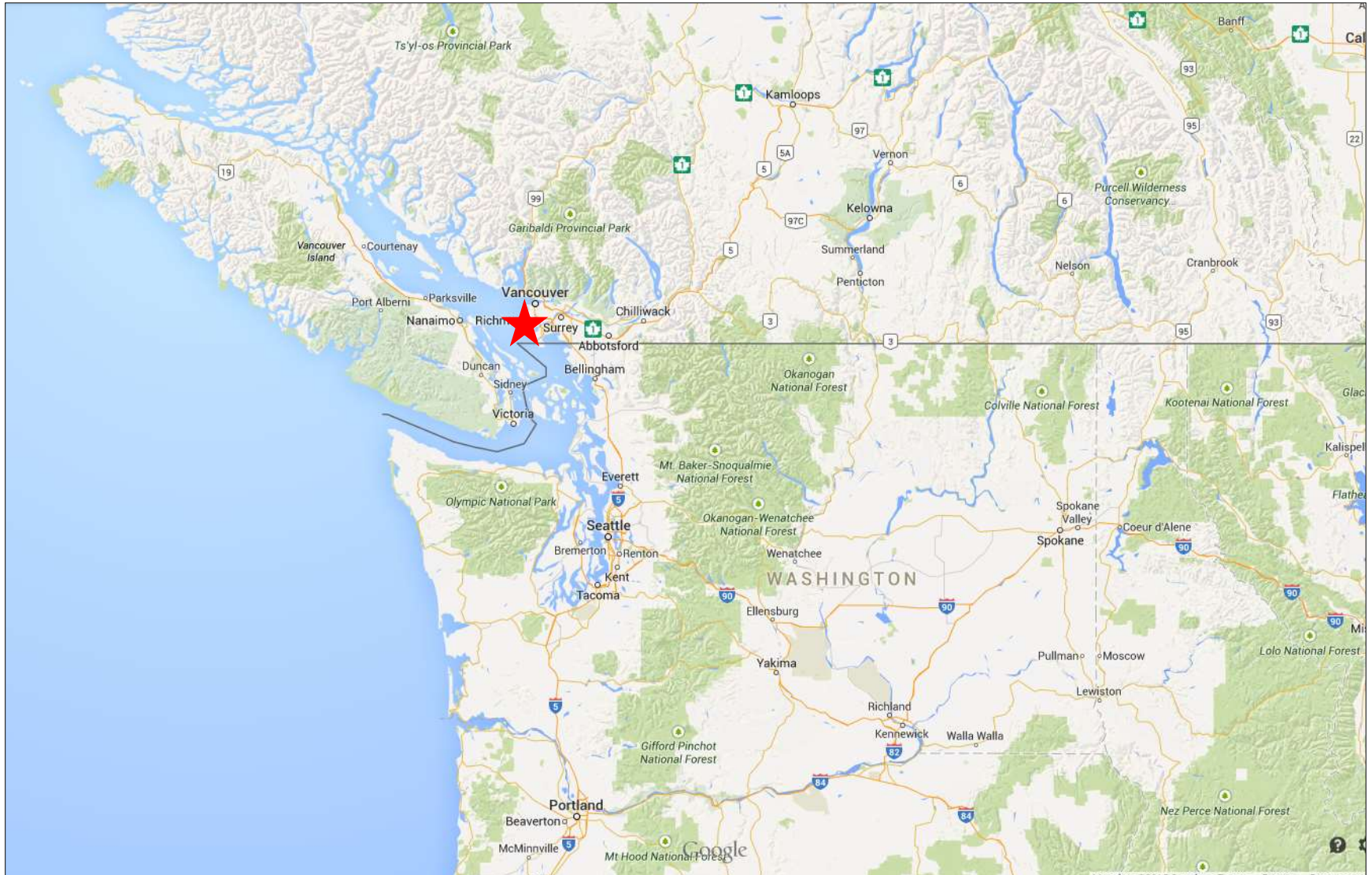# Next Generation Container Terminals: Roberts Bank Terminal 2
Port & Terminal Technology – Miami
Krystle McBride, AECOM
April 21, 2015

Overview

- Project site: Vancouver, Canada

- Planning challenges

- Capacity Analysis

- Performance simulation

- Highlights of recommended option

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Regional Map

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Roberts Bank, Vancouver, Canada

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Proposed T2 Site

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Automated Terminals & On-Terminal Rail Operations

- Less than 25% of vessel volume in northern Europe, where the standard ASC terminal design originated

- Vs. 2/3 of vessel volume in Vancouver

- Options to use robotic transport to the rail
  - Direct RMG to RMG handoff
  - Overhead Bridge crane transfer from ASC to IYRMG
  - Autoshuttle transfer and partial gate access to ASCs

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IY at Rear of Terminal was Preferable

