



FEBRUARY 5 - 6 • LOS ANGELES, CA

SMART PORTS

(INFORMATION TECHNOLOGY)

Title: Envisioning Tomorrow's Terminal:
Improving Cargo Flow from Ship to Gate

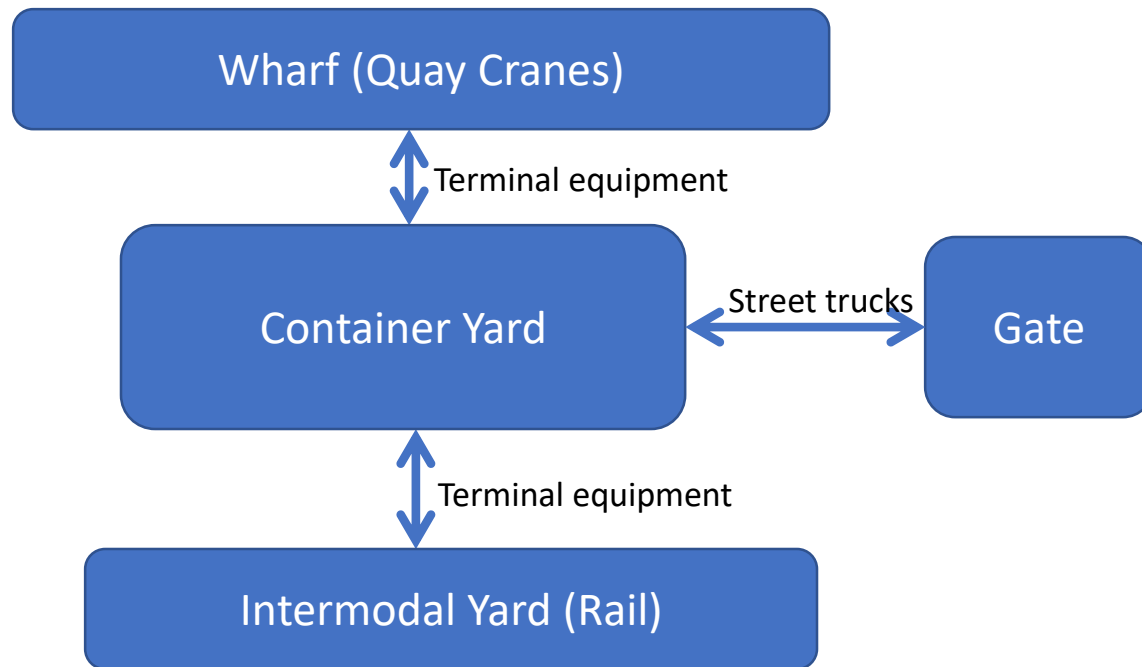
Presented By: Mark Sisson, P.E., AECOM



Terminal Best Practice for IT

- 100% appointments
- Pre-advisement of status to minimize trucker trouble
- Advance rehandling of containers to minimize trucker wait time (much easier to do with automation)
- Efficient stacking, and encouragement of large import blocks (Peel offs)
- Automated data collection for trucks at gate (no people in lanes)
- Automated inventory control (no lost boxes)
- Automated container handling with remote control of equipment as needed

