Las Cruces – El Paso Commuter Rail

South Central Regional Transit District
Passenger Rail Feasibility Study

Center for Neighborhood Technology

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I.   Executive Summary

The South Central Regional Transit District (SCRTD) of New Mexico has engaged a consulting team led by the Center for Neighborhood Technology to study the feasibility of establishing a passenger rail service between Las Cruces, New Mexico and El Paso, Texas. The following report presents the findings of this study.

An Adequate Socio-Economic Base for Commuter Rail Transit: With a growing population of more than a million New Mexico and Texas residents, a diverse and growing economy that features science-based as well as traditional industrial business sectors, anchoring institutions that include two leading research universities, and participation in the largest bi-national metropolitan area on the US-Mexican border, the Las Cruces – El Paso corridor has a more than adequate demographic and economic base to support a commuter rail service. Furthermore, in a fourteen-mile wide corridor that encases the proposed rail line, more approximately 60% of households spend more than 45% of their income on the combined costs of housing and transportation. The region has a strong economic need as well as opportunity for a new service that can reduce transportation costs.

Indications of Weak Demand for Current Service But Strong Public Support for Improved Transit: Over the past five years bus-based municipal transit services in Las Cruces and El Paso, as well as a state-sponsored commuter bus service have experienced essentially flat ridership. However, the new SCRTD inter-community bus service is growing rapidly; the City of El Paso is implementing bus rapid transit services; the long range transportation plans of the Las Cruces and El Paso regions call for the establishment of fixed guideway transit services that will anchor development. In the course of this study approximately 200 Doña Ana County residents attended two public meetings about proposed rail transit service, and more than 1,000 residents completed an on-line\paper survey with 87% stating their desire to ride a rail transit service. A new rail transit service will need to overcome travel patterns and a built environment in which cars have been the only viable means of transportation for decades, but a strong public will and emerging programs exist to make this change.

The Question of the BNSF Railway's Position: The proposed commuter rail service would operate on a 43- mile-long segment of the BNSF Railway's "El Paso Subdivision" track. The BNSF's volume of freight movement on this line is currently light by any standard, which may incline the railroad to reach a shared use agreement or sale of the rail infrastructure on moderate terms. At the same time, this rail segment ends in the only rail crossing of the US-Mexican border that BNSF owns. If the railroad plans a strategic initiative to capture freight movement to and from Mexico, its price to share infrastructure with a passenger rail service may be significantly higher. BNSF's position will only be made clear in serious negotiations with SCRTD and other public sector partners, and its stance will have a major impact on capital requirements to establish the rail service.

The Challenge of Feasibility: The central question of this study is whether or not an adequate demographic and economic base to support commuter rail, coupled with a strong public will to establish such a service, can overcome entrenched patterns of car dependence and the possibility that the BNSF Railway may price its rail infrastructure beyond its current economic value. This question may be

answered in favor of new rail transit service if the service can be planned with an accurate understanding of its market and the lessons of comparable railroads, and if it can be planned to operate with maximum value to the community, creativity in its financing and marketing, and efficiency in its operations. It is in this context that the study addresses the technical issues of feasibility: projected ridership, service schedules, station area conditions, capital requirements, operating costs, collateral development, funding and financing.

Projected Ridership: Ridership was estimated primarily using a sketch model specifically designed for commuter rail ridership projections and published by the Transportation Research Board. Inputs to this model are demographic, socio-economic, and land use conditions of the Las Cruces – El Paso corridor. Its projected ridership for the Las Cruces – El Paso corridor falls within the range of 4,452 to 7,403 average daily riders, which is in the upper middle ridership level for 10 comparable commuter rail services. A critical factor in projections of ridership within this range is whether or not the terminal stations of the commuter rail line are "transit centers", meaning that they are connected to 4 or more bus lines and/or are located in a thriving central business district.

Service Plan and Schedule: To serve this ridership with minimum capital investment, the CNT team has proposed alternative service schedules that provide 8, 9, or 10 weekday round trips between Las Cruces and El Paso. Under each schedule trains would arrive before 8:00 a.m. at both terminal stations; a mix of express and all stop trains would be provided; travel times for a train run would range between 52 and 72 minutes. Within the range of the three service alternatives, the time elapsed between train arrivals (aka headways) would vary from 30 to 60 minutes during peak periods and remain constant at 120 minutes for midday service.

Station Area Conditions: Eight stations are proposed for the passenger service line: Las Cruces, Mesilla Park, Berino/Vado, Anthony, Canutillo, Montoya, Sunland Park, and El Paso. Today none of the half-mile radius areas around these stations could be described as a transit-oriented development (TOD). They lack a balanced mix of housing and amenities or intensive development; their infrastructure is oriented to car traffic rather than pedestrians; they have substantial blocks of vacant land. This is true of the terminal station areas as well as the intermediate stops. Currently the terminal stations do not qualify as "transit centers" because they are neither business centers nor connected to four or more bus lines. However, both terminal stations are within a mile of a multi-route bus center; they lie on the periphery of their respective central business districts; and they are each the subject of an intensive TOD plan supported by their local governments. So both terminals could become transit centers with the execution of development plans and\or readily achievable additions to their bus connectivity. Among intermediate station stations: Anthony has planned an ambitious downtown redevelopment plan that includes a rail station; Sunland Park is expected to gain population rapidly from ongoing, nearby development; Mesilla Park's value as a transit center could be sharply increased with improved connectivity to New Mexico State University. Each of the station areas contains sufficient vacant land to provide sites for new development and commuter parking.

Capital Requirements: The estimated capital requirements to establish the Las Cruces to El Paso passenger rail service fall into two categories: investments that will depend heavily on the value BNSF

places on the line for freight movement and investment for items that the passenger rail service's management may make on the basis of their market knowledge and business philosophy with little reference to BNSF.

- Capital requirements heavily influenced by BNSF include: the basic right to use the rail infrastructure, which might be conveyed by a shared use agreement or purchase of the rail line, the degree to which rail infrastructure would be upgraded to support additional freight movement and passenger service, and whether BNSF would agree to lease existing maintenance yard space to the passenger service. Depending on how BNSF values this line segment, the costs of use or acquisition might vary from $120 Million to $430 Million.
- Capital requirements about which passenger rail managers may make decisions on the basis of market information and the experience of comparable railroads, with little influence from BNSF, include the acquisition of rolling stock (locomotives and passenger cars) and the development of train stations. The range of these requirements is $22.6 Million to $74.8 Million, depending largely on whether the passenger railroad purchases used or new equipment. If used equipment is selected the passenger service will need to be prepared for higher maintenance and risk management costs.
- Total capital requirements may vary within a range of $142.6 Million to $505.4 Million.

