



# EMPTY CONTAINER REUSE

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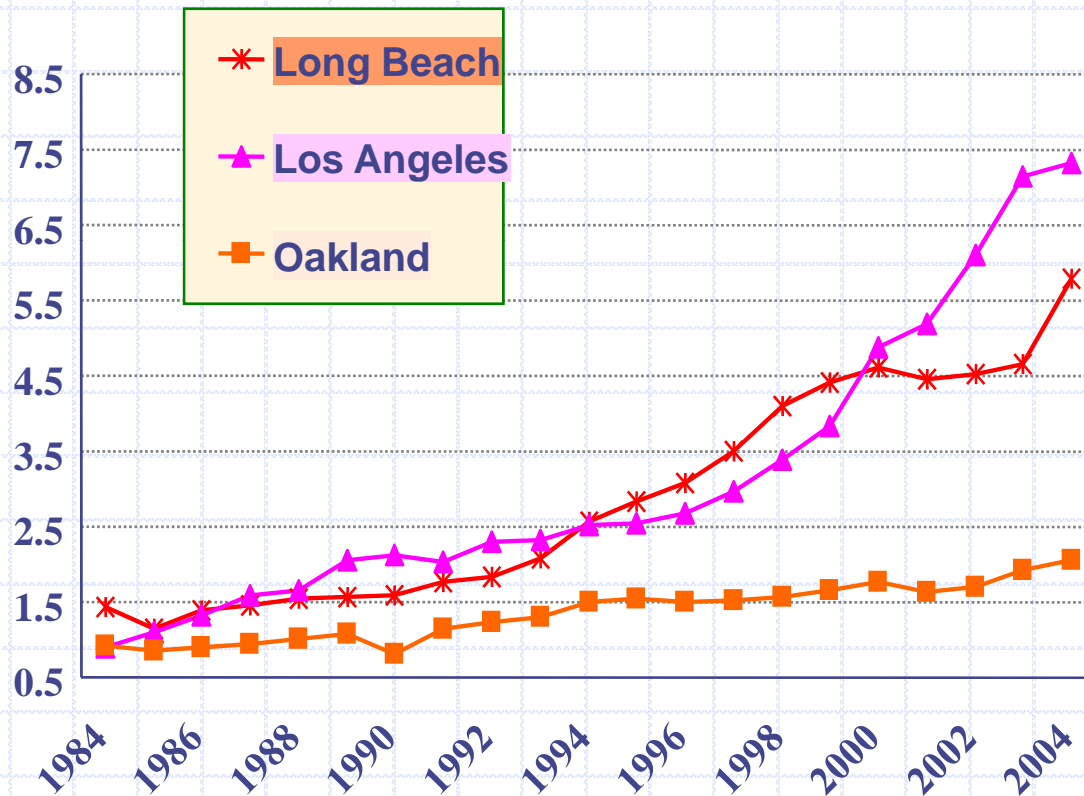
**Hossein Jula,** Penn State University

