

Robert Johansen, P.E. – JWD Group
Jeannie Beckett – Port of Tacoma
Bryan Tomperi, P.E. – Jacobs Civil

High Volume, High Velocity Intermodal Operations

AAPA Facilities Engineering Seminar – Jacksonville, Fl.
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

Equipment Design Responses

Intermodal Response

Increased Throughput and Congestion

PORT of TACOMA U.S.A.

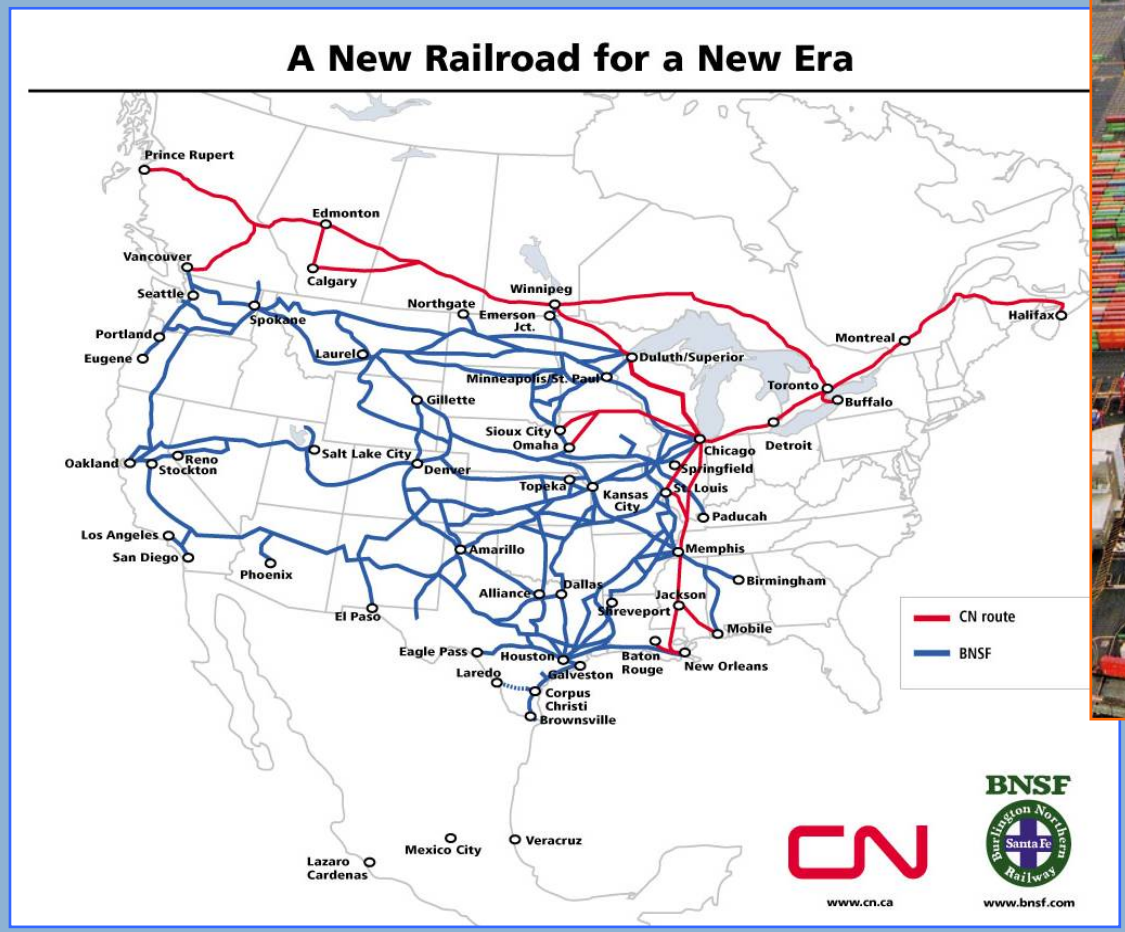
Intermodal Response

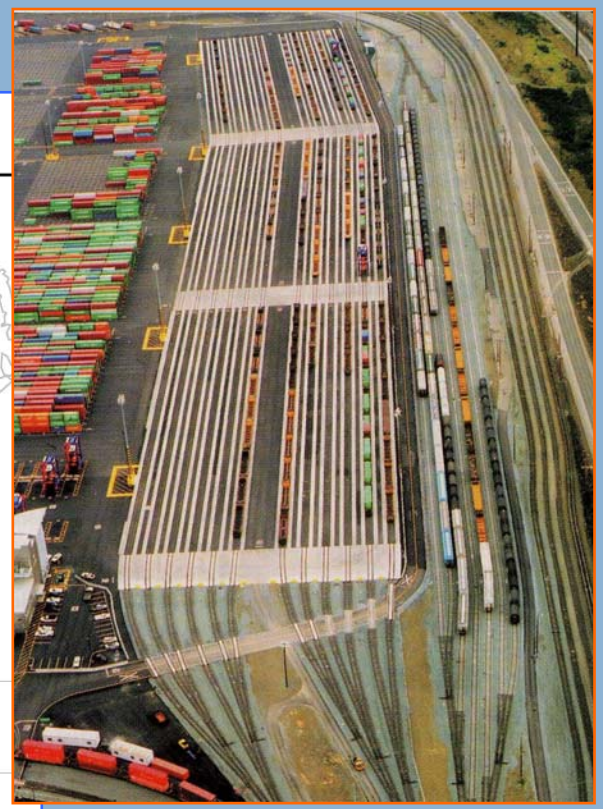
- Increased Velocity
- Increased Storage Density
- Increased Reliability

… results in
More Throughput
And Better
Customer Service

Intermodal Response

– Upgraded Rail Infrastructure





Intermodal Response

$3 Billion± to address congestion within the L.A. Basin

– Dedicated Rail Corridors

Intermodal Response

Intermodal Response

– Dedicated Intermodal Facilities

Intermodal Response

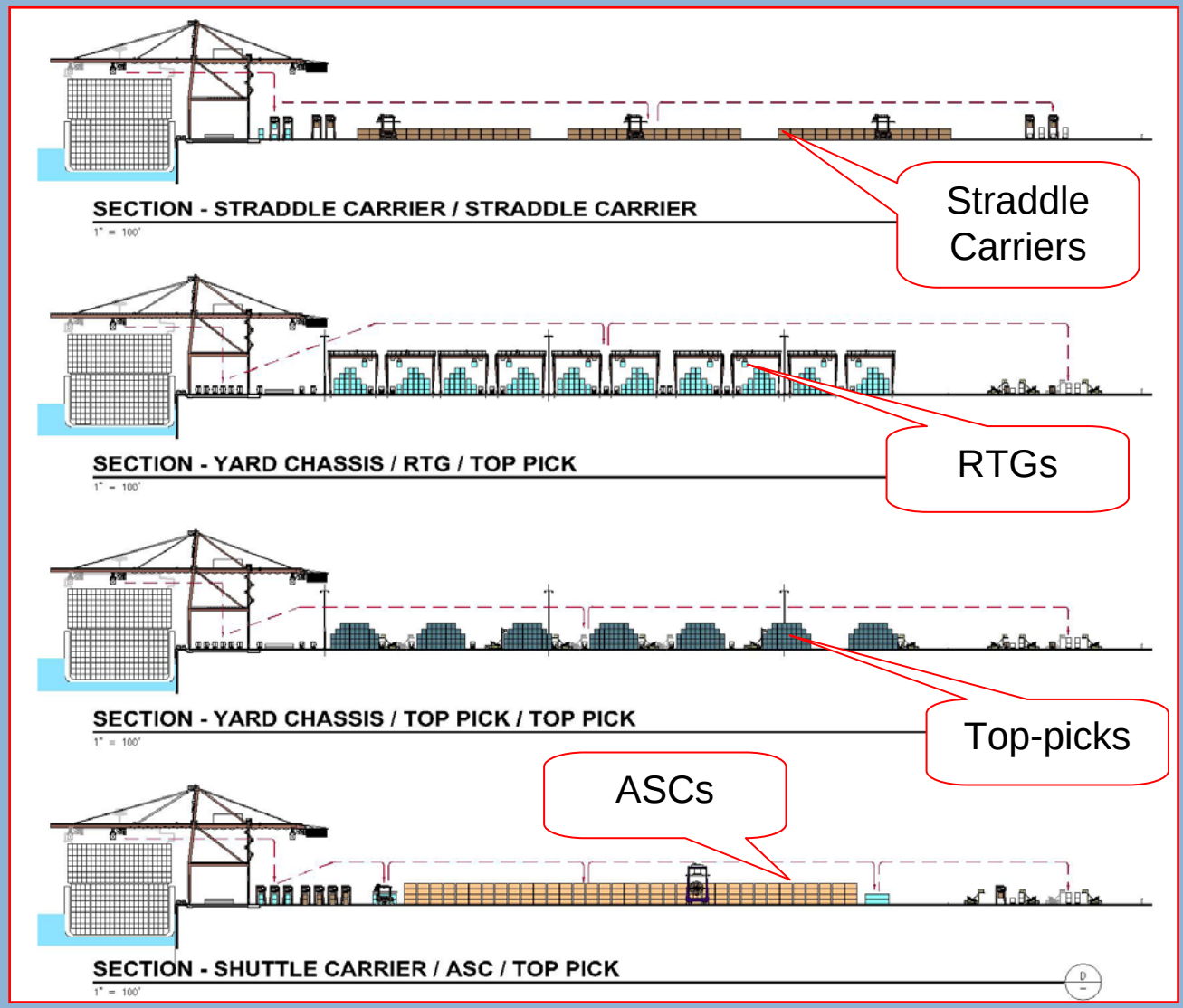
- Grade Separations
- On-dock Intermodal Terminals

