AAPA Marine Terminal Management Training Program

Assuring Supply Chain Efficiency

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Assuring Supply Chain Efficiency

Some Quotes:

"The real driving force behind globalization is….the declining cost of international transport."

The Journal of Commerce
"The Box That Changed the World"

"It is only recently and cautiously that we have moved far from the oceans to places like Siberia or Nebraska and it is by no means clear that places so far removed from the sea are viable in the long term."

John Szarkowski

Assuring Supply Chain Efficiency

- The "global" economy
  - Land masses
    - People
    - Governments, religions, economies
    - People like to define themselves
  - Oceans
    - Differentiator
    - Allow us to be different
    - Connector (highway)
    - Relatively maintenance free
  - Trade
    - The common denominator
    - The economic connector
    - Fosters interdependence =
    - A good thing

Assuring Supply Chain Efficiency

- People need to move stuff
- The people of the world are connected by very deep water
- Water is very strong
- Water is very slippery

Assuring Supply Chain Efficiency

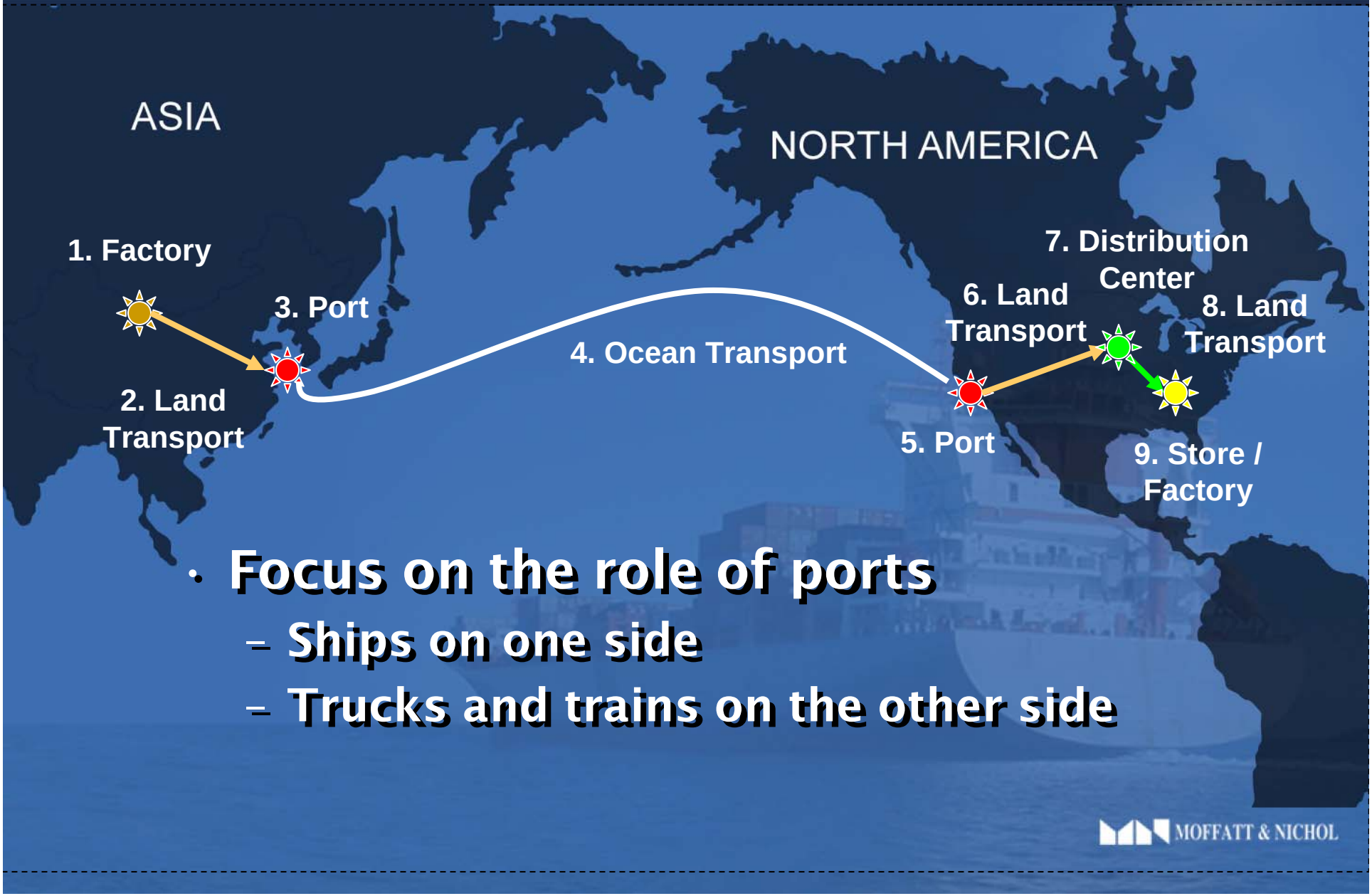
Floatation is, always and forever, the best way to move stuff on this planet

What is Efficiency?

- **Capacity**
  - TEU's per acre
- **Speed**
  - Moves per hour
- **Reliability**
  - On time
- **Cost**
  - $ per move
- **Efficiency**
  - Delivering capacity, speed and reliability at the lowest possible cost

"The real driving force behind globalization is….the declining cost of international transport."

What is the Supply Chain?



- **Focus on the role of ports**
  - **Ships on one side**
  - **Trucks and trains on the other side**

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Assuring Supply Chain Efficiency

"The real driving force behind globalization is….the declining cost of international transport."

Tools of (the) Trade:

"The Container"
"The Container Ship"

honorable mentions

"The Personal Computer"
"The Internet"

Container Vessels

- The modern container ship is certainly an example of "efficiency"

1
10,000 TEU
Container
Ship

18
8,000 Foot
Double-Stack
Trains
(27 Miles)
(50 Acres)

5,800
Trucks
(60 Miles)
(95 Acres)

600
Boeing 747
Cargo Liners

DISCHARGE *OR* LOAD ONLY !

= = =

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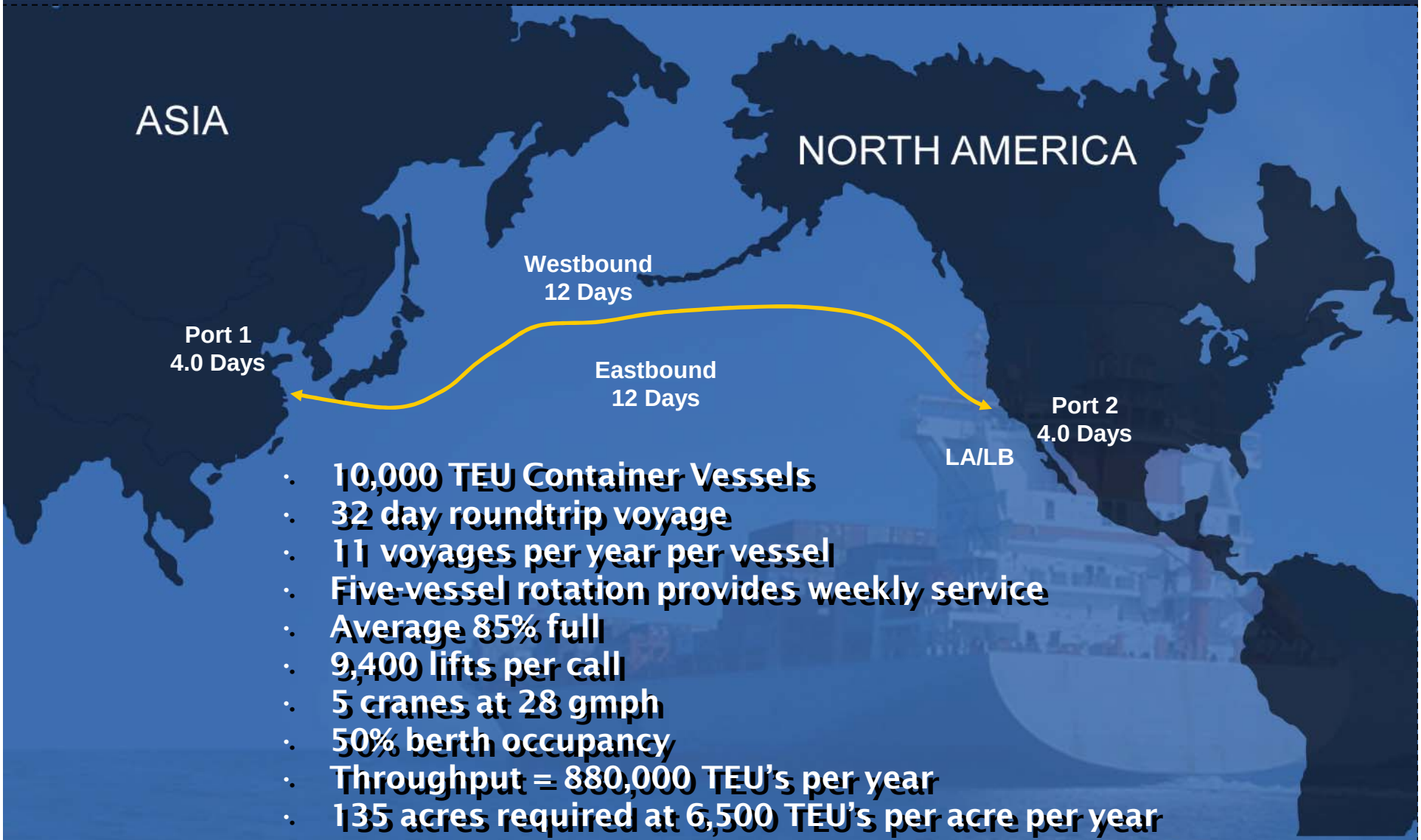
The Container Ship

- 10,000 TEU vessel
- Equivalent of 5,000 – 40 foot containers
- 12,000 pairs of Nikes per container
- Equivalent of 60,000,000 pairs per vessel
- Value = $4,500,000,000.00 @ $75.00/pair
- Transportation cost = $0.30 / pair

