

Fremantle Port

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SIS48 – Towards Sustainable Technology Drive Port City Development Management

**Improving Port Landside Efficiency and Sustainability through
Intelligent Systems**

24 October 2019

Intelligent Transport Systems World Congress - Singapore



**FREMANTLE
PORTS**



Victoria Quay

Rous Head

North Quay

Fremantle Inner Harbour

SMART MOVES

Road and Rail



Port Landside Challenges

- Efficient preparation of freight for pick up from / delivery to terminals
- Entry/Exit to terminals, without delay or difficulty
- No congestion on port or port access roads
- Supply Chain (particularly Terminals and ECPs) incentivised (*and monitored*) to perform (*i.e.: provide freight in timely manner, operate after hours, utilise non-road (e.g. rail options), reduce externalities (e.g. road noise)*)
- Vehicle overloading (*safety, road damage*)
- Reducing the numbers of vehicles to/from ports (efficient loading)
- Increase visibility of freight operations to allow improved planning, increased speed and prevention of errors/double handling
- No Data Silos
- Balanced charges throughout the supply chain



Inner Harbour operates adjacent to urban areas



Challenges operating close to residential areas



FREMANTLE PORTS

Real Time Port Operation

Digital Twin

Virtual Digital Twin of the Port to provide real time 3D visualisation of port operations and to enable simulation modelling and "what if" scenario planning

Port Community EcoSystem Portal

An interconnected digital platform that facilitates information exchange among stakeholders in the port value chain, from both the public and private sectors. This would facilitate ships berthing on arrival, consuming services just in time and reducing turnaround times. Service and logistics providers would be able to plan and allocate pilots, berths, ship supplies and other port services more efficiently.

Intelligent Port Orchestration

Unified platforms for integrating real time data from multiple sources to provide a unified real time, spatial view across Fremantle port operations. Coordinated execution of land side and ship side operations to facilitate inter-modal cargo flow and connections. Intelligent notification and harmonisation of train, truck and vessels scheduling.

Intelligent Vessel Traffic Mgt Info Systems

Next generation systems that leverage Data Exchange Systems, Digital Technology, Predictive and Data Analytics and Smart Applications to enable seamless transfer of data across the port ecosystem and improve vessel navigation and logistics.

Smart HSEC

Health, Safety, Security and Environmental risks in ports will be addressed pre-emptively or in real time by infusing surveillance systems with video and data analytics, and machine-triggered responses. Real time location tracking and geo-fencing to improve security and safety that is integrated with a streamlined permit to work system.

Drones

The use of Drones will improve operational efficiency and can be used for ship inspections, navigational awareness, port surveillance and emergency management.

Industrial Internet of Things (IIOT) Solutions

Internet of Things (IoT) solutions for machine learning enabled, data driven optimisation.

Inner Harbour - Fremantle

Port Ops & Enterprise

Outer Harbour - KBJ & KBT

Visual Representation

To create a real-time and dynamic representation of the port environment to enhance FPA's situational awareness in order to understand, learn, and respond to changes. Key focus areas could include:

- Ship information, movements, schedules and notices
- Berth management, allocation and scheduling
- Marine infrastructure status, incidence and maintenance
- Safety incidents, notifications & alerting
- Land side logistics, traffic and rail movements
- Financial and throughput tracking and alerting

Data Contextualisation & Aggregation

To provide richer information for more informed decision making, data must be understood in context. In order to create context, data will need to be:

- Measured and captured at its source points (eg: sensors, controllers and devices)
- Integrated, linked and combined from various systems inside and external to the FPA
- Automatically aggregated
- Continually fed and made available to visualisation systems

Technology Platforms

In order to digitally represent contextualised data, FP will need to consolidate, utilise and leverage common technology platforms, such as:

- Data ingestion technologies that capture relevant IT and OT data sources
- Unified data repositories and management to store and share information
- Common business management systems, for example an ERP
- Visualisation & Intelligence (eg: BI & Geospatial)
- Process control and automation (ie: HMI, SCADA and Historian)

Intelligent Berth Risk Management

Real time capturing of operational data combined with real time calculation and intelligent prediction to provide automated alerts to avoid damage to berthing assets. Also intelligent berth planning and scheduling.

- MVP1: Berth Loading Alerts (Cranes on Berth/ Ships Against)
- MVP2: Bollard Loading Alerts
- MVP2: Shore Tension Alerts
- MVP4: Ship Alerts eg. anchor dragging, grounding risk

Port Ecosystem & CDM (Collaborative Decision Making)

Digitisation and real time data exchange between actors for Port Calls.

- MVP1: Movement of Dangerous Cargo
- MVP2: General Cargo Berth Clearance
- MVP3: Tracking and Automation of Clearance Handover

Scheduling and Work Force Mgt

Automated workforce scheduling and HSEC support

- MVP1: Electronic Permits to Work Outer Harbour
- MVP2: Electronic Permits to Work Inner Harbour

- MVP1: Real time work scheduling, rostering and handover mgt
- MVP2: Real time mobile access to work scheduling, rostering and handover information
- MVP3: HSEC alerting
- MVP4: Fatigue mgt

Port Activity Monitoring

Real time visibility of key port activity.

