TBA® SIMULATION EMULATION SOFTWARE

IT is transforming terminal design and performance

Use of IT tools is not just an enabler any more, it is essential

Mahim Khanna,
Regional Director, TBA bv

TBA

- ✔ | Who is TBA ?

ABOUT TBA
Terminal design, simulation optimization services & software

- Terminal design, operations & automation specialist.
- Recognized leaders in terminal simulation & quantifying performance
- HQ in The Netherlands, but operate globally. 600 port Terminal & intermodal projects in 60 countries
- 9 of 10 largest global operators use TBA services
- TBA has been involved in the many of the most innovative terminal design projects globally over the last 10 years.
- Sample development projects
  - Europe (Rotterdam (APMT & RWG), Antwerp, London)
  - Middle East (Jebel Ali terminals and Khalifa terminal),
  - North America (Los Angeles / Long Beach, New York/New Jersey and Virginia)
- Many terminal a terminal & rail projects in Oceania. Sample of rail include Moorebank, Chullora, Dynon, Acacia Ridge, MCS, NSW Ports
- Software
  - TEAMS- Fleet management software, controlling the worlds most & complex automated terminals.
  - TOS optimizing tools

PSA The World's Port of Call

Lifting Global Trade. APM TERMINALS

EUROGATE

EVERGREEN

CMA CGM

DP WORLD

HANJIN SHIPPING

COSCO

HPH

TiL Terminal Investment Limited SA

ect Europe Container Terminals

IT is transforming terminal design and performance

Contents

1. Role of technology tools in terminal design

2. How technology tools can drive performance & training?

3. Developments in container shipping environment & how that relates to operations & performance

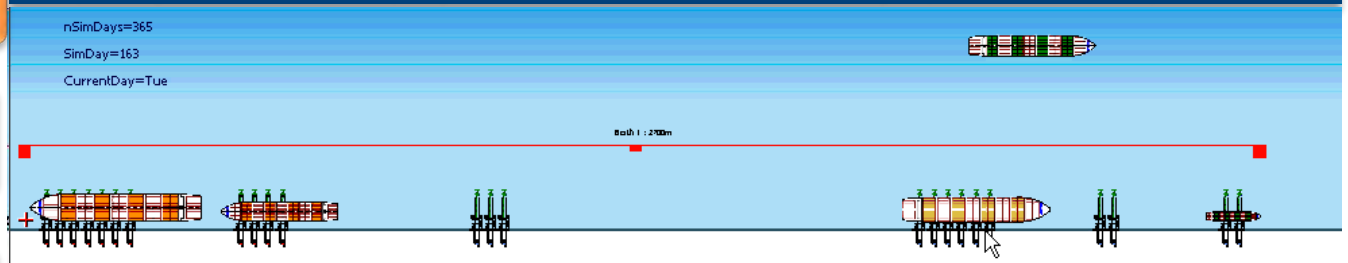
The role of technology to optimize terminal design

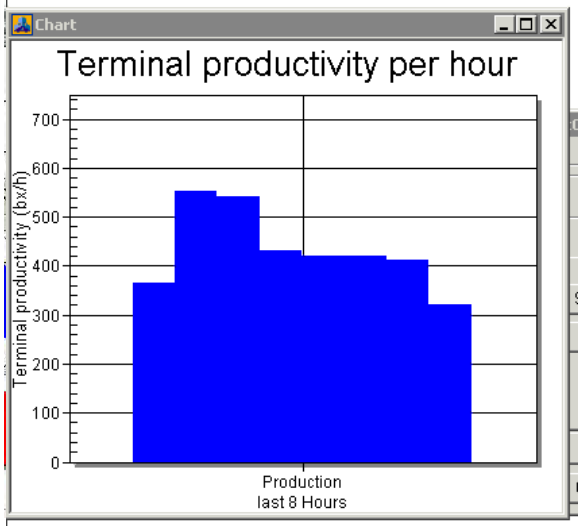
Steps for terminal design

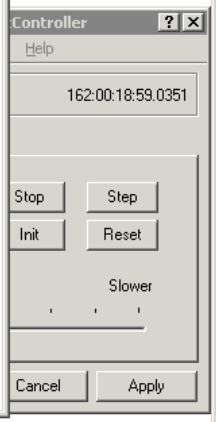
(Capacity simulation)

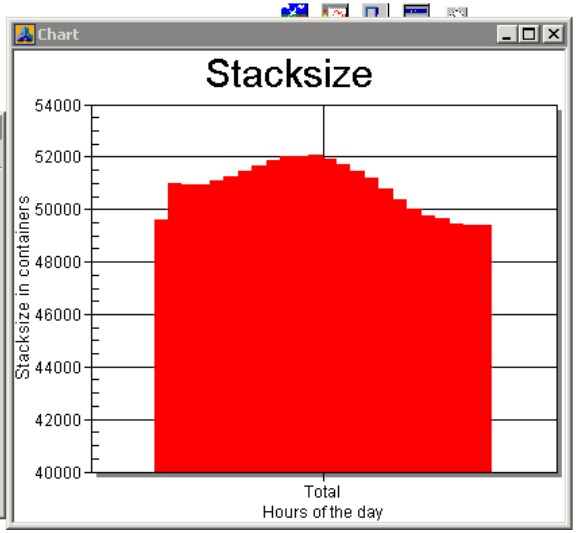
Pre selection Conceptual layouts

Capacity simulation - quay, rail and road to define key operational requirements









What is the impact of changing call size even with same volume ?

Can the rail/berth handle the targeted volume?

How many cranes or tracks are required. What is impact of call size changes

What is the peak handling demand on the yard?

What is the yard inventory over time?

The role of simulation in terminal design

Comparing various modes of operation

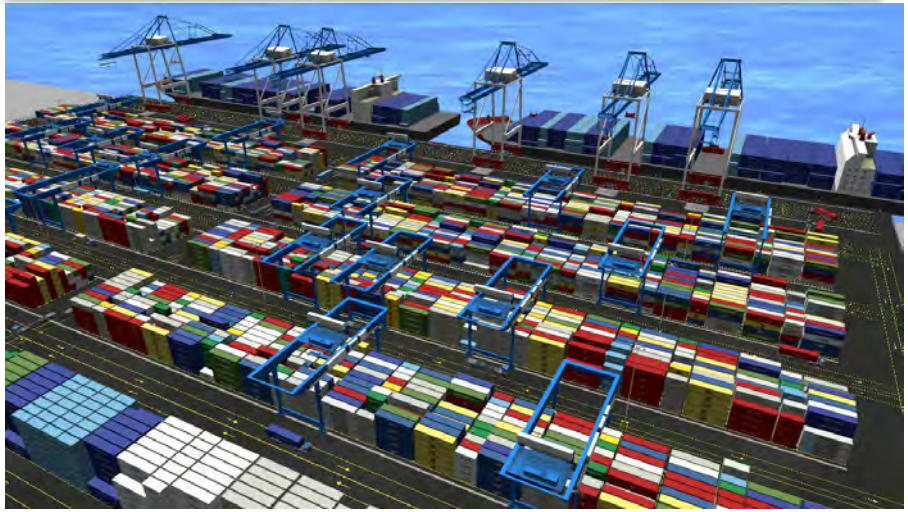
(Capacity simulation)

Pre selection
Conceptual layouts

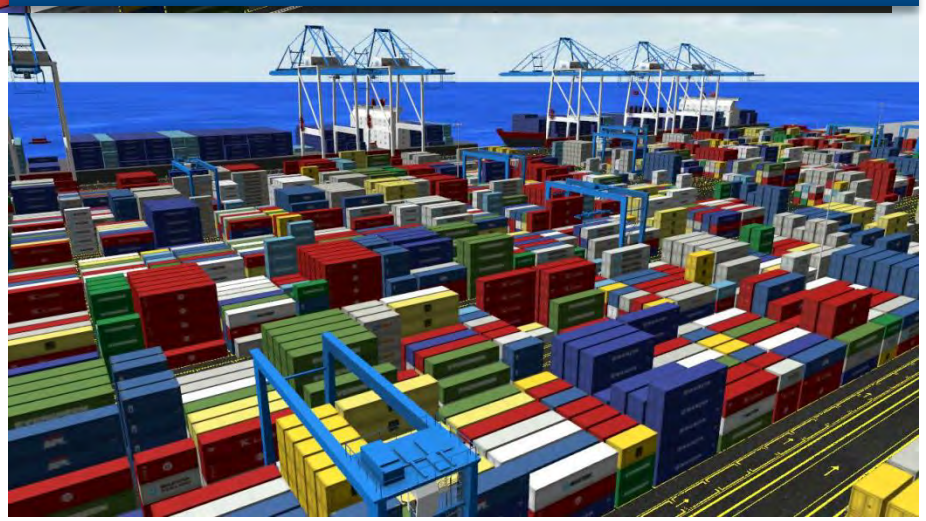
Terminal simulation of
Conceptual layouts

ASC + Shuttle carrier

C-RMG + TT operation



RTG + TT operation



The role of technology in terminal design

(Capacity simulation)

Pre selection
Conceptual layouts

Terminal simulation
Selected alternatives

Simulate terminal design to measure performance and various senstivities

Changing grounding/TOS logic.

Impact of twin lift or prioritizing rail

How transfer points are required.

Is there a bottleneck at the gate?

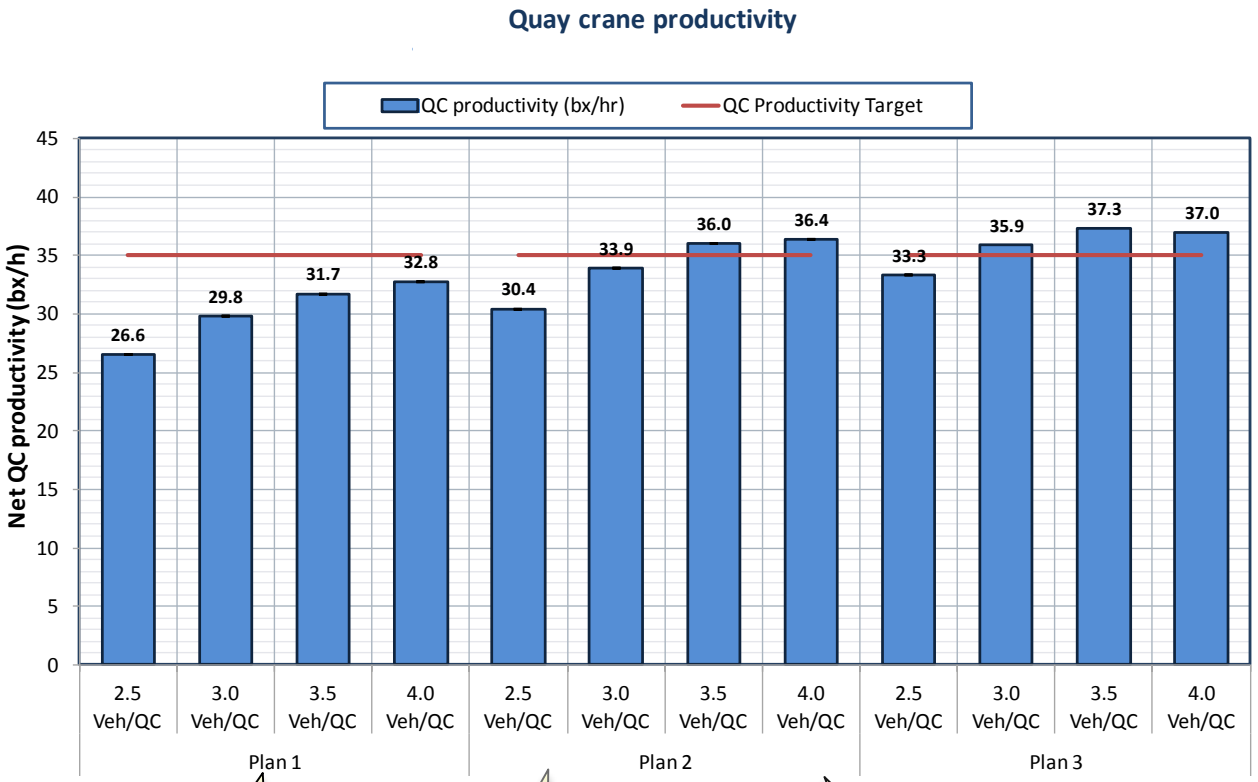
The role of simulation in terminal design

Comparing various modes of operation

(Capacity simulation)

Pre selection
Conceptual layouts

Terminal simulation
Selected alternatives



Plan 1 does not meet performance target due to insufficient stacking cranes

Plans 2 & 3 offer a better truck service when compared to plan 1

Plans 2 & 3 can meet the target using 3.5 & 3.0 ShC per QC

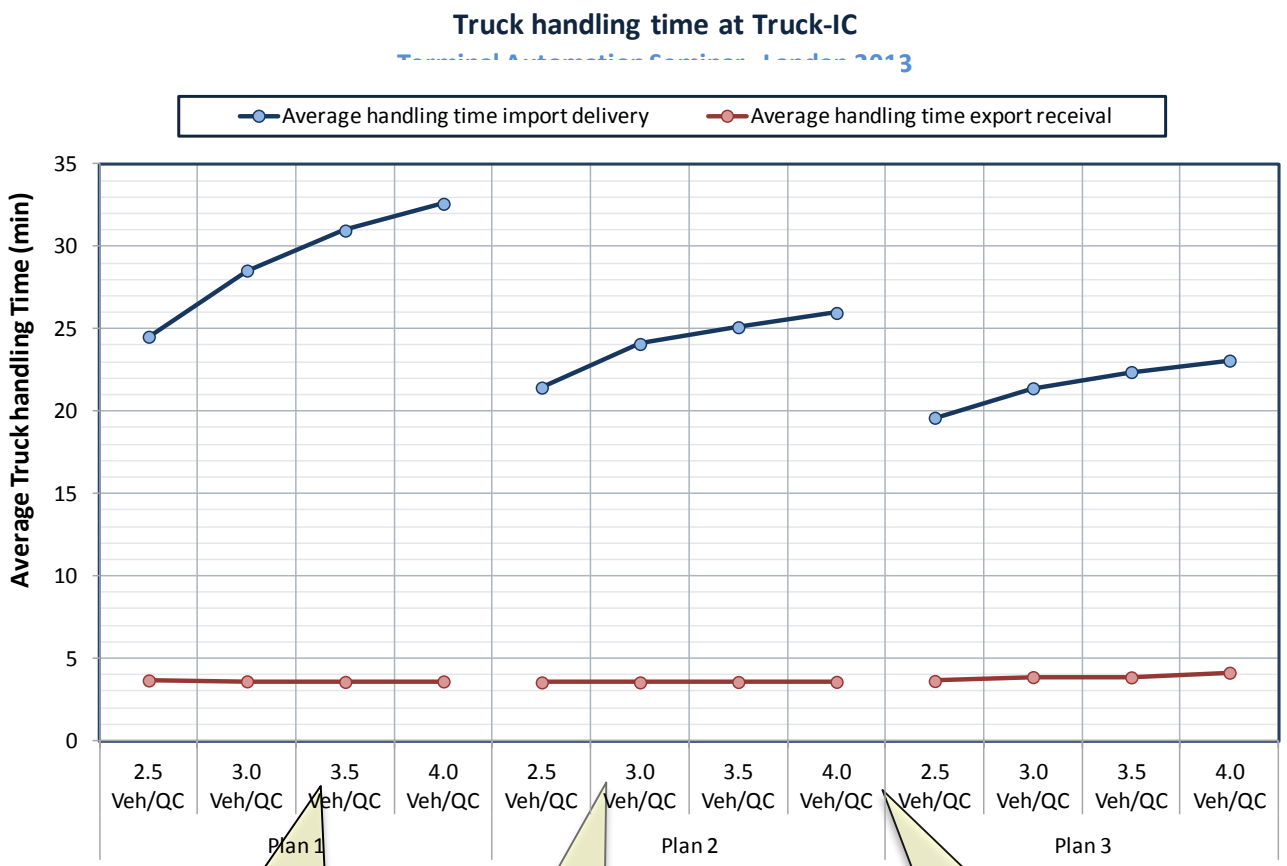
The role of simulation in terminal design

