

Strategic Mobility 21



Southern California Agile Supply Network (SCASN)

A Mathematical Optimization Model Approach

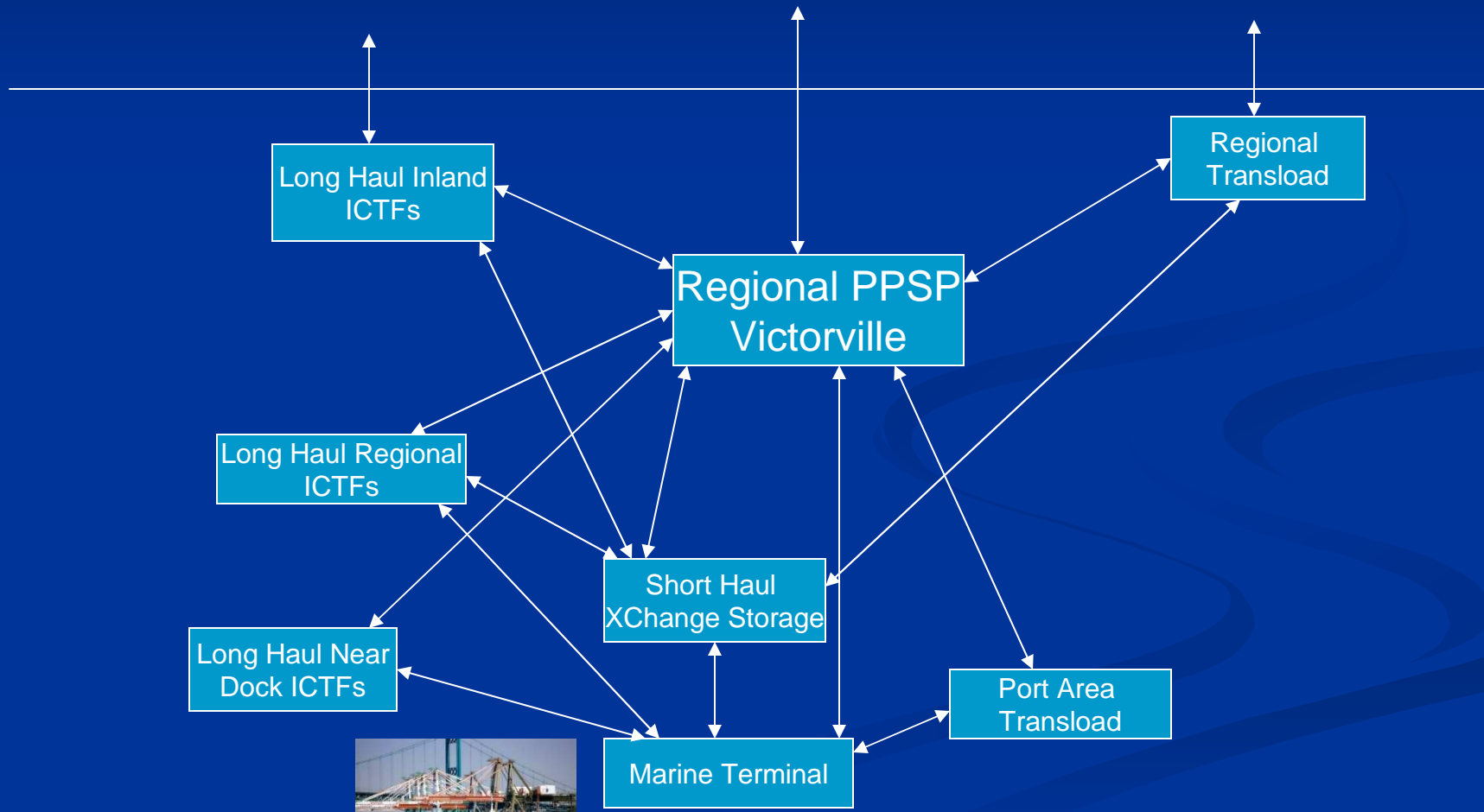
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CSULB