Example Container Service: Asia – North America



- 10,000 TEU Container Vessels
- 32 day roundtrip voyage
- 11 voyages per year per vessel
- Five-vessel rotation provides weekly service
- Average 85% full
- 9,400 lifts per call
- 5 cranes at 28 gmph
- 50% berth occupancy
- Throughput = 880,000 TEU's per year
- 135 acres required at 6,500 TEU's per acre per year

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Port "Capacity"

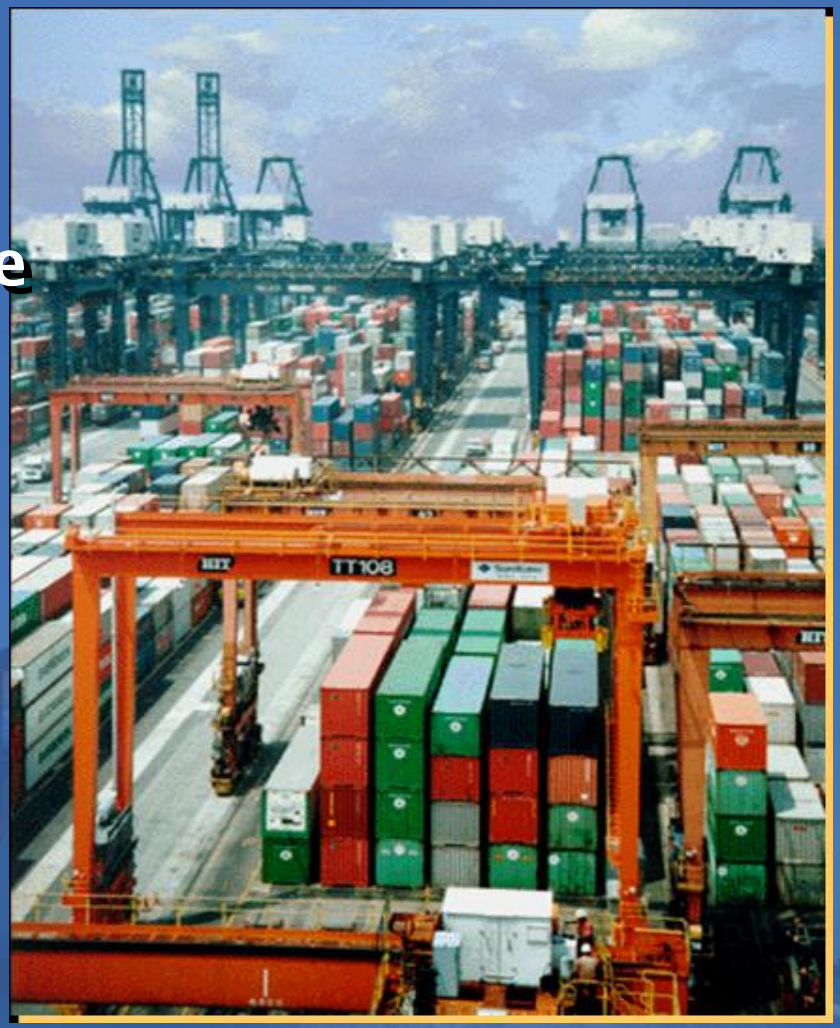
- **Berth**
  - Vessel size & call frequency
  - Load and discharge per call
  - Cranes, assignment and productivity
- **Storage Yard**
  - Stacking system
  - Dwell time
  - Utilization
- **Gate**
  - Lanes
  - Transactions per hour per lane
  - Hours of operation
- **Rail**
  - Working track & turnover rate

Port “Efficiency”

- Berth
  - Reliability of vessel schedules
  - Stevedoring productivity
  - Berth – CY interface
  - Data flow
    - OCR on dock cranes, yard cranes

Port “Efficiency”

- Yard
  - High stack utilization
  - Low container dwell time
  - Minimize false moves
    - Digging
    - Repositioning
  - Real time performance
    - Moves per hour
  - Hours of operation
  - Gate scheduling system



Port "Efficiency"

- Gate
  - Integration of processes and technologies
    - Security
    - Interchange
    - Inspection
  - Data collection
    - Accuracy
    - Elimination of redundant data input
  - Manning
  - Hours of operation
  - Scheduling system
  - Interface with container yard

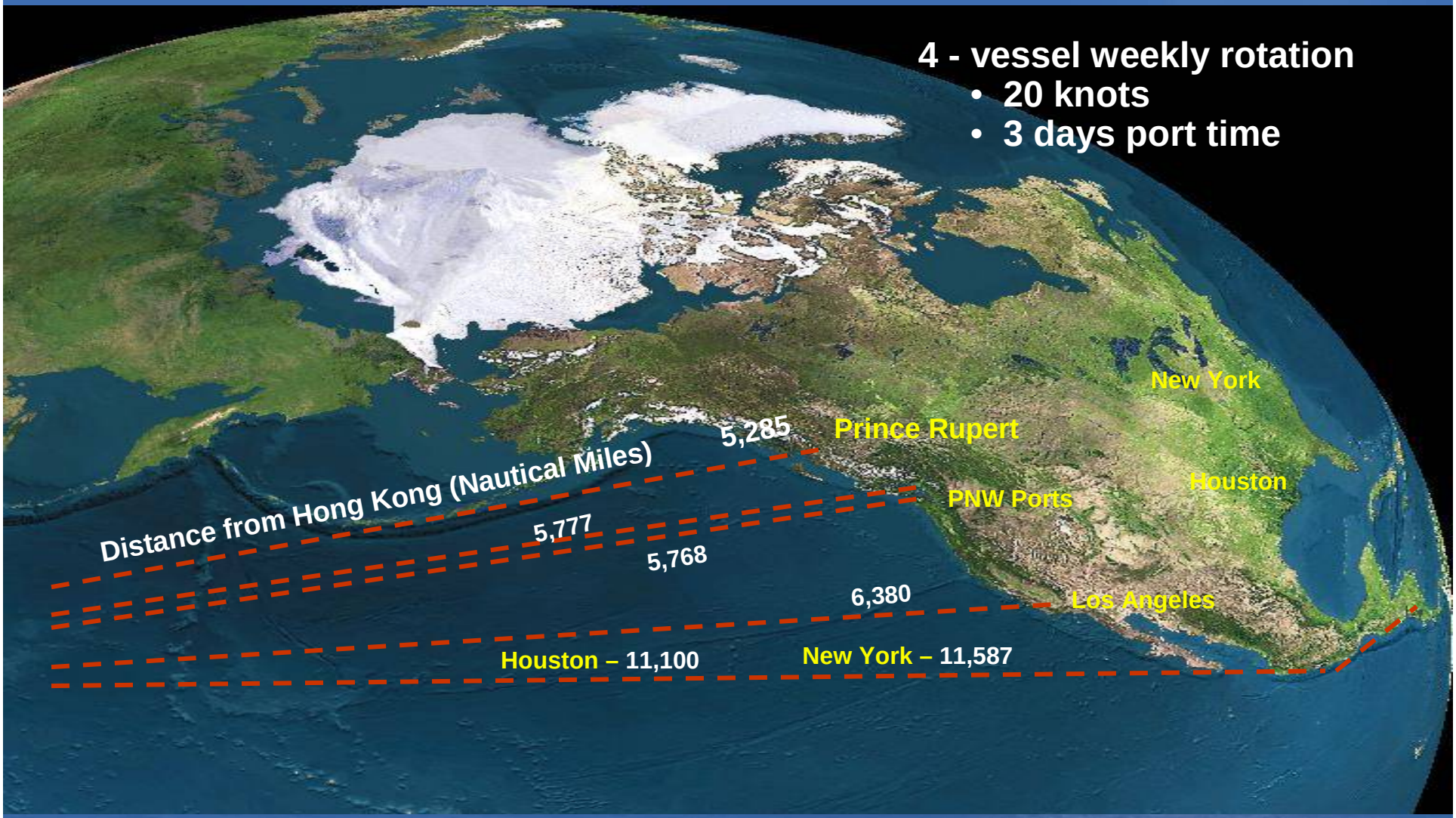
Port “Efficiency”

- **Rail**
  - Train schedules & reliability
  - Inbound-outbound balance
  - Working track length
  - Number and productivity of lifting equipment
  - Storage track amount and proximity
  - Switching availability