Comparing various modes of operation

(Capacity simulation)

Pre selection
Conceptual layouts

Terminal simulation
Selected alternatives



Plan 1 does not meet performance target due to insufficient stacking cranes

Plans 2 & 3 offer a better truck service when compared to plan 1

Plans 2 & 3 can meet the target using 3.5 & 3.0 ShC per QC

The role of simulation in terminal design

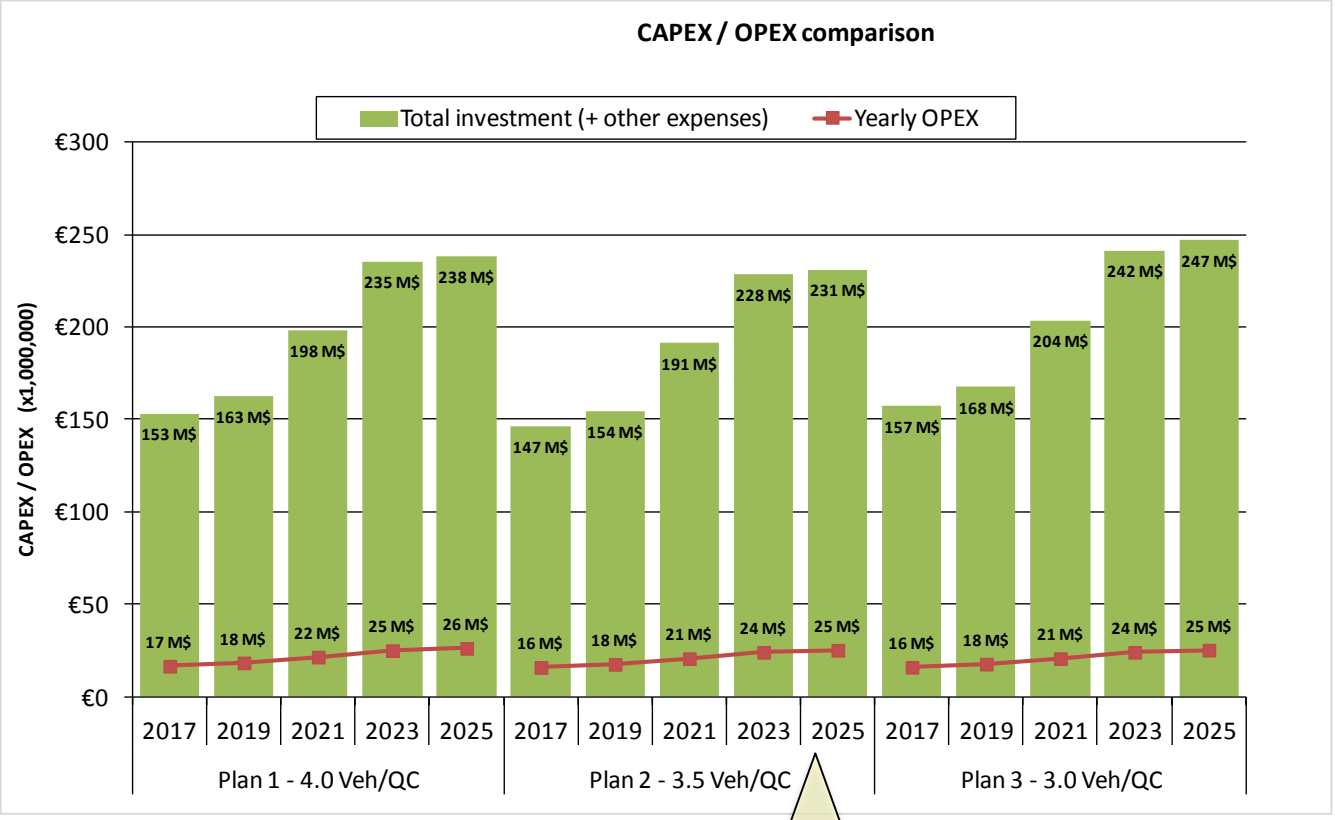
Evaluating OPEX and CAPEX

(Capacity simulation)

Pre selection
Conceptual layouts

Terminal simulation
Selected alternatives

CAPEX/OPEX
Analysis



Plans 2 & 3 have similar operating costs, however plan 2 requires 16 M$ less investment

The role of simulation in the design of (automated) container terminals

Evaluating gate capacity

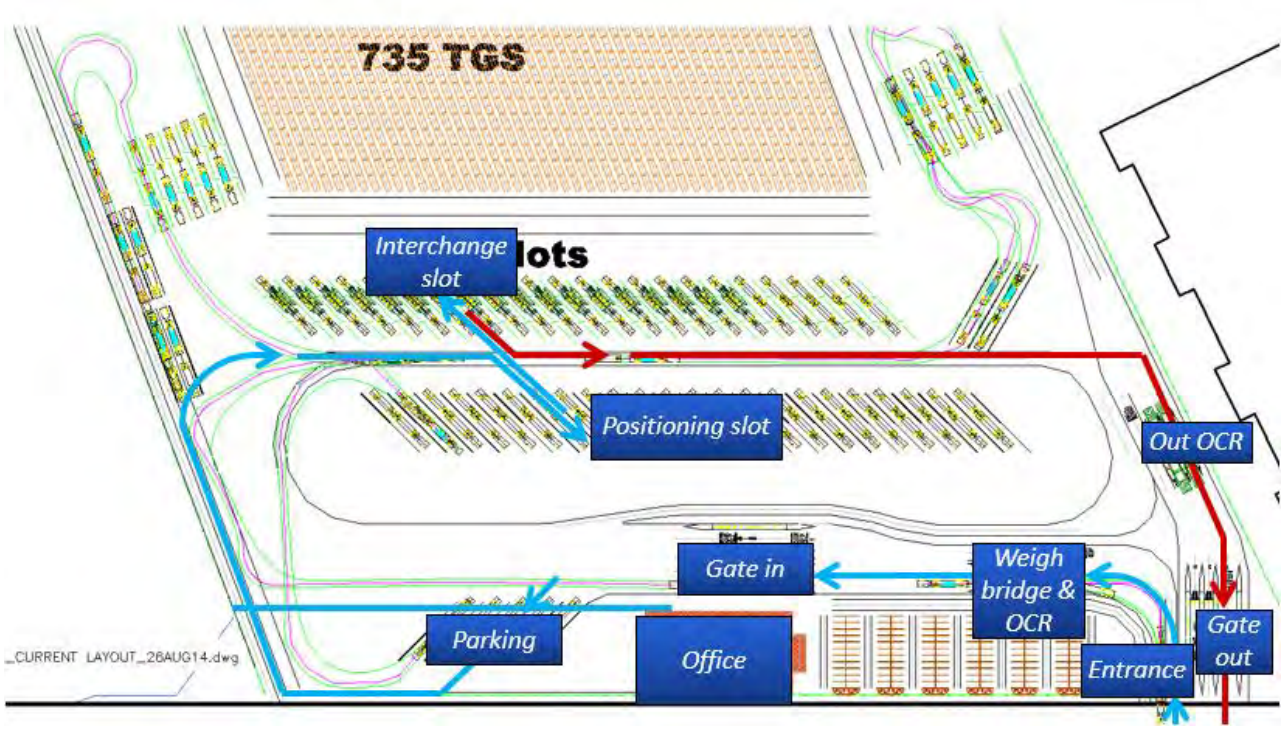
(Capacity simulation)

Pre selection
Conceptual layouts

Terminal simulation
Selected alternatives

CAPEX/OPEX
Analysis

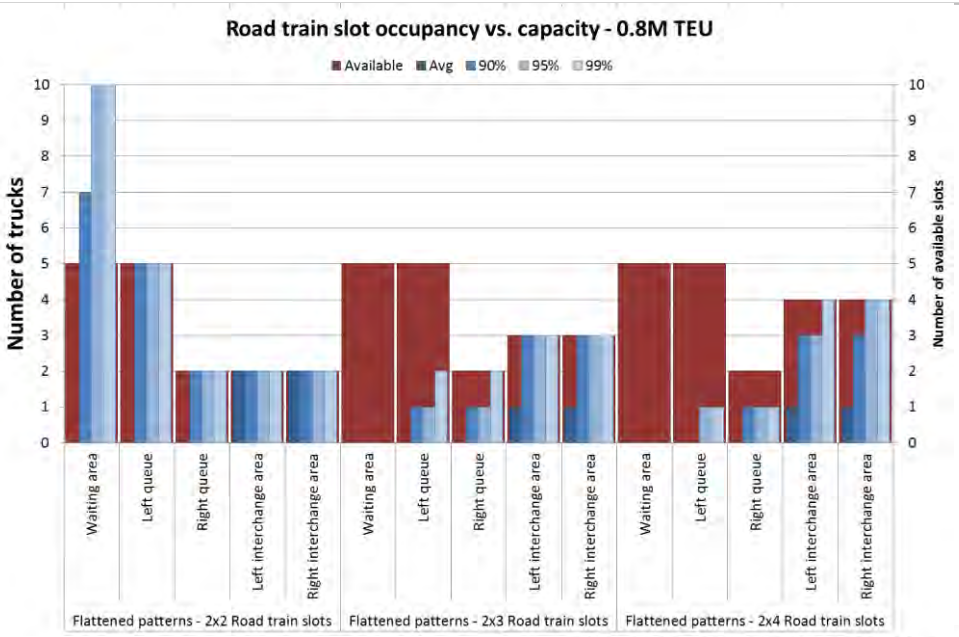
Detailed simulation

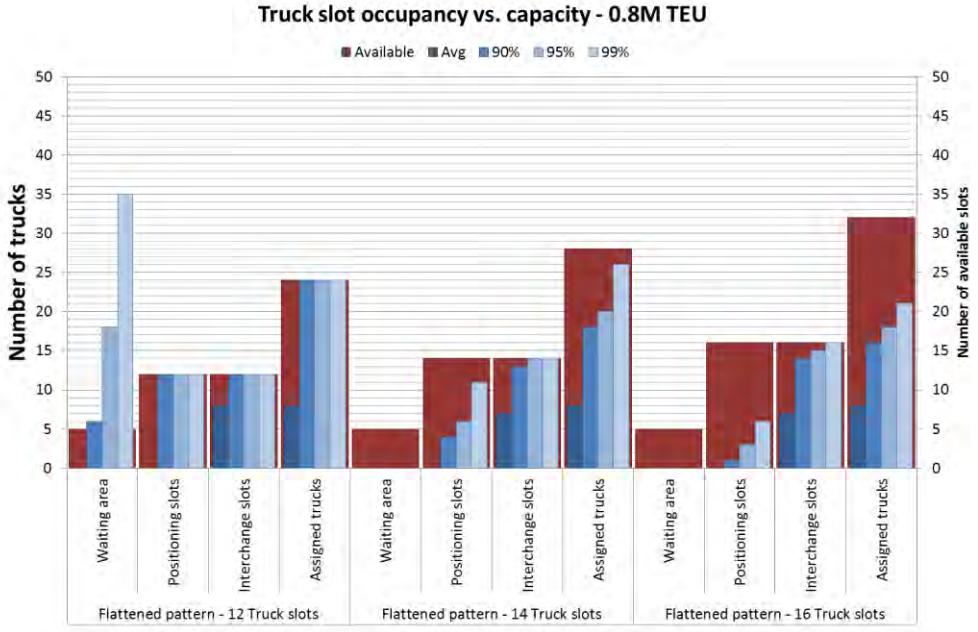


The role of simulation in the design of (automated) container terminals

Evaluating gate capacity

- (Capacity simulation)
- Pre selection
  Conceptual layouts
- Terminal simulation
  Selected alternatives
- CAPEX/OPEX
  Analysis
- Detailed simulation