Net Operating Costs: Costs to operate the Las Cruces - El Paso passenger rail service have been estimated by analyzing the operating costs of 9 comparable railroads:

- Estimated on the basis of annual operating costs relative to annual ridership, the Las Cruces – El Paso line's annual operating costs may be expected to range from $16.8 Million to $21.3 Million, depending on the level of ridership.
- Estimated on the basis of cost per revenue mile, the proposed line's annual operating costs are likely to range from $12.6 to $13.2 Million, depending on the service plan followed.
- Estimated on the basis of comparable railroad fares and revenues, the median estimated one-way fare for this line would be $3.60, and fare box recovery would be in the range of 28% to 43%.

Collateral Benefits: In addition to providing a desired transit service for thousands of residents, the Las Cruces – El Paso passenger rail service would stimulate transit-oriented development (TOD) in its station areas. Estimating the scale of this development would require a study at least as extensive as the present rail feasibility study. However, as an order of magnitude, it would be expected that over a decade intensively developing a half mile radius area, that is now largely undeveloped, in the approximate center of two cities and six towns would entail hundreds of millions of dollars in investments, the formation of dozens of small businesses, the construction of thousands of housing units, and the creation of thousands of jobs. The development would substantially alter the economic and land use patterns of the corridor. Additional direct benefits that may be estimated more readily are the impacts of predicable numbers of workers commuting by rail instead of car. On an annual basis these impacts include:

- $442,226 – Public Road Construction and Maintenance Costs
- $11,055,659 – Congestion Reduction Costs
- $ 2,653,358 – Accident Reduction Costs

- $1, 211,700 - Air Pollution Health Impact Costs
  $15,362,943 – Total Avoided Costs

In addition to these public benefits, the households of commuters who choose rail over driving alone would realize average savings of approximately $9,800 per year and collective savings of approximately $35 million per annum.

Recommended Financing and Development Steps: CNT's analysis indicates that the Las Cruces-El Paso rail service could operate successfully on a basis similar to comparable commuter rail services if the large capital requirement, including compensation to BNSF can be managed. At this stage, which is still early in the planning of the passenger rail system, CNT recommends that the SCRTD take the following strategic and inter-related steps to meet the capital requirements and other challenges of developing this service.

- **Establish a partnership for the development of the passenger rail line with the governmental and transportation management institutions of El Paso.** Such a partnership appears desirable in light of several facts: El Paso has as much or more to gain from the creation of the proposed service and substantially more resources to move toward its implementation. El Paso shares Doña Ana County's commitment to sustainable development and is implementing fixed guideway transit services. Bi-state transit authorities have record of successfully operating commuter rail services, as exemplified by the Southeastern Pennsylvania Transportation Authority (SEPTA) and the Downeaster Railroad of the Northern New England Passenger Rail Authority (NNEPRA). In some cases interstate cooperation encouraged by the federal government can provide a competitive advantage in the pursuit of funding.

- **Make collateral transit-oriented development (TOD) an integral part of passenger rail development; explore value-capture financing.** The analysis of this study has underscored the well-known relationship between station area development, including access to jobs, and the successful rail transit operations. Station areas in the Las Cruces – El Paso corridor are now consistently under-developed but have strong TOD potential, given establishment of the proposed rail service. Linking station area development to transit development is not only necessary to build ridership, but it generates multiple opportunities for public and private funding and financing. In an optimal development financing scenario, station areas across the corridor would be integrated in a zone within which some part of the incremental economic value generated by the rail service would be used to finance the development of that service. SCRTD and its partners should consider engaging legal counsel to consider how an approximation of such a value capture scenario could be implemented in light of the Anti-Donation Clause in New Mexico's state constitution.

- **Consider engaging a shortline railroad as a negotiating and operating partner.** Shortline railroads today include rail holding companies that operate both passenger and freight services. Such a company might be a valuable partner in the negotiations of SCRTD and its partners with BNSF. Under some scenarios that could include BNSF's sale of the rail line segment, a shortline railroad might be an operator of both freight and passenger services, ensuring smooth connections between these functions.

- **Position the passenger rail service for the broadest range of opportunities in federal and state funding.** SCRTD and its partners should, of course, pursue federal transportation funding opportunities including the Federal Transit Administration's Small Starts program and other FTA funding opportunities. SCRTD and its partners should also develop positions to apply for TIGER and Fast Lane funding or such programs with similar goals as may emerge from Congress in the near future. While the New Mexico DOT has expressed a disinterest in making further investments in the rail network, particularly if these would encumber NMDOT resources in rail ownership or management, the State may be a valuable and willing partner in the pursuit of federal funding for transportation improvement projects. By linking passenger rail development to TOD and potentially freight operations, the SCRTD partnership would potentially gain access to a broader range of funding opportunities, including programs of the Economic Development Administration (EDA), Housing and Urban Development Administration (HUD), and the Environmental Protection Association (EPA). Through public private partnerships, SCRTD and its associates may also qualify for federal financing on extremely favorable terms through the undersubscribed and potentially expanding programs of the Railroad Rehabilitation & Improvement Financing (RRIF) and the Transportation Infrastructure Finance and Innovation Act (TIFIA).
- **Creatively Pursue Niche Ridership Markets.** Certainly finance and development come before rider marketing, but the Las Cruces-El Paso service would have a rich range of special market opportunities, and the incorporation of marketing programs to reach these audiences the commuter service's business plan could strengthen its case for development resources. Niche opportunities include:
  o College students who might be engaged through U-Pass programs in which universities provide transit access as a student amenity, providing the transit agency with institutional customers and building the ridership base
  o Mexican nationals who might benefit from the recent expansion of the border area zone allowing free access as far into the US as Las Cruces
  o Special service offerings for the elderly, a rapidly growing segment of the corridor's population
  o Mobilization of the strong public interest in passenger rail into a booster organization that would encourage ridership and contribute to positive rider experiences

II. Introduction

The heavily travelled corridor between Las Cruces and El Paso, crossing county and state lines, is an area of opportunity for the South Central Regional Transit District (SCRTD) to expand equitable transportation options in this by-state region. This study analyzes the feasibility of establishing a commuter rail service as a major element of these expanded options.

A. Purpose of the Study

SCRTD contracted Center for Neighborhood Technology (CNT) to carry out the following tasks through this study:

1. Assess some of the base line conditions in the Las Cruces – El Paso Corridor that would affect and be affected by a new passenger rail transportation service including: demographic and economic characteristics of the Corridor's communities and the role and condition of its transportation systems, including the freight rail line of the BNSF Railway at the Corridor's center.
2. Propose a passenger rail service plan, including estimated ridership and planned schedules, that would meet some basic community needs and enhance the Corridor communities' opportunities for sustainable development;
3. Propose an operations plan, including recommended types and amounts of rolling stock that would implement the service plan, with the lowest cost that would ensure quality service.
4. Propose a financial plan, with estimated capital and operating costs, which would enable realization of the operations plan.
5. Carry out the tasks of the study with extensive community involvement.
6. Estimate the major economic and environmental benefits that would be likely to follow from the creation of proposed passenger rail service.
7. Recommend a negotiating position with the BNSF Railway for realization of the proposed rail service.