- MVP1: Real time operational view - live traffic
- MVP2: Maintenance operations eg. Diving, Berth Maintenance
- MVP3: Inner harbour light vehicle tracking
- MVP4: KBT light vehicle tracking
- MVP5: COP Data Integration (vessel and visit details)
- MVP6: Navigation Aid status (including ability to turn on)
- MVP7: Real time train tracking
- MVP8: COP Predictive View
- MVP9: Real time truck tracking

Port Security Information Management

Integration of security systems and incident management.

- MVP1: Land side boundary breaches
- MVP2: Incident alert and camera repositioning
- MVP3: Container movement tracking
- MVP4: Real time detection of uncleared containers leaving site
- MVP5: Automatic Drone Detection and Intervention

Port Automation

Automation and augmentation of manual port processes.

- MVP1: Berth planning
- MVP2: Berth scheduling



Fremantle Ports "4.0"



What we've been doing - Landside

- Getting better co-ordination of heavy vehicles into and out of a sensitive precinct
- Looking at better ways of doing it – Innovation
- Go beyond Australia ... to be world standard
- Actually making a difference – not just co-ordinate but take action

Congestion Management

Truck Marshalling

Vehicle Detection System – instant monitoring of delays

Messaging

In Cab Telematics Driver Information

Queuing Control

Key Performance Indicators

Port Trading Community Eco-system

“Digital Twin” Development

The Future!

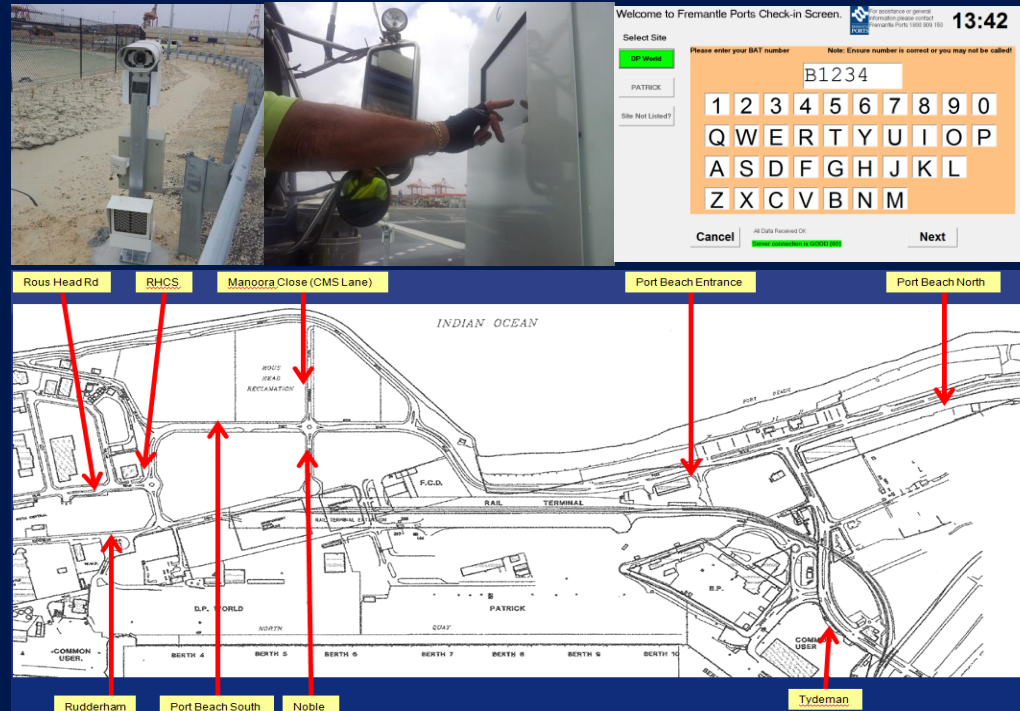
Truck
Congestion
Management
System



Why is it important?

- Lengthens the useful life of vital infrastructure
- Improves the relationship with our community partners
- Increases efficiency and makes our Western Australia more competitive
- Increases the value and importance of the Port in everyone's eyes
- Shows that we are at the forefront of innovation

Congestion Management System is a core example



That



sustainability

*celebrating sustainability
triumphs wherever they
originate*





FREMANTLE
PORTS



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[DATA](#)

[RESULTS](#)

[UNFORESEEN EVENTS](#)

[OBJECTIONS](#)

[KPI ACTION PLANS](#)

[TENANTS](#)

[REPORTS](#)

[ADMIN](#)

History Tenant

[Change Password](#)

[Logout](#)

Site Key Performance Indicators

- Newly created land areas have given the Port the opportunity to guide key land-side efficiencies.
- KPIs linked to results we wish them to achieve
- KPIs included in all new leases – Incentive for good performance
- Tenant Operating Performance System (TOPS)
- Verification through Intelligent Transport Systems



Truck Control System - The Developments

Queuing Control

- Largely impractical manual means of determining this
- Eliminates Queuing – environmentally friendly, community aware and driver amenity focused
- Focuses attention on this neglected area of logistics (“what do I care about queues?”)

Vehicle Detection (including Truck Turn Time - TTT)

- Measurement of duration at port – CO2 implications
- Increase throughput

In Cab Telematics (IVU) – Driver Information System

- Take information from Congestion Management System and send direct to driver – Go live end19
- Driver able to act on issue prior to arriving at port – keeping trucks away from port (Virtual TMA?)