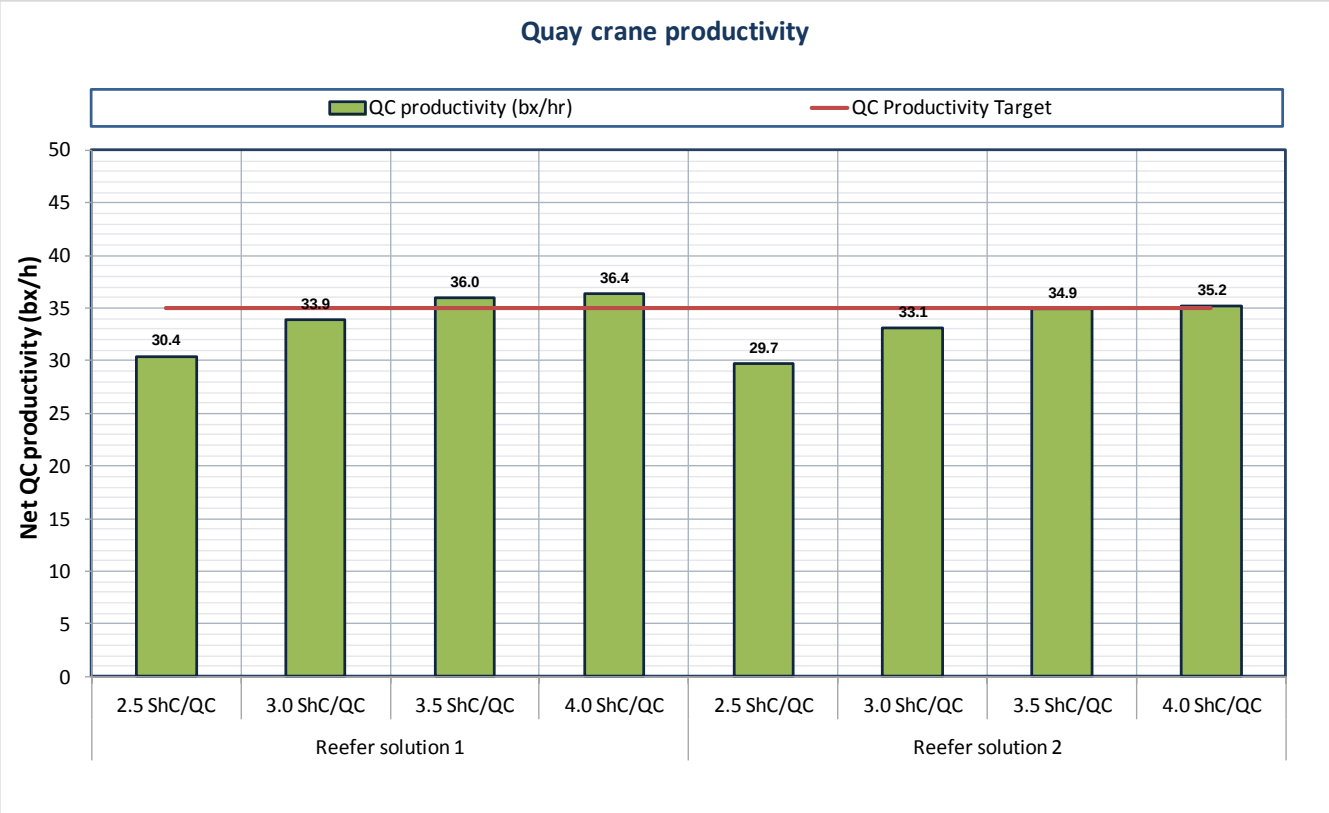




The role of simulation in the design of (automated) container terminals

Detailing reefer capacity and handling

- (Capacity simulation)
- Pre selection
  Conceptual layouts
- Terminal simulation
  Selected alternatives
- CAPEX/OPEX
  Analysis
- Detailed simulation



What is the optimal number and locations of reefer racks?

What is the impact of reefer men safety rules and (un)plug procedures on performance?

The role of simulation in the design of (automated) container terminals

Detailing reefer capacity and handling

- (Capacity simulation)
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- CAPEX/OPEX
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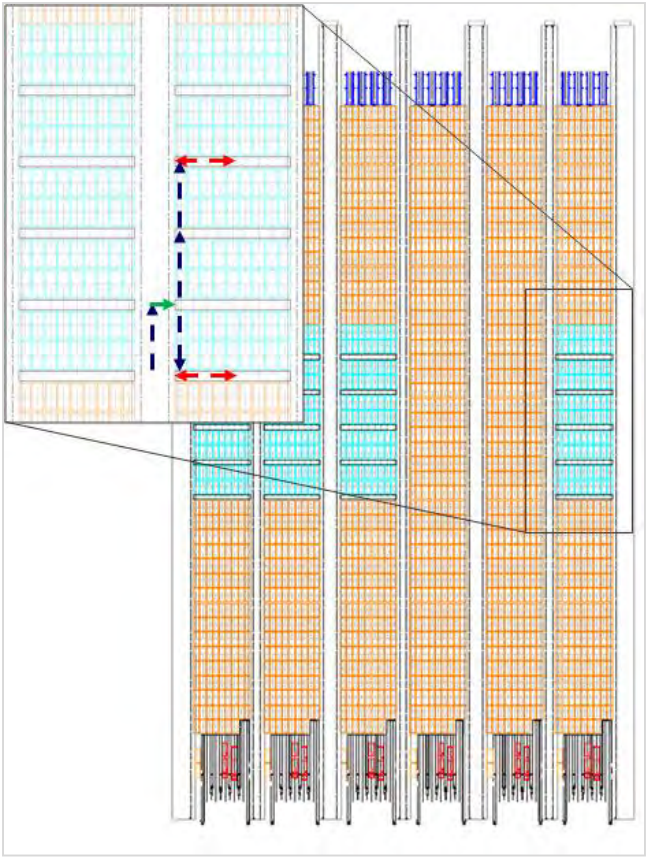
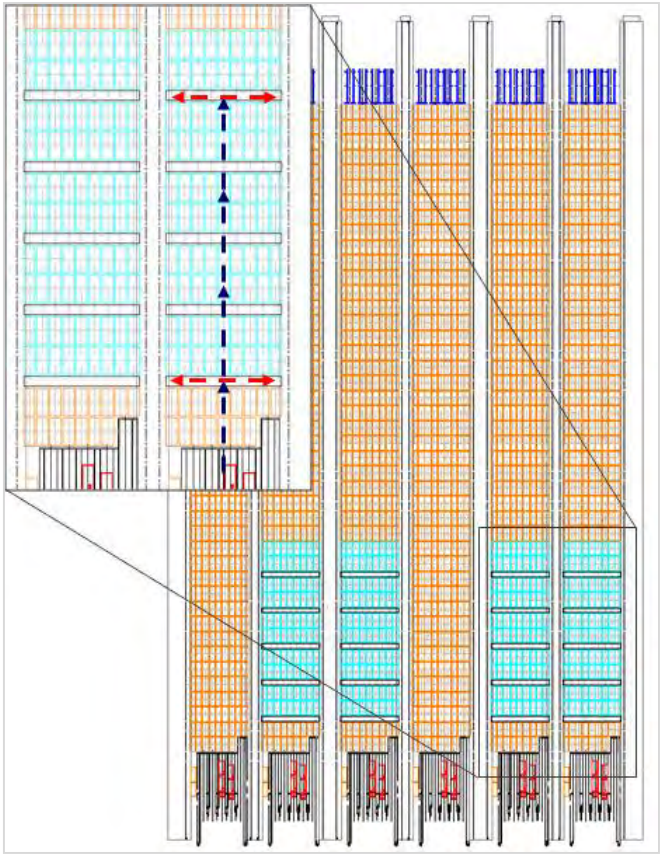
- Detailed simulation





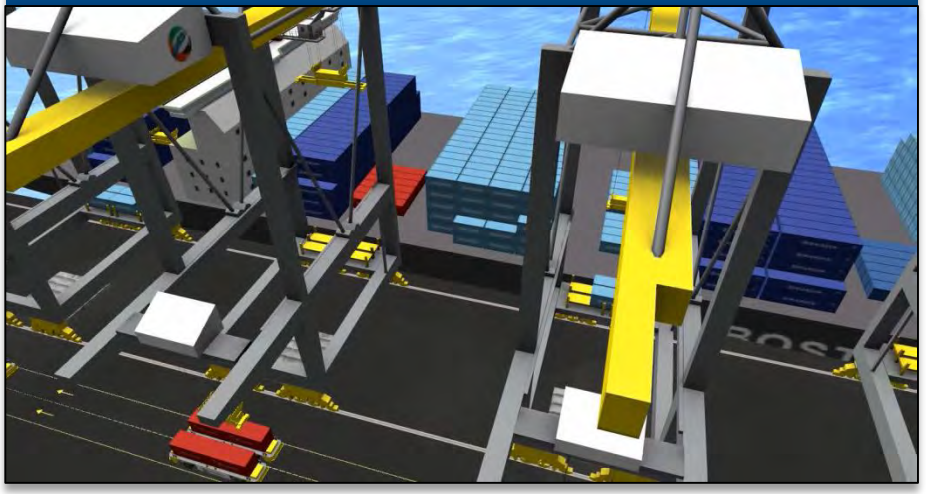
What is the optimal number and locations of reefer racks?

What is the impact of reefer men safety rules and (un)plug procedures on performance?

The role of simulation in the design of (automated) container terminals *Analyzing impact of advanced operating modes & Equipment specs*

- (Capacity simulation)
- Pre selection
  Conceptual layouts
- Terminal simulation
  Selected alternatives
- CAPEX/OPEX
  Analysis
- Detailed simulation
- Supporting simulations

Determining optimal crane specification

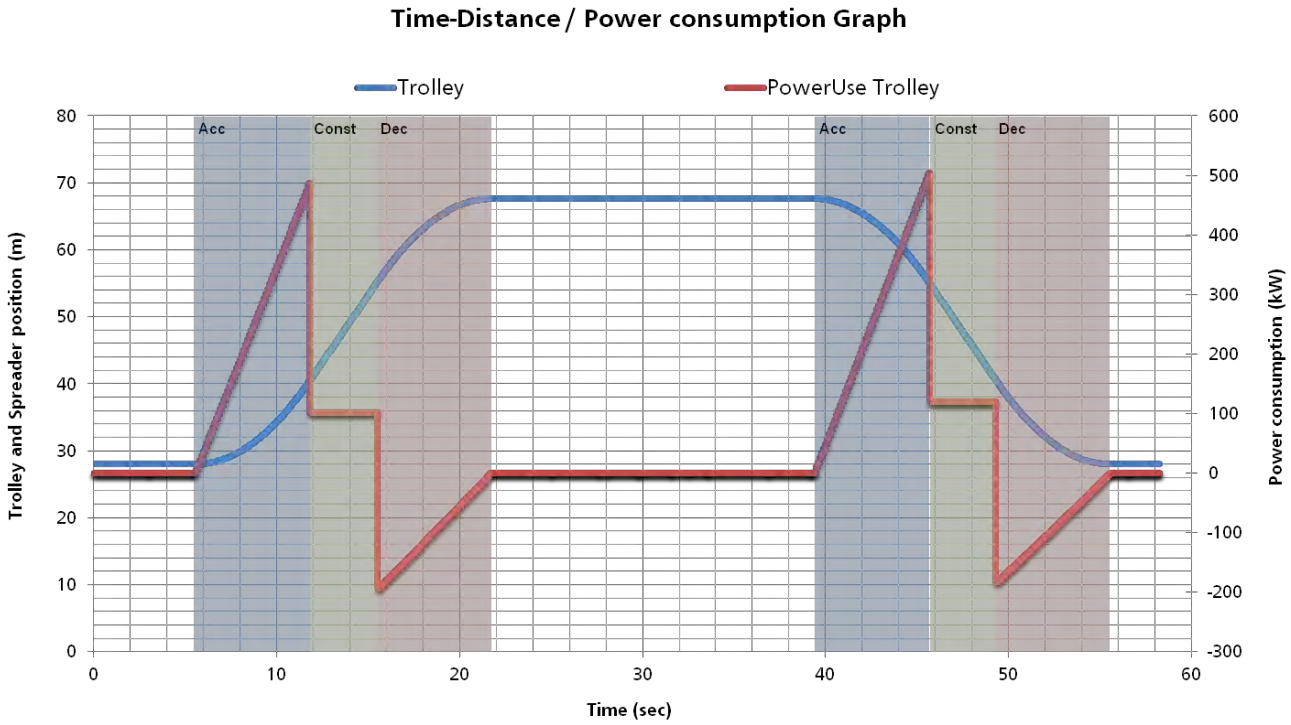


Tandem-lift operation

The role of simulation in the design of (automated) container terminals

Analyzing power requirements

- (Capacity simulation)
- Pre selection
  Conceptual layouts
- Terminal simulation
  Selected alternatives
- CAPEX/OPEX
  Analysis
- Detailed simulation



How much power is required for groups of specific equipment (ASCs, QC) or for reefers?

Determine the power use over time, including the maxim power demand

The role of simulation in the design of (automated) container terminals

Analyzing power requirements

- (Capacity simulation)
- Pre selection
  Conceptual layouts
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- CAPEX/OPEX
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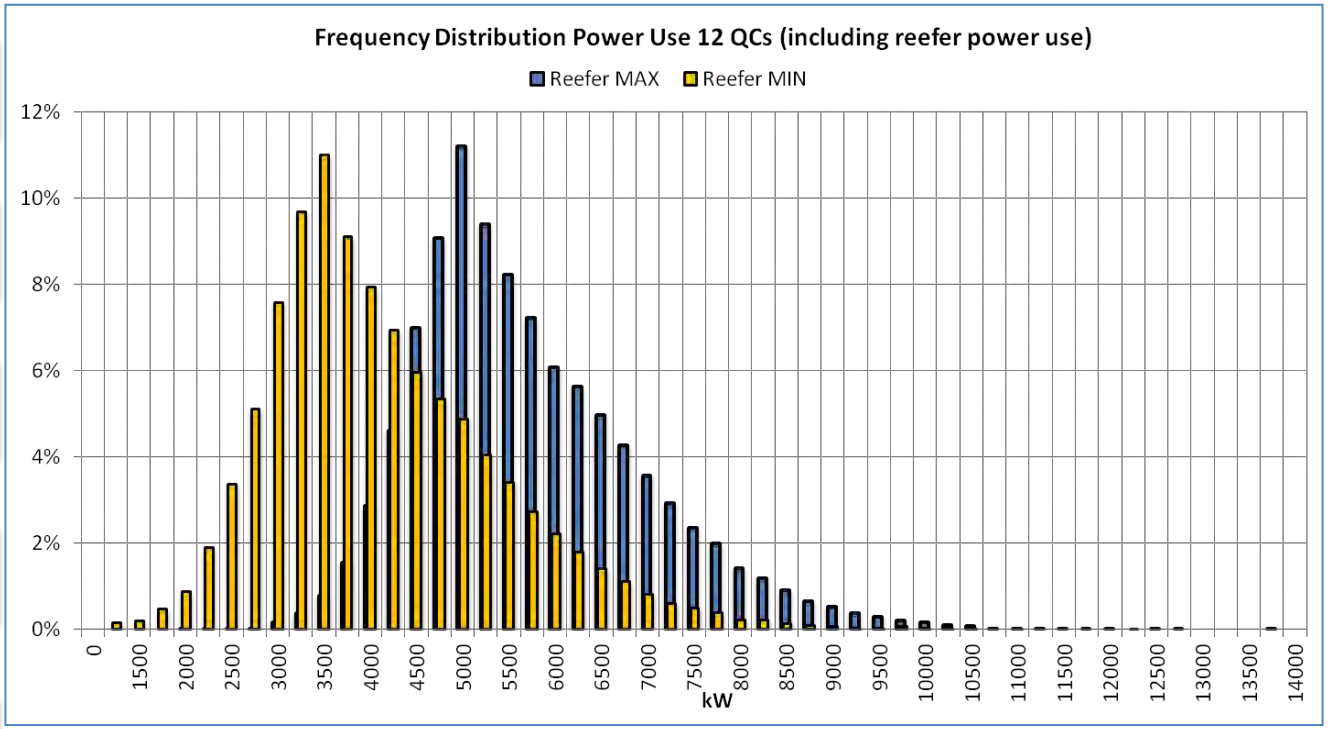
- Detailed simulation



How much power is required for groups of specific equipment (ASCs, QC) or for reefers?