B. Project Team

The Center for Neighborhood Technology (CNT) is the primary author and prime contractor of this study. CNT is a forty-year-old not-for-profit organization that performs research and manages pilot projects in order to simultaneously improve the economies and natural environments of communities and regions. CNT is an experienced planner of transit-oriented developments and transit services that fulfill its economic and environmental mission. In this study CNT has received valuable support from three subcontractor organizations: Iowa Pacific Railroad Corporation, Prime Focus LLC, and Ngage New Mexico.

Iowa Pacific Railroad Corporation is an operator of short-line railroads that perform passenger and freight services. Iowa Pacific has provided technical advice to CNT on the capital and operating costs of the proposed El Paso – Las Cruces rail service.

Prime Focus LLC is led by its principal Elizabeth Ogard, who is a career manager of rail and trucking services, with years of management experience in the BNSF Railway. Ms. Ogard has provided CNT with advice on rail operations and costs and guidance in preparing an approach to BNSF.

Ngage New Mexico, the Las Cruces – based public engagement firm, provided a dimension of public involvement with the project, organizing well-attended public meetings and conducting a survey completed by over 1,000 potential passengers of the rail service.

C. Regional Impact

Doña Ana and El Paso counties have a high economic dependency on each other – approximately 11,500 jobs in El Paso are held by residents of Doña Ana county and 4,600 residents of El Paso city work in Doña Ana County, per the 2014 Longitudinal Employment Household Data (LEHD). On average, 80% of these commuting trips were made by single occupancy vehicles and a very small percent of these trips were made by public transportation. Yet it is notable that 9.7% and 12% of all commuting trips made by Doña Ana County and El Paso city residents are made by carpooling, indicating openness to ways of commuting other than driving alone. El Paso and La Cruces also contain a combined population of over 45,000 university and technical college students, a prime transit customer group. These segments of the population, along with the growing percentage of elderly residents[1] indicate a latent market for transit services.

Doña Ana County is projected to add 72,000[2] more residents by 2040 and 9,380[3] new jobs by 2022. The El Paso area's population is expected to swell to 1.2 million by 2040, with a gain of 138,000[4] additional jobs. An essential part of attracting new jobs and companies to improve the economy is to provide transportation options and adding rail transit will increase the attractiveness of the Doña Ana – El Paso region.

Viva Doña Ana, the Doña Ana County Comprehensive Plan, and the Long Range Transportation Plan of southeast New Mexico's Metropolitan Planning Organization (MPO) all include goals to increase access to public transportation, improve air quality, decrease household transportation costs and promote public health.

D. Study Area

The Corridor that is the study area of this project is centered on the 42-mile existing BNSF freight rail line that connects El Paso's Union Station to Las Cruces, running parallel to I-25. A passenger rail

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[1] One Valley One Vision 2040 – Doña Ana County Plan Regional Plan
[2] Transport 2040: Metropolitan Transportation Plan Update, Mesilla Valley MPO, 2015
[3] New Mexico 2015: State of the Workforce Report, New Mexico Department of Workforce Solutions
[4] Horizon 2040:Metropolitan Transportation Plan, El Paso MPO

service that used this infrastructure would connect the major activity centers of El Paso and Las Cruces, and provide service to Sunland Park, Montoya, Canutillo, Anthony, Berino and Vado.

Figure 1: Proposed Passenger Rail Line
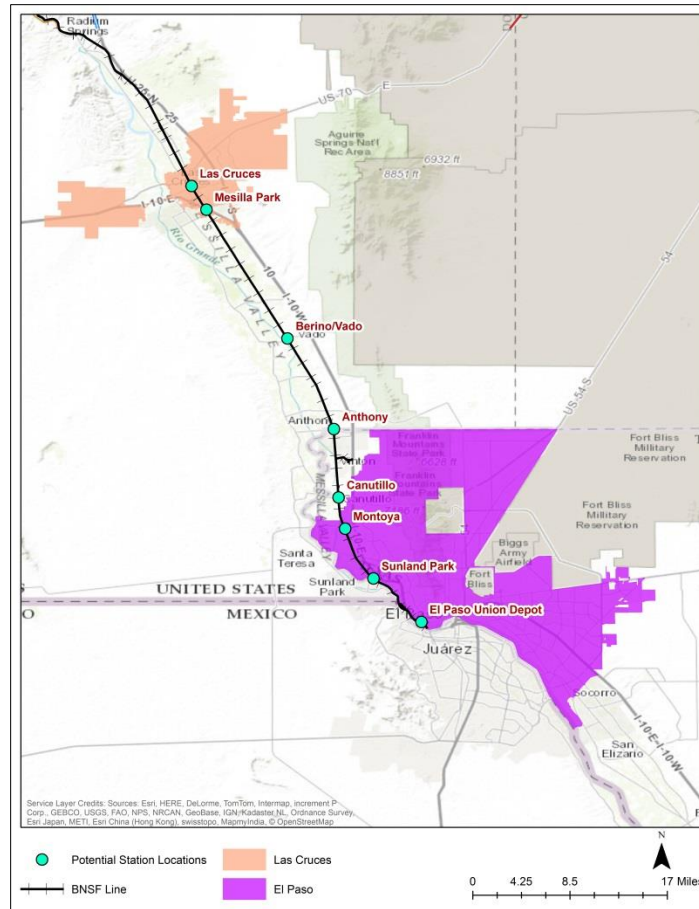
Table 1: Population Growth

	2000 Census	2014 ACS	Population Change
El Paso	563,662	669,771	18.8%
Sunland Park	13,309	14,794	11.2%
Canutillo	5,129	6,091	18.8%
Anthony	7,904	9,462	19.7%
Vado	3,003	2,781	-7.4%
Berino	No data	1,674	-
Mesilla Park	2,180	2,364	8.4%
Las Cruces	74,267	100,360	35.1%
Total	**669,454**	**807,297**	**20.6%**

Communities along the Corridor are growing – since 2000 population increased by 20 percent and is expected to add another 20 percent by 2030. Population and job density is the highest along I-10 & I-25 expressways and in particular within the city limits of El Paso, Las Cruces and Anthony.

Land uses along the Corridor include agricultural, residential, commercial and industrial. Due to the terrain conditions and rural nature, population density is highest in El Paso, Anthony & Las Cruces. An extensive description of the demographic, economic, and land use features of the proposed rail service corridor is provided in Section II of this report.