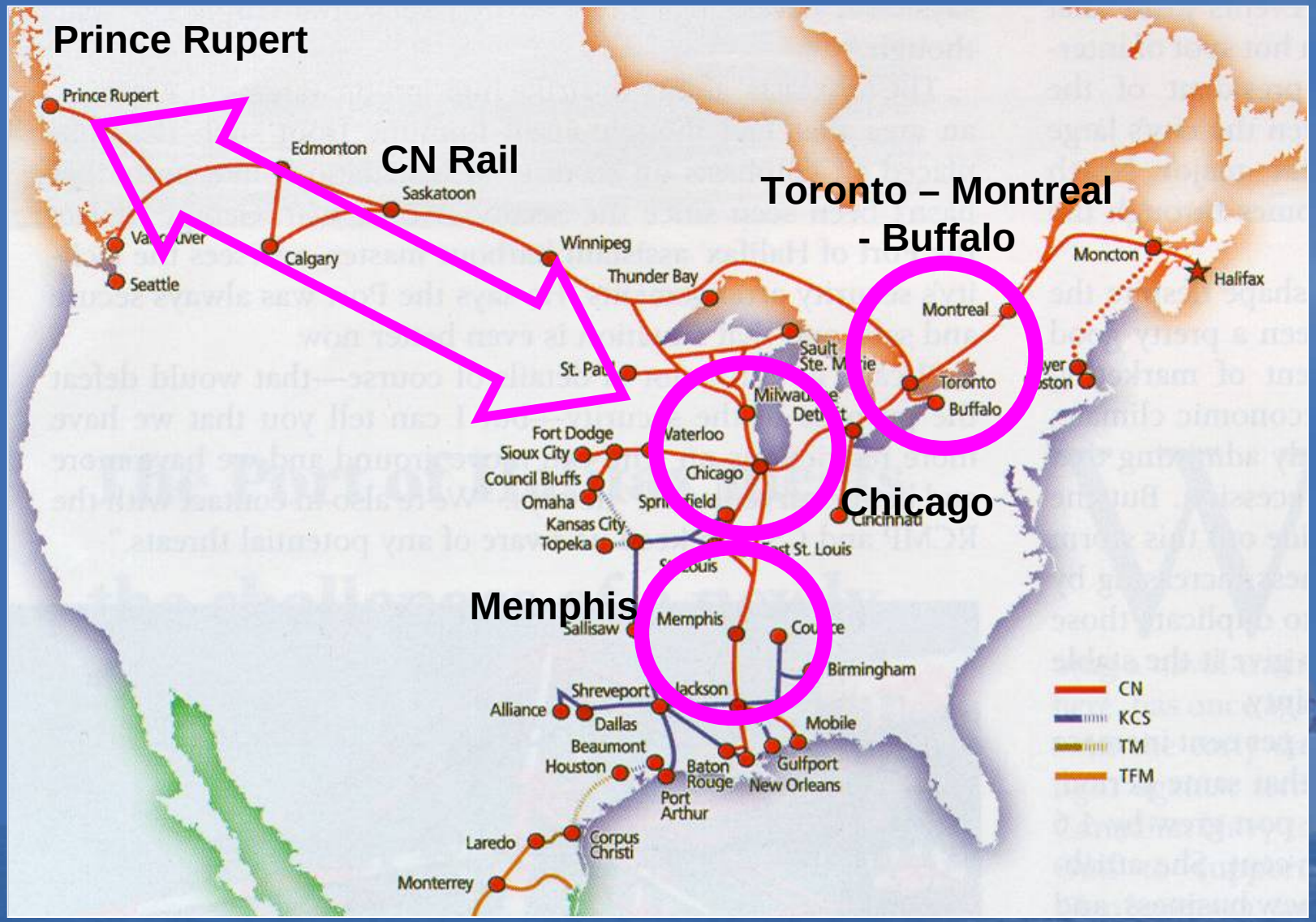
Example – Prince Rupert

- Why is Prince Rupert a good example?
  - Directly hard wired into the supply chain
  - All intermodal (rail) cargo
  - Terminal situated between shipping lines and railroad, both driven to minimize time and cost by maximizing asset utilization
    - Shipping line – vessels, crews
      - Four-vessel rotation, three days maximum port time
    - Railroad, engines, crews and cars
      - 12-hour engine, crew dwell
      - 24 hour maximum car dwell
      - Dedicated car fleet
  - Both vessel and rail are optimized in a scheduled, steady-state system
  - Limited terminal assets

Prince Rupert

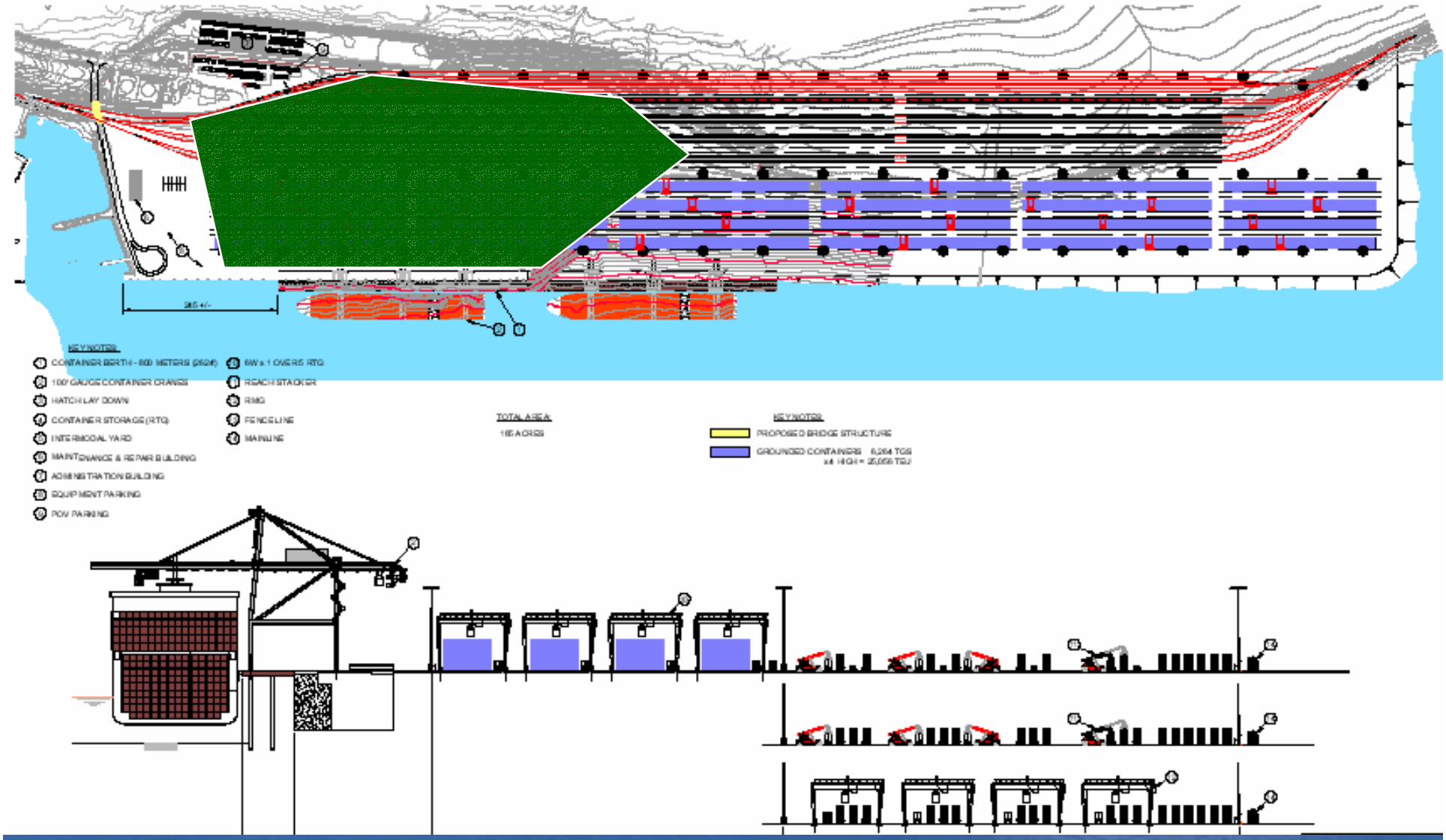


Prince Rupert



Phase 1 – 500,000 TEU's p.a.

Phase 2 – 1.5 Million TEUs p.a.



Prince Rupert

- Perfect steady state
  - Berth
    - Two vessels per week
    - 3.5 days apart
  - Rail
    - Four 10,000 foot trains each way each day
    - Arrive - spot – strip – load – depart
- Life is good
- But what if;
  - Vessels are late
  - Trains are late

- Recoverability analysis
- Terminal capacity = ***Maximum throughput at which the terminal can recover from a scheduling event***

Test Phase 2 at Capacity

- **Annual Throughput**
  - 1,500,000 TEU's
  - 830,000 Annual Lifts at 1.8 TEU/lift
  - All throughput Intermodal
  - 50% Import, 50% Export
- **Weekly Vessel and Rail Lifts**
  - Import 8,013 Lifts
  - Export 8,013 Lifts
- **Two 8,000 TEU vessel Calls per week**
- **Four cranes (30 box moves/hour) for each vessel**

Test Phase 2 at Capacity

- Four 10,000 foot trains each way per day
- Eight inland destinations (a, b, …, h)
- Two train consists
  - Train A: 5 destinations (a, b, c, d and e);
  - Train B: 4 destinations (b, f, g and h);
- Steady state schedule for trains:
  - Train Arrival (WB): 12 AM, 4 AM, 12 PM & 4 PM
  - Train Departure (EB): 8 AM, 12 PM, 8 PM & 12 AM