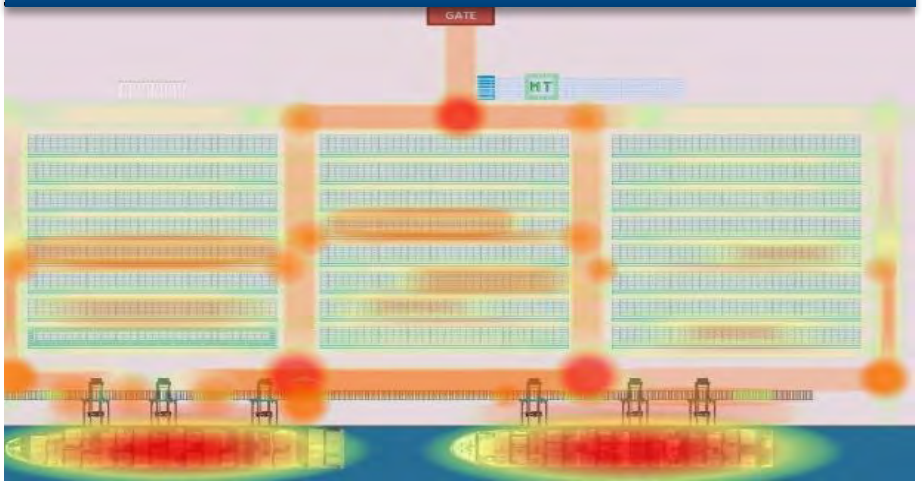
Determine the power use over time, including the maxim power demand

The role of simulation in the design of (automated) container terminals

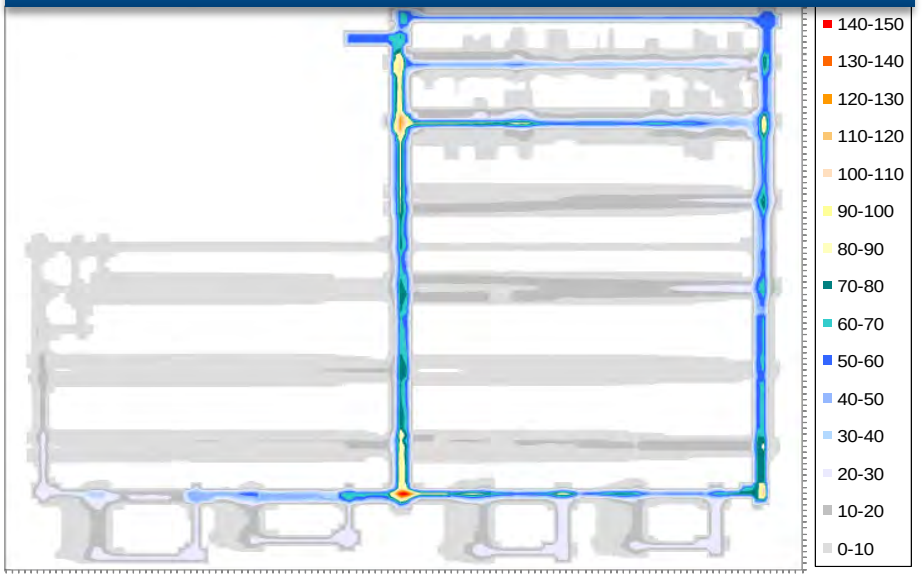
Analyzing traffic congestion and environmental impact

- (Capacity simulation)
- Pre selection
  Conceptual layouts
- Terminal simulation
  Selected alternatives
- CAPEX/OPEX
  Analysis
- Detailed simulation

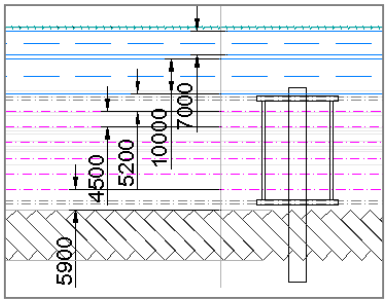
Environmental footprint



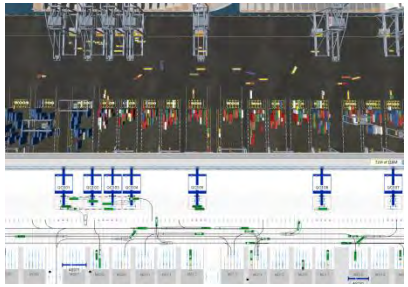
Congestion measurement / Pavement repetition



Rotterdam World Gateway – Maasvlakte 2 (The Netherlands) 2015



- 4 roads to back of terminal
- 5 operating track and 1 passing track
- One long terminal used as two bundles
- chassis TP at an angle



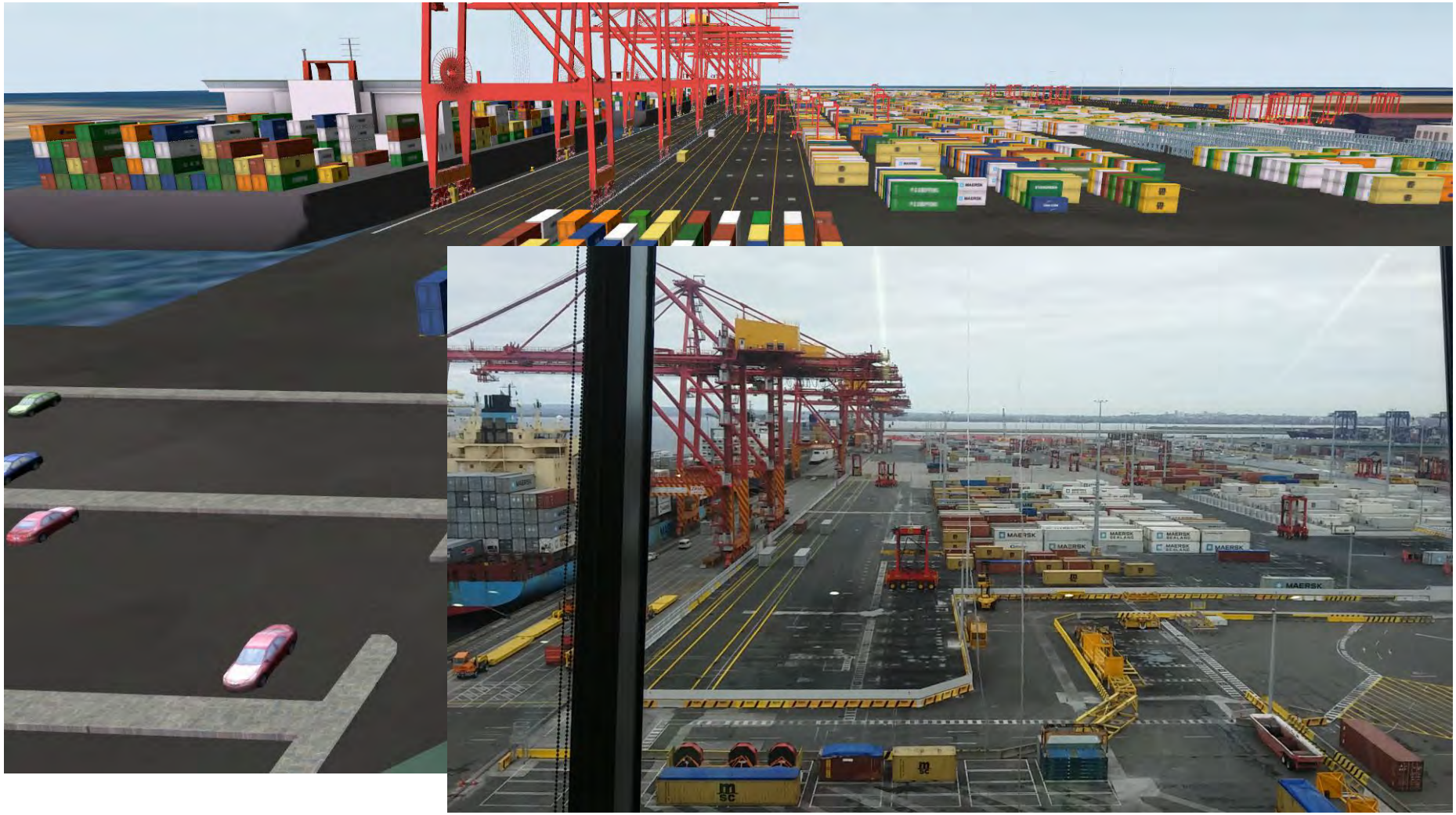
Rail terminal

Cantilever modules

Block of 10 modules

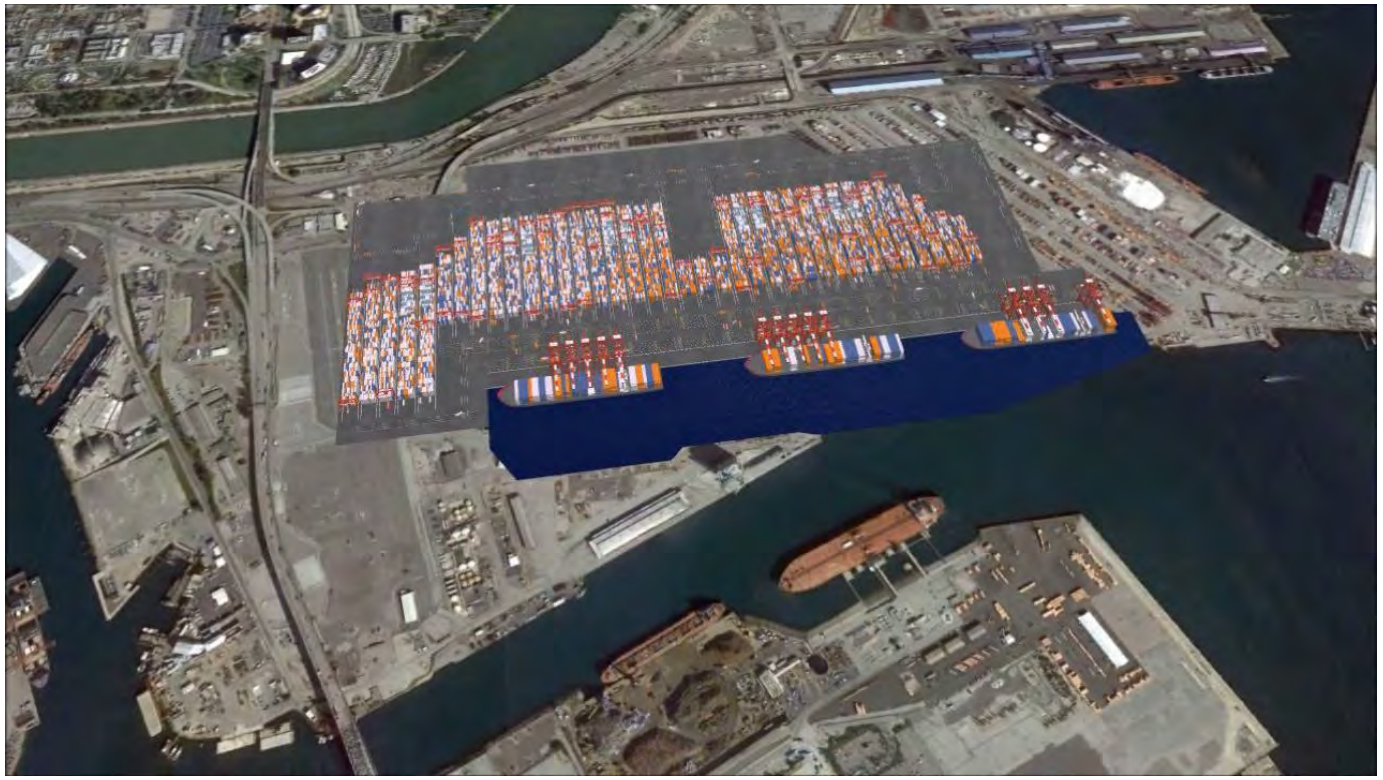
Barge stack and barge quay

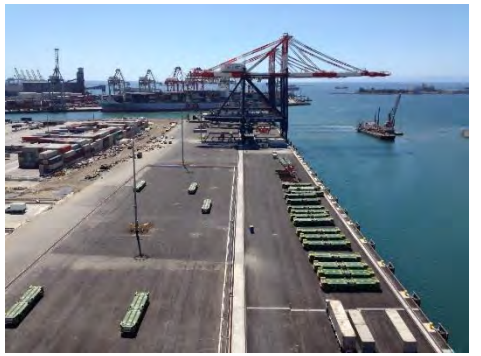
Simulation 2010 Vs. Live operation 2015

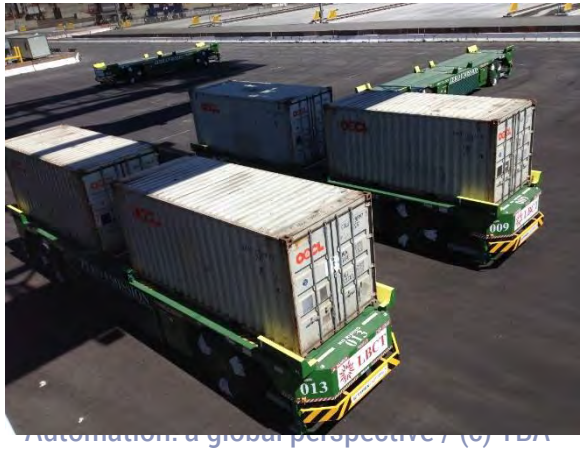


- ✔ | Videos are from Control tower. (quality of simulation video is much improved now as compared to 2010)
- ✔ | Simulation is with 6 QC, but live operation is 2 QC only