Intermodal Response

- Upgraded operating paradigms
- New support equipment

Container Yard Operations

Container Yard Operations



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

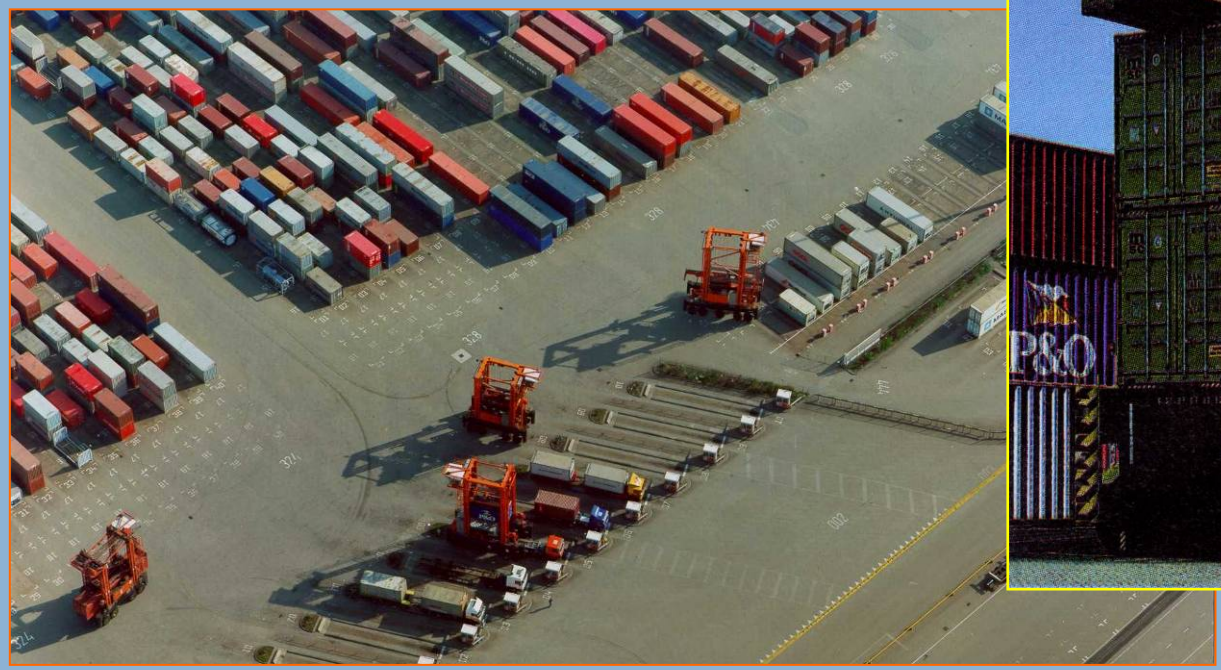
RTG Operation

- High density
- Moderate selectivity
- Adjacent truck access
- Hardened runways

Yard Operations

Straddle Carrier Operation

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



Yard Operations

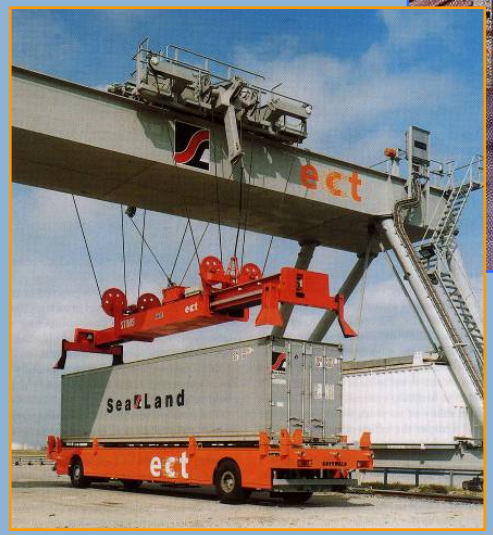
RMG Operation

- High density
- Moderate selectivity
- Adjacent truck access
- Railed runways
- Electric power

Yard Operations

Automated Yard Crane Operation

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



Yard Operations

PORT of TACOMA U.S.A.

Yard Chassis

- Coupled transfer
- Flexible travel path
- Low capital cost
- Low maintenance cost
- Transport only

Multi-Trailer Train

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

Yard Operations

AGVs

- Coupled transfer
- Inflexible travel path
- IT labor force
- High capital cost
- High maintenance cost
- Transport only

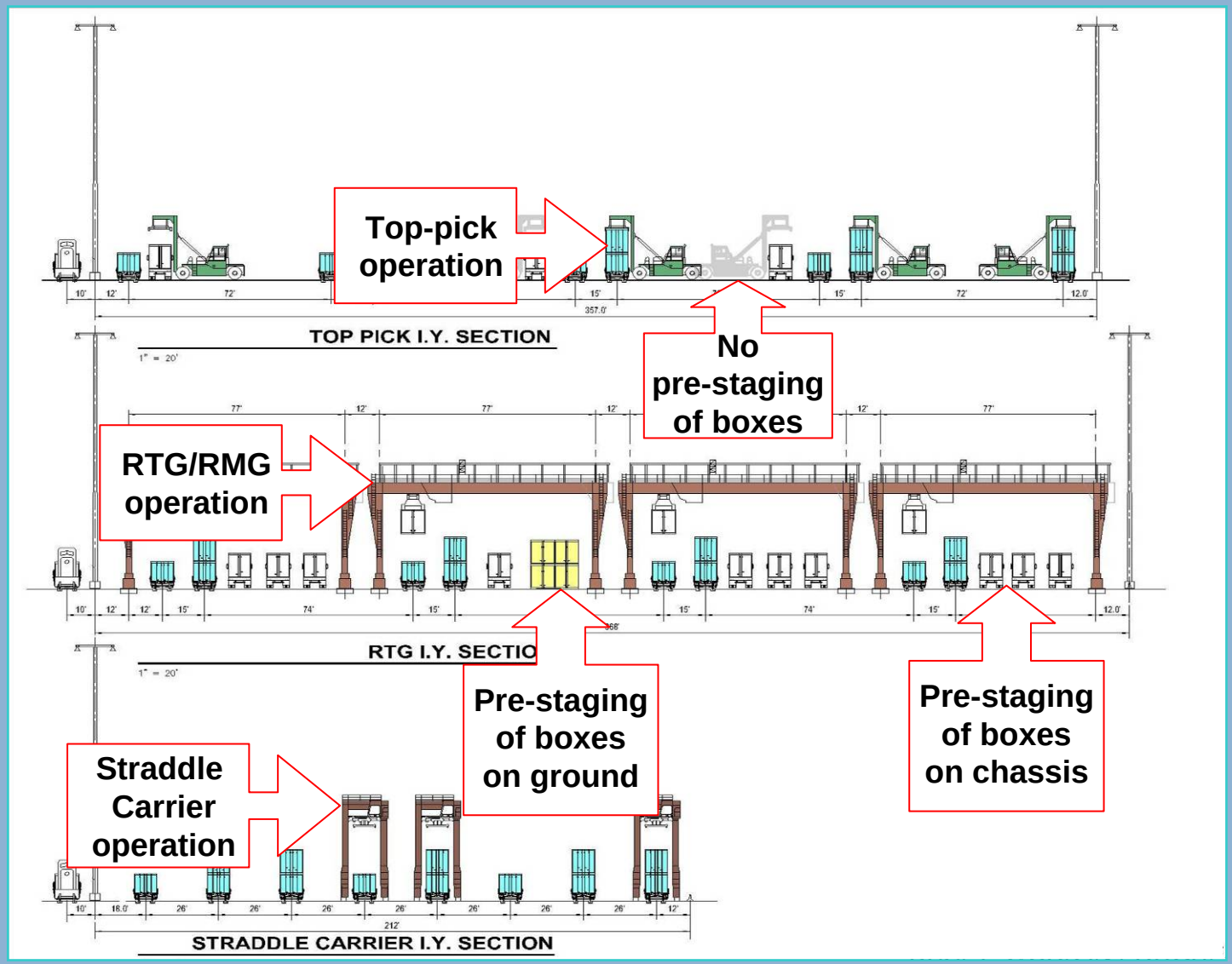
Shuttle/Straddle Carrier

- Uncoupled transfer
- Flexible travel direction
- Moderate labor force
- High capital cost
- High maintenance cost
- Transport & stack

PORT of TACOMA U.S.A.