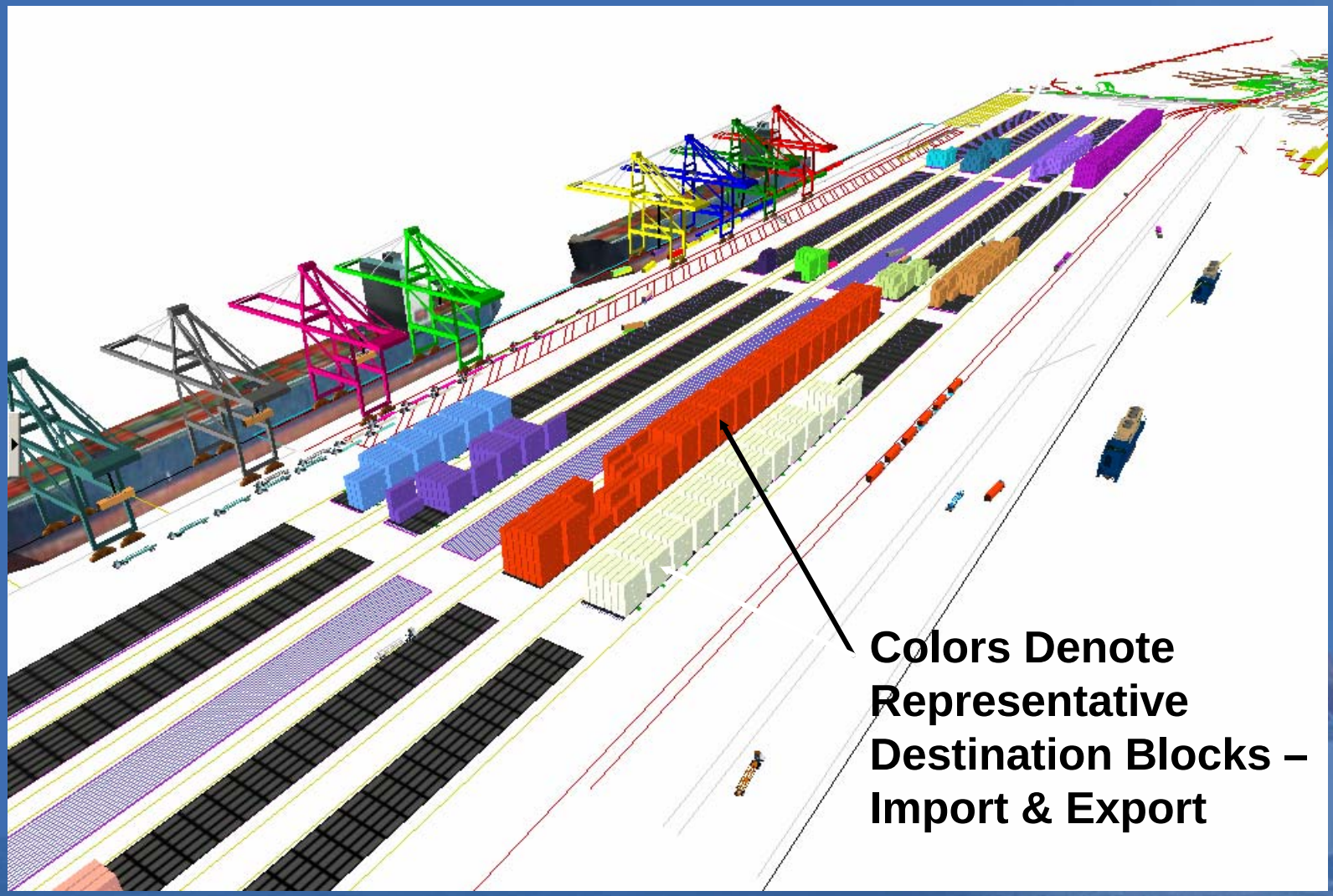
Variables for Analysis

- **Vessel Schedules**
  - "Good Vessel" – Steady state
    - Two vessels arrive with 3.5 days apart. One 8:00Am Monday; The other 8:00PM Thursday
  - "Bad Vessel"
    - Two 8,000 TEU vessels arrive at the same time, 8:00AM Monday
- **Train Schedules**
  - "Good Train" – Steady State
    - Train A and B arrive and departure alternately each day
  - "Bad Train"
    - Day 1 all Train A, Day 2 all Train B, Day 3 all Train A, Day 4 all Train B, and so on

Recoverability Analysis Scenarios

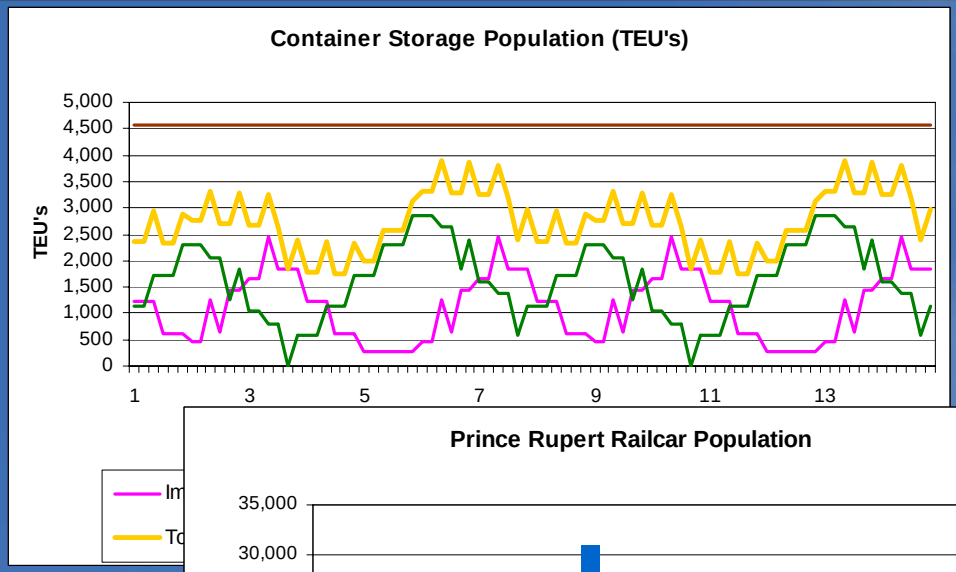
- Four combinations of the two variables;
  - Scenario 1: Bad Vessel, Good Train
  - Scenario 2: Good Vessel, Good Train
    - Best Case
  - Scenario 3: Bad Vessel, Bad Train
    - Worst Case
  - Scenario 4: Good Vessel, Bad Train

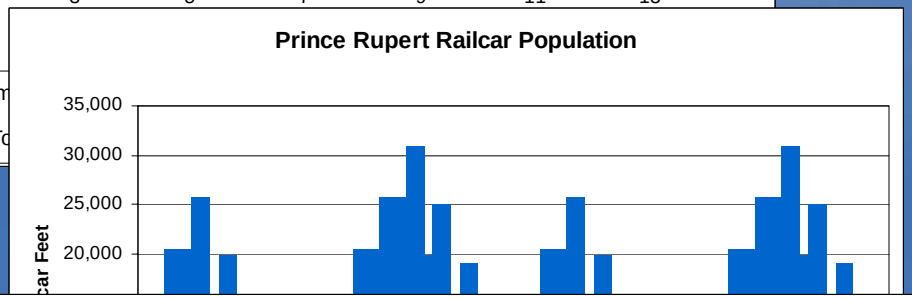
The Analysis Tool - Simulation Model

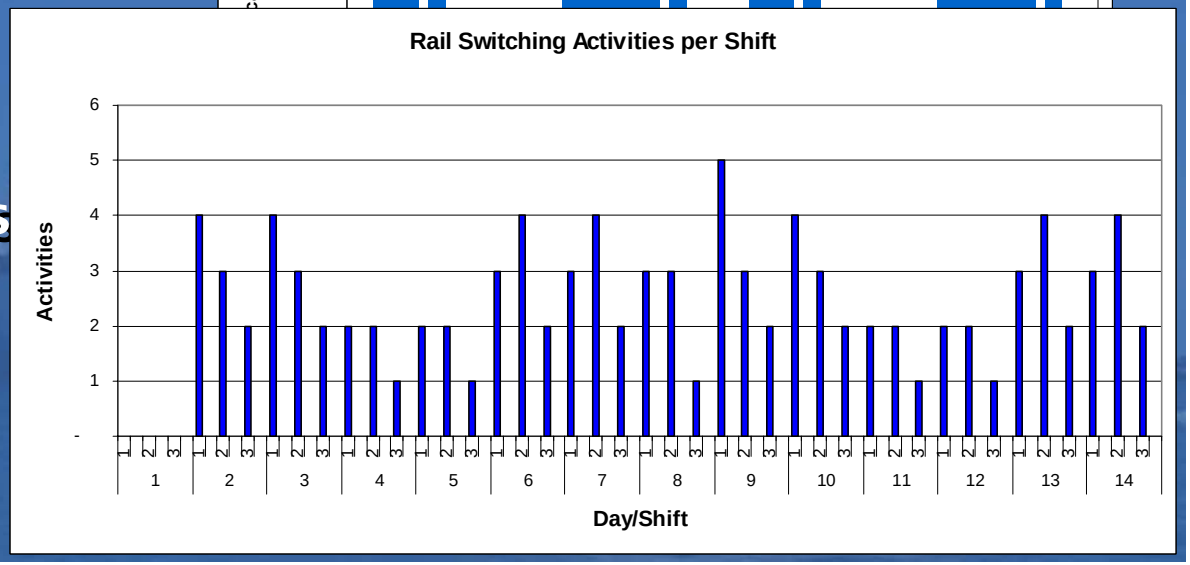


The Analysis Tool - Simulation Model

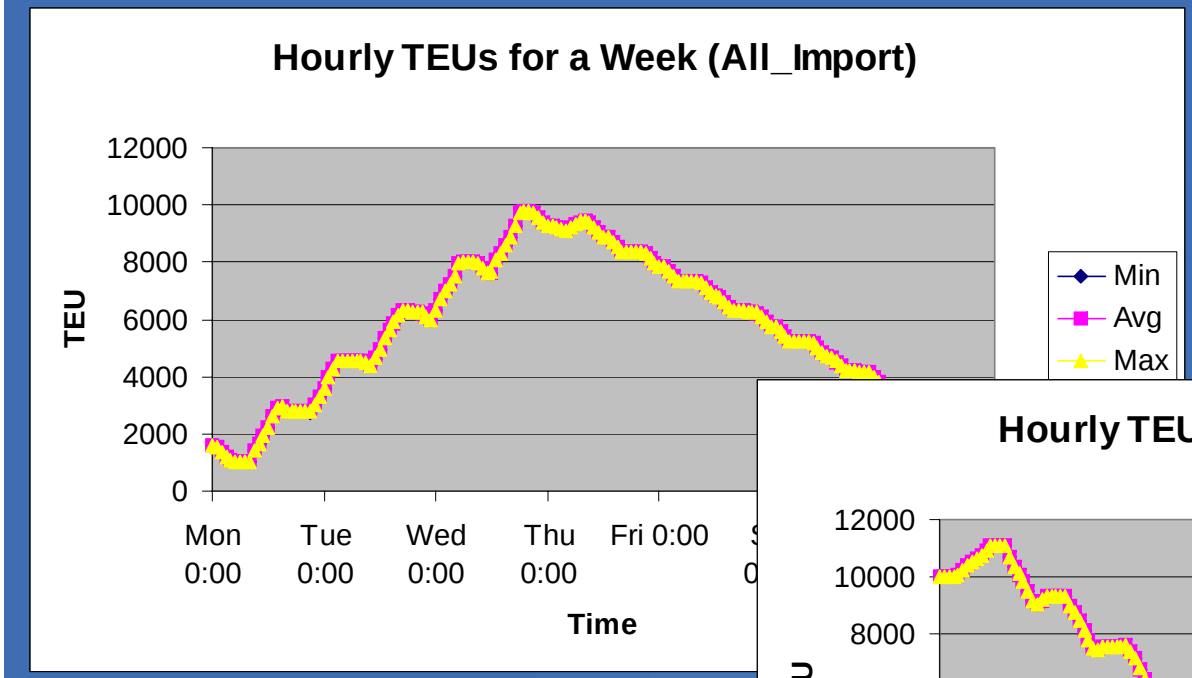
- **Model Resources**
  - Vessels
  - Trains
  - Dock cranes
  - Yard cranes
  - Storage slots
  - Rail track
  - Switch engines
- **Model Tracks**
  - Containers
  - Rail cars
  - Equipment moves