Long Beach Container Terminal (Port of Long Beach) (Planned 2016)





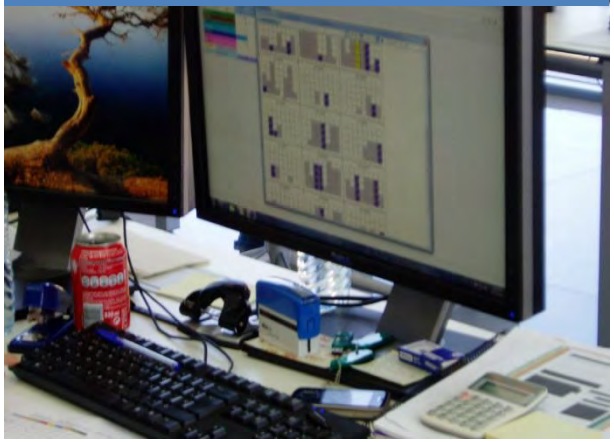


How technology tools can drive performance & training

- ✔ | Examples of optimizing performance

Process Automation: Gate operations

1. Truck appointment, including container number



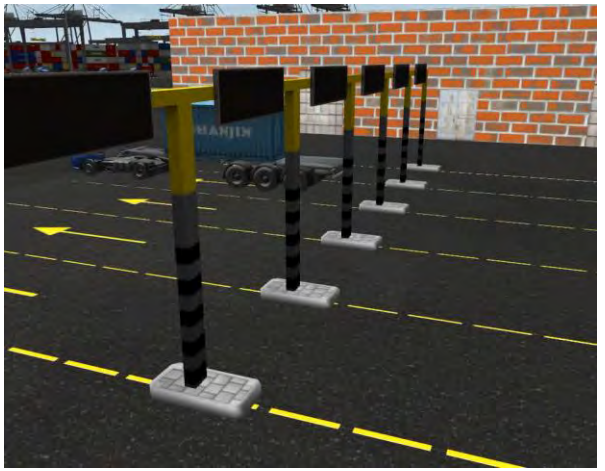
2. LPR + OCR

3. OCR read + known appointments → >99.9% quality

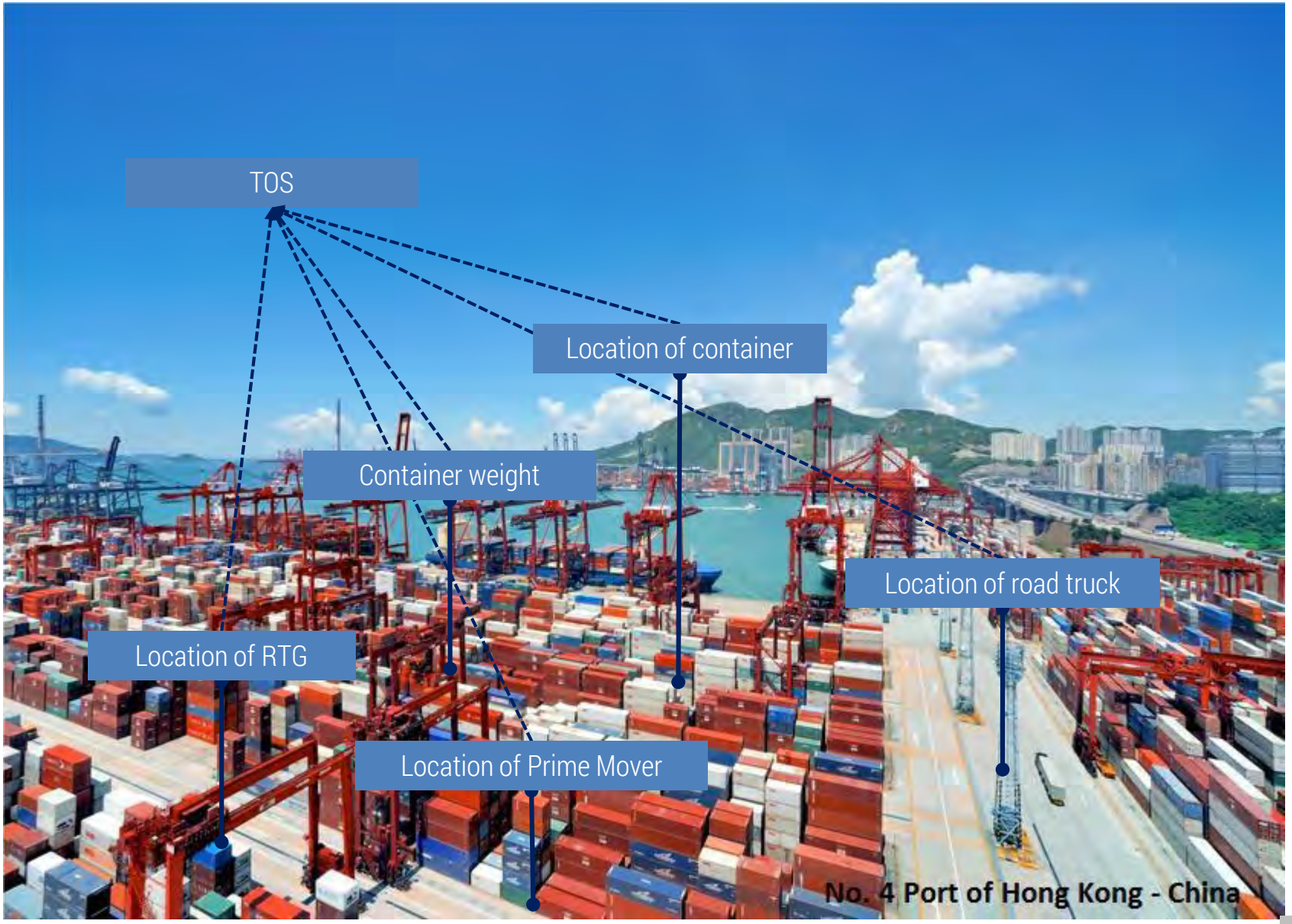
4. X-ray / radiation scan

5. Pedestal for driver ID + ticket

6. Routing advise

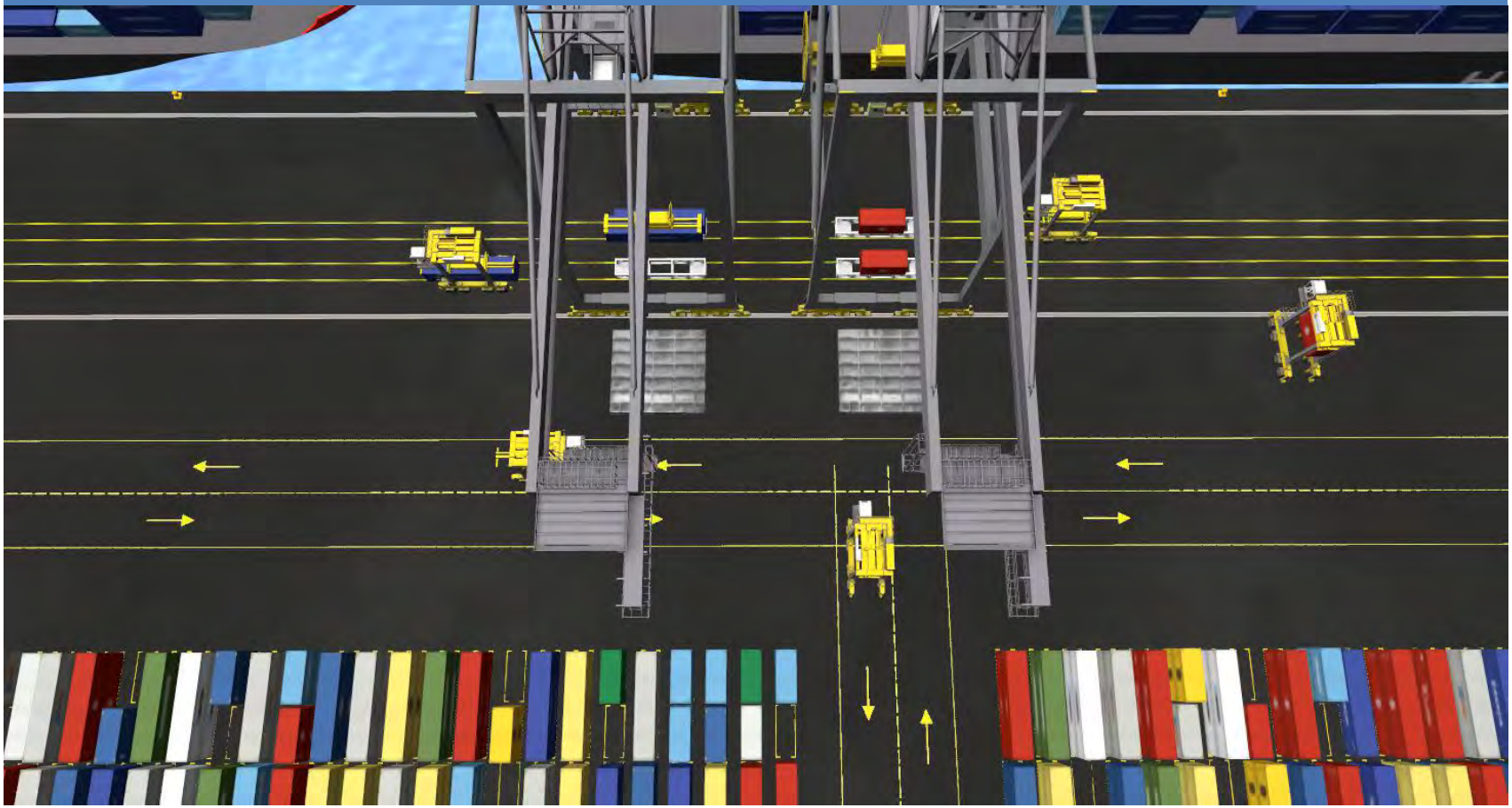


Process automation



Automated decision making

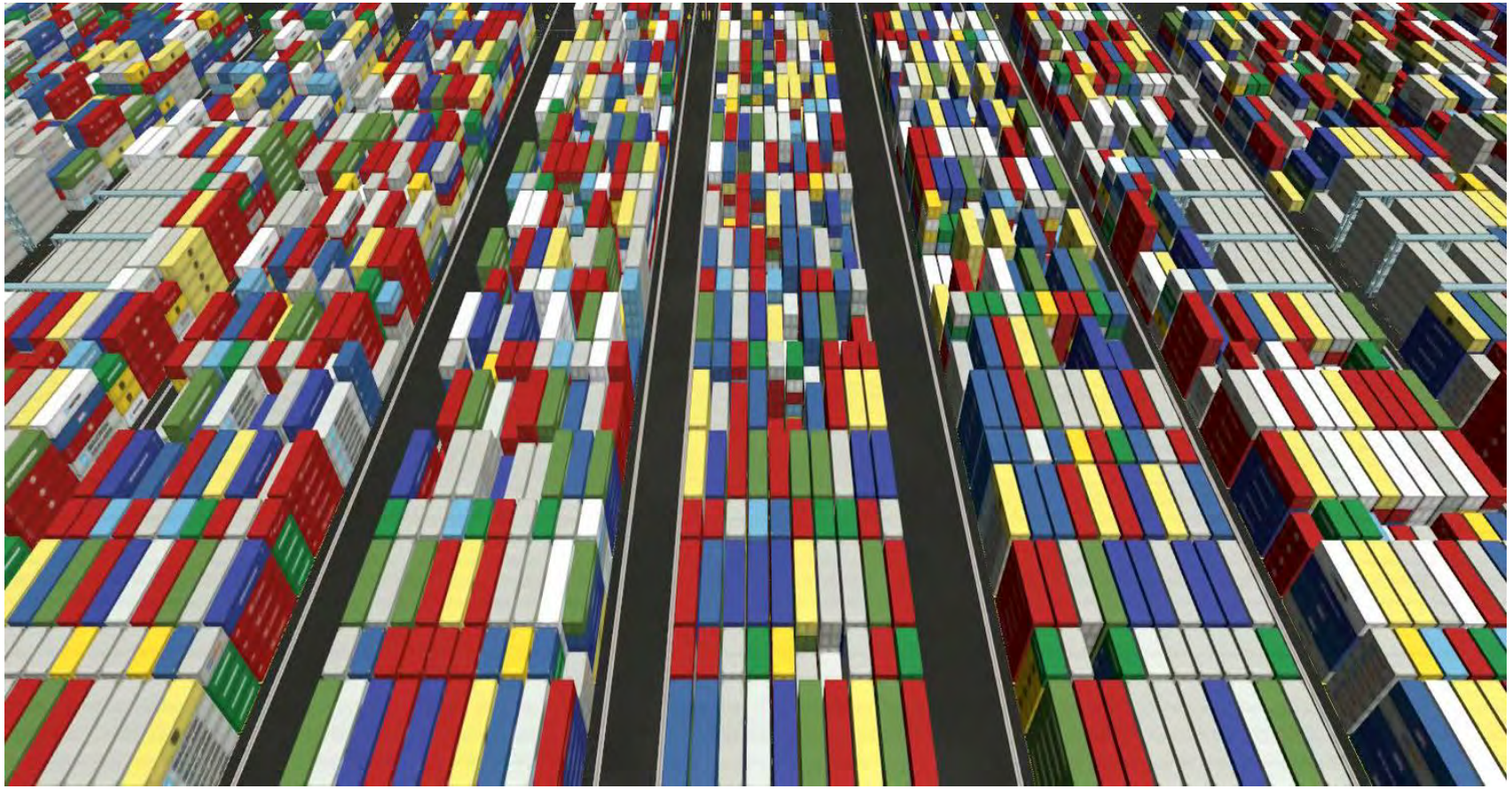
Automated vehicle dispatching & pooled allocation



