Sustainable Design for the Cargo Handling Terminal of the Future

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Peter R. Vandermat, Ing.
Transportation Business Analyst
JWD Group, a division of DMJM Harris

Alternate Container Terminal Design

Euromax Terminal, Rotterdam – Conceptual Design

Review of Green Terminal Features

Euromax Terminal, Rotterdam – "Green" Features

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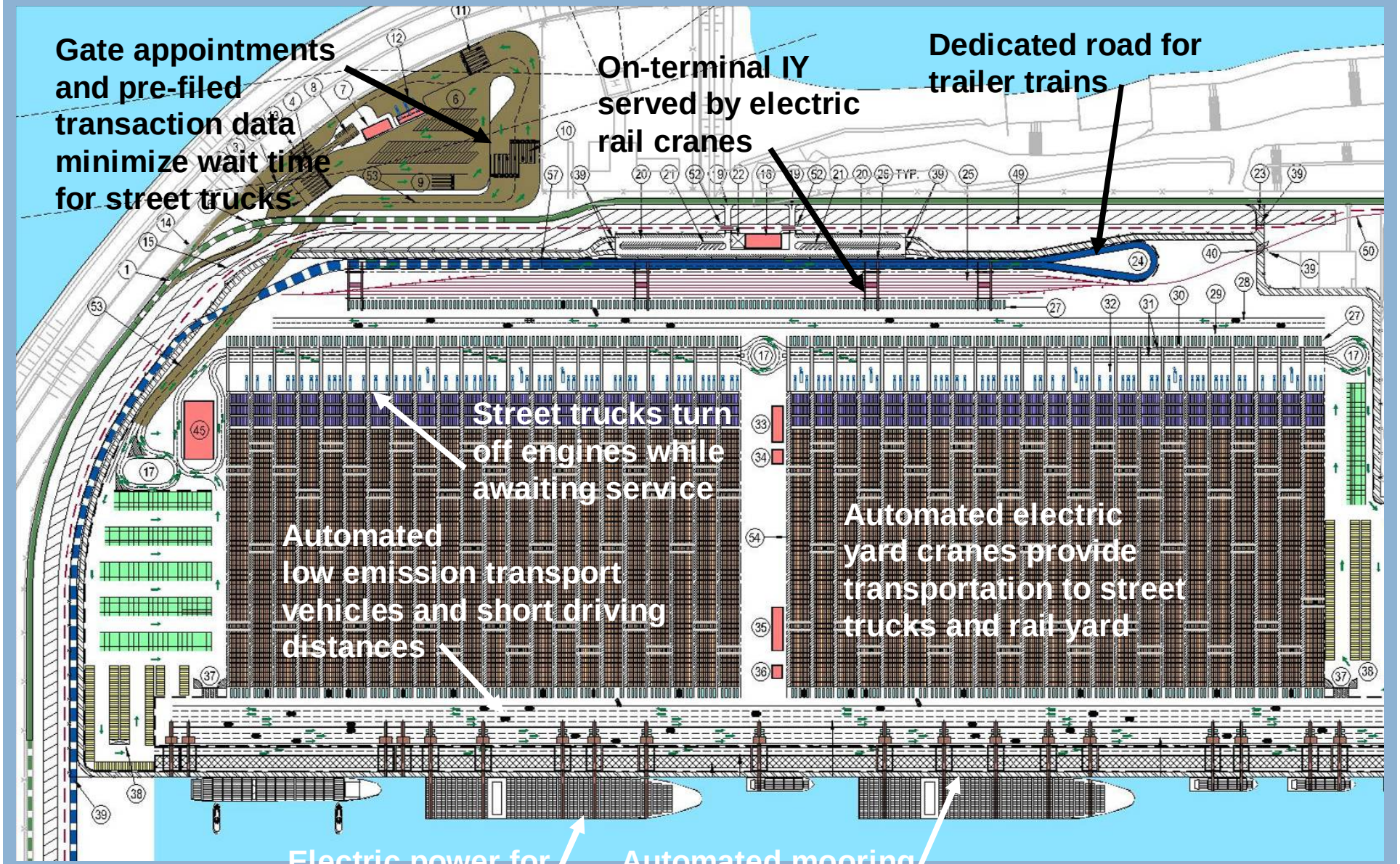


