Memorandum

TO: Bill Craven
New Mexico Department of Transportation

FROM: Rachel Copperman, Andreas Aeppli, Erin Kersh

DATE: August 29, 2014

RE: **Amtrak Southwest Chief Economic Impact Study: Base Year Ridership Results and Methodology**

BNSF and Amtrak have been in negotiations to develop a new joint use agreement that sets conditions for use by the Chicago – Los Angeles Southwest Chief (SWC) of a secondary BNSF main line in Kansas, Colorado and New Mexico. In New Mexico, BNSF owns 183 miles of this route, which runs from the Colorado/New Mexico state line through Raton, Las Vegas, and Lamy. Between Lamy, Albuquerque, and Isleta, the route used by the SWC is owned by NMDOT. At Isleta, the SWC turns west on a BNSF-owned line to Dalies, where it joins the BNSF Transcontinental (Transcon) to reach Gallup, NM, Arizona and California.

East of Lamy, the SWC is the only regular user of the track, and Amtrak would thus be burdened with the full cost of its maintenance. This has led to an examination of alternative routes, of which the only viable option is BNSF's Transcon alignment through Witchita, KS, Amarillo, TX, and Clovis and Belen, NM. Relocation from the current alignment to BNSF's Transcon would result in the cessation of passenger train service to the New Mexico communities of Raton, Las Vegas and Lamy, along with all SWC stations in Colorado and three in Kansas. Service to Albuquerque and Gallup would be retained, and potential new communities on the Transcon in New Mexico could be served, with Clovis, Vaughn and Belen considered by NMDOT as the most likely candidates. At minimum, the other new stations along a Transcon routing would likely include Amarillo, TX, Waynoka, OK, and Wichita, KS, as shown in Figure 1.

The communities of Raton, Las Vegas and Lamy, the surrounding areas, and the State of New Mexico would be economically impacted by the loss of Amtrak service to these three communities if the SWC is relocated. From a state perspective, these potential economic losses might be offset by the economic gains that would accrue to the newly served communities along the Transcon, and potentially a net increase in visitors to New Mexico from the SWC, if the reroute were to result in higher ridership to the state.

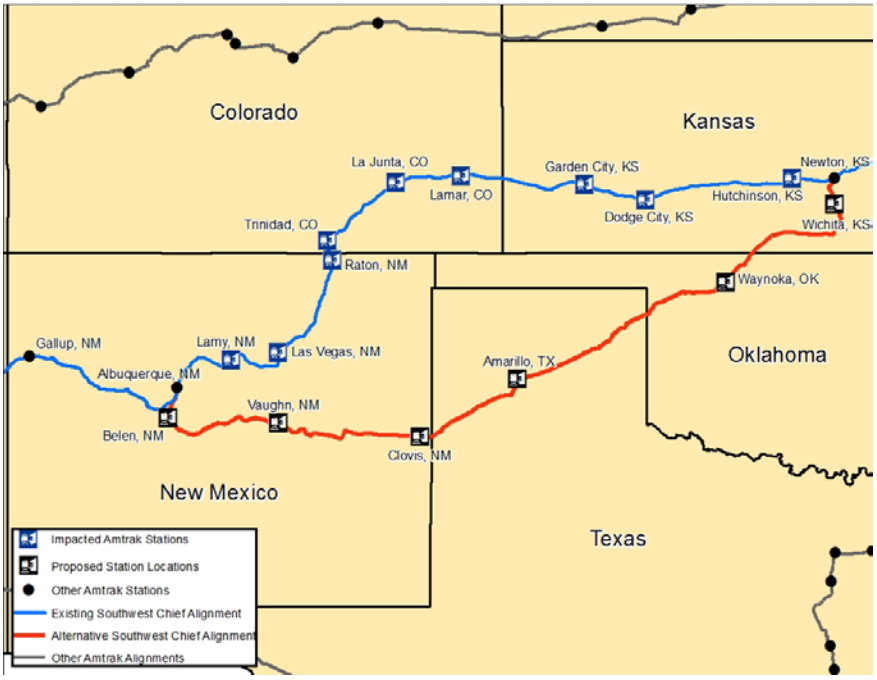

Figure 1 Existing and Proposed Southwest Chief Alignments

The fundamental ingredient underlying an assessment of the economic impacts of staying on the current route versus a reroute across BNSF's Transcon is ridership, and the characteristics of that ridership. This memorandum provides Cambridge Systematics' estimates of patronage for the existing and potential SWC route within New Mexico for a 2013 base year.

Approach

There is no existing data available showing long distance travel by origin and destination across modes for the markets that would be affected by a potential reroute of the SWC. Furthermore, the available time and resources precluded development of this data through surveys and other collection methods. We thus estimated ridership by market using a modeling approach that utilizes available indicators of potential usage and comparing them to ridership in other similar markets. Such characteristics include:

- Demographics (population, employment, etc.) of markets served by the train,
- Travel time and distance between origin-destination (OD) pairs,
- Availability of alternative for-hire modes (air),
- Major visitor attractions (such as national parks), and
- Schedule, e.g. time of day during which train would serve a particular market.

To estimate ridership at the new stations, linear regression equations were estimated by regressing existing station-level characteristics against annual ridership of existing stations

along the SWC as well as all of Amtrak's Chicago – West Coast long distance trains. These regression equations were then used to predict ridership at the new stations using the characteristics of those locations. Then, to estimate where the ridership at the new stations might originate or terminate, we developed a gravity model using the origin-destination trip table from the existing SWC line. This proved to be insufficiently reflective of actual performance, such that we then developed distributions for the new stations manually by comparing existing station distributions with new stations having similar characteristics.

Each element of the process is further described in the sections that follow. Final results can be found in Summary of Findings, starting on page 17.

Data

We collected data from several different sources including Amtrak, U.S. Census, National Park Service, and the Federal Aviation Administration (FAA). The following sections review the sources and nature of data used in the study.