The Southern California Agile Supply Network (SCASN) Model

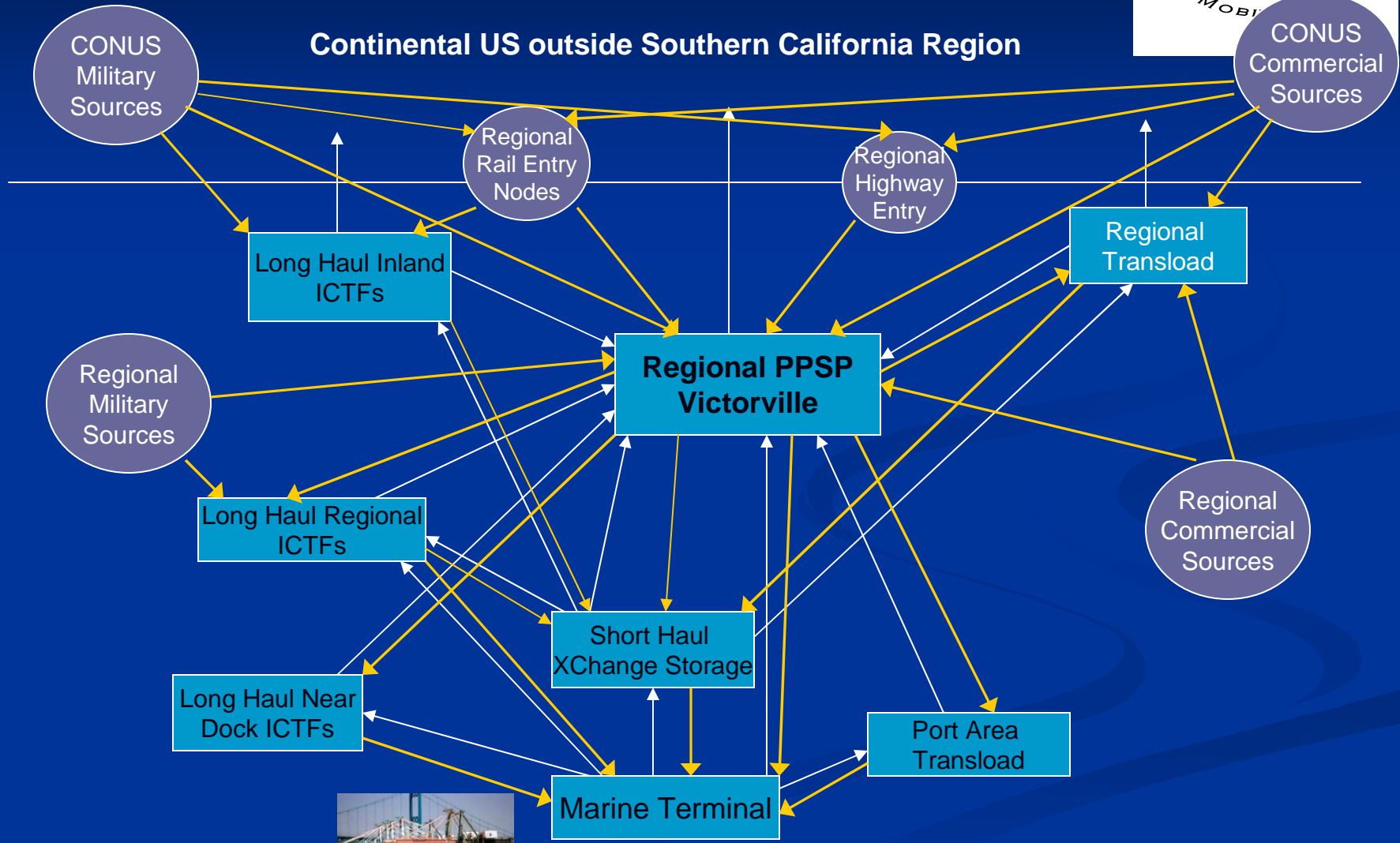


- Has User Reconfigurable Nodes and Segments
- Supports User Defined Constraints, Restraints and Environments
- Permits Optimization of single and multi-dimensional objectives
- Will be Usable and Reconfigurable Via a future Web Portal
- Is Employed Across Multiple Transportation Modes
- Can Integrate “Single Point” Node or Segment Models

A Typical Regional Agile Supply Network Model



A Typical Regional Agile Supply Network Model



Research Questions



- What are the most effective ways to move the containers (locally and pass through)?
- What are the effects of military deployment on commercial capability?
- What would be the costs and benefits of infrastructure changes?

