

MOFFATT & NICHOL



Creative People, Practical Solutions.

“Terminal of the Future in San Pedro Bay”

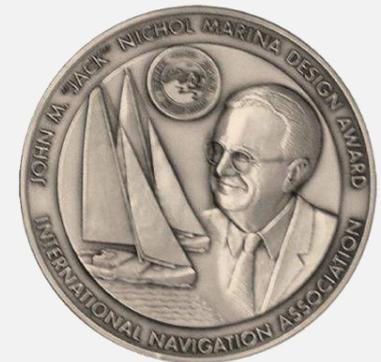
by
Ashebir Jacob
Larry Nye
Moffatt & Nichol

September 15, 2015

Moffatt & Nichol

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- Founded in 1945 in Southern California to serve the evolving Naval, Port and Maritime Industries
- 550+ employees; 27 offices (North America, Europe, Latin America, Middle East, Pacific Rim)
- A recognized leader in marine terminal planning, analysis, design and goods movement economics



Container Shipping 101

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“...the real driving force behind globalization is the declining cost of international transport...”

Journal of Commerce

The Box That Changed the World

It has always been about cost

It will always be about cost

But it is also about reliability

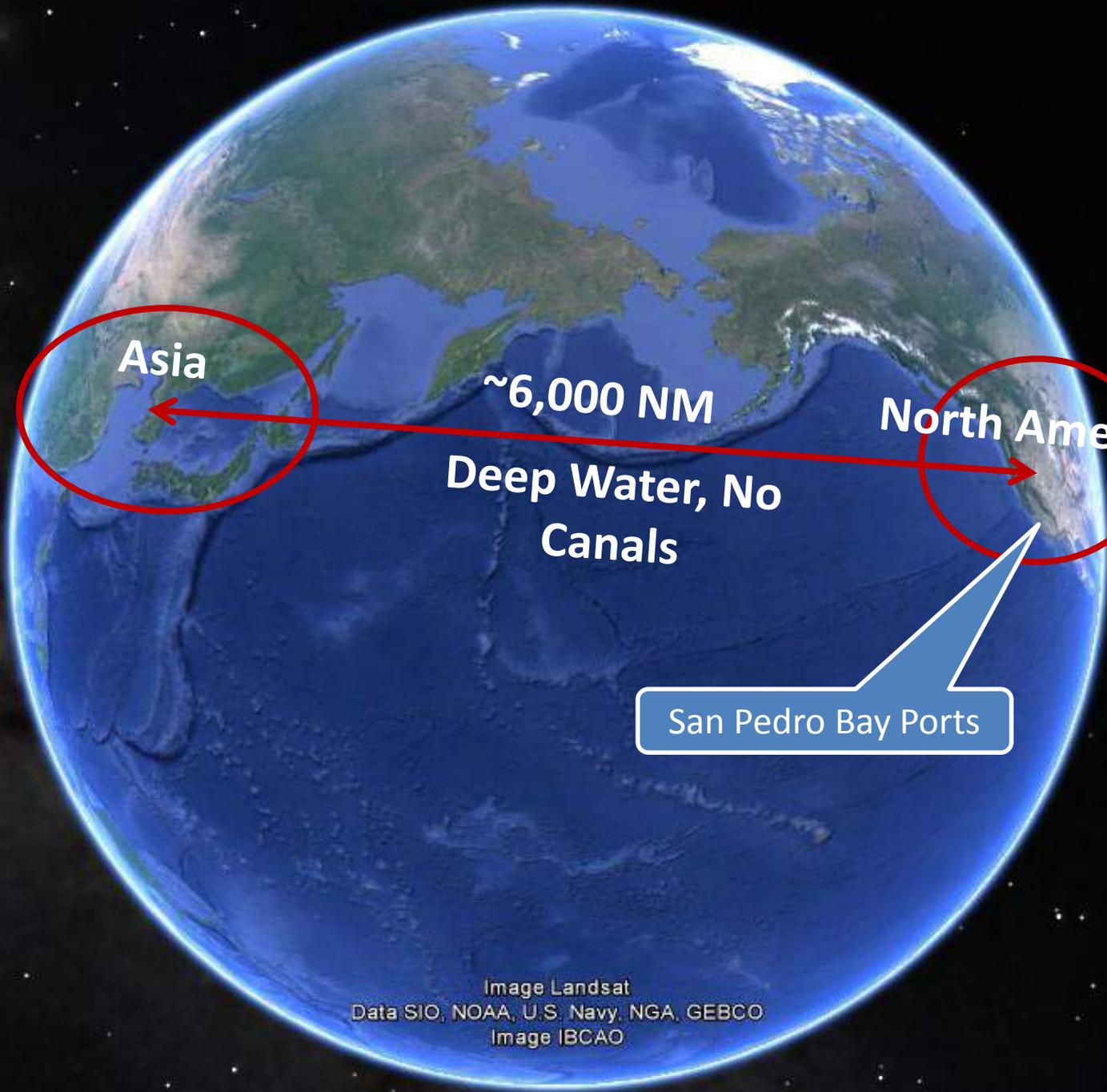
Container Shipping 101

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

Ocean shipping is, forever and always the best way to move stuff on this planet.





Asia

~6,000 NM

North America

Deep Water, No
Canals

San Pedro Bay Ports

Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image IBCAO

Google e

San Pedro Bay Ports are Blessed

- “Geo-nautically” positioned between Asia and North America
- Near-perfect year-round weather
- Natural headland and federal breakwater protecting a ~15,000 acre embayment with ~40 foot water depth and a sandy bottom
- Relatively inexpensive deepening and reclamation
- Rock quarry on the water in Catalina Island
- Local population of ~12 M people
- High Capacity (avalanche-free) highway and rail connectivity to US hinterland and ~350 M people (the rest of ‘em)
- Two competing ports, well-managed for the benefit of local and national beneficiaries
 - Historically building state-of-the-art port, road and rail infrastructure ahead of demand
 - Over 3,000 acres of dedicated container terminals
- If that were not enough;
 - \$Billions in oil and gas resting below it all
 - California is the worlds 10th largest economy

San Pedro Bay

Rock Quarry

Data LDEO-Columbia, NSF, NOAA
Data USGS
Image Landsat

Google

Where have We Been?

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- About 50 years into containerization
- US
 - Chassis-based systems (original Sea-Land model)
 - Responsive ports developed relatively large terminal areas
 - NY/NJ, LA/LB, Oakland, Houston, GPA
 - Strong waterfront labor unions
 - Relatively high labor cost
 - Relatively slow to densify, change/innovate
- Rest of world
 - Spared from the chassis “curse”
 - Little space, higher terminal storage/throughput density required
 - Varying labor jurisdiction and power
 - Container handling automation developed in the 1990’s
 - Netherlands, Germany, UK, Australia

Where are We Now?

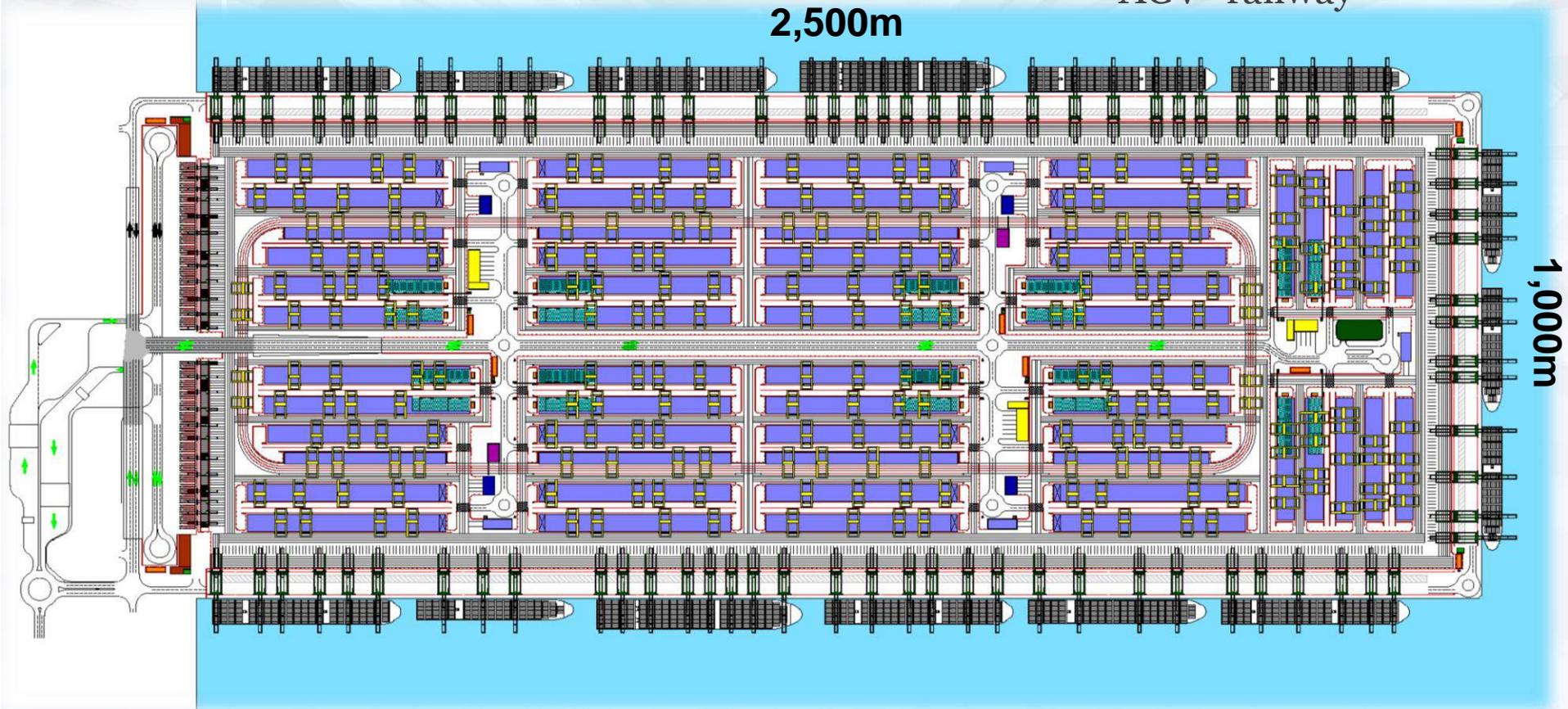
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- SP Bay
 - Large vessels and call sizes
 - 8,000 > 14,000 TEU vessels
 - 8,000 lifts per call > 14,000
 - Terminals densifying
 - Draying to offsite support yards
 - Pier pass
 - Latest container handling technologies are being deployed
 - Operating procedures changing to match technologies

“Terminal of the Future”

Singapore Next Generation Container Port Competition

- 20M TEU per year
- 80% Transshipment
- 200,000 slots
- 78 STS cranes
- 200 Yard cranes
- 27 Landside transfer cranes
- Recessed terminal “AGV” railway

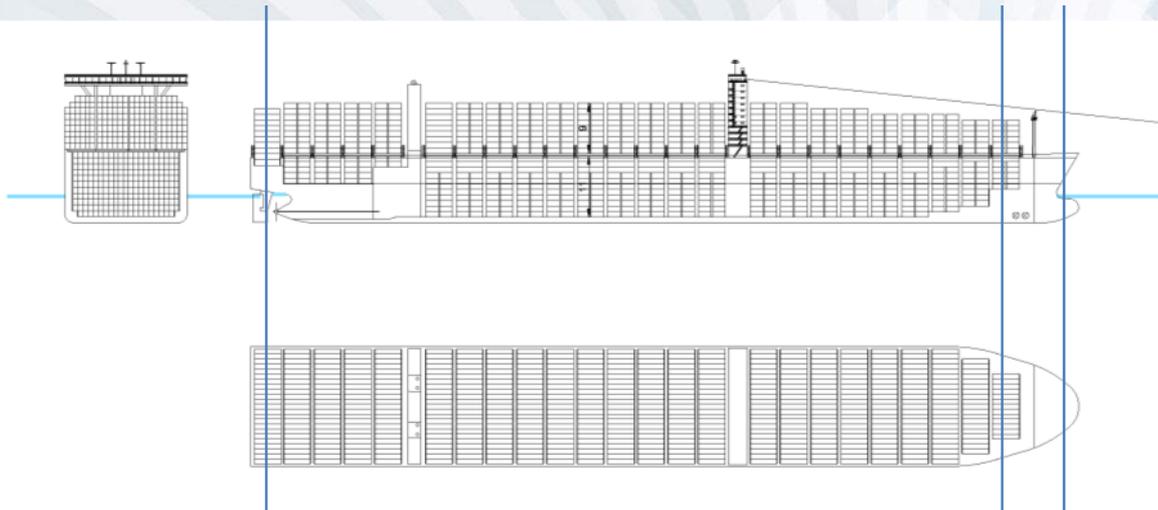


Where are We Going?

