Brexit, particularly with EU bound export traffic, where Goods Vehicle Movement Service (GVMS) and destination border control approvals will need to be checked before loading to vessel.

Portsmouth International Port, like many UK ports, has a footprint that is constrained by the city but is also neighbour to Royal Navy facilities. The port is linked closely to the M275 motorway, with only 13 truck lengths to the junction from the gate, creating rapid wider city logistical impacts from any delays at the port entrance.

In 2021, the city council is implementing a Clean Air Zone to reduce air pollution in the area and also manage the M275 access, however port-bound traffic is not included in the Zone and thus will not be actively managed.

Within the port, operational efficiency can be impacted by random truck arrivals. At present, there is a need for a large marshalling and parking area to accommodate trucks that may arrive onsite anywhere between the statutory minimum of 2 hours (for HMRC processing) currently up-to 12 hours prior to loading. Vessel assignment and load sequencing are not known at gate-in, requiring truckers to register and verify with ferry operators in-person after arrival. Whilst at the port, obligations for current Border Force and HMRC regulatory checks and inspections require manual support by staff. After Brexit, along with GVMS, imports from the EU will be subject to new & additional checks under the Common Transit Convention (CTC) and for phytosanitary (SPS) inspections. This administrative burden will impact vehicle processing at the port, placing the yard areas under further pressure. To manage these short-term pressures whilst processes bed-in, the port already has a triage area planned for J1 of the M275 to check and export freight traffic for the EU.

Traffic destined for the Channel Islands and Isle of Wight can bypass EU-related procedures and move straight to shipment, but traffic congestion may also impact this specific traffic.

Looking to the future, the port aspires to more actively manage their estate to improve efficiency of operations, improve safety, reduce costs and vehicle emissions. The port aims to do this through the use of technology, to bring more intelligence into the complex management of freight traffic. As a publicly-owned facility, the needs of the city and its residents are vital; maximising throughput and profitability for Portsmouth remains a core objective.

Innovation by Numbers

Portsmouth International Port handles over 220,000 trucks and 610,000 cars annually (2019)
In early 2020, over 400 export trucks arrived early each week at the port for their vessel, with an average waiting time for loading of over 9.5 hours; an inefficient use of port yard storage

"Timely and predictable ferry discharge and loading operations in Portsmouth are critical for the national supply chain; the use of technology to support intelligent management of this interchange is a key part of our strategy and is expected to boost efficiency and customer service for our freight clients"

Mike Sellers, Port Director

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The Solution

Resolve congestion risks with export traffic upstream from the port using on-the-move technology to reduce on-port administration and freight delays.

Freight bookings are taken in advance by ferry operators. Administrative processing for export clearances is undertaken in parallel using Government platforms (such as the new GVMS), preparing freight for shipment in advance of arrival in the vicinity of the port. Further systems manage on-port inspections and pre-shipment checks. The port operates with systems to manage gate access, terminal yard management and stevedoring operations; however, there is no integrated view of all this data together. An integrated platform would provide transparency (with intentional exception of anti-terrorism or police demands) on freight status and readiness for shipment. Such Port Community Systems (PCS) are in operation across the UK to provide consignment (usually container-related) control and data-sharing across multiple actors.

Once a shared view of freight bookings, approval status and port readiness is established, then real-time decisions can be built upon this platform to dynamically manage arriving vehicle traffic.

ANPR/Data Sharing

Live data capture from the motorway network, about 20-30 miles from Portsmouth, to the west (M27) and east (A27) will use ANPR cameras to create a virtual pre-gate for trucks passing through. Edge-computing cameras will be expecting specific vehicle registrations and report back when passing inbound to the port gate-zone.

3 How it Could Work

A multi-layered technology solution, for diverse stakeholders, to create a quick response to guide hauliers on their route to Portsmouth. Robust interfacing and safety-compliant tools for drivers will be vital.

To avoid data protection concerns, only tractor unit registrations will be identified, no persons or other road users; the on-device data processing capability ensures that no video streaming will be required, reducing networking demands to suit 3G/4G capacity. It is important to note that such technology can be extended for dangerous goods placards, trailer numbers, vehicle length or size, to further improve data integration.