PATH-UTC Conference, October 2007

# The problem



# Container Traffic at California Ports (millions of TEUs)



# Projections

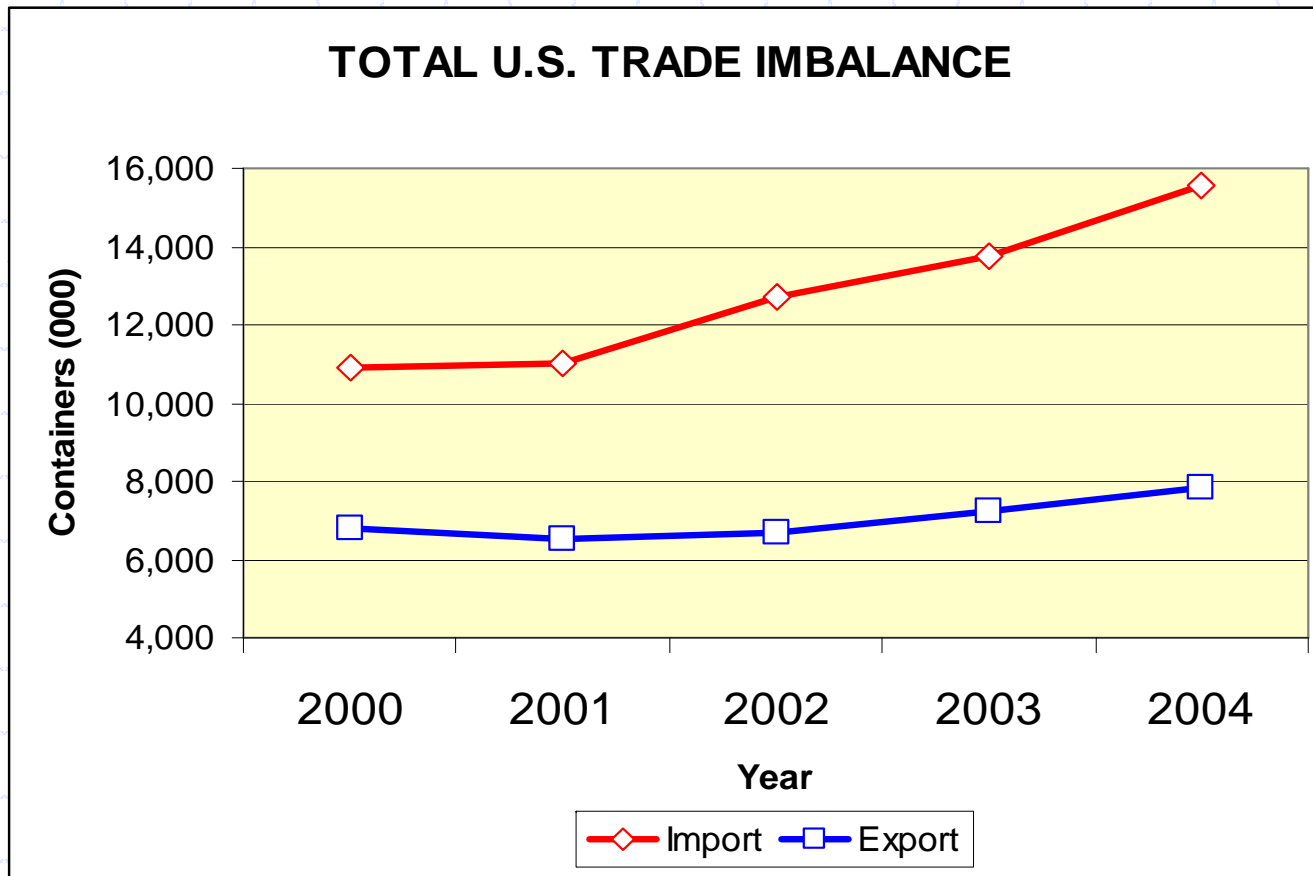
## ◆ Ports of Los Angeles/Long Beach

- 19.7 million TEUs in 2010
- 36.0 million TEUs in 2020

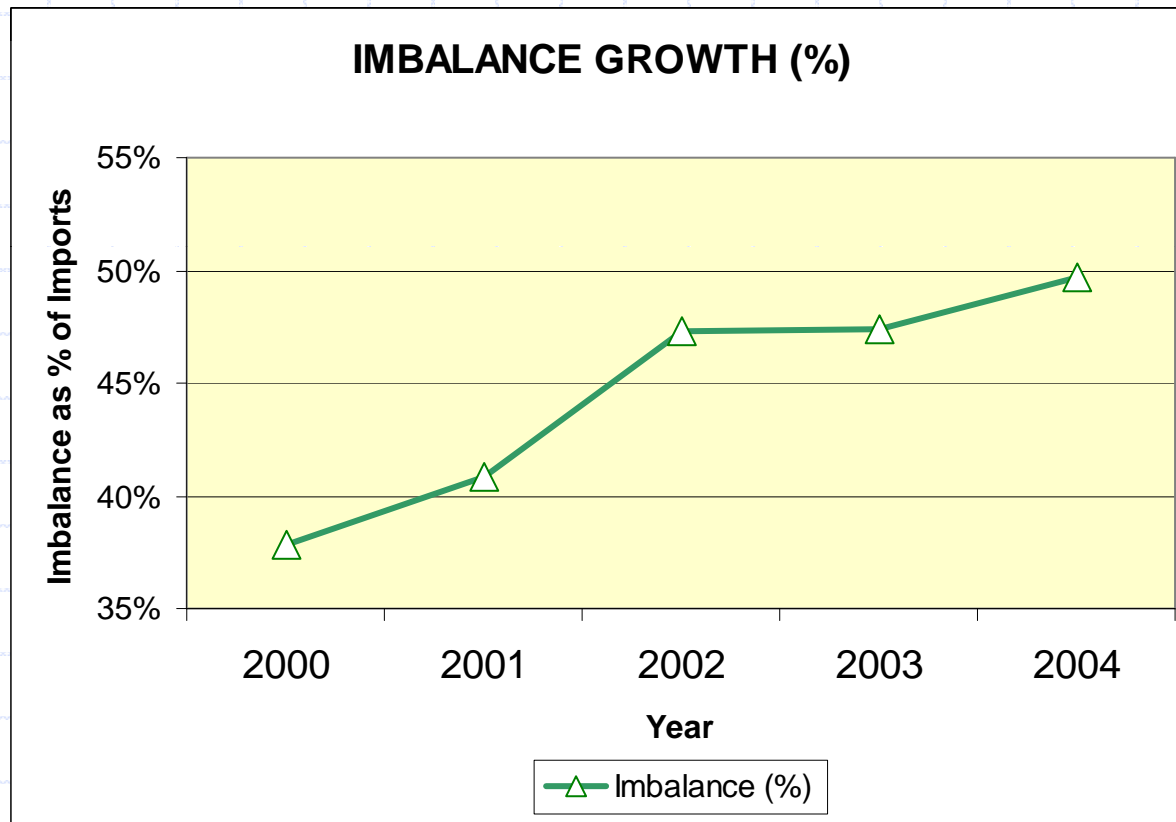