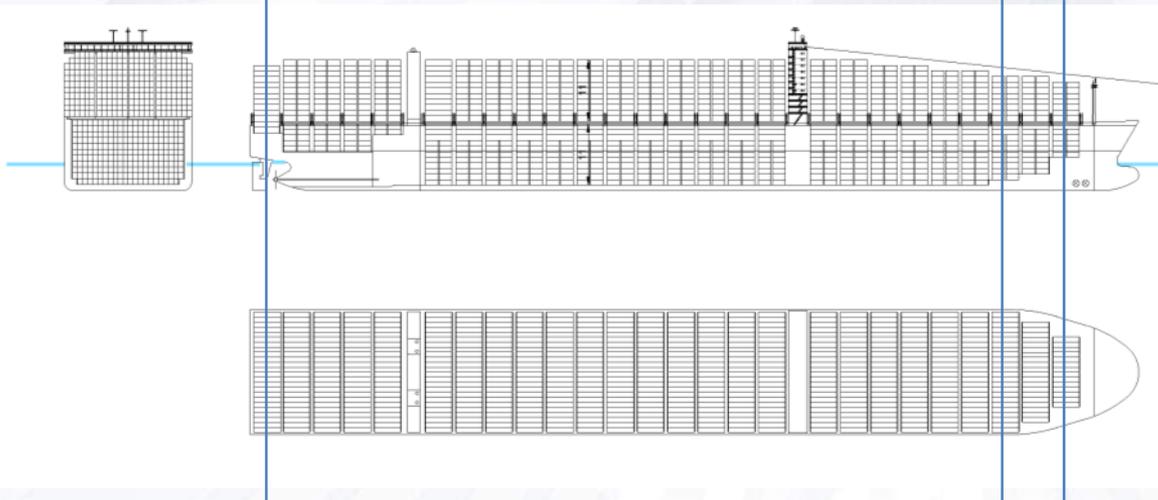
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- Even larger vessels
 - 18,000 > 22,000 TEU
- Maturing North American population
- Shifting economies and demographics
 - North America and Europe aging
 - Latin America maturing
 - Asia and Africa growing
- Panama Canal Third Locks project opening next year (14,000 TEU)
 - “Will it effect SP Bay?”

18,000 and 22,000? TEU Vessels



EEE – 18,000 TEU



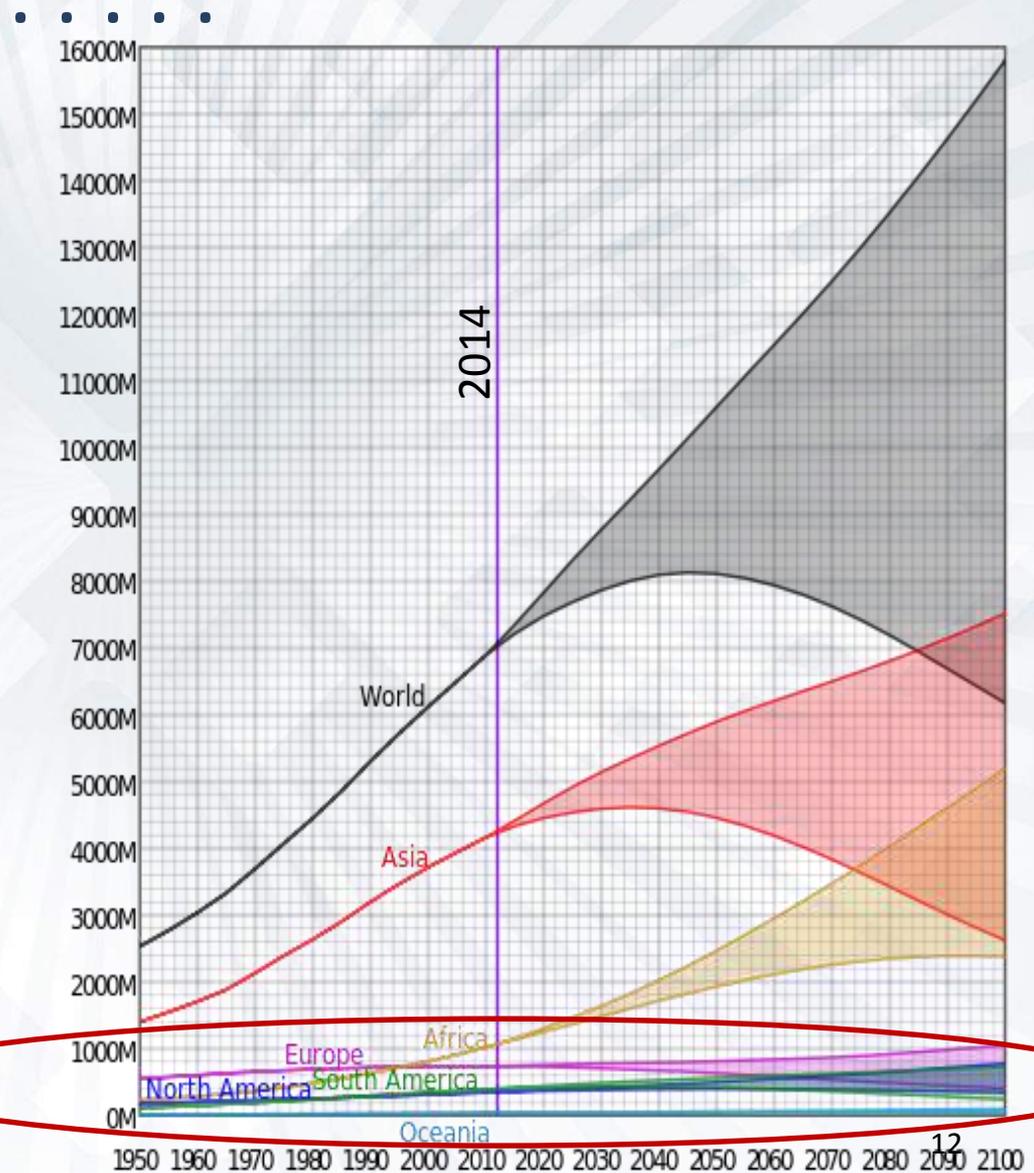
Conceptual – 22,000 TEU

- **18,000 TEU**
 - 1,312 ft loa
 - 202 ft beam
 - 204 ft high
 - 11 + 9 High Cube
 - 24 - 40' bays
 - Aircraft ~ 185'?
- **22,000 TEU Concept**
 - 1,400 ft loa
 - 202 ft beam
 - 224 ft high
 - 11 + 11 High Cube
 - 26 - 40' bays (guess)
 - Aircraft ~ 185'?

World Population Projection

- North America is a “Maturing Market”
 - Population is aging and stabilizing
 - *If optimum vessel size “settles”, the next generation of SP bay terminals could last a long time*
 - *We could (finally) create “near perfect”, optimized terminals for this port*

Europe, North and South America



What is the Future?

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- “System Optimization”
- Vessels, services, service speeds, terminals, landside transportation all “Right-Size” and “Right Speed” for optimum service/cost
- Consistency, reliability, sustainability and predictability with lowest cost

Port Planning 101

- So, we port people only need to get our arms around a few things.....



Primary Drivers of Change in the Past

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- Containerized trade volume growth
- Vessel size increases
- Technological advances
 - Computers, internet, automation, etc., etc.
- Changing market pressures
 - Transit speed
 - Intermodal (double-stack)
 - Just-in-time delivery
 - Big box DC's
 - Increasing fuel costs
- Environmental regulations & concerns
 - Slow steaming

Terminal of the Future (San Pedro Bay)

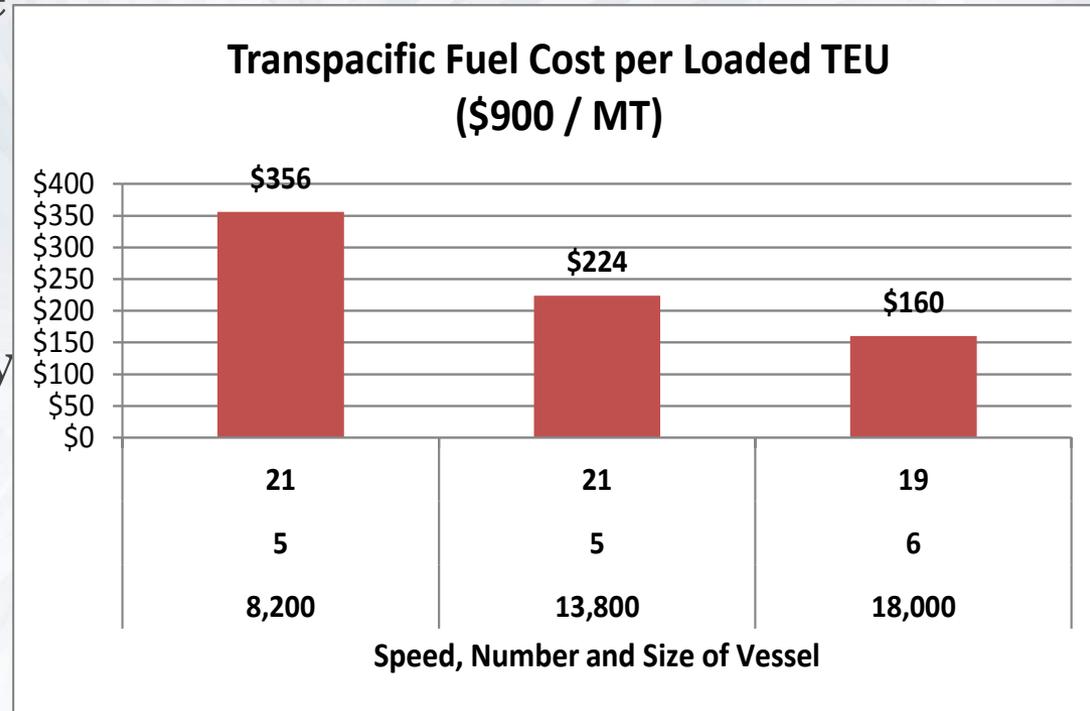
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- Large vessels with large number of moves per call
- Optimized services and terminals
 - Electrically powered container handling
 - “Automated”, “semi-automated” and “driver assisted” container handling where it makes sense to increase productivity
 - Ship-to-shore cranes?
 - Waterside transport?
 - Container stacking / retrieval?
 - Gate/truck service?
 - Rail loading/unloading?
- People
 - Jobs, safety, security and the environment