E. 2009 Study

A feasibility analysis for the proposed rail service was conducted by Connetics Transportation Group in 2009. The study made recommendations on station locations, operating statistics, capital costs, operational costs and potential ridership. The CNT team has updated all the data from the 2009 study and built on it, adding additional dimensions of analysis including:

- A broader consideration of the demographic and economic conditions of the passenger rail service corridor;
- Input from public meetings attended by some 200 participants and a survey completed by over 1,000 service corridor residents and stakeholders;
- A more systematic analysis of 10 comparable commuter railroads, based on their operating data recorded in the National Transportation Database;
- The application of a national sketch model for projecting commuter rail ridership that considers conditions of transit connectivity and station area demographics.
- Analyses of investment options and cost estimates based on relevant data drawn from the National Transportation Database

While adding these analyses, CNT has been pleased that some of its important findings – including estimates of ridership and some capital and operating costs – are close to the results of the 2009 study or are readily explicable in light of the additional or more current data that CNT has considered.

F. Qualitative Research and Public Engagement

In this study CNT has reviewed an extensive set of reports and plans that document economic and social conditions, along with existing transportation infrastructure and services. CNT also conducted more than twenty interviews with transportation and economic development officials, scholars, and corporate managers to deepen our understanding of the study area.

Ngage New Mexico organized two public meetings in April 2016 (in Las Cruces & Anthony) with a total attendance of approximately 200 participants between the two sessions. At the meetings CNT presented an overview of the line alignment, cities and towns served, some background information on existing demographic and economic conditions in the service area, and data on comparable commuter rail lines in other regions. The larger portion of time at both meetings was devoted to

questions, answers, and comments. The clear majority of participants' comments were supportive of commuter rail as a service that could save household time and money, stimulate existing business and new development in the service areas, preserve air quality, and provide a low-stress means of transportation for recreation and social trips as well as commuting to jobs and education. A minority of participants voiced concern about the potential public costs of the rail service, citing the Albuquerque to Taos Rail Runner service, which was described as generating a large debt and high operating costs.

Ngage New Mexico conducted a survey to gauge the acceptance of the proposed passenger rail line, the reasons for which passengers would use the line, possible difficulties that would make potential passengers unwilling or unable to use the service and a reasonable fare for the service. Although the survey was not designed to secure a representative sample of public opinion, it received over 1,000 responses, and individual questions received an average 90% response rate. 87% of the respondents said they would use the rail service between Las Cruces & El Paso. Work commute and college trips were the most commonly given uses for daily travel; 61% of respondents would commute to work daily, and 35% would travel to college each day. Over 90% of respondents would also use the train occasionally for recreation, social trips or appointments. Over 80% of survey respondents would travel between the terminal stations of Las Cruces and El Paso, rather than using intermediate stations. Many respondents care about saving time, which means that service to intermediate stops should be carefully chosen to maximize ridership while not deterring time-saving commuters. The responses from the surveys have informed estimates of ridership and proposals for service schedules and fares. A summary of all survey responses is provided in Appendix A.

Figure 2: Survey Findings: Purpose of Rail Travel
Commuter Rail Survey

Q3 **For what purpose would you travel by train?**

Answered: 915   Skipped: 90

Las Cruces-El Paso Commuter Rail Feasibility Study
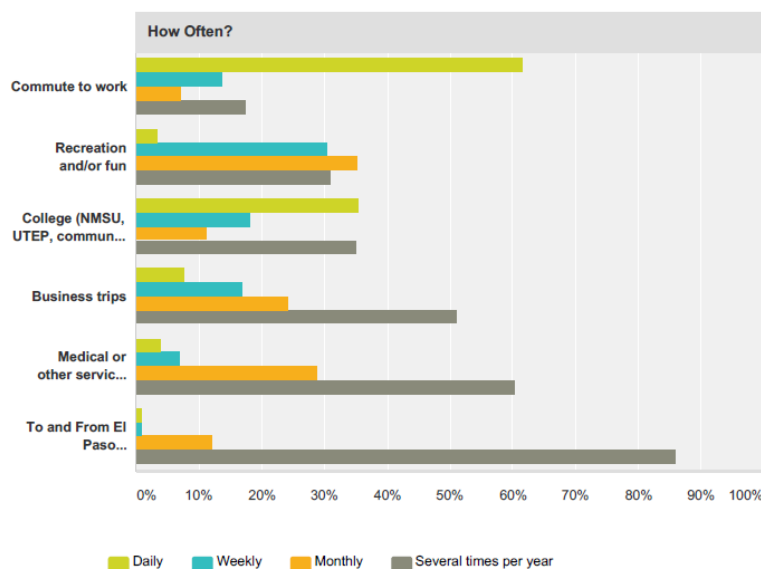
III.   Corridor Snapshot: Demography & Economy

A.   Population, Age Segmentation, Income & Educational Attainment

Between 2000 and 2015, the population of Las Cruces increased 36.2% from 74,267 to 101,164. Half of the County population lives in Las Cruces. 19% of the County lives in rural areas, and the remainder in the other municipalities. The overall population of Doña Ana County increased 22.5% from 2000 (174,682) to 2015 (213,963), according to the Long Range Transportation Plan of the Mesilla Valley Planning Authority, the Metropolitan Planning Organization (MPO) of the County. Two large contributors to this increase have been the growing retiree population and the presence of Doña Ana Community College and New Mexico State University, which have a combined enrollment of approximately 25,000 students. The U.S. Census Bureau projects that New Mexico's, population of residents over 65 will increase by 141% from 1995 to 2025. As New Mexico's second largest city with an attractive climate, medical and educational centers, access to El Paso, and viable public transportation, the Las Cruces area can expect to participate in this senior population growth at the same rate as the entire state or a higher rate.

From 2000 to 2010, the El Paso County population increased from 759,632 residents to 800,647 residents for a compounded annual growth rate (CAGR) of 1.65 percent. Comparatively, Doña Ana's population growth was even more significant with a CAGR of 1.82 percent. By 2030, the El Paso MPO region is projected to reach a population of one million, which will require the construction of an additional 143,000 homes.

Within these two regions, the area of most immediate concern for passenger rail feasibility is a corridor of seven miles radius around the BNSF rail line, the proposed passenger rail service route. This corridor encompasses the large bulk of Doña Ana County's population, including virtually all of its areas of population density and a growing sector of the El Paso metropolitan area. The growing senior population in both regions is disproportionately located within the corridor. Currently high percentages of the corridor population are low income households and have low levels of education. However, these aspects of the corridor's demography are likely to change rapidly, as university attendance and jobs requiring a college education are driving factors in the corridor's population and economy.