Typical Container Terminal Flow



Example RTG Block

All traffic shares a single load lane



Top Picks are Used Where Selectivity is Not Needed

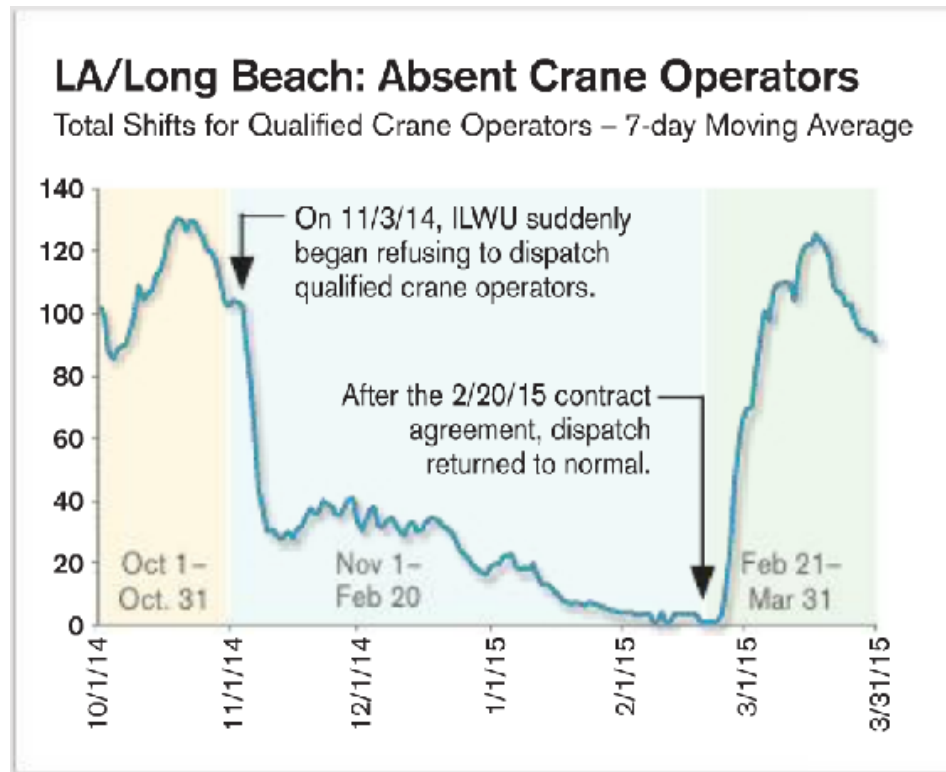


Why Automate a Terminal?

- Operating cost (labor) savings
- Insurance against labor shortages, strikes, slowdowns
- Ability to run closer to 24/7, especially for housekeeping moves
- Reduction in lost time for personnel changes (lunch, end of shift, etc.)
- Increased safety
- More pleasant working environment for operators
- Improved street truck service time
- Improved vessel productivity?
- Emissions reduction?
- Increased capacity?