Big(ger) Ships are Coming to San Pedro Bay

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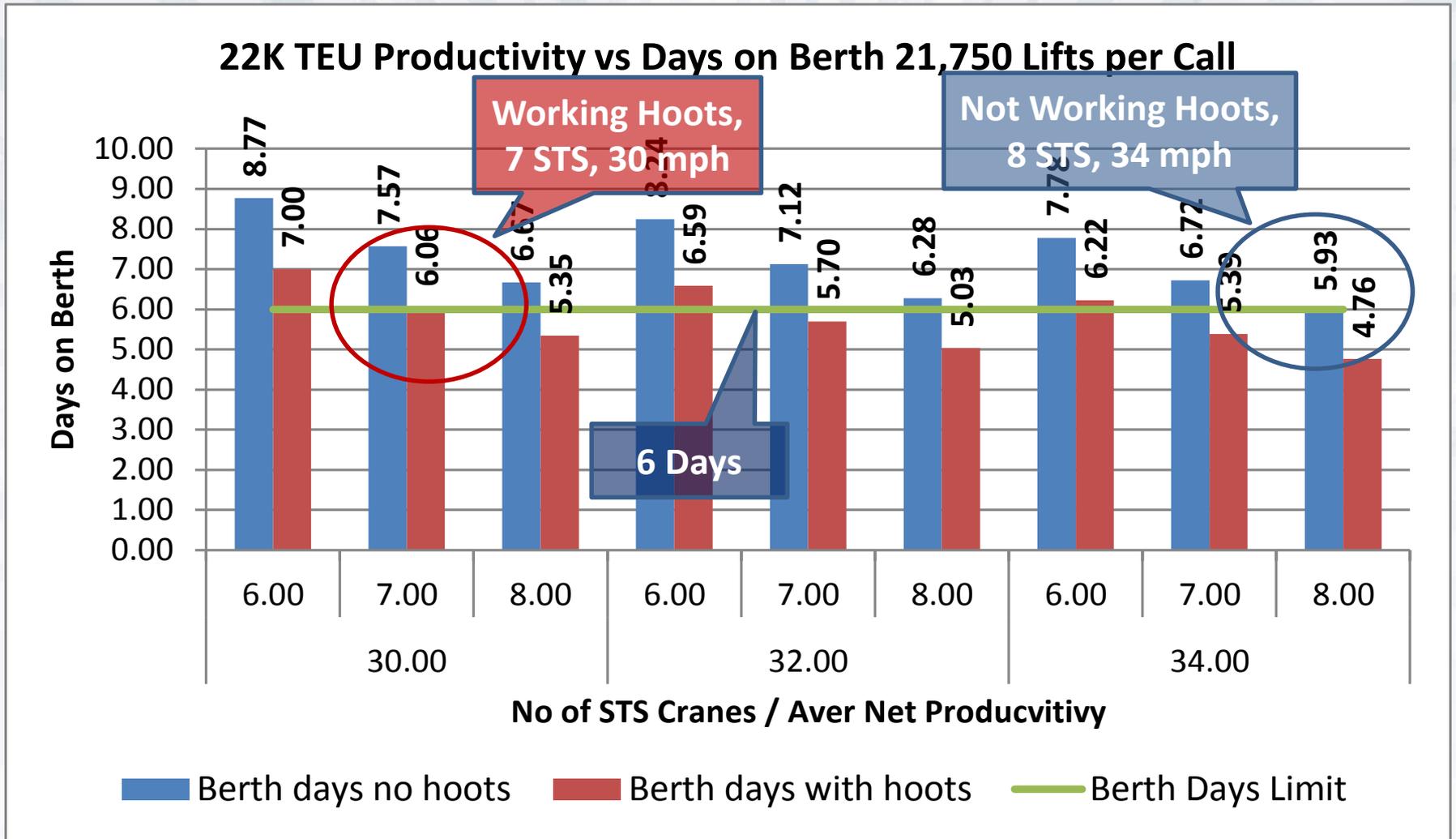
- Larger vessels, steaming at optimum speed reduce slot cost
 - More efficient power plants and hulls
- 14,000 TEU is New Panamax
- 18 - 22,000 TEU is nearly Suezmax
- But there are no canals between Asia and SP Bay
- How big will they get?
- 22,000 - 24,000 TEU is already being discussed
- Will these prove to be the optimum for Asia-NA?



Optimized Asia – NA Service; San Pedro Bay Terminal

- 6 - 22,000 TEU vessels
- 19 knots
 - 41 total days per rotation, 25 sailing days, 2 days early-late allowance, 14 port days, 7 days each side
- Average 90% full, 2.0M TEU / year throughput generated / service
- 21,750 lifts per call accomplished within ~6 days
- High reliability, recoverability
- Low cost per box
- What will it take?

22,000 TEU Vessel 21,750 moves per Call



Ship-to-Shore Cranes

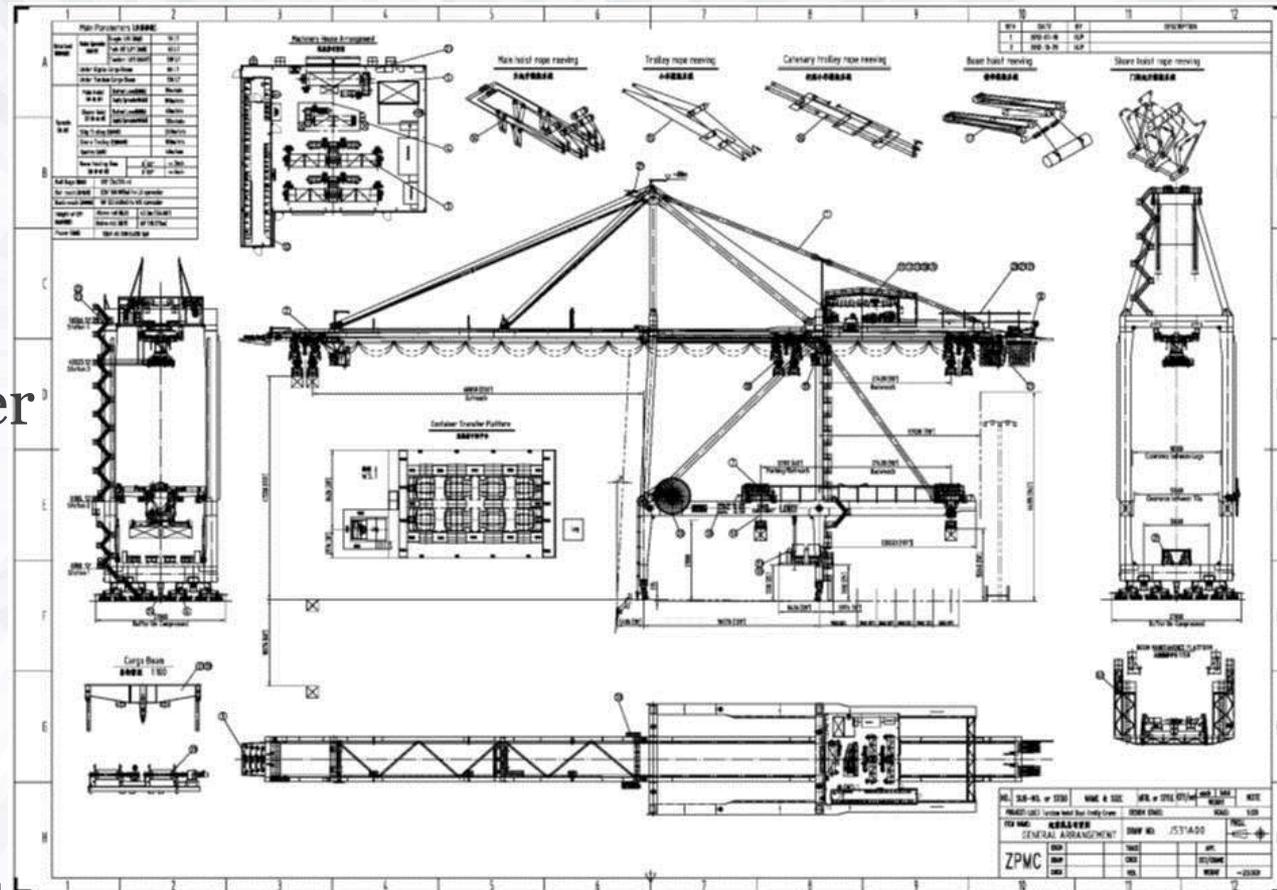
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Ship-to-Shore Cranes

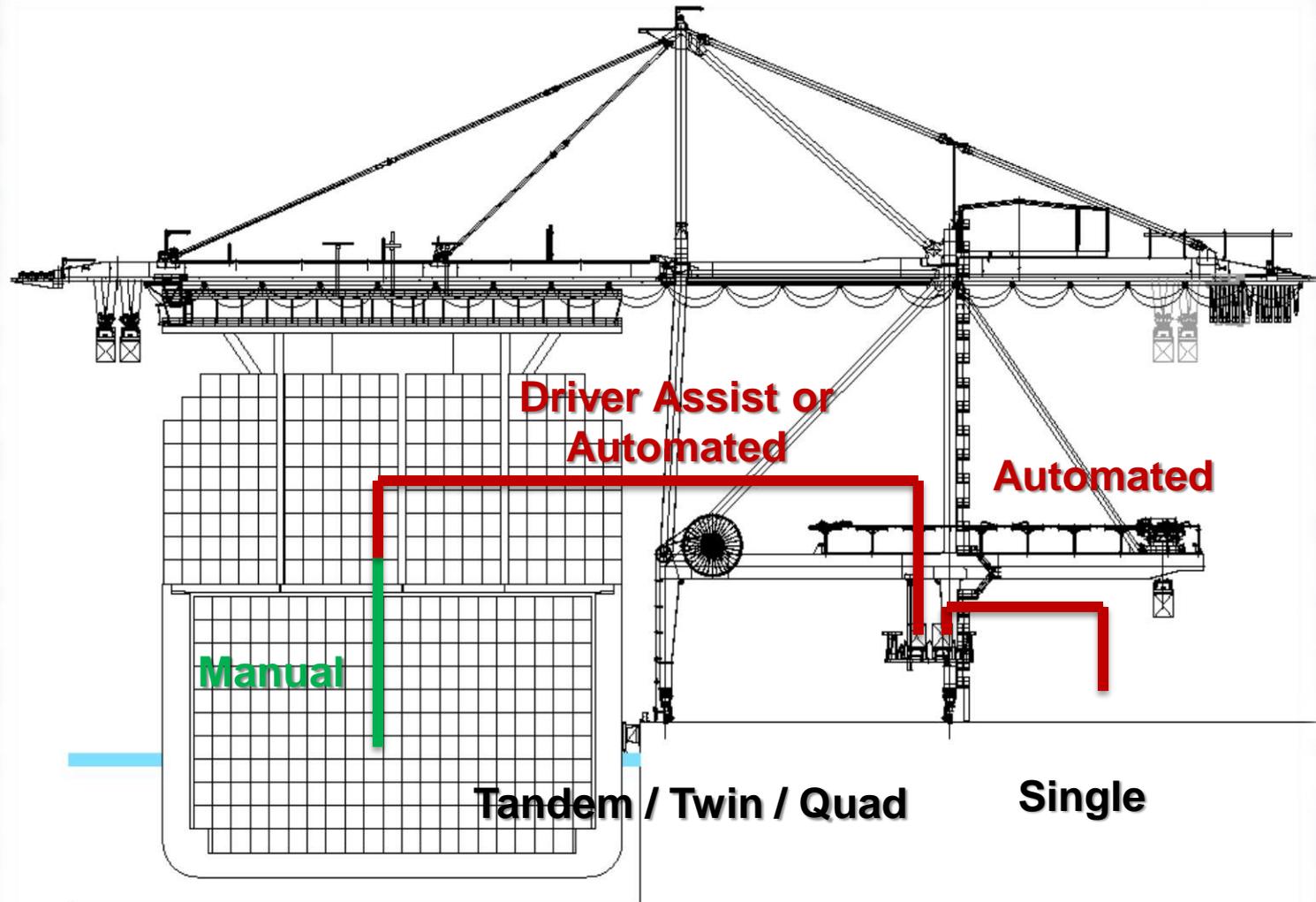
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- Dual trolley, tandem / single
- Elevated transfer/IBC platform
- 30-40 moves per hour
- Driver assist functions
- Remote operation?
- Handoff to HTS in back-reach