We Are Developing a Mathematical Model of SCASN



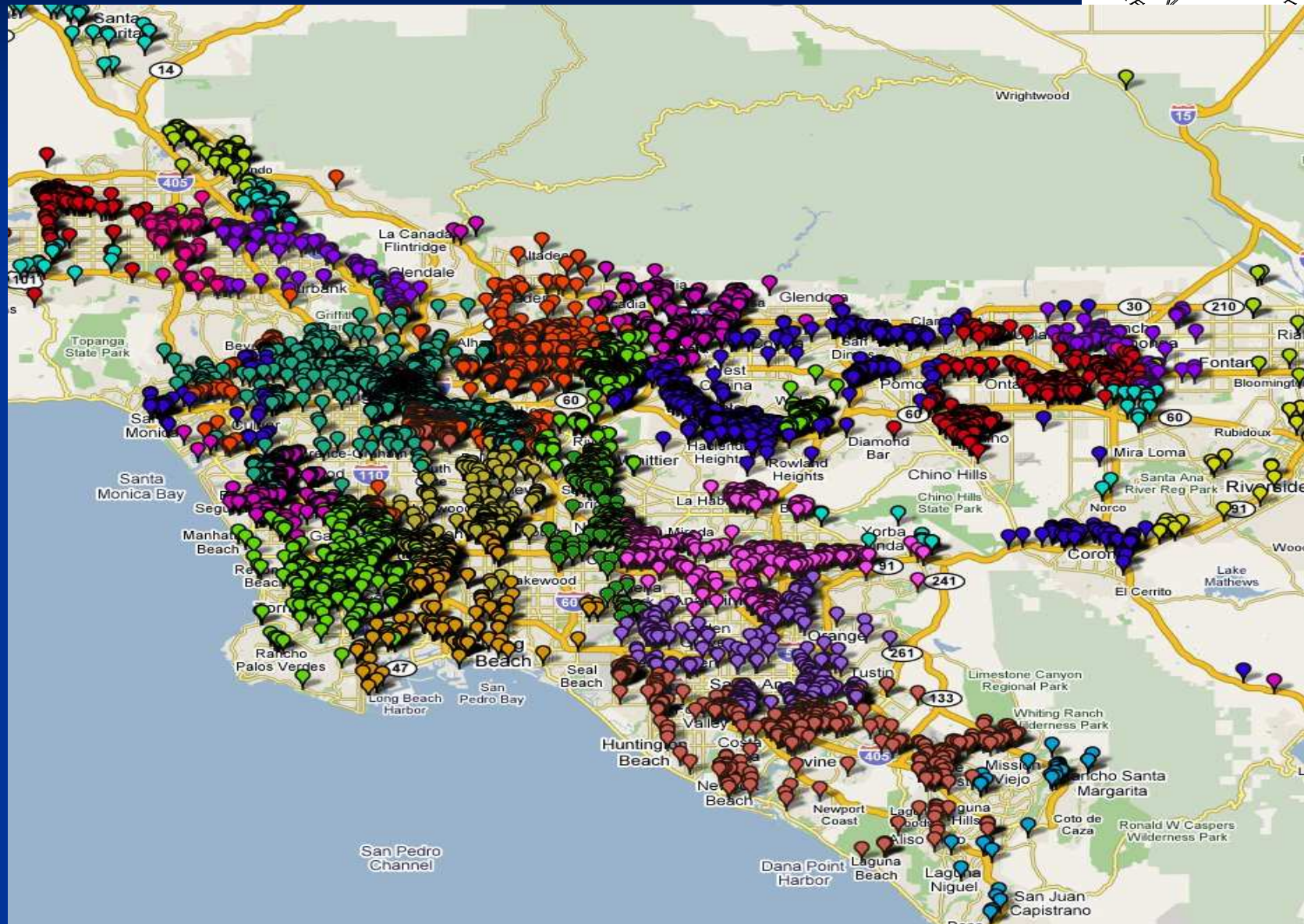
- The model is based on a complex transportation network
 - Nodes representing source, destination, and transfer facilities
 - Arcs representing rail and major surface roads
- We use optimization techniques to examine various policy decisions:
 - Multimodal transport
 - Network design
- We also use simulation techniques to identify current and future bottlenecks (focus on optimization in this presentation)
- The model offers a cost and benefit tradeoffs of each option
- Southern California region is used as a base case