Amtrak Southwest Chief Existing Ridership Data

Amtrak provided us with detailed ridership information for the SWC route. This included:

- Annual ridership and revenue by month for fiscal years 2012 and 2013;
- Ridership between all station pairs on the SWC line (i.e. origin-destination trip table);
- FY 2013 ridership and revenue at each station;
- Percent of trips at each station that begin at the station;
- Average days away from station for round trips beginning at the station;
- Average days at destination for round trips where the station is the destination;
- Ridership of the connecting bus service between Raton, NM, Pueblo, Colorado Springs and Denver; and,
- Annual ridership at each station that connect to other Amtrak routes, and the routes with which they connect.

We also obtained information on trip purpose from 2010, which Amtrak acquires through passenger surveys. The data was provided in aggregate form for the entire route, and not by state or individual station. Amtrak personnel indicated that the sample size is not sufficient to provide station-specific trip-purpose information.

Travel Time, Distance, and Schedules for Amtrak Routes

Locations for all current Amtrak stations were obtained through the "Find a Station" option on the Amtrak website[1]. Time and mileage between stations were determined from the most recent route timetables[2], also available through the Amtrak website. For distances between proposed Amtrak stations located along the Transcon route, the listing for the San Francisco Chief posted in the June 1965 **Official Guide** was consulted[3].

Amtrak Ridership Data on Other Routes

In addition to ridership data for the SWC, Amtrak provided us with total FY 2013 ridership by station and line for the three other long-distance trains operating between Chicago and the West Coast, the *Empire Builder*, *Texas Eagle*, and *California Zephyr*. As a result, data on ridership by route for 178 stations was available for analysis.

Demographics

Population within a defined distance of a station was determined using 2010 Census data available at the ZIP Code Tabulation Area (ZCTA) level[4]. Each of these zip codes was transformed into a single point representing the centroid of the zip code. For each station, a defined radius was determined (i.e. 10, 25, 50 miles). All zip codes with a centroid within that radius were selected and the sum of the populations within the selected areas was assigned to the station. In the case that no centroids fell within the radius, the population of the zip code in which the station is located was used.

Employment and median household income were determined from the most recent American Community Survey (2008-2012). This data was assessed at the county level. Similar to the methodology for population estimates, the centroids of the counties falling within a certain radii of a station (i.e. 50, 75, and 150 miles) were included in the summation of employment and average of the median household incomes.

National Parks

National park and monument locations were obtained from Natural Earth[5]. Data includes the 398 authorized National Park Service units in the United States, current as of the October 2012 designation of the Cesar Chavez National Monument. The parks are categorized, based on the size of the park, into: a) Parks over 100,000 acres, b) Parks under 100,000 acres, and c) Linear parks. Visitor numbers in 2013 for all parks within 150 miles of each station were obtained from

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[1] http://www.amtrak.com/find-train-bus-stations
[2] http://www.amtrak.com/train-schedules-timetables
[3] http://www.streamlinerschedules.com/concourse/track8/sanfranchief196506.html
[4] https://www.census.gov/geo/maps-data/data/tiger-data.html
[5] http://www.naturalearthdata.com/downloads/10m-cultural-vectors/parks-and-protected-lands/

the National Park Service Visitor Use Statistics website[6]. Visitor counts for all parks falling within a certain radii (i.e. 50, 75, and 150 miles) were summed together for each station.

Distance to Airports

Locations of commercial service airports were obtained using the Federal Aviation Administration's Airport Contacts Information[7]. This location information was then joined to the preliminary 2013 passenger boarding information[8]. Airports with fewer than 1,000 passenger boardings were removed from this list, unless they are serving essential air service communities. Essential Air Service (EAS) communities were identified through the United States Department of Transportation Office of Policy. The Aviation Policy division maintains a current list of eligible EAS communities, last updated October 29, 2013[9]. Passenger volumes at airports within 75 miles of each station were calculated. The closet airport to each station was also noted.

Other Data

A significant traffic generator along the existing SWC route is the Philmont Scout Ranch, located near Raton. Philmont provided us with mode splits and a count of campers using the SWC to access the camp.[10] These data, together with the Denver bus connection data, were used to examine the ridership at Raton.

New Station Ridership Estimation

In order to estimate ridership at the newly served stops along BNSF's Transcon, linear regression equations were estimated by regressing existing station-level characteristics on annual ridership of existing stations. These regression equations were then used to predict ridership at the new stations using station-level characteristics of those stations.

As noted previously, we were provided the percentage of ridership originating versus terminating by station for the SWC. For the other three Chicago-West Coast services, we were given only total ridership by station. We thus estimated three separate regression equations:

1. Total annual ridership at each station on all Chicago-West Coast services, regressed against station-level characteristics;
2. Annual ridership originating at the SWC stations, regressed against station-level characteristics; and,

[6] https://irma.nps.gov/Stats/
[7] http://www.faa.gov/airports/airport_safety/airportdata_5010/
[8] http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/
[9] http://www.dot.gov/policy/aviation-policy/small-community-rural-air-service/essential-air-service
[10] Information was collected during an interview with Sid Covington, Base Camp Manager for the Philmont Ranch, July 25, 2014.

3. Annual ridership terminating at the SWC stations, regressed against station-level characteristics.

Total Annual Ridership Regression Equation for all Lines

A number of socio-economic, transportation, and land-use variables were tested in the regression equations for total annual ridership. Different forms of the variables were tested (i.e. values vs. indicator variables). The variables were derived from the data sources discussed above and listed in Table 1.

Table 1 Station-Level Characteristics Tested in Total Annual Ridership Regression Equation

Station-Level Characteristic	Description	Variable Forms Tested	Source
Amtrak route	Amtrak route that is associated with the station and ridership numbers	Indicator	Amtrak
Train arrives at night	Train arrives/departs between 12 AM and 6 AM	Indicator	Amtrak
Location of station relative to other stations	Distance to closest station; Distance to terminal stations; Terminal Station indicator	Value; Indicator	Amtrak
Population in surrounding counties	Total population of counties within 50 or 75 miles of stations; Total population greater than various thresholds; Metropolitan area within 50 or 75 miles of station	Value; Indicator	ACS
Population in surrounding zip codes	Total population of zip codes within 10, 25, 50 or 75 miles of stations; Total population greater than various thresholds	Value; Indicator	Census
Median household income in surrounding counties	Average of median household income of counties within 50 or 75 miles of station	Value	ACS
Total employment in surrounding counties	Total employment of counties within 50 or 75 miles of station	Value	ACS
Recreation employment in surrounding counties	Arts, entertainment, and recreation, and accommodation and food services workers within 50 or 75 miles of station; Percentage of total employment is recreation	Value; Indicator	ACS
Visitors to National Parks	Annual visitors to National Parks within 50, 75, and 150 miles of station; Number of National Parks within 50, 75, and 150 miles of station; Visitor numbers above certain thresholds	Value; Indicator	Natural Earth, NPS
Location and size of airports relative to stations	Existence of various size airports within 50, 75, and 150 miles of station; Distance to various size airports to station	Value; Indicator	FAA