- ✔ | Efficient prime route setting
- ✔ | Pooling of resources

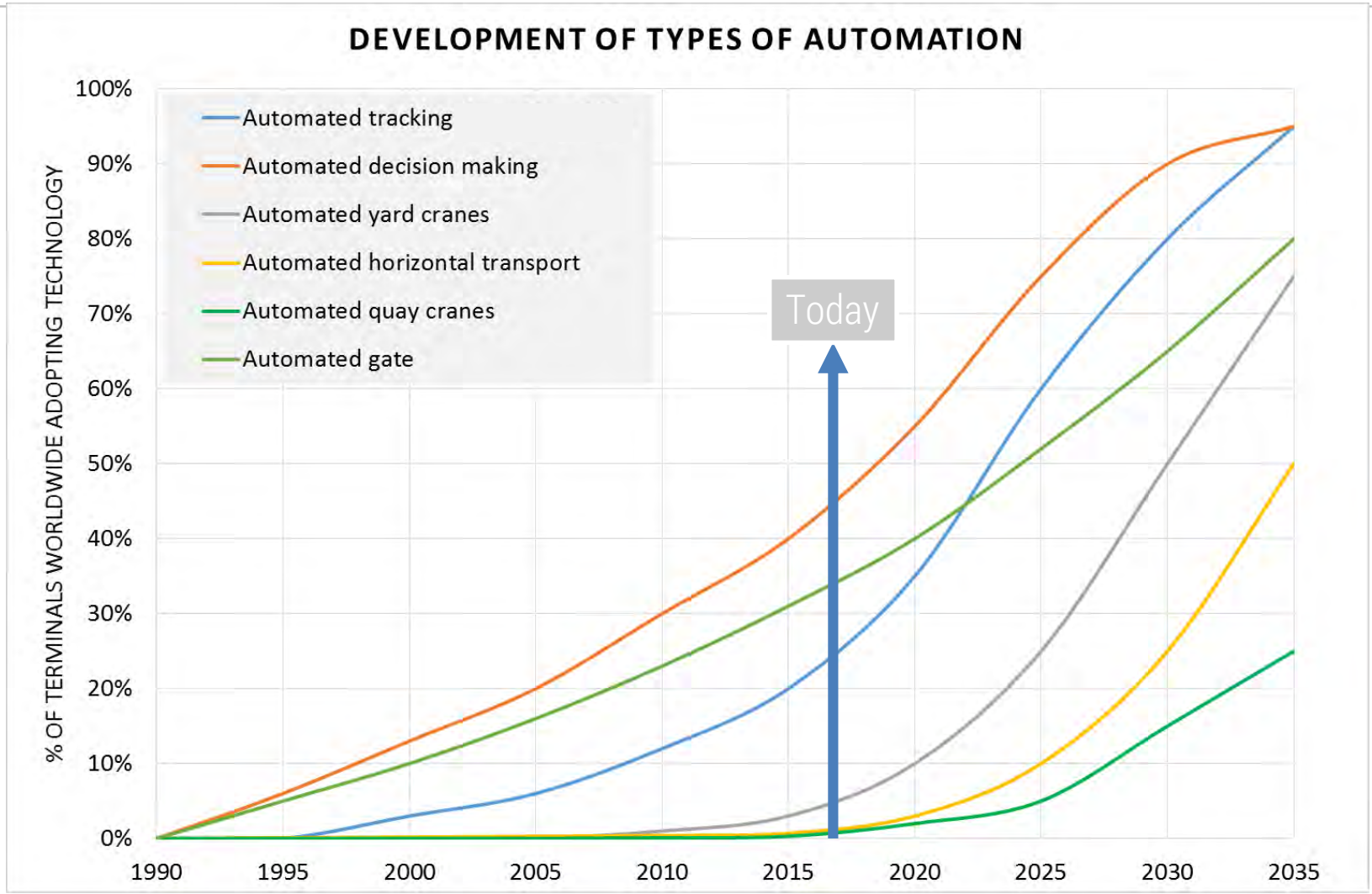
Automated decision making

Automated container decking (position assignment) based on algorithms & parameters

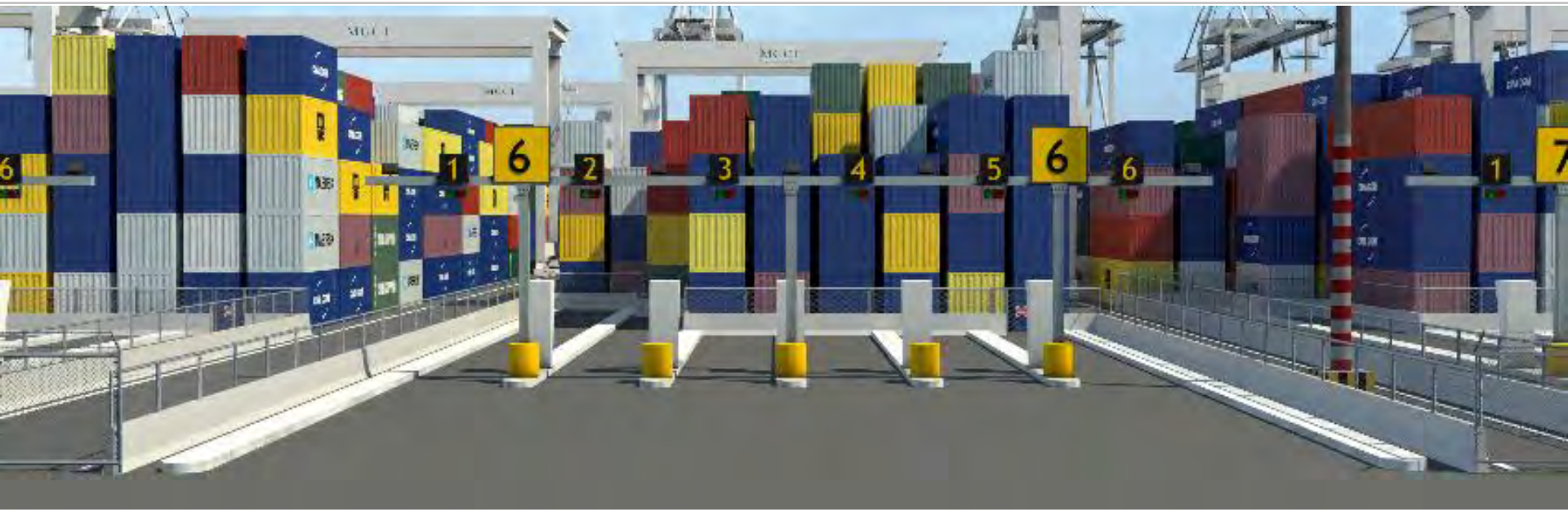


- ✔ | Optimal grounding decision, balancing many a criteria
- ✔ | It is not often achievable just by quick best judgement. Multiple iterations, testing strategy
- ✔ | Example - Re-deck the yard to test in virtual environment

Terminal adapting automation technology



- ✔ | Growing adoption of automation
- ✔ | Some automation technologies are well established & proven successful, but more are being developed
- ✔ | Need to find the right balance technology & conditions



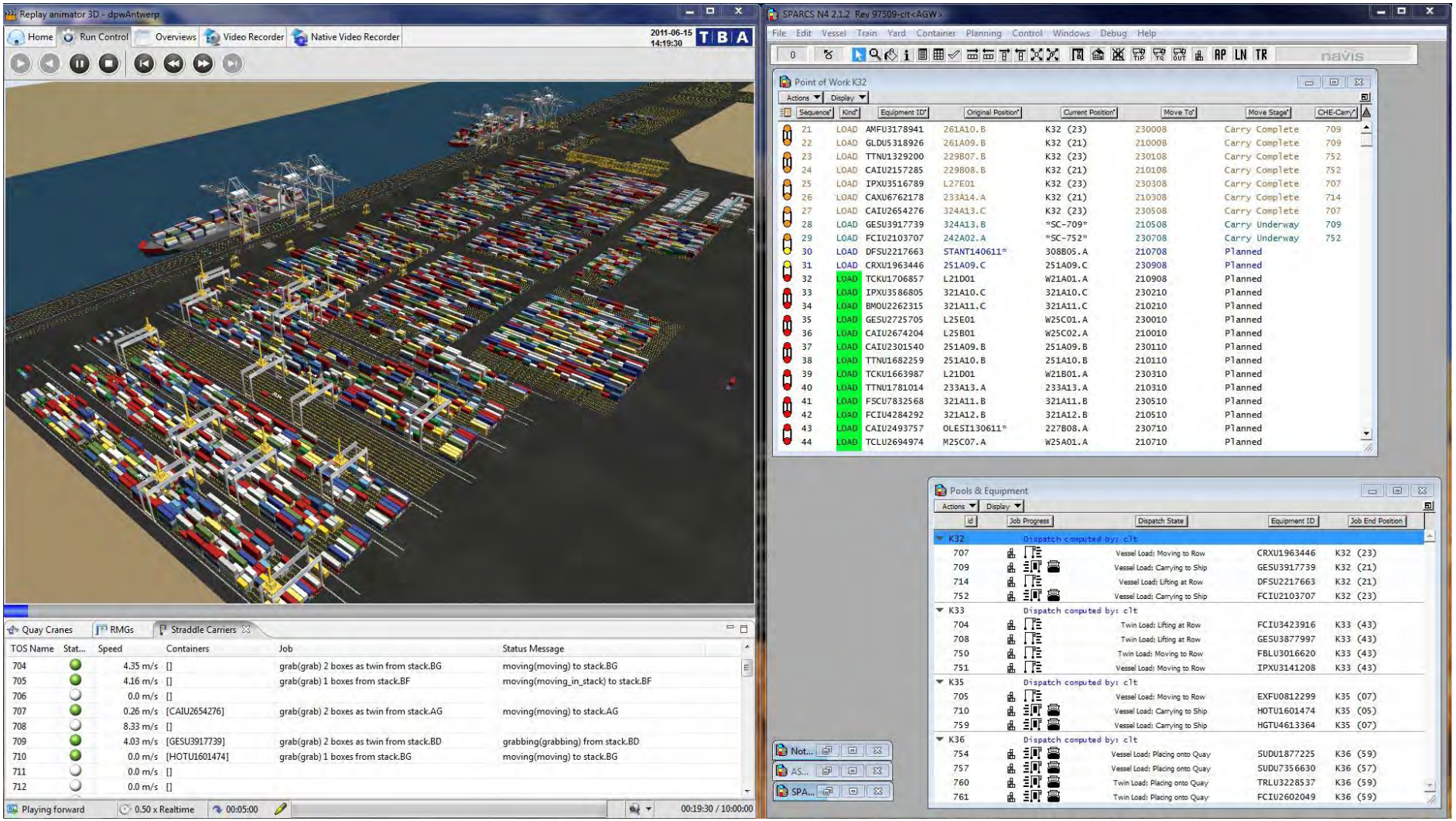
EMULATION

Virtual terminal linked to live TOS

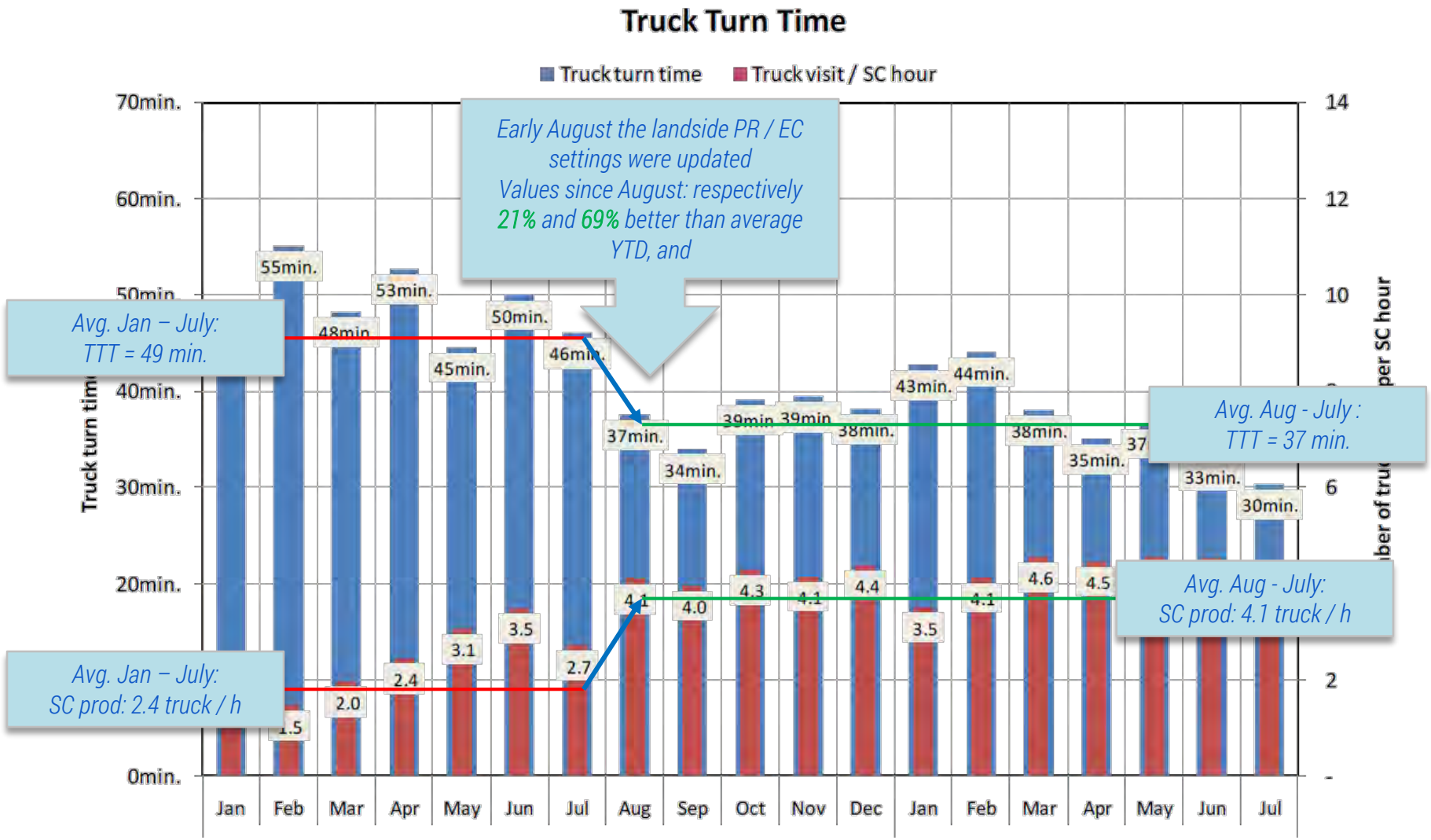
- ✔ Testing, tuning, training

- ✔ The questions:
  - Testing in virtual environment
  - How do I quantify if my terminal is using the TOS to it's full potential?
  - How do I quantify benefits of operational changes or setting changes for my terminal?