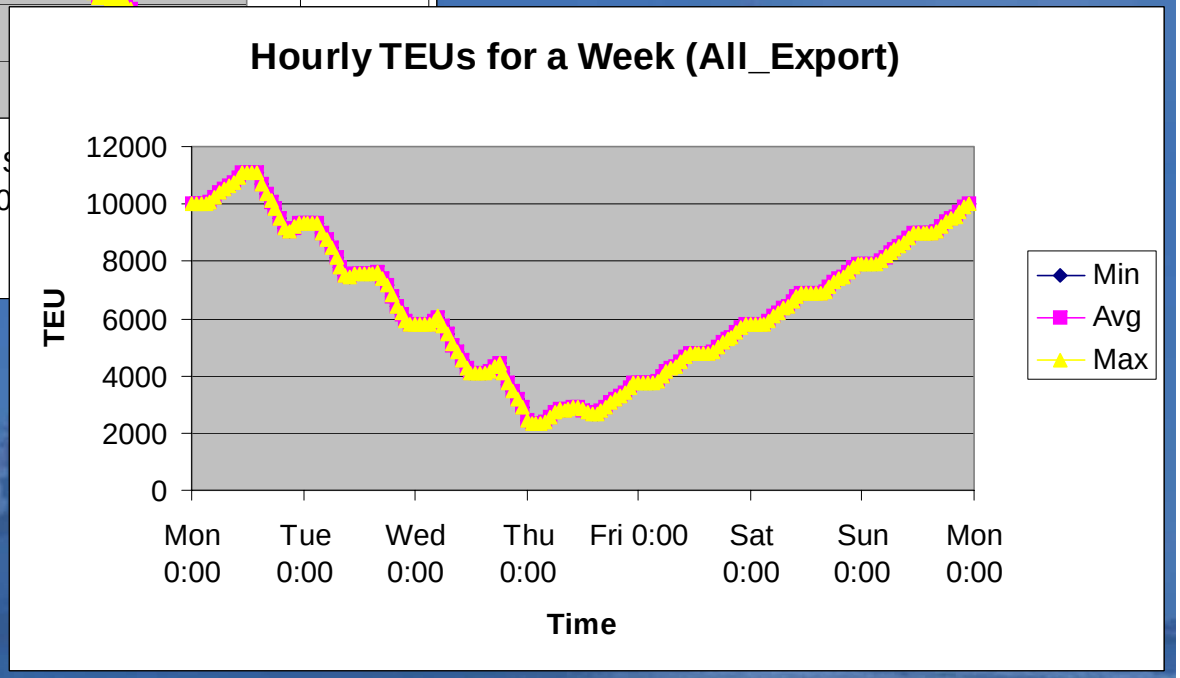


Scenario 1 : Bad Vessel Good Train



Max Import = 9,763 TEU's

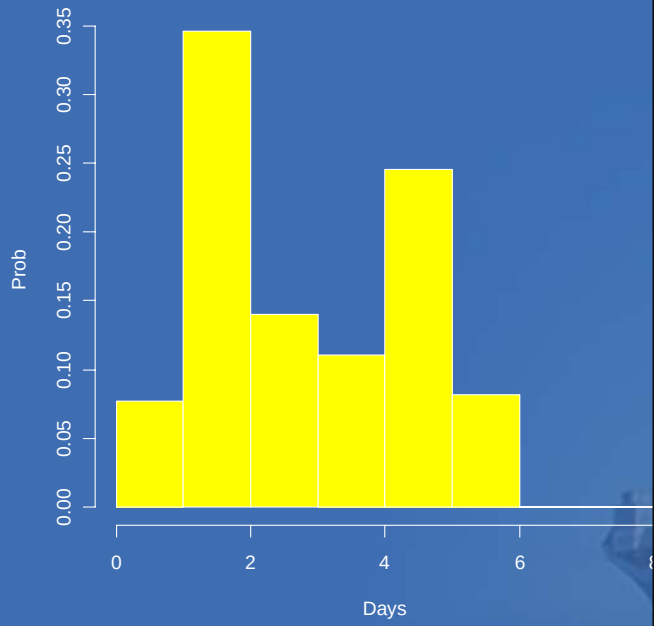
Max Export = 11,065 TEU's

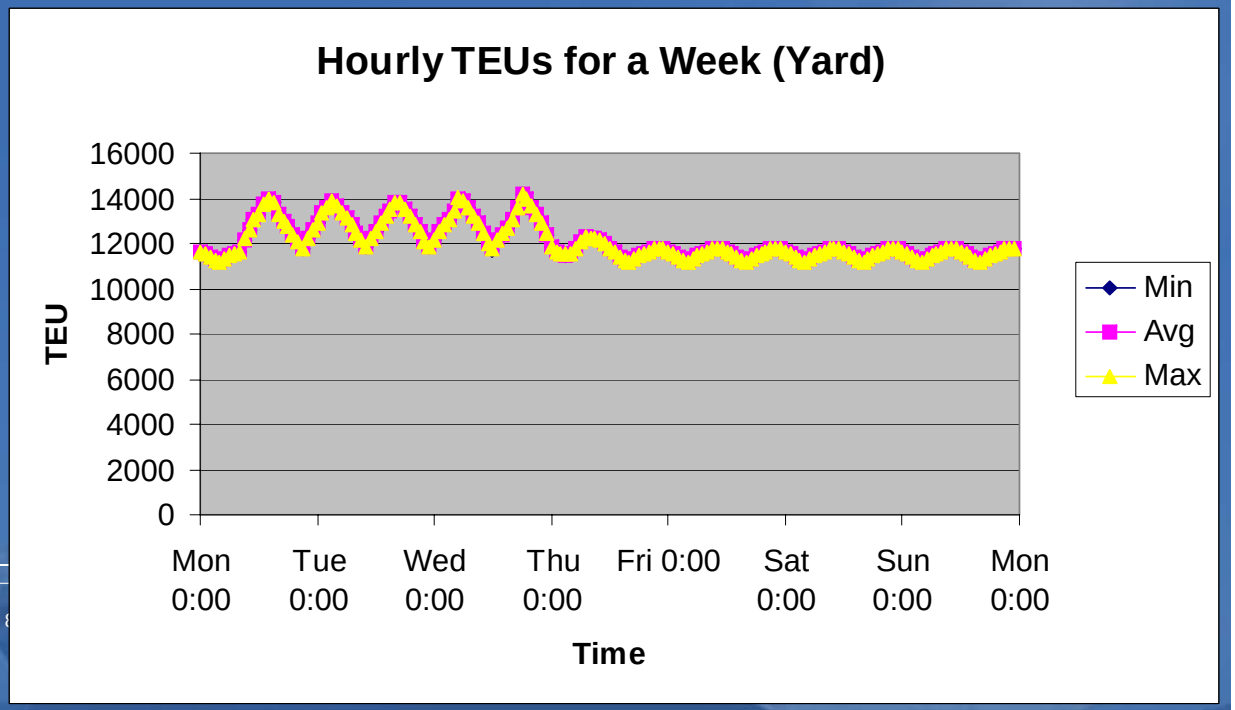


Scenario 1: Bad Vessel Good Train

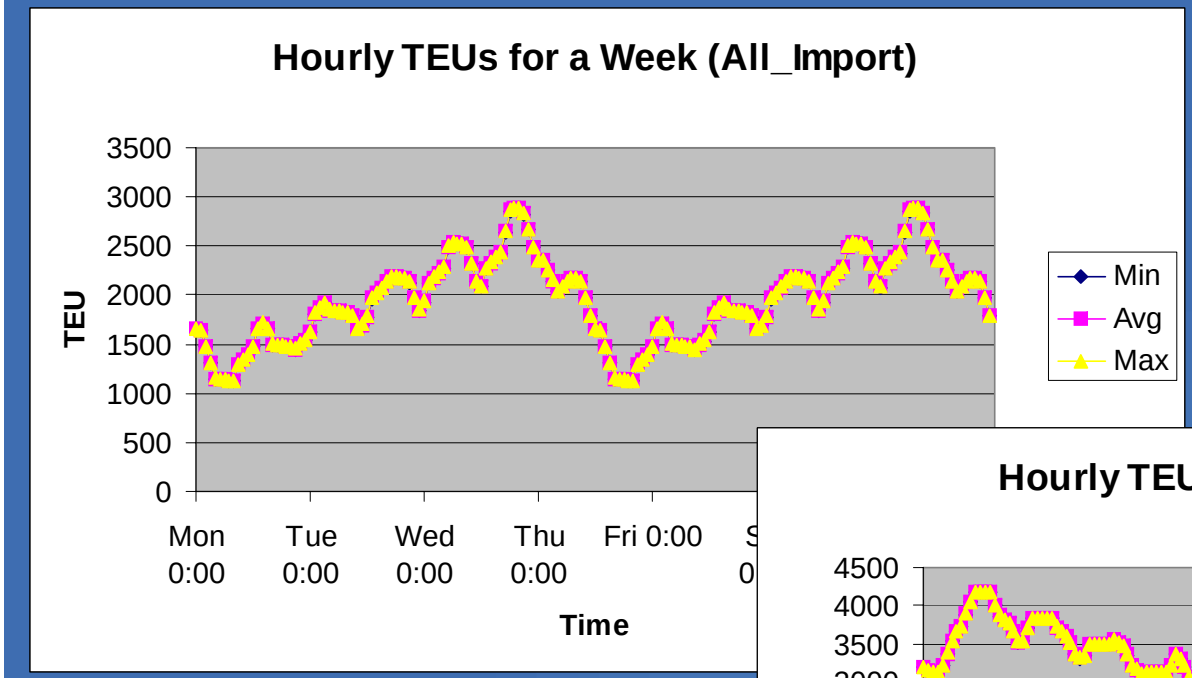
Average Dwell = 2.87 Days
Average Inventory = 12,081 TEU's
Max Inventory = 14,209 TEU's