During the estimation process it became evident that stations located within larger cities responded differently to station-level characteristics than those located in smaller sized cities, or

rural areas. Since the new SWC stations reside in cities less than 500,000 (ex: Wichita, KS has a 10-mile radius population of approximately 400,000), we eliminated all stations with population greater than 500,000 within a 10-mile radius. Table 2 shows the final regression equation that was developed.

Table 2 Total Annual Ridership Regression Equation

Variable	Coefficient	Standard Error	T-Stat	P-Value
Median Household Income within 50 miles	0.072	0.035	2.085	0.039
Total population within 10 miles of Station (zip code based)	0.075	0.012	6.439	0.000
Recreation Employment (within 75 miles of station) is greater than 11.5% of total employment	10610.056	3187.999	3.328	0.001
Station resides on Empire Builder Route	7543.637	2363.933	3.191	0.002
Adjusted R-square	0.575			
Number of Observations	122			

Predicted ridership was plotted against observed ridership to assess how well the model was performing against existing data and to identify any outliers in the data. Figure 2 shows this graph. Many of the outliers reflect stations with an especially large amount of tourist traffic (i.e. Whitefish, MT) or spikes in employment activity that was not captured in the ACS data (i.e. Williston, ND).

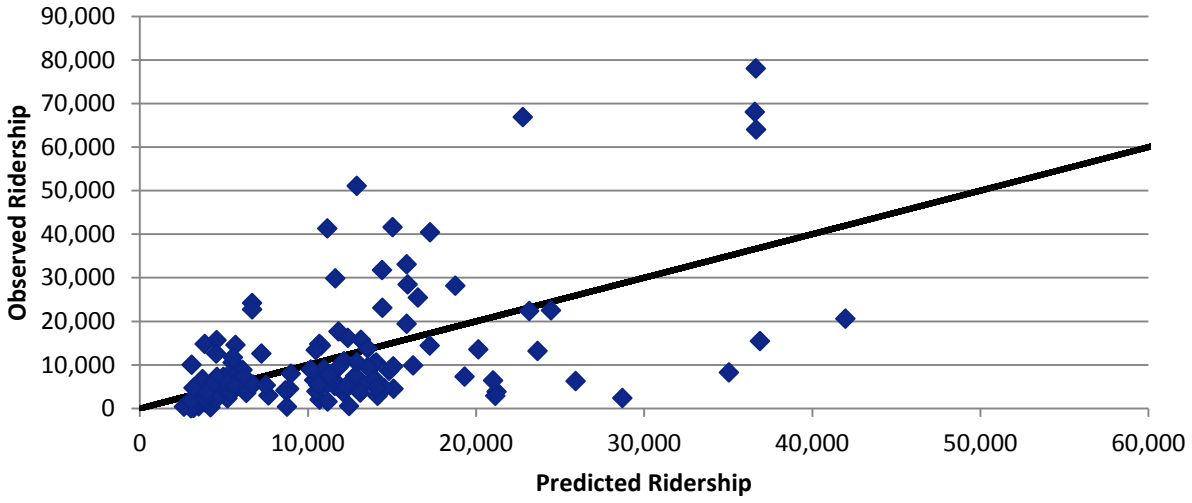

Figure 2 Total Annual Ridership Regression Equation Predicted vs. Observed Ridership

The predicted versus observed ridership values for the existing New Mexico stations is shown in Table 3. The model under predicts ridership for all stations except for Las Vegas. The table also shows the predicted ridership on potential stations in New Mexico along the Transcon.

Table 3 Total Annual Ridership Regression Equation Predicted vs. Observed Ridership for New Mexico Stations

	Current Ridership on Existing Line	Predicted Ridership from Model	Difference	% Change
Gallup	15,647	4,582	-11,065	-71%
Albuquerque	78,066	36,644	-41,422	-53%
Lamy	12,551	7,239	-5,312	-42%
Las Vegas	5,376	13,228	7,852	146%
Raton	15,733	13,163	-2,570	-16%
Belen		4,868		
Vaughn		2,666		
Clovis		6,168		

Annual Ridership Originating at the SWC Stations Regression Equation

The same socio-economic, transportation, and land-use variables that are shown in Table 1 were tested in the regression equations for annual origin ridership, using SWC data only. In addition, additional variables were tested that are listed in Table 4. Different forms of the variables were tested (i.e. values vs. indicator variables).

Table 4 Additional Station-Level Characteristics Tested in Annual Origin Ridership Regression Equation

Station-Level Characteristic	Description	Variable Forms Tested	Source
City Population	Population within city boundaries in which station resides; City population greater than various thresholds	Indicator	Amtrak
Special Generator	Station is nearby an attraction that produces a large amount of ridership	Indicator	Amtrak

It became clear during the estimation process that the two terminal stations of Los Angeles and Chicago, along with the California stations within the Los Angeles metropolitan area responded differently to station-level characteristics than all other stations. Thus, these stations were removed from the regression equations.

There is also a large difference in population for Albuquerque and Kansas City compared to the other SWC stations. We tested removing these stations from the regression equations as well. However, while the statistical fit was lower with the removal of these stations, the overall predicted ridership for each station was similar. This similarity in results is due to the inclusion

of the "large population" indicator variable. Table 5 shows the final regression equation that was developed.