Intermodal Rail Operations

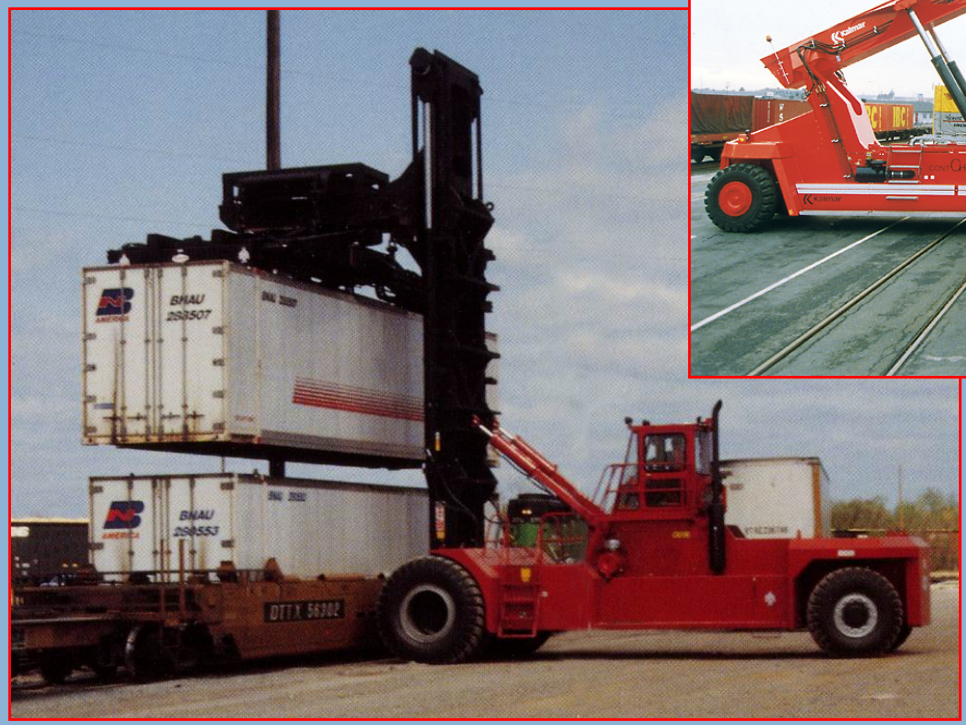
Alternative Loading Schemes/Geometry



Intermodal Rail Operations

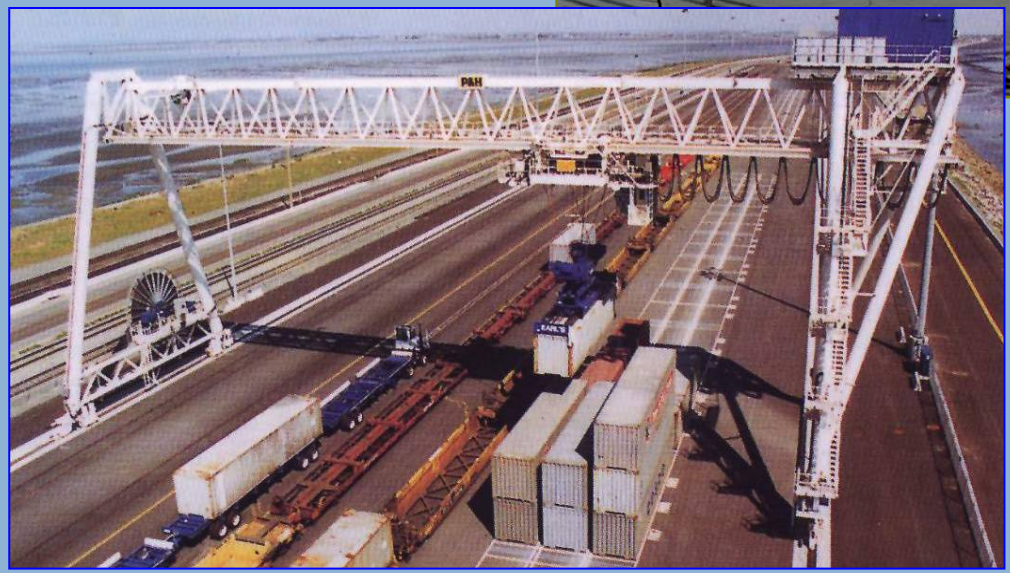
Top-pick/Reach Stacker Operation

- 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

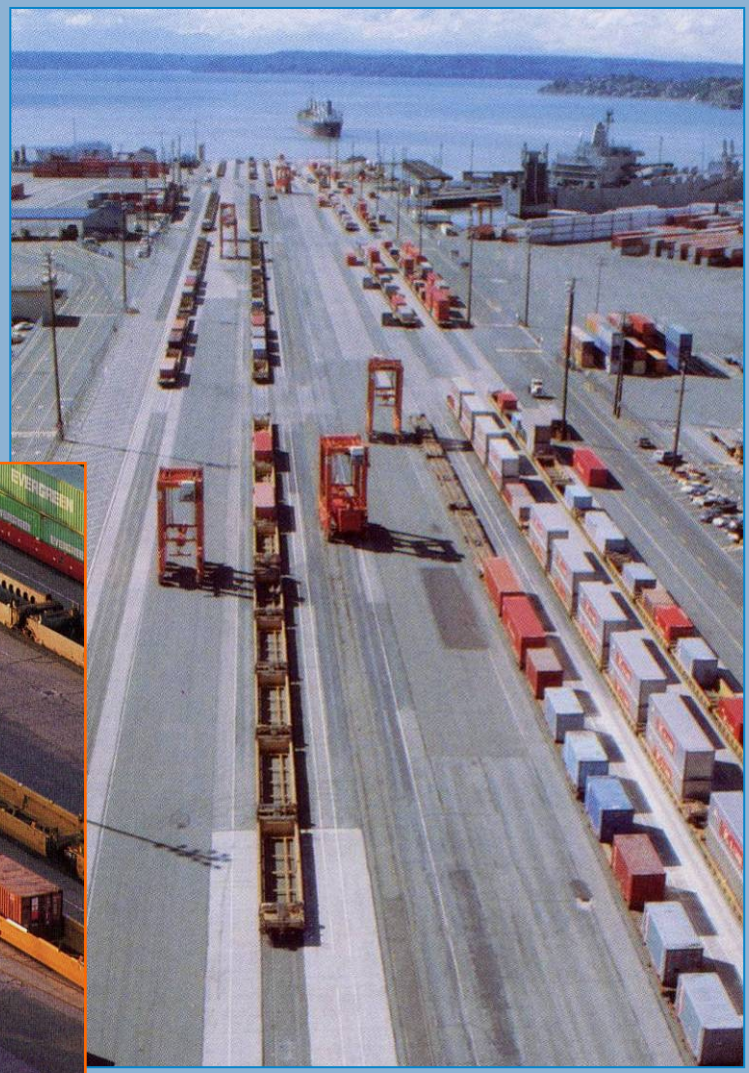


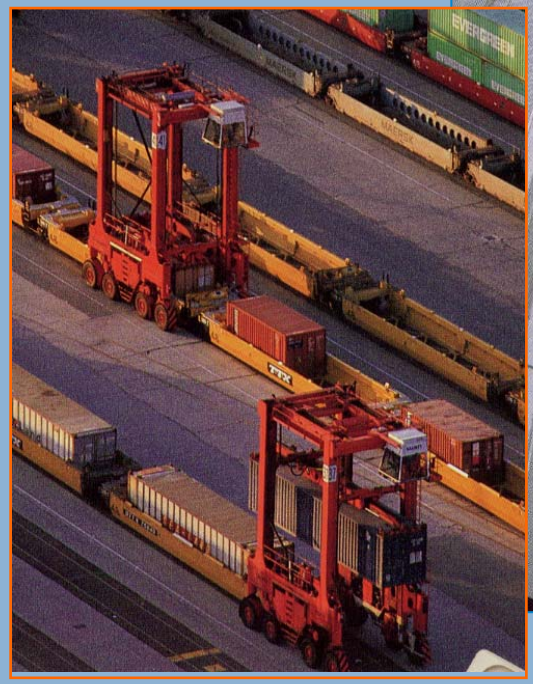
Large Span RMG Operations

- Multi-track access
- Multi-access aisles
- Pre-staging of boxes

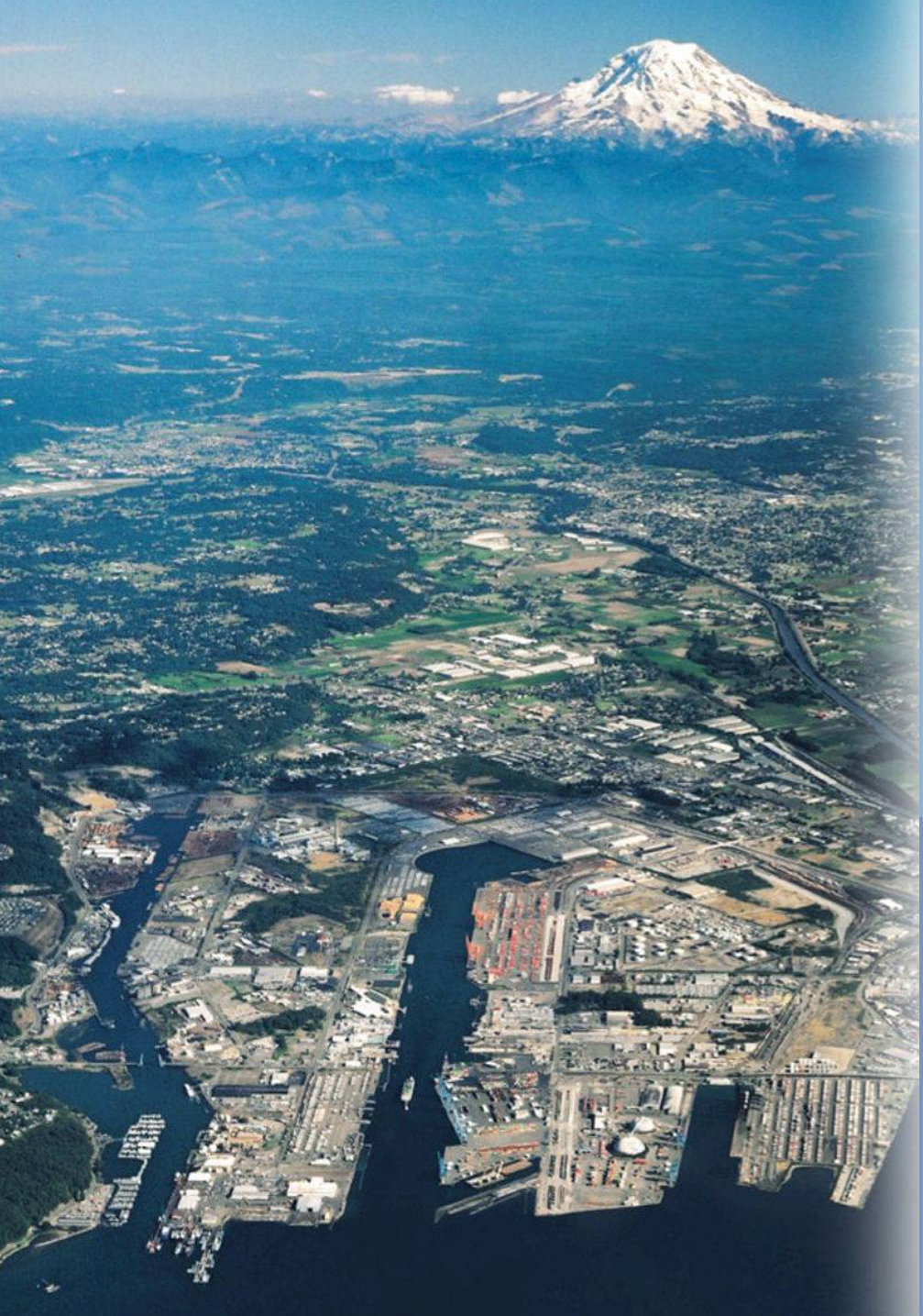
Straddle Carrier Operation

- Single track access
- Narrow access aisles
- No pre-staging of boxes
- Wider straddle carrier





PORT of TACOMA U.S.A.



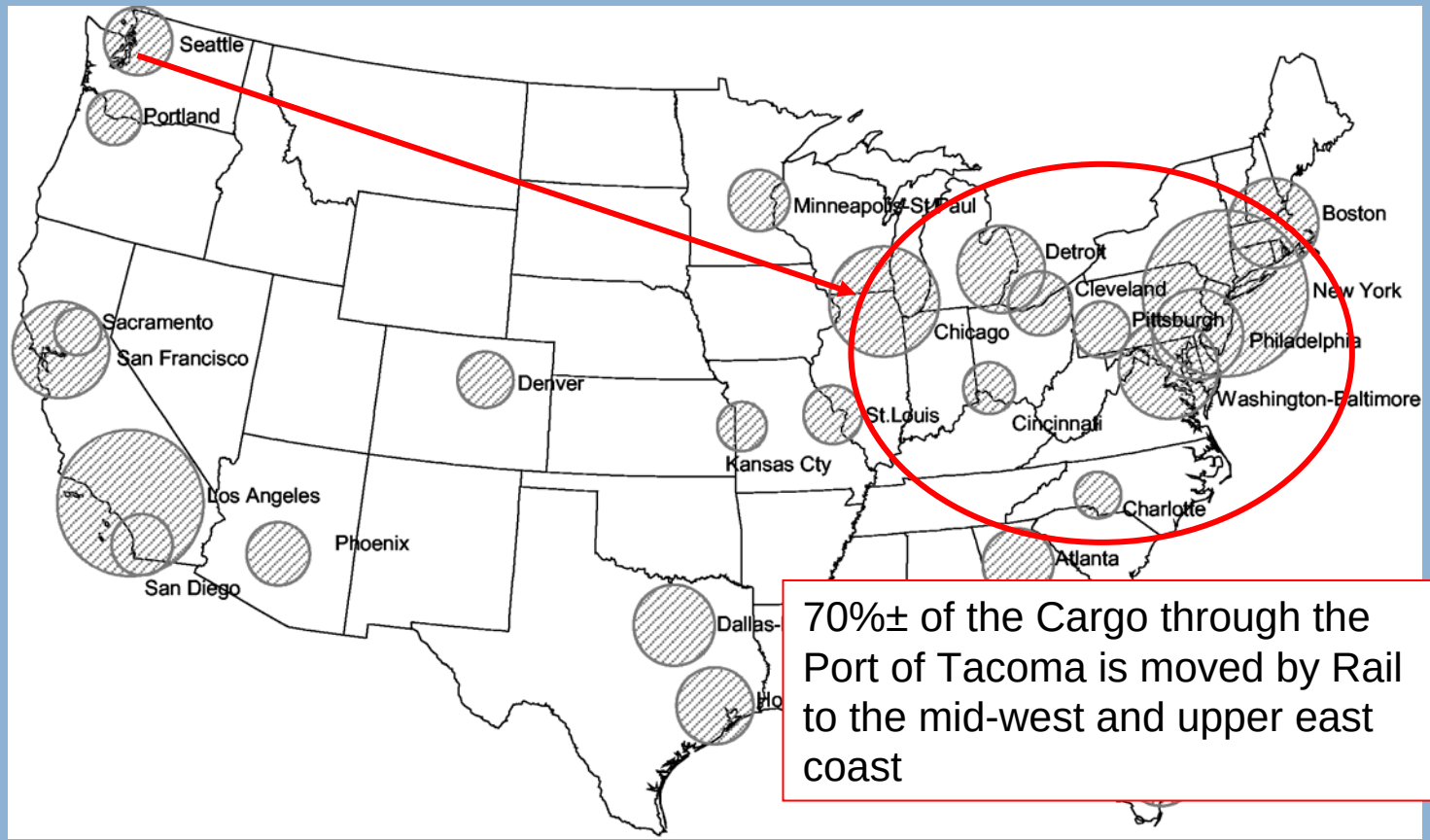
DMJM HARRIS | AECOM

A Case Study
Intermodal Development at the Port of Tacoma

PORT of TACOMA U.S.A.

