



The
Scotland
5G Centre

Advanced Connectivity for Scottish Green Freeport

Realising Possibilities,
Transforming Futures

The Scotland 5G Centre - Advanced Connectivity for Scottish Green Freeports

At the Scotland 5G Centre, we're reaching out to industry across all sectors as well as to Scotland's 32 local authorities, aiming to build awareness of the potential of advanced connectivity to bring economic benefit to Scotland and improve our way of life.

As we move into the post-COVID era and companies' re-boot their growth strategies, we want to support your development by helping you to understand and overcome your connectivity challenges by partnering with you to develop solutions that will support your growth. The competition to become a Scottish Green Freeport presents an ideal opportunity for us to support those who choose to bid. The prospectus specifically calls for **"Innovation in Greenport's"** (para 2.4.3) and outlines some of the technologies that might be considered. Each one of these can best be supported by high-capacity, advanced connectivity.

As the centre for advanced connectivity, The Scotland 5G Centre are keen to help you understand the merits of the various types of advanced connectivity and find the solution that will best support the adoption of the connected port technologies outlined in the prospectus. Even if you are not bidding, we'd be glad to discuss your connectivity challenges.

As a publicly-funded body we are charged with providing a range of support services to industry, including technical consultancy, innovation challenges, advice & signposting and the opportunity to see exactly how a private, stand-alone 5G network can support port automation

at one of our regional '5G Connect Hubs' and better understand how these solutions can both accelerate your journey towards net zero whilst also reducing your costs. Below, is an outline of how advanced connectivity can achieve these outcomes with some illustrative 'real-world' examples.



I hope that you will feel compelled to reach- out to us. We are keen to see the very latest port technologies deployed at Scotland's ports and helping to drive growth, investment and employment across the nation.

Ian Sharp, Business Development Manager, The Scotland 5G Centre, Glasgow



Green Freeports and 5G - Facts, Futures and the way Forward

Introduction

The Scottish Green Freeports project will use invention to drive the country's 21st century economy as trade, engineering and communication innovation drove that of the 19th, while prioritising the environment. All of its aims, such as creating high quality jobs, high technology R&D and manufacturing clusters, and innovative port processes, require a state-of-the-art digital infrastructure - something explicitly required in section 2.4.3 of the prospectus.

An industrial digital infrastructure capable of supporting the many necessary aspects of a successful Green Freeport needs to do many things not just well, but superlatively. It must deliver all sorts of data wherever and whenever needed, with guaranteed high speeds, low delays and unimpeachable reliability. It must support very large numbers of simultaneous users, but be economical for the small start-up. It must support maximal automation of itself and other services, and require minimal physical installation and upkeep. It must be inherently secure, yet work with open standards to speed adoption, innovation and co-operation between partners.

There is only one unified standard system that provides all these necessities, and has a roadmap, decades into the future. 5G.

What is 5G and why does it work for Green Freeports?

Although 5G is a unified standard, it has two natures. One is the familiar, consumer-facing public side, that of faster data, longer range, more of the entertainment and Internet connectivity that people have come to expect from 4G.

The other aspect is far more revolutionary. 5G is the first mobile data standard specifically engineered for universal business and industrial use through private networks. It builds on all the experiences of the previous generations, and adds the capabilities for sensors, controls, monitoring, remote processing, automated management and network configuration that modern data-driven businesses need. It is scalable, bringing very high availability and very high bandwidth to wide areas quickly and reliably. It brings intelligence to machines - the Internet of Things (IoT), vehicular and robotic, production lines and logistics systems - and makes sure the right data is available where and when it's needed by humans and AIs.

In practical terms, it means that when building out new infrastructure or attracting new concerns, the provision of connectivity is a given. With the full ecosystem of the mobile data industry to support a local 5G infrastructure, reliable solutions are available from a wide range of suppliers, with economics as important as the capabilities.

The Scotland 5G Centre has an unparalleled knowledge of the 5G landscape, the technologies, companies, agencies and use cases that can help any enterprise make the best use of this unique technology. We're here to be the partner you need to make 5G the best choice for your Green Freeport digital infrastructure.



5G: what it does and why you need it?

5G is built around a number of concepts that are essential for the innovative business, providing a platform of digital services that support logistics, control, automation, robotics, monitoring and distributed smart systems at any scale. Here are some of the key ideas, what they mean and why they're needed.

Low Latency

5G is designed to handle data with very short delays, or low latency. This is important if you need to control machinery at a distance, react to a sensor in real time, or use AI to identify what's happening on a video stream swiftly enough to make decisions while objects are in transit, for example. 5G gives innovators the freedom to decide when and where data is processed, without having to create specially engineered links.

Edge Support

As computers get smaller and more powerful, control decisions and computational processing can be distributed away from the traditional model of centralisation.