Queuing detection At ICL

Attention,
There is queuing happening at 2016/07/08 15:29:13 at site ICL.
Please click here for live view ([link](#)) or playback view. ([link](#))

Regards,
Fremantle Port

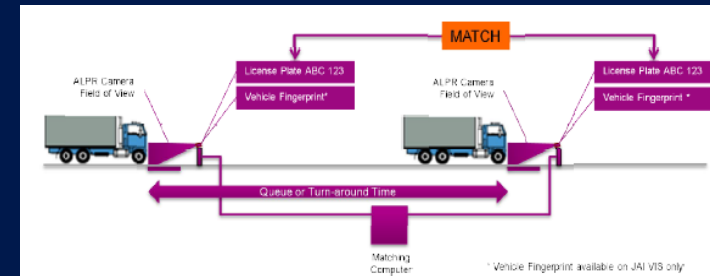
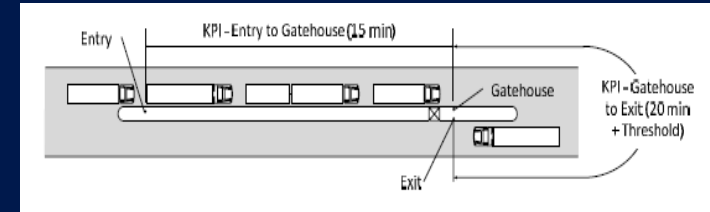
Fremantle Ports Queuing Control System

Search Criteria: Camera: QCP, KOOR, SULW, ICL, PAT2, PAT1

Time	Camera	Image
21/02/2018 1:51:11 PM	SULW	
21/02/2018 1:28:53 PM	ICL	



Recently sent, delay-saving messages – sent direct to cab

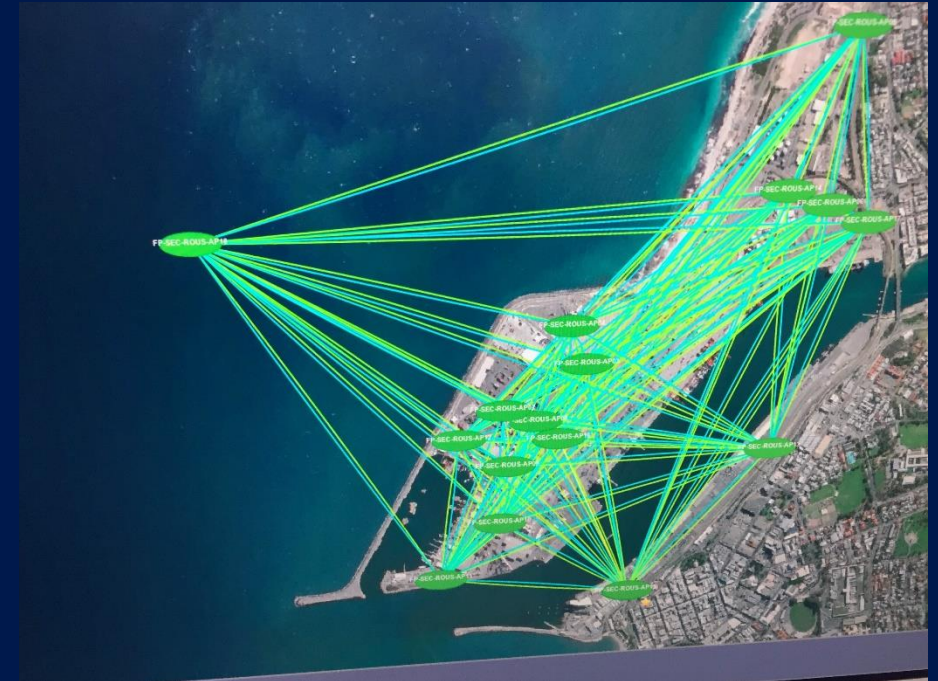
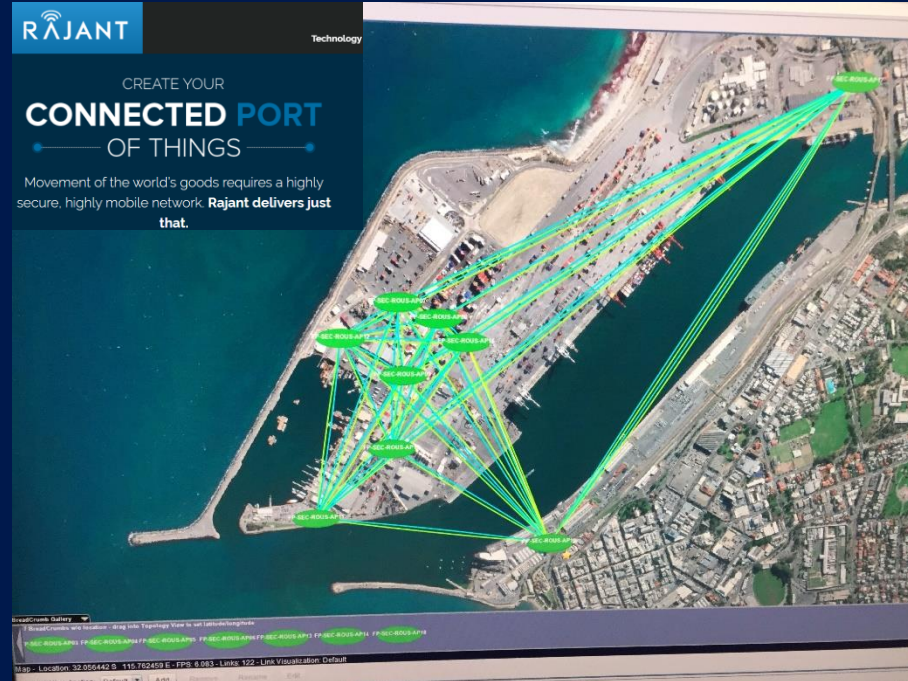


