



Caltrans Division of Research,  
Innovation and System Information

# Research

# Results

Transportation  
Safety and  
Mobility

## Integration of Passenger and Freight Rail Scheduling

Develop a solution approach that will improve the efficiency of freight trains by reducing their traveling times while maintaining the punctuality of passenger trains. This was accomplished by developing an integrated routing and scheduling model.

SEPTEMBER 2016

**Project Title:**

Integration of Passenger and Freight Rail Scheduling

**Task Number:** 2935

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**Task Manager:**

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### WHAT WAS THE NEED?

In the United States, freight railways are one of the major ways to transport goods from ports to inland destinations. According to an Association of American Railroad's study, rail companies move more than 40% of the nation's total freight. Given the fact that the freight railway industry is already running without much excess capacity, better planning and scheduling tools are needed to effectively manage the scarce resources, to cope with the rapidly increasing demand for railway transportation.

### WHAT WAS OUR GOAL?

The goal of this research was to test an integrated methodology in a rail network to see if the average travel times for freight trains decreased, and if tardiness times of passenger trains was reduced.

### WHAT DID WE DO?

- A literature review of published material that focused on different aspects of the rail scheduling problem.
- Following the reviews, the network structure and mathematical model to integrate passenger and freight rail scheduling when they share the same trackage to improve the efficiency of freight trains by reducing their travel times while maintaining the punctuality of passenger trains in the same railway network was defined.
- A proposed solution framework was presented.



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- The experimental results of the solution framework are presented.
- Explore the implementation and applicability of the researchers conclusions.
- Summarize work and discuss applicability and areas for new research.

## WHAT WAS THE OUTCOME?

- The results of this research showed the developed decomposition-based solution framework solves the rail scheduling problems more efficiently than directly deploying a commercial optimization solver such as CPLEX, while maintaining a high quality solution.
- The decomposition heuristic procedure provides solutions that are near optimal on a test problem for a small rail network.
- The results were only compared to the optimal solution for small size problems, since it is computationally hard to find optimal solutions for large rail networks. Thus, for a large rail network, the report shows the comparison of the decomposition procedure with other heuristic approaches, and results show that developed heuristic outperforms other heuristic rules.

## WHAT IS THE BENEFIT?

The results show the developed heuristic approach reduces travel times for freight trains and reduce tardiness of passenger trains better than other research algorithms. Adopting these strategies will help optimize our rail system.

## IMAGES

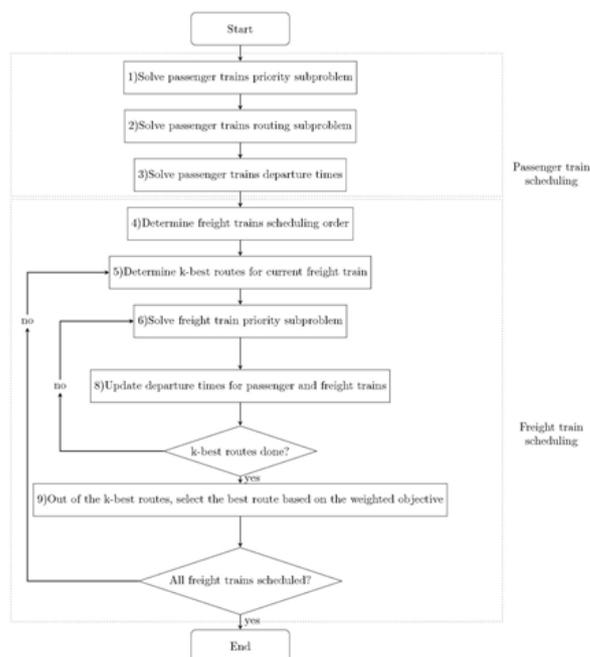


Image 1: The Flow Chart of the Solution Procedure

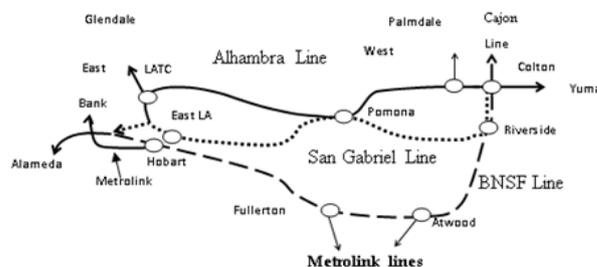


Image 2: Three Main Distinct Rail Lines in the Los Angeles Area