Congestion Reduction through Efficient Empty Container Movement

Santiago Carvajal
Professor Maged Dessouky

Department of Industrial and System Engineering,
University of Southern California

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Presentation Outline

Background

Project Objective and Timetable

Literature Review

Empty Container Model

Future Work and Conclusion
Problem Statement

- 15.3 million TEUs of traffic cargo passed through the ports in 2015
- 4.3 million of these were empty containers, this is about 30% of all traffic.
- This creates a lot of unnecessary truck traffic around the Ports
Current Container Movement

- Inefficient movement of empty containers due to lack of “Street Exchanges”
- Biggest reason is coordination problem between companies for “Street Exchanges”
- Empty Container Problem wants to increase “Street Exchanges” to make container movement more efficient

Current Container Flow
Double Container Trucks

• Greener and more efficient truck movement
• Increases the number of possible truck routes
• Potentially reduces the number of trips to the port
Project Objective

• To develop a truck schedule including double container trucks that moves containers efficiently, to reduce congestion and pollution around the Ports of Los Angeles and Long Beach.
There has been some work done on the Empty Container Problem, but not using double container trucks:

- Strategies for an operational model: Jula (2006), Bandeira et al. (2009), Li et al. (2014).
- Stochastic demand: Erera et al. (2009), Braekers et al. (2013).
Model Description

- Model one day to be able to determine container movement for that day.
- Each location has a container demand at each time unit that is then used as supply for other locations at a later time unit.
- Containers are moved by either single or double container trucks.
Mathematical Model

• The objective of our model is to minimize the transportation cost needed to meet all the demand.
• Solving for deterministic demand for one day
• 4 types of locations: Importers, Exporters, Depots and Port
  • Each location demands a certain type of container (empty/full) and can only provide a certain type
Mathematical Model (continued)

• After solving the dynamic assignment problem use result as demand to get a Vehicle Routing Problem (VRP) schedule.
• We solve VRP by a modified version of Ropke and Pisinger’s Adaptive Large Neighborhood Search
• Get better solution by iteratively solving one problem and then modifying the other.
### Results for Study of Ports of Los Angeles and Long Beach

<table>
<thead>
<tr>
<th></th>
<th># Double Trucks</th>
<th># Single Trucks</th>
<th>Double Truck Miles</th>
<th>Single Truck Miles</th>
<th>Empty Truck Miles</th>
<th>Total Truck Miles</th>
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</thead>
<tbody>
<tr>
<td>Double Container Reuse</td>
<td>100</td>
<td>0</td>
<td>1555.7</td>
<td>0</td>
<td>341</td>
<td>1896.7</td>
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<tr>
<td>Single Container Reuse</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>3113.7</td>
<td>615</td>
<td>3728.7</td>
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<tr>
<td>Single Direct (Current)</td>
<td>0</td>
<td>200</td>
<td>0</td>
<td>3699.7</td>
<td>546.8</td>
<td>4246.5</td>
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</table>
Expected Benefits

• Get assignment for daily container demand to reduce traffic congestion especially around the Ports
• Better management of empty containers to reduce number of truck trips and reduce cost
Future Work

• Incorporate future stochastic demand.
• Make specific algorithm for VRP with capacity 2.
• Make the truck routes dynamic so they are able to adapt to daily circumstances.
Thank you
Any Questions
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