High Volume, High Velocity Intermodal Operations

January 2006
Overview

– Industry Trends
– Equipment Design Responses
– Intermodal Response
– Container Yard Operations
  • Yard Operating Systems
  • Yard Transport Equipment
  • Intermodal Rail Operations
– Port of Tacoma – a Case Study
– Systems Approach to IY Design
Industry Trends

- Larger ships
- Larger terminals
- Higher throughput volumes
- Integrated intermodal facilities
- Increased usage of technology
- Increased throughput velocities
- More environmental implications
  - Congestion
  - Pollution
- Enhanced security measures
Equipment Design Responses

- Bigger & Faster Cranes
- Improved Crane Configurations
- Multi-lift Crane Configurations
- Improved Operating Scenarios
- Use of Automation
Intermodal Response

Increased Throughput and Congestion
Intermodal Response

- Increased Velocity
- Increased Storage Density
- Increased Reliability

... results in More Throughput And Better Customer Service
Intermodal Response

– Upgraded Rail Infrastructure

A New Railroad for a New Era

CN route
BNSF

JWD Group, A division of DMJM Harris
$3 Billion± to address congestion within the L.A. Basin
Intermodal Response

- Dedicated Intermodal Facilities

POLA Terminal 300

POLA Terminal 400

POLB Terminal T
Intermodal Response

- Grade Separations
- On-dock Intermodal Terminals
Intermodal Response

- Upgraded operating paradigms
- New support equipment
Container Yard Operations
Container Yard Operations

- **Straddle Carriers**
- **RTGs**
- **Top-picks**
- **ASCs**
Wheeled Operation

- Low density
- Good selectivity
- Direct street truck access
- Truck maneuvering aisles
Top-Handler Operation

- High density
- Poor selectivity
- Adjacent truck access
- Large maneuvering aisle
RTG Operation

- High density
- Moderate selectivity
- Adjacent truck access
- Hardened runways
Straddle Carrier Operation

- Low/Moderate density
- Fair selectivity
- Remote truck transfer areas
- S/C maneuvering aisles
RMG Operation

- High density
- Moderate selectivity
- Adjacent truck access
- Railed runways
- Electric power
Automated Yard Crane Operation

- High density
- Moderate selectivity
- Remote truck transfers
- Railed runways
- Electric power
- Auto-shuffling
Yard Chassis

– Coupled transfer
– Flexible travel path
– Low capital cost

- Low maintenance cost
- Transport only

Yard Operations
Multi-Trailer Train

- Coupled transfer
- Inflexible travel direction
- Moderate labor force
- Moderate capital cost
- Moderate maintenance cost
- Transport only
AGVs

- Coupled transfer
- Inflexible travel path
- IT labor force
- High capital cost
- High maintenance cost
- Transport only
Shuttle/Straddle Carrier

- Uncoupled transfer
- Flexible travel direction
- Moderate labor force
- High capital cost
- High maintenance cost
- Transport & stack
Intermodal Rail Operations
Alternative Loading Schemes/Geometry

Top-pick operation

No pre-staging of boxes

RTG/RMG operation

Pre-staging of boxes on ground

Straddle Carrier operation

Pre-staging of boxes on chassis
Top-pick/Reach Stacker Operation

- Two track reach maximum
- Wide service aisles
- No pre-staging of boxes
RTG/RMG Operation

- Multi-track access
- Multi-access aisles
- Pre-staging of boxes
Large Span RMG Operations

- Multi-track access
- Multi-access aisles
- Pre-staging of boxes
Straddle Carrier Operation

- Single track access
- Narrow access aisles
- No pre-staging of boxes
- Wider straddle carrier
JWD Group, A division of DMJM Harris

A Case Study
Intermodal Development at the Port of Tacoma
#1 Goal for the Port of Tacoma

- The Port of Tacoma to be the most efficient and reliable intermodal gateway in North America

70%± of the Cargo through the Port of Tacoma is moved by Rail to the mid-west and upper east coast
Intermodal Growth Strategies

Intermodal Transportation Group

Port of Tacoma

VELOCITY  DENSITY  RELIABILITY
Growth is Coming from all Directions
Intermodal Lift Projections

From 1999 - 2004 = 76% growth
2004 - 2009 = 106% growth, a compounding growth rate of 16%.