Southern California is a Natural Choice

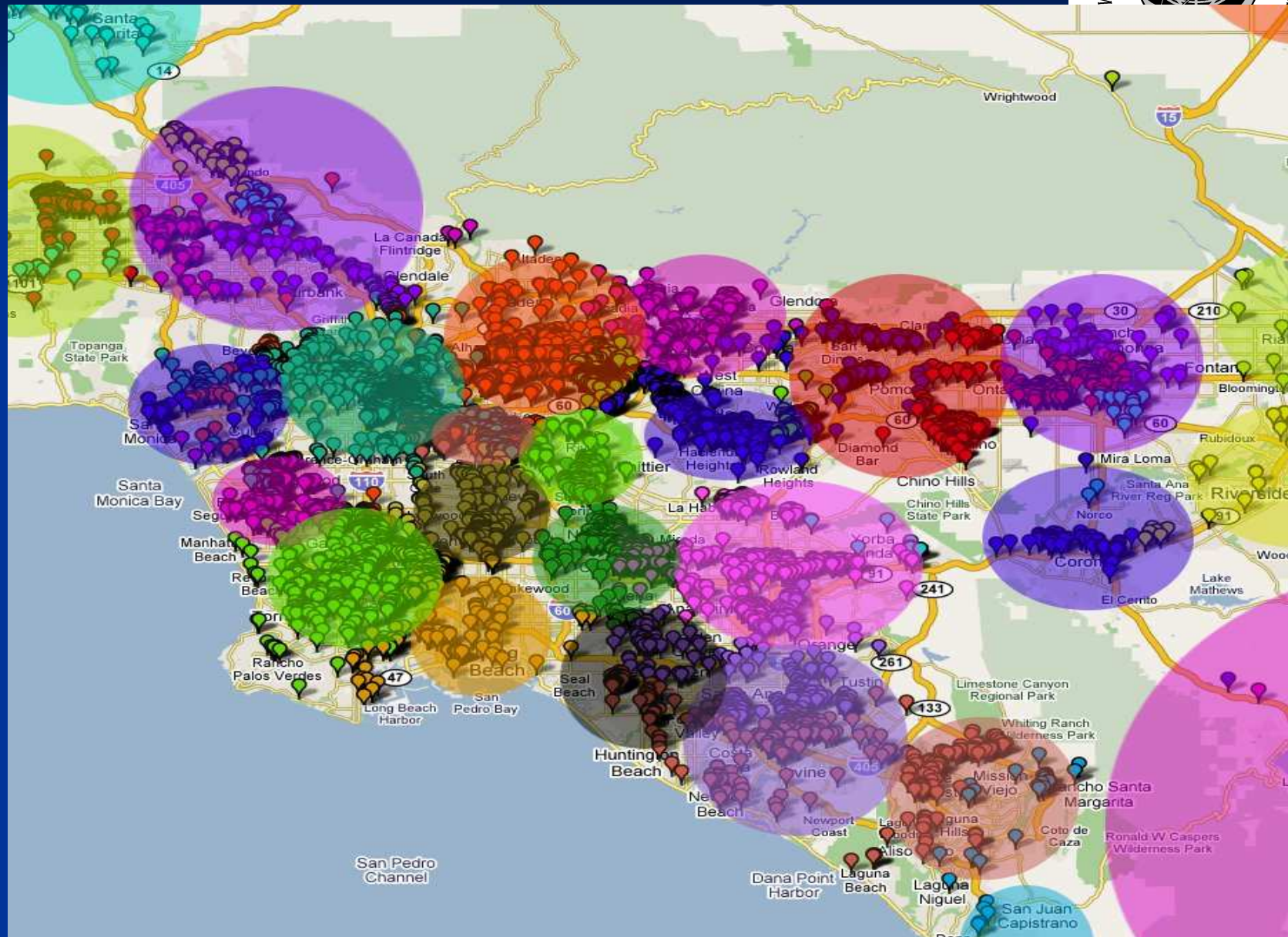


- Four commercial container ports
- 15 marine terminals in POLA & POLB
- Handled about 45% of all U.S. int'l container traffic
 - Largest container port gateway in U.S., 5th world-wide
 - Largest single rail intermodal operation in U.S.
 - 15% of the national market & 60% of the entire west coast in warehousing/transloading space
- Two major railroads: BNSF and UP
- Has 6 of the most congested bottlenecks for trucks in U.S.
- Major defense facilities nearby

Warehousing/Distribution Facilities in Southern California: a dense network



Warehousing/Distribution Facilities in Southern Cal: aggregate to reduce complexity



This Model Offers Several Options and Capabilities



- Determine, at a **strategic level**, the most **effective** ways in which a transportation network can be used for container movements for any user-defined performance metric.
- Identify **best possible ways** to respond to unanticipated events or situations (e.g., military deployment, major disaster).
- Can be applied to a small area with high level of details, or larger geographical area with more aggregations.

This Model Offers Several Options and Capabilities



- Analyze Impact of changes to the transportation network (e.g., expand rail service, build additional rail track, add inland node, etc.)
- Provide concrete and verifiable measure of costs and benefits of alternative cargo handling, transportation and location/allocation options.
 - Provide evidence in negotiations with the private sector or in public policy discussions.
- Pinpoint deficiency of current practice, inadequacy of current infrastructure, and identify possible changes.

Methodology



The task consists of **4 steps**:

- Construct model of the supply network, define nodes & arcs with parameters, and performance metrics.
- Find and test solution using hypothetical data.
- Apply solution technique to the Southern California supply network defined using historical data.
- Conduct experiments and sensitivity analysis.