Sustainability Features of Euromax - 1

- At least 60% fewer diesel engines than “traditional” comparable terminal
- High crane productivity – faster vessel turn-around
- Relatively low street truck volumes due to:
  - Transshipment to/from short-sea vessels
  - Transshipment to/from river barges
  - On-dock intermodal rail yard
  - Dedicated trailer-train road network for transfer of containers to other terminals or intermodal yards
- In-terminal street truck driving distances are minimized

Sustainability Features of Euromax - 2

- Use of technologies minimize truck turn times:
  - Appointment system
  - Electronic pre-filing of gate transaction data
- Application of LEED principles in building design
  - Environmental “friendly” materials
  - Energy efficient
- Features under consideration:
  - Alternate Marine Power (AMP) for docked vessels
  - Use of Automated Mooring systems
- “Missing” feature
  - Settlement ponds for initial rainfall run-off

Economic Features

- High investment cost for:
  - Container handling equipment
  - Container handling equipment infrastructure
  - Computer hardware and software
- High net crane productivity of 35 lifts/hr
- High level of automation reduces personnel cost
- Lower personnel cost offsets the high investment cost
- Cost per vessel lift currently comparable to “traditional” terminal and expected to be lower in the future

Societal Features

- High use of alternate transport (short-sea, barge, rail) reduces truck trips, truck emissions, and congestion
- Safe work environment:
  - Strict (fenced) separation between manual and automated functions
  - Fewer people on terminal reduces accidents
  - Street trucks restricted to land-side of yard cranes and there are virtually no intersections
- Terminal design includes daycare center with outdoor playground

Vessel Emissions Reductions

Alternate Marine Power

Standard evolving toward:

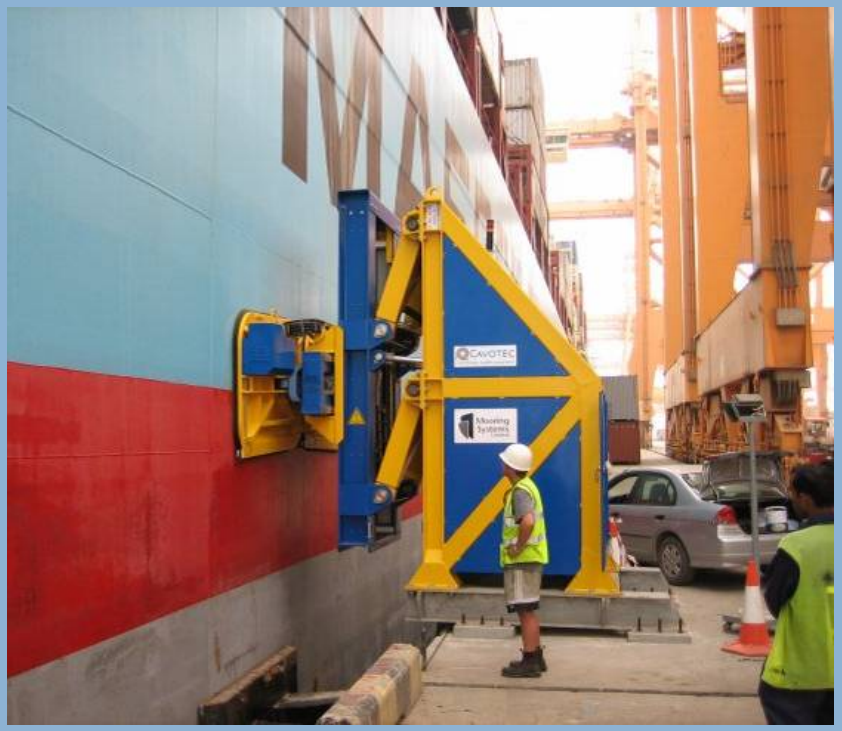
- Supply of 6.6 kV to receptacles placed at 100-foot intervals along the wharf
- Ships equipped with power cables, transformers, and switch gear
- Ships have 60 Hz power – problem for countries with 50 Hz