Table 2: 7-mile radius corridor demographic data

Population	456,885
Jobs	215,580
Population – Under 18	118,477
Percent Population – Under 18	26%
Population – Over 65	60,260
Percent Population – Over 65	13%
Households	157,217
Median Income	$45,410
HH making less than 15k Income	31,099
Percent HH making less than 15k Income	20%
Educational Attainment – HS or less	123,814
Educational Attainment – Percent HS or less	27%

Figure 3: Population per Square Mile & Population over 65 per Census Block Group
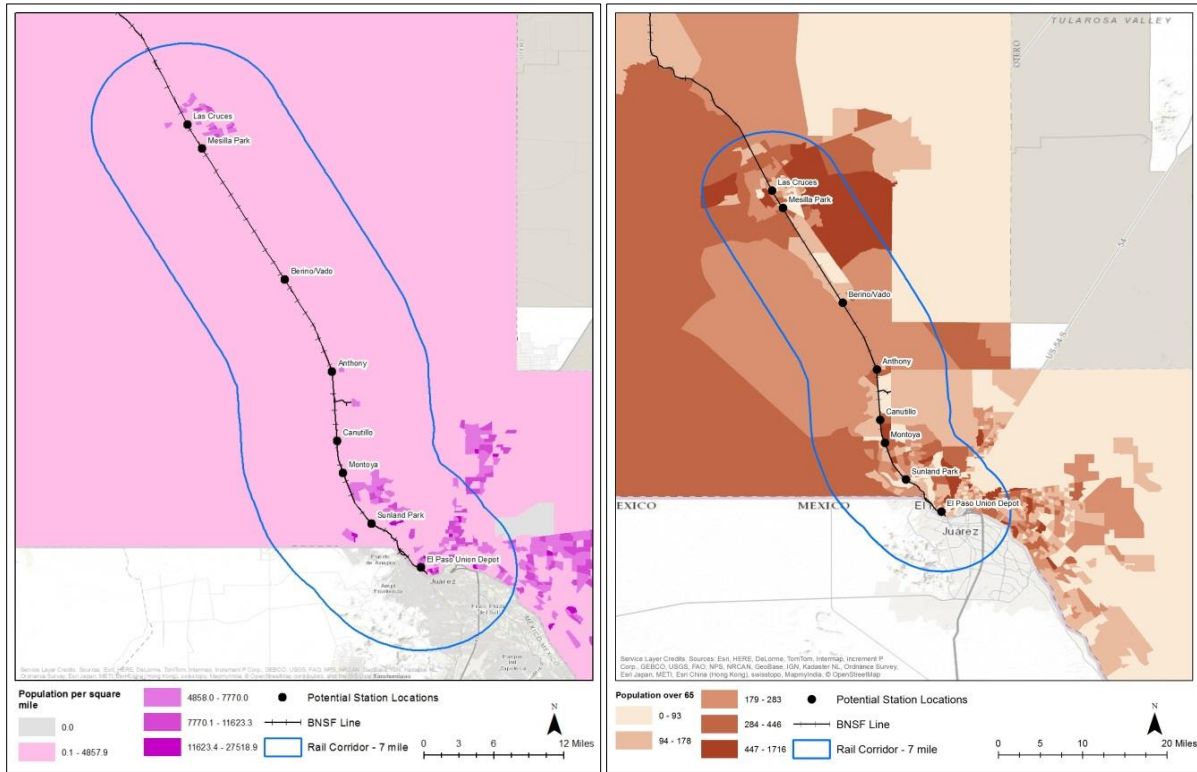
Figure 4: Distribution of Low-Income Households & Population with High School or Less by Census Block Group
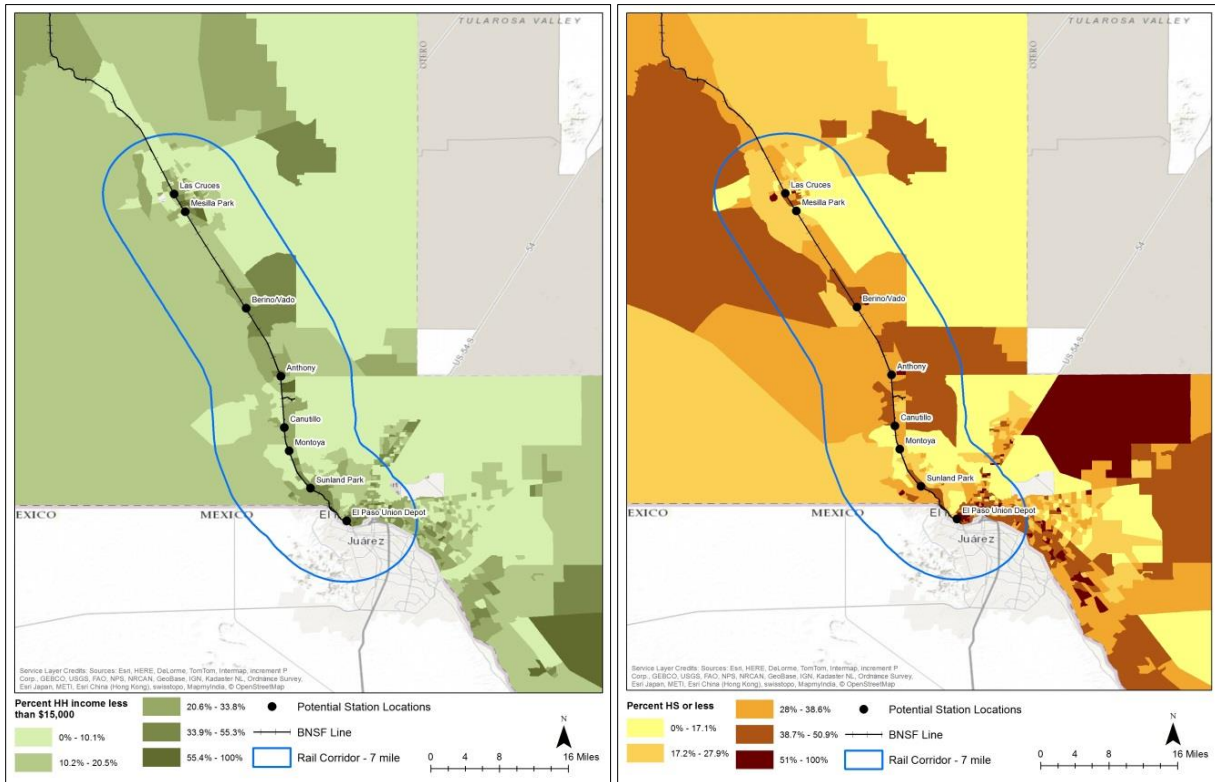
B. Employment – Trends & Sector Analysis

The New Mexico Department of Workforce Solution's 2015 "State of the Workforce Report," projected that employment in the Las Cruces region would increase from 75,450 to 84,830, representing growth of 12.4 percent or 9,380 new jobs, making it the center for employment growth in the Southeastern area of the state. Within the Las Cruces region, the construction, wholesale trade, retail trade, finance and insurance, and the professional, scientific, and technical services sectors are anticipated to experience the greatest growth. Currently, the largest employment sectors in Doña Ana County are Education and Health Services (34%), Retail Trade (11%), Public Administration (10%), and Arts/Entertainment, Food, and Recreational Services (10%). Several examples of major employers include the, City of Las Cruces, Gadsden Independent School District, Memorial Medical Center, Las Cruces Public Schools, New Mexico State University, and White Sands Missile Range.