The emulation running together with SPARCS N4

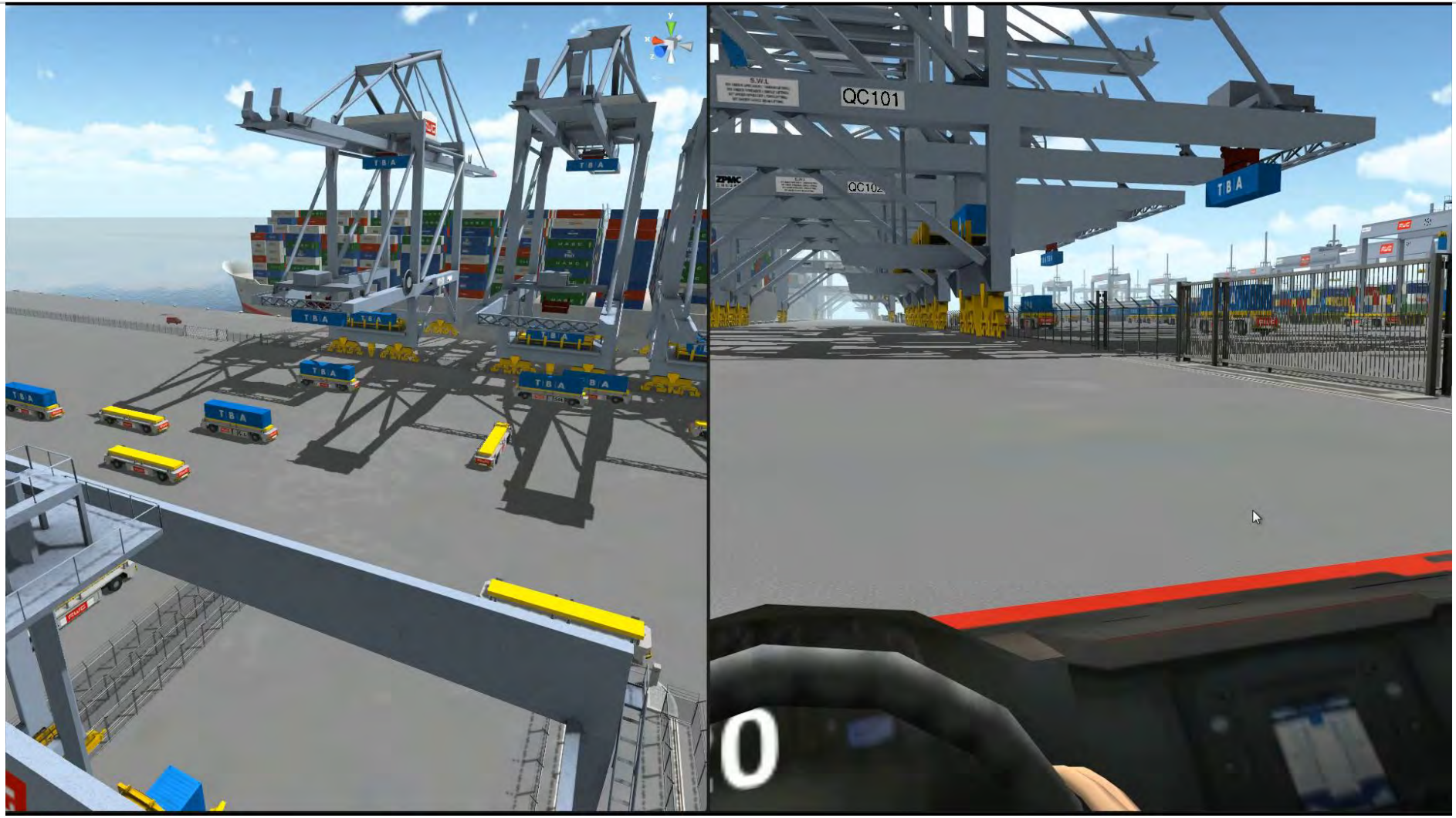


Using emulation as training tool



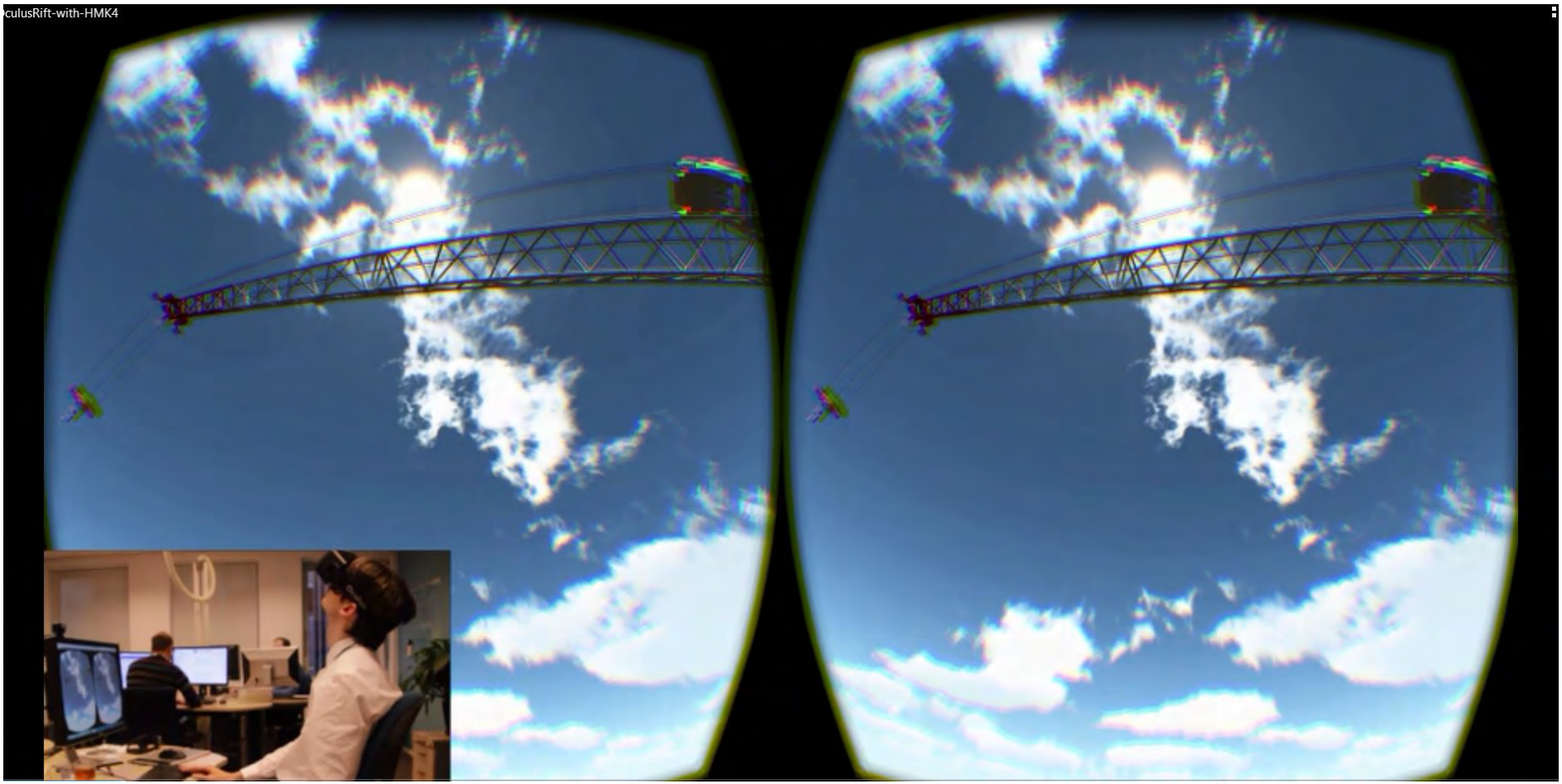
- ✔ | Other examples – planner training, dispatcher, autostow training
- ✔ | Team or management game- operate a virtual terminal and compete against other teams

Safety training 3d immersion & 360 3D degree videos



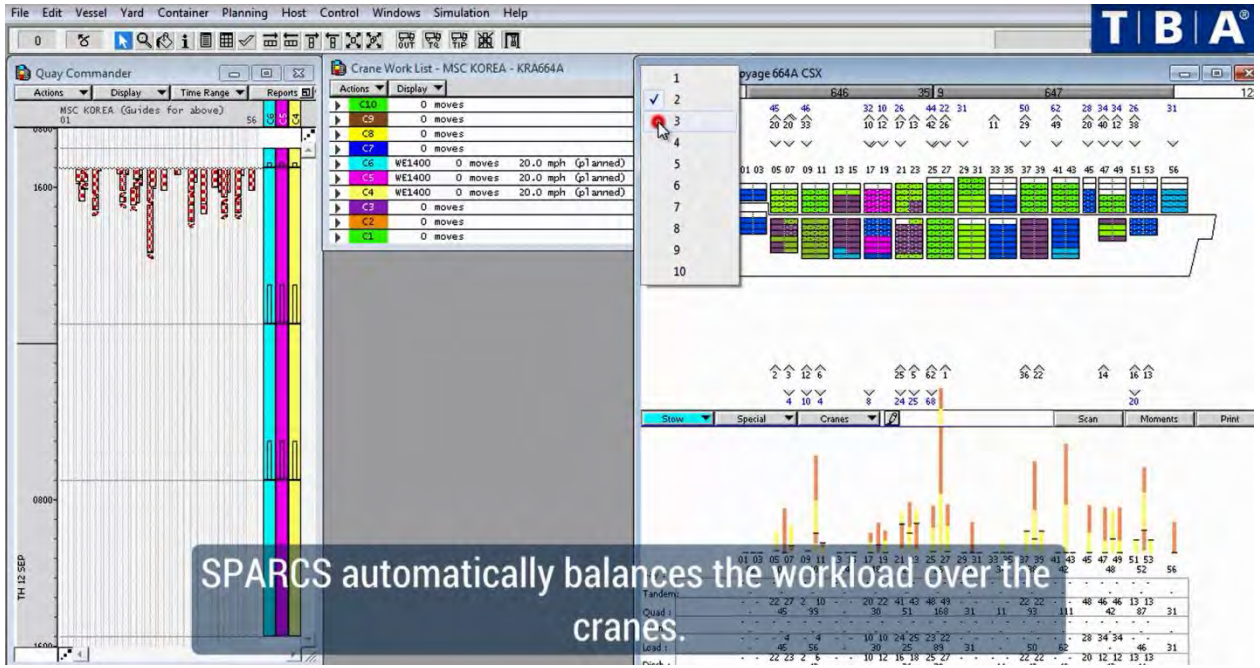
- ✔ | Near live training
- ✔ | 3d Immersion

OculusRift- visit & walk around virtual terminal



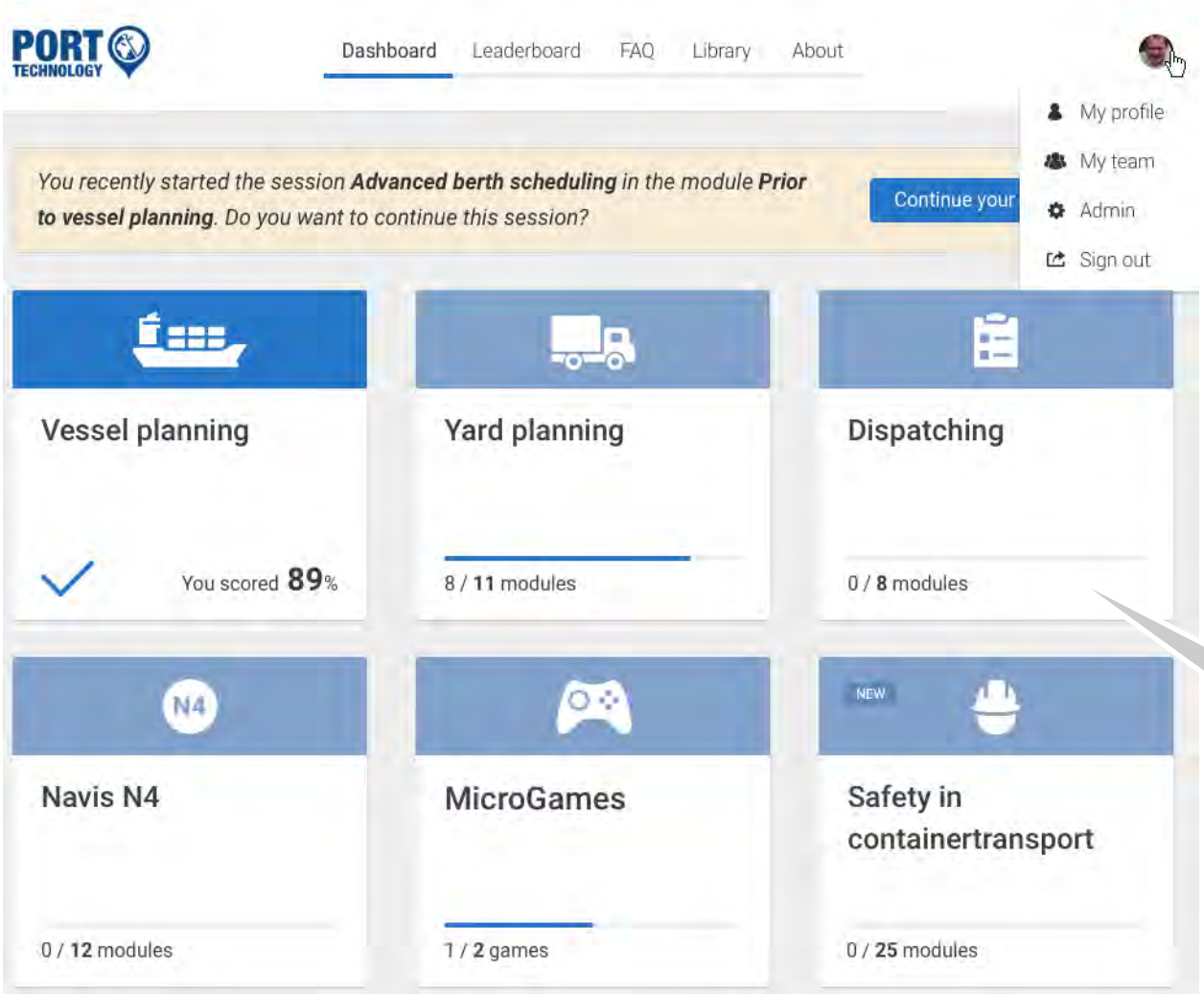
TOS Training portal- Web based – independent terminals