#1 Goal for the Port of Tacoma

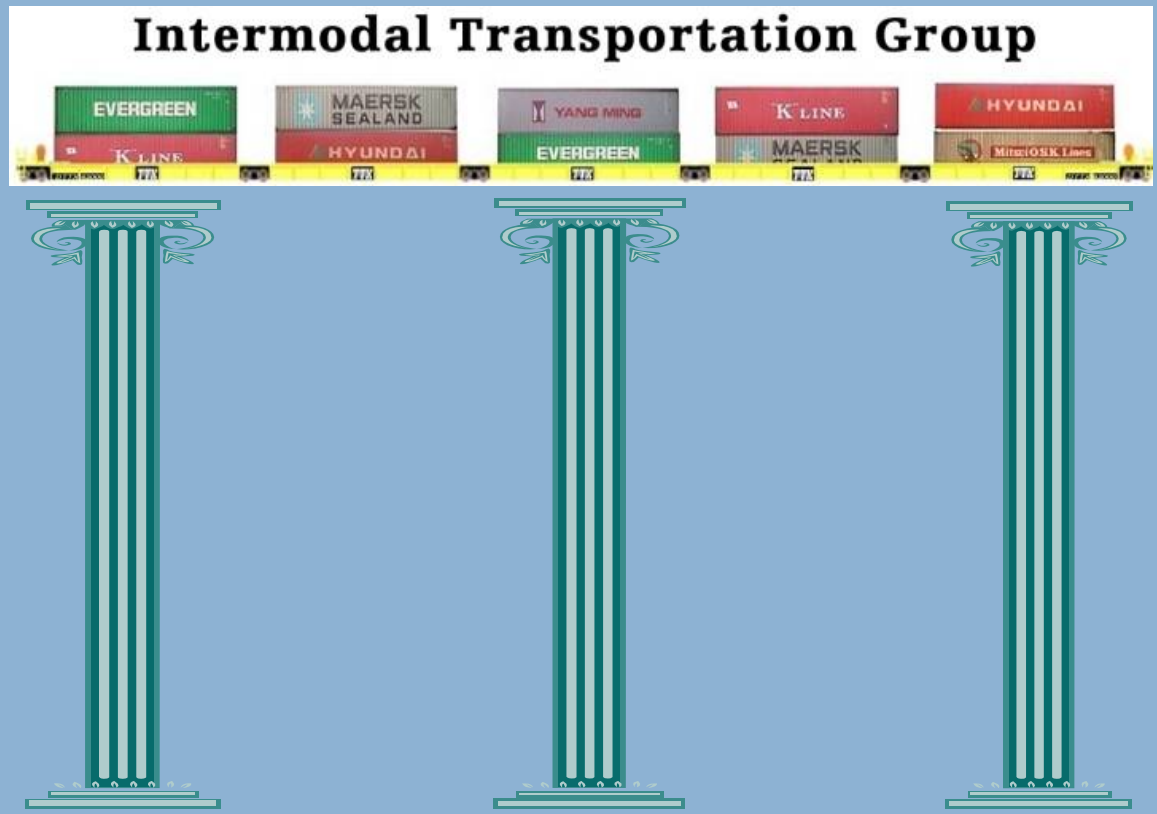
– The Port of Tacoma to be the most efficient and reliable intermodal gateway in North America