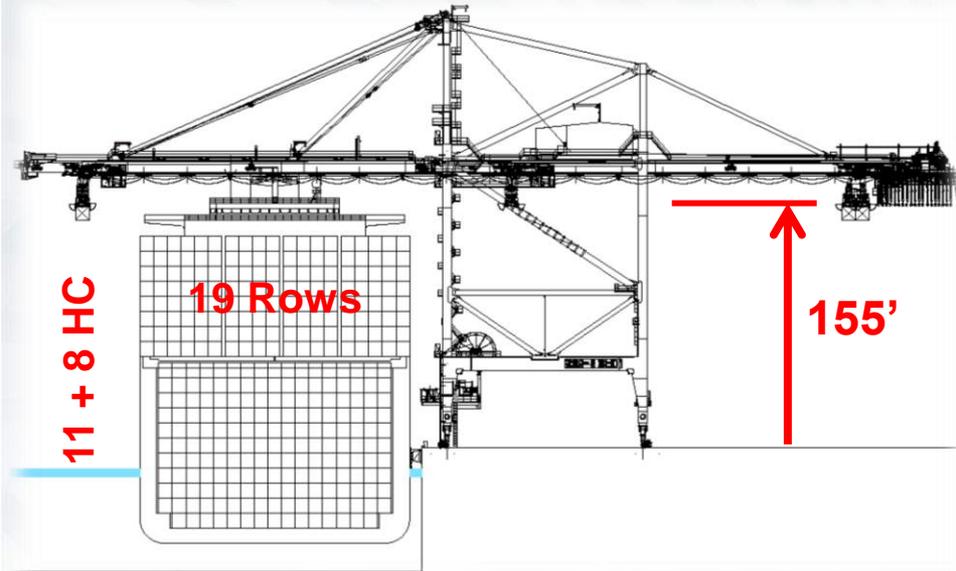
Ship-to-Shore Cranes

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New Panamax & EEE STS Cranes

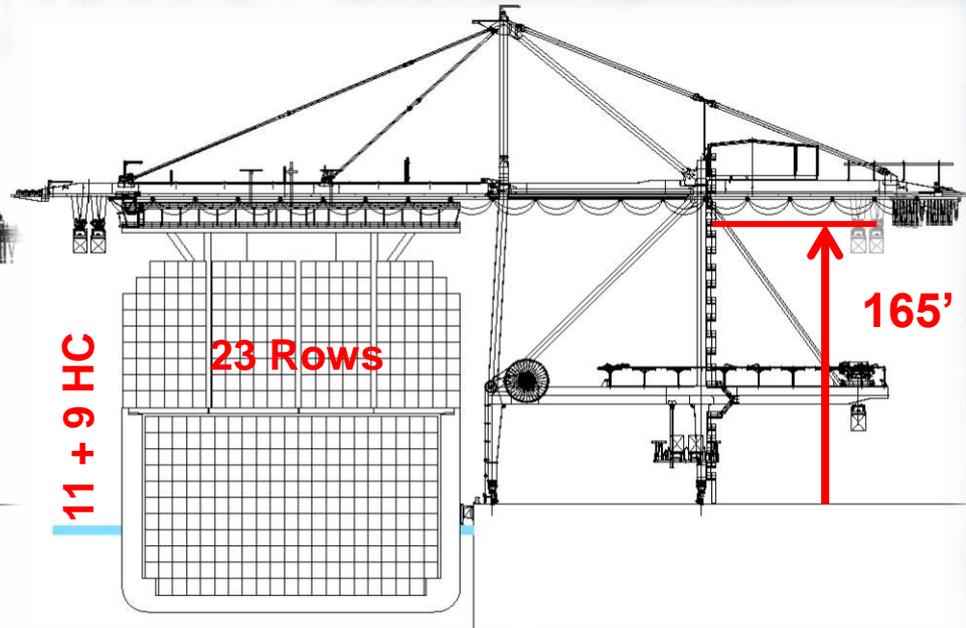
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14,000 TEU - New Panamax

Single Trolley

Twin 20' / Tandem 40' Spreader



18,000 TEU - EEE

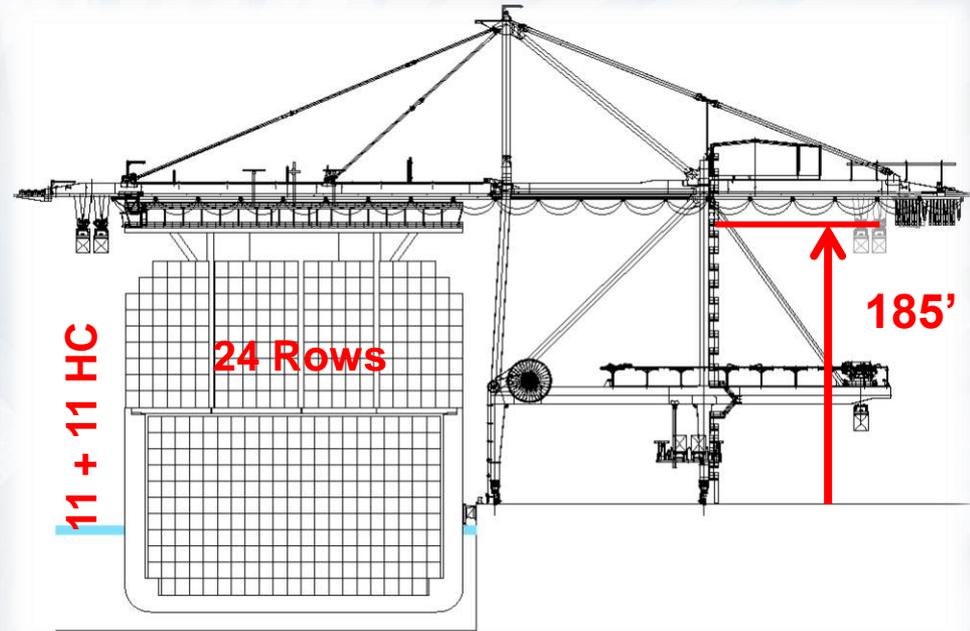
Dual Trolley

Twin 20' / Tandem 40' Spreader

Conceptual 22,000 TEU

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- Outreach 225'
- Lift Height 185'