# Projections



# US Trade Imbalance 2000-04



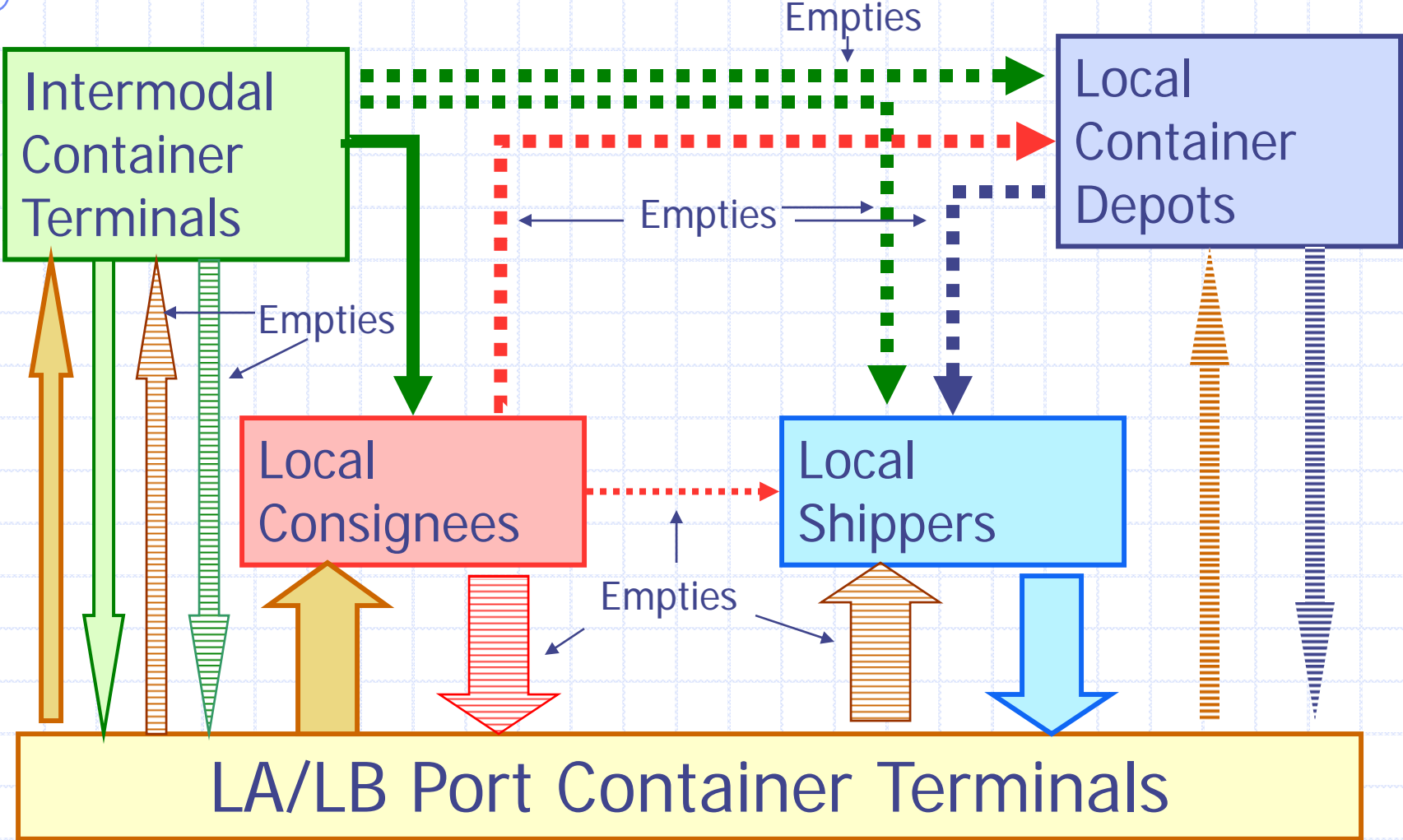
# Imbalance Growth 2000-04



# Movement of Empty Containers

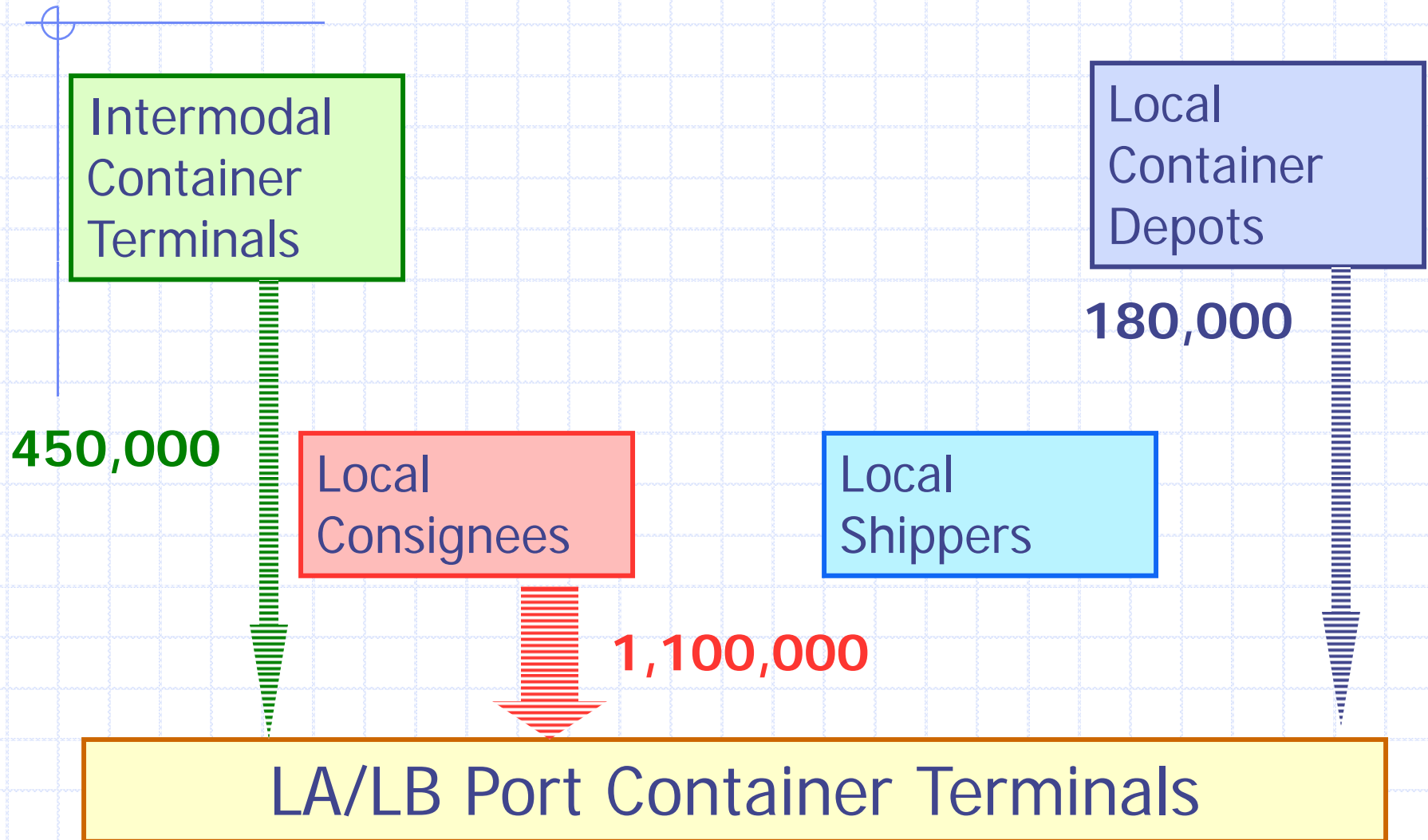
Full Arrows: Flows of Loaded Containers

Dashed Arrows: Flows of Empty Containers



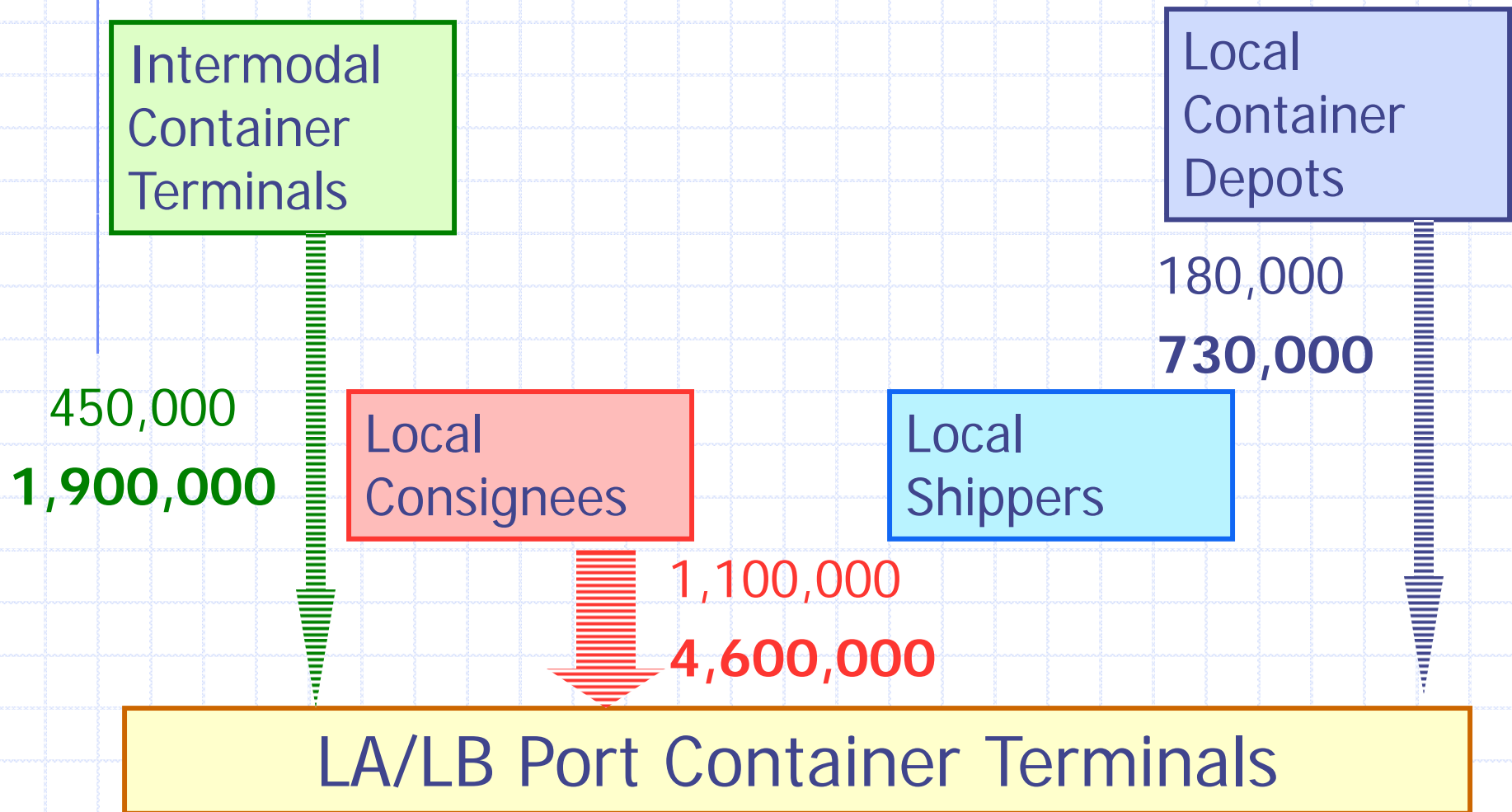
# Empty Containers

Estimated Inbound 2000 Traffic



