Berth Productivity

Asaf Ashar, PhD
UNO/Transportation Institute
National Ports & Waterways Initiative
www.asafashar.com

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Agenda

• **Definition** of Moves and Hours
• Ship / Gang Chart
• Berth and Crane *Productivity Indicators*
• **Factors** Affecting Berth Productivity
• Productivity and *Capacity*
• **Public Interest**
Moves per Hour?

• Moves:
  – **Productive Moves** – Crane Cycle (“Lift”), Multiple-Box Lifting, Dual Cycling
  – **Unproductive Moves** – Hatchcover, Re-Handling

• Berth (Ship?) Hour:
  – **Productive Hours** – Crane Cycling
  – **Unproductive Hours** – During Ship’s Berth Time; Between Ships
  – Three-level separation of times, based on controllability and cost: **Gross, Net, Net-Net Productivities**
Ship / Gang Time-Chart

- Port Time (t8 - t1)
  - ETA
  - Gross Berth Time (t7 - t4)
  - ETD
- Ship (S H I P)
  - t1, t2, t3, t4, t5, t6, t7, t8
  - --Buoy In
  - --Pilot & Tug
  - --1st Line
  - --Gang On-Board
  - Gang Off-Board
  - Last Line
  - Buoy Out

- Net Berth Time (t6 - t5)
- Net Gang Time (t12 - t11)
- Gross Gang Time (t13 - t10)
- Net/Net Crane Time

- Net Berth Time (t6 - t5)
- Late Start
- Cycling
- Early Finish
- Shift Start
- Shift End
- Delays

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# Berth and Gang Indicators

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Definitions</th>
<th>Productivity Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buoy-to-buoy</td>
<td>Port Time</td>
<td></td>
</tr>
<tr>
<td>Ship</td>
<td>First-to-last line</td>
<td>Gross Berth Time</td>
</tr>
<tr>
<td></td>
<td>First-to-last box</td>
<td>Net Berth Time</td>
</tr>
<tr>
<td>Assigned</td>
<td>Gross Gang Time</td>
<td>Gross Gang Productivity</td>
</tr>
<tr>
<td>Gang</td>
<td>Working (first-to-last box)</td>
<td>Net Gang Time</td>
</tr>
<tr>
<td></td>
<td>Box handling</td>
<td>Net Net Gang Time</td>
</tr>
</tbody>
</table>
Factor Affecting Productivity

• Traffic Composition: Domestic vs. Transshipment
• Ship and Call Size, Stowage Plan, Order in Rotation
• Terminal Layout and Equipment
• Labor Contract (Shift Structure, Meals, Relief)

• Labor Proficiency & Motivation (Incentive Program, Automation)

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Crane Technology & Density

Emma Maersk (11,000 TEU)

- 4320 ft
- 7.95 FLR
- 543 m
- 10 cm
- 54 C
Berth Productivity = f (Call Size)
Productivity, Utilization and Capacity

**Berth Productivity** \((\text{Moves/Hour})\) =
Crane Productivity \((\text{Moves/Hour})\) x Crane Density

**Berth Capacity** \((\text{TEUs/Year})\) =
Berth Productivity \((\text{Moves/Hour})\) x TEUs/Move x **Berth Utilization** \((\%)\) x 24 x 365

Berth Utilization vs. Terminal Cost vs. Ship’s Waiting
# Berth Capacity Indicators

<table>
<thead>
<tr>
<th>Year</th>
<th>Type of Berth</th>
<th>Berth Length (m)</th>
<th>Depth Alongside (m)</th>
<th>Berths per Terminal</th>
<th>Design Ship</th>
<th>Berth Capacity (TEUs)</th>
<th>Berth-m Capacity (TEUs/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>Sub Panamax</td>
<td>250</td>
<td>12</td>
<td>3</td>
<td>3,000</td>
<td>350,000</td>
<td>1,400</td>
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<tr>
<td>2012</td>
<td>Panamax</td>
<td>280</td>
<td>14</td>
<td>3</td>
<td>4,500</td>
<td>450,000</td>
<td>1,607</td>
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<tr>
<td>2012</td>
<td>Panamax</td>
<td>280</td>
<td>14</td>
<td>4</td>
<td>4,500</td>
<td>495,000</td>
<td>1,768</td>
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<tr>
<td>2014</td>
<td>Post Panamax I</td>
<td>300</td>
<td>15</td>
<td>3</td>
<td>5,700</td>
<td>500,000</td>
<td>1,667</td>
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<td>2014</td>
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<td>15</td>
<td>4</td>
<td>5,700</td>
<td>550,000</td>
<td>1,833</td>
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<tr>
<td>2017</td>
<td>Post Panamax II</td>
<td>350</td>
<td>16</td>
<td>4</td>
<td>8,000</td>
<td>700,000</td>
<td>2,000</td>
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<tr>
<td>2025</td>
<td>Post Panamax III</td>
<td>400</td>
<td>16 - 18</td>
<td>4</td>
<td>12,000</td>
<td>1,000,000</td>
<td>2,500</td>
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<tr>
<td>2009</td>
<td>Multipurpose</td>
<td>150</td>
<td>10 - 11</td>
<td>2</td>
<td>1,000</td>
<td>100,000</td>
<td>667</td>
</tr>
</tbody>
</table>

Source: A. Ashar, NPWI 2009
Public Interest

• Terminal Cost  = f(Productivity); \textit{Competition}
• Capacity = f(Productivity); \textit{Planning}
• Use of \textit{scarce} waterfront land
• Public money, especially land and water access; Externalities
• MPH too crude; Needs to be better specified and Expanded
• Need for \textit{national/international productivity databases}
• Competition vs. Cooperation
Each party has its own interest – but share interest in productivity
Thank you!

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