Table 5 Annual Origin Ridership Regression Equation

Variable	Coefficient	Standard Error	T-Stat	P-Value
City Population	0.096	0.009	10.191	0.000
Median Household Income within 50 miles	0.065	0.019	3.405	0.002
Indicator variable if City Population is greater than 100,000	-10462.859	3252.213	-3.217	0.004
Adjusted R-square	0.862			
Number of Observations	28			

Predicted ridership was plotted against observed ridership to assess how well the model was performing against existing data and to identify any outliers in the data. Figure 3 shows this graph. Galesburg, IL, Flagstaff AZ, and Lawrence, KS have the largest discrepancy between observed and predicted ridership. Between Chicago and Galesburg Amtrak offers four daily frequencies in each direction, along with an Amtrak Thruway bus route serving Davenport, IA, Bloomington-Normal, IL and Indianapolis, IN, which most likely contributes to the higher overall rail ridership for that station. Flagstaff is approximately 145 miles from Phoenix, Arizona's largest city and the 13th largest U.S. metropolitan region, with a population approaching 4.2 million in 2010. Lawrence, KS, for unknown reasons, has far lower ridership compared to stations with similar sized populations (perhaps brought on by its proximity to Kansas City and the late hour at which the train calls at the station).

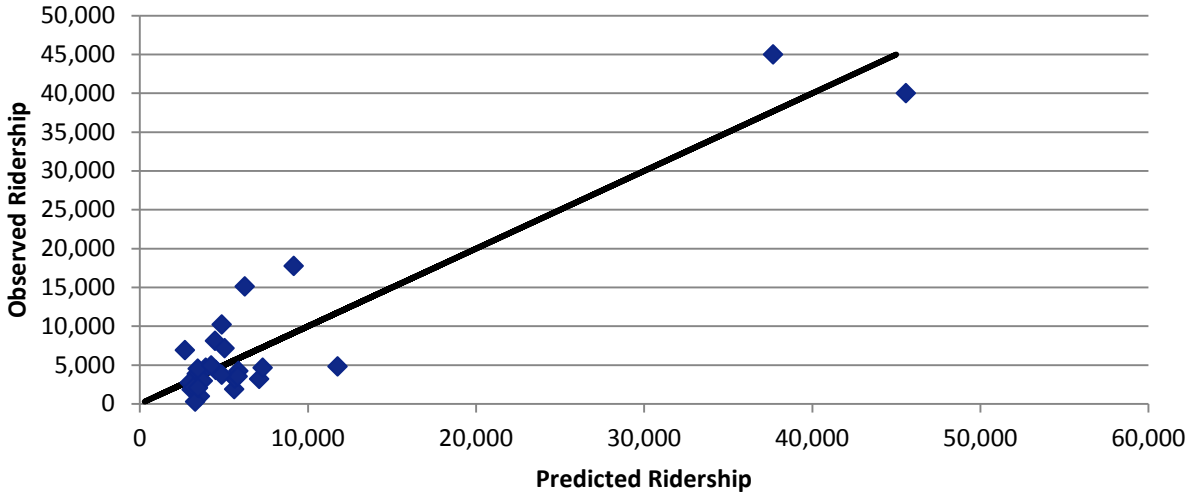

Figure 3 Annual Origin Ridership Regression Equation Predicted vs. Observed Ridership

The predicted versus observed ridership values for the existing New Mexico stations is shown in Table 6. The model over predicts ridership for all stations except for Gallup. The table also shows the predicted ridership for the Transcon alternative in New Mexico.

Table 6 Annual Origin Ridership Regression Equation Predicted vs. Observed Ridership for New Mexico Stations

	Current Ridership on Existing Line	Predicted Ridership from Model	Difference	% Change
Gallup	8,089	4,474	-3,615	-45%
Albuquerque	39,970	45,571	5,601	14%
Lamy	1,845	3,090	1,245	67%
Las Vegas	2,946	3,752	806	27%
Raton	2,690	2,972	282	10%
Belen		3,537		
Vaughn		2,433		
Clovis		6,139		

Annual Ridership Terminating at SWC Stations Regression Equation

The same socio-economic, transportation, and land-use variables that are shown in Table 1 and Table 4 were tested in the regression equations for annual ending ridership. Different forms of the variables were tested (i.e. values vs. indicator variables).

As with the origin ridership regressions, we removed the two terminal stations of Los Angeles and Chicago, along with the California stations within the Los Angeles metropolitan area from the regression equations. Table 7 shows the final regression equation that was developed. There is also a large difference in population for Albuquerque and Kansas City compared to the other SWC stations. We investigated removing these stations from the regression equations as well. However, while the statistical fit was lower with the removal of these stations, the overall predicted ridership for each station was similar. This similarity in results is due to the inclusion of the "large population" indicator variable.

Table 7 Annual Destination Ridership Regression Equation

Variable	Coefficient	Standard Error	T-Stat	P-Value
City Population	0.068	0.009	7.545	0.000
Recreation Employment (within 75 miles of station) is greater than 11.5% of total employment	6694.528	1221.362	5.481	0.000
Indicator variable if City Population is greater than 100,000	-5181.111	3024.541	-1.713	0.099
Adjusted R-square	0.842			
Number of Observations	28			

Predicted ridership was plotted against observed ridership to assess how well the model was performing against existing data and to identify any outliers in the data. Figure 4 shows this graph. The biggest outlier is Flagstaff, AZ, which is Amtrak's main gateway to the Grand Canyon, and, as noted previously, is closest to Phoenix.