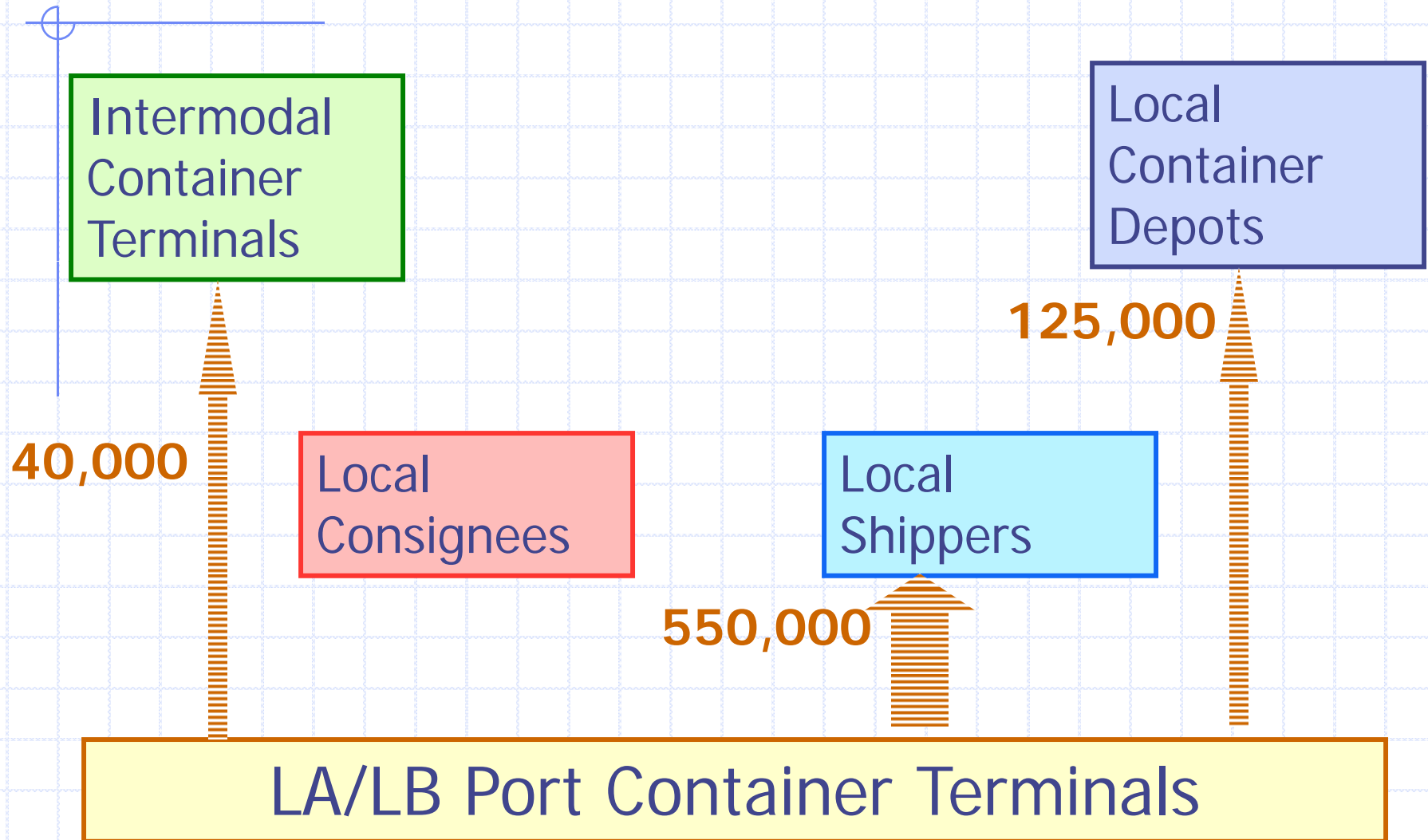
# Empty Containers

## Projected Inbound 2020 Traffic



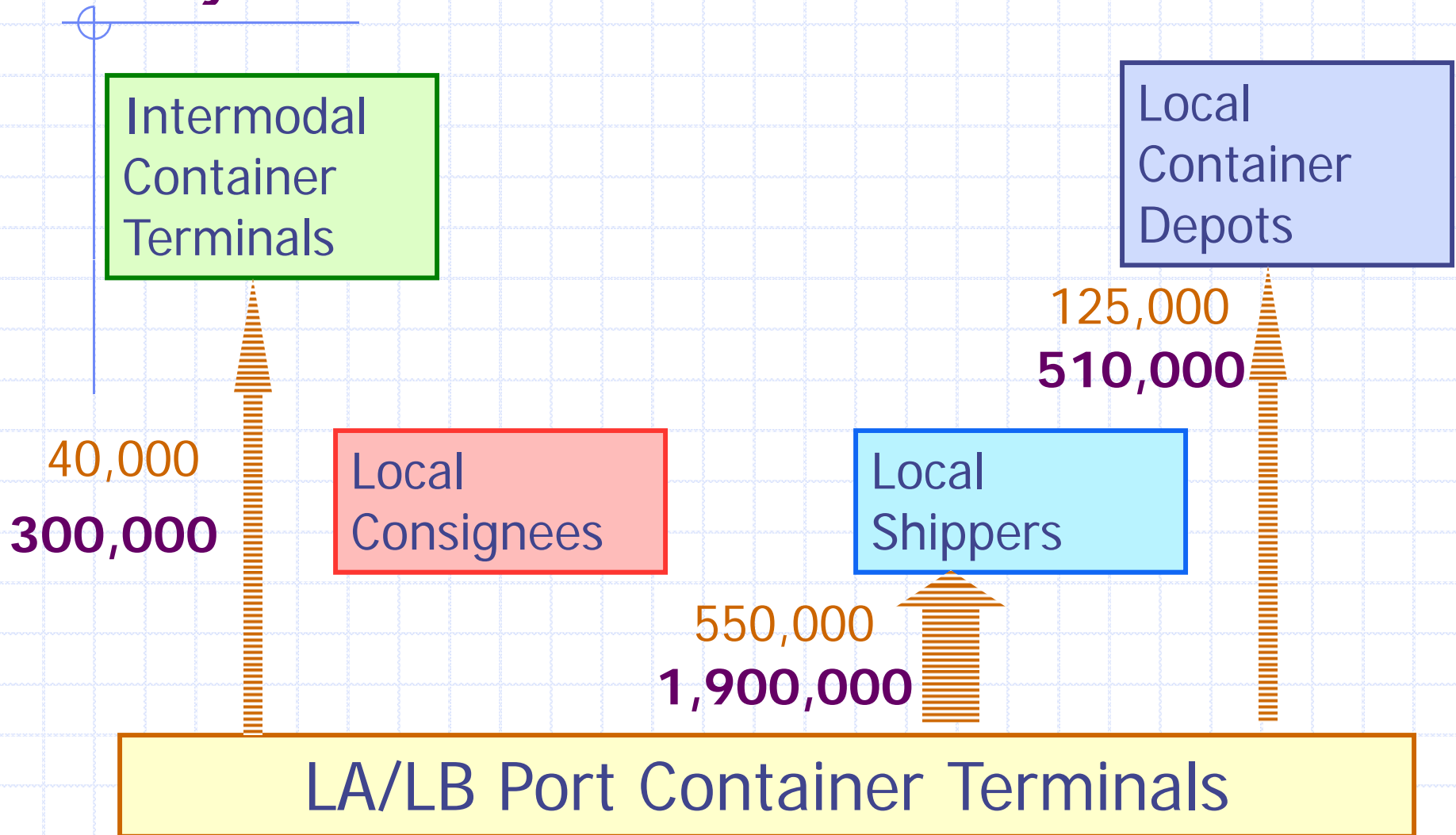
# Empty Containers

## Estimated Outbound 2000 Traffic



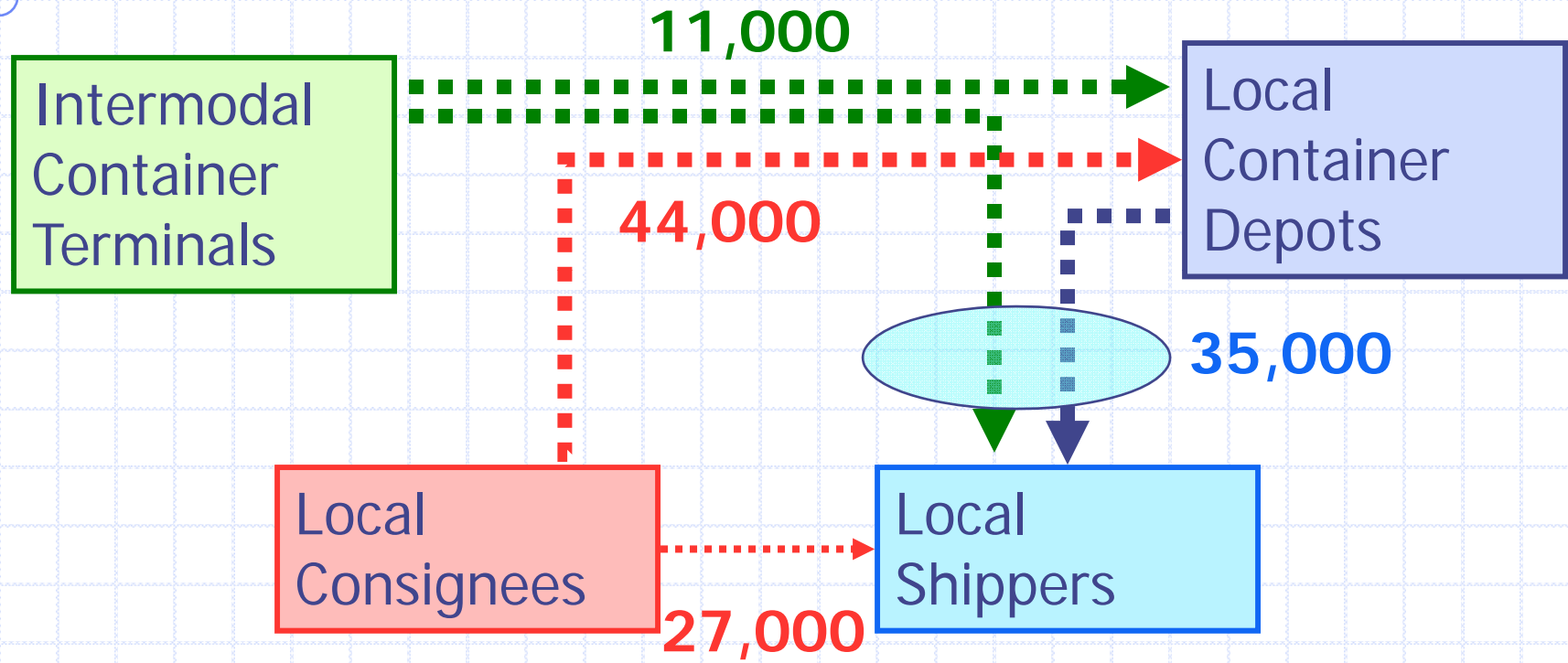
# Empty Containers

## Projected Outbound 2020 Traffic



# Empty