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Technical Feasibility Study of Passenger Rail Service along the West Route between Las Vegas and Los Angeles

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Abstract

The study evaluates the feasibility of running passenger train service from Las Vegas, NV on the Union Pacific Railroad (UPRR), to Barstow, on the Burlington Northern Santa Fe (BNSF) track, to Mojave on UPRR track again, and to Lancaster connecting Metrolink to their destinations in Southern California. In this study, the railroad infrastructure was inventoried and issues related to running the passenger service were identified. Passenger train operation was evaluated based on the Rail Traffic Controller (RTC) simulation model. The performance measures of passenger trains including travel time, overall delay and average speed are analyzed. The uncertainty in freight flow and its impact on providing the passenger service is addressed by conducting a sensitivity analysis. The conclusion is that the existing railroad infrastructure is sufficient to provide a passenger train service from Las Vegas to Los Angeles. From an operational perspective, the passenger train is not expected to influence freight trains' performance on the existing railroads. When freight train flows are increased to 50%, the influence of passenger train service on the freight operation is still minimal. This study recommends restoring a platform at the Las Vegas Station. At the Mojave Station, special care should be given on running the passenger trains where there is no direct railroad connection from BNSF to UPRR. Platforms and walkways require construction at the Lancaster Station for transferring passengers between the Metrolink trains and X-Train. Transferring the passenger train at this station involves stopping the train on mainline and coordinating the operations between different railroads.

Keywords

Passenger Train Service, Railroad Operation, RTC Simulation Model, Train

Performance, Sensitivity Analysis

1. Introduction

The passenger rail service between Las Vegas, Nevada and Los Angeles, California dates back from 1981 to 1997. During this period, an Amtrak service, *Desert Wind*, provided passenger rail service between these two cities through Barstow, Victorville, San Bernardino and Fullerton. Its scheduled eastbound travel time was six hours, 55 minutes, and its westbound travel time seven hours, 15 minutes. Due to a number of reasons, particularly unreliable travel time which made it less competitive versus travel by automobile, Desert Wind stopped its service in 1997. In an attempt to reduce the travel time, in March 1997, Amtrak completed a study to identify potential improvements. Unfortunately, as a result of budget constraints and other issues, the passenger rail service between these two cities was never re-established.

In 2007 the Regional Transportation Commission of Southern Nevada conducted a study to evaluate the alternatives of re-establishing the passenger train service between these two cities [1]. Even though the study only considered public agencies to initiate the rail passenger service, in 2009, a private company, the Las Vegas Railway Express Inc. (also called X-Train) launched its campaign to provide the rail passenger service. Instead of running passenger trains regularly, X-Train plans to provide excursion train service only for special events in Las Vegas in order to minimize the disturbance of passenger train service to the freight operation.

The objective of this study is to evaluate the technical feasibility of providing an excursion passenger rail service between Los Angeles and Las Vegas following the West Route. The technical feasibility will address the rail infrastructure needs, evaluate railroad operation for passenger rail service, and assess the impact of freight operation fluctuation on the passenger service. To achieve this objective, this study assessed the railroads' infrastructure inventory the proposed passenger train will run on. The railroad operation involving the passenger trains in the freight railroad operation environment was evaluated using a rail traffic simulation model.

To evaluate the feasibility of providing a passenger train service between Los Angeles and Las Vegas along the West Route, a five-step procedure is followed. First, relevant literature is reviewed where similar studies are summarized. The second step inventories the infrastructure needed to operate the passenger train service. The third step evaluates operation of the proposed passenger train service on railroad facilities. The impact of operating the passenger train service was evaluated by comparing the performance measures from running the railroad systems with and without the passenger train service using the Rail Traffic Controller (RTC) software. The fourth step evaluates the impact of different levels of operations serving a higher number of freight trains on the passenger train service (sensitivity analysis). The fifth step provides conclusions on this feasibility study where by the passenger train service is viewed as feasible if there is sufficient infrastructure allowing trains to operate over the network with performance measures acceptable to the railroads and the passenger service provider.