An Example of Unreliable Labor

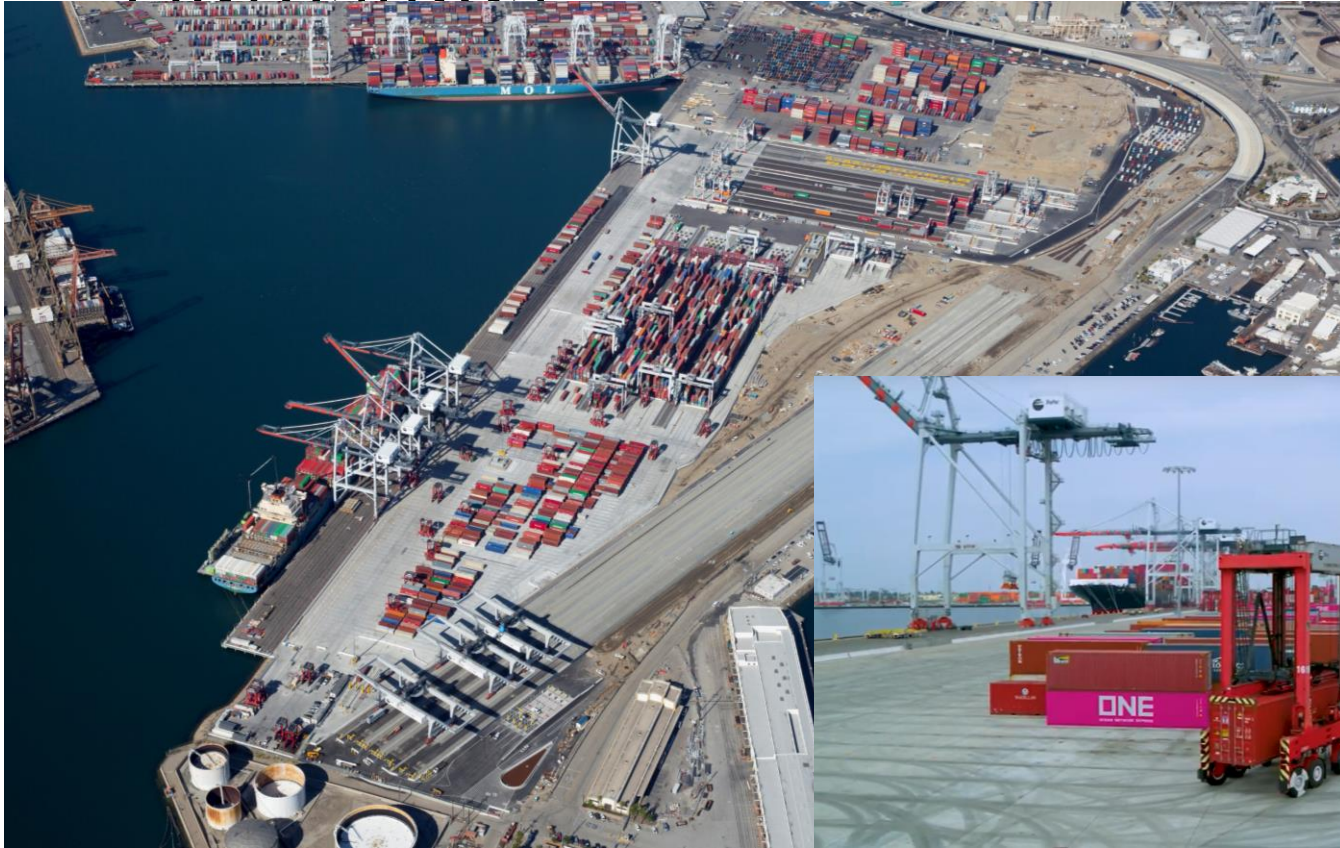
source: PMA 2014 Annual Report



Example ASC Terminal – APMT Norfolk



TraPac, POLA, Combines ASCs and Autostads



Long Beach Container Terminal



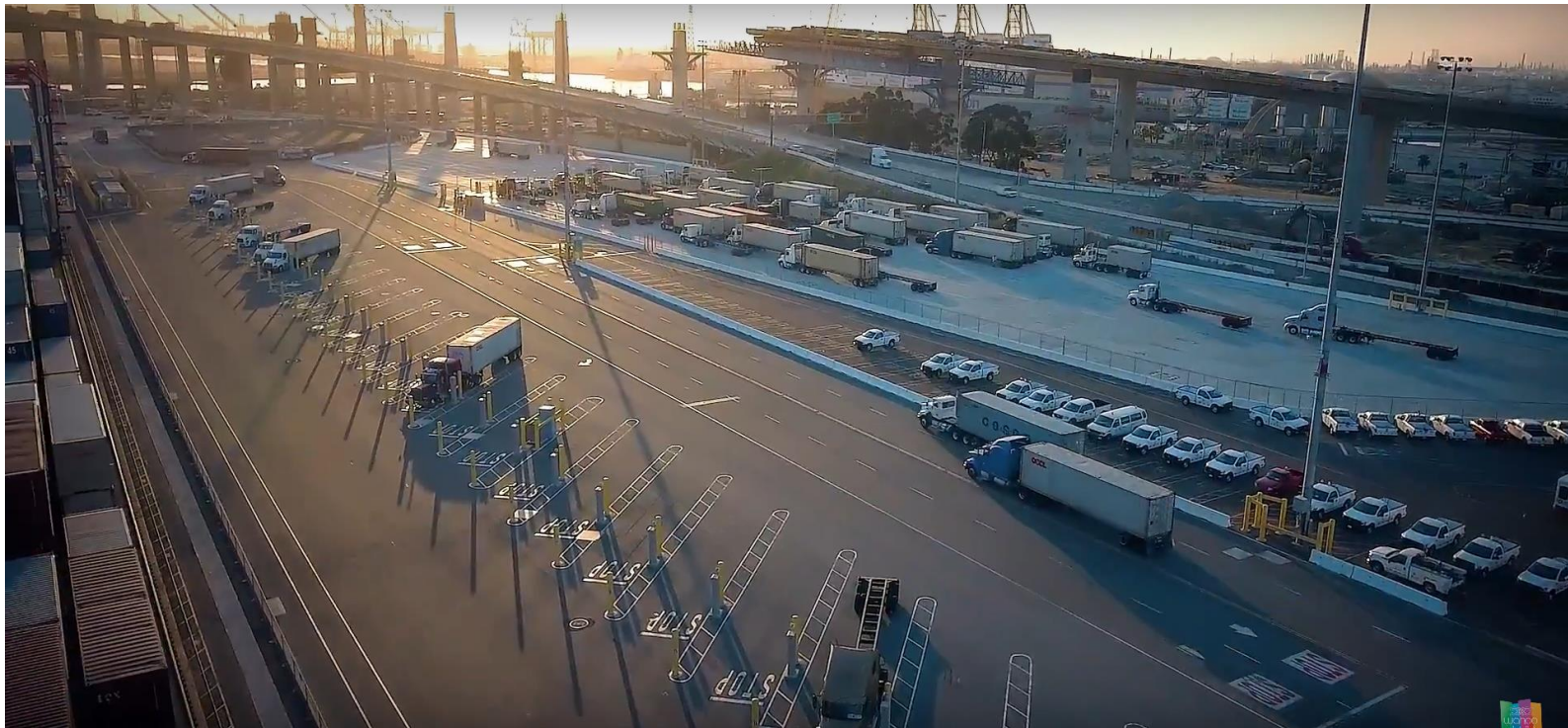
Example ASC Operator Room

Any driver can control any crane

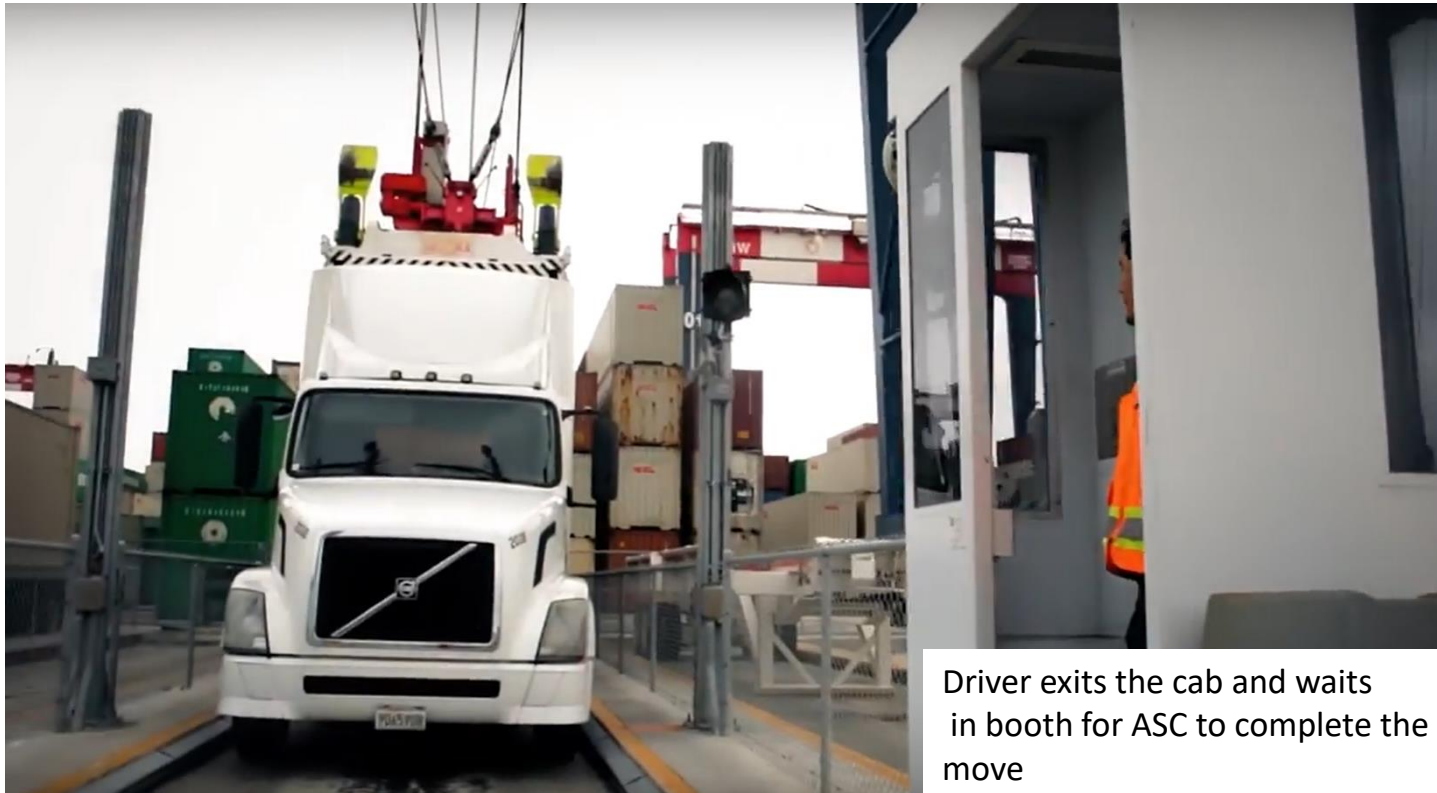


LBCT Gate Congestion Management Zone

ASC blocks have only 4-5 truck spots each

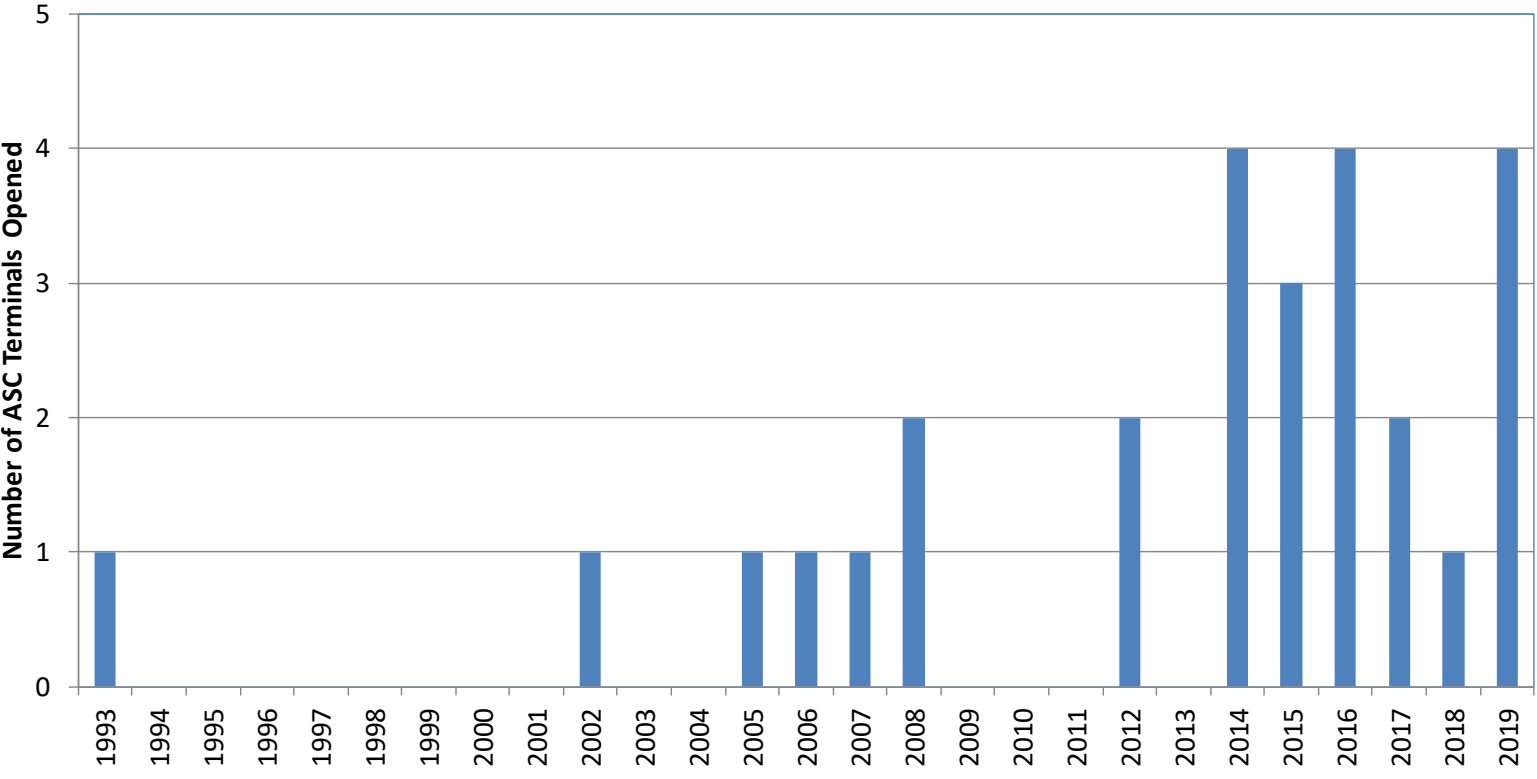


LBCT Street Truck Loading Zone



Driver exits the cab and waits in booth for ASC to complete the move