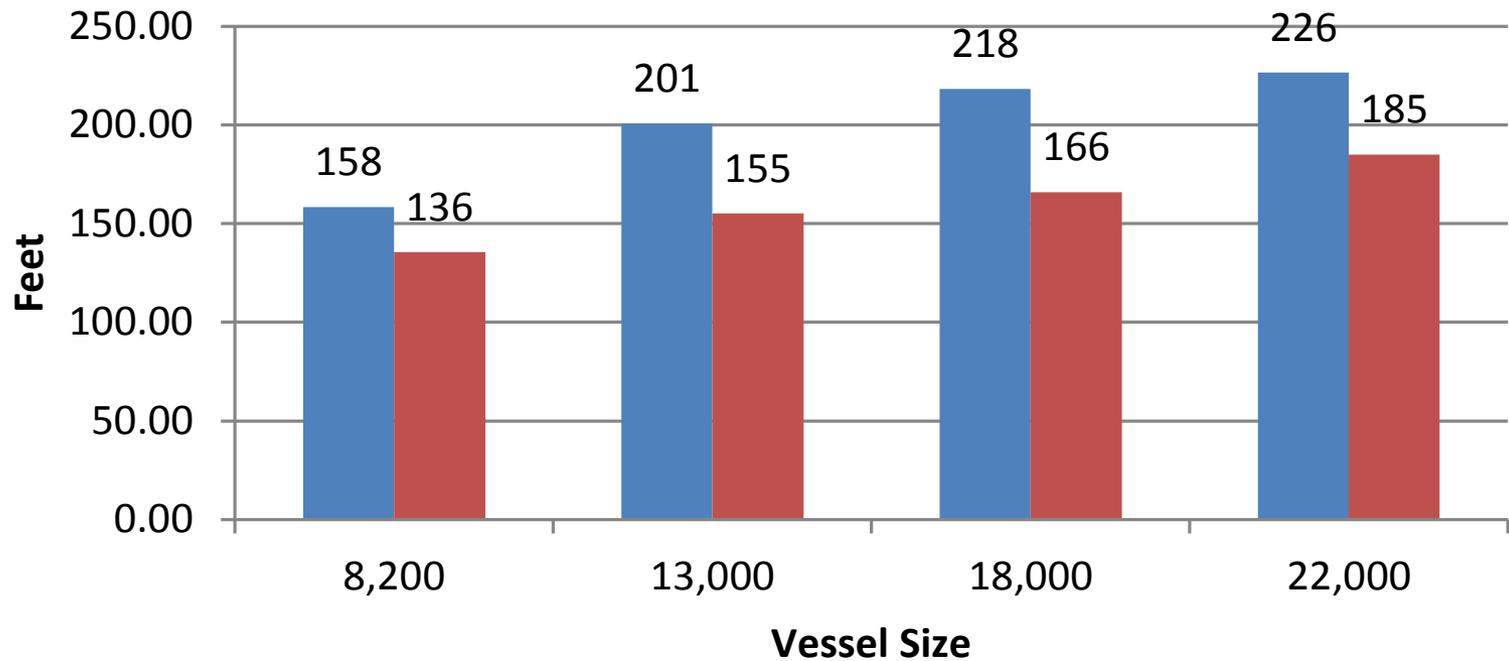
22,000 TEU - EEE

**Dual Trolley
Twin 20' / Tandem 40' Spreader**

STS Crane Dimensions

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Outreach and Lift Height

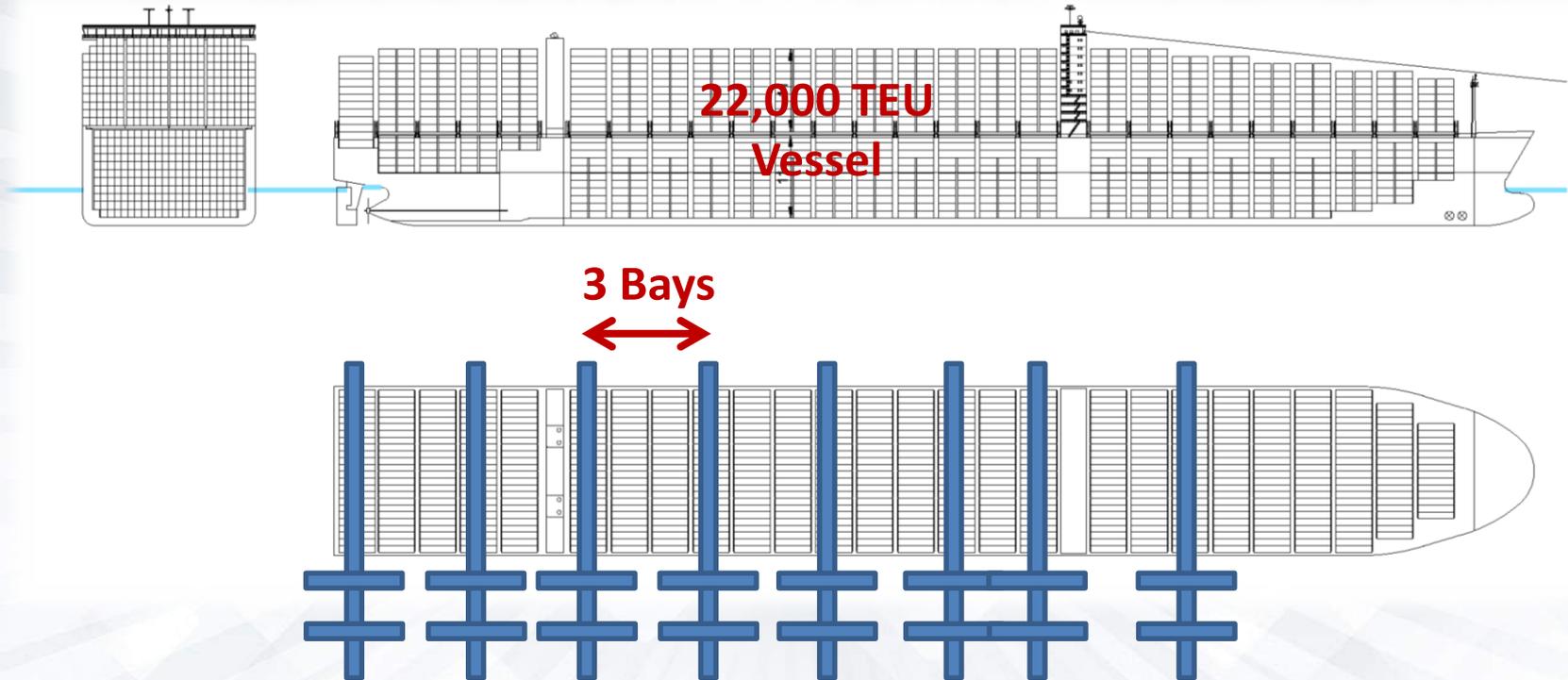


- Required Outreach incl 2.0M overrun
- Recommended Lift Height Above Rails

STS Wheel Loads

“Dedicated” 22K TEU Berth

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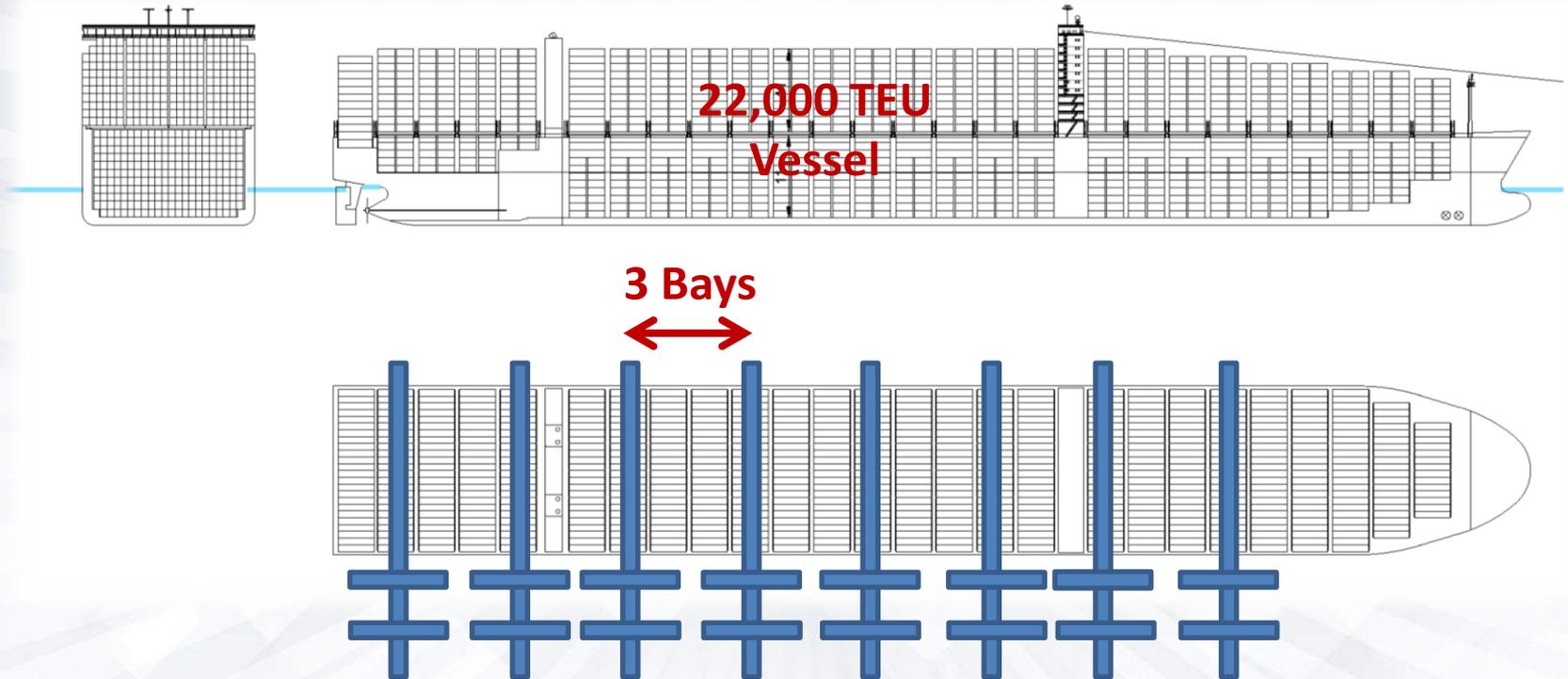


- 26 - 40' bays / 8 STS cranes = 3.25 bays / STS
- Do we have to stay with 88 feet Bumper-Bumper and 16 wheels per corner?
- Why not 133.5' B-B, 20 wheels per corner?

STS Wheel Loads

“Dedicated” 22K TEU Berth

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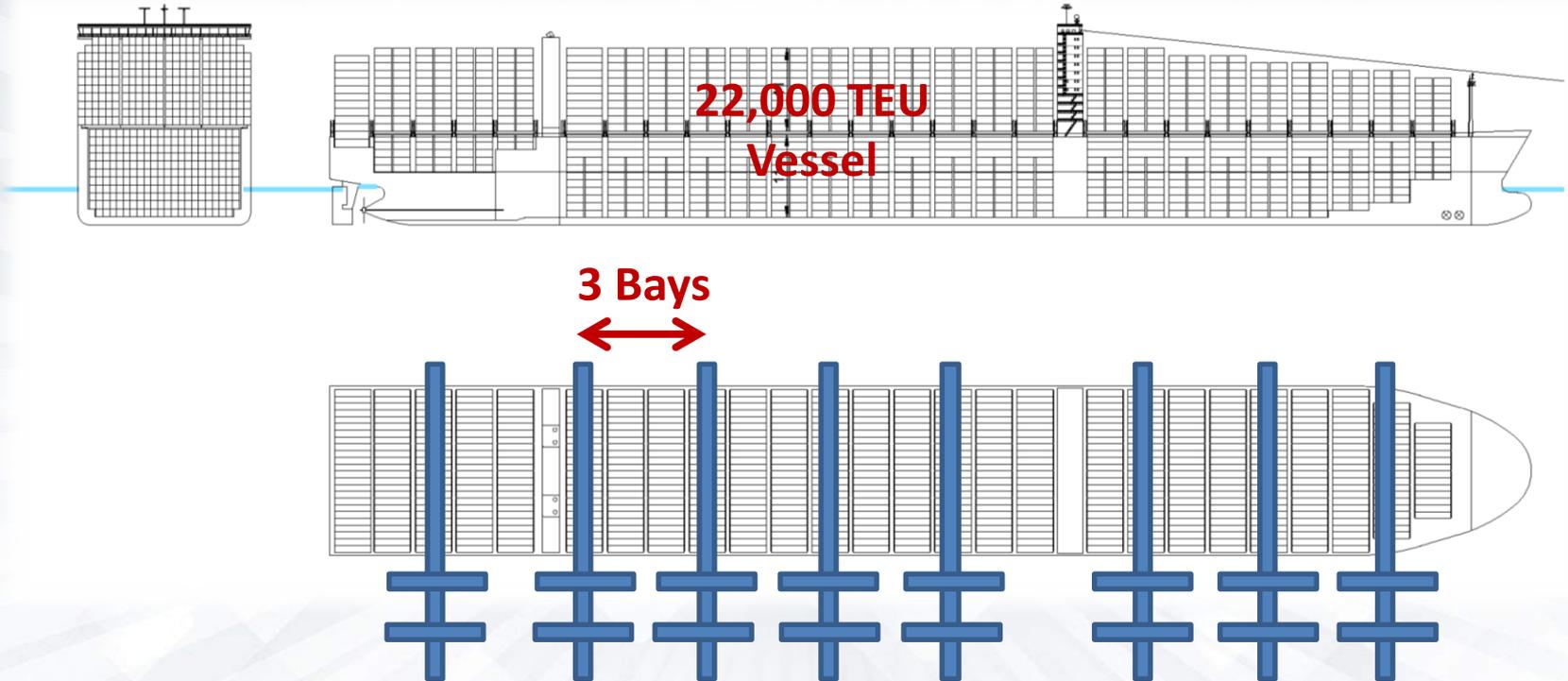


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STS Wheel Loads

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Waterside Transport

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- Detailed gathering and distributing tasks to/from storage
 - Move any box, from any location to any location at any time
- Must be rubber-tired
 - AGV (battery operated)
 - AShC (hybrid diesel)