2. Literature Review

Providing passenger rail service using existing rail infrastructure between Las Vegas and Los Angeles was conducted by IBI Group in 2007 for the Regional Transportation Commission of Southern Nevada [1]. In this study, the Train Performance Calculator (TPC) was used in deriving train travel time. The issue with the TPC is that it does not consider the interaction between passenger trains with freight trains, which is important in determining the travel time when the number of trains is high. A different railroad simulation model is adopted in Leachman [2] where the train travel over a network is considered. This model is proprietary in nature. It was shown in the NCHRP report 657 [3] where the Railroad Traffic Controller (RTC) simulation model can capture train movement on a complex railroad network while interactions between trains are fully considered. The study by HNTB [4] used delays, average speed and on-time performance from the RTC software to determine the feasibility of passenger rail service between Austin and Houston. In the RTC model [5], delay is computed as the difference between the runtime that a train would travel without conflicting with any other train and the actual runtime when a train is moving with the actual meet and pass conflicts. It can be standardized with the number of train miles as Delay/100Train-miles which is defined as significant reduction in delay minutes per 100 train miles. The Average Speed which is considered as the average operating speed, in miles per hour, of the measured trains operating across the entire or part of the network.

3. Railroad Infrastructure Inventory Issues

UPRR, BNSF and Metrolink are three railroads (see **Figure 1**) involved in the West Route that the proposed passenger train service will operate.

Even with track and signal available, there are three major issues at Las Vegas, Mojave and Lancaster stations. Currently, no platform exists for passengers at the Las Vegas Station in the City of Las Vegas Downtown. To allow passengers on and off the train at the entrance, a platform should be built (**Figure 2**).

The connection from the BNSF Division to UPRR Division or vice versa is not ideal. To operate passenger trains from Lancaster, CA to Barstow, CA through the Mojave Station, the trains must stop at the Mojave Station first, which can be seen in **Figure 3**. The engine pushing the end of the train will become the head of the train, pulling the train forward, while the engine originally pulling at the front will become the tail of the train, pushing the train forward. This process would increase additional delay of about 30 minutes.

At the Lancaster Station, there is no siding and platform for the passenger train from the UPRR line to stop, which can be shown in Figure 4. The passenger train may have to stop on the mainline at the station and let the passengers get on or off the train. In this case, a temporary platform and a walkway should be built allowing passengers to make the transfer from the Metrolink trains to the X-Train.

Figure 1. The proposed west route of the passenger service.

Figure 2. Platform at the Las Vegas station.

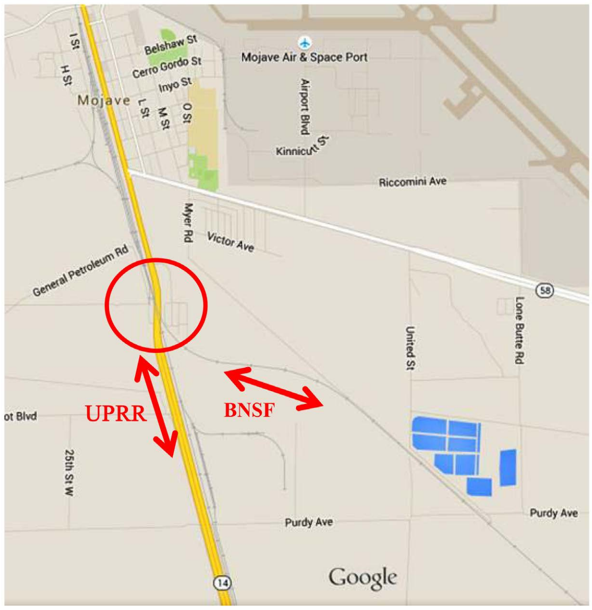

Figure 3. Connection at Mojave.