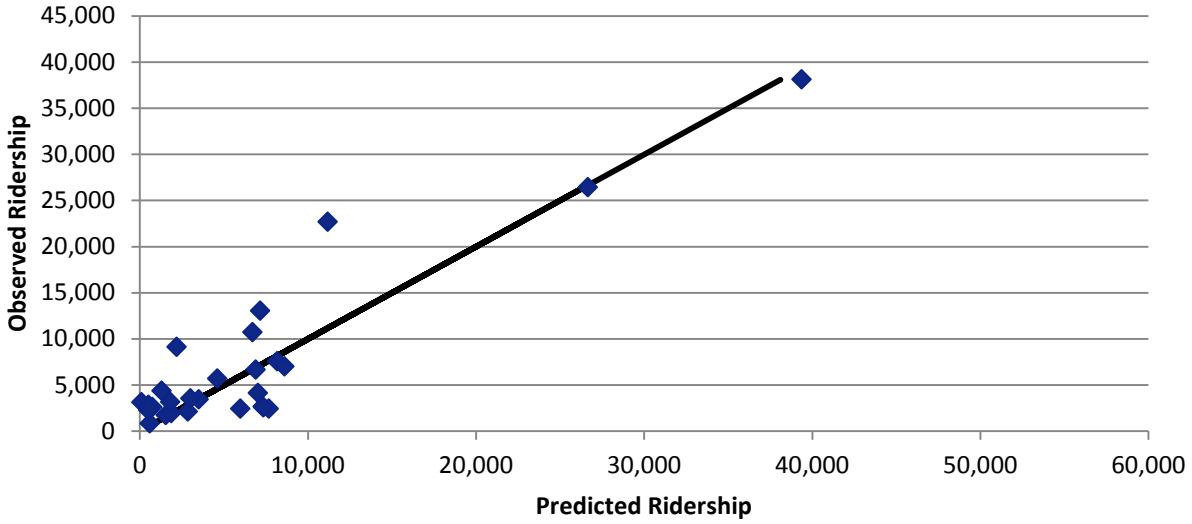

Figure 4 Annual Destination Ridership Regression Equation Predicted vs. Observed Ridership

The predicted versus observed ridership values for the existing New Mexico stations is shown in Table 8. The model slightly over predicts ridership at Albuquerque and Gallup and significantly over predicts ridership at Las Vegas. The model under predicts ridership at Lamy and Raton, of which both stations are known to have special generator ridership. In the case of Lamy, it is the proximity to Santa Fe, while for Raton, it is the Philmont Ranch and the motor coach connection with Denver, Colorado. The table also shows the predicted ridership at the three locations in New Mexico that would likely be served by a rerouted SWC.

Table 8 Annual Destination Ridership Regression Equation Predicted vs. Observed Ridership for New Mexico Stations

	Current Ridership on Existing Line	Predicted Ridership from Model	Difference	% Change
Gallup	7,558	8,172	614	8%
Albuquerque	38,096	39,374	1,278	3%
Lamy	10,706	6,709	-3,997	-37%
Las Vegas	2,430	7,677	5,247	216%
Raton	13,043	7,164	-5,879	-45%
Belen		7,193		
Vaughn		37		
Clovis		2,575		

Results

All three regression equations were applied to the new SWC stations, using the station-level characteristics surrounding the new stations, to estimate total ridership at the new stations. The resulting ridership for the New Mexico stations are shown in Table 9. The results of the Annual Origin Ridership regression and the Annual Ending Ridership regression were summed, and then the average of the All Lines regression and the Summation of the Origin and Destination Ridership results was obtained to compute total annual ridership at the new stations.

Table 9 Total Annual Ridership on New SWC Stations Calculated from Regression Equations

New Stations	All Lines	Origin Only	Destination Only	Total of Origin + Destination	Avg. of All Lines and Origin + Destination
Belen, NM	4,868	3,537	7,193	10,730	7,799
Vaughn, NM	2,666	2,433	37	2,470	2,568
Clovis, NM	6,168	6,139	2,575	8,714	7,441

Given the lack of significant special generators at Belen, Vaughn, and Clovis that might attract a significant amount of ridership, as presently seen at Lamy and Raton, there is reason to believe that the percentage of origin vs. destination ridership would be close to proportional. Except for Williams Junction, AZ which has the special generator of the Grand Canyon, Lamy, and Raton all other SWC stations have percentage origin ridership of at least 32%. The percentage of origin ridership at Las Vegas was 55 percent in 2013, as shown in Table 10 along with the current New Mexico stations. This ratio is assumed for the alternative New Mexico stations. These percentages along with rounded ridership totals for the New Mexico stations are shown in Table 11.

Table 10 Total Ridership by Origin and Destination for Existing SWC New Mexico Stations

New Stations	Origin Percentage	Destination Percentage	Origin Ridership	Destination Ridership	Total Ridership
Gallup	52%	48%	8,089	7,558	15,647
Albuquerque	51%	49%	39,970	3,8096	78,066
Lamy	15%	85%	1,845	10,706	12,551
Las Vegas	55%	45%	2,946	2,430	5,376
Raton	17%	83%	2,690	13,043	15,733
Total	44%	56%	55,540	71,833	127,373

Table 11 Total Ridership by Origin and Destination for SWC New Mexico Stations on Transcon Alignment

New Stations	Origin Percentage	Destination Percentage	Origin Ridership	Destination Ridership	Total Ridership
Gallup	52%	48%	8,736	8,064	16,800
Albuquerque	51%	49%	40,698	39,102	79,800
Belen, NM	55%	45%	4,290	3,510	7,800
Vaughn, NM	55%	45%	1,430	1,170	2,600
Clovis, NM	55%	45%	4,070	3,330	7,400
Total	52%	48%	59,224	55,176	114,400

Retention of Ridership from Stations Losing Service

An important component in estimating ridership of a reroute is the degree to which passengers boarding or alighting at stations on the Raton Pass route would continue to use the SWC if the train were rerouted over BNSF's Transcon. This issue is of particular relevance for Lamy and Raton, which have unique characteristics and produce significant volumes for the SWC. It is beyond the model's ability to estimate how many visitors to Lamy or Raton would continue to use the Southwest Chief as part of their trips, or even to continue making their trips, were the SWC realigned to the Amarillo route. Similarly, whether Amtrak would continue its connecting motorcoach service from Denver to Raton as a Denver to Albuquerque connection, as it did temporarily in 2007-2008, and how many of the existing riders would continue to use this service if it continued, is beyond the ability of the model to estimate.

Trip Purpose

An important element in projecting potential ridership, along with its economic impact on a region, is trip purpose. Although Amtrak passenger surveys include questions about trip purpose, sample sizes are not sufficient to provide station-level profiles. Thus, the trip purpose data supplied by Amtrak covered the SWC as a whole, and is summarized in Figure 5.