Chart of ASC Terminals Worldwide by Start Year



US Unions and Automation

- ***ILWU***: Contract states that any position can be automated. Individual terminals may have unique agreements on staffing.
- ***ILA***: Contract states that “full automation” meaning robotic transport is prohibited. Semi-automation meaning remotely operated cranes such as ASCs are OK.

Highlights of US Automation Projects

	APMT VA	Global NJ	TraPac, POLA	LBCT
Year opened	2007	2014	2015	2016
STS to CY	Manual shuttle (diesel)	Manual shuttle (diesel)	Autostrad (diesel)	AGV (electric)
CY storage	ASC (1-over-5)	ASC (1-over-5)	ASC (1-over-5)	ASC (1-over-6)
Street truck service	ASC interface	ASC interface	ASC interface	ASC interface
CY - rail transfer	Manual tractor (diesel)	Street truck	Autostrad (diesel)	Manual tractor (diesel)
IY Crane	RTG (diesel)	RMG off-site	Automated RMG	Manual RMG

Electrification is a Priority for Equipment Makers

https://www.youtube.com/watch?v=BTgk6oOy6_4

- “ ... reachstackers, terminal tractors ... our strategy is very easy and simple ... we want to have zero emission operations ... it means electric or electric battery operations”
- From TOC Europe Conference 2021