Once a pre-booked vehicle enters the zone, checks on its regulatory status, vessel schedule and the port's current yard planning conditions will be made in a few seconds. These checks will decide if the truck can proceed to the port directly or shall be diverted to a holding location. This will specifically address freight that does not have clearance in GVMS or is arriving too early for the vessel (depending on the current yard utilisation at the port). Additionally, this process will filter out all freight for Channel Islands or Isle of Wight services and fast-track these vehicles onward to their destinations in the city.

Drivers that are not clear to proceed to the port at that time will receive communications within a few seconds by a mobile application message (ideally integrated to the fleet management system of the haulage company) and by use of dedicated matrix signs above lane 1 of the M275 to communicate vehicle registration and diversion instruction.

This virtual pre-gate will enable those vehicles proceeding to the port to be fast-tracked upon arrival at the port, with the use of further ANPR and automated gate processing.
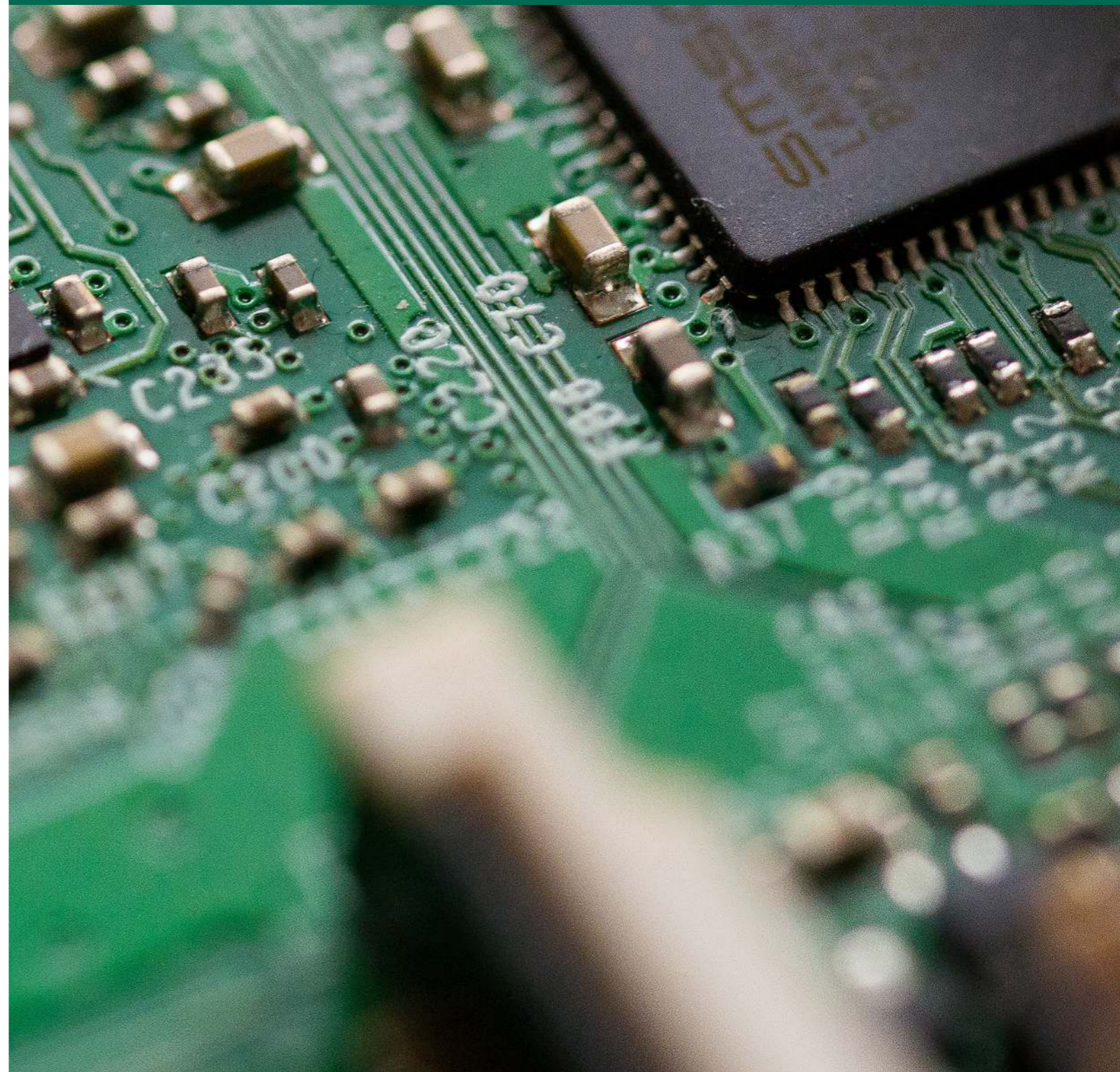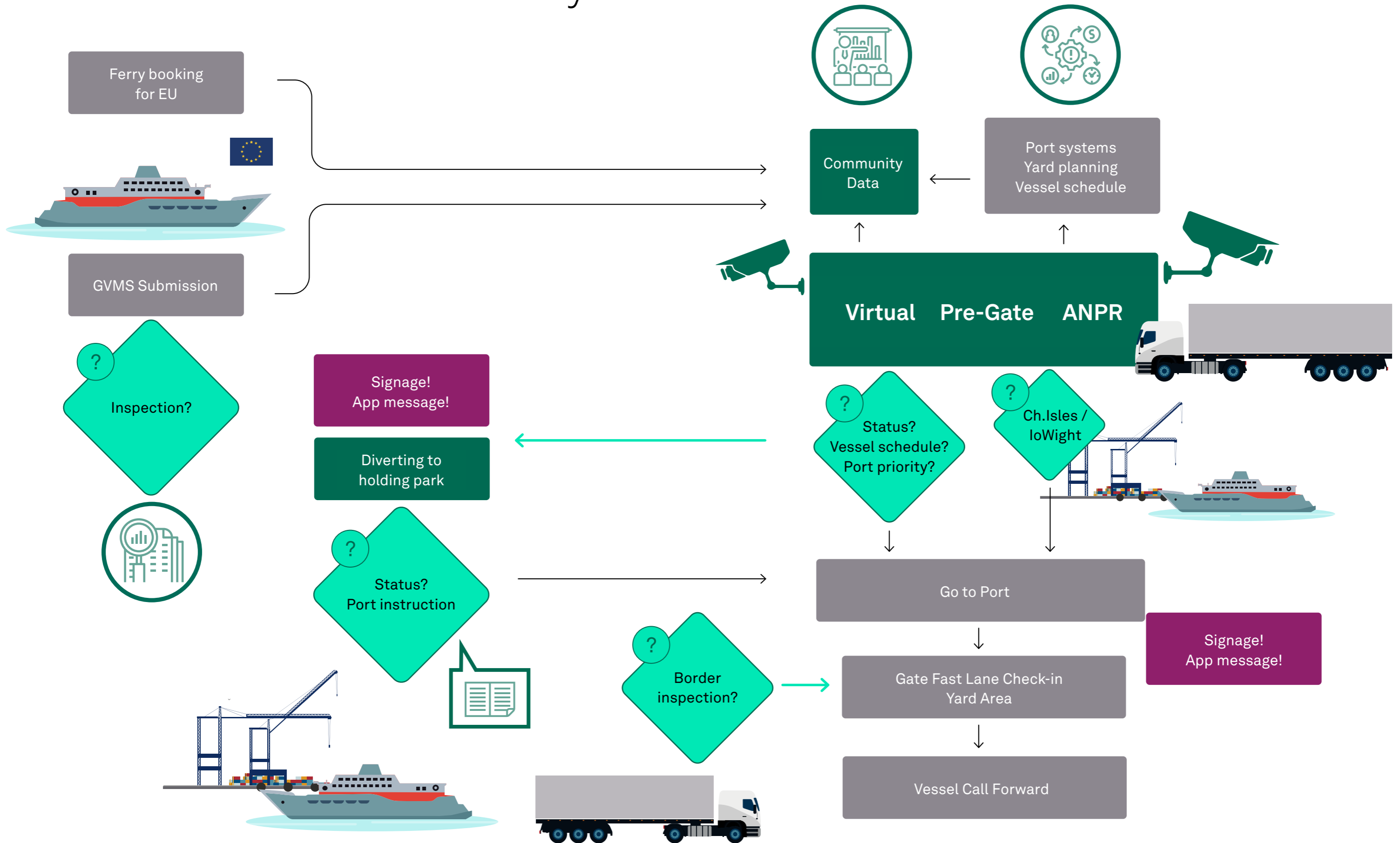
The mobile application will be used to release trucks from the future holding area. When the trucks are cleared and the vessel is open to receive trucks, the trucks will receive a message to proceed down to the port. This toolkit shall also be used for on-port communications to hauliers, with lane locations, safety messages and call-forward to the vessel for loading.