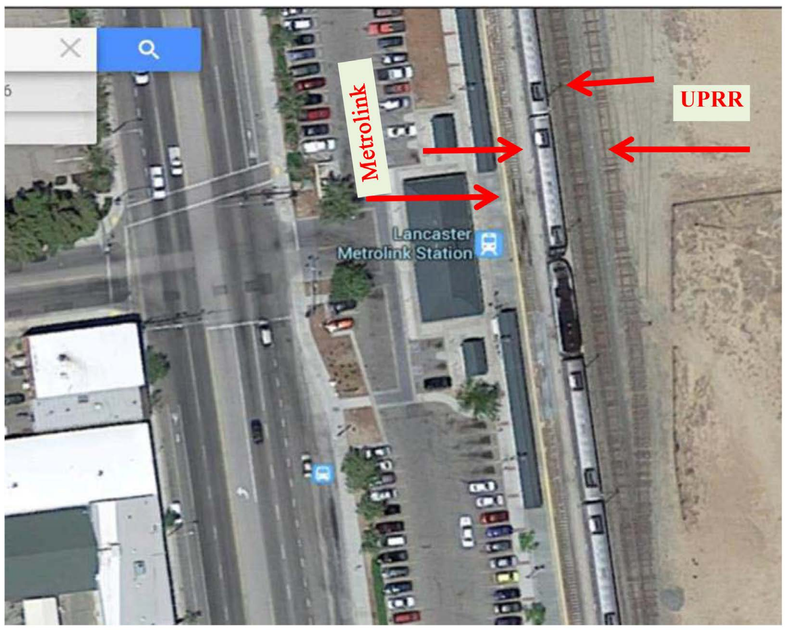

Figure 4. Platform at the lancaster station.

4. Data Collection and Analysis

Given the existing railroad infrastructure, studying railroad operations involving passenger trains provides a way to evaluate whether there is an operational process allowing passenger trains to run from its origin to destination. From this process the total travel time for passenger trains can be determined given a specified departure and arrival times at their original and destination stations. In addition, the impact of operating passenger trains on freight railroad operations can also be evaluated.

The operational process for passenger train service is evaluated using railroad traffic simulation software: Rail Traffic Controller. In addition to the railroad geometry, grades and signal data from the websites in [6] [7] [8] [9] [10], the railroad traffic data were also collected from railfan websites and employee timetable (ETT) as shown in Table 1. The train movement pattern is shown in Figure 5.

Train distribution assumed in the simulation model is based on the fact that more than 50% of the train trips are made during the daytime. The train headways were assumed to be 30 minutes for busy locations (Barstow to Daggett) and one hour for non-busy locations. A minimum of four night hours were left for maintenance activities for the operating trains and rail infrastructure. The passenger trains are proposed to travel eastbound (outbound trip) from Lancaster to Las Vegas on Friday and travel westbound (return trip) from Las Vegas to Lancaster on Sunday. The eastbound train will depart Lancaster around 9:30 am; while the westbound will depart Las Vegas around 4:00 pm.

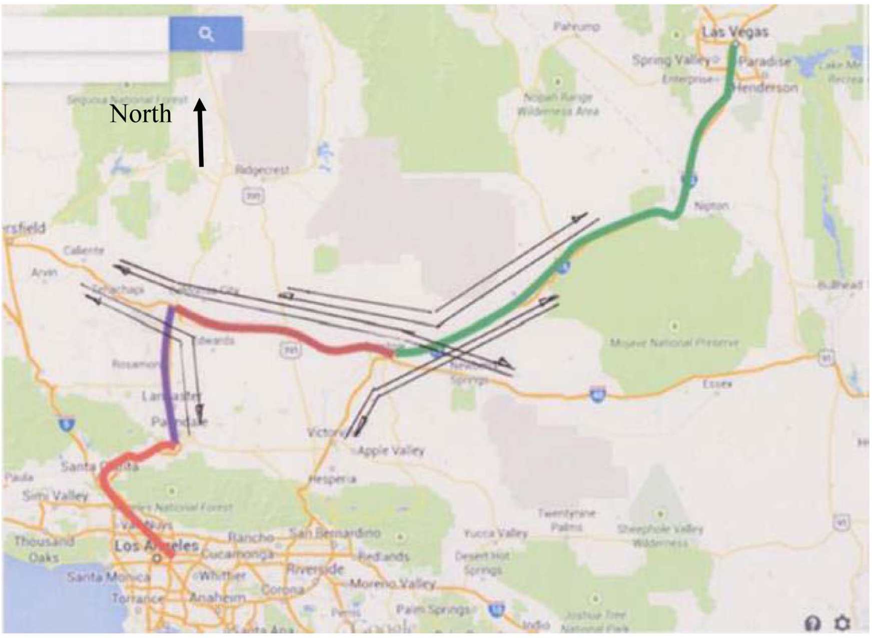

Figure 5. Freight train movement patterns.

Table 1. Traffic count.