- Difficult to pass gate containers over IY

- Competition for spreaders between vessel and rail operations

- Embedded IY operations required big, expensive, CY RMGs

- Not enough land area was saved to merit the technical risks
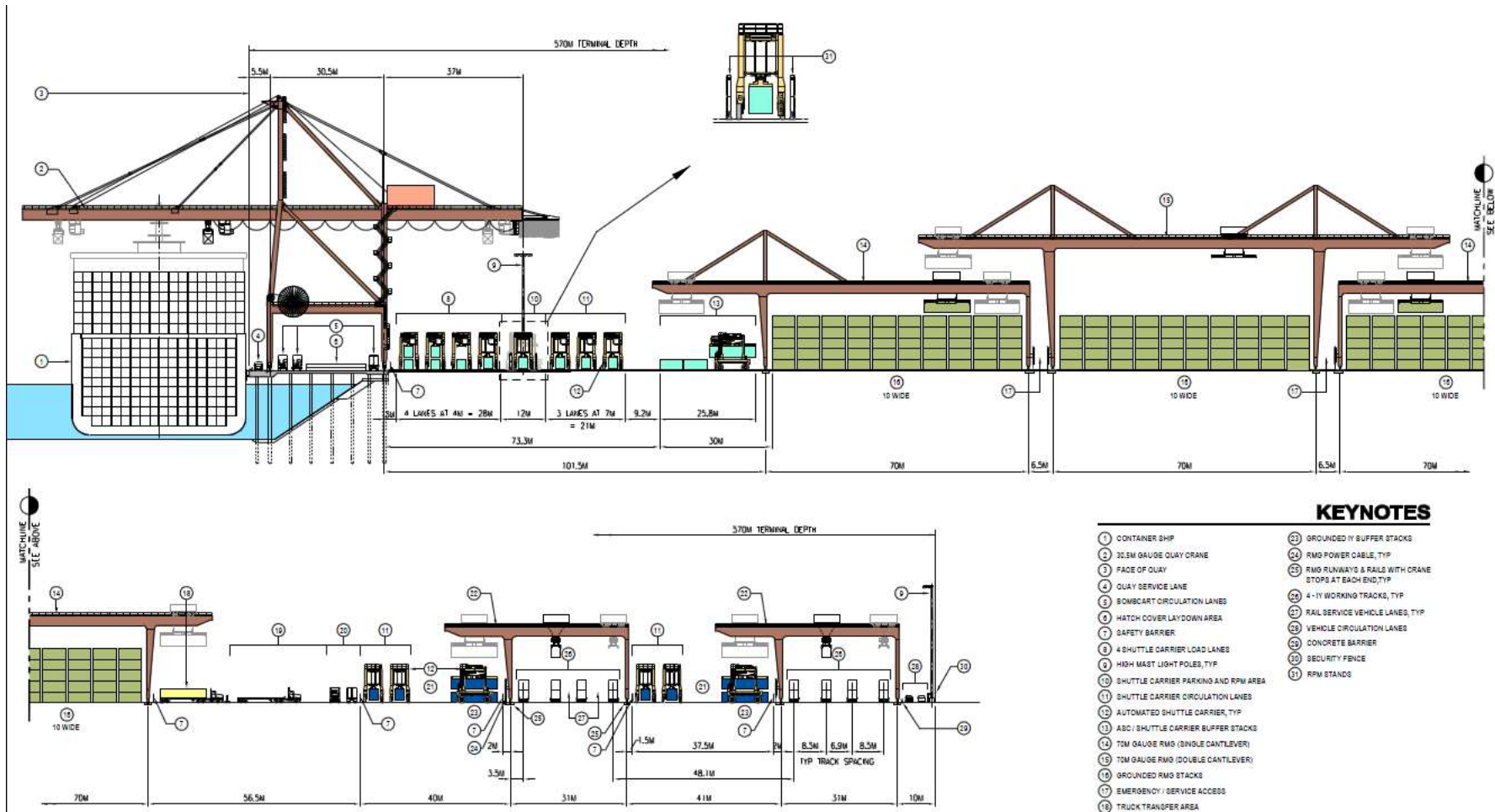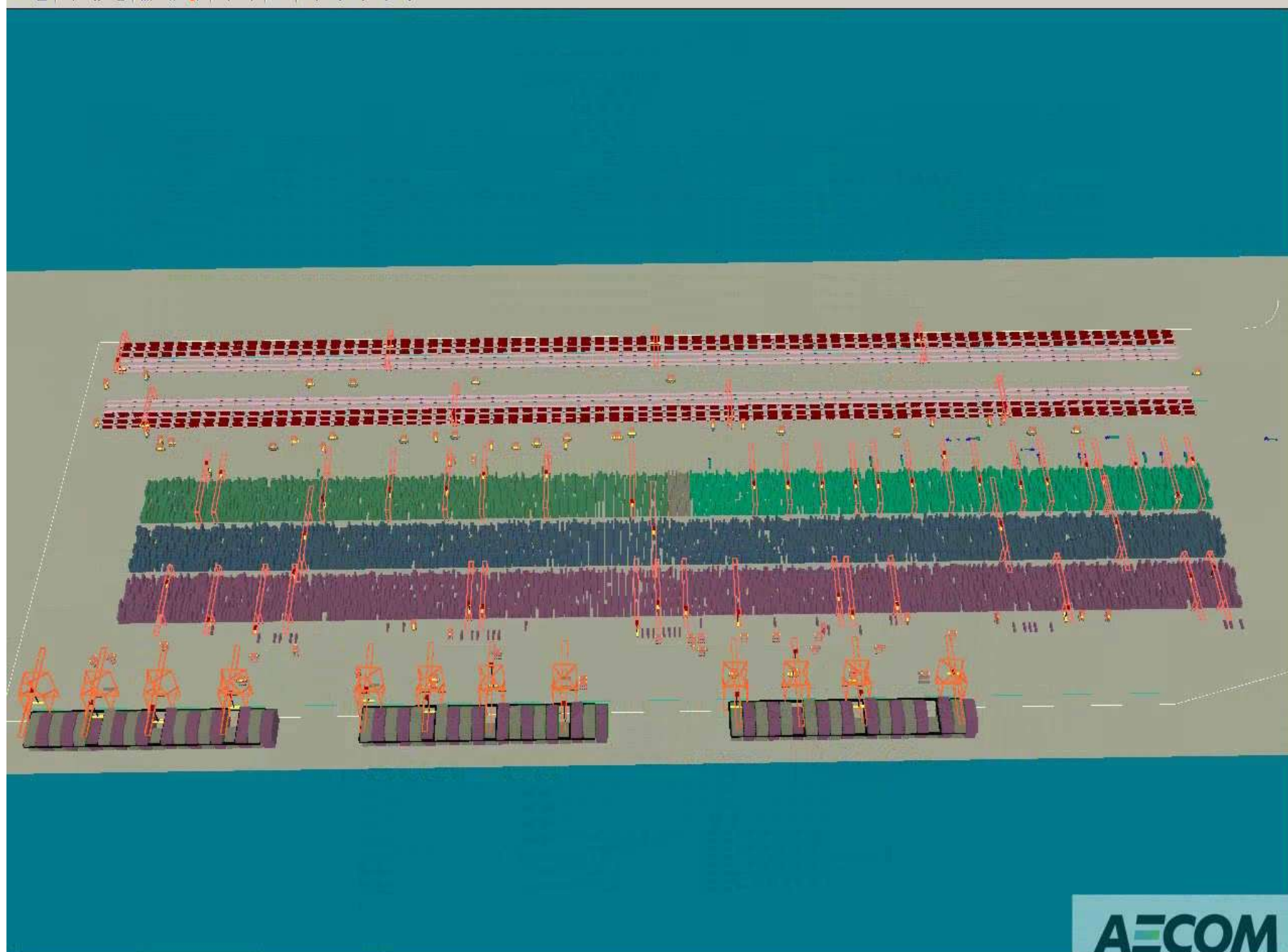
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How can Euromax-type Terminals be Improved?