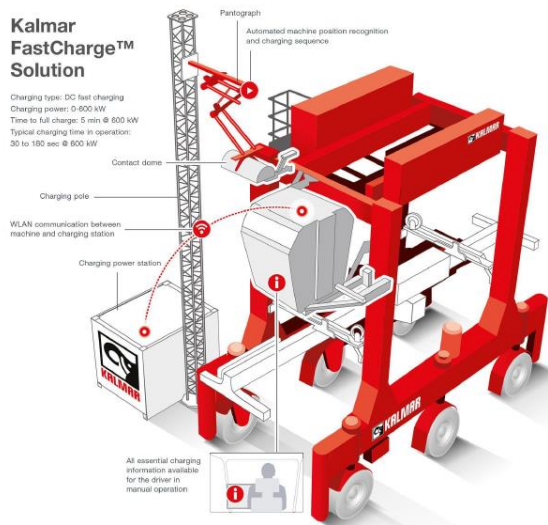


Electric Power is now Standard for AGVs



Autostrads are all Diesel Today, but Electric Prototypes are Being Tested

Kalmar FastCharge™ charging set-up



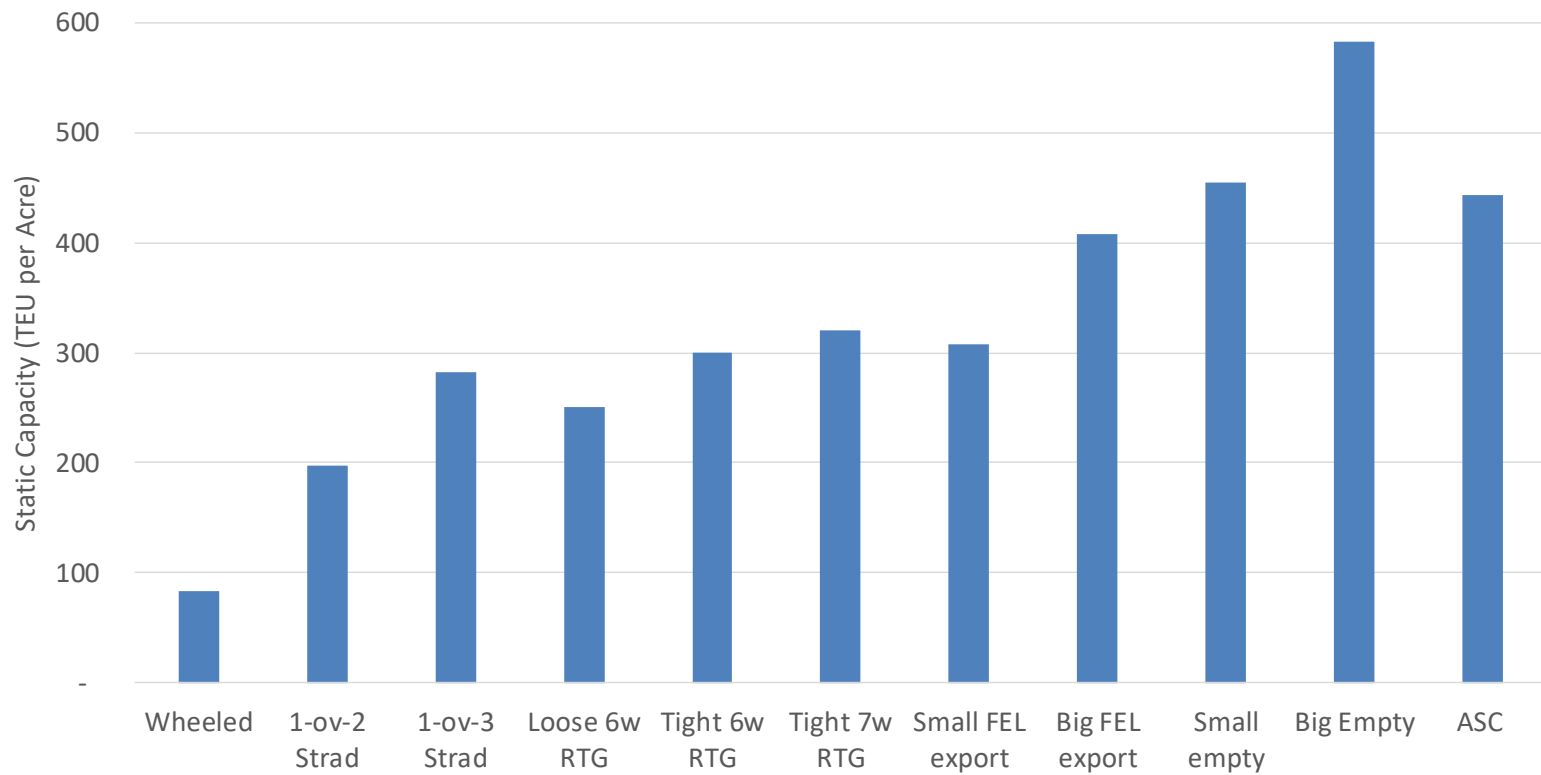
But Automated
Terminals are Less
Productive than Manual
Terminals, Right?

“Yes, excessive automation at Tesla was a mistake,... Humans are underrated.”