Time Slot:	13:00-14:00
Turnaround Average Achieved:	52
Allowed Average Time:	25
Time Slot:	14:00-15:00
Turnaround Average Achieved:	51
Allowed Average Time:	25
Time Slot:	15:00-16:00
Turnaround Average Achieved:	65
Allowed Average Time:	25

21/02/18 14:09:41	21/02/18 14:08:42	1EOZ678		21/02/18 15:05:52	21/02/18 15:05:52	1EOZ673		00:56
21/02/18 14:10:57	21/02/18 14:10:58	1DUK336		21/02/18 15:08:26	21/02/18 15:08:26	1DUK336		00:57
21/02/18 14:14:34	21/02/18 14:14:35	1DKP850		21/02/18 15:36:22	21/02/18 15:36:22	1DKP850		01:21
21/02/18 14:14:44	21/02/18 14:14:45	1DBU827		21/02/18 15:34:41	21/02/18 15:34:41	1DBU827		01:19
21/02/18 14:15:10	21/02/18 14:15:11	1GCX377		21/02/18 15:39:27	21/02/18 15:39:27	1GCX377		01:24
21/02/18 14:19:38	21/02/18 14:19:39	1DWM786		21/02/18 15:33:44	21/02/18 15:33:44	1DWM786		01:14

Smart Camera Technologies

- Independently, Transport for NSW and Fremantle Ports are working on projects to use camera analytics to improve supply chain visibility
- Mobile cameras, combined with Rajant wireless mesh, allow totally flexible deployment with direct linkage of high bandwidth video and other data feeds straight into port-own fibre network
- New ANPR-enabled Trailercams (see below) is the final element of the Truck Control System
- The inclusion of mobile units increases the mesh strength considerably.
- Fremantle Ports is also considering the associated Wireless Mesh Technology to allow connectivity with operational data sources (e.g. Drones)