- ✔ I Instruction movies with voiceover
- ✔ I 3D visualization of the effects in operations
- ✔ I Documentation (PDF)
- ✔ I Statistics
- ✔ I Tests
- ✔ I Games

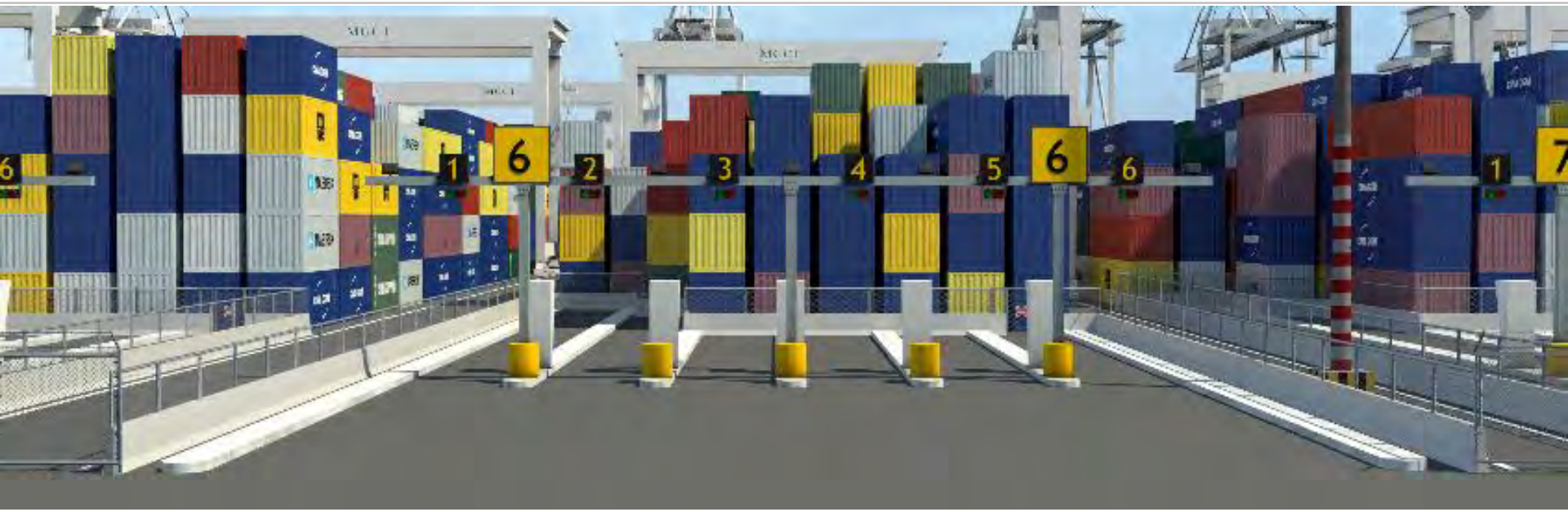


TOS Training Portal – Dash board- independent terminals

- ✔ | Progress per training is shown
- ✔ | Score per training is shown
- ✔ | Discussion & chat portal
- ✔ | Shared information
- ✔ | Games



Trainings each containing several modules



Developments in container shipping environment & how that relates to operations & performance

Terminal operating environment & performance

Liner shipping environment

- ✔ I 7-8% of TEU fleet is laid up. Container shipping index is lowest in many trades.
- ✔ I Shipping line consolidation & larger alliances
- ✔ I Lines are making large losses. What next when fuel prices increase again, will BAF be enough or still more pressure.
- ✔ I Impact on service providers (in a contestable market)?
- ✔ I Some ports have seen a 50-70% increase in vessel & call size
- ✔ I Pots & terminal - What's your size?

Terminal operating environment & performance

- ✔ Call size increase & much higher peak with similar volume
- ✔ Expected ports stay is similar i.e. berth productivity increase ~ with call size increase
- ✔ Community & environmental standards are adding costs & expectations
- ✔ Limited scope for rate increase in many cases where there is real competition
- ✔ Adding more quay length, cranes or gate lanes is expensive
- ✔ New greenfield developments are not cheap (especially in current economic uncertainty & without resources boom…)
- ✔ If we look back, ports have given rise to thriving cities & communities, but now ports are under pressure from urban encroachment, yet volumes continues to grow
- ✔ Use of technology holds the silver lining to get more from less
  - Design new terminals & future developments plan using the best tools at hand.
  - Drive performance & optimize operations with available tools and assistance
  - Improve staff operational & safety training & understanding
- ✔ Inland terminal may provide another lease of life & added capacity to some terminals

Thank you for your attention

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Company board:
Ir. Martijn Coeveld – CEO / Managing Director
Dr. ir. Yvo Saanen – COO / Managing Director
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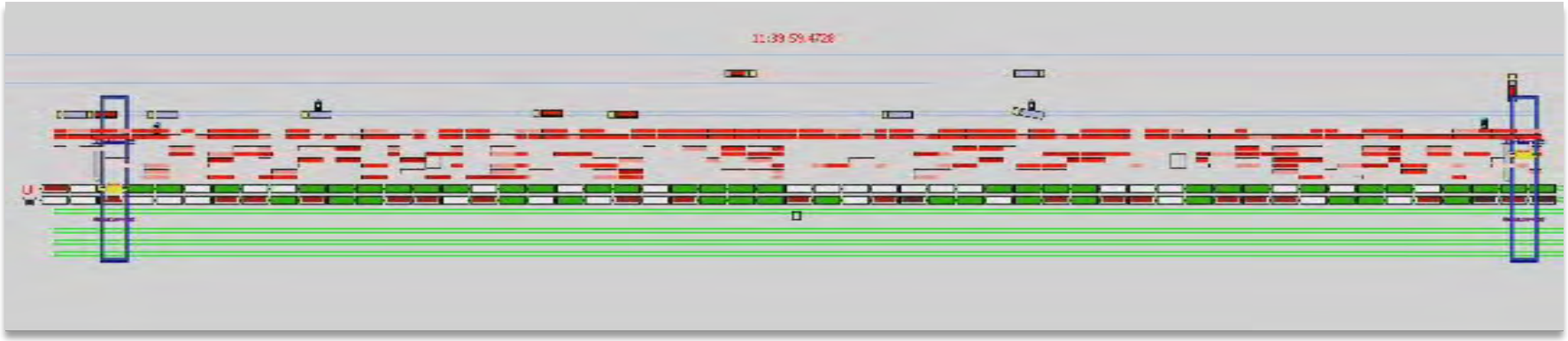
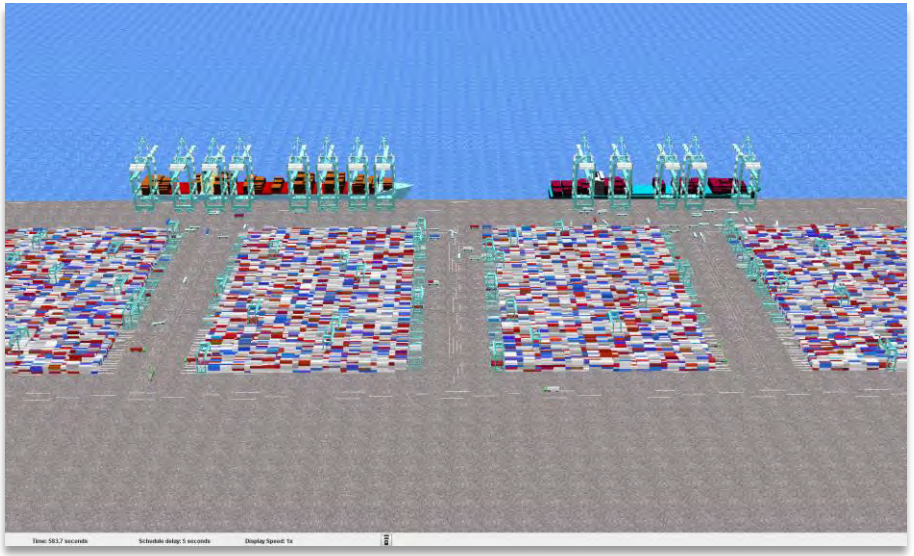
- ✔ | Burchardkai Hamburg (600,000 TEU)
- ✔ | Tollerort Hamburg (600,000 TEU)
- ✔ | Acacia Ridge Brisbane (500,000 TEU)
- ✔ | Antwerp Gateway (450,000 TEU)
- ✔ | UP Long Beach (1,500,000 containers)
- ✔ | Port Botany Rail yard (490,000 TEU)
- ✔ | Euromax Rail Terminal (450,000 TEU)
- ✔ | Hupac Intermodal Galarate (1,000,000 TEU)
- ✔ | Ludwigshafen Intermodal (150,000 TEU)
- ✔ | WCT Meerhout (250,000 TEU)
- ✔ | CXSI Ohio (500,000 TEU)
- ✔ | Kutno intermodal (250,000 TEU)
- ✔ | Frenkendorf, Switzerland (250,000 TEU)
- ✔ | Chullora, Sydney 450,000 TEU
- ✔ | Dynon, Melbourne (600,000 TEUs)
- ✔ | Moorebank, Sydney (1,500,000 TEUs)
- ✔ | MCS, Sydney (450,000 TEUs)
- ✔ | NSW Ports Port Botany 3,00,000 TEU

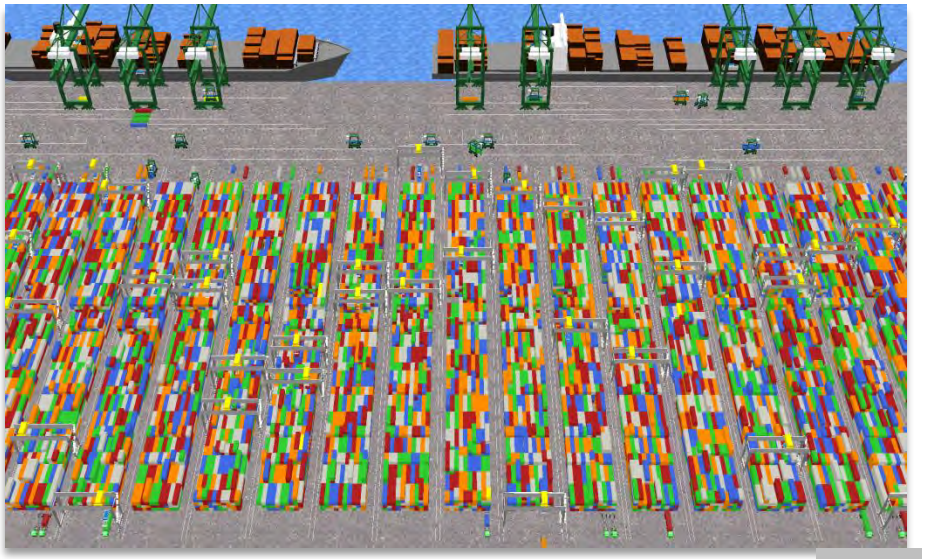


Summary Project Portfolio

✔ Design of new facilities:
- APMT North America – Norfolk (2003 – 2007)
- DPWorld – Antwerp Gateway (2004 – 2007)
- HPH / Euromax Rotterdam (2004 - 2008))
- DPWorld - London Gateway (2005 – 2008)
- HPH / ECT – barge / feeder terminal Rotterdam (2006)
- DP World - Jebel Ali CT2 (2006)
- DPWorld – Fishermans Island Terminal (2007 - 2008)
- Transnet – Nquga & Durban Container Terminal (2007)
- HPH Tercat - Barcelona Muelle Prat (2007)
- APMT – Maasvlakte II terminal (2008 - 2009)
- DP World - Jebel Ali CT3 & CT4 (2008)
- DPWorld – Rotterdam World Gateway (2009)
- Lekki Port (Nigeria, 2010)
- Khalifa Port (2010)



✔ Extension of existing facilities:
- APMT Algeciras (2003 – 2008)
- DPWorld – Southampton container terminal (2008)
- Port of Gothenburg (2004, 2007 - 2008)
- APMT – Tanjung Pelepas (2005 – 2008)
- HHLA – Burchardkai Hamburg (2006)
- HPH - Thamesport extension (2006)
- PSA Voltri Terminal Europe (2006)
- Packer Avenue Terminal Philadelphia (2006 – 2007)
- HHLA – Tollerort container terminal Hamburg (2007)
- ICTF – UPRR Long Beach (2007)
- Northport, Malaysia (2007 - 2008)
- Global New York (2009)
- Port Otago (2009)
- Namport (2010)



Summary Project Portfolio

- ✔ Optimization of existing facilities (layout, TOS, operations):
  - DPWorld Port Botany, West Swanson (2006 - 2008)
  - HHLA – Container terminal Altenwerder (2007 – 2008)
  - Durban Container Terminal (2007)
  - DPWorld Caucedo, Chennai, Manilla , Sokhna (2007 - 2010)
  - APMT Rotterdam (2007 – 2010)
  - TSI Vancouver (2008 - 2009)
  - Ocupa Manzanillo (2008)
  - **Port of Napier (2009-2010)**
  - **PNCT New York (2010)**

- ✔ Performance assessment of equipment specifications
  - NTB (2004, 2006)
  - Euromax (2005)
  - APMT-PTP (2006)

- ✔ Optimization Terminal Operating Systems (CONTROLS):
  - DPWorld Pusan Newport (2006, 2010)
  - APMT Portsmouth, Rotterdam, Algeciras (2006 - 2008)
  - Eurogate Hamburg (2007)
    MSC Home Terminal (2007 – 2009)
  - DPWorld Antwerp Gateway (2008 - 2009)
  - Gothenborg Havn (2009)
  - DP World Callao (2010)
  - Namport (2010)
  - Busan New Port (2010)

- ✔ Delivery Automated Equipment Control Systems (TEAMS)
  - CTA (Hamburg, 2002)
  - Euromax (Rotterdam, 2008)
  - Antwerp Gateway (2007)