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

Port of Tacoma

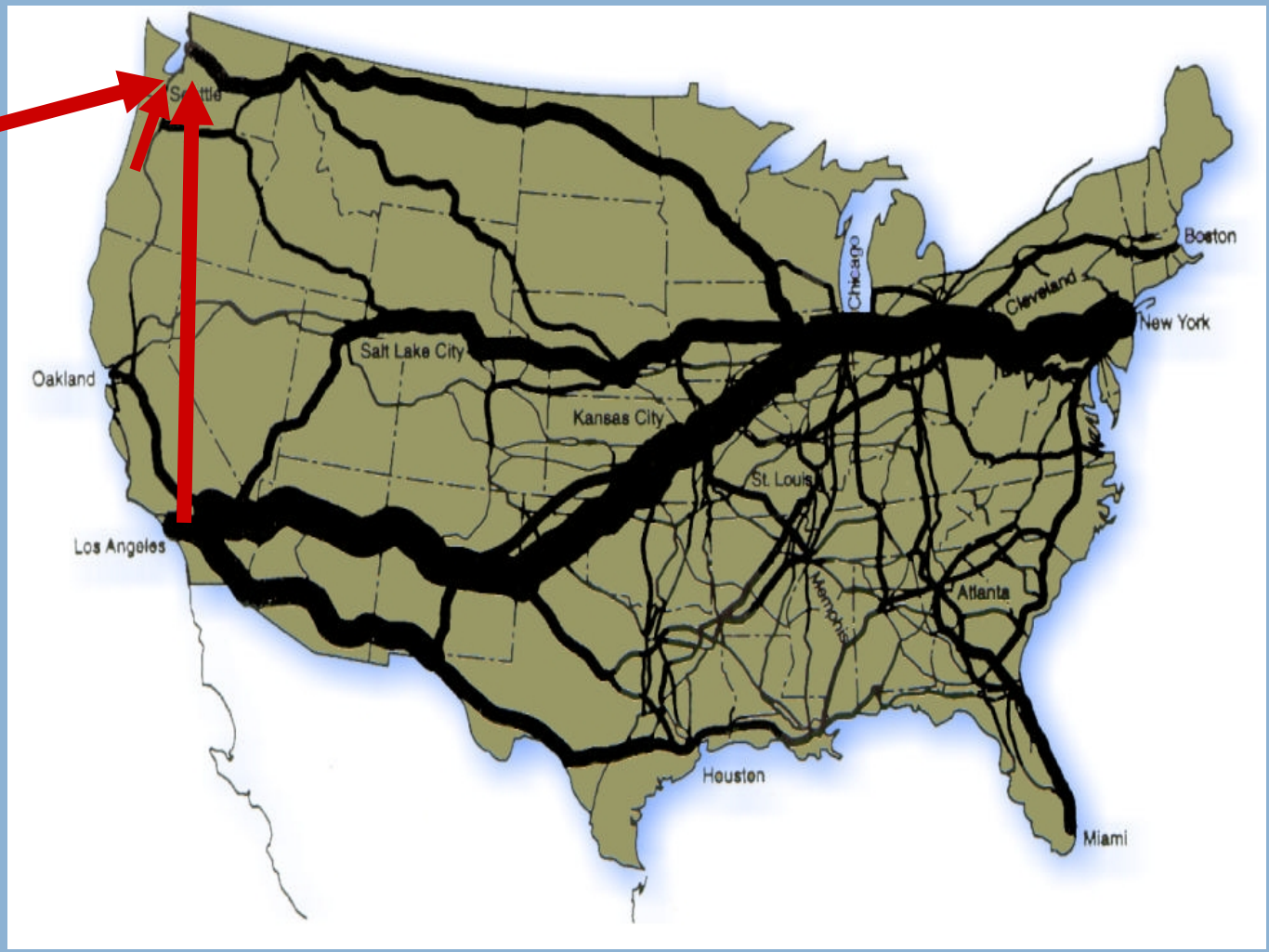
Intermodal Growth Strategies



VELOCITY **DENSITY** **RELIABILITY**

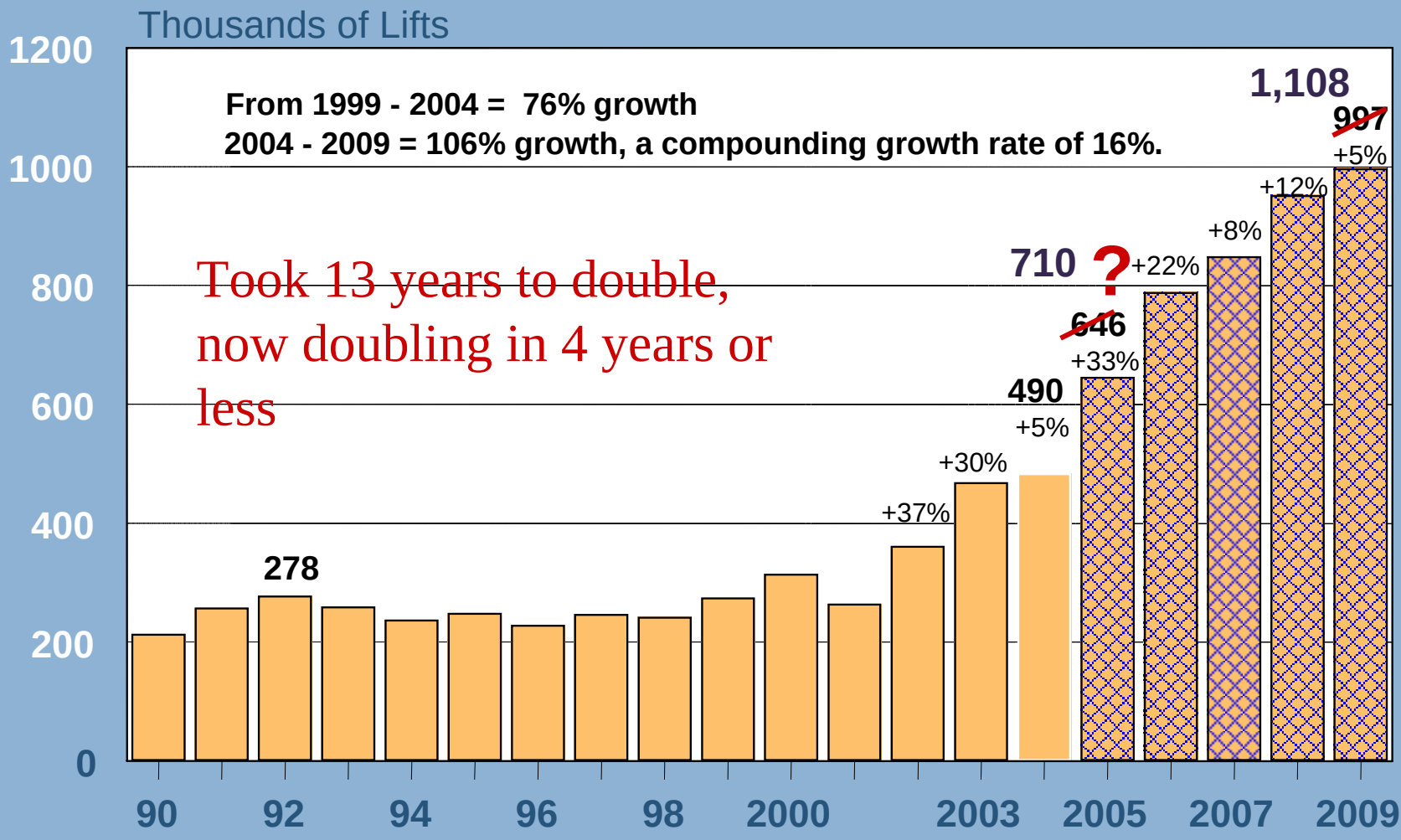
Port of Tacoma

Growth is Coming from all Directions



Port of Tacoma

Intermodal Lift Projections



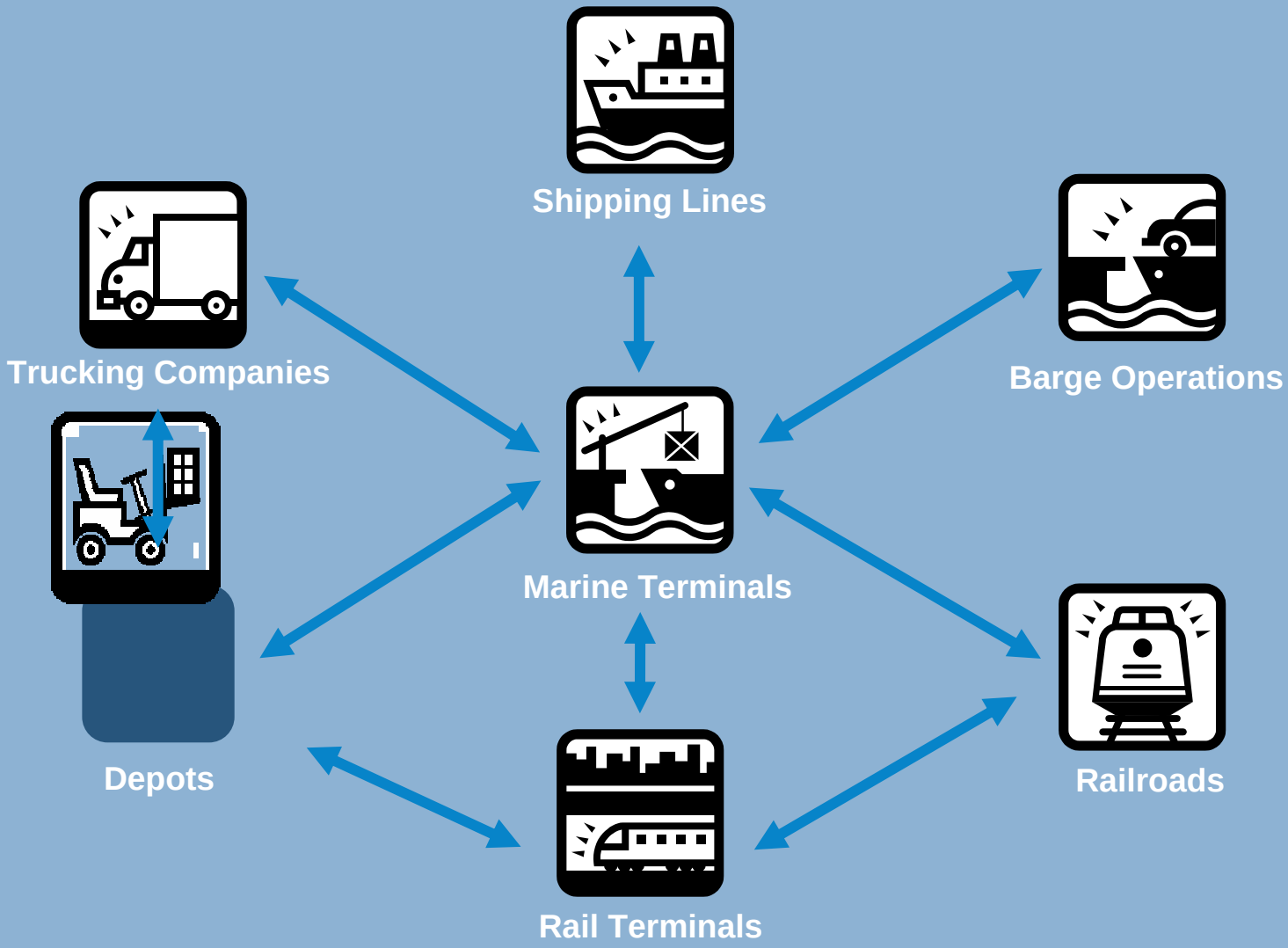
N:\hgwdata\annual.prs

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

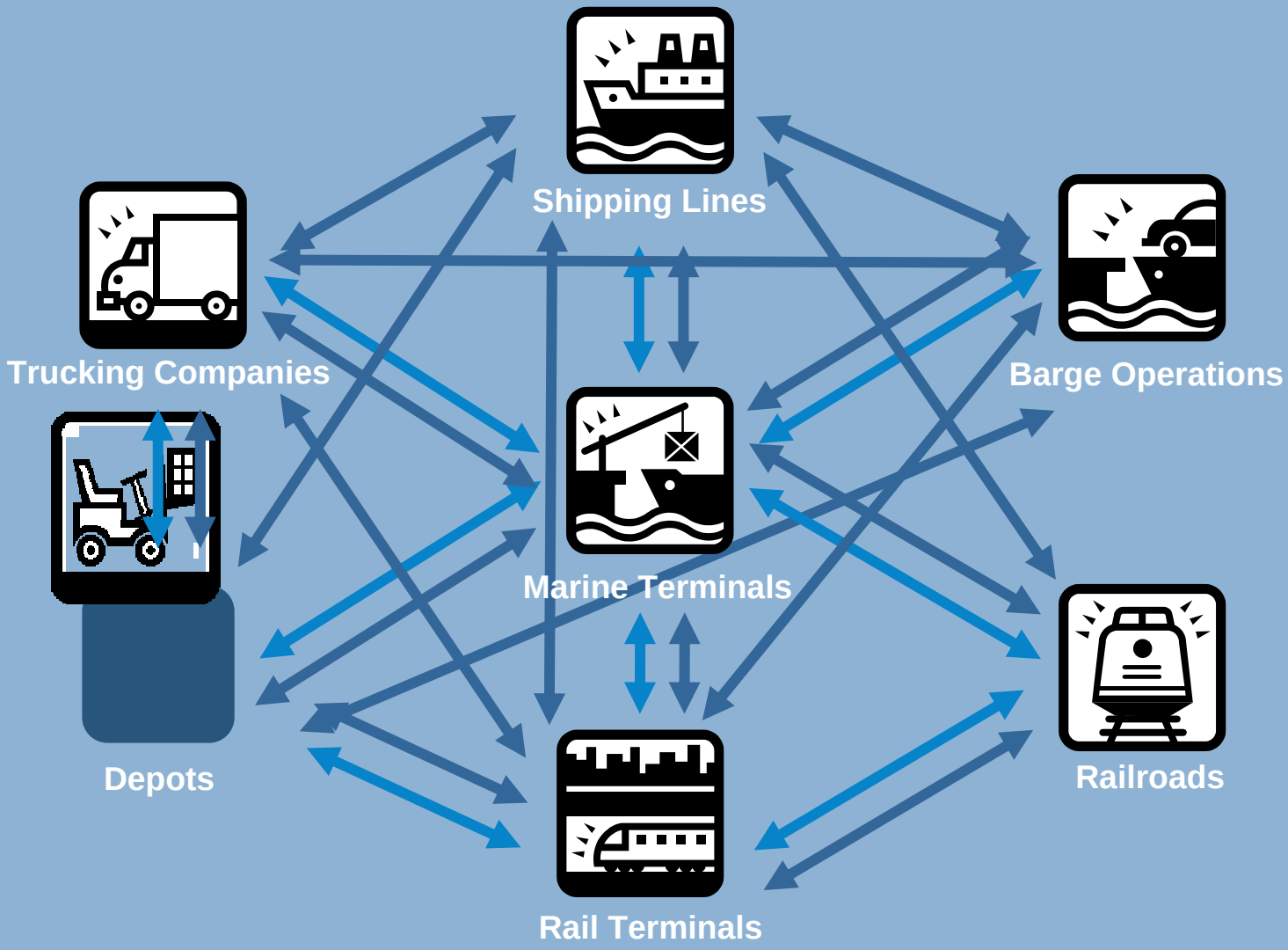
Port of Tacoma

Current Port Community Model

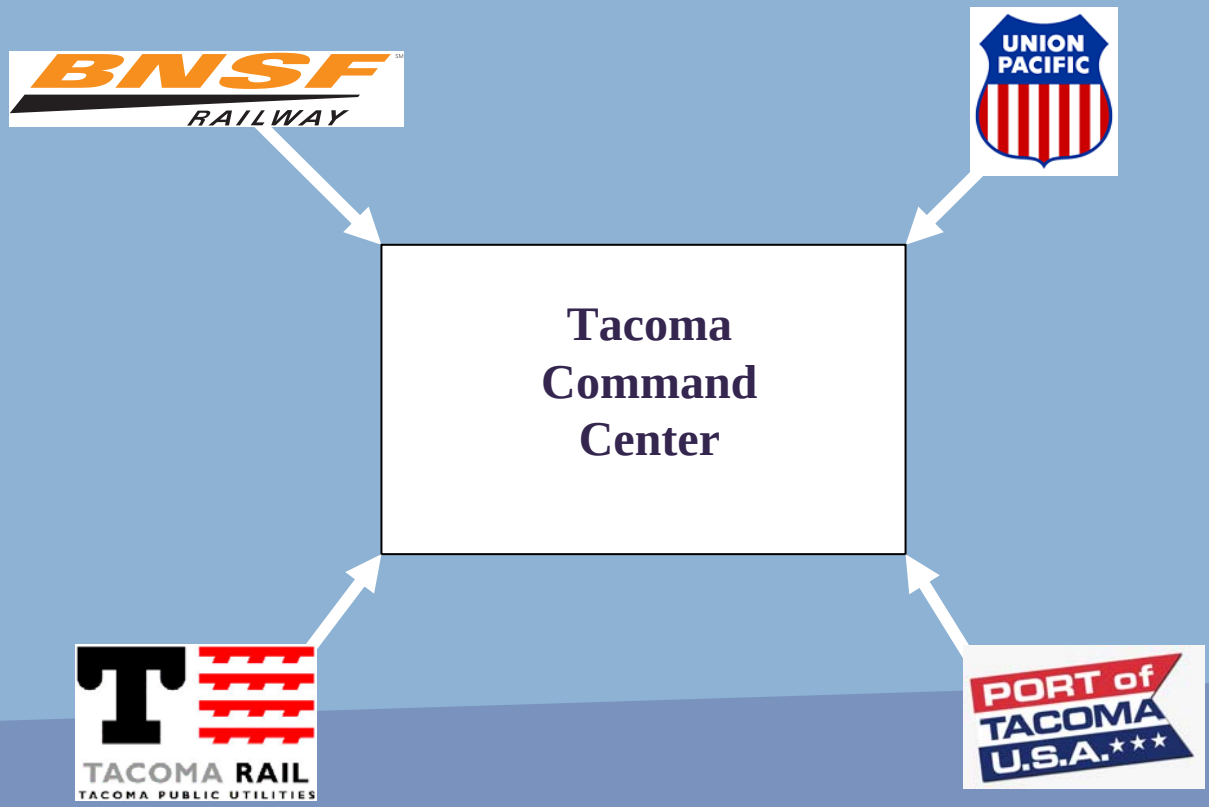