- Automated shuttle carriers instead of AGVs
  - Decoupled operations
  - Significant buffer capacity
  - Fewer machines makes congestion management easier

- Robotic transport access to the railyard: Euromax uses manual tractors+chassis for CY<>IY moves

- Alternate CY orientation to increase CY density?

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A Nested RMG CY Concept

KEYNOTES

1. CONTAINER SHIP
2. 30.5M GAUGE QUAY CRANE
3. FACE OF QUAY
4. QUAY SERVICE LANE
5. BOMBCART CIRCULATION LANES
6. HATCH COVER LAYDOWN AREA
7. SAFETY BARRIER
8. 4 SHUTTLE CARRIER LOAD LANES
9. HIGH MAST LIGHT POLES, TYP
10. SHUTTLE CARRIER PARKING AND RPM AREA
11. SHUTTLE CARRIER CIRCULATION LANES
12. AUTOMATED SHUTTLE CARRIER, TYP
13. ASC / SHUTTLE CARRIER BUFFER STACKS
14. 70M GAUGE RMG (SINGLE CANTILEVER)
15. 70M GAUGE RMG (DOUBLE CANTILEVER)
16. GROUNDED RMG STACKS
17. EMERGENCY / SERVICE ACCESS
18. TRUCK TRANSFER AREA
19. GROUNDED IY BUFFER STACKS
20. RMG POWER CABLE, TYP
21. RMG RUNWAYS & RAILS WITH CRANE STOPS AT EACH END, TYP
22. 4 - IY WORKING TRACKS, TYP
23. RAIL SERVICE VEHICLE LANES, TYP
24. VEHICLE CIRCULATION LANES
25. CONCRETE BARRIER
26. SECURITY FENCE
27. RPM STANDS

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File   Edit   Run   View   Window   Help

Animating   Time: 540.00

Weaknesses of Nested CY Operations vs. ASCs

- Very large and expensive cranes

- Difficult to manage crane location and spread load to keep all cranes busy
  - In an ASC terminal, only one yard crane can pick a given container from stevedoring buffer
  - In a nested RMG terminal, many cranes can pick a container, and TOS must continually manage crane assignment