The Transportation Network Optimization Model



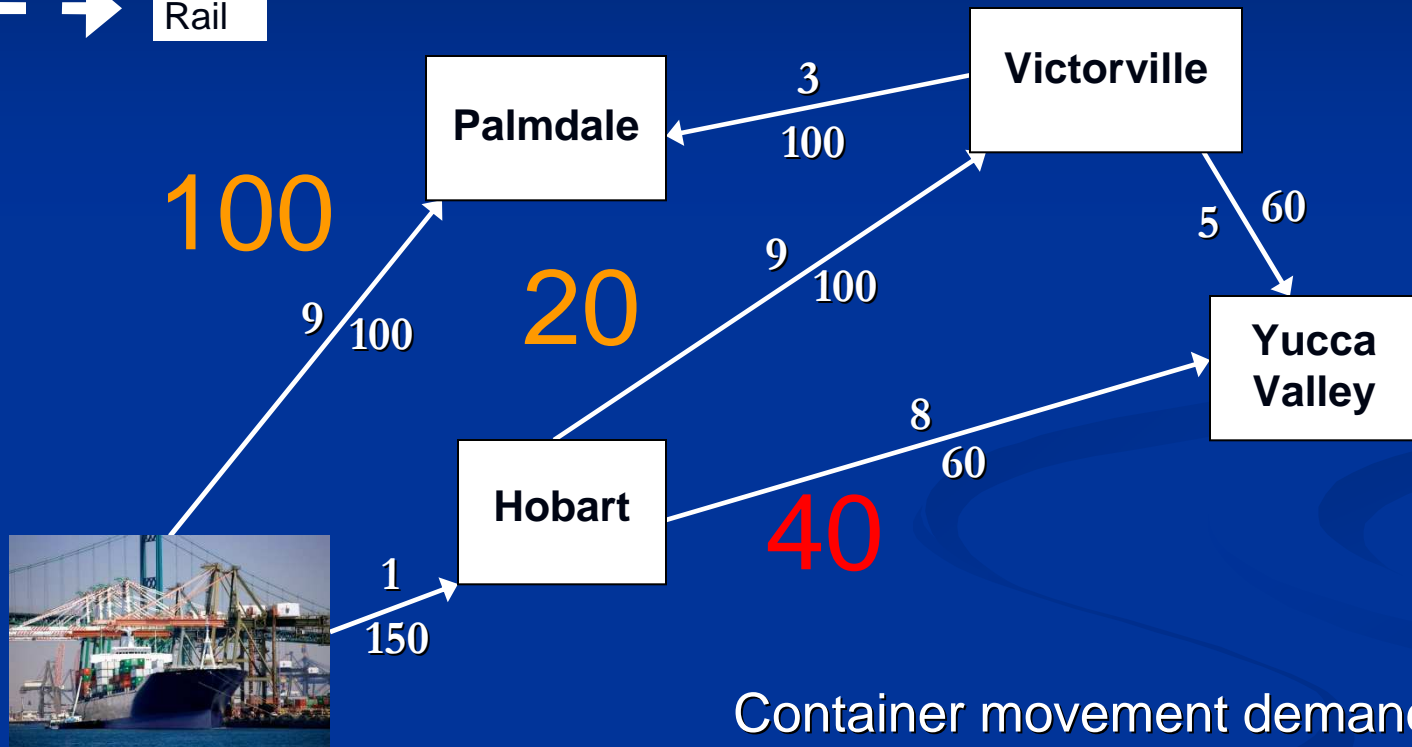
- The goal is to optimize an objective (e.g., minimize cost or maximize throughput). Objective may be single or weighted average of multiple.
- While meeting
 - Supply and demand requirements
 - Road and rail throughput
 - Transportation capacity
 - Environmental and other regulatory constraints
 - Spatial and temporal limitation
 - Other constraints

An Example



→ Truck

- → Rail



Total Cost = 1520

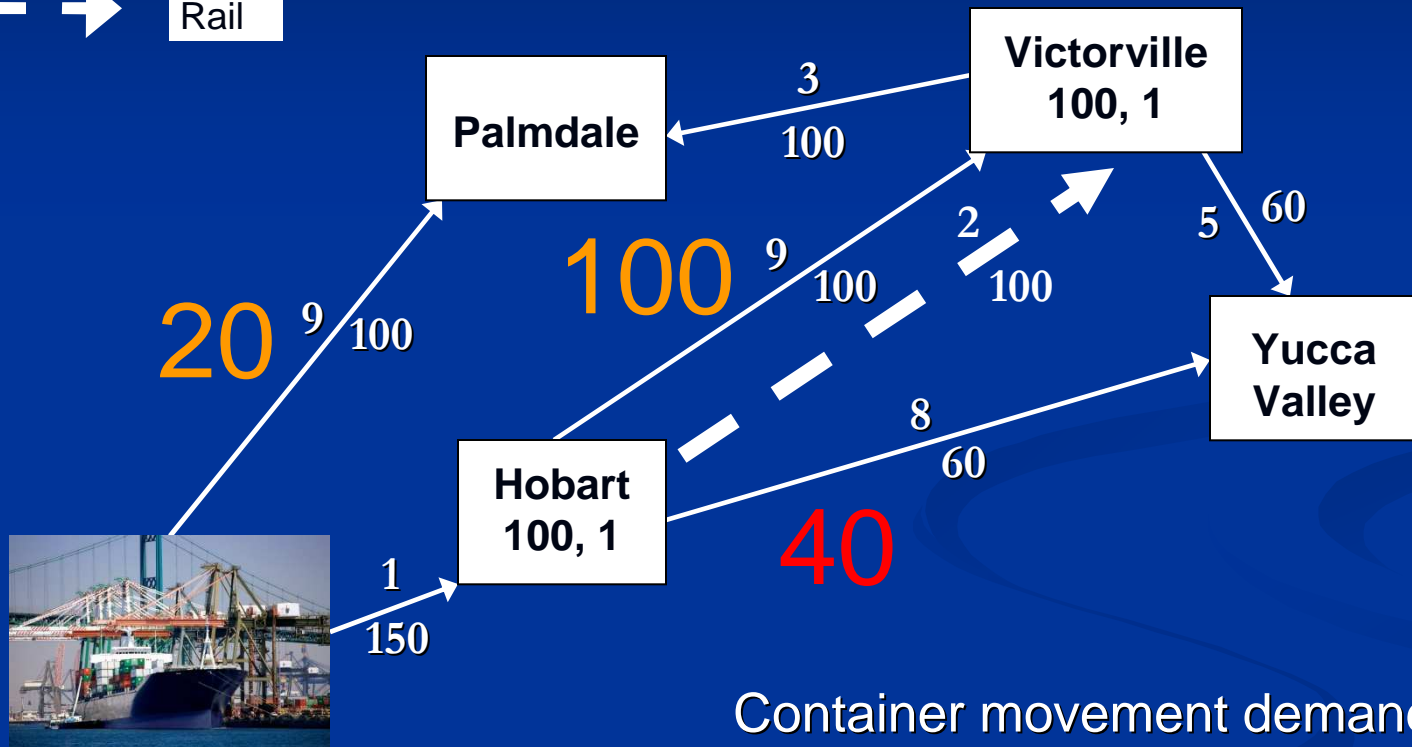
Container movement demands:
 Port to Palmdale = 120
 Port to Yucca Valley = 40