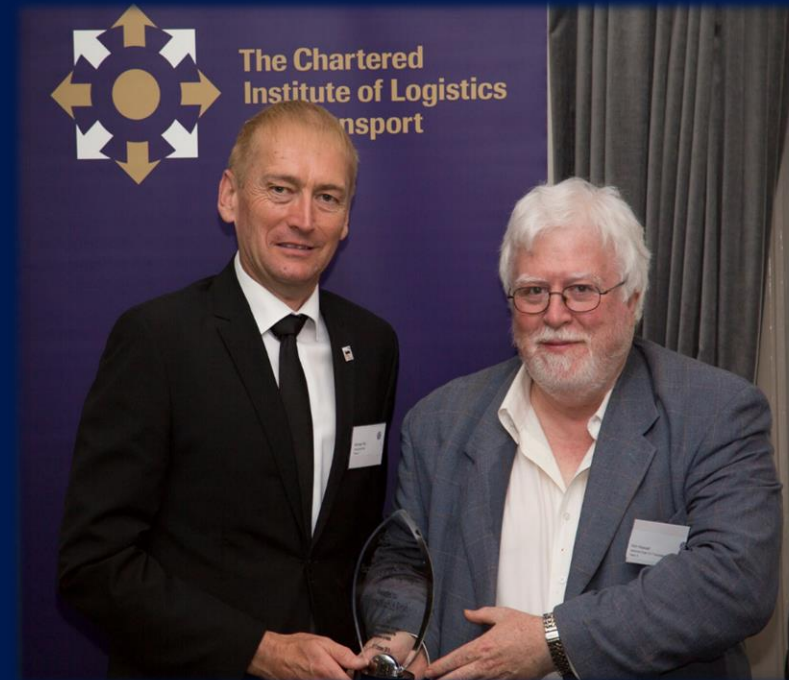


Innovation and Supply Chain Excellence Awards - Five received in 2018

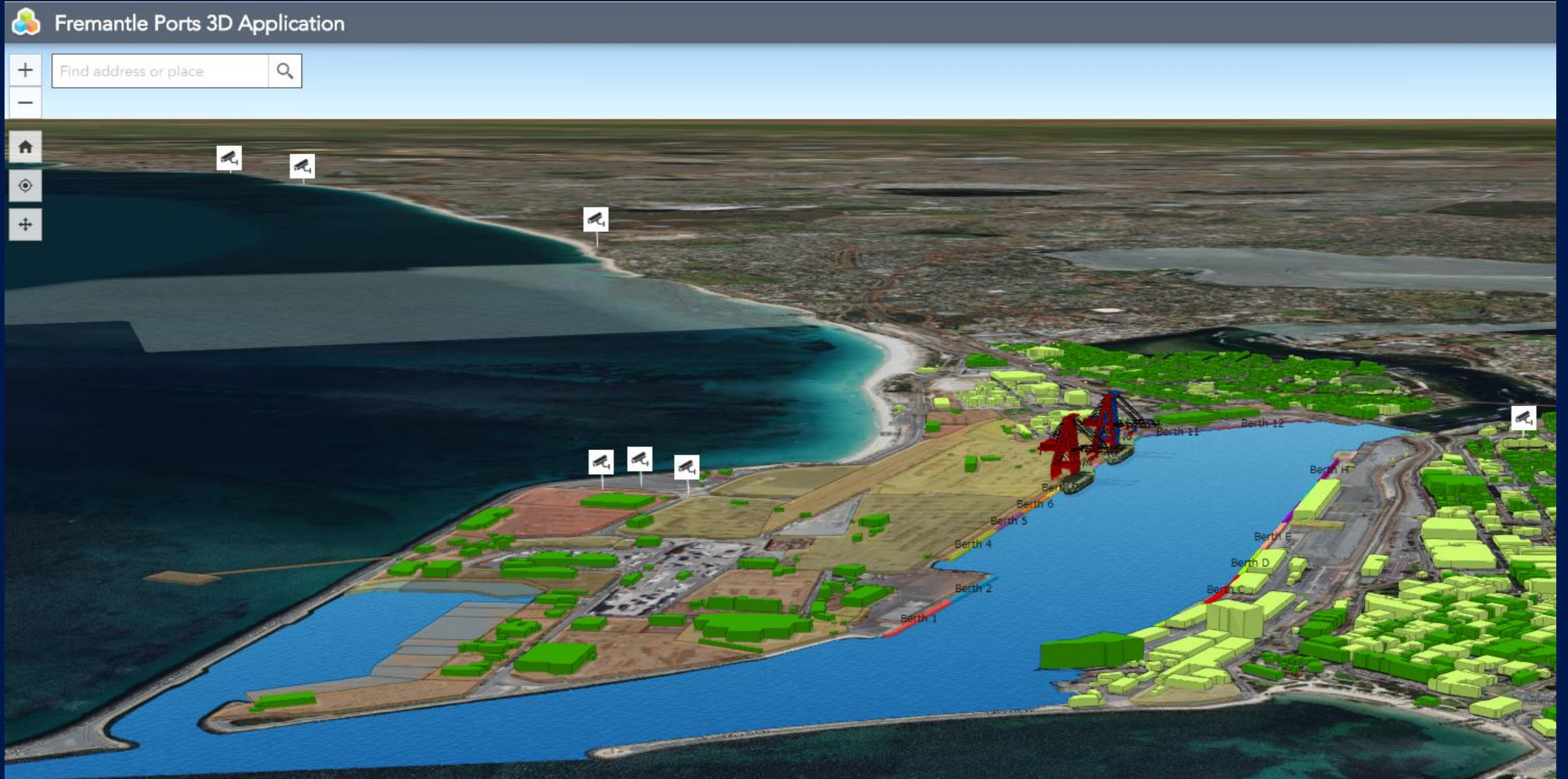


The screenshot shows the Fremantle Ports website with the following content:

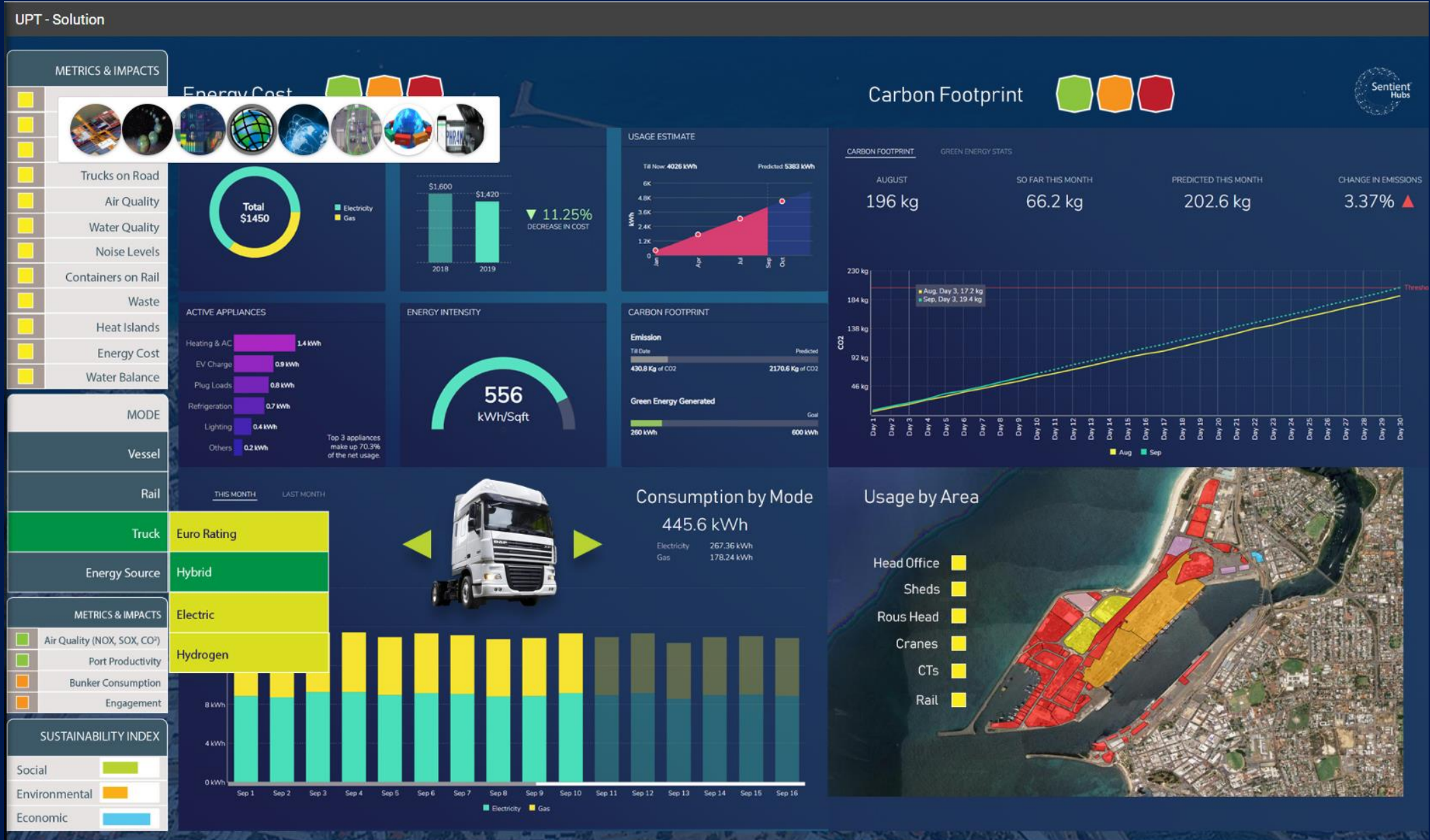
- Header:** FREMANTLE PORTS Western Australia
- Navigation:** About Fremantle Ports, Port Business & Operations, Planning & Projects, Community & Education, Visiting the Port, News & Publications
- NEWS Section:**
 - 11/06/18 - Fremantle Business Awards 2018 announced**
Congratulations to all winners at the Fremantle Business Awards 2018
[Read more](#)
 - 01/06/18 - Two awards for Fremantle Ports' truck management system**
Innovations in managing road operations at the port have garnered two awards.
[Read more](#)
 - 11/05/18 - North Quay Container Terminals EOI**
Fremantle Ports invites expressions of interest to develop and operate the intern...
[Read more](#)
- News Archive**
- Category Tiles:** SHIPPING MOVEMENTS, HISTORY & HERITAGE, CRUISING, FREMANTLE WATERFRONT
- Video Player:** A video showing a woman holding a large, multi-faceted award trophy. The video caption reads: "Our Truck Control System won two awards at the 2018 WA Transport, Supply Chain and Logistics Awards held recently. - [Find out more.](#)"