- Requirement of 3 rows of cranes to get sufficient CY storage capacity

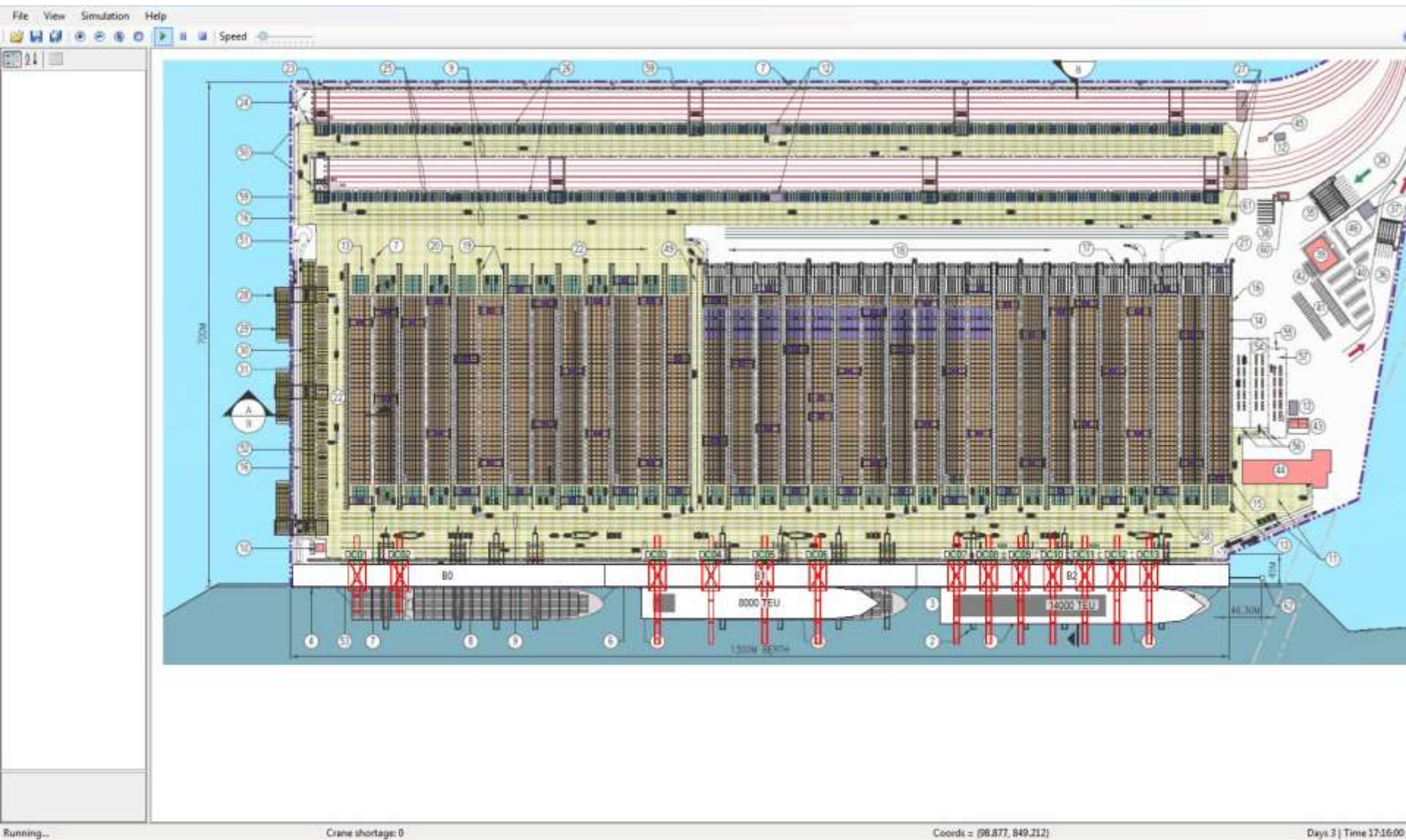- General technical risk overall due to lack of precedent: ASCs have low technical risk

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Areas of Performance Analyzed with Simulation

- Equipment vs. performance (# shuttles per dock crane, etc.)