Total Storage Req'd.
Shared Im/Ex = 20,800 TEU's
Segregated Im/Ex = 30,500 TEU's



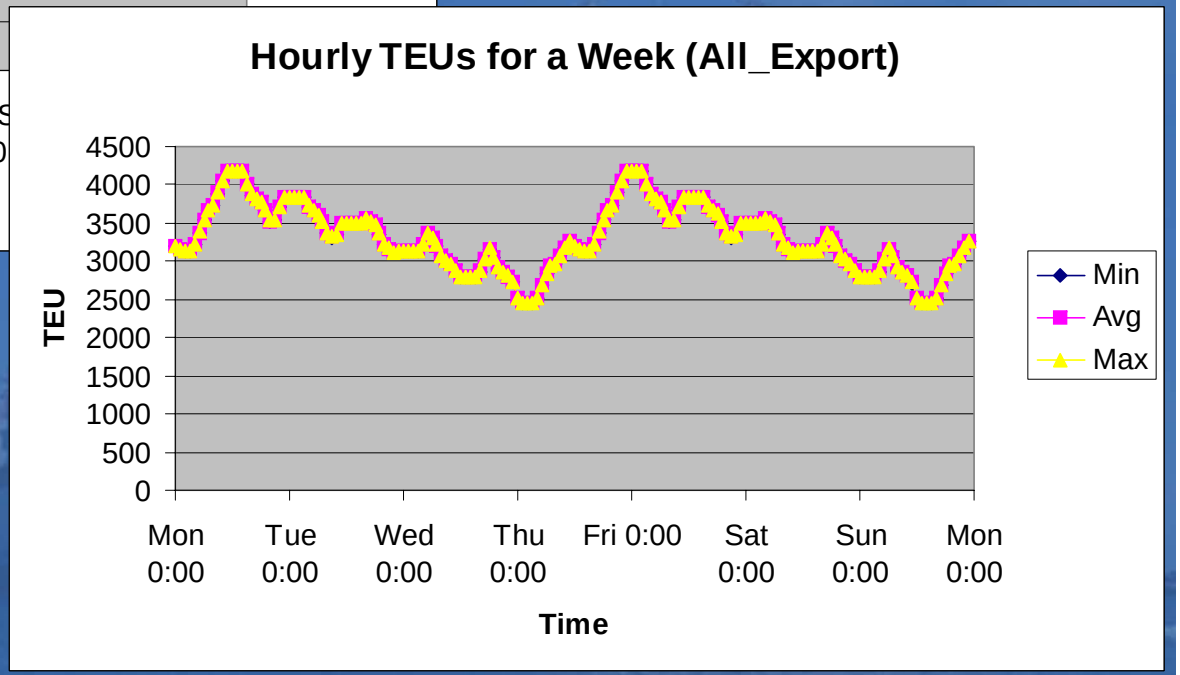


Scenario 2 : Good Vessel Good Train



Max Import = 2,961 TEU's

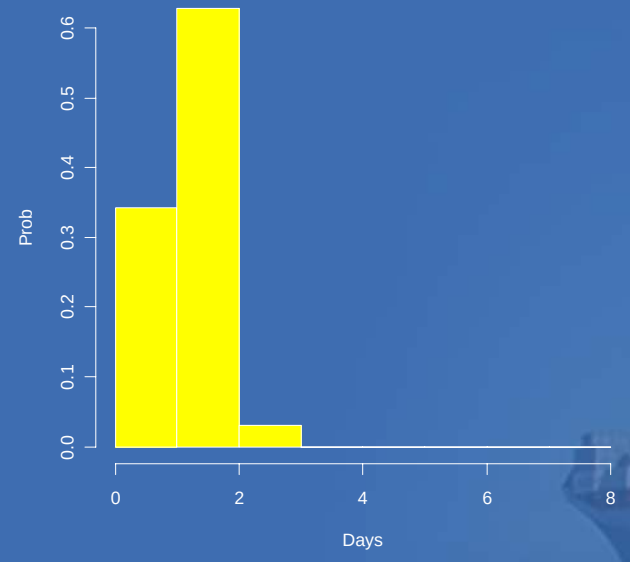
Max Export = 4,190 TEU's

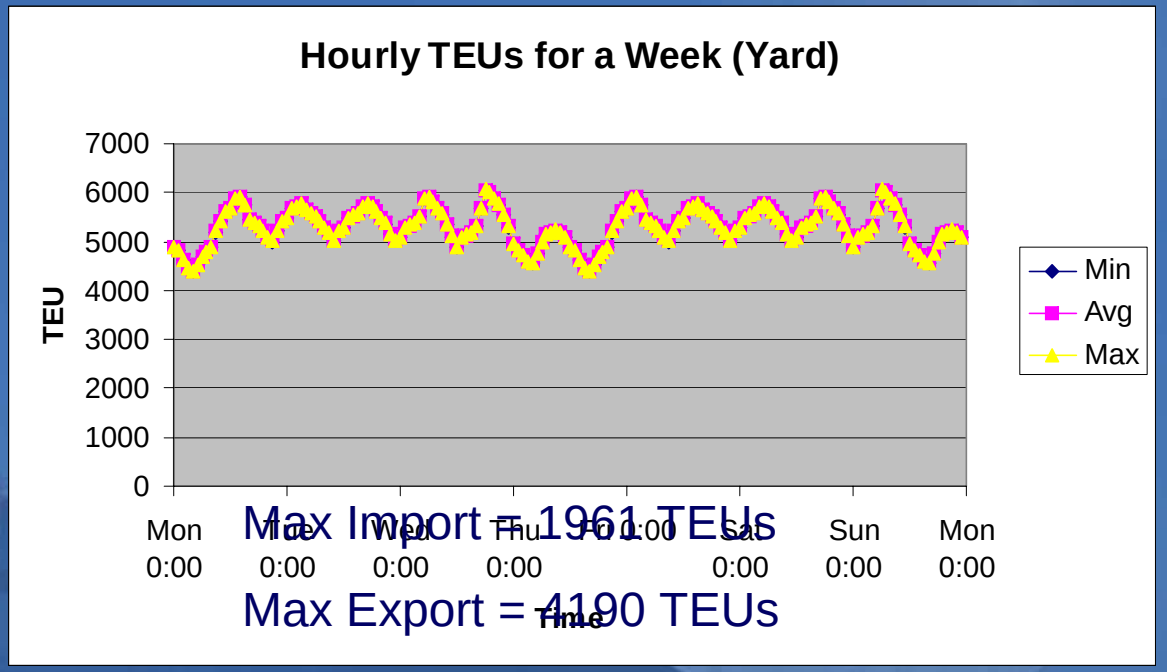


Scenario 2 : Good Vessel Good Train

Average Dwell = 1.25 Days
Average Inventory = 5,305 TEU's
Max Inventory = 6,064 TEU's