How it Works – Driver Journey

Ferry booking for EU

GVMS Submission

Inspection?

Signage!
App message!

Diverting to holding park

Status?
Port instruction

Community Data

Port systems
Yard planning
Vessel schedule

Virtual Pre-Gate ANPR

Status?
Vessel schedule?
Port priority?

Ch.Isles /
IoWight

Border inspection?

Go to Port

Gate Fast Lane Check-in
Yard Area

Signage!
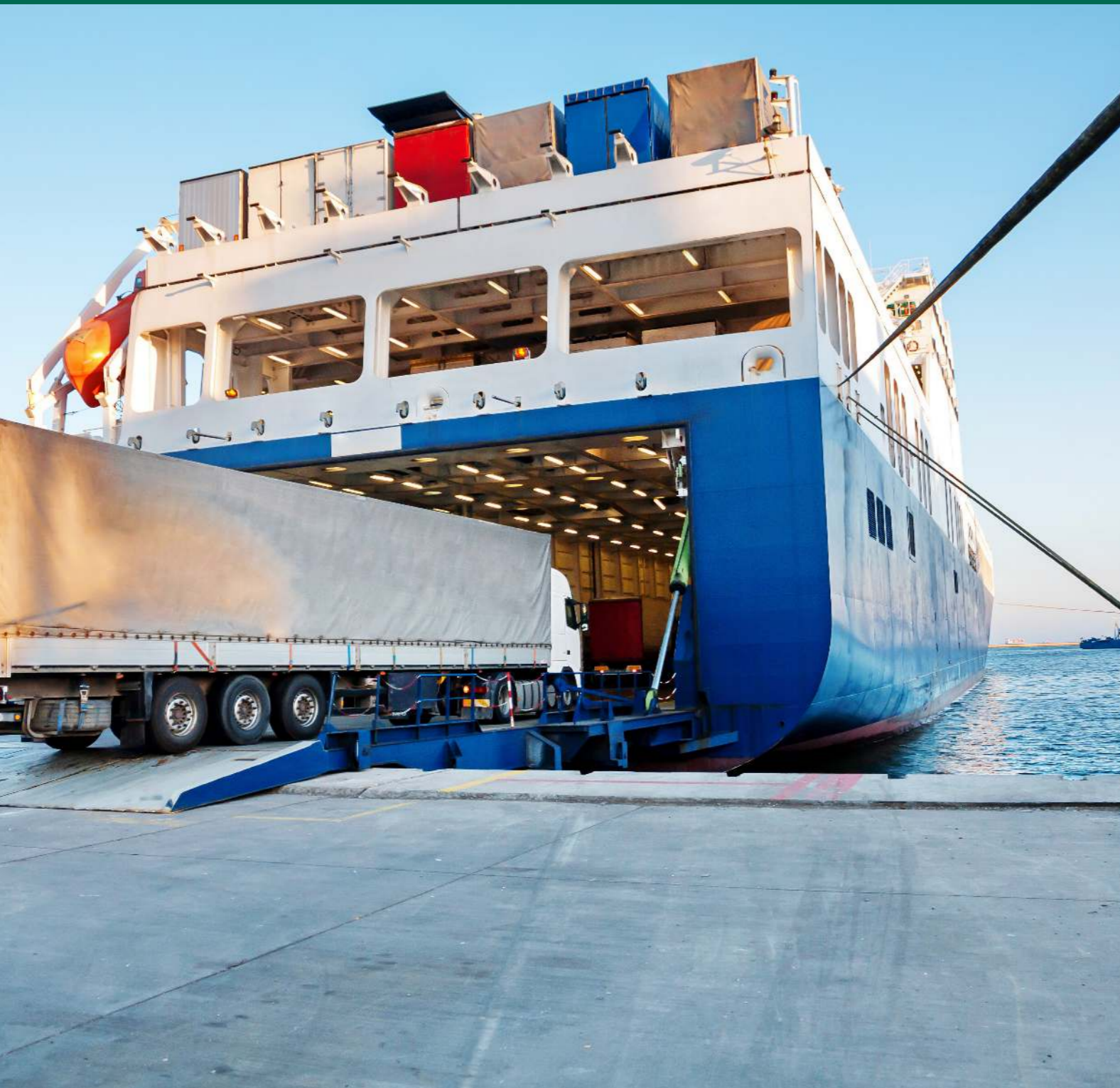App message!