- Sensitivity to "kind" vs. "harsh" load sequences

- Sensitivity to advanced re-handling for gate arrivals

- Power demand for electric yard cranes

- Relative emissions

- Optimal terminal phasing (e.g. berth construction phasing and related CY and IY backland to balance berth capacity)
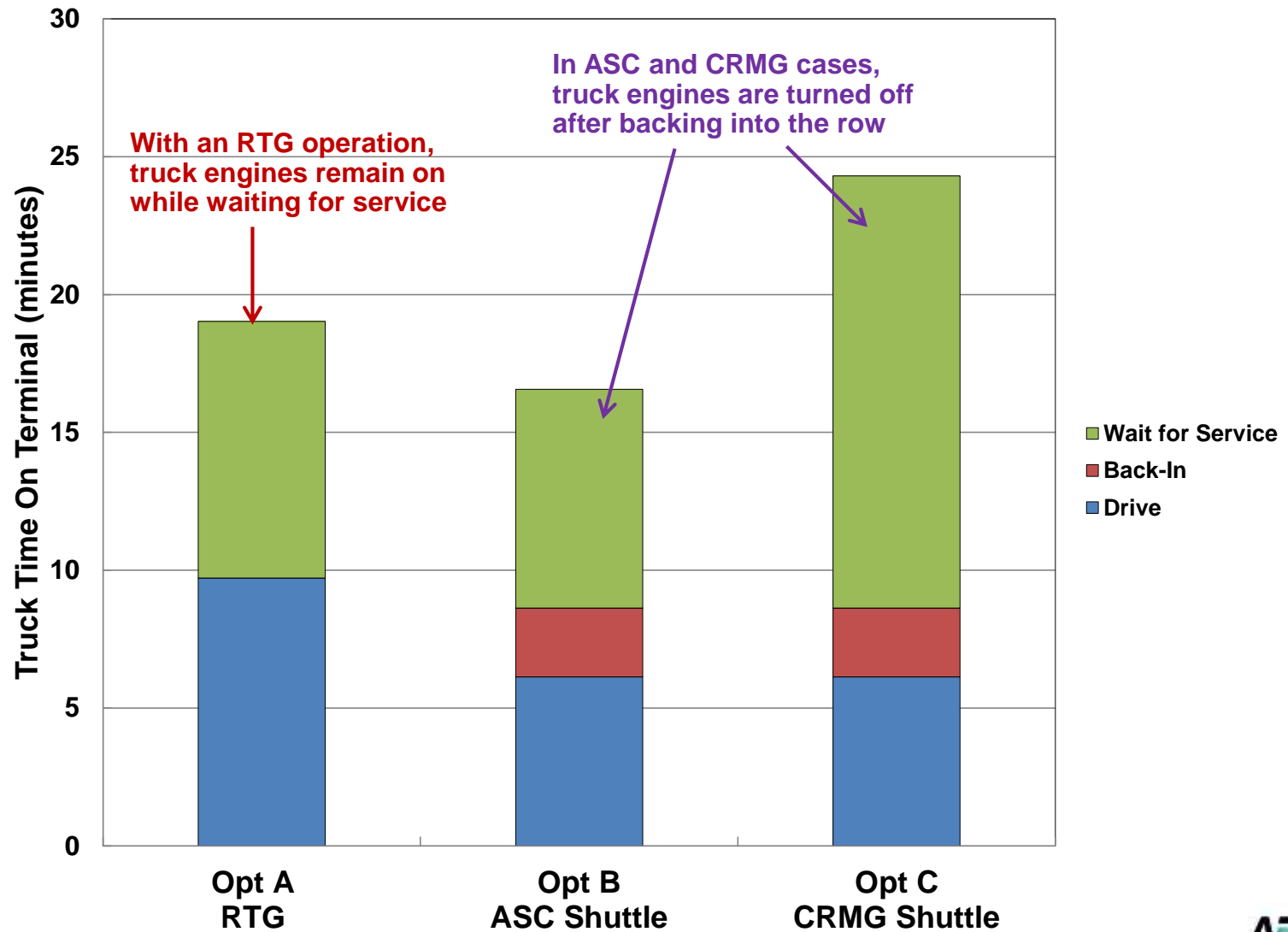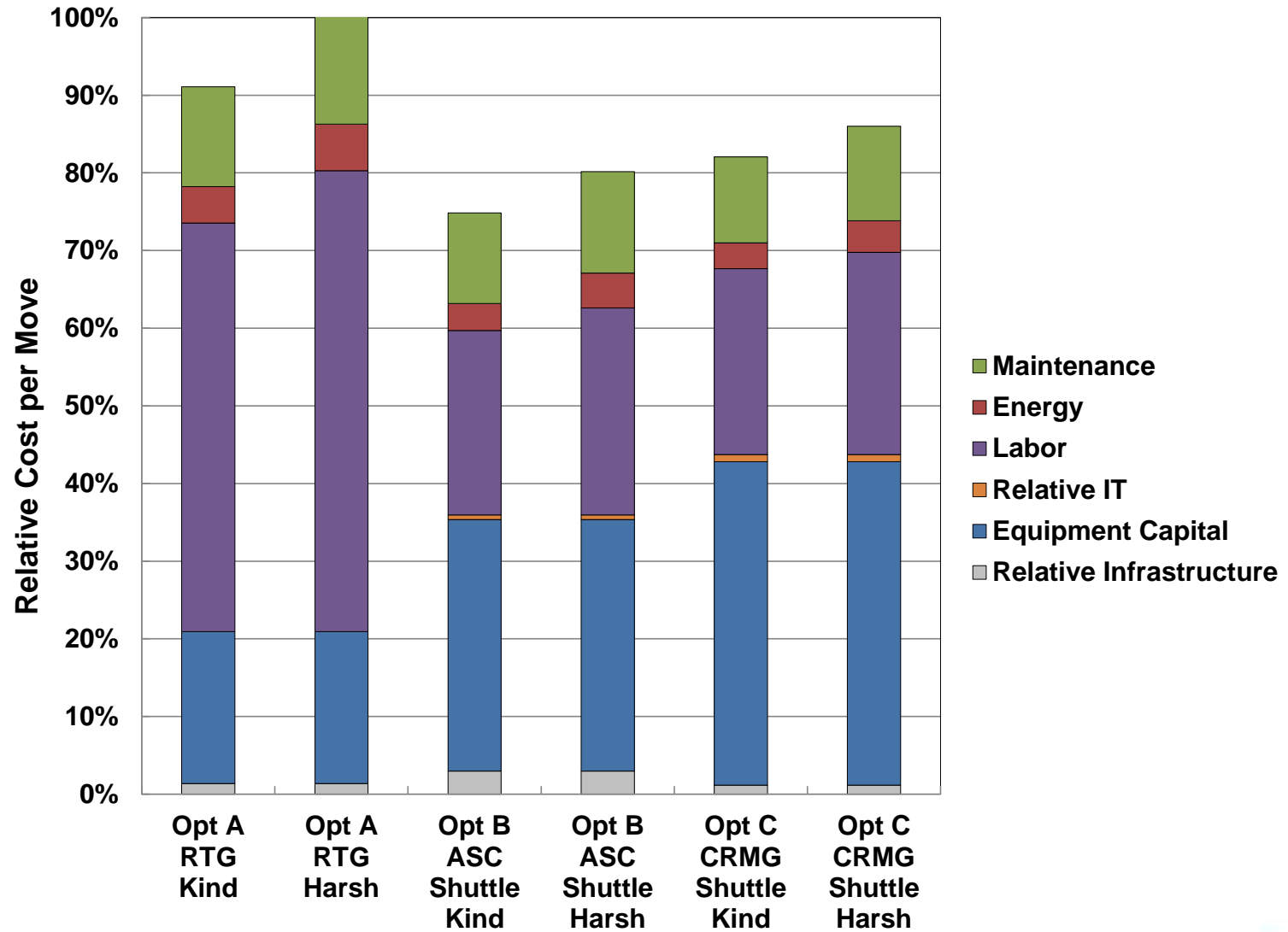
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BERTHA Model of RBT2