Port “Digital Twin” Developments (Data Feeds used for Analysis)



Port "Digital Twin" Developments (Examples: Carbon Measurement)



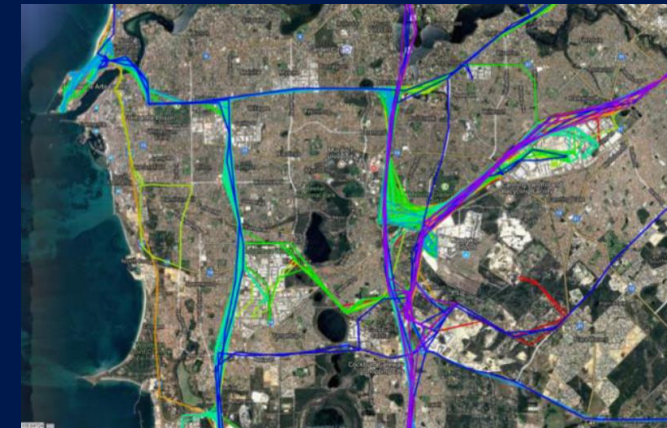
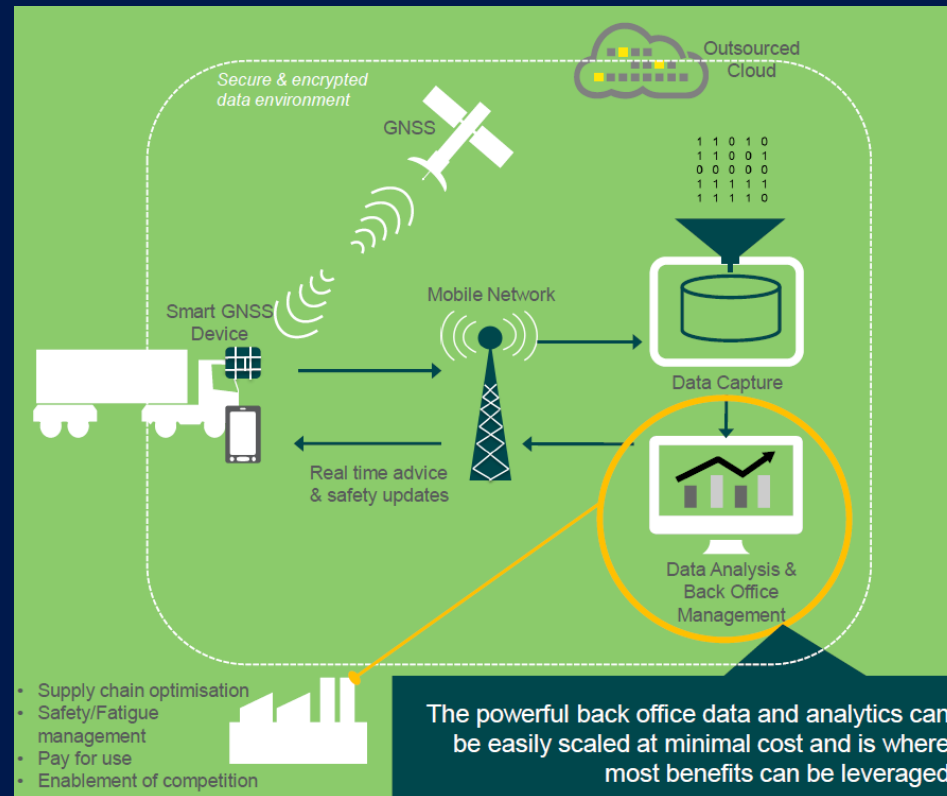
“Smart” Plates