An Example (cont.)



→ Truck

- - -> Rail



Total Cost = 1340

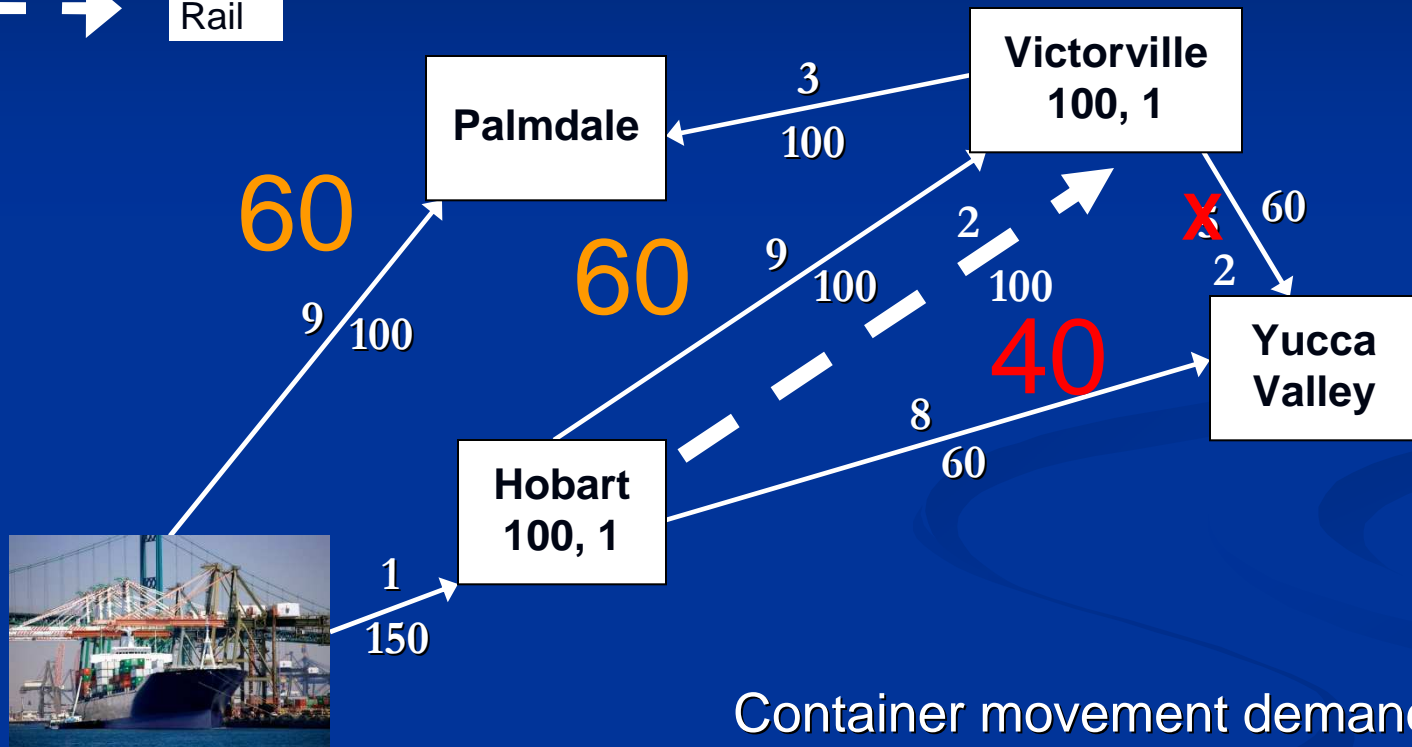
Container movement demands:
 Port to Palmdale = 120
 Port to Yucca Valley = 40

An Example (cont.)