Port of Tacoma

Proposed Port Community Model



Port of Tacoma



Port of Tacoma

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

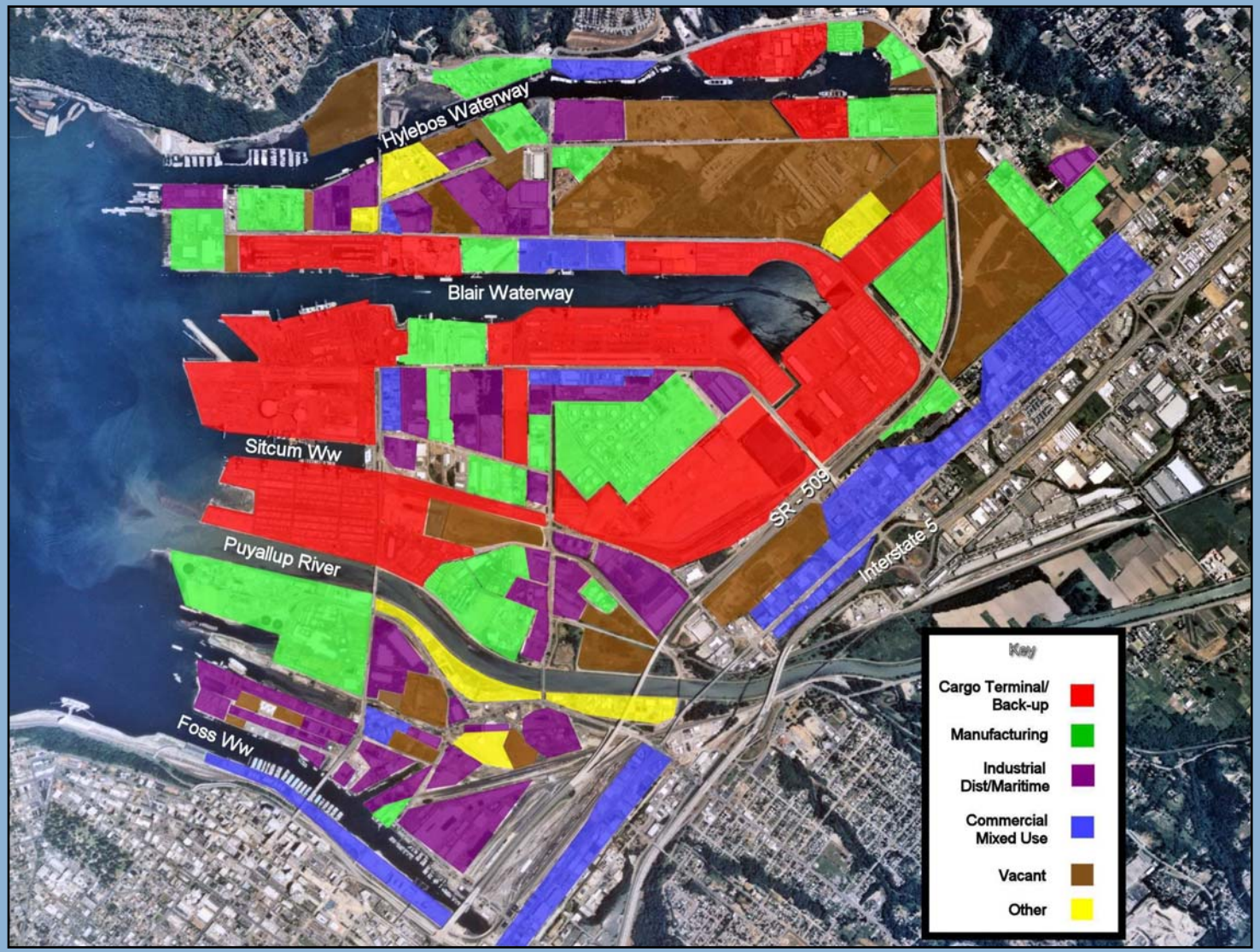
- Develop Intermodal Line of Business Strategic Plan
- Continue to develop regional perspective on growth and demand
- Continue to engage the mainlines and understand their plans
- Continue to engage neighbors and enhance relationships
- Complete development of the Business Exchange
- Continue to investigate 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