The El Paso MPO has projected that by 2030 the region will gain approximately 138,000 jobs, thereby expanding the job base by 47 percent. The MPO's projections demonstrate that the region's job base is expected to grow at the same rate as its population. Between 2003 and 2013, the largest sector for employment growth in El Paso County was Health Care and Social Assistance (12,919 new jobs), followed by Accommodation and Food Services (10,751 new jobs), Public Administration (6,044 new jobs), Retail Trade (5,766 new jobs), and Professional, Scientific, and Technical Services (4,423 new jobs).

The aerospace research, testing, and development industry is a major driver of the regional economy. Spaceport America, White Sands Missile Range, the NASA White Sands Test Facility, the New Mexico State University Physical Science Laboratory, the Technical Analysis and Applications UAS Flight Center, Holloman Air Force Base, the X-Prize Cup Competition, Las Cruces International Airport, and El Paso International Airport are all located along the Las Cruces-El Paso corridor.

C. Population & Employment Projections

Population

University of New Mexico's Bureau of Business and Economic Research projects that by 2040 some 86,000 new residents will call Doña Ana County home. Since 2010 the County has not experienced growth at the rate of previous projections, but population growth continues, adding thousands of new residents per year. The One, Valley, One Vision planning process has observed a preference for smaller lot developments served by public transportation in the region which is similar to national trends noticed amongst downsizing baby boomers and millennials. The cohort above 65 years of age will continue to increase between 2010 & 2040 and make up a larger share of the population. In 2010 news service CNBC ranked Las Cruces as number two on "America's top place to retire" list.

Table 3: Doña Ana County Population Projections

2010	2015	2020	2025	2030	2035	2040
210,536	226,855	243,164	258,887	273,513	286,818	299,088

Source: Mesilla MPO MTP, Projections by Bureau of Business and Economic Research, University of New Mexico

The population of the El Paso MPO area is expected to reach one million by 2030 and 1.1 million by 2040, requiring 143,000 new homes to be built to accommodate the growth. The MPO expects more residents to live in or close to the central city as the downtown area becomes denser and commuting costs in the region increase.

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Table 4: El Paso MPO Population Projections

	2007	2010	2020	2030	2040
Population	786,560	832,836	951,072	1,060,674	1,158,195
Housing	256,198	270,326	314,789	358,115	399,153
Employment	291,878	306,656	340,998	382,021	429,455

Source: El Paso MPO

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Employment

The New Mexico Department of Workforce Solution's 2015 "State of the Workforce Report," projected that employment in the Las Cruces region would increase from 75,450 to 84,830, between 2012 & 2022, representing growth of 12.4 percent or 9,380 new jobs, making it the center for employment growth in the southeastern area of the state. Within the Las Cruces region, the construction, wholesale trade, retail trade, finance and insurance, and the professional, scientific, and technical services sectors are anticipated to experience the greatest growth.

By 2030, the El Paso MPO has projected that the region will gain approximately 138,000 new jobs, thereby expanding the job base by 47 percent. The MPO's projections demonstrate that the region's job base is expected to grow at the same rate as its population.

Generally, the El Paso MPO anticipates that the majority of population growth will occur outside of the urban center, with some growth extending along the Northwest branch of I-10 towards Las Cruces. However, the majority of employment growth will occur in the downtown area of El Paso, meaning that more people will have to travel further in order to reach employment. These projections demonstrate the potential to capture these new workers as train commuters and are in keeping with current commuter trends. As noted in the introduction to this report, approximately 18,000 people currently travel between El Paso and Doña Ana County for work on an average day. 11,857 of these commuters begin their trips in Doña Ana (5.7% of the County population), and they hold 3.9% of El Paso County's 304,939 total jobs. Comparatively, 6,521, or less than 1%, of the El Paso County population travels to Doña Ana County for work. The combination of trends in knowledge-based industry growth and residential development are likely to increase the pool of commuters who could become rail service passengers.

D. Housing & Transportation Costs

Traditionally affordability was measured as the cost of housing not exceeding 30% of income. CNT's Housing and Transportation Index combines housing and transportation costs to provide an expanded view of affordability (not more than 45% of income for housing + transportation). Residents of Doña Ana and El Paso counties on average pay more than 60% of their income towards

housing and transportation costs[5]. However, communities along the proposed rail corridor are the region's most affordable for their residents, primarily because these relatively urban neighborhoods have the regions' best access to transit and amenities within walking distance; so that resident households can live without owning a car for every working adult. The proposed rail transit service would significantly heighten this advantage.

Figure 5: Housing & Transportation Costs as Percent of Income
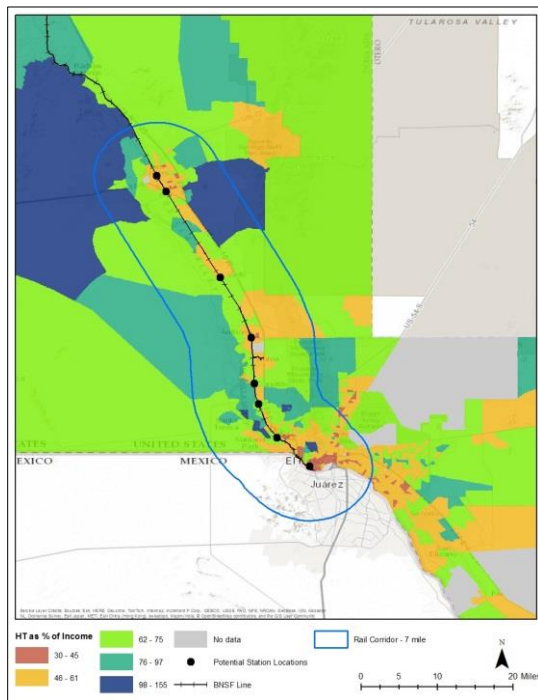
The residents living along the proposed commuter line pay upwards of $12,000 per year towards transportation costs. Providing better public transportation can significantly reduce these expenses. The areas of red in the map below are census block groups in which residents pay between $14,000 & $17,500 per year for transportation. It is prudent to provide transit feeder connections to the proposed commuter line from the surrounding areas to relieve their burden and to make the commuter rail more effective.