Container Stacking and Retrieval

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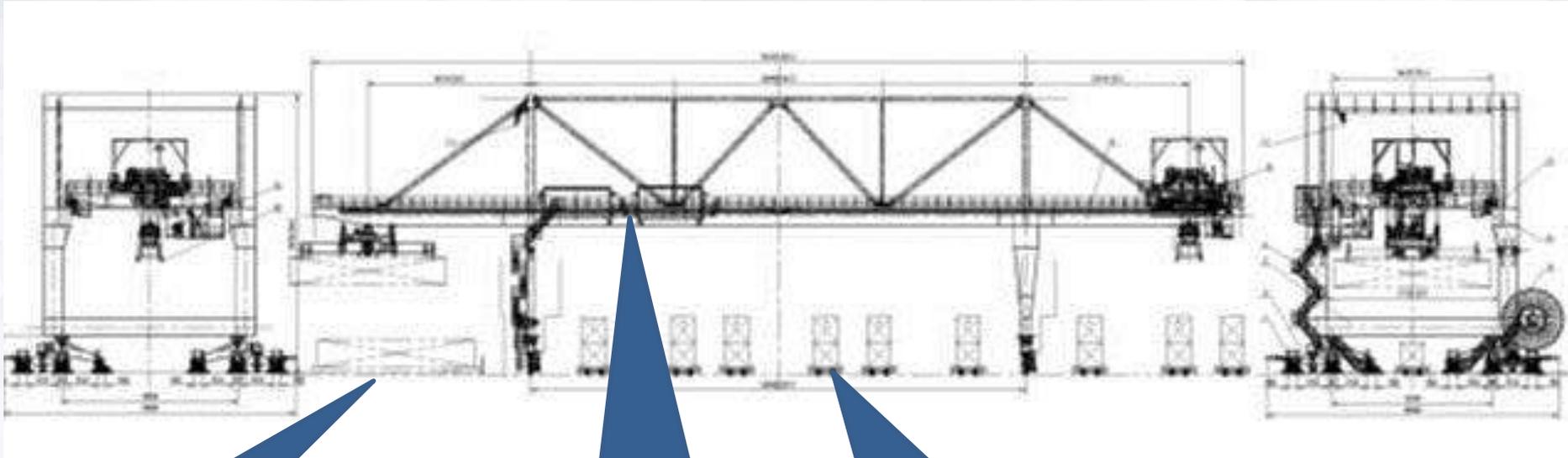
- End-loaded stacking/retrieval cranes
- Side-loaded stacking / retrieval with landside transfer cranes



Rail Unloading/Loading

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- Wide-span gantries
- Ground crew safety



Buffer slots, bomb carts or ShC's

Wide-span gantries with rotators

Up to eight working tracks

Stacking

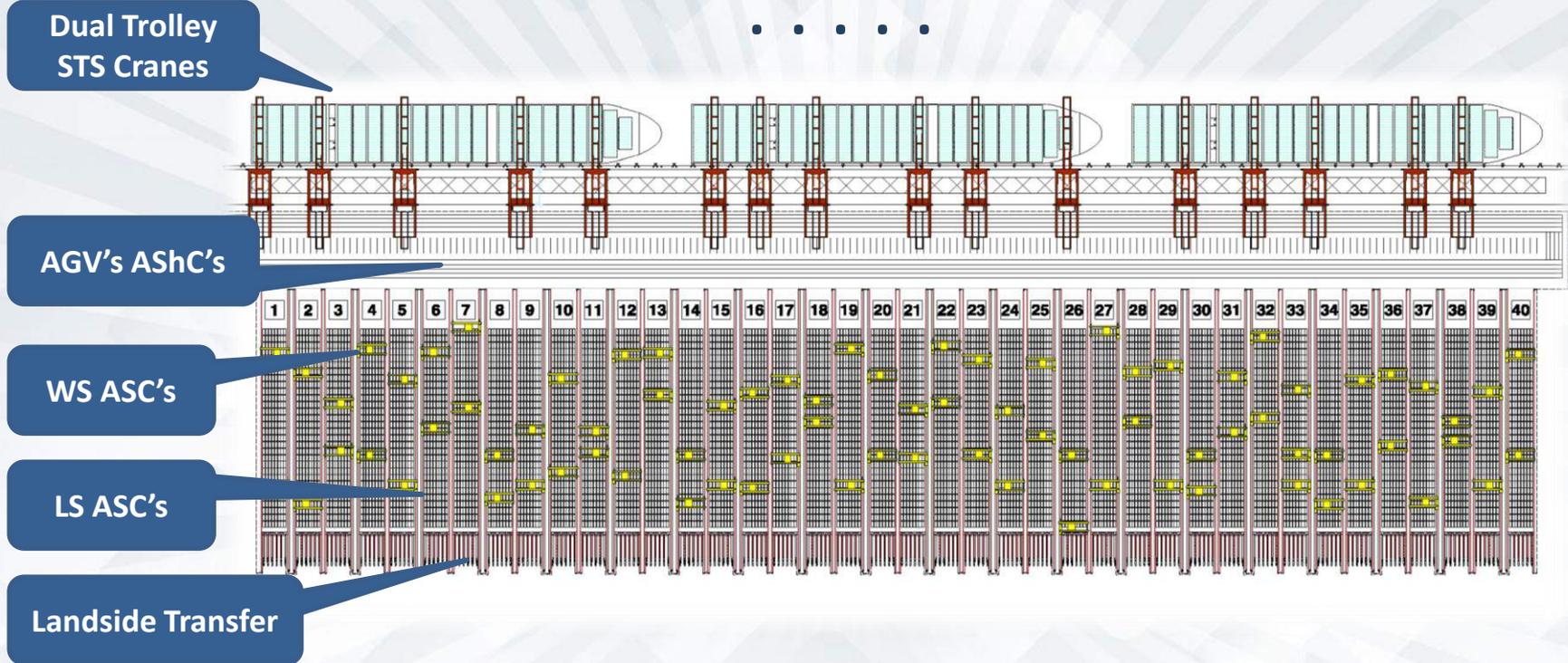
End-Loaded or Side Loaded?

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- End-Loaded twin (ala MHT and Trapac)
 - Most cost effective for high import-export, low transshipment
 - ASC's are separated for waterside and landside, difficult to balance
 - Waterside and landside handling capacity is fixed
 - WS ASC ~18
 - LS ASC ~13
 - **Won't fit on all sites**
- Side-Loaded
 - More costly than EL for high import-export
 - Higher ASC productivity
 - WS moves ~23
 - LS moves ~ 19
 - ASC fleet is combined, all waterside, all landside
 - Handling capacity is variable
 - Requires fewer ASC's, additional LTC's and more AGV's or ShC's
 - **Won't fit on all sites**

3M TEU End-Loaded Twin ASC Terminal

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- 40 WS ASC's at 18 mph = 720 net WS mph
- 40 LS ASC's at 13 mph = 520 net LS mph
- ~64 AGV's (or ~48 ShC's)
- ~\$275M Equipment (not incl. STS)

3M TEU Side-Loaded ASC Terminal

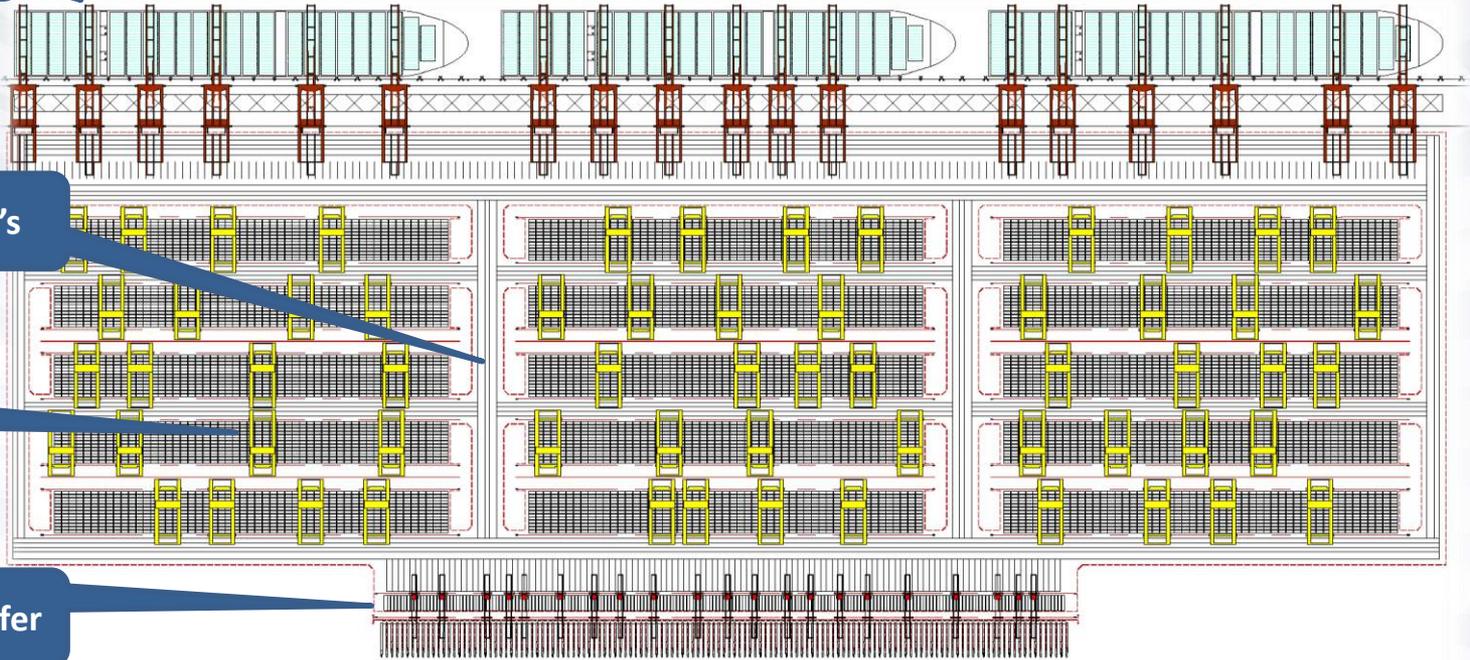
Dual Trolley
STS Cranes

...