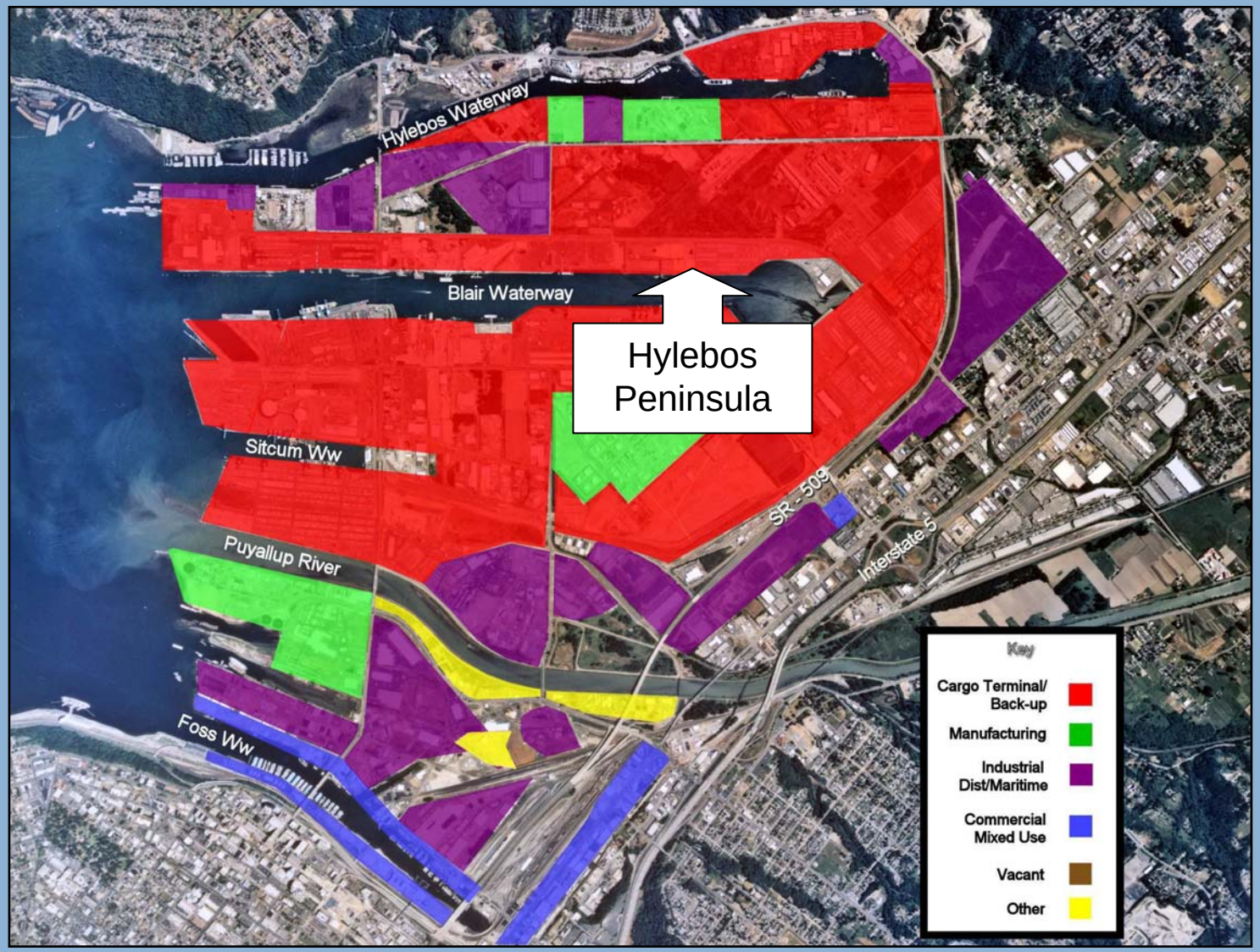
Port of Tacoma

Density - 2004 Land Use



Port of Tacoma

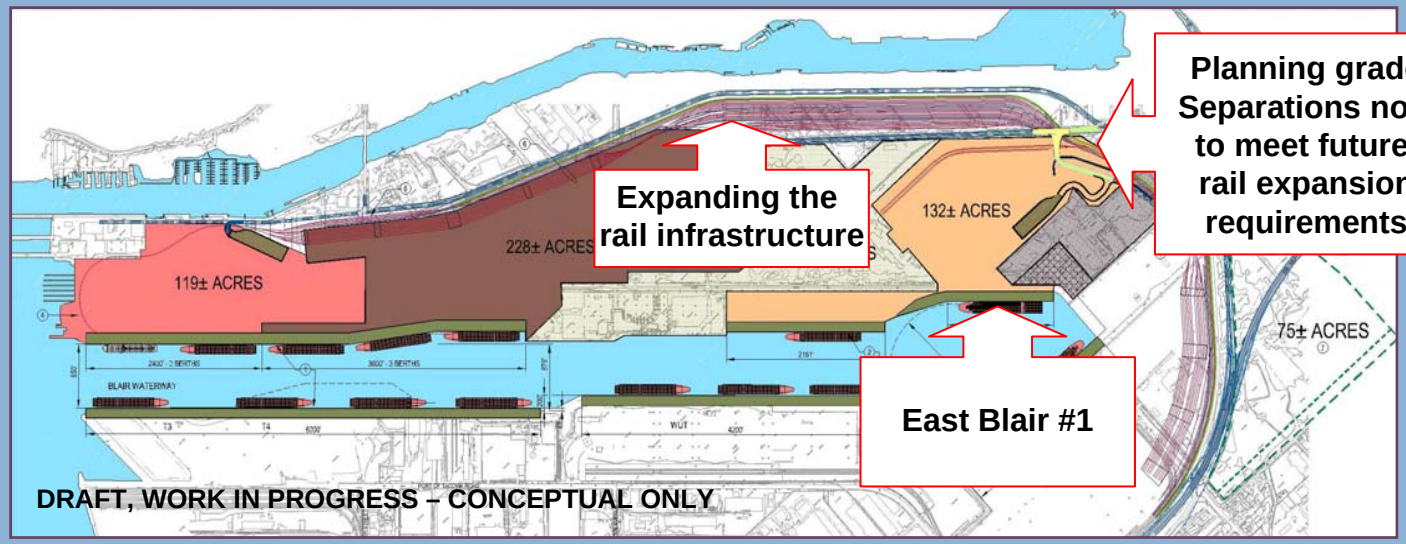
Density - 2020 Land Use

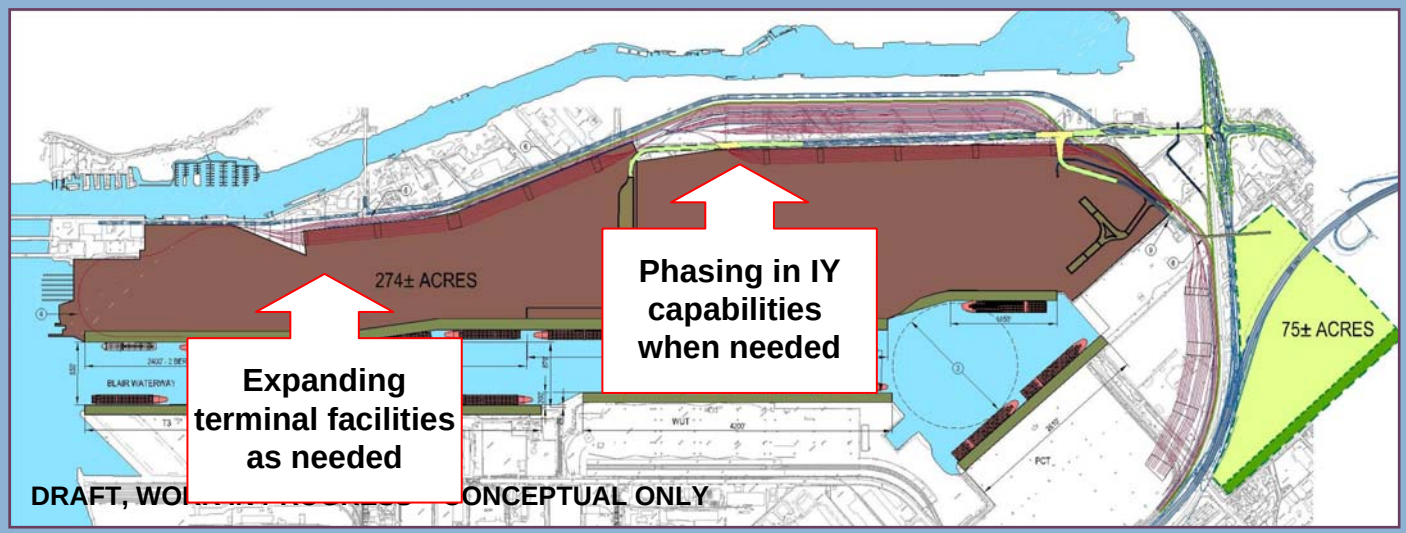


Port of Tacoma

Density - Phased Planning for the Future

DMJM HARRIS | AECOM

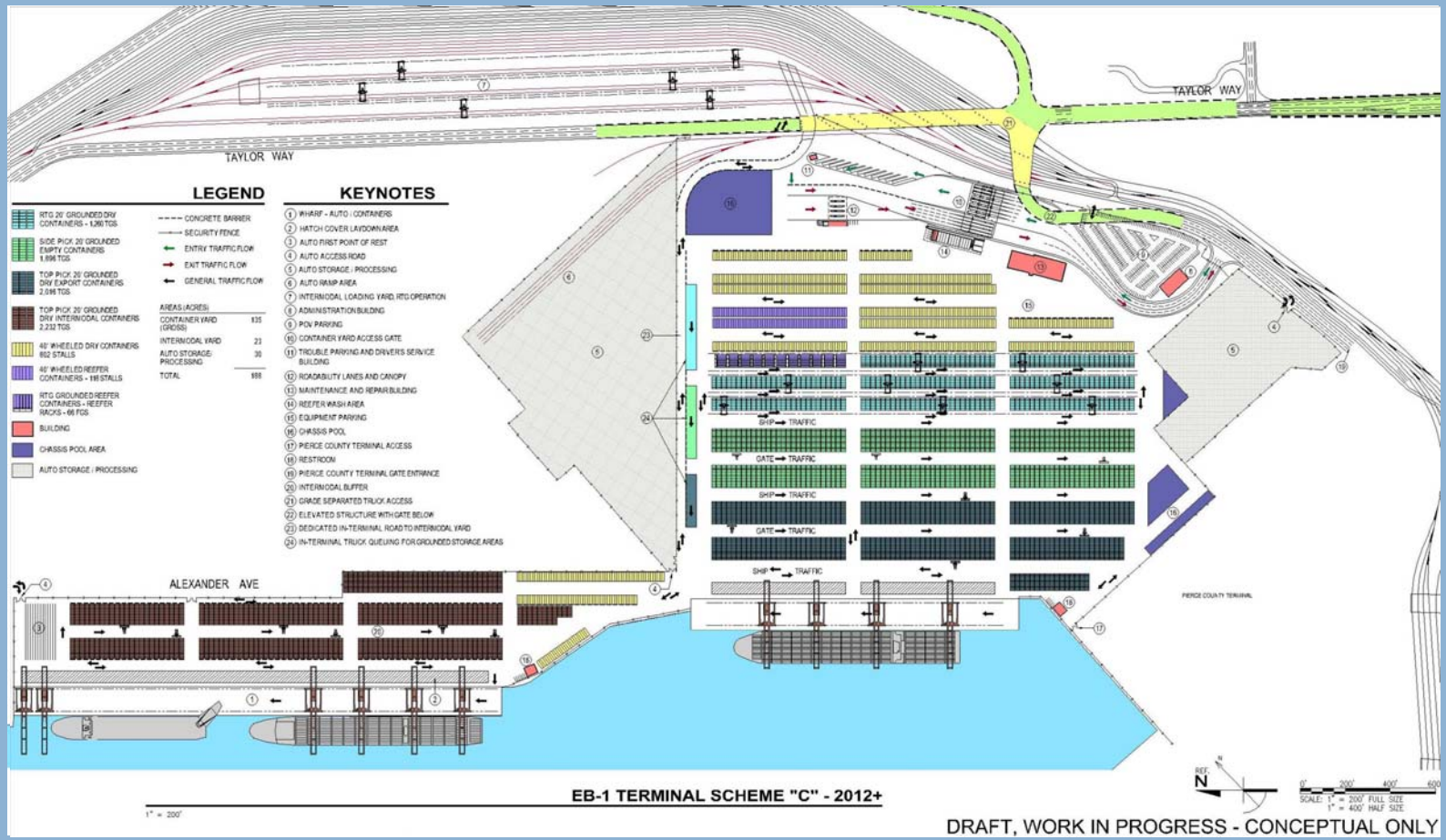




Port of Tacoma

PORT of TACOMA U.S.A.