Containers

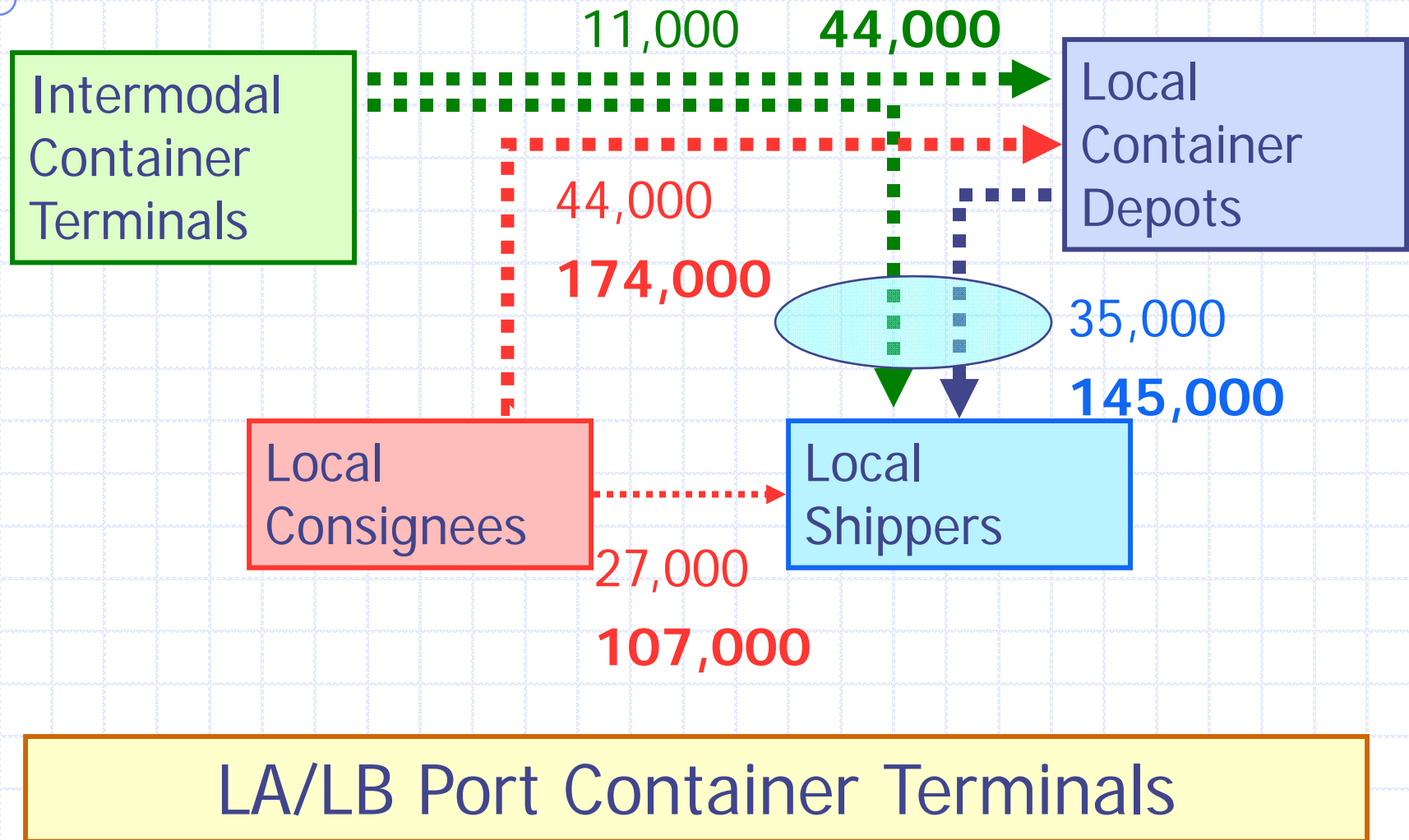
## Estimated Cross-Town 2000 Traffic



LA/LB Port Container Terminals

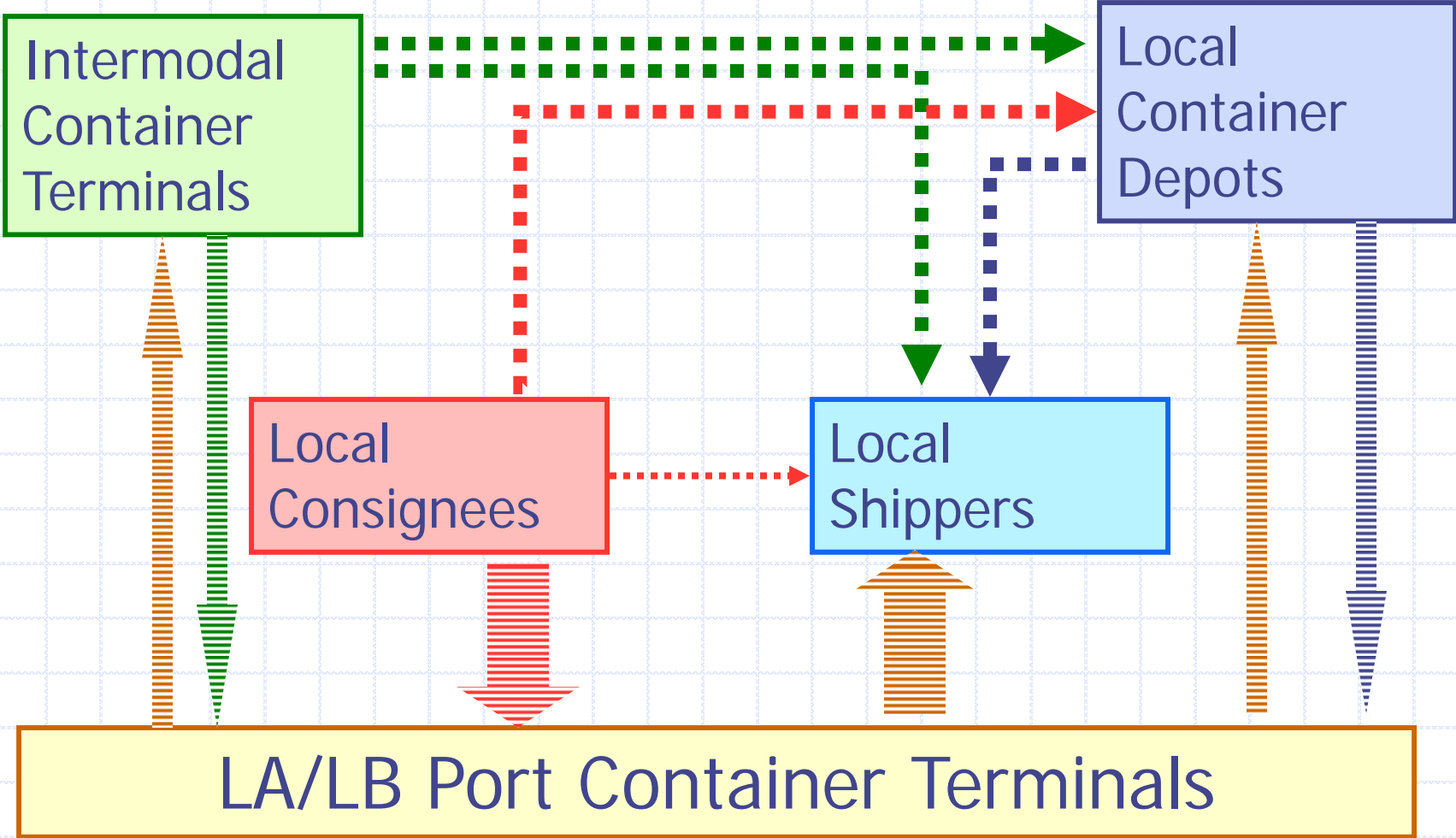
# Empty Containers

## Projected Cross-Town 2020 Traffic

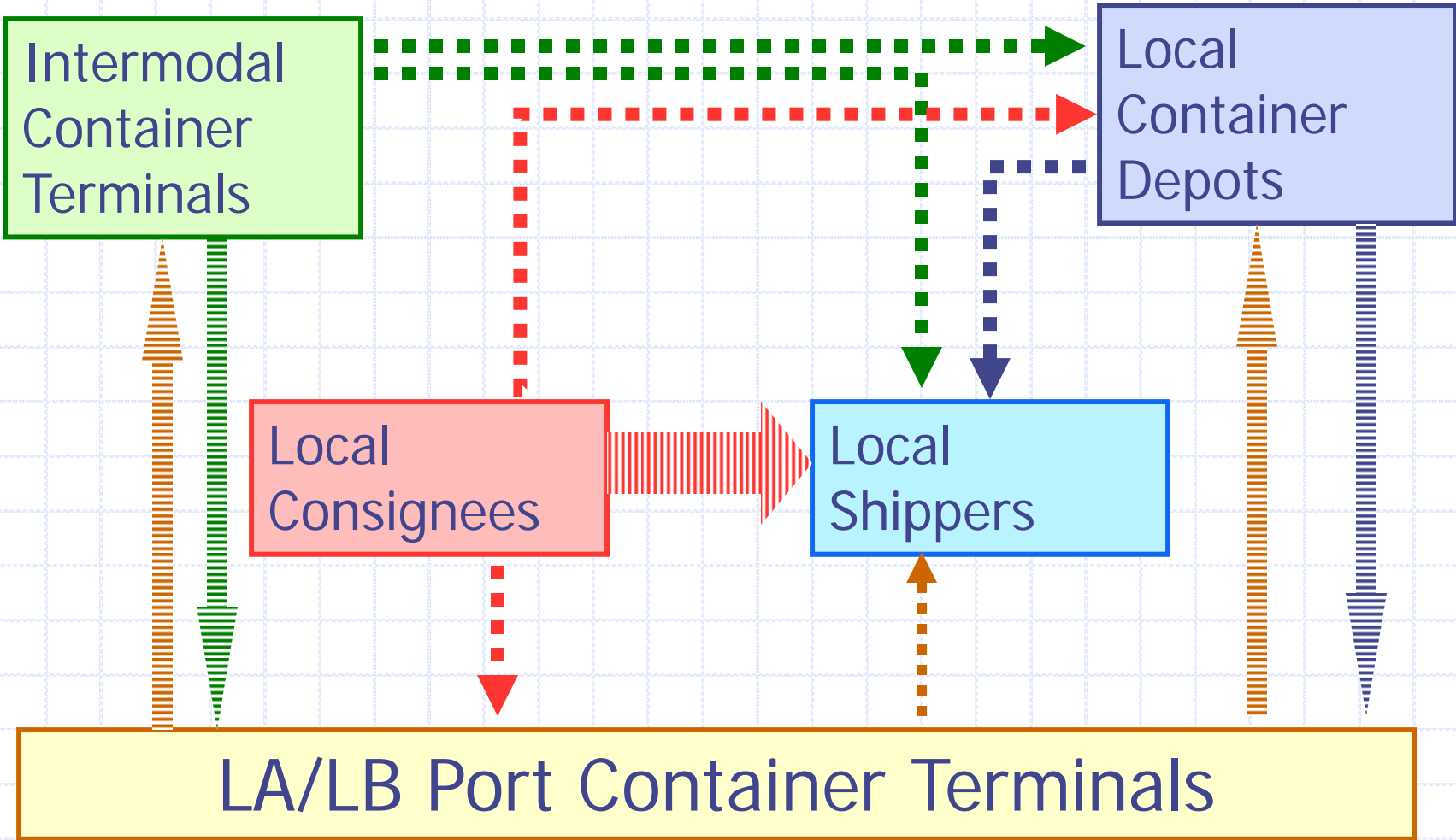


# Change Current Practices

## Empty Container Reuse



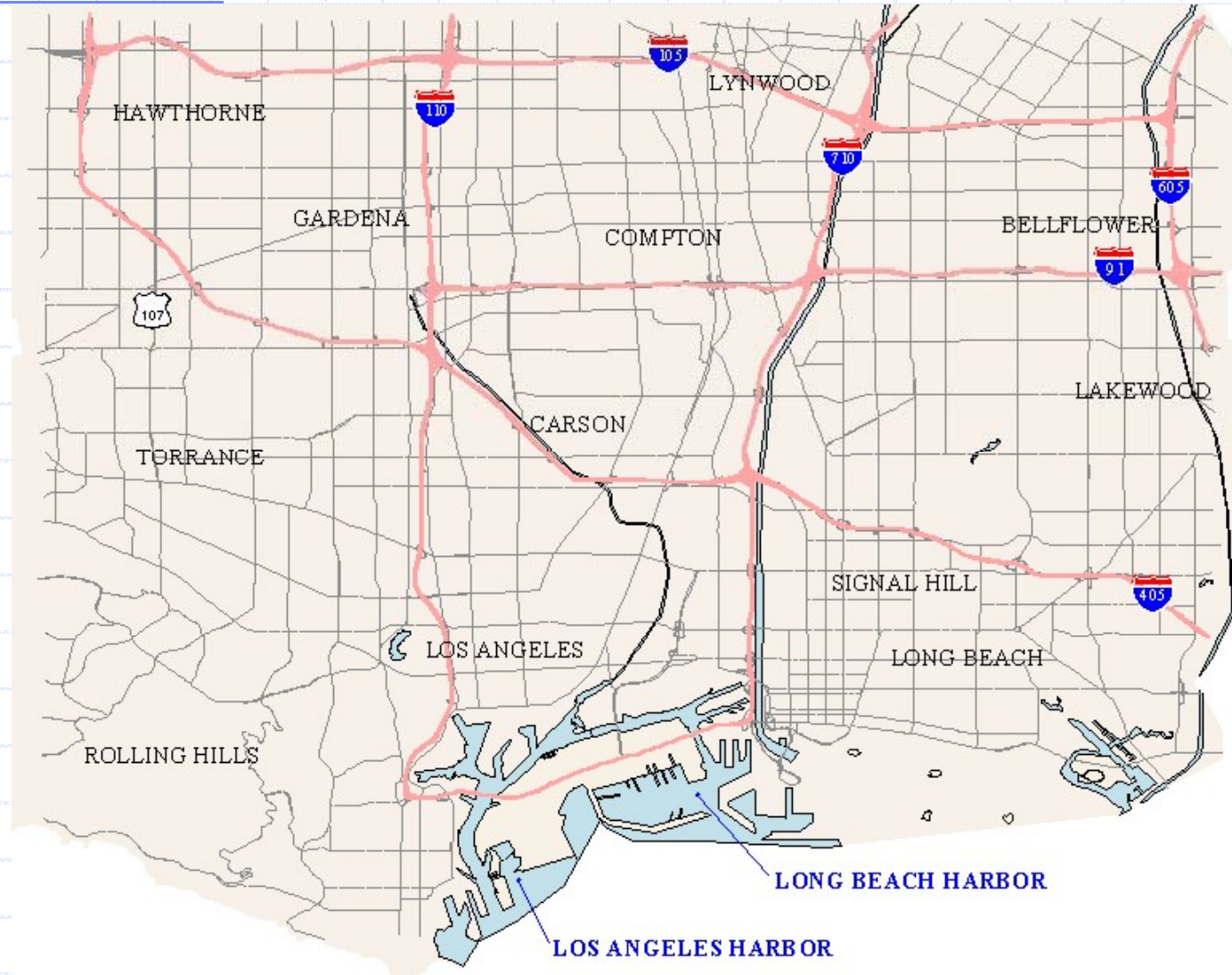