Figure 6: Annual Transportation Costs
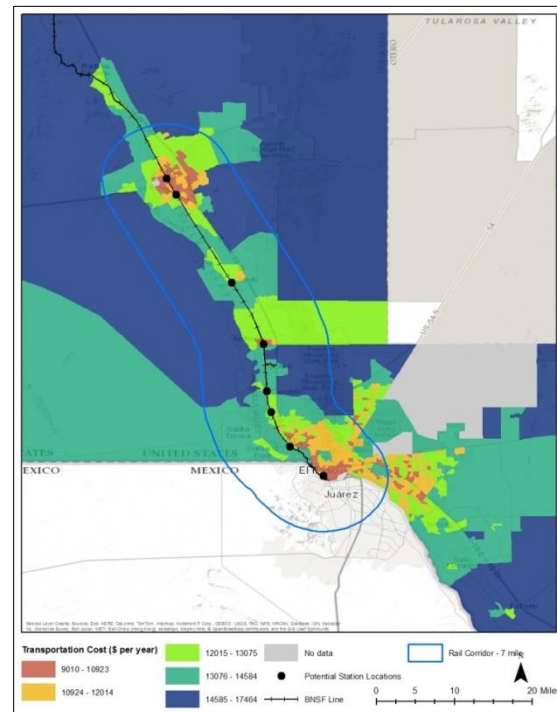
Ninety percent of all commuters living within the city of El Paso live within ½ mile of transit compared to 77% of the CBSA commuters. This access to transit reduces annual transportation costs for the city residents ($11,986) compared to the CBSA residents ($12,295).

Seventy one percent of all commuters living within the city of Las Cruces live within ½ mile of transit compared to 41% of the CBSA commuters. Residents of the city have lower transportation costs ($11,367) than CBSA residents ($12,319).

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[5] Center for Neighborhood Technology 2013 H+T® Index

Las Cruces-El Paso Commuter Rail Feasibility Study

E. Mexico and the Regional Industrial Economy

While the sectors of the Doña Ana County and El Paso regional economies that are experiencing the highest job growth and are of most direct relevance to passenger rail service are in professional and personal services within the US, the larger economy that these border area regions share with Mexico also merits consideration in this study. The Las Cruces, NM-El Paso, TX-Ciudad Juarez, Mexico region is home to over 2.5 million people and constitutes the largest metro area on the U.S.-Mexico Border.[6] The region is also the 7th largest center for manufacturing in North America, with employment exceeding 230,000. The merchandise trade, industrial employment, and international population of the entire border area contribute to the demand for professional and service industries and to the pool of potential transit riders.

Border Area Industrial Economy

There are over 300 maquiladoras located in Juarez, which manufacture products ranging from electronics to automotive parts. The Las Cruces-El Paso region provides many options for manufacturers to transport these goods. Manufacturers can ship by rail with UP or BNSF, by truck on I-10 and I-25, or by air through El Paso International Airport, Las Cruces, International Airport, and Doña Ana County Airport. Freight movement over the border is facilitated by the U.S. port of entry at Santa Teresa, which is one of the most modern on the U.S.-Mexico border with over three million square feet of industrial space across two industrial parks.

These assets are important both to the regional and national economies, as Mexico is the third largest trading partner for the United States as well as the leading export destination for New Mexico. For example, 18% of all U.S.-Mexico trade, more than $80 billion, passed through the Las Cruces-El Paso region in 2011.[7] Manufacturers also benefit from the region's southern location, which leads to limited weather delays, as well as the tax structure in the region. Doña Ana County has one of the lowest property tax rates in the country, no inventory tax, and several tax incentives.

Border Crossings and Potential Ridership

The US Department of Homeland Security allows Mexican residents with valid Border Crossing Cards to enter southern New Mexico easily for commerce, trade and tourism. In 2013[8], the ruling extended the distance allowance into US from 25 miles to 55 miles (the border area), making Las Cruces a viable destination for Mexican nationals. The commuter rail line can be instrumental in attracting a large number of people who cross the border for shopping and education.

El Paso Border Crossings: In 2015, over 2.2 million[9] people crossed the border per month at one of the four border crossings in El Paso; namely, Paso Del Norte, Stanton DCL, Bridges of the Americas and Zaragoza.

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[6] http://www.mveda.com/docs/Regional-Profile.pdf
[7] http://www.mveda.com/docs/Regional-Profile.pdf
[8] https://www.regulations.gov/document?D=USCBP-2012-0030-0043
[9] Border Crossing/Entry Data, Bureau of Transportation Statistics, 2015

	Train Passengers	Bus Passengers	Personal Vehicle Passengers	Pedestrians
2015 average per month	482	22,181	1,665,201	570,641

On average, 2.1 million passenger trips are made to El Paso and beyond in a month. Many Juarez residents cross the border a few times a week for employment, shopping and recreational reasons. Bus loads tend to be smaller – an average of 13 passengers per bus. There is no distinction between the Dos Naciones buses that run every 30 minutes between El Paso and Juarez and the many airport shuttles.

Santa Teresa Border Crossings: The Santa Teresa border crossing is not as used as the El Paso crossings, yet is accessed by more than 113,000 people per month. Passenger car loads tend to be bigger (2.3) – this location might be used by people accessing jobs in the borderplex region and/or as a gateway to New Mexico cities.

Table 6: Broder Crossings, Santa Teresa, 2015

	Train Passengers	Bus Passengers	Personal Vehicle Passengers	Pedestrians
2015 average per month	0	127	99,997	13,380

F. Assets & Impediments

Assets
Preceding subsections of this snapshot discuss demographic and economic patterns in the Las Cruces and El Paso regions and the rail corridor that unites them. The following paragraphs note specific, institutions, and companies that may be significant for the proposed passenger rail service, as anchors or as conditions that may affect ridership or development along the rail line.

- Las Cruces – regional significance
  According to the Mesilla Valley Economic Development Alliance (MVEDA) 2012 Regional Profile, Las Cruces has a well-established base of firms that provide customer services to large national brands, including Sitel, Allstate, Empereon Marketing, and Cyracom. As some of these centers focus on translation services, there is great value for this industry in Las Cruces' large bilingual population, which constitutes over 30% of the workforce.

  Las Cruces is additionally a significant center for aerospace and renewable energy research, testing, and development firms and agencies. The region is home to employers such as Boeing, General Dynamics, PSI, Raytheon, NASA, and the Southwest Technology Development Institute, which interact frequently with New Mexico State University's College of Engineering as well as Doña Ana Community College's workforce development program.