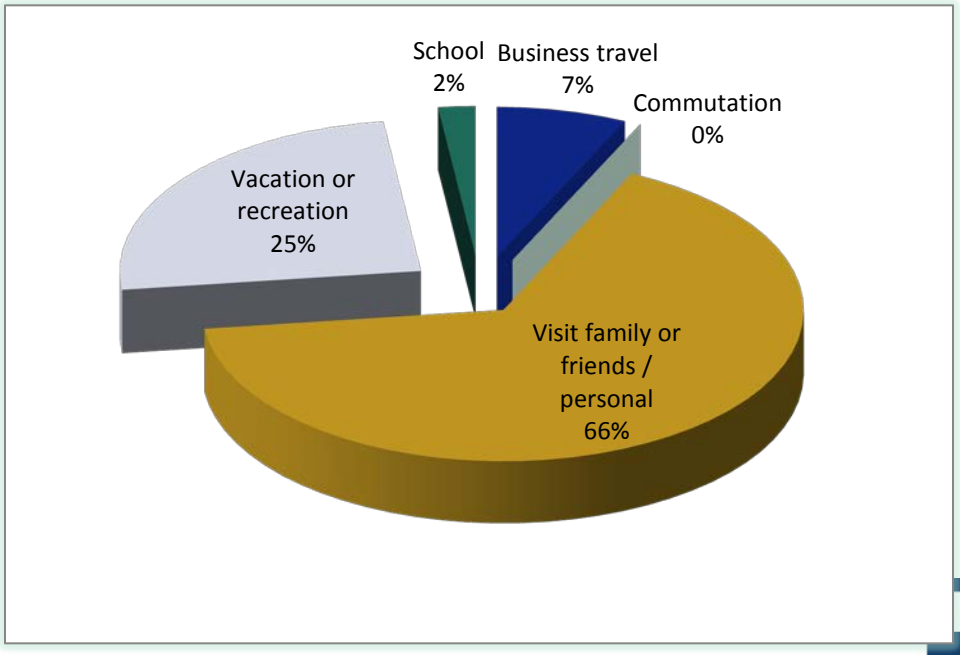

Figure 5 Southwest Chief Trip Purpose Percentages (2010)

Notably, tourism accounts for one quarter of SWC travel. Given the tourism-driven nature of the Raton (as indicated by the Philmont Ranch visitation volumes) and Lamy (Santa Fe as a major tourism draw) economies, the tourism-derived volume to those stations substantially exceeds 25 percent of volume handled. Ridership at Las Vegas, Albuquerque, and Gallup is likely more reflective of the SWC's overall trip purpose profile. The other new Amtrak stations will have a trip purpose profile more similar to the rest of the SWC route. Table 12, below, shows the trip purpose percentages by station for the existing and proposed New Mexico stations. For Raton and Lamy, we used estimates based on available data, while for the other stations, we used the train-wide average, adjusted for the higher portion of tourism-related travel to Raton and Lamy.

Table 12 Estimated Trip Purpose Percentage at New Mexico Stations on Existing and Transcon Route

Station	Business/ Commute	Personal & School	Vacation/ Recreation
Gallup	7%	71%	22%
Albuquerque	7%	71%	22%
Lamy	5%	45%	50%
Las Vegas	7%	71%	22%
Raton	1%	9%	90%
Belen	7%	71%	22%
Vaughn	7%	71%	22%
Clovis	7%	71%	22%

Trip Distribution

In order to determine where the ridership at the new stations is originating or terminating we developed a gravity model using the origin-destination trip table from the existing SWC line. The gravity model was then used to predict the distribution of the new station ridership. The predicted distribution was then compared to the existing ridership distribution at similar stations. In comparing these distributions, it became evident that the gravity model was over-predicting the number of trips to the terminal stations of Los Angeles and Chicago, and under-predicting ridership to the medium sized cities, such as Albuquerque, Wichita, and Kansas City. Instead of using the gravity model to predict the distribution of the new SWC station ridership, we develop distributions for the new stations manually by matching the distributions of existing stations with stations holding similar characteristics along the alternative route.

Table 13 shows the distribution of ridership at the new alternative SWC New Mexico stations. The high percentage of trips from Belen to most other geographic areas, compared to the other stations, is due to it's proximity to Albuquerque. Since there is an existing commuter rail service between Belen and Albuquerque we do not predict that anyone will choose to travel by Amtrak between these two locations.

Table 13 Distribution of Rerouted SWC Ridership at New Mexico Stations

	Gallup	Albuquerque	Belen	Vaughn	Clovis
Los Angeles, CA	25%	36%	28%	18%	16%
Rest of CA	15%	21%	14%	12%	10%
Arizona	5%	6%	6%	5%	4%
Gallup	0%	9%	1%	1%	1%
Albuquerque, NM	40%	0%	0%	34%	20%
Rest of NM	1%	3%	1%	1%	1%
Amarillo, TX	3%	2%	2%	2%	16%
Wichita, KS and OK	5%	4%	12%	5%	6%
Rest of KS	1%	1%	4%	4%	4%
Kansas City, MO	1%	3%	10%	4%	5%
Rest of MO, IA, rest of IL	1%	3%	8%	3%	4%
Chicago, IL	3%	13%	14%	11%	13%

For comparison purposes, Table 14 shows the distributions of the New Mexico stations for the current alignment.

Table 14 Distribution of Ridership at New Mexico Stations for Existing Alignment

	Gallup	Albuquerque	Lamy	Las Vegas	Raton
Los Angeles, CA	26%	36%	24%	18%	18%
Rest of CA	17%	21%	10%	15%	11%
Arizona	5%	6%	7%	5%	5%
Gallup	0%	9%	0%	1%	1%
Albuquerque, NM	43%	0%	2%	29%	9%
Rest of NM	2%	4%	2%	6%	4%
Colorado	0%	2%	2%	4%	3%
Kansas	2%	3%	24%	5%	4%
Kansas City, MO	1%	3%	6%	3%	17%
Rest of MO, IA, rest of IL	1%	3%	4%	3%	8%
Chicago, IL	3%	13%	19%	11%	20%

The trip tables for the existing alignment were developed directly from the origin-destination data provided by Amtrak. Approximately 2% of the SWC's ridership was not assigned to an OD pair, and thus there was a discrepancy between the station boarding data provided by Amtrak and the OD data provided by Amtrak. To correct for this difference, and to ensure that the trip tables for a potential reroute on BNSF's Transcon line can be directly compared to the existing trip tables, the trip tables we have developed for the existing alignment factor the entire Amtrak OD trip table up by 2% across all OD pairs.