# Street Turn



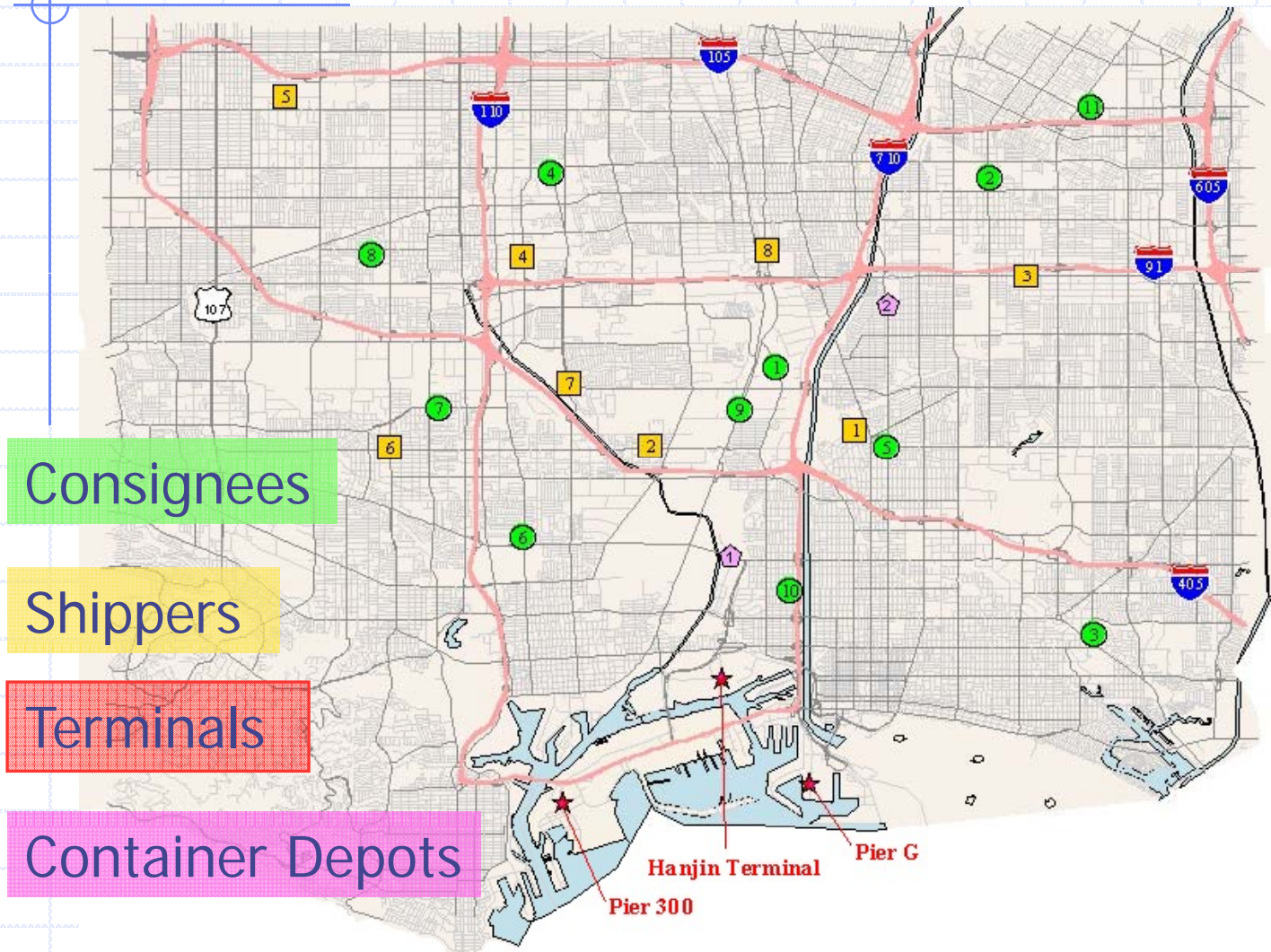
# Modeling, Analysis and Optimization

- ◆ *Base Scenario: Current Practices*
- ◆ *Static Street-Turn, Depot-Direct Scenario: Optimization*
- ◆ *Dynamic Base Scenario*
- ◆ *Dynamic Street-Turn, Depot-Direct Scenario: Optimization*