AGV's or AShC's

ASC's

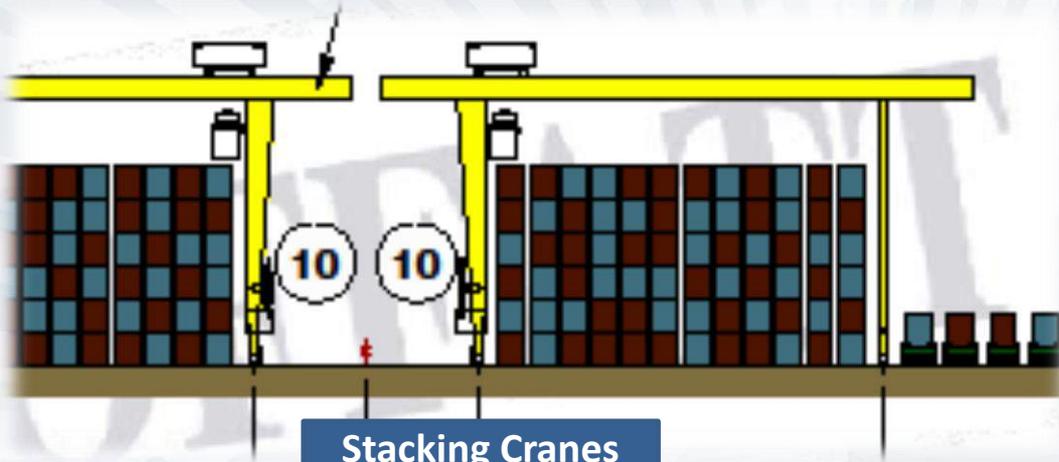
Landside Transfer



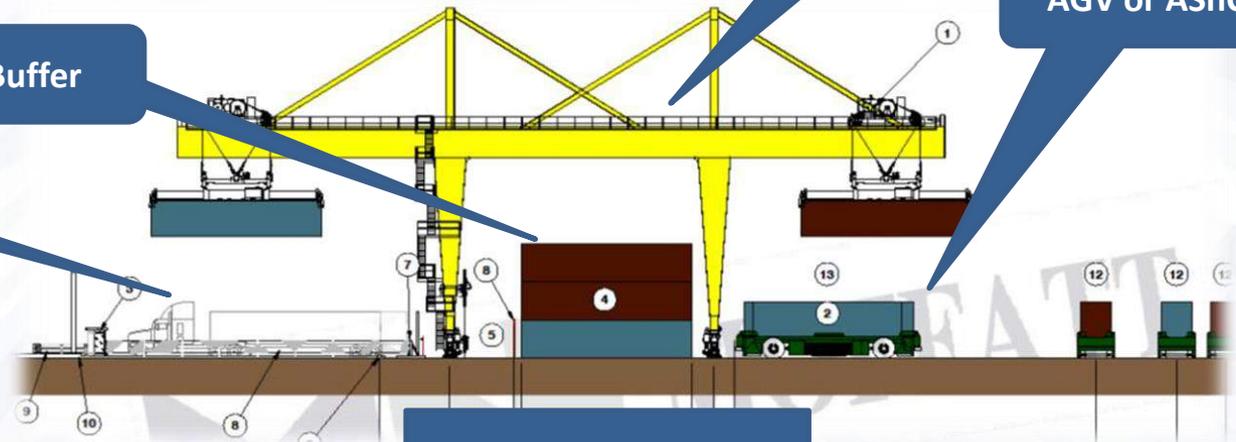
- 60 (larger) ASC's at 19-23 mph = 1,260 WS/LS mph
- 21 LTC's
- ~156 AGV's (or about 132 ShC's)
- ~\$400M Equipment (not incl. STS)

Side-Loaded ASC's & Landside Transfer

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Stacking Cranes
12W x 6 H



OTR Truck

Buffer

LTC

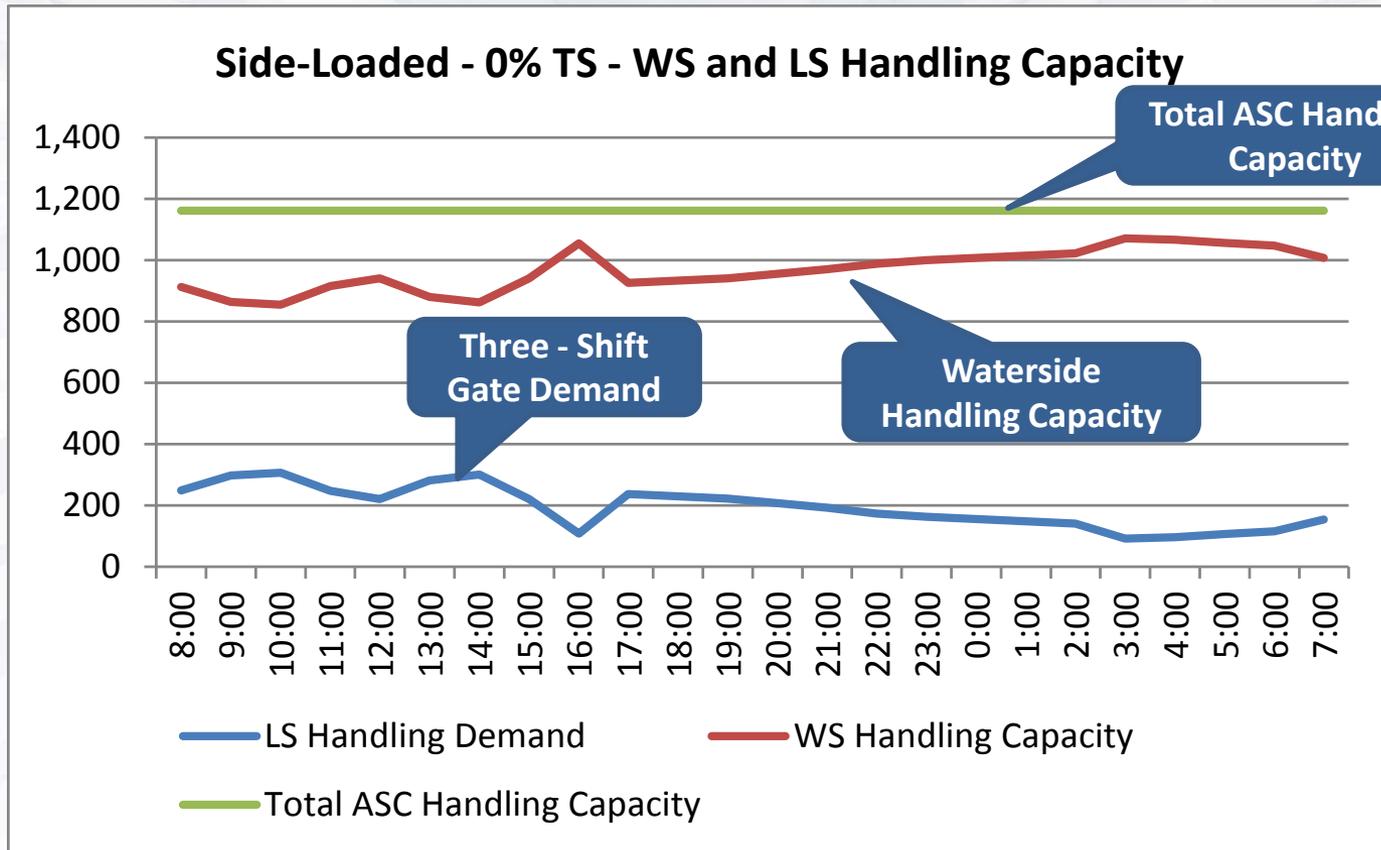
AGV or AShC

Landside Transfer

Side-Loaded ASC Advantage

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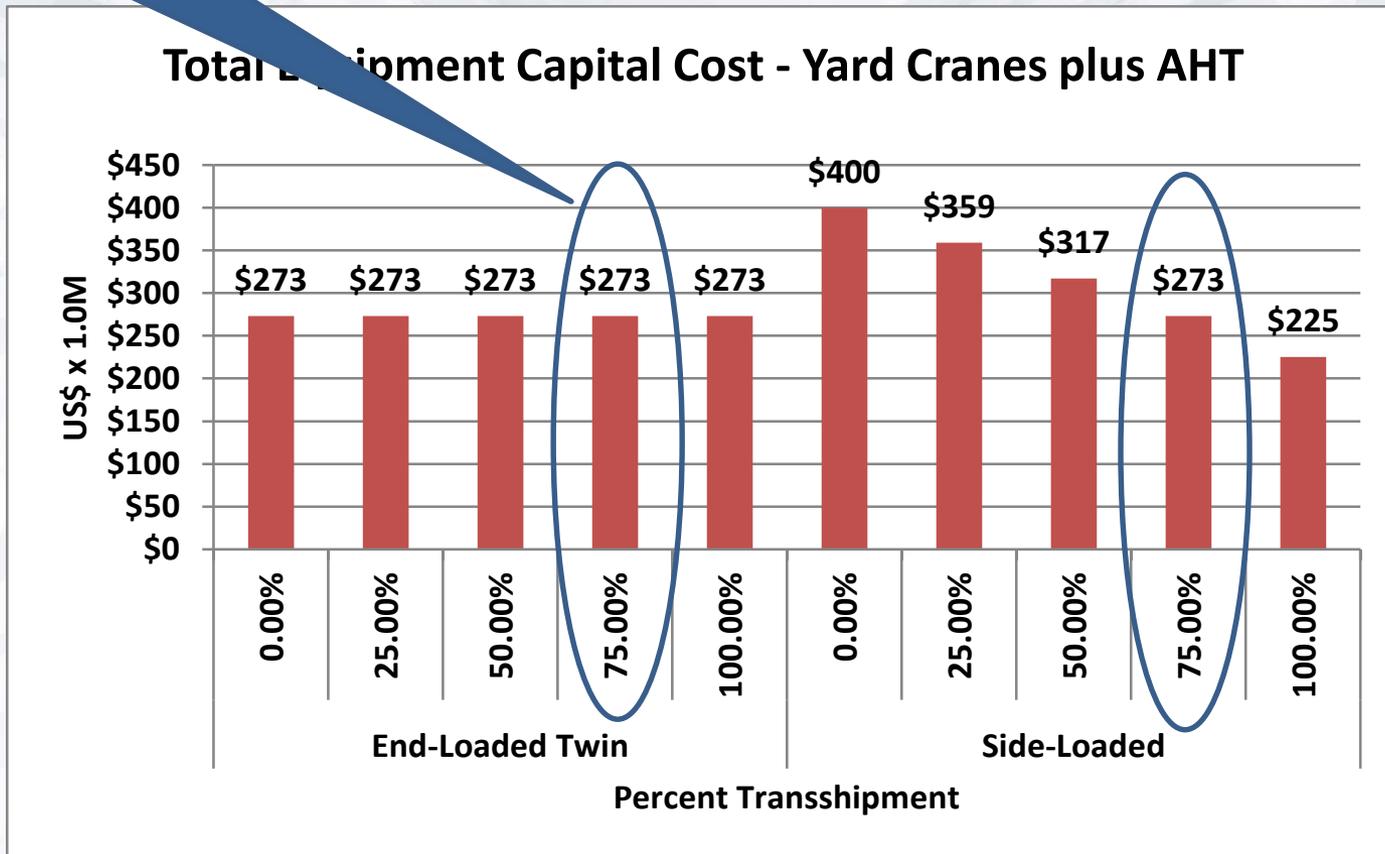
- Shared ASC handling capacity (HC) can be assigned to either waterside or landside
 - Waterside HC = Total HC – Instantaneous landside demand
- Export boxes received onto AHT can be sent directly to vessel
- Fits some terminal shapes that End-Loaded will not



Equipment Cost End-Loaded vs Side-Loaded?