- How to better identify vehicles, within and outside the port – medium term?
- Global Navigation Satellite System (GNSS) enabled licence plates
- Allows better data on port-related vehicle activity on public roads

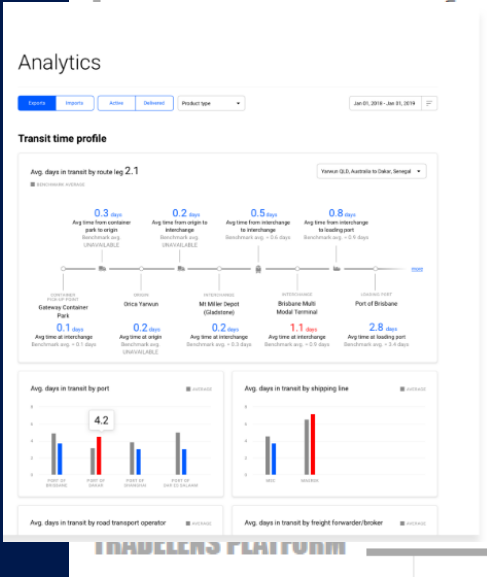
GNSS & Mobile Network (Primary Solution)



- + Scalable & Flexible. Accurate Positioning
- + Non intrusive
- + Supports multi-laned free flow (MLFF)
- + 2 way communication technology
- Cost effective
- Urban Canyoning (i.e. between buildings)
- Mobile network black-spots



Port Community Trading Eco-Systems



Descriptive and predictive analytics to optimise routes, compare providers performance and find cost efficiencies

Examine your time at each route leg compared to the average. Benchmark the performance of your suppliers with real data. And examine better trade routes to find faster and more cost effective ways of delivering your goods. Data based decisions to optimise your logistics.



The future of Trade Community System

- Smart contracts to remove third parties and pay less fees**
 Using ethereum based blockchain technology, smart contracts will be built in, for example to release payment to suppliers when certain criteria is met.
- Scalability with the Internet of Things**
 The Trade Community System is future proofed to allow the Intergration of new data sets when they become available. For example smart locks, GPS enabled containers, and temperature controlled smart containers.
- Supply chain integrity with complete traceability**
 Trace every ingredient that went into making your product to guarantee it's authenticity – And provide data backed certifications to your end customer or consumer.
- A B2B logistics marketplace**
 Expanding the platform to allow importers or exporters to post a job on a logistics marketplace and let supply chain providers come to them.

UN Sustainable Development Goals Analysis – Recent Considerations



SUSTAINABLE DEVELOPMENT GOALS

UN SDG		Importance to Westport	Alignment to ISCA Sustainability Categories ¹	MCA Criteria Relevant to SDGs	How the Westport Strategy can impact the UN SDGs		
					Plan & Procure	Design & Construct	Operate
 11 SUSTAINABLE CITIES AND COMMUNITIES	Make cities and human settlements inclusive, safe, resilient and sustainable	High	<ul style="list-style-type: none"> • Context • Resilience • Options Assessment and Business Case • Benefits • Energy and Carbon • Green Infrastructure • Environmental Impacts • Resource Efficiency • Stakeholder Engagement • Heritage 	<ul style="list-style-type: none"> • Land use compatibility • Net amenity impacts • Heritage • Land transport safety • Terrestrial environmental impacts • Marine environmental impacts • Energy and carbon • Infrastructure capacity, scalability and operational efficiency 	<ul style="list-style-type: none"> • Collaborate with cities and governments to find solutions to future freight mobility needs that minimize environmental impact while making transport safer and more affordable. • Bring together government, NGO's and citizens to jointly analyse, discuss and act so that Westport Strategy contributes to making our cities more competitive, safe, resource-efficient, resilient and inclusive. • Reform private sector finance investment strategies to support integrated and sustainable urban development like sustainable urban transport, low-carbon buildings, and resilient infrastructure • Plan to protect and enhance heritage values which may be impacted by the project • Reward suppliers who implement corporate giving or volunteering programs that provide food for disadvantaged social groups 	<ul style="list-style-type: none"> • Interpretation strategies are prepared to enrich understanding of the place while providing guidance for aspects of the development of the area that will build on its unique characteristics. • Bring heritage values in design and construction 	
	 17 PARTNERSHIPS FOR THE GOALS	Strengthen the means of implementation and revitalize the global partnership for sustainable development	Very High	<ul style="list-style-type: none"> • Leadership and Management • Sustainable Procurement • Resilience • Resource Efficiency • Stakeholder Engagement • Legacy 	<ul style="list-style-type: none"> • Governance / ownership flexibility • Heritage 	<ul style="list-style-type: none"> • Collaborate with ISCA, IA & IAWA, City deals, PIANC universities and NGO's to support the achievement of the sustainable development goals. • Develop <u>Kaart Koort Waarnginy</u> (Head, Heart, Talking) Aboriginal engagement process. • Bring together government, NGO's and citizens to jointly analyse, discuss and act so that Westport Strategy contributes to making our cities more competitive, safe, resource-efficient, resilient and inclusive. • Commit to forward procurement to challenge industry to innovate to meet a project need – e.g. to commit to purchase a service or product once developed that will reduce waste. • Seek innovation in supply chains to gain greater shared value and to generate new markets. 	<ul style="list-style-type: none"> • IMO, ISCA, <u>SBEncr</u>, GBCA Greenstar Communities, Waste Authority, Ports Australia, FLC, POTF • <u>Kaart Koort Waarnginy</u> (Head, Heart, Talking) Aboriginal engagement process • PIANC <u>WwN</u> • IMO, ISCA, <u>SBEncr</u>, GBCA, Waste Authority, Ports Australia, FLC, POTF.