Total Storage Req'd.
Shared Im/Ex = 8,895 TEU's
Segregated Im/Ex =10,488 TEU's





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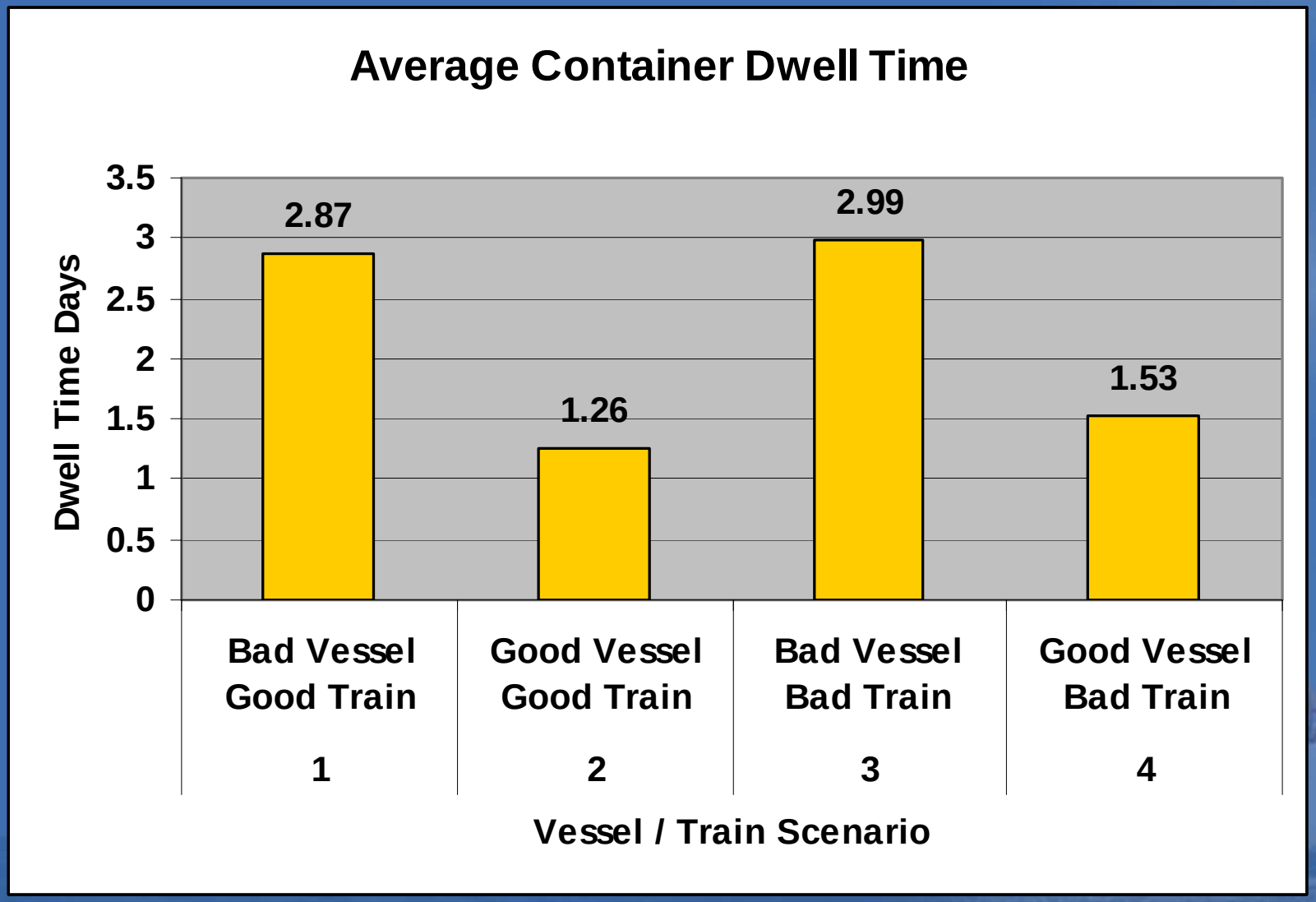
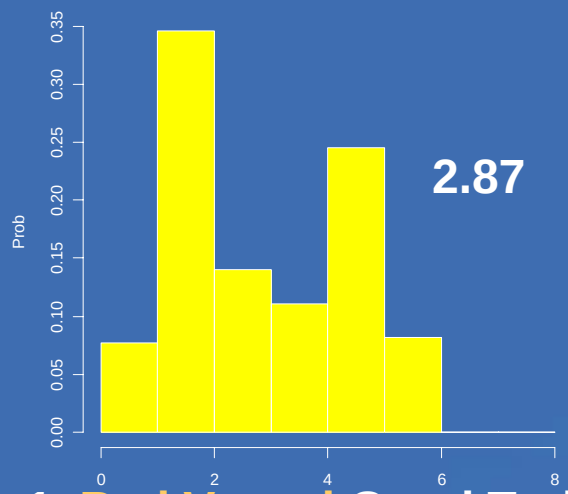
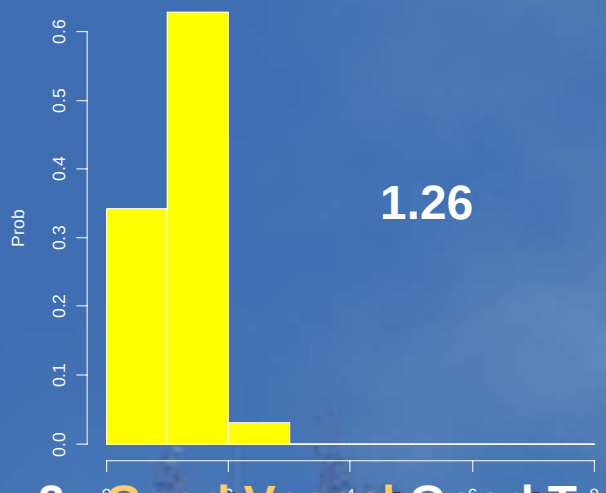
Container Dwell Time Comparison



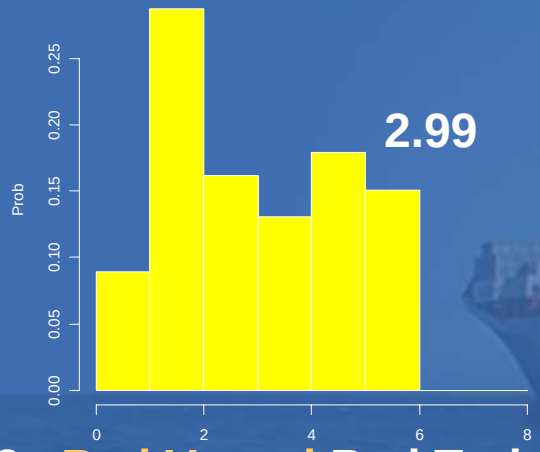
Container Dwell Time Comparison



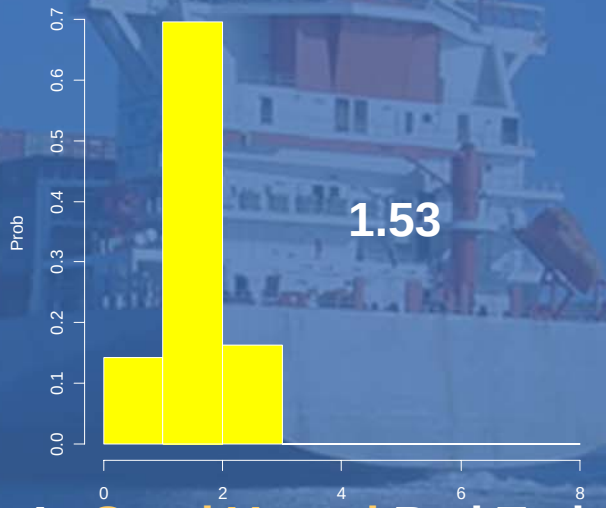
1. Bad Vessel Good Train



2. Good Vessel Good Train



3. Bad Vessel Bad Train



4. Good Vessel Bad Train

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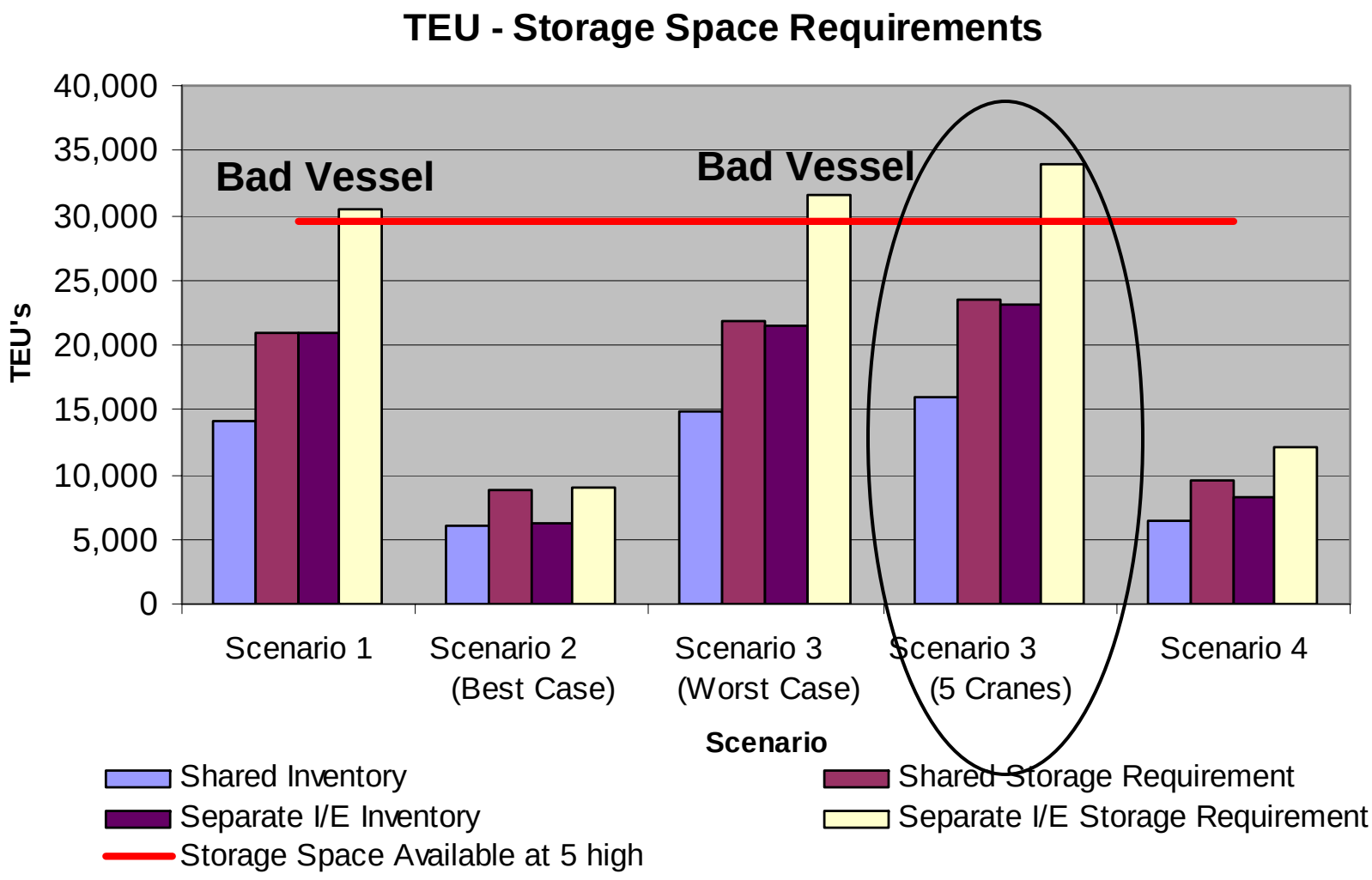
Container Dwell Time Comparison

Findings



Assuring Supply Chain Efficiency

Some More Quotes:

"I have no need of ports, I get everything I need from the internet."