# Case Study: The LA/LB Port Area



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Consignees

Shippers

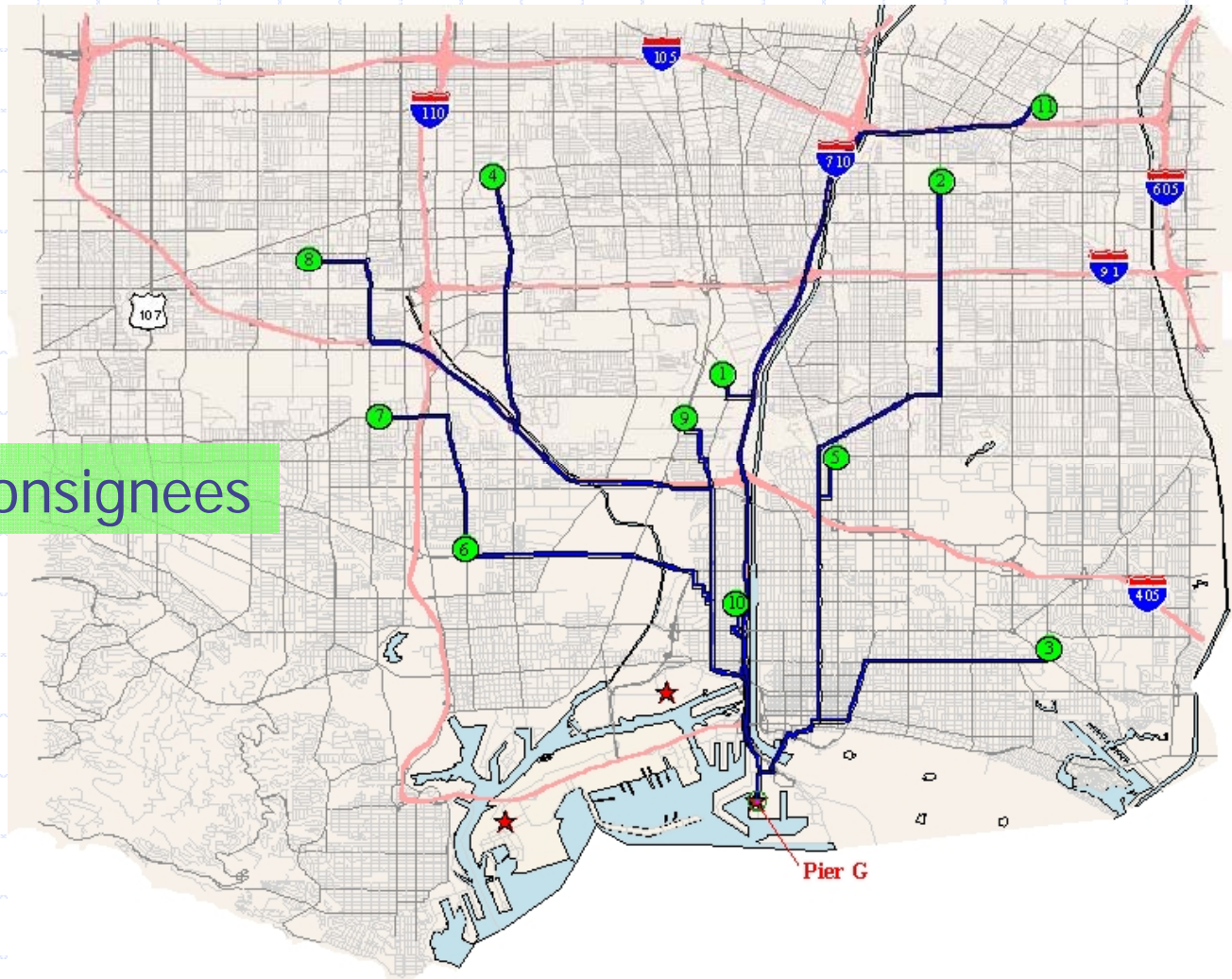
Terminals

Container Depots

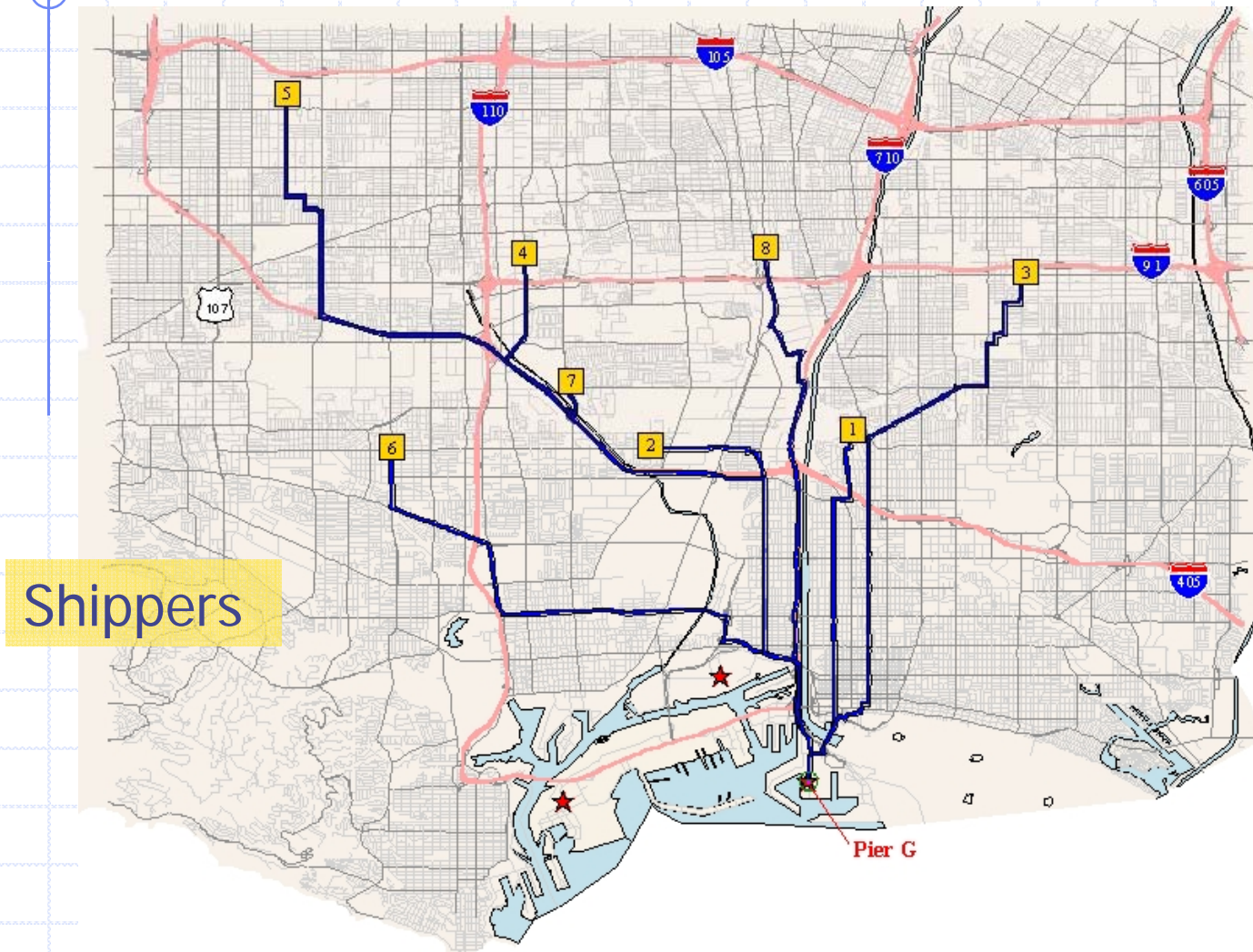
Pier 300  
Hanjin Terminal  
Pier G

# Base Scenario: Current Practices

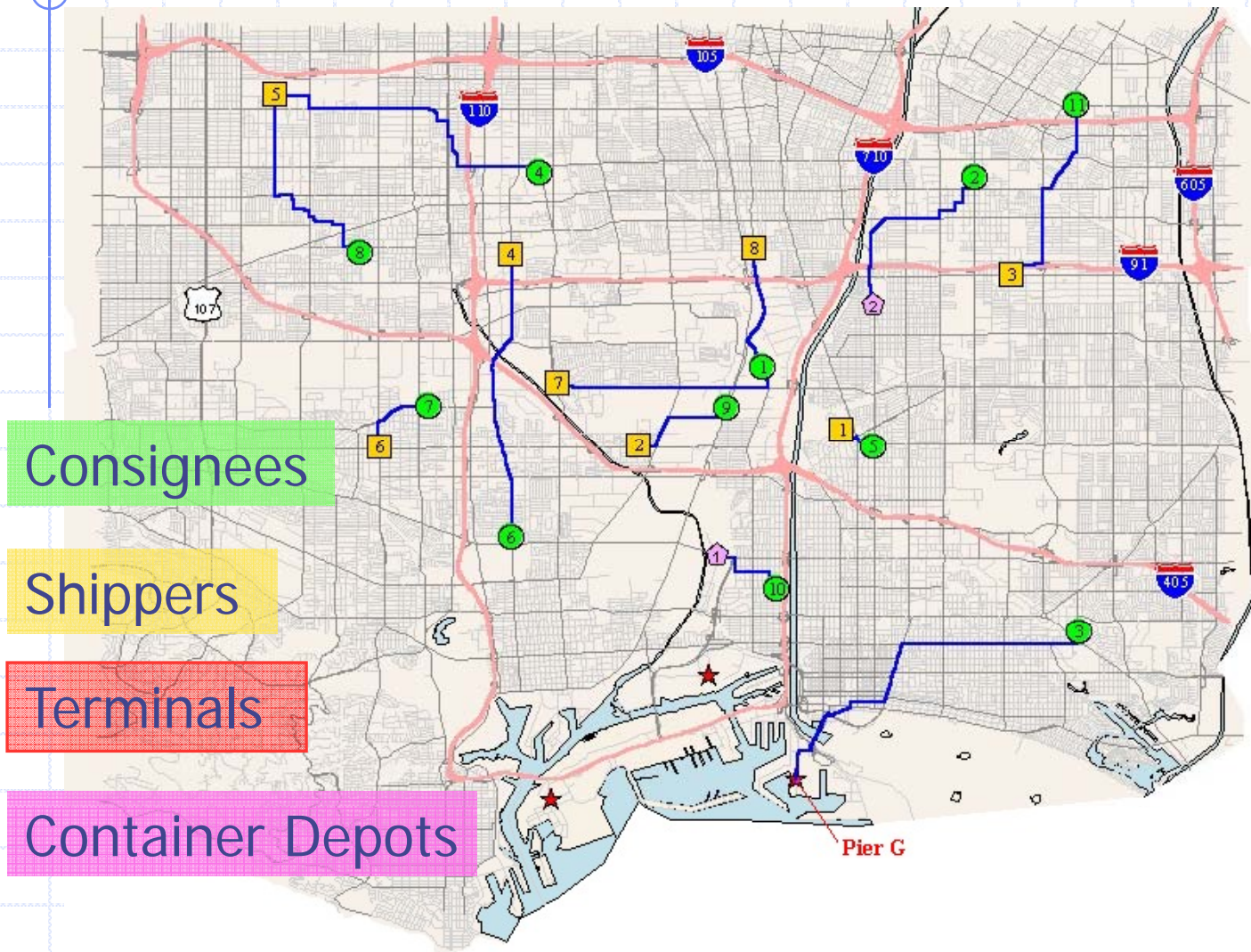
Consignees



# Base Scenario: Current Practices



# Street Turn & Depot Direct Static Optimization



# Dynamic Empty Container Reuse

- ◆ Supply and Demand change in time
- ◆ Various planning horizons
- ◆ Operational scenarios
  - 2000-A: Typical day in 2000
  - 2000-B: Busy day in 2000
  - 2010: Projected average day in 2010
  - 2020: Projected average day in 2020

# Dynamic Empty Container Reuse

Scenario			Base		Reuse	
	Supply Empties at Consign	Demand Empties at Shippers	Cost (VMT)	Total Empty Trips	Cost (VMT)	Empty Trips to Port & Depots
2000-A	219	107	5,483	326	2,466	142
2000-B	547	267	13,832	814	6,182	349
2010	985	534	25,568	1519	10,572	587