Used to determine the berth capacity of the complete terminal, as well as the capacity of one and two berth interim construction phases

Street Truck Time On-Terminal

With an RTG operation, truck engines remain on while waiting for service

In ASC and CRMG cases, truck engines are turned off after backing into the row

Truck Time On Terminal (minutes)

Wait for Service
Back-In
Drive

Opt A RTG
Opt B ASC Shuttle
Opt C CRMG Shuttle

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Relative Cost per Move

Example ASC Electricity Use Histogram

Peak use of single ASC of about 700 kW x 66 ASCs = 46,200kW
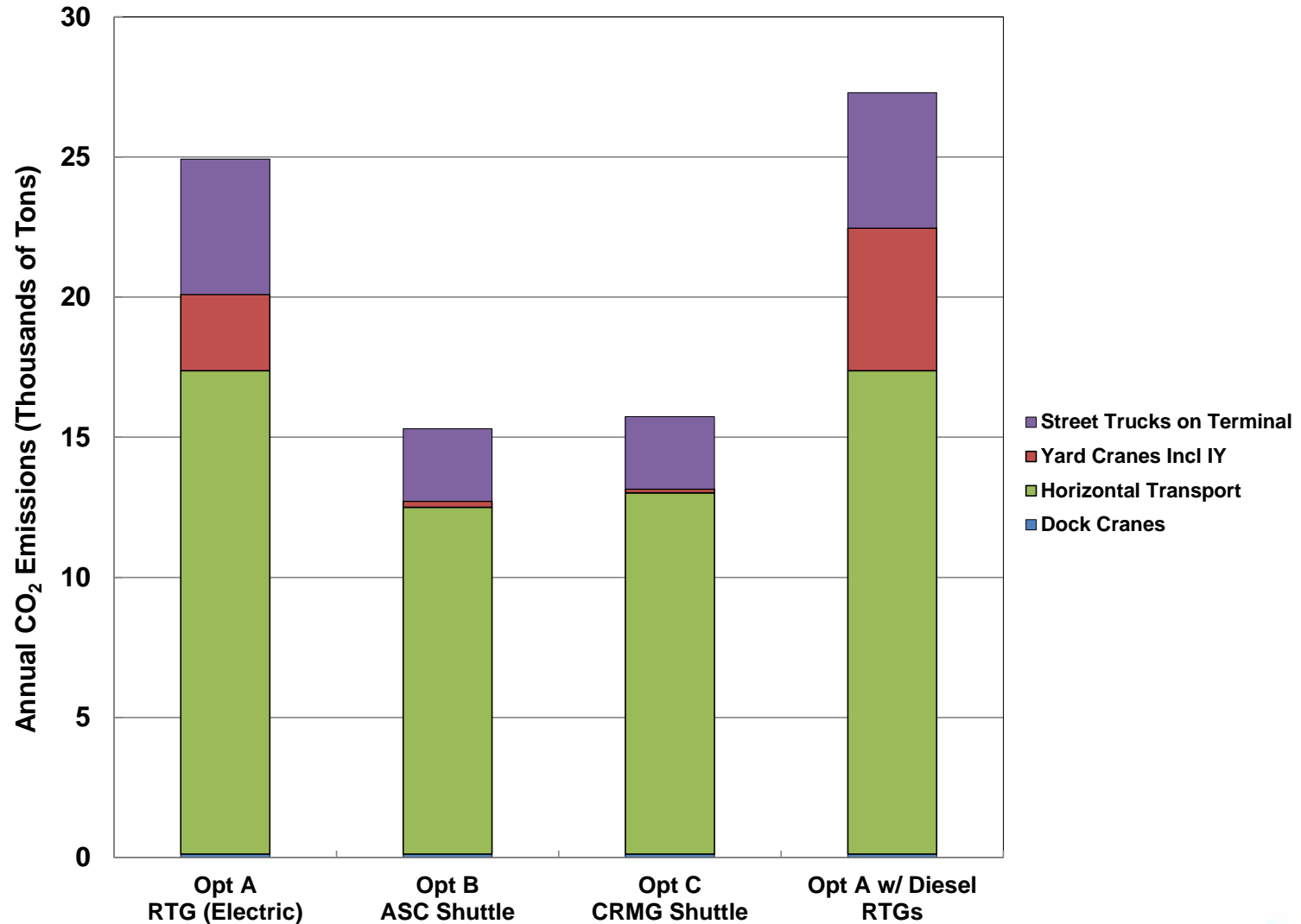**More than 4x the maximum observation in simulation!**