Elon Musk, April 2018



Terminal Storage Density by Mode



Example High Density Empty Storage



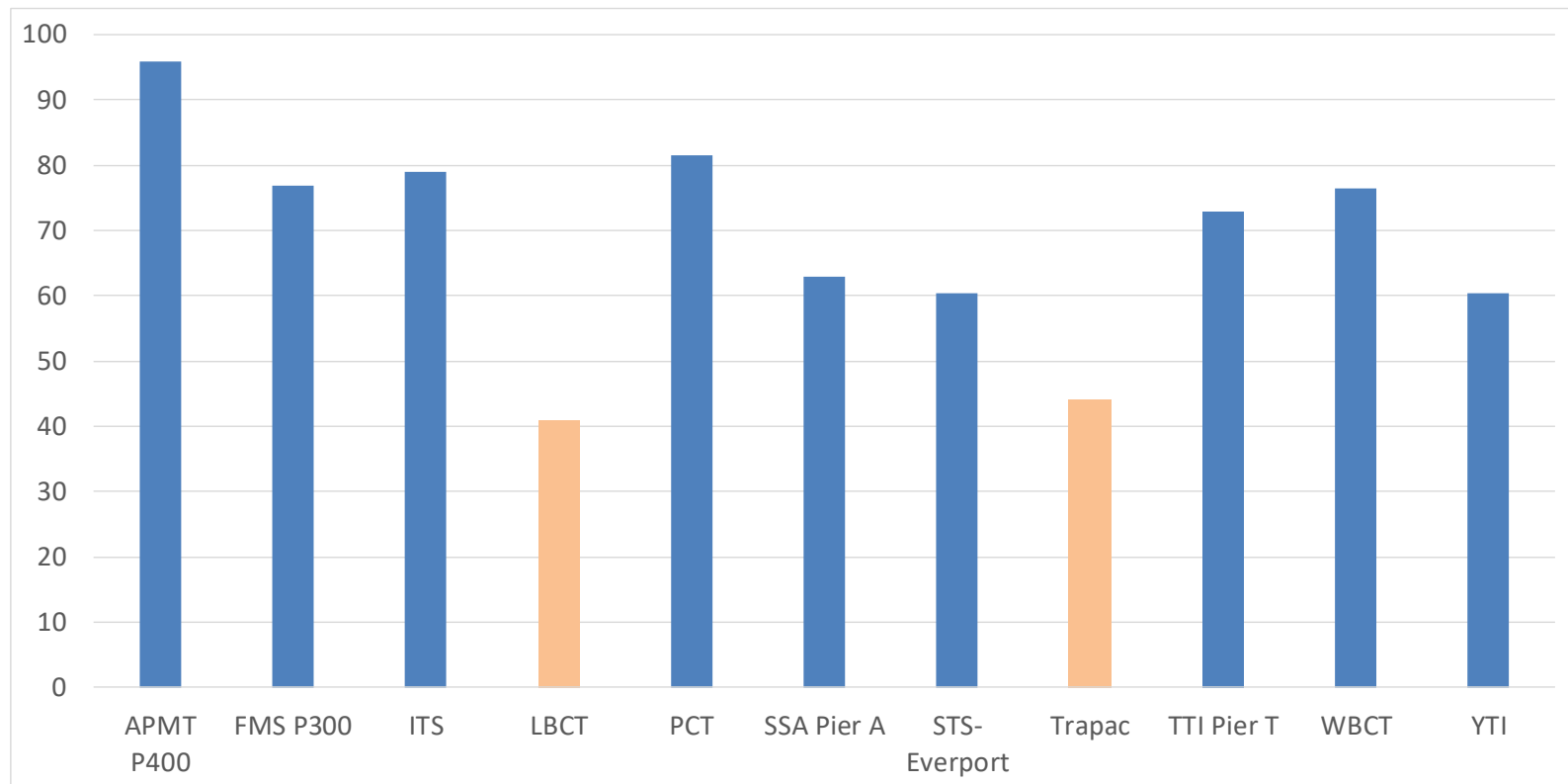
Typical Range of STS Crane Productivity

(Lifts per hour)

- US manual terminals: 25-35
- Fully automated terminals Year 1 of ops: 15-25
- Fully automated terminals Year 5+: 25-35
- Do you care more about per-hour or per day productivity?
 - $16\text{hr} * 30\text{mv/hr} = 480$ moves per crane-day
 - $21\text{hr} * 25\text{mv/hr} = 525$ moves per crane-day

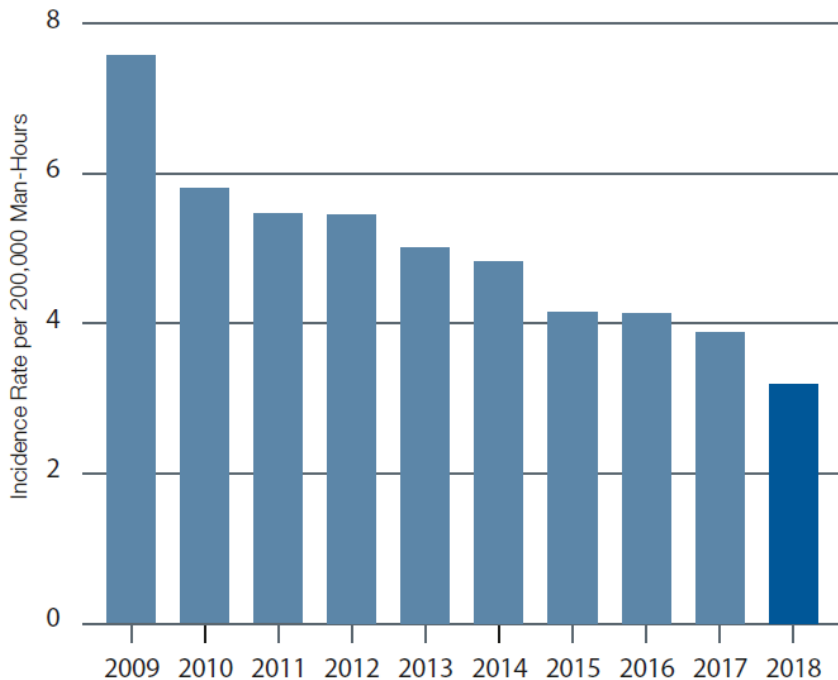
SoCal Automated Terminals have Excellent Truck Turn Time

Source HTA/JOC (Sept 2019 data)



Fewer Workers = Fewer Injuries?