Subdivision	Segment	Traffic Count by Direction	
		East	West
Cima (UPRR)	Las Vegas—Daggett	12	13
Needles (BNSF)	Daggett—Barstow	35	35
Mojave (BNSF)	Barstow—Mojave	14	15
Mojave (UPRR)	Mojave—Lancaster	18	17

5. Results

Given these specifications and passenger train operation, the RTC model outputs were analyzed.

The comparison of operation performance is based on three criteria from the simulation model: Delay in Percentage, Delay in Minutes/100Train-miles, and Average Speed. Given the same criteria, the sensitivity analysis was performed to investigate the variations of the impact of the passenger rail service on freight trains under very high freight train flow on the railroad network. In this sensitivity analysis, the number of freight trains is assumed to grow by 50% within 20 years with two steps of 25% increments. The Delay Percentages are the percent of time that a train is delayed en route for conflicts, extended dwells or randomized late departures.

Figure 6 presents the Delay Percentages for the Base Case where no passenger trains are considered and with the proposed passenger train service considered, and corresponding sensitivity analysis respectively. The graphs show that proposed passenger train service increases the Delay Percentage by 0.08% after introduction of passenger train. The sensitivity analysis shows the increased in Delay Percentages by 1.66 and 4.31, respectively.

Delay (the time trains are stopped waiting for a clear route) is measured in minutes per 100 train miles, a typical freight rail measurement. Figure 7 shows the Delay of 0.03 minutes/100Train-miles was observed after passenger train introduction. It implies that the introduction of passenger trains attributes to an additional 0.03 minutes for a freight train traveling in a 100 mile segment, which is very small thus indicating that the proposed passenger train service has an insignificant impact to freight railroad operations. Even after sensitivity analysis, the delay incurred was observed to be 1.62 and 4.22 for 25 and 50 percent increase in freight traffic flow.

The average speed is the over-the-rail train speed not including terminal dwell time, time for loading and unloading, and the time trains spend in storage yards. In the case of a proposed passenger train, the average speed was found to be 54.13 mph, higher than when there is no passenger train by 0.12 mph (see Figure 8). The increase in train average speed was attributed to the train mix. In the case of a passenger train, the passenger trains travel at higher speeds (79 mph) than the freight trains (70 mph). The mix of existing lower speed freight trains and proposed higher speed passenger trains results in higher average speed.

Figure 8 indicates that the average speed decrease from 54.13 mph for all trains on average considering the passenger train service to 53.39 mph and 52.22 mph for the 25% and 50% freight train increase, respectively. The reduction in average speed is less than two miles per hour, which is also viewed as minimal. In summary, the proposed passenger train service will not significantly influence the performance of the freight trains even when the number of freight trains increases significantly.

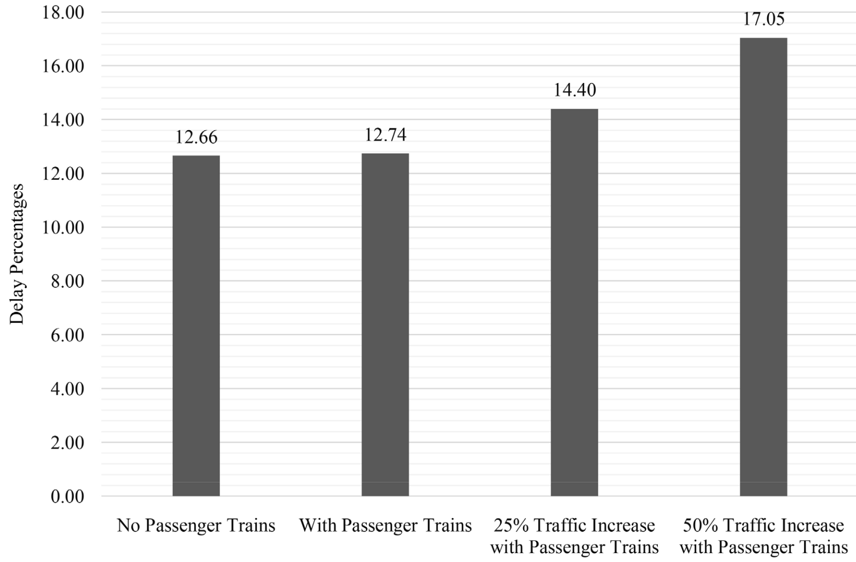

Figure 6. Delay percentages.