Took 13 years to double, now doubling in 4 years or less

90 92 94 96 98 2000 2003 2005 2007 2009

Thousands of Lifts

N:\hwdata\annual.prs

JWD Group, A division of DMJM Harris

34
Inland Strategy Development

- Sustainable Business Units that provide both Internal and External Customers a Seamless Solution to meeting the needs of the marketplace
- Recognizing the different needs of each Business Unit
A joint partnership of Rail Partners responsible for increasing the velocity of the all rail traffic moving off of and onto the Tacoma Tideflats
Strategic Approaches

- Develop Intermodal Line of Business Strategic Plan
- Continue to develop regional perspective on growth and demand
- Continue to engage the mainlines and understand their plans
- Continue to engage neighbors and enhance relationships
- Complete development of the Business Exchange
- Continue to investigate offsite options
- Investigate a wider range of funding options
- Document POT Processes and look for improvement opportunities
- Proactively manage rail flows to meet terminal productivity goals
Design Solutions for the Future

- Participate in FAST Corridor – 15 Puget Sound Grade Separations Projects with 20 public/private Partners
- Working with the State Port Association to review Statewide Road and Rail Capacity
- Develop and Update Phased Master Plans
- Develop Terminal Conceptual Plans and Budgets
- Develop Detailed Designs to meet Client Goals/Needs
Density - 2004 Land Use

Port of Tacoma
Density - 2020 Land Use

Hylebos Peninsula
Density - Phased Planning for the Future

Expanding the rail infrastructure

Planning grade Separations now to meet future rail expansion requirements

Expanding terminal facilities as needed

Phasing in IY capabilities when needed

Port of Tacoma
Density - Phased Planning for the Future

Port of Tacoma

JWD Group, A division of DMJM Harris
Reliability - Creating Solutions

Adding Redundancy & Increasing Capacity

Bullfrog Junction

Chilcote Junction

Port of Tacoma
Systems Approach to Planning & Design
Systems Approach to Planning & Design

- Approaching the terminal as a complete system
- Aware of the characteristics of each element within the system
- Understanding the dynamics between these elements
- Focused on Client goals/needs
- Determining the best mix
Dealing with the Terminal as a System

Systems Approach

SECTION - STRADDLE CARRIER / STRADDLE CARRIER

SECTION - YARD CHASSIS / RTG / TOP PICK

SECTION - YARD CHASSIS / TOP PICK / TOP PICK

SECTION - SHUTTLE CARRIER / ASC / TOP PICK
Velocity – Analyzing Different Systems

- Uncoupled handoffs optimize machine velocities

<table>
<thead>
<tr>
<th>RELATIVE SYSTEM VELOCITY ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA TABLE #1 (sec’s)</td>
</tr>
<tr>
<td>QUAY CRANES</td>
</tr>
<tr>
<td>TROLLEY TO CENTER LOAD LANE</td>
</tr>
<tr>
<td>LOADER TO DECK &amp; RELEASE BOX</td>
</tr>
<tr>
<td>WAIT FOR CHASSIS</td>
</tr>
<tr>
<td>SPOT TO CHASSIS &amp; RELEASE BOX</td>
</tr>
<tr>
<td>PICK BOX &amp; DECK</td>
</tr>
<tr>
<td>TRANSFER TO STORAGE</td>
</tr>
<tr>
<td>MOVE BOX TO STACK OR TRED</td>
</tr>
<tr>
<td>WAIT FOR YARD HANDLER &amp; PICK BOX</td>
</tr>
<tr>
<td>RELEASE BOX &amp; PART</td>
</tr>
<tr>
<td>TRANSFER FROM STORAGE</td>
</tr>
<tr>
<td>WAIT FOR YARD HANDLER &amp; RELEASE BOX</td>
</tr>
<tr>
<td>PICK &amp; MOVE BOX TO TRED</td>
</tr>
<tr>
<td>ALIGN &amp; PICK BOX</td>
</tr>
<tr>
<td>DRIVES TO CYCLES</td>
</tr>
<tr>
<td>IT OPERATIONS</td>
</tr>
<tr>
<td>WAIT FOR HANDLER</td>
</tr>
<tr>
<td>RELEASE BOX &amp; PART</td>
</tr>
<tr>
<td>LOAD TO TRED</td>
</tr>
<tr>
<td>ENSSEL TO CYCLES</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

JWD Group, A division of DMJM Harris
Velocity – Emerging Technologies

- Implications of multi-box handling
Velocity – New Security Requirements

- Integrating new federal security requirements
- Minimizing impacts to on-going operations
Analysis and Simulation Modeling

– Spread Sheet Modeling
– Discrete Event Modeling
Systems Approach to Planning & Design

- Focused on Client goals/needs
- Professional knowledge of container handling systems
- Data substantiated by analysis and simulation modeling
- Refinement through iterative plan development

... results in Improved Intermodal Operations, Increased Productivity, and Enhanced Reliability
Thank you for your attention!