This improves performance, reliability, scalability, security and flexibility. 5G is built around edge concepts, both to improve its own performance and to support other systems that use it.

Reliable Bandwidth for Voice, Video & Data

Earlier generations of mobile data could provide high speed data, but with uncertain performance due to too many users in a cell or a few users making too great a demand. A private 5G network not only has better overall provision, but it can control the who, when and where of its delivery. Different data streams can be given different priorities using a technique called network slicing,

meaning no matter how much video and voice data is being used, business-critical control and data connections will always get through on time.

Standardisation & Ecosystem

5G is a global standard, supported by thousands of suppliers and a huge pool of expertise. This makes it an ideal underlying infrastructure that gives an enterprise choice to balance economics, performance and supply chain confidence. It also means that innovators can build to very well understood, tested and available ways of adding smart connectivity to their designs, making what was once a major headache a wheel that no longer needs reinventing.

Security

Data security is not optional. Not only does any disruption or data breach threaten an organisation's daily operation, security is part of the regulatory compliance landscape. 5G data transfer and control systems have been designed to satisfy the needs of state-level communications networks, and have been designed in and verified at every level.

Explicit IoT & Vehicular Support

Modern manufacturing, data processing, logistics and infrastructure systems are utterly reliant on remote sensing and control. Maximal efficiency relies on remote data sensing and autonomous decision making supported by an unconditionally reliable network - the Internet of THINGS. 5G is designed to provide the type and quality of services this approach demands. Being wireless, this is as true of autonomous mobile robots, trucks and drones as it is of a traffic light or a container ID reader. You may or may not end up using autonomous flying vehicles, but if you do, 5G will support them.

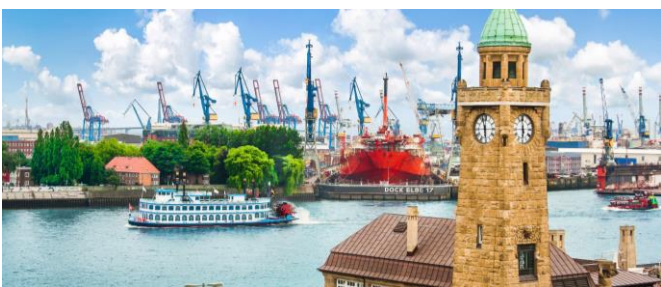
Flexibility, Scalability, Reliability

High speed data used to be restricted to physical wires. With 5G, that's no longer true, and it makes the most of having a very advanced model of wireless data to be able to adapt to different needs very quickly. A small cell can be added for a local high-demand spot, or a long-distance link established to a new site. Extensive performance monitoring and automated system management keep reliability very high, with very good visibility of moment-by-moment and overall performance giving implementers and managers all the data to run today and plan for tomorrow. 5G networks cover individual buildings through to continents.

5G and Innovative Port Solutions: Four Examples

Many established ports are evaluating and using 5G for real-world tasks, no two installations are the same, each port has its own challenges and approach to creating a smart solution.

- **Port of Hamburg**



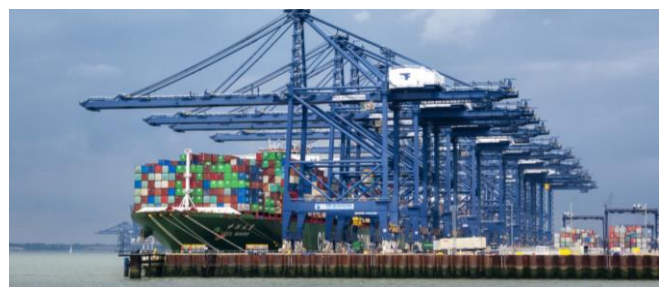
Covering 8000 hectares, half land and half water, the port is a complex of warehousing and trans-shipment facilities connected by waterways, roads, 118 bridges, and 300 kms of railways. By 2025, the port expects to handle 18 million containers annual, tens of thousands of trucks per day, including autonomous and remotely controlled vehicles, and collect data from around 100,000 mobile sensors.

The current telecommunications network uses 350 km of fibre, multiple radio technologies for nautical operations, public 4G, and Wi-Fi for indoor use, and is not seen as adequate for the future needs of traffic and congestion management, environmental sensing, infrastructure monitoring, or new, more efficient and net-zero focused logistics. For example, the 4G provisioning already saturates during events when as many as a million visitors are within the port area.