% of Observations (y-axis)

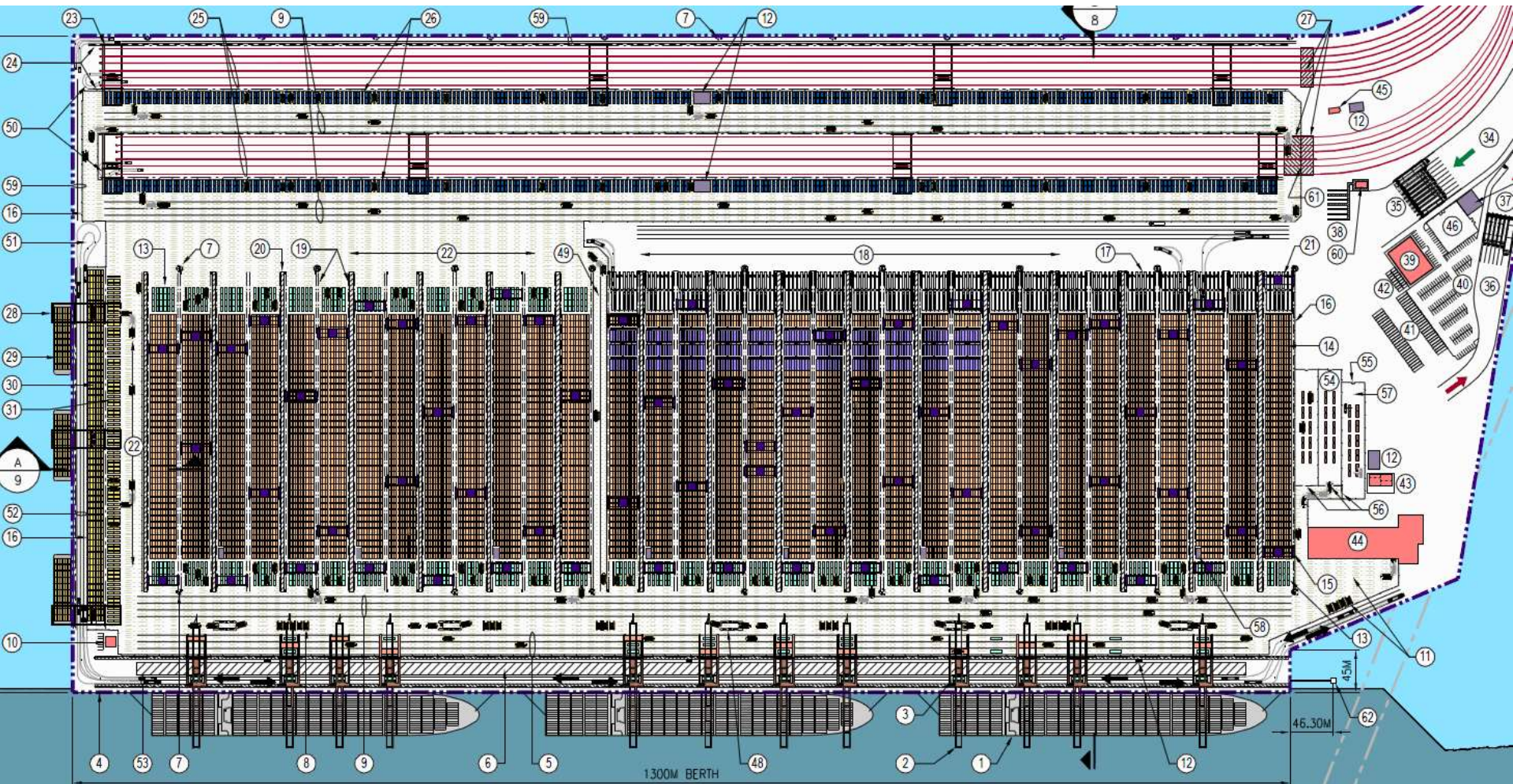**CY and IY Crane Total Power Usage (kW)** (x-axis)