The proposed alternative alignment trip tables were developed by combining the distribution percentages described above for the new stations with the existing alignment OD data. The following methodology was implemented:

1. Begin with the existing alignment OD table.
2. Delete OD pairs associated with stations not on the proposed alignment.
3. Add in data for the new stations that matches the boarding totals and distributions developed for each new station.

This methodology assumes that identical station pairs on the existing and proposed alignment will have identical ridership irrespective of any changes in level-of-service caused by the new alignment. Given the nature of passengers utilizing rail for long-distance travel, and the magnitude of the level-of-service changes (i.e. the change in travel time will likely only be a few hours, and most certainly less than six hours), this is a very reasonable assumption.

Summary of Findings

Using the estimated ridership results the distribution of new station trips, ridership to all New Mexico stations was estimated for the year 2013. Table 15 shows the predicted ridership by trip purpose, and Table 16 shows the predicted ridership by origin and destination on the Transcon alternative compared to the existing SWC line for all New Mexico stations.

The net effect of the reroute would be a reduction in ridership associated with New Mexico by approximately 13,000 trips in 2013, but as discussed elsewhere these estimates do not include any existing riders to Lamy or Raton that might continue to use the Southwest Chief, nor does it include the potential for travelers to and from cities in southeastern New Mexico that are not on the proposed reroute to use the Southwest Chief. Business/commute and other trips would increase modestly on the reroute, while vacation and recreation trips would see a decrease of close to 15,000 trips. This high proportion of decrease in vacation and recreation travel is driven by the cessation of service to Lamy and Raton. However, it is likely that some of this traffic could be retained, which will be the subject of a separate analysis.

Table 15 Current SWC Ridership vs. Predicted Ridership for all New Mexico Stations by Trip Purpose

Station	Total	Business/ Commute	Other (Visiting Family/Friends, Personal, School)	Vacation/ Recreation
Current Ridership on Existing Route				
Gallup	15,600	1,092	11,076	3,432
Albuquerque	78,100	5,467	55,451	17,182
Lamy	12,600	630	5,670	6,300
Las Vegas	5,400	378	3,834	1,188
Raton	15,700	157	1,413	14,130
Belen	-	-	-	-
Vaughn	-	-	-	-

Station	Total	Business/ Commute	Other (Visiting Family/Friends, Personal, School)	Vacation/ Recreation
Clovis	-	-	-	-
Total	127,400	7,724	77,444	42,232
Predicted Ridership for Reroute				
Gallup	16,800	1,176	11,928	3,696
Albuquerque	79,800	5,586	56,658	17,556
Lamy	0	0	0	0
Las Vegas	0	0	0	0
Raton	0	0	0	0
Belen	7,800	546	5,538	1,716
Vaughn	2,600	182	1,846	572
Clovis	7,400	518	5,254	1,628
Total	114,400	8,008	81,224	25,168
Change in Ridership				
Gallup	1,200	84	852	264
Albuquerque	1,700	119	1,207	374
Lamy	-12,600	-630	-5,670	-6,300
Las Vegas	-5,400	-378	-3,834	-1,188
Raton	-15,700	-157	-1,413	-14,130
Belen	7,800	546	5,538	1,716
Vaughn	2,600	182	1,846	572
Clovis	7,400	518	5,254	1,628
Total	-13,000	284	3,780	-17,064

Table 16 Current SWC Ridership vs. Predicted Ridership for all New Mexico Stations by Origin and Destination

Station	Total	Origin	Destination
Current Ridership on Existing Route			
Gallup	15,600	8,112	7,488
Albuquerque	78,100	39,831	38,269
Lamy	12,600	1,890	10,710
Las Vegas	5,400	2,970	2,430
Raton	15,700	2,669	13,031
Belen	-	-	-
Vaughn	-	-	-
Clovis	-	-	-
Total	127,400	55,472	71,928

Station	Total	Origin	Destination
Predicted Ridership for Reroute			
Gallup	16,800	8,736	8,064
Albuquerque	79,800	40,698	39,102
Lamy	-	-	-
Las Vegas	-	-	-
Raton	-	-	-
Belen	7,800	4,290	3,510
Vaughn	2,600	1,430	1,170
Clovis	7,400	4,070	3,330
Total	114,400	59,224	55,176
Change in Ridership			
Gallup	1,200	624	576
Albuquerque	1,700	867	833
Lamy	-12,600	-1,890	-10,710
Las Vegas	-5,400	-2,970	-2,430
Raton	-15,700	-2,669	-13,031
Belen	7,800	4,290	3,510
Vaughn	2,600	1,430	1,170
Clovis	7,400	4,070	3,330
Total	-13,000	3,752	-16,752

Station Characteristics

The characteristics of each station along the current and potential SWC route are briefly described below.

Existing New Mexico Southwest Chief Stations

Lamy

The small town of Lamy (population 218 in 2010), New Mexico had a ridership of 12,600 in 2013, largely due to its close proximity to Santa Fe and Los Alamos. Approximately 85% of passengers using Lamy are visitors from elsewhere, the second highest percentage of any station served by the Southwest Chief. Connections to Santa Fe are serviced by a shuttle carrying 2,400 passengers annually. While there are no hotels located in the town of Lamy, this station also serves as the closest stop for both the Bandelier National Monument in Los Alamos and the Pecos National Historic Park. Although the Santa Fe Municipal Airport is closer to Lamy, most air travelers use Albuquerque with its far more extensive service.

Las Vegas

The 13,500 resident town of Las Vegas, New Mexico saw 5,400 board and alight the SWC in 2013. Local schools and universities include New Mexico Highlands University and the United World College. Albuquerque is the primary commercial airport serving the city, although the far smaller Santa Fe municipal airport is closer.

Raton

Raton, New Mexico currently has a ridership of 15,700 annually, of which more than 80 percent of the traffic is associated with the Philmont Ranch (approximately 9,400 passengers) and the connecting motor coach service (approximately 3,800) to Denver. In addition to Philmont Ranch, other popular destinations include Sugarite Canyon State Park, Capulin Volcano National Monument, Cimmaron Canyon State Park, and the National Rifle Association's Whittington Center. The major Denver and Albuquerque airports are equidistant from Raton, with Colorado Springs being closer.