Automated Mooring Systems

- Reduce ship idle time during line handling
- Typical time to attach and secure vessel ~ 12 seconds

Ferry Terminal
Auckland, NZ

Maersk S-Class Vessel
Salalah, Oman



Indented Berth

Up to 9 cranes working simultaneously

Alternative faster cranes:

- Dual hoist ~20%
- Tandem spreader ~50%

Unique Ceres Features:

- Cranes specifically designed for low noise (65 db at ~100 feet)
- Straddle carriers also designed for low noise

Ceres Paragon Terminal, Amsterdam

Container Yard Emissions Reductions

Electric Yard Cranes

Double-cantilevered Rail-mounted Gantry Crane

- Stacks 10 and more deep
- Up to 6-high
- Separation between street and terminal trucks
- Electric - environmentally friendly
- Heavy - require substantial foundation for rail support

Automated Stacking Cranes (ASCs)

Electric, quiet, and can work without lights

Gottwald Design for Antwerp, Belgium

Container Terminal Altenwerder, Hamburg, Germany

European Combined Terminal, Rotterdam, Netherlands

Rubber-tired Gantry Cranes (RTGs)

Kalmar Electric RTG
Oslo, Norway
Zero emissions

ZPMC Capacitor RTG
Seattle, Washington
10% - 13% fuel reduction
Significant emissions reduction ~ 20% or more

Intermodal Railyards

Electric Yard Cranes

On-terminal Intermodal Yards

- Trains emit less per ton-mile than trucks.
- If cargo is destined for rail, on-terminal is better than off-terminal.
- Electric cranes to load and unload trains; common practice in Europe.
- Automated intermodal terminal in conceptual design for Port of Oakland

APL Pier 300 Terminal, Los Angeles

Transport Equipment

Yard Tractors

- Existing tractors retro-fitted to reduce emissions
- New equipment:
  - Cleanest available diesel engines
  - LNG/CNG
- Hybrid yard tractor under development
- Electric yard tractor in “thinking” stage

Automated Guided Vehicles

- Automated vehicles are typically linked with end-loaded yard stacks
- Minimizes travel distance
- Robots drive more smoothly than humans
- Robot vehicle can be hybrid-electric with diesel or natural gas engine
  - Regenerative braking
  - Engine off during idle

Street Truck Emissions Reductions

Process/technology-related to minimize turn-time

- Gate:
  - Extended gate hours
  - Terminal appointments
    - Based on gate capacity, and
    - Based on specific yard crane capacity
  - Electronic pre-filing of gate transaction data and electronic payment of terminal charges
  - Instrumentation in gate allows for non-stop processing
- Yard:
  - Automated yard inventory – no “lost” boxes
  - Significant productivity gains from “look ahead” capabilities
    - Pre-stage containers
    - Don’t stack on top of containers needed next

To be sustainable

- Future terminal design will include:
  - Wharves that can support the weight of heavier cranes
  - Use of automated stacking cranes
  - Use of hybrid or electric container transporters
  - Extensive use of transfer to on-dock or near-dock rail transport
- Cost of reconfiguring existing facilities is very high – most likely to happen at end of useful life
- In short-term:
  - Use of more environmentally friendly transporters and yard cranes
  - Improvements in processes and supporting technologies to reduce truck processing and yard turn-times and minimize container re-handling activities


SkySails
Thank You

Contact Information

Peter R. Vandermat, Ing.

Transportation Business Analyst

JWD Group, a division of DMJM Harris | AECOM

300 Lakeside Dr., Suite 220
Oakland, CA 94612
Main: (510) 832-5466
Direct: (510) 844-0546
Fax: (510) 835-3464
Cell: (510) 407-3294
Email: Peter.Vandermat@dmjmharris.com

Web: www.jwdgroup.com, www.dmjmharris.com