Vessel Call Forward

4 Wider Impacts

The efficiency of ro-ro freight transit is of national significance to the UK plc and locally vital to many port cities like Portsmouth.

Trailer freight via the Channel, North or Irish Seas is a vital part of the national supply chain. Departure from the European Union will not change the need for the fast transit of cargo. The sector is investing in technology to support the demands of new regulatory controls coming into force in 2021, which will enable greater data-sharing opportunities, leading to wider operational efficiency benefits for ferry operators, ports and transport companies alike.

The use of on-the-move technology to check, filter, divert or fast-track vehicles en-route to the ferry port is a combination of trusted technologies to create a valuable new toolkit for managing short-term challenges post Brexit, but is intended to morph into a permanent process for improving service and productivity of terminals.

For the wider freight community, more predictable port waiting and processing times (by use of automated check-in processes and reducedon-port marshalling) will lead to improved vehicle and driver productivity and scheduling.

Active management of freight vehicles coming into the city could also be used to reduce peak-time congestion on the M275, improving resident transit and reducing the air pollution created by idling trucks queuing outside the port. This supports the objectives of the Portsmouth Clean Air Zone, which is a challenge shared by many other port cities.

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The diversion of consignments that are not fully cleared will also reward and improve adoption of GVMS and automated systems across the industry by prepared freight operators.

Within the port, improved planning and electronic communications to customers will improve operational safety by reducing the number of marshals required on-site.

The principles of a virtual pre-gate, refined check-in and automated gate processing can also be extended to cars and leisure traffic, further improving peak-month congestion and the experience for those using the port.

Technology for autonomous trucking and platooning of road trucks is progressing quickly; integrated systems for controlling the hub interchanges at ports and on the motorway network will be vital to the safe operation and commercial success of such innovations. The use of virtual pre-gate concepts for ports will be important in the adoption of such road transport automation.

In Portsmouth, as a leading example of a port city, provision of such a system would reduce on-terminal congestion, supporting up-to a 10% increase in yard capacity by managing early arrivals and on-site marshalling, which will enable future growth.

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5 Implementation Route

This solution is a fresh combination of existing technologies to solve a Europe-wide challenge. Rule refinement, commercial team-work and trials are vital to its success.

All the technology needed for this solution is active within the UK, within the ports and transport sectors, so is tried and trusted, with a readily available network of providers and integration specialists. Leadership and a detailed programme will be required to transform the currently fragmented process environment.

Highways England already operate over 1500 ANPR cameras across the motorway network; matrix signage now plays a critical role in the Smart Motorways initiative across the UK. Several Port Community System software providers have been active in the UK for over 30 years and continue to innovate in the maritime sector.

Within the Scandinavian and Mediterranean ro-ro freight markets, advances for virtual check-in, integrated data and upstream transport management are well underway, with EU-funded projects facilitated through the Motorways of the Sea (TEN-T) fund.

