Container Terminal Planning & Operations
Current and Coming Trends

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Ports America
Trends

• Bigger Ships, Again
• Automation
  – Tactical
  – Strategic
• Privatization
  Public-Private Partnerships
The Big Ship Challenge

• Big Ships. Really Big Ships.
• Again
• The “Maersk Challenge”
• Again
• 6,000 vessel lifts in 24 hours? Sure! No Problem!
6,000 Lifts in 24 Hours: Vessel Flow

• 250 boxes / hour across the apron
• In a “typical” U.S. Import/Export facility:
  – 5,400 import load TEUs with 3.6 days dwell
  – 3,600 export load TEUs with 6.0 days dwell
  – 1,800 export empty TEUs with 5.6 days dwell
6,000 Lifts in 24 Hours: Yard Space

- Peak storage demand, for one call/week:
  - 5,200 import load TEUs
  - 4,500 export load TEUs
  - 2,200 export empty TEUs
  - 1,000 depot empty TEUs

- 37 acres / 15 hectares net CY at maximum credible density

- 47 acres / 19 hectares gross terminal area

- For just one ship/week
6,000 Lifts in 24 Hours: Yard Flow

• Waterside on the day of the call:
  – 3,000 import loads discharged
  – 2,000 export loads loaded
  – 1,000 export empties loaded

• Landside (for two successive calls):
  – 900 import loads delivered
  – 700 export loads received
  – 600 empties received

• Yard Volume: 8,200 lifts in 24 hours:
  – 340 lifts/hour with uniform 24-hour gate operation
  – 560 lifts/hour with SoCal 16-hour gate operation
6,000 Lifts in 24 Hours: Machines

• Import RTGs:
  – 20 lifts/hour vsl, 10 net lifts/hr gate
  – 22 machines

• Export Top-picks:
  – 20 lifts/hour gate or vessel
  – 18 machines

• About one machine every 300 ft (100 m) of storage row, about seven 40’ bays apart

• About 400 circulating waterside and landside vehicles at any one time
But then, there are...

- ...more than one ship per week
- ...variable ship schedules
- ...unreliable export bookings
- ...10% to 12% loaded reefers
- ...“hot” intermodal rail traffic
- ...“hot” key-customer traffic
- ...special security scans (VACIS, etc.)
- ...customs holds, productivity variations, weather, and other random factors
- All making the situation much tougher
### Impact of Call Duration on Peak Storage

<table>
<thead>
<tr>
<th>Type</th>
<th>Duration</th>
<th>VF</th>
<th>Storage</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import</td>
<td>1 days</td>
<td>0.96</td>
<td>5,180</td>
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<tr>
<td><strong>5,400 TEUs</strong></td>
<td>2 days</td>
<td>0.87</td>
<td>4,700</td>
<td>91%</td>
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<td></td>
<td>3 days</td>
<td>0.81</td>
<td>4,370</td>
<td>84%</td>
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<tr>
<td>Export</td>
<td>1 days</td>
<td>1.24</td>
<td>4,460</td>
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<tr>
<td><strong>3,600 TEUs</strong></td>
<td>2 days</td>
<td>1.15</td>
<td>4,140</td>
<td>93%</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>1.08</td>
<td>3,890</td>
<td>87%</td>
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<tr>
<td>Fulls</td>
<td>1 days</td>
<td></td>
<td>9,640</td>
<td></td>
</tr>
<tr>
<td><strong>9,000 TEUs</strong></td>
<td>2 days</td>
<td></td>
<td>8,840</td>
<td>92%</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td></td>
<td>8,260</td>
<td>86%</td>
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- Stretching duration:
  - To two days saves 8%
  - To three days saves 14%
### Impact of Call Two-Call Interval on Storage

<table>
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<th>Storage</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import</td>
<td>1 days</td>
<td>1.74</td>
<td>9,400</td>
<td>120%</td>
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<tr>
<td>5,400 TEUs</td>
<td>2 days</td>
<td>1.64</td>
<td>8,860</td>
<td>113%</td>
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<tr>
<td></td>
<td>3 days</td>
<td>1.45</td>
<td>7,830</td>
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<tr>
<td>Export</td>
<td>1 days</td>
<td>2.30</td>
<td>8,280</td>
<td>109%</td>
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<tr>
<td>3,600 TEUs</td>
<td>2 days</td>
<td>2.19</td>
<td>7,880</td>
<td>104%</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>2.11</td>
<td>7,600</td>
<td></td>
</tr>
<tr>
<td>Fulls</td>
<td>1 days</td>
<td></td>
<td>17,680</td>
<td>115%</td>
</tr>
<tr>
<td>9,000 TEUs</td>
<td>2 days</td>
<td></td>
<td>16,740</td>
<td>108%</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td></td>
<td>15,430</td>
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</table>

- Decreasing vessel interval from three days:
  - To two days increases demand 8%
  - To one day increases demand 15%
Thruput, Density, Velocity, and Safety

- 6000 lifts/day = 560 lifts/hour = 15 lifts/hour/acre
- “Keep it simple, stupid” (KISS), is no longer viable
- Every utilization of every storage and production slot will need to be:
  - Planned in advance
  - Dynamically managed
  - Automatically allotted in real time
  - Optimized for productivity
  - Constrained by safety
- Whether the terminal is manned or automated, its management will have to look automated...
Automation

• To date, automation in the U.S. has been “tactical”:
  – Optical character recognition
  – Inventory control
  – Equipment tracking and coordination
  – Equipment assignment