→ Truck

- - - - - Rail



Total Cost = 1300

Container movement demands:
 Port to Palmdale = 120
 Port to Yucca Valley = 40

Current Status of the Project



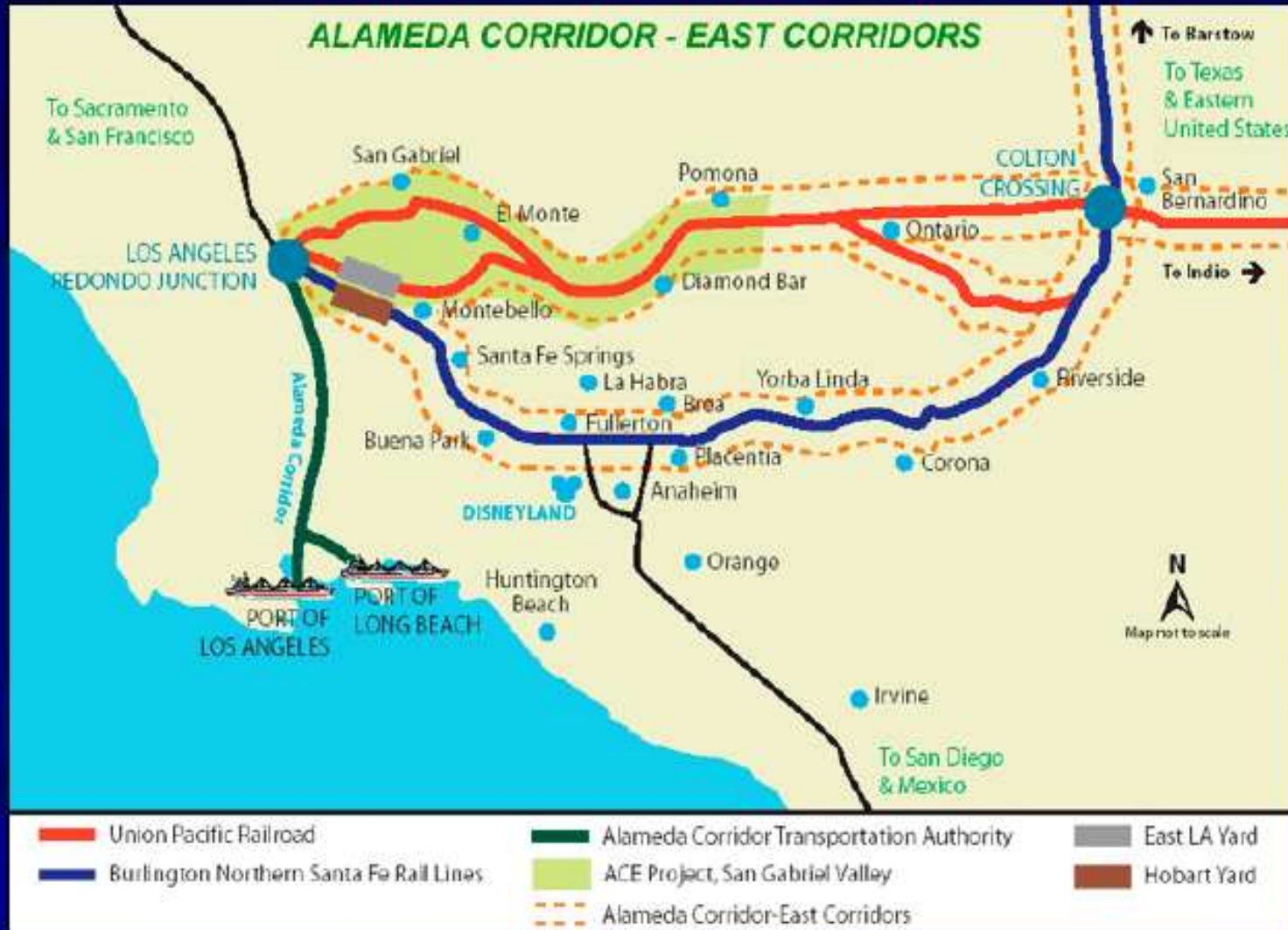
- Basic model constructed.
- Solution to the network model developed using MATLAB. Test conducted using randomly generated data.
- Organizing Southern California region data for supply network scenarios for model application.
- Working on Supply Network simulation.
- Consulted on Colton Crossing rail overpass project.
- Collaborative testing may eventually be conducted via a web portal.

Colton Crossing An Application



- Study the potential public benefits of the proposed construction of an overpass at the Colton Crossing in the east-west direction.
- Use model to determine what benefits the construction of the overpass would provide in the context of the rail network.