Stations Located on Both Alignments

Albuquerque

Ridership at the Albuquerque, New Mexico station is anticipated to increase by 1,700 from 78,100 to 79,800 riders annually if the SWC were rerouted to BNSF's Transcon across Texas and Oklahoma. This net increase in volume is associated with ridership to and from the new SWC cities of Amarillo and Wichita, KS (approximately 4,800 riders) offsetting the loss of existing ridership to and from Lamy, Las Vegas, and Raton (3,100 riders). Half a million residents reside in the city of Albuquerque while the metropolitan area encompasses over 900,000 total residents. Albuquerque hosts the only major commercial airport in New Mexico, with the International Sunport handling around 6 million passengers annually in recent years.

Gallup

Ridership at the Gallup, New Mexico station is anticipated to increase by 1,200 from 15,600 to 16,800 due to the proposed new alignment of the SWC. With roughly 22,000 residents, there are numerous hotels for visitors along the historic Route 66. Gallup serves as the closest location for various national parks and monuments, including El Morro, El Mapais, Chaco Culture, Aztec Ruins, Canyon de Chelly, and the Hubbell Trading Post. Combined, these national sites receive over 1 million visitors annually, largely due to Canyon de Chelly's position as one of the most visited national monuments in the United States. The closest major commercial airport is Albuquerque.

Proposed New Mexico Southwest Chief Stations

Belen

Belen, New Mexico is projected to serve 7,800 riders with the new alignment of the SWC. Located approximately 35 miles south of Albuquerque, this town of 7,000 residents anchors the

southern extent of the Albuquerque metropolitan area. Since 2006, Belen has been the southern terminus for the Rail Runner Express that operates between Belen, Albuquerque and Santa Fe. While the Southwest Chief could carry passengers between Belen and Albuquerque, it is presumed potential riders would prefer to use the more frequent, and less expensive, Rail Runner Express service.

Vaughn

Vaughn, New Mexico is projected to serve 2,600 riders with a rerouted SWC. With a current population in the 400's, Vaughn and environs is not a significant tourist draw, with the closest outdoor recreational opportunity being White Sands National Monument, located 150 miles south of this town. The nearest commercial air service can be found in Albuquerque. Vaughn would be the closest Amtrak station to the New Mexico cities of Santa Rosa (39 miles away), Las Vegas (69 miles), Roswell (96 miles), and Artesia (130 miles). The model cannot estimate how many passengers to or from these cities would use an Amtrak station in Vaughn.

Clovis

Ridership in Clovis, New Mexico is projected at 7,400 with the new alignment of the SWC. With a population of nearly 40,000, Clovis is an essential air service community served by Clovis Municipal Airport, which has roughly 1,400 enplanements a year. The nearest major commercial airport is located in Amarillo. While some distance from national parks, a station at Clovis would service several universities including Embry-Riddle Aeronautical University at the nearby Cannon Air Force Base as well as Eastern New Mexico University 20 miles to the south. Clovis would be the closest Amtrak station to the New Mexico cities of Portales (18 miles away), Tucumcari (83 miles) Lovington (102 miles), and Hobbs (116 miles). The model cannot estimate how many passengers to or from these cities would use an Amtrak station in Clovis.

Model Limitations

By the very nature of the approach used for this analysis, with its lack of data on actual travel demand between the markets that are being examined, the projected ridership should be viewed as a rough outline for what might be expected to occur. They are reflective of the typical performance of the SWC and the other Amtrak Chicago – West Coast long distance trains in similar markets, and thus do provide a reasonable indication of what might be expected.

There are a number of short-comings to the approach that should be explicitly mentioned. We only used existing rail ridership travel data, including level-of-service and travel demand, to assess the overall demand for travel by rail on the proposed route. We did not use level-of-service data and travel demand on competing modes such as air and auto for either the existing or the Transcon route. This meant that we could not develop a more detailed travel demand model to assess diversion between the various modes. This means that our analysis used very

little data pertaining to air, auto, and rail travel times, travel costs, and frequency of service, and availability of alternatives.

In addition, as described above, we attempted to develop a number of different types of variables to test in our ridership regression equations that represented station-level characteristics. These variables were limited by the data and the level of geographic granularity that was available to us. Thus, while we found certain results from the ridership estimation, it is unclear whether the lack of a particular variable that may affect ridership is the result of the station-level characteristic truly having no influence on rail ridership, or whether it is a function of the nature of the variable tested.

For example, we found that the population outside of a 10 mile radius from a station did not significantly influence ridership at that station. It is possible that the unit of geography (i.e. county or zip codes with centroids within a certain distance of a station) did not adequately capture nearby populations, or that the population within 10 miles of a station was correlated with farther out populations such that the farther away population variable was insignificant when tested with the closer in population variable. It's also possible that the nature of rail ridership is such that rail is mostly an attractive modal option if the origin or destination is close to the rail station. Without more detailed data on the actual origins and destinations of rail passengers, it is difficult to assess why these variables did not influence rail ridership.

Because the model's estimates of origins, destinations, and overall station ridership are insensitive to population and employment located outside a short radius from each station, the model cannot be used to predict the number of passengers presently using Lamy as a destination for trips to Santa Fe that would still make their trip and take the Southwest Chief to Albuquerque if the SWC were rerouted through Amarillo. Similarly, the model cannot predict how many Boy Scouts destined for the Philmont Scout Ranch would still make their trip and take the Southwest Chief to Albuquerque, Amarillo, or some other station and complete their trip via bus. Also, the potential for the Vaughn and Clovis stations on the rerouted alignment to attract ridership to or from New Mexico cities such as Roswell, Hobbs, Portales, Santa Rosa, or Las Vegas cannot be estimated by the model.

Lastly, the model cannot capture any potential gains or losses in ridership based simply on the train's route. There is anecdotal evidence that some routes attract disproportionate ridership based on scenery. While the existing SWC alignment and its proposed realignment are of similar length and are presumed to have similar travel times, the existing SWC alignment across Colorado and northern New Mexico passes through two historic and scenic mountain passes, Raton Pass and Glorieta Pass, while the reroute would follow less scenically attractive terrain.