



Caltrans Division of Research,
Innovation and System Information

Research



Transportation
Safety and Mobility

Congestion Reduction through Efficient Empty Container Movement

To develop an optimization-based vehicle routing framework that integrates routing for laden and empty containers.

WHAT IS THE NEED?

Benefitting from the expansion of U.S. trade, especially the international trade between the U.S. and the tremendous economic expansion of Asia, the maritime transportation industry has been growing steadily during the past decades. This increase in international trade resulted in the growth of containerized traffic between marine ports and the consignees/consigners in hinterland. These trips contribute to traffic congestion and air pollution along transportation corridors and in urban areas. However, due to imbalanced containerized trade between imports and exports, as well as the business agreements of container leasing, empty container movement takes up more than 20% of the total container handling. In general, carriers still prefer to lease containers in shortage areas and off-hire them in surplus areas since expenses will be lower than repositioning containers. Therefore, there is a need to develop an overall solution approach to model and provide strategies to efficiently route the carriers, to schedule the containerized traffic and to reuse empty containers.

WHAT WAS OUR GOAL?

An optimization-based vehicle routing framework that integrates routing for laden and empty containers is proposed, while jointly conducting dynamic multi-trailer truck routing, container reuse methodology, and container leasing strategy. The proposed routing model provides a dynamic routing plan to deliver laden containers and reposition empty containers. The proposed research will shed insights into the dynamic multi-trailer truck containerized vehicle routing environment. The aim of the approach is to develop methodologies to reduce truck movements by reducing empty container movements.

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Project Title:

Congestion Reduction through Efficient Empty Container Movement

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Caltrans provides a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.

WHAT DID WE DO?

- Performed literature review
- Developed empty container management model
- VRP (Vehicle Routing Problem) model formulation
- Performed model validation and experimental analysis
- Final report prepared and submitted to Caltrans

WHAT WAS THE OUTCOME?

The proposed model was tested using container demand data from the Ports of Los Angeles and Long Beach as well as randomly generated data sets. The tests focused on intermodal stations within 20 miles from the port where 40-foot containers and 52-foot containers can be switched. The models tested included the current policy of no container reuse, a container reuse policy using only single container trucks, and a container reuse policy using both single and double container trucks. These experiments showed that there is an improvement over the current policy in using both single and double container reuse policies. The container reuse policy using only single containers has a 12% reduction in truck miles compared to the current policy and there is a 55% reduction when using both single and double container trucks. Although currently double container trucks are not allowed in the Port area or in some of the roads near the Port area, this study shows the impact in the reduction of truck miles if the infrastructure were modified to accommodate double container trucks.

WHAT IS THE BENEFIT?

If empty container reuse is implemented (either with single container or double container trucks),

the number of trucks and truck miles needed to fulfill the daily container demand may be reduced, whereby reducing the traffic congestion and the environmental impact of the growing logistics activities centered around the Port area.