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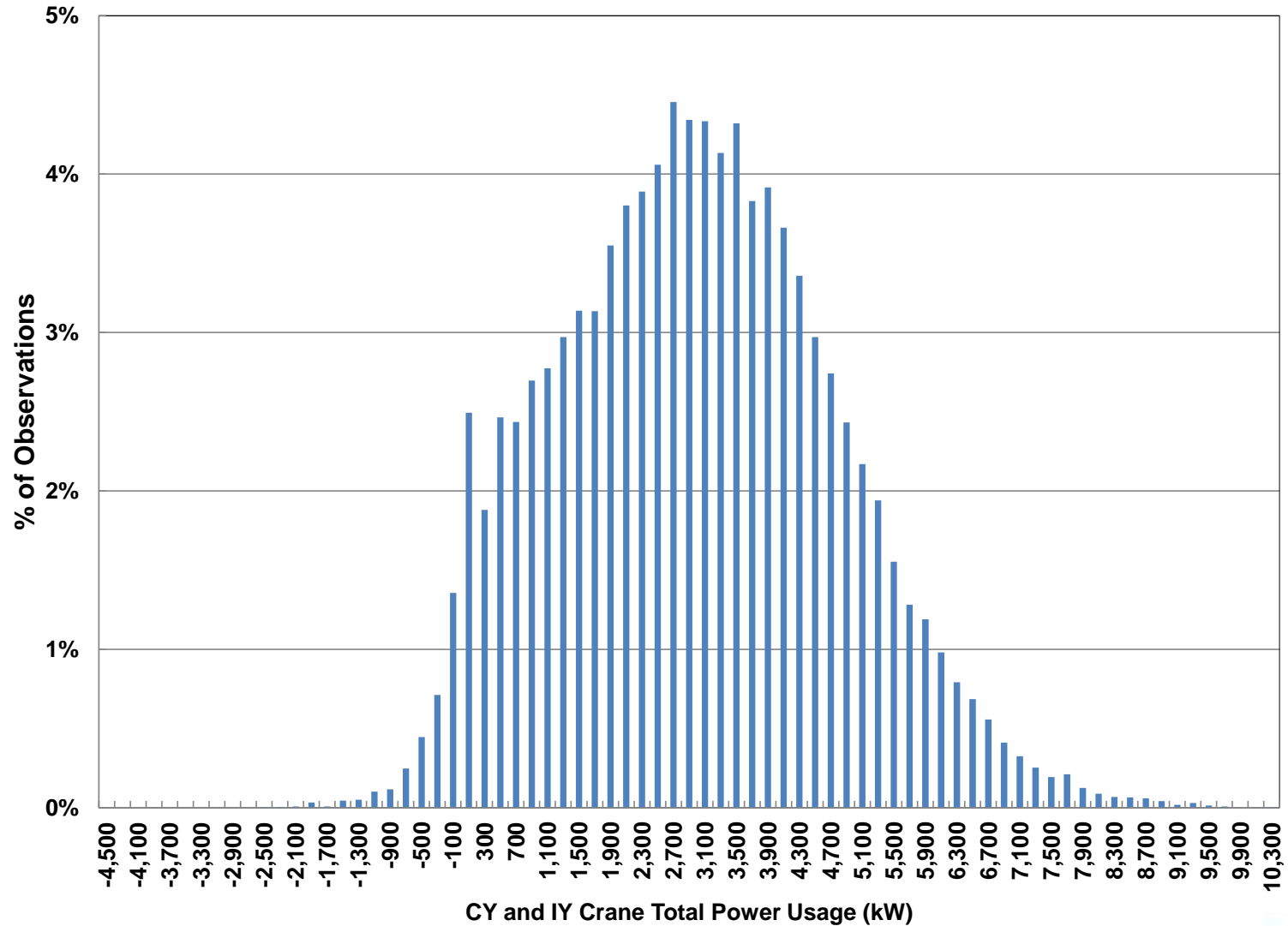
Emissions Analysis

Incorporates simulation results regarding equipment time per operating mode, such as street trucks with engines turned off after backing into ASC buffers, strad idle vs. travel time, etc.

Legend:
- Street Trucks on Terminal
- Yard Cranes Incl IY
- Horizontal Transport
- Dock Cranes

Y-axis: Annual CO_2 Emissions (Thousands of Tons)

X-axis categories:
- Opt A RTG (Electric)
- Opt B ASC Shuttle
- Opt C CRMG Shuttle
- Opt A w/ Diesel RTGs

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Final Concept

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Highlights of Final Layout

- Two parallel IY modules to accommodate a high fraction of rail

- Auto shuttles used for stevedoring and rail transport

- ASC bypass aisle allows for direct IY<>quayside access

- Optional barge berth on secondary quay if desired

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Rendering of Final Conceptual Layout

Proposed Roberts Bank
Terminal 2

Existing
Roberts Bank Terminals

DELTA

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Thank You

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