Integrating Management of Truck and Rail Systems in LA

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Project Objective

- Develop efficient train scheduling algorithms that take advantage of new technologies such as Positive Train Control (PTC) and the new concept of dynamic headway control.
- To estimate the additional amount of freight that the rail system can handle if the developed control rules are used to control rail movement in Southern California.

Project Description

- Introduce three heuristic dispatching rules for trains travelling on double-track railway segments with heterogeneous traffic and fixed headway. Switching polices are inspired by the idea of routing fast trains from the designated track to alternative tracks if feasible.
- Advance train scheduling and routing through dynamic headway control facilitated by Positive Train Control (PTC).

Research Approach

Dispatching Policies:

- The first switchable policy is to switch the fast train, if it has potential delay on its designated track, to the designated track for the opposite direction if that track is empty.
- The second policy has a smarter condition to dispatch the trains by considering the speed of the attempting switching train.
- The last policy is that fast trains are switched to the opposite direction designated track if they do not extend the current busy period on the opposite direction designated track for a tolerable length of time.
- Extra scenarios where crossovers are placed are considered.

Dynamic Headway Control:

- Establish a model to utilize the dynamic headway control concept.
- Provide a solution procedure to the established dynamic headway model.

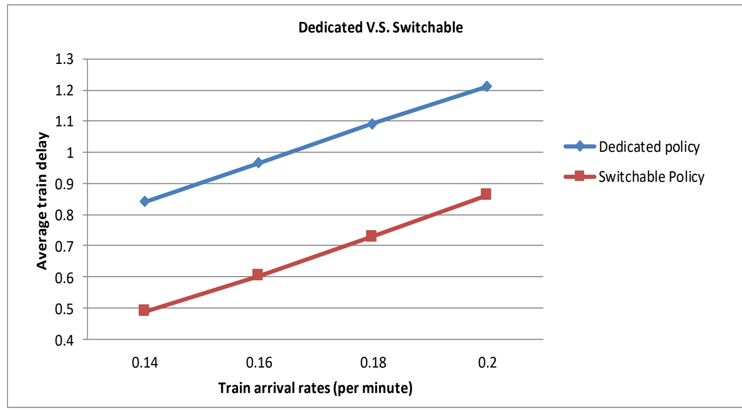
Data

- Actual railway network from Downtown Los Angeles to Pomona.
- Data includes mileage information for tracks, railway trackage configurations including junctions, single track, double tracks and triple tracks, and daily train counts including passenger and freight trains.

Results

I. *Dispatching Policies Comparison*

- As expected, the delay increases as the arrival rates increase but the gap between the dedicated policy and the switchable policy reduces at the increased rates since there is less opportunity for switching when there are more trains in the network.
- The results clearly show that the switchable policy dominates the dedicated policy as the arrival rates vary. In this numerical experiment, the switchable policy can reduce the average train delay by as high as 41.9%.



II. *Dynamic Headway Control*

- As shown in the table below, the dynamic headway approach, performs much better than the constant headway method. From the table, we can clearly see that the dynamic headway method can assign the track resources more efficiently.

Table: Average Delay (Measured in Minutes)

Number of trains per day	Constant headway method	Dynamic headway method
10	1.40	1.21
20	2.87	2.74
40	5.49	5.27
60	9.42	8.85
80	13.29	12.69
100	20.68	16.90
150	55.44	32.02

Conclusions

- The best switchable policy reduces the average train delay by 21%.
- With the existence of crossovers in the middle of a double-track segment, the proposed switchable policy can reduce the average delay by 41.9%.
- The simulation results show that with dynamic headway control, the rail capacity could be increased by 20%.