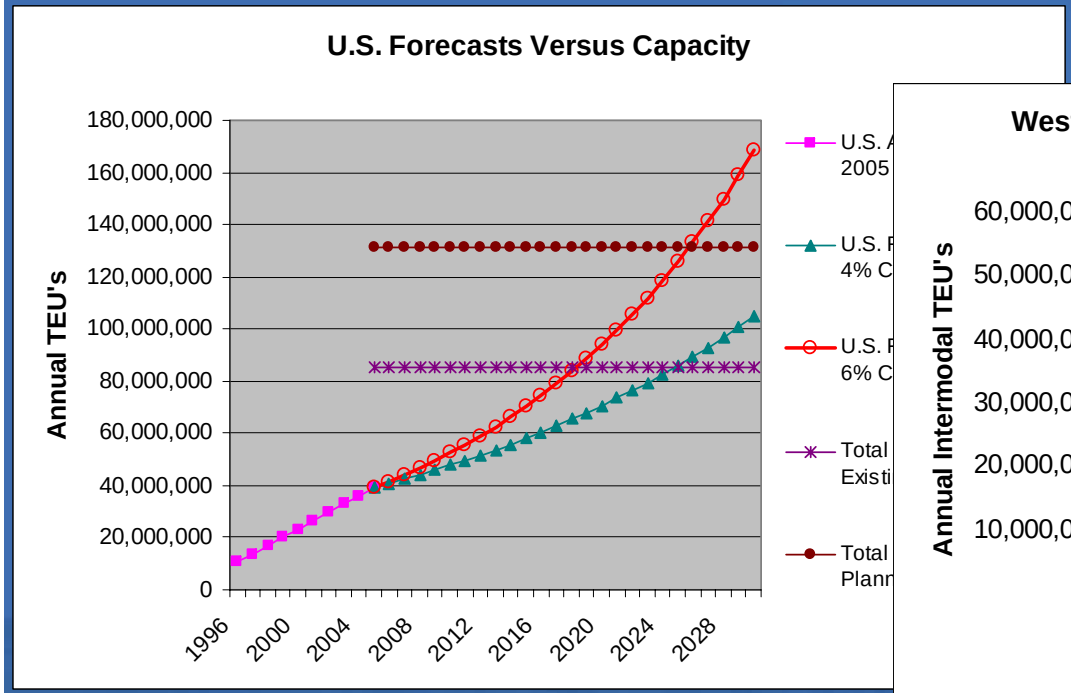
Unidentified citizen at a port permit hearing

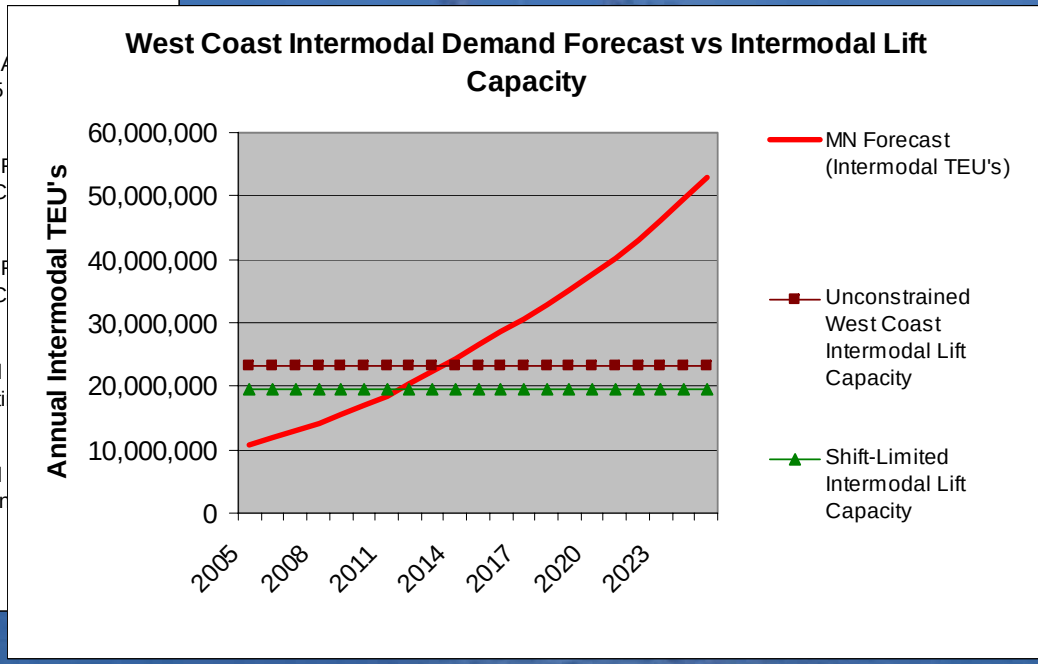
"The Dirty Truth About U. S. Ports…"

NRDC Report "Harboring Pollution"

Assuring Supply Chain Efficiency

- **Threats**
  - Port capacity
  - Intermodal lift capacity
  - Highway & rail infrastructure





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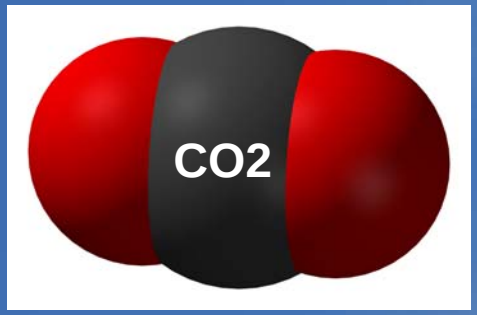
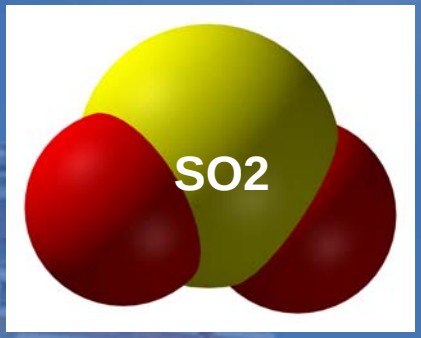
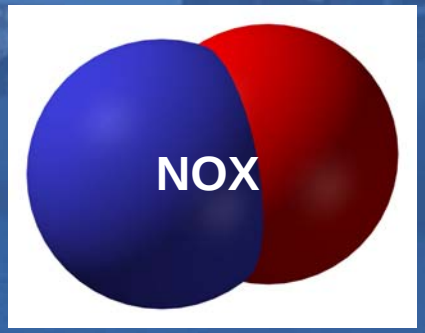
- **Threats**
  - **Public perception of the role of ports**
    - **"I have no need of ports…**
    - **"The dirty truth…**
    - **etc.**

Assuring Supply Chain Efficiency

- **Hot topics**
  - Air quality
    - Global warming
      - CO2
    - Local / regional smog
      - Standards / attainment
      - NOX
      - SO2
      - Diesel PM
      - Ozone
    - Fuel switching
    - Cold ironing







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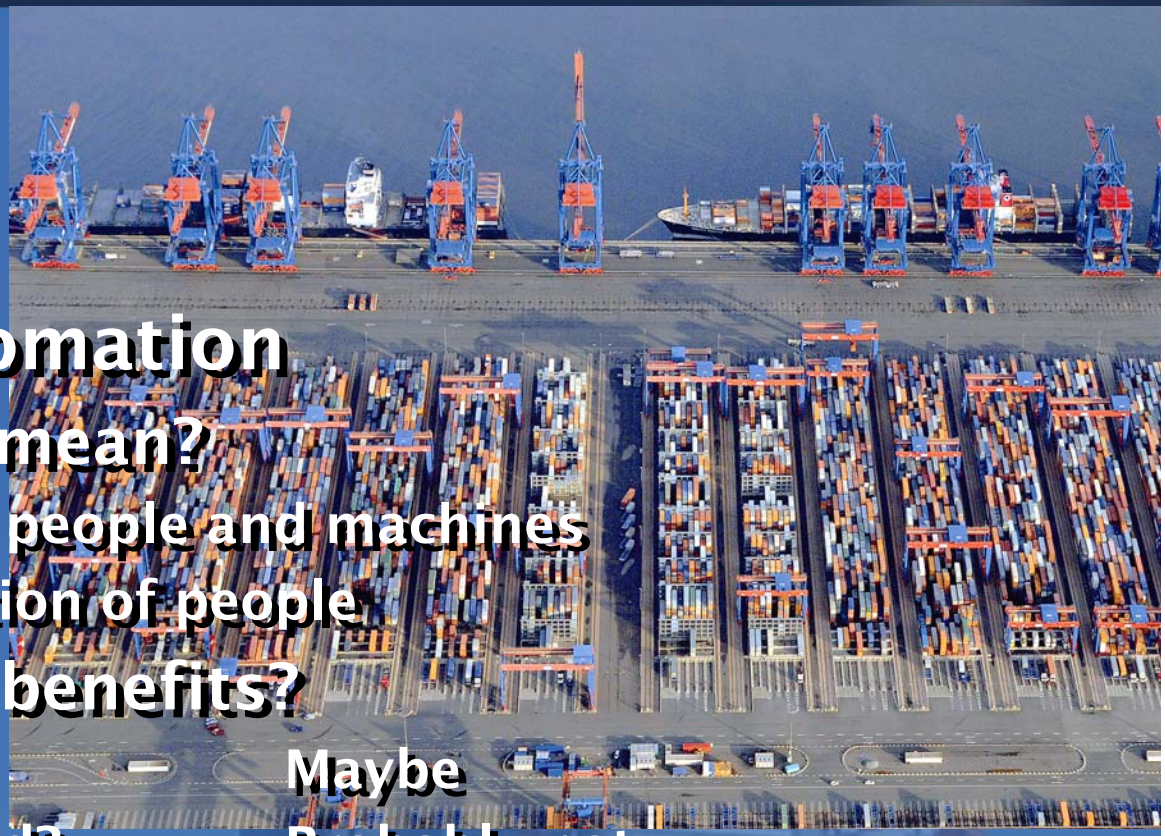

- Hot topics
  - Terminal automation
    - What does it mean?
      - De-coupling people and machines
      - Not elimination of people
    - What are the benefits?
      - Capacity? Maybe
      - Service speed? Probably not
      - Cost? Maybe / hopefully
      - Emissions Yes. Electric yard cranes


Thank You!