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Equipment cost is equal at about 75% Transshipment



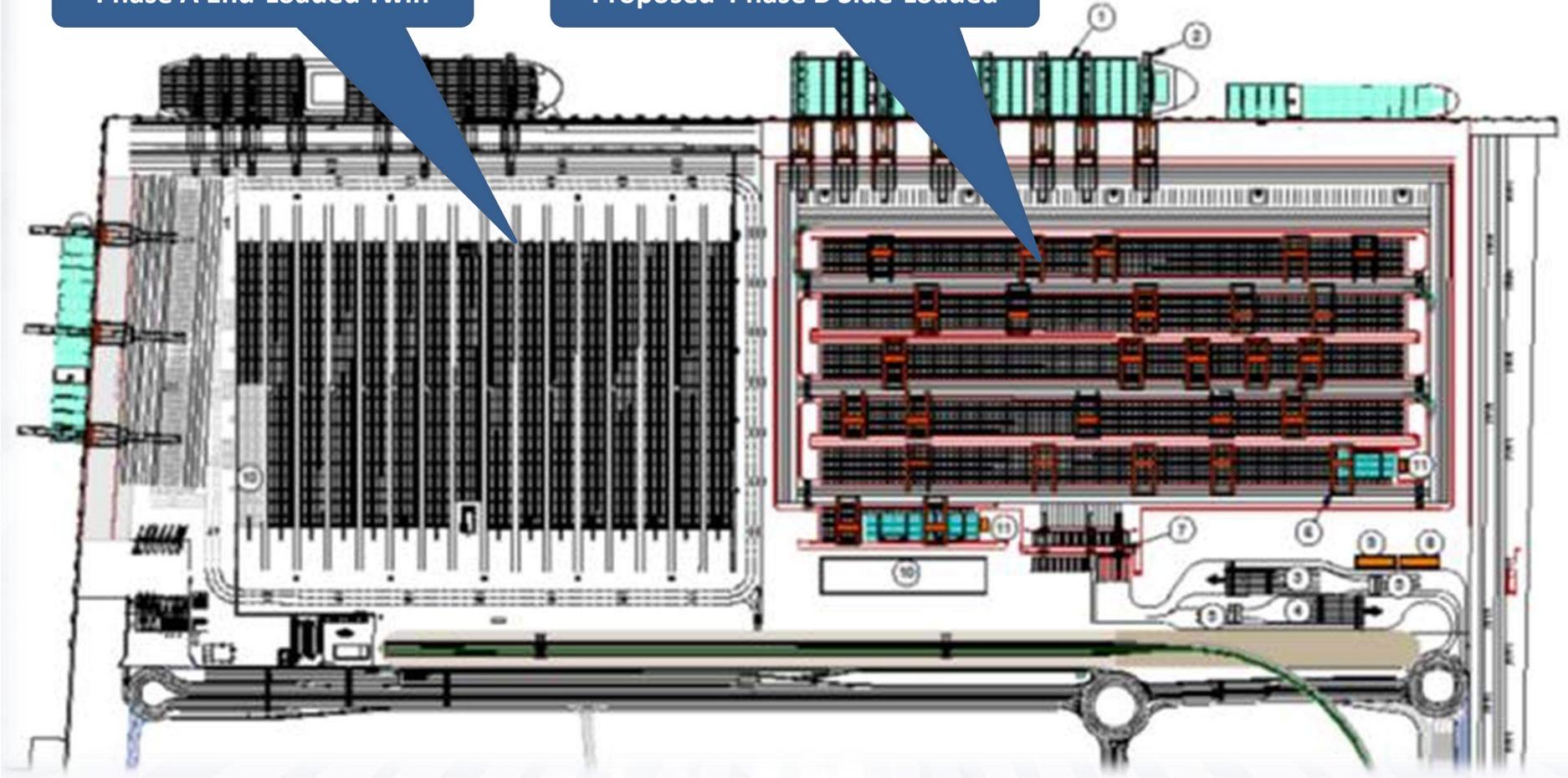
Example Where End-loaded Does Not Work Well

Algeciras - 95% Transshipment

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Phase A End-Loaded Twin

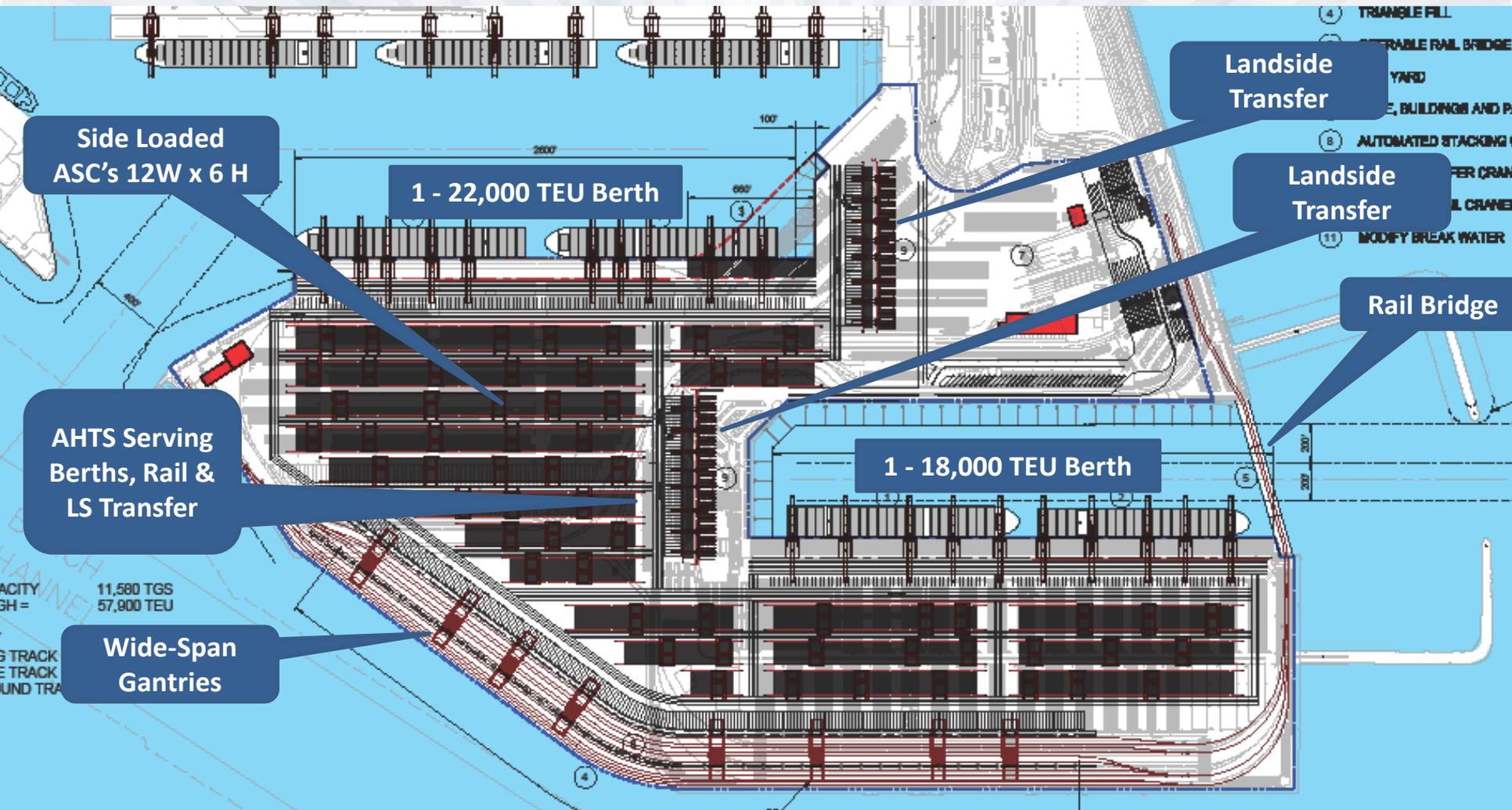
Proposed Phase B Side-Loaded



Example Where End-Loaded Would Not Work Well

Pier J - 3.5M TEU

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Side Loaded
ASC's 12W x 6 H

1 - 22,000 TEU Berth

AHTS Serving
Berths, Rail &
LS Transfer

Wide-Span
Gantries

Landside
Transfer

Landside
Transfer

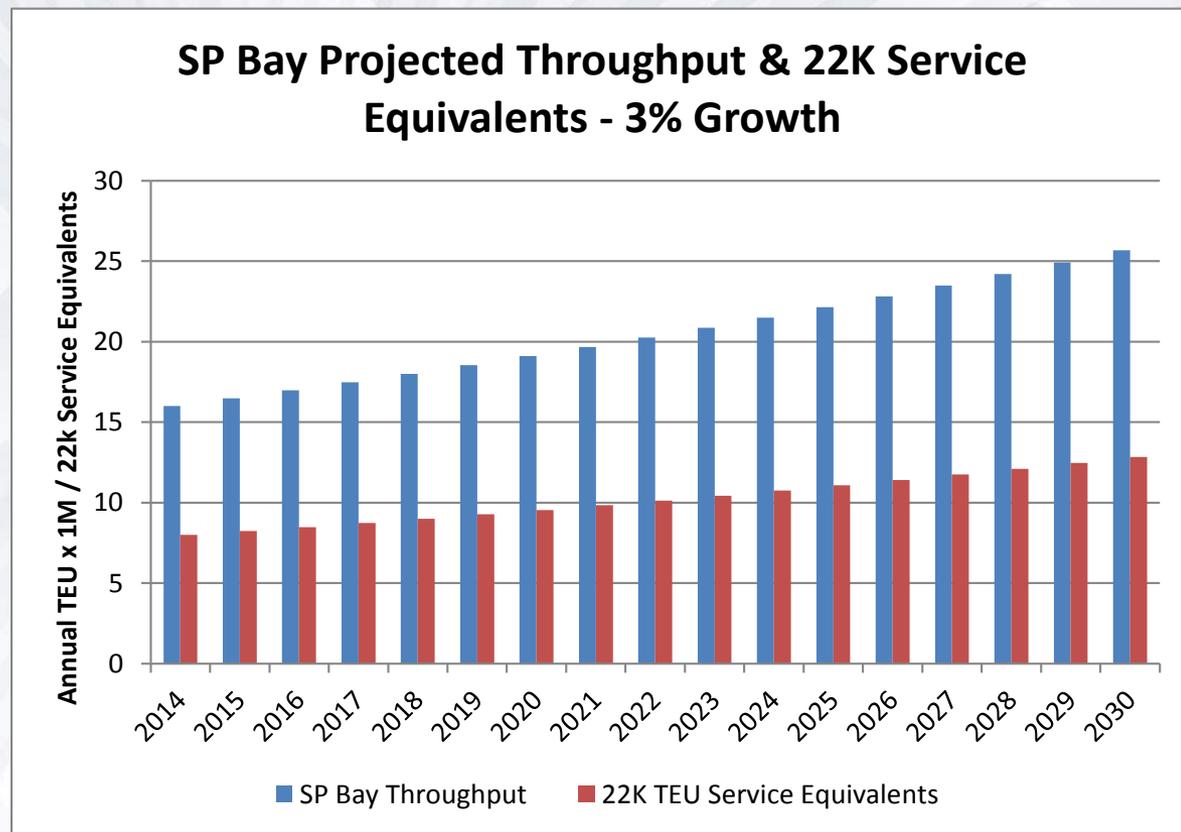
Rail Bridge

1 - 18,000 TEU Berth

How Many 22K Services Might There Be in San Pedro Bay?

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- In 2030 at 3% growth rate, SP Bay throughput might be 25M TEU
 - equal to 12 - 22,000 TEU weekly “vessel equivalents”
- So, we might actually have as many as 6 of them



Where Can We Put Them?

.....

- 22,000 TEU service at 90% aver. full generates throughput of 2.0 M annual TEU's
- Requires about **43,500 TEU storage slots**
 - ~ **85 net acres** of end- or side-loaded ASC stacking area
 - ~ **100 net acres** of RTG area
- **Which terminals have 100 net CY acres to serve one vessel per week?**

Conclusions?

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- SP Bay will continue into the future as a port complex of regional and national significance
- Larger vessels and higher throughput are coming
- New technologies and processes need to be applied
- For terminals, it is somewhat basic business as usual
 - Adequate **capacity**
 - Required **productivity**
 - Predictable **cost**
 - Weekly **reliability**
 - **But all on a larger and leaner scale**
- Strive for Optimization
- There is no “standard plan” that will work for every terminal

THANK YOU!