Westport "Thinkathon" — Disruptors and Solutions



- Minimal finished product imports – manufacturing will be done locally in automated, "3D printer" type factories.
- If not, then new products – WA as a "Halal hub"
- Imports will be concentrated raw products not available locally.
- Roads will be better utilised handling many more "motion platforms" (vehicles) than today, meaning shorthaul rail will disappear.
- Grade Separated / Platform roads and more tunnels
- If there are warehouses, they will be vertical and automated (both internally and loading/unloading).

**Fremantle Option 2 and Kwinana Option 24
Shared port scenario featuring the Blue Highway**

This option is the same as the second-ranked option in the previous page except it incorporates the Blue Highway concept of transferring containers from Fremantle to Kwinana on shorter draught barges.

This scenario has been included in the document to allow stakeholders to thoroughly investigate the viability of the Blue Highway – which is a common method of transferring containers between ports in other countries.

For the purposes of this particular summary document, this concept will be treated as an end state. However, it is more likely that the Blue Highway will be a transitional phase, due to low capital cost requirements.

The Blue Highway concept proposes containers being moved directly from the large container ships into small barges using specially designed loading equipment. The barges would then transport the containers directly to the Kwinana port for off-loading onto trucks.

A benefit of the Blue Highway is that less dredging may be required due to the shorter depth of the barges.

The intermodal facility on the Kwinana port would allow for containers to be off-loaded directly from the barge onto trucks, as shown in Image 1 (See right). This would save on time and infrastructure costs.

For additional information to understand the ongoing conditions being the result of work that requires a timeframe to be built to protect the barges and containers from operations. Further, the operational needs of this option are likely to be high given the requirement to meet in specialised equipment and barges.

Kwinana Option 11 – ranked 4th*

This light footprint port is a stand-alone option handling the full 3.8 million TEU container task. It has a typically smaller footprint than a conventional port as the RTG operations are enclosed and located in a separate area – in this instance, at Latitude 32. The theory is that a narrower port will have better marine environmental outcomes, however this concept is relatively new for container ports and must be further tested. Containers would be moved to or from the ship via Automated Guided Vehicles (AGVs) that transfer them over a slim 'land bridge' to the RTG at Latitude 32, where they are then transferred to trains or trucks.

This option is located in the north of Cockburn Sound. It will be serviced by an expanded Rwyer Road Heavy Goods through Toke Road Highway and a freight rail duplication between the Cockburn Triangle and the Kwinana Intermodal Area. It connects to local roads via the end of the North Beach Road and connects south into Cockburn Sound via the Alcoa jetty utilizing the existing channel. Ships would enter and leave the port from the north.

The first-ranked option was Kwinana Option 13 (hybrid conventional port), which is an expanded and state of Option 11 but with more. Even though Option 13 scored slightly higher, it was rejected in favor of Option 11 as it was seen as a more land-intensive and costly component of a hybrid design (which could be added to the future if needed).

The strengths of this option are:

- Situated highly on most criteria across the board
- Innovative narrow design that could deliver superior marine environmental outcomes.
- Good land use outcomes
- Utilises Latitude 32 industrial estate as a natural extension, which is the purpose for which that land was acquired by Government

Potential weaknesses of this option are:

- Connecting the land bridge from the port to Latitude 32 will be challenging
- Light footprint ports are a new concept and have not yet been tested in Australian conditions, an extensive amount of research will need to be done to see whether this design is viable.
- Some unknowns in relation to the capital and operational costs.
- Hydrodynamic impacts on Cockburn Sound will be thoroughly tested.

Other Future Considerations?

Potential Disruptors?

- Autonomous Vehicles
- Trade Community Systems - Visibility along the chain (Distributed Ledger)
- Smart contracts as part of Distributed Ledger?
- Digital Printing and automated factories - why produce in and import when you can produce locally at the same cost?
- Advanced Drone and/or Elevated Sky-rail/Cable-car technology - when the container can be lifted aurally rather than terrestrially
- Land-bridging (in at one end of the country and rail delivery to other end)
- 24/7 operations (e.g. overcoming the a variety of costs and extending the use of vehicles = overcome the issue of infrastructure bottle-necks on roads)
- Ever more efficient and emission friendly vehicles - less community resistance to night operations

Boosting Multi-modality?

- Subsidies for rail
- KPI's for rail operators using port infrastructure (cost to deliver to rail the same as the cost to place onto truck)
- KPIs with incentives for on-port operator tenants (terminals, logistics operations)
- Incentive pricing systems on transport operators (peak period pricing, exemptions for rail)
- Port access road charges
- Utilise rail lines for ITV use when the rail is not running
- Move the port and design the new one:
 - Using AGVs to move containers to an IMT
 - With IMT built around a Logistics Village concept (direct access from rail to warehouse by reachstacker)
 - With IMT that is fully automated

Many thanks

Further Queries

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