The port has installed a proof-of-concept dual base station 5G private network, which has demonstrated ultra-reliable connectivity to safety critical systems such as the traffic lights, which would be too costly to connect with fibre. A dual data centre approach, one local, one 500km away, has shown very low latency processing for data that needs it, with efficient big data processing at larger latencies. The port is connecting up environmental and other sensors, including emissions monitoring on barges, and is working towards the delivery of 3D augmented/virtual reality maps and services locations to building and maintenance teams working on-site.

https://telent.com/assets/uploads/docs/Hamburg_port_casestudy.pdf

- **Port of Felixstowe**



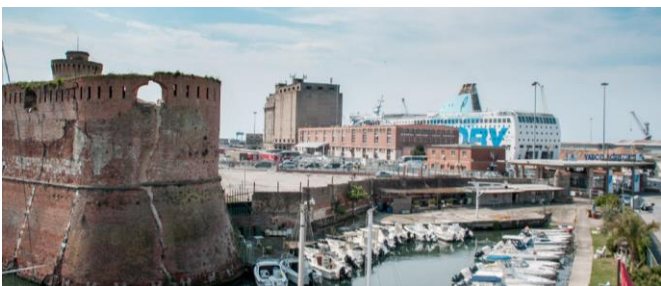
The Port of Felixstowe is the busiest container port in the UK and the eight biggest in Europe by traffic, handling around half of Britain's containerised trade, nearly 4 million containers, in an area of 342 hectares. It is the largest UK port to deploy 5G and the Internet of Things (IoT) technology.

The project is initially delivering on two use cases: predictive maintenance of quay cranes using IoT sensors and providing communications for remote control yard cranes. Its current remote-control quay and yard cranes use CCTV, with limitations on bandwidth and flexibility for extension across the port.

Six quay cranes are being fitted with IoT Sensors to understand the stresses and strains placed on them by day-to-day operation. An algorithm analyses crane use and container movements required to maximise the amount of time cranes are in use, handling them to reduce the cost associated with emergency repairs and day-to-day maintenance. 5G has been chosen to handle the huge volume of data collected which will be used to train the algorithm at levels that would not be sustainable over 4G. 5G's low latency enables the systems to operate in real-time which could enable 'in the moment' safety-critical applications.

<https://www.porttechnology.org/news/felixstowe-becomes-largest-uk-port-to-deploy-5g/>

• Port of Livorno



At 345 hectares, the Italian Port of Livorno is one of the most important ports in the Mediterranean, handling some 600,000 containers per year. It has been working with state and industry partners since 2018 to test a number of use cases for 5G, and has adopted the technology as the backbone of its Port of the Future project.

Among the many use cases tested and individual proofs-of-concept is the COREALIS optimization of container terminal operations. This is a 5G-based control module for managing general cargo, performing real-time control of loading/unloading operations, collecting data via yard vehicles and implanted sensors such as LIDAR, and making operating decisions based on real-time analytical processing. It detects general cargo in a shorter time than usual human-driven communications, and provides better cargo management. The optimisation lowered fuel consumption as well as associated CO2 emissions. The port has found emission reduction for one terminal operation of 8.2 percent.

It estimates annual savings of EUR 2.5 million savings (through optimised vessel berthing and a 25 percent improvement in productivity through 5G remote-controlled gantry and quay cranes. It has identified 65 different areas of quantitative improvement through the project.

https://www.ericsson.com/4a0630/assets/local/cases/customer-cases/2020/ericsson_portofthefuture_report.pdf

• Port of Bristol



The Port of Bristol covers some 1,100 hectares and handles 27% UK aviation fuel imports, 3 million tonnes of dry bulk goods and over half a million motor vehicles. It is one of the first batch of UK Freeports. It is introducing 5G to track the movement of goods and materials at container, pallet and individual items levels.

This not only improves visibility but boosts efficiency, as real-time automated monitoring and recognition replaces existing manual scanned barcode identification. This is part of a 'chain of custody' concept that positively locates goods at all times and lets them move through the port quickly and seamlessly.

High precision indoor tracking and low-power tags on pallets, equipment and materials passes real-time location data to the cloud, providing both humans and algorithms complete visibility of goods. This enables true digital twins - an exact computer model of real conditions - for traceability of inventory, reducing loss of assets and ultimately improving end-to-end efficiency by an estimated 25 percent. Geofencing also improves security by monitoring for any movement outside designated areas, while the seamless tracking allows a certificate of conformity to be created, guaranteeing the condition of the goods. As well as location, sensors can record environmental factors such as temperature and events such as shock, with early detection of problems expected to provide a 30% reduction in lost and damaged assets.

<https://uk5g.org/discover/5g-industry/transport-logistics/5g-in-transporting-goods-UK/5g-in-asset-trace-and-track-UK/>

What to do next?

5G is an essential infrastructure component for modern ports, not only to optimise and improve current systems and processes but to enable the next generation of innovation. New industrial companies moving onto the freeport will demand it, as companies demand wired Internet connectivity today.

The secret to making it work is partnership, and we are ready to partner with you. Use our unmatched knowledge of business and industrial 5G, our established relationships with suppliers and government, and our experience in matching the needs of business with the right mix of technologies and services.