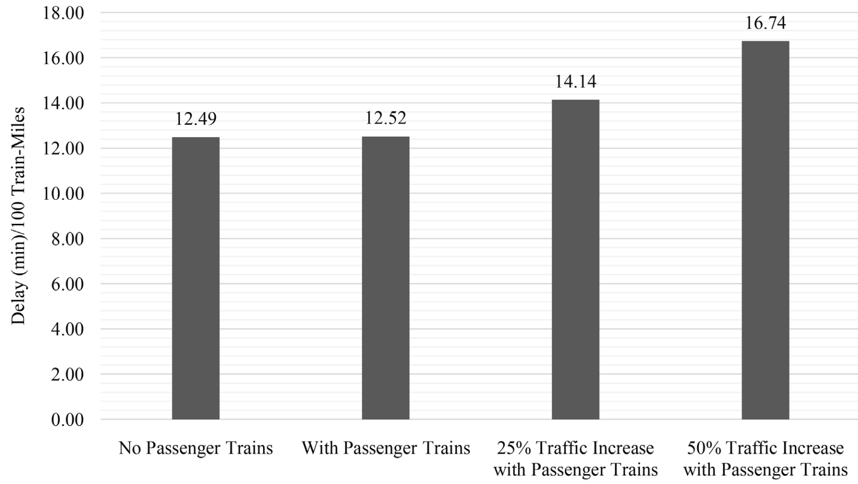

Figure 7. Delay (min)/100Train-miles.

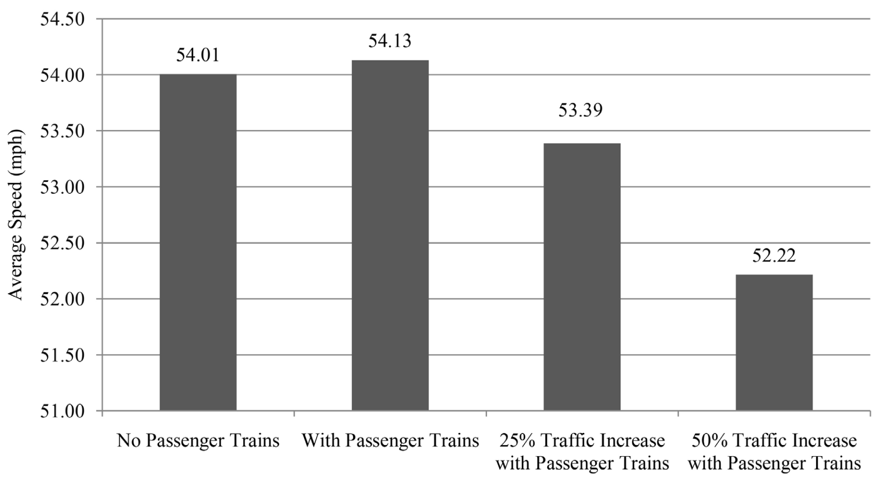

Figure 8. Average speed variations.

6. Conclusion and Recommendations

The study evaluates the feasibility of running passenger train service from Las Vegas, NV to Los Angeles, CA. The railroad infrastructure was inventoried and issues of running the passenger service were identified. The passenger train operation was evaluated based on a railroad simulation model. The conclusion is that the existing railroad infrastructure is sufficient to provide a passenger train service from Las Vegas to Los Angeles. From an operational perspective, the passenger train will not significantly influence freight train performance along the existing railroads.

It is recommended that a platform at the Las Vegas Station be built to allow passengers to board the trains. Running passenger trains at the Mojave Station in California would incur delay for changing travel direction between BNSF and UPRR. The total travel time of the proposed passenger train would be reduced significantly if a direct connection is built. Platforms and walkways should be built for passenger transferring between the Metrolink trains and the X-Train at Lancaster. It is recommended that Metrolink allow the proposed passenger trains to run on their tracks to reach their destination in Southern California in one-seat. Without a transfer at the Metrolink, train service would appear more attractive to customers.

The economic feasibility of passenger train service should be evaluated where ridership, revenue and cost of the passenger train service can be estimated. Success of the passenger service lies upon cooperation among the railroads that the passenger train would operate on. Relevant issues such as operation fees to pay these railroads should be addressed appropriately. This study has proven the viability in railroad operations. It is upon the service provider to ensure the convenient service to customers.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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