2020	2,188	908	52,857	3096	25,608	1506

# Sensitivity to Length of Planning Horizon Scenario 2000-B

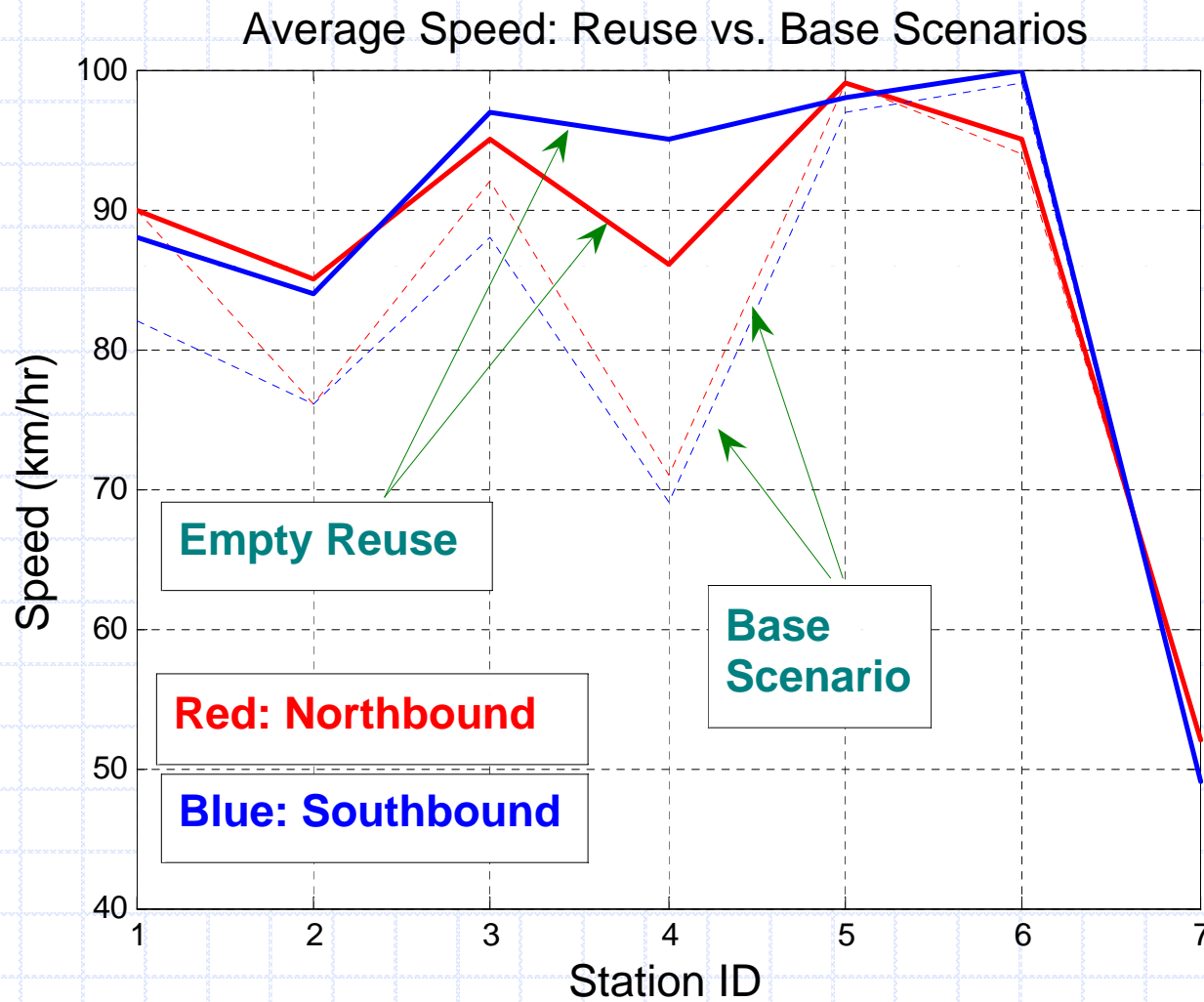
Planning Horizon			Base		Reuse	
	Hours	Supply Empties at Consign	Demand Empties at Shippers	Cost (VMT)	Total Empty Trips	Cost (VMT)
T=4	547	267	13,707	814	6,688	415
T=8	547	267	13,975	814	6,194	342
T=16	547	267	13,683	814	5,616	312
T=24	547	267	13,764	814	5,683	301

# Sensitivity to Parameter $\alpha$

## Scenario 2000-B


			Base		Reuse	
Value of $\alpha$	Supply Empties at Consign	Demand Empties at Shippers	Cost (VMT)	Total Empty Trips	Cost (VMT)	Empty Trips to Port & Depots
0.01	547	267	13,763	814	5,818	342
1	547	267	13,698	814	6,194	342
10	547	267	13,910	814	8,268	542
100	547	267	13,854	814	11,264	814

# Effect on Traffic



# Conclusions

- ◆ Empty container reuse can:
  - Decrease number of trips to ports
  - Reduce traffic congestion, pollution & noise
  - Benefit dray companies and truckers
  - Benefit terminals and ocean carriers
  - Etc.



THANK YOU !