Once a clear business case has been established, then the path to implementation has three key stages;

1. **Regulatory & Commercial Alignment**

    Transparent and integrated sharing of data between many actors will require refinement of commercial, administrative and regulatory controls and practices, to allow the benefits to be realised from a virtual, automated and open system.   This may include Department for Transport and ISPS regulatory rules on port 'boundaries', ferry operator processes for in-person identity checks, and various elements within HMRC and DEFRA related to post-Brexit freight processing that will change in 2021.

2. **Technical Design & Trials**

    With a selection of qualified vendors, develop a technical design for the platform and an integration strategy with the various actors. The real-time data capture and processing can be built out and tested in physical trials to determine the ideal road network locations for the virtual pre-gate, signage and holding areas. Practical trials will be vital to establish the correct algorithmic configuration and to create effective communication with drivers.

3. **Implementation**

    With such a diversity of port clients, the fast-pace of ferry port activity and the sensitive competitive position amongst Channel ports, a robust and cautious implementation strategy will be required, to gradually roll-out the programme. This will need to be actively managed to minimise any bedding-in challenges and be sufficiently agile to ensure port users share in the benefits from the new tools.

Implementation process

1
Regulatory &
Commercial Alignment

2
Technical Design & Trials

3
Implementation
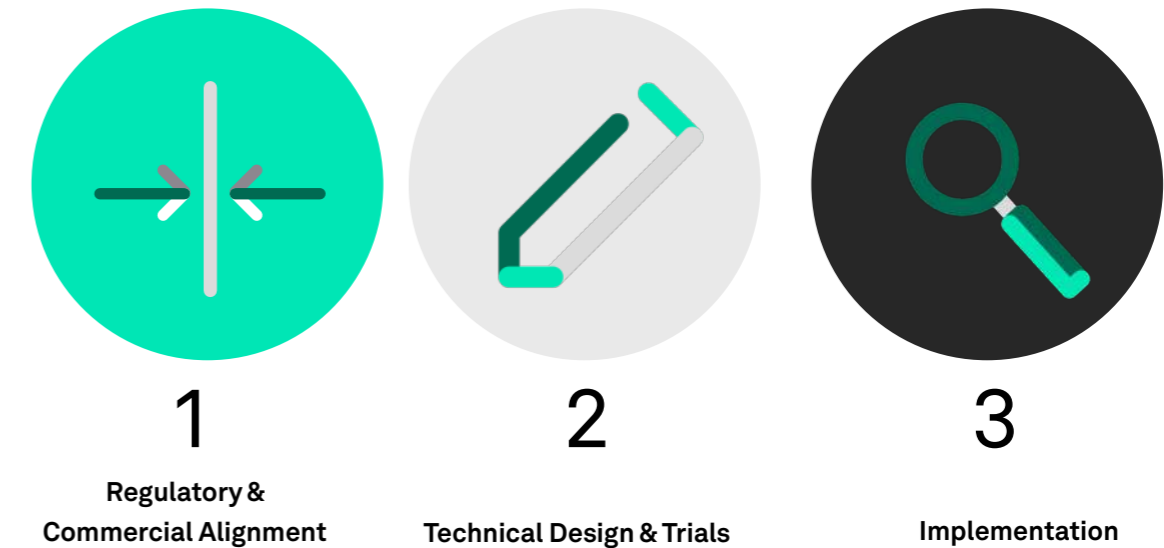
Ferry operators are fiercely competitive, for the good of the industry, and any data 'sharing' concept will require a series of protective data layers to ensure the new solution is entirely objective and does not provide any particular advantage to port, transport company or ferry operator. This is technologically straightforward and managed within existing community data systems, being more of a commercial mindset challenge.

Next steps

- Establish an industry working group to develop and validate the regulatory and operational processes, identifying any changes to law or process to maximise the benefits
- Build a pilot project in Portsmouth to validate the solution and business case
- Consider the investment value of a UK-wide ro/ro freight monitoring solution for short-sea ferry crossings

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