Source PMA 2018 Annual Report p20



Most Injured Longshore Occupations

Semi-Tractor	93
Lasher	71
Mechanic, ILWU	70
Holdman	43
Dockman	31
Top Handler/Side Pick	18
Crane, Cont Gantry	14
Auto Driver	13
Linesman	11
Gearman	6

What Else Can be Automated?

- ***Vessel mooring via vacuum pads.*** Less appealing as vessel size increases and cost of mooring per move declines
- ***STS crane operation.*** Remote cranes are in operation in a handful of terminals worldwide, but not yet in US.
- ***IBC Handling.*** Robotic prototypes in use in China. If successful this will both reduce cost and increase STS productivity!
- ***RTG operation.*** Remote RTG cranes are in operation in a handful of terminals worldwide, but not yet in US.
- ***Terminal tractors.*** Some prototypes in operations in Asia today. A great deal is being invested in street truck automation that can also be applied here.

Prototype IBC Robot at QQCTN, China

Source: <https://www.youtube.com/watch?v=E--R0r4RBEs>



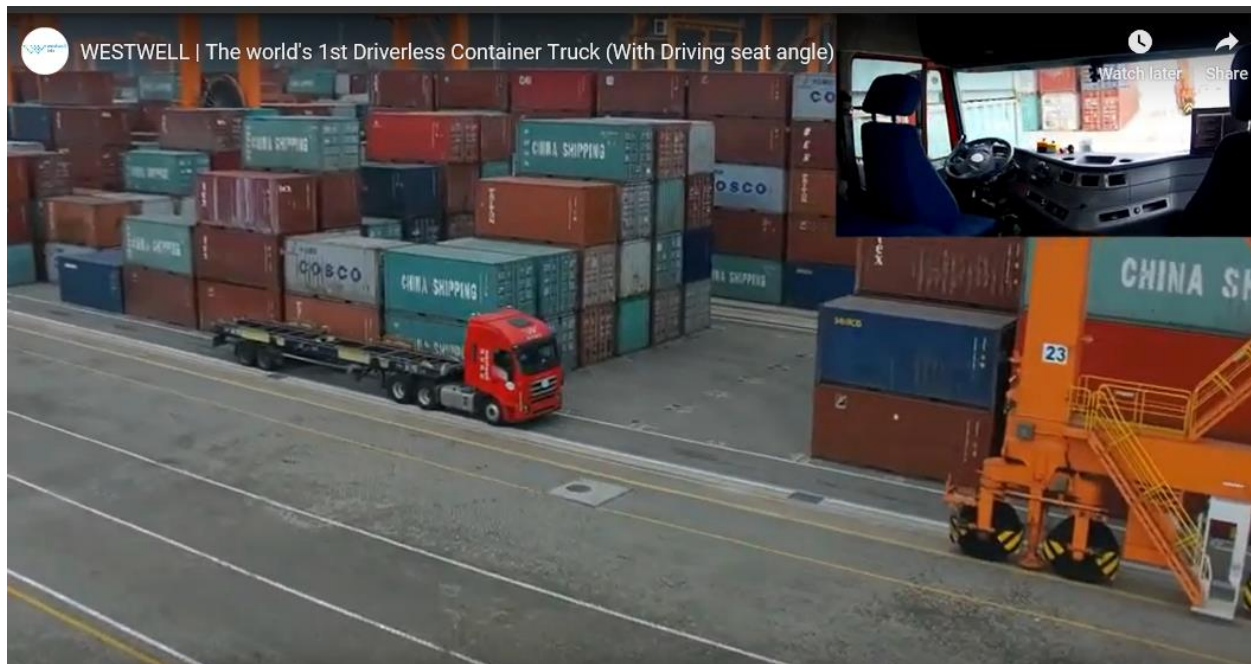
Volvo's Vera Automated Truck

Prototype Operating in Gothenberg



Westwell Automated Terminal Tractor

Prototype testing at Zhuhai China



<https://www.youtube.com/watch?v=PxtPAseopko>

What Jobs Will be Left with Maximum Automation? (i.e. a “Fully Automated” terminal)

- Lashing gangs on vessel
- Remote drivers for pick/set activity and safety supervision
- Remote clerks for exception handling
- Rail IBC (coning) crews
- Top-pick/side pick operators (high density empty piles especially)
- Maintenance technicians
- Vessel and rail planners
- IT support staff, cybersecurity specialists, etc.
- Management

Final Thoughts

- IT and software systems are key to performance of automated terminals
- Technical progress only goes in one direction - technical risk of automation declines every year
- Automation is likely to get ever more popular worldwide, but change will be gradual due to high cost and hassle of remodel projects
- Automation and electrification are not related
 - Every autostrad is diesel in 2019
 - Many manual RTGs are electric in 2019
- Automation style will vary a great deal from place to place
- Many factors influence the appeal of automation on a given terminal – each project is unique and merits a good deal of study before committing to large investments

Thank You

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