Density - Phased Planning for the Future



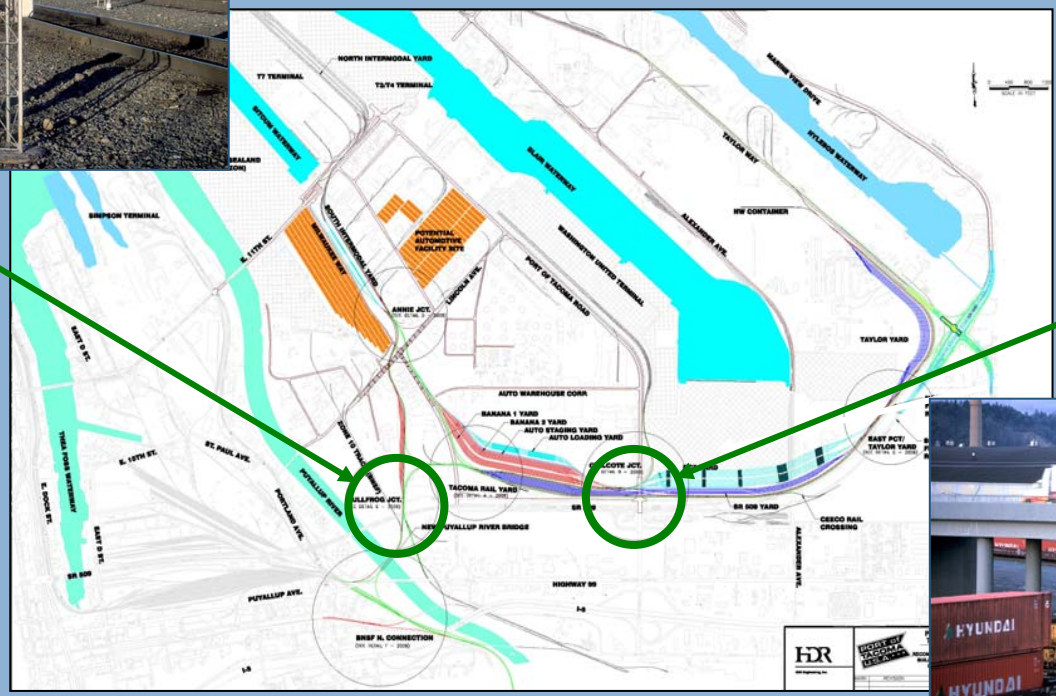
Port of Tacoma

Reliability - Creating Solutions

Adding Redundancy & Increasing Capacity

Bullfrog Junction

Chilcote Junction



Port of Tacoma

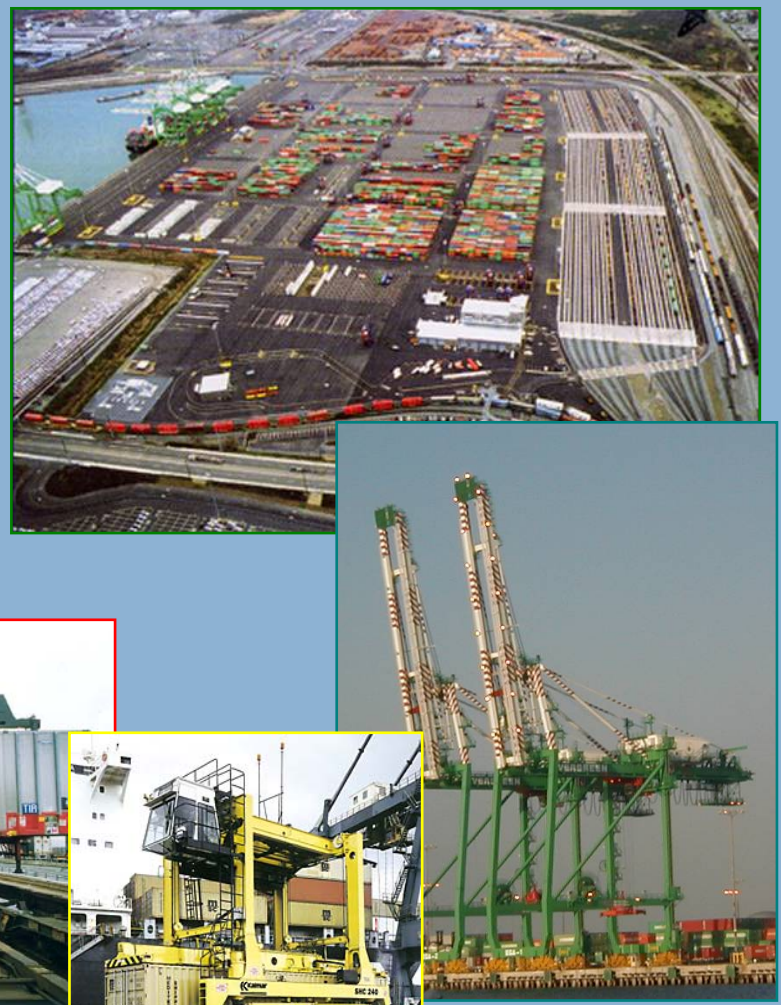
Systems Approach to Planning & Design

DMJM HARRIS | AECOM

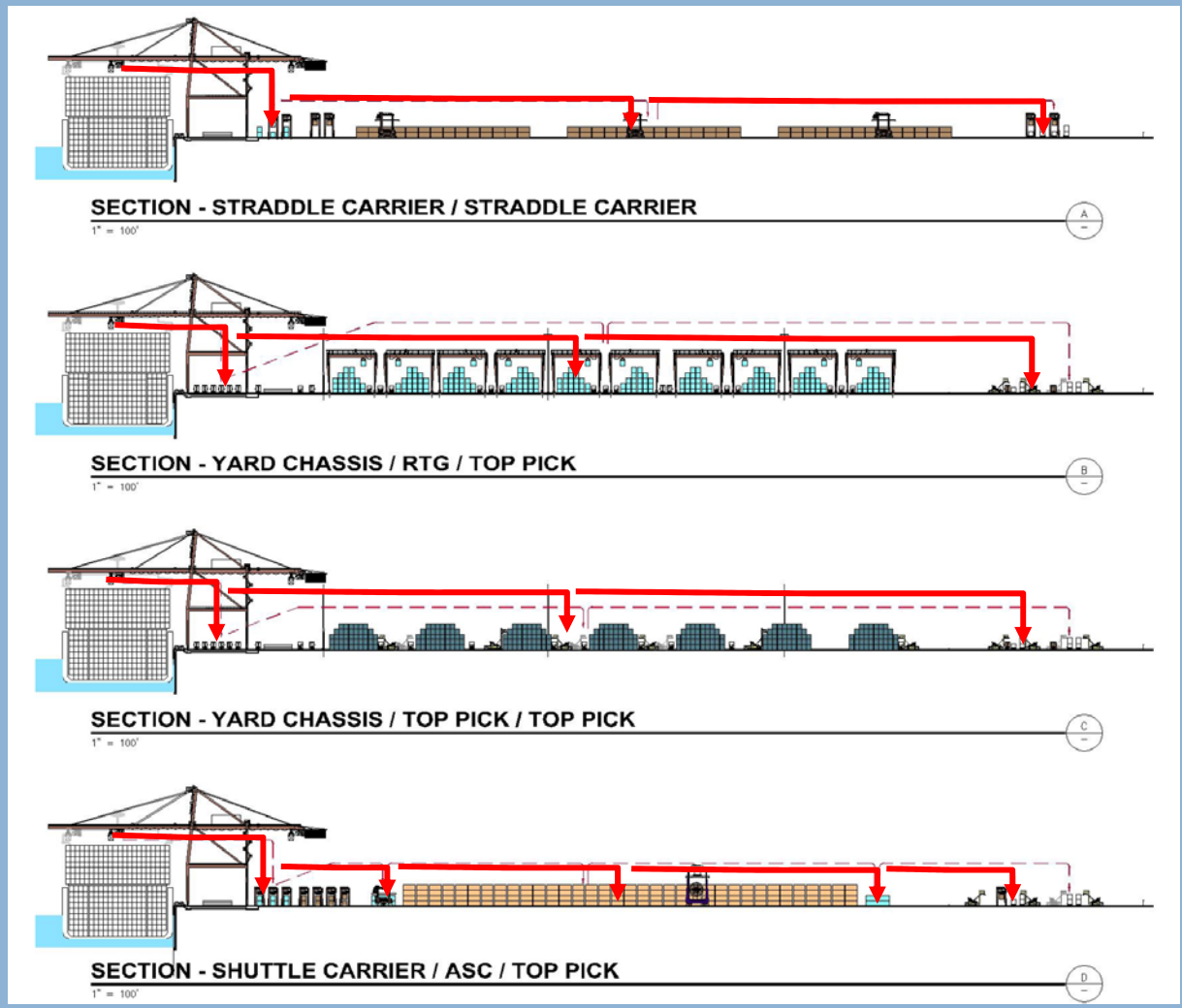
PORT of TACOMA U.S.A.

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

Velocity – Analyzing Different Systems

– Uncoupled handoffs optimize machine velocities

RELATIVE SYSTEM VELOCITY ANALYSIS
DATA TABLE #1 (sec's)

QUAY CRANES	(A)	(B)	(C)	(D)
• TROLLEY TO CENTER LOAD LANE	38	30	30	38
• LOWER TO DECK & RELEASE BOX	10	X	X	10
• WAIT FOR CHASSIS	X	10	10	X
• SPOT TO CHASSIS & RELEASE BOX	X	15	15	X
• PICK BOX @ DECK	15	X	X	15
TRANSFER TO STORAGE				
• MOVE BOX TO STACK CENTROID	85	95	95	200
• WAIT FOR YARD HANDLER & PICK BOX	X	75	75	X
• RELEASE BOX & DEPART	15	X	X	15
TRANSFER FROM STORAGE				
• WAIT FOR YARD HANDLER AT S…	X			X
• PICK & MOVE BOX TO C…				100
• ALIGN & PICK BOX				20
• DRIVE TO IY CENTRO…				120
IY OPERATIONS				
• WAIT FOR HANDLER				X
…X & DEPART			15	15
…LOAD TO…			30	30
			650±	560±

398 sec

650± sec

650 sec

563± sec

250± sec

350± sec

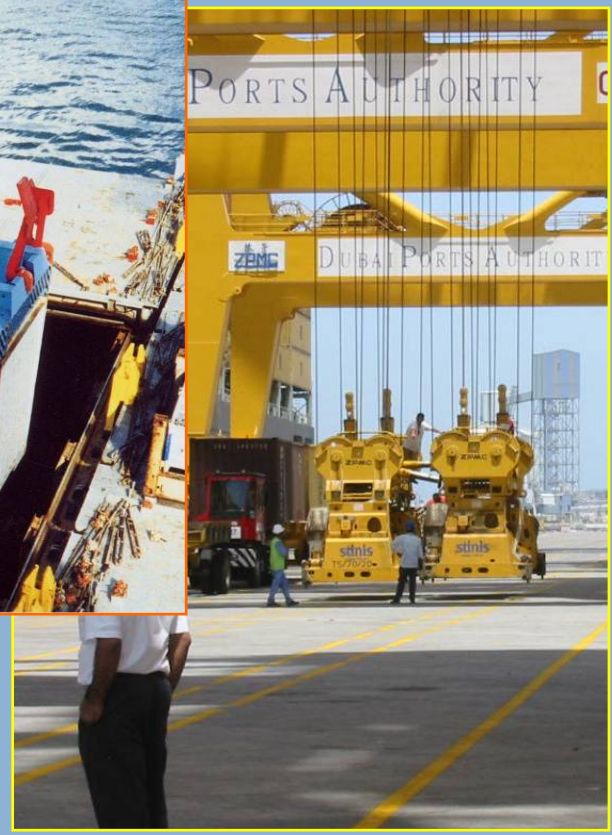
D… DATA … ESSEL TO IY
… (sec's)

…IY	(A)	(B)	(C)	(D)
	250±	350±	350±	250±

Systems Approach

Velocity – Emerging Technologies

– Implications of multi-box handling



Systems Approach

PORT of TACOMA U.S.A.

Velocity – New Security Requirements

- Integrating new federal security requirements
- Minimizing impacts to on-going operations

RPM Portals

Analysis and Simulation Modeling

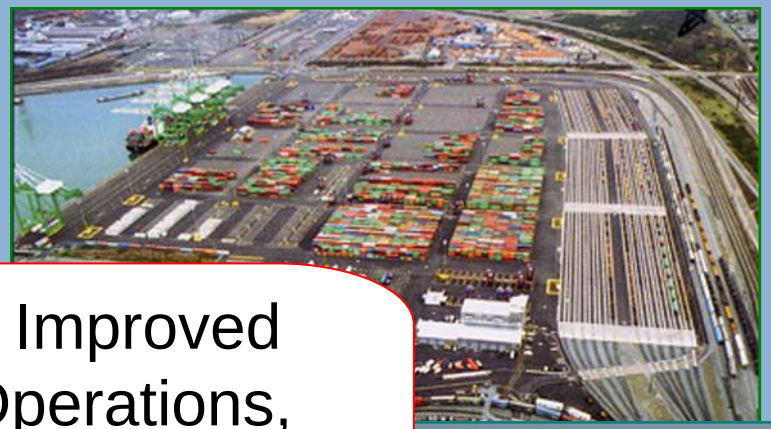
- Spread Sheet Modeling
- Discrete Event Modeling

Systems Approach

Systems Approach to Planning & Design

- Focused on Clien[illegible]oals/needs
- Professional knowl[illegible]of container handling sy[illegible]
- Data substantiated [illegible] and simulation m[illegible]
- Refinement throu[illegible] plan developme[illegible]

…. results in Improved Intermodal Operations, Increased Productivity, and Enhanced Reliability



Systems Approach

PORT of TACOMA U.S.A.

Thank you for your attention!

DMJM HARRIS | AECOM