Alameda Corridor East



Colton Crossing An Aerial View



Colton Crossing Close Up



Colton Crossing Facts



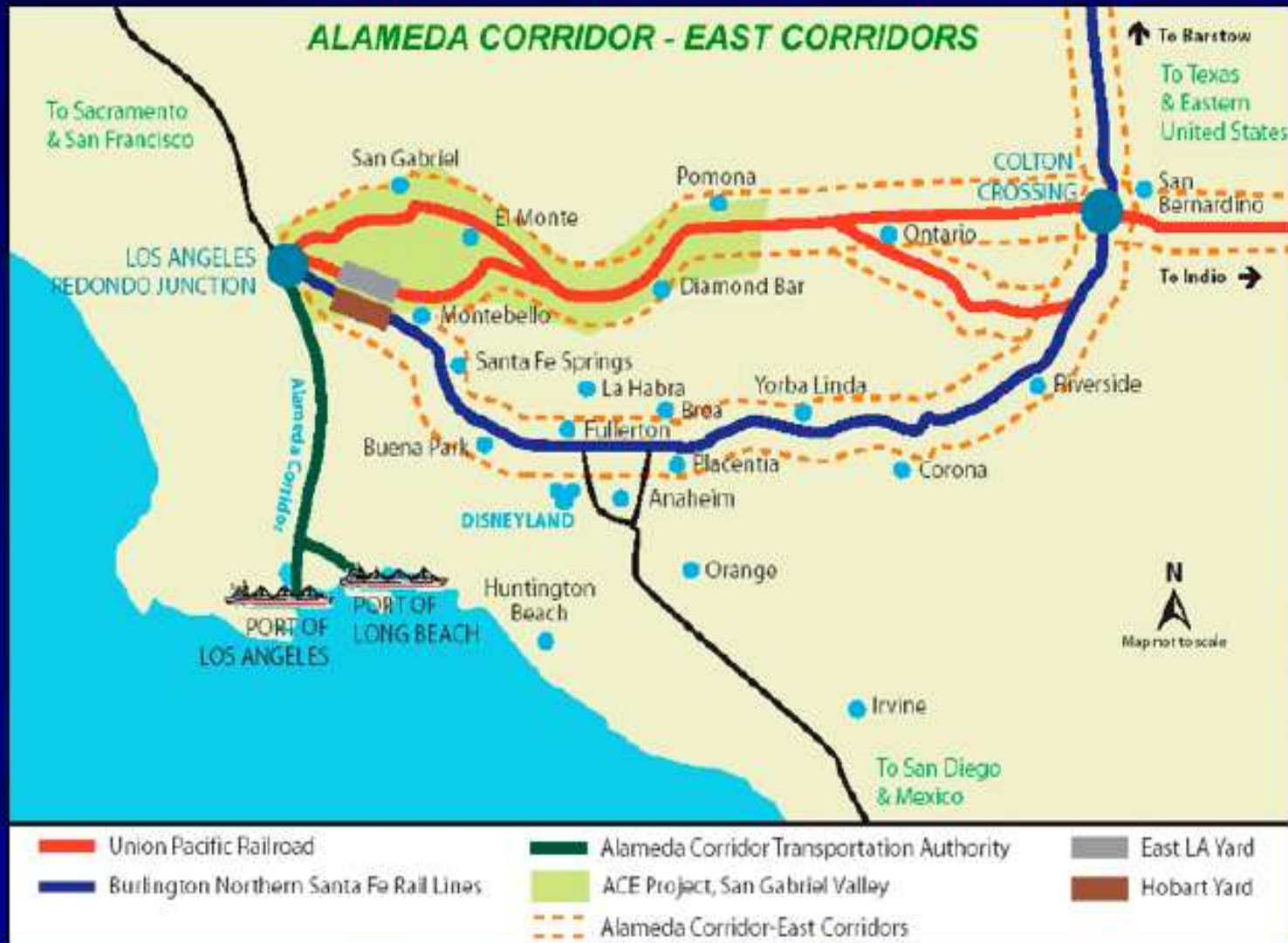
- East/west line is owned by UP.
- North/south line owned by BNSF.
- Crossing itself is controlled by BNSF.
- Overpass would be built along the UP line (east/west).

Colton Crossing Data (2005)



- On average 64.3 BNSF trains travel per day through the crossing along the I-15 corridor.
- 22 UP trains travel through Colton Crossing along I-15 on BNSF San Bernardino subdivision.
- 60 UP trains (mostly eastward) initially follow I-10 corridor before turning southwest to Riverside and then turning north on BNSF line and then turning east right before the crossing back onto the UP line.
- 48 UP trains traveling through crossing along I-10 corridor.

Alameda Corridor East



Model Findings



- Building the overpass removes only one bottleneck.
- East of the Colton Crossing large segments are still single track. North of the crossing is the Cajon pass.
- This severely restricts the flow through the crossing even after construction of the overpass.

Main Benefits



- UP will gain greater scheduling independence from BNSF.
- This will create the potential for greater scheduling efficiency, resulting in up to about 20 additional trains per day.

Additional Findings



- An additional third track between the Colton Crossing and the Cajon pass will allow to potentially double the number of southbound trains per day.

Advantages of a Regional Supply Network Model



- Provides a tool to identify/study global impacts, even on changes that may appear to be local.
- Provides concrete cost/benefit analysis findings that can help in negotiations between private and public sectors on supply network improvement projects.
- Illustrates keys to successful modeling: appropriate level of aggregation and proper choice of cost functions.