• In Europe, automation has also been “strategic”:
  – Automation of equipment operations
  – Automated rail-mounted stacking cranes
  – Automated guided vehicles
  – Automated strads and shuttles
  – Semi-automated dock and yard gantries
Tactical Automation

• Substantial penetration of USWC
• Potential spread to USEC, depending on ILA pact
• Substantial reduction or elimination of “clerk”-type activities and manning
• Next steps:
  – Installation of “driver assist” technologies on RTGs
  – Emulation to optimize operational strategies
  – Intelligent yard equipment assignment
Strategic Automation

• Currently only one terminal with strategic automation in the U.S.: Portsmouth, Virginia
  – Using Automated Stacking Cranes (ASCs) + manned strad

• Coming soon:
  – TRAPAC, Los Angeles: ASCs + automated shuttles
  – Middle Harbor, Long Beach: ASCs + auto guided vehicles
  – Global Terminals, New York: Jim Devine

• Other Potentials:
  – Pier S, Long Beach: ASCs + automated shuttles
  – Berth 305, Los Angeles: ASCs + AGVs
  – Deltaport 2, Vancouver, BC
Pier S Plan
Pier S Plan
Traditional Economics

- Terminal infrastructure is expensive and fixed
- Infrastructure bought by Port and leased to Tenant/Operator
- Infrastructure cost recovery thru lease, wharfage, and dockage
- Equipment is relatively cheap and portable
- Equipment bought and maintained by Tenant/Operator
- Labor is expensive, tactical, variable, and complex
- Labor is hired and managed by Operator
Automated Economics

• Infrastructure still expensive, but now tied to Tenant-specific automation scheme
• Equipment and automation control is much more expensive, and no longer portable
• Regular labor is reduced, and has a very different assignment pattern
• Management labor is increased, requiring more skills, training, and sophistication
• The economic model is very different
Economic Models

• Traditional:
  – Port is doing a “CapEx Recovery” via the lease
  – Operator is doing “OpEx Recovery” through operating contract with the liner, marking up labor costs

• Automated:
  – Port is still doing a CapEx Recovery, but more so
  – Tenant/Operator must also do CapEx Recovery on the automation suite
  – Trying to do CapEx Recovery by marking up the costs of a shrinking labor pool is tough
  – Tenant/Operator must have some sort of MAG from the liner(s) – a very different economic model
Public and Private

• Rather than a clean division: Public Port and Private Operator, Public CapEx and Private OpEx
• We have more of a mixing of public and private investment
• Public-Private Partnerships are becoming more common...
Public Private Partnerships

• Are becoming more common as port authorities encounter more financial limitations
• Result in the terminal operating company getting involved with port facility development
• Result in the terminal manager getting involved with oversight of design and construction
• Result in the need for new skills, expertise, and discipline in the terminal staff
Ports America’s current PPPs

- Oakland: 50 years
  Densification & Automation
- Newark: 30 years
  50 Acre Expansion
- Baltimore: 50 years
  4th Berth

Overview

Outer Harbor, Oakland
Port Newark, Newark Bay
Seagirt, Baltimore
Oakland, Outer Harbor PPP

- Focused on creation of “Mega Terminal” for bigger ships, and rehabilitation of Port’s oldest infrastructure
- All infrastructure and rehab to be paid for by Tenant, in exchange for lighter lease terms
- A shift of the Port’s traditional capital role to the Tenant
- The Tenant’s “CapEx Recovery” to be achieved with lower lease operating costs on a very long lease
Ports America Investments in Oakland

- New entry complex, exit complex
- New data center and conduit trunks
- Major pavement reconstruction and re-grading
- Demolition of old marine building, gate building, administration building, storage buildings
- Construction of new automobile parking area
- Installation of new backup power
- Construction of shore power capacity for ships
- Installation of new terminal lighting system
- More to come, including planned automation
New Entry Gate
New Exit Gate
Traffic Optimization
Seagirt, Baltimore PPP

- Focused on “New Panamax” capability by 2014 to coincide with Panama Canal widening
  - New Berth IV with 50 foot dredge depth
  - New Super Post-Panamax cranes
- To be purchased by the Tenant, in exchange for lighter lease terms
- A shift of the Port’s traditional capital role to the Tenant
- The Tenant’s “CapEx Recovery” to be achieved with lower lease operating costs on a very long lease
Ports America Investments in Baltimore

- New 1200’ deep-water berth and mooring dolphin
- Rehabilitation of the terminal containment dike
- Installation of new drainage control structures
- Dredging of the berth area to 50 foot depth
- Purchase and installation of four new dock gantry cranes
- Construction of a satellite chassis operating yard
- Augmentation of the terminal power grid
- More to come, including new buildings
New Wharf
Four New Cranes
PPP Benefits

• Development is accelerated, and made cheaper, by Tenant’s profit motive
• Development is better tuned to the Tenant’s specific needs
• Development is less politicized
• Development and operating costs can be better balanced
• Development can better reflect Tenant’s investment in new operating technologies
PPP Challenges

- Tenant inherits “archaeology”
- Tenant’s staff may not be as adept at the ins and outs of development
- Port retains authority in permitting, but not responsibility for costs incurred
- Continued influence of Port’s “social engineering” efforts
- Perceived inequities between different Tenants
- Development more site-local than regional-strategic
To Conclude...

- Pressure for augmented capabilities and capacities continues
- New technologies will require reconsideration of traditional roles and funding methods
- Funding is tight
- Creativity in funding and development is needed
- The role of the terminal manager is expanding from operations to development
- Privatization is causing many paradigm shifts
- Flexibility is needed on all fronts