There are several industrial parks in Las Cruces that take full advantage of the city's proximity to the Santa Teresa port of entry, the Union Pacific railroad, Interstate 10, and the Las Cruces International Airport. Between West Mesa Industrial Park, Verde Logistics Park, Verde Bi-National Park, and Hatch Industrial Park, the Las Cruces region contains over 2,200 acres of industrially zoned land.

Additionally, with a growing retirement population, Las Cruces has become a regional center for healthcare. The two major community hospitals, Memorial Medical Center and Mountain View Regional medical center, are supported by a network of additional healthcare facilities including a rehabilitation hospital, an acute care hospital, two psychiatric hospitals, and several nursing agencies, clinics, retirement centers, and assisted living centers.

- El Paso – regional significance – job center, healthcare, airport, entertainment
  As discussed in Section II.E of this report, El Paso's location on the U.S.-Mexico border plays a significant role in the region's economy. According to the Dallas Federal Reserve Bank, transportation services employment in El Paso increases by 5.4% whenever there is a 10% gain in maquiladora output.[10] El Paso is a center for shipping and distribution of goods manufactured in Mexico, as it is equidistant from Denver and Los Angeles and has direct rail connections to the Midwest. Additionally, the 24,000 acre Santa Teresa Industrial Park, located along the New Mexico-Mexico border, is expected to be in a strong position to take advantage of increased border trade volumes and contribute to regional employment.

The El Paso International Airport and the city's location along I-10 further contribute to El Paso's importance as a freight transportation center. As a result, El Paso has a very large transportation and logistics industry, including companies such as UPS Supply Chain Solutions, J.B. Hunt Transport, Inc., and Ceva Logistics.

Additionally, El Paso is home to Fort Bliss, the second largest U.S. Army installation in the country.   From 2007 to 2011 Fort Bliss increased its workforce from 22,000 soldiers and employees to 41,000.[11] Between 2006 and 2009, the expansion of the base resulted in $3.2 billion in construction contracts. An additional $1 billion in construction contracts is expected to come from the construction of new William Beaumont Army Medical Center, which is scheduled to open in 2019. Though the expansion of Fort Bliss is coming to an end, this large institution will continue to contribute to the region's economy.

The medical services and research sector is also growing in El Paso due to the expansion of the Medical Center of the Americas (MCA). MCA is medical campus that focuses its research

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[10] http://www.planelpaso.org/wp-content/uploads/2016/04/Plan-El-Paso_vol2_adopted_for-web.pdf
[11] http://www.planelpaso.org/wp-content/uploads/2016/04/Plan-El-Paso_vol2_adopted_for-web.pdf

and services on issues relevant to the Hispanic population, the border, and military options. El Paso Children's Hospital, the Texas Tech University Perry School of Nursing, the University Medical Center of El Paso, the Texas Tech University Foster School of Medicine, and several other facilities are all located on the MCA campus.[12]

- Universities – in-state tuition for El Paso & Doña Ana County students in NMSU & UTEP; incubators of biotech companies

New Mexico State University (NMSU), located in Las Cruces, is the largest university in the state of New Mexico with an enrollment on the main campus of over 18,000, including over 3,500 graduate students.[13] Resident tuition for NMSU is estimated at $6,479 for the 2016-2017 school year.[14] This tuition rate applies to Colorado residents through the states' reciprocal tuition program; this tuition rate is also applicable to Texas residents' living within 135 miles of the campus[15], but the tuition for all other non-resident students is currently estimated at $21,234.

NMSU's College of Engineering operates several research programs that contribute to the development of the region's science and technology sector and prepares students for careers in these fields.[16] The University provides research opportunities in applied optics, aerospace science technology, environmental, computing research, and biotechnology. Specifically, the College of Engineering houses the Southwest Technology Development Institute (SWTDI), research and development center for renewable energy. SWTDI operates a three-acre facility, the Southwest Region Experiment Station, which conducts tests of renewable energy systems and develops and implements solar and wind energy programs. Additionally, the College of Engineering is home to the Manufacturing Technology and Engineering Center (M-TEC). M-TEC provides free services to local start-up companies with economic development potential.

The University of Texas at El Paso (UTEP) is the sixth largest school in the University of Texas System with a total enrollment of 23,397. In 2010, UTEP was ranked second among the UT system schools for federal research funding. The University projects that it will reach its benchmark of $100 million in externally funded research by the 2017-2018 school year.[17] Currently, UTEP estimates its tuition rate for in-state students at $6,314 and for out-of-state students at $16,126.[18] Currently, UTEP in-state tuition rates are also available to residents of 8 New Mexico counties that border Texas[19].

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[12] http://www.planelpaso.org/wp-content/uploads/2016/04/Plan-El-Paso_vol2_adopted_for-web.pdf

[13] http://www.mveda.com/docs/Regional-Profile.pdf

[14] https://admissions.nmsu.edu/pay-for-school/

[15] http://aces.nmsu.edu/academics/elpaso.html

[16] http://www.mveda.com/docs/Regional-Profile.pdf

[17] http://www.utep.edu/aboutUTEP/strategic_plan_research.pdf

[18] http://estechcdn.utep.edu/FinancialAid/Financial_Aid_COA_UG_Non_Resident_1516.pdf

[19] http://academics.utep.edu/Default.aspx?tabid=66165

UTEP's College of Engineering offers degree programs in biomedical, environmental, industrial, and manufacturing engineering, among others.[20] The college is also home to several research centers, including the Center for Space Exploration and Technology Research (cSETR) and the W.M. Keck Center for 3-D Innovation. cSETR frequently collaborates with partners such as NASA and Boeing to promote research in propulsion and energy engineering. The center recently received a $5 million NASA grant to develop the next generation of rocket engines with the use of liquid methane.[21] The Keck Center is a state-of-the art advanced manufacturing lab dedicated to engineering medical and mechanical materials with 3-D printing technology. America Makes, the nation's leading public-private partnership for 3-D printing research and development, recently partnered with UTEP and opened its first satellite center at the Keck Center.[22]

- Science-Based Tourism

  The Las Cruces – El Paso Corridor is the home of unique scientific institutions that contribute significantly to the region's knowledge-based industries and are also of interest to the general public as tourist destinations.

  Spaceport America – According to Spaceport America's business plan, it welcomes 3,000 visitors per year and has plans to host 61,000 annual visitors by 2017[23]. The Spaceport aspires to host ten events per year to build public interest and revenue. Considerations related to studying a passenger rail connection to the Spaceport are noted in Section III.D.

  White Sands National Monument, the largest gypsum dune field in the world, spreads over 275 square miles in Doña Ana County and is a popular tourist destination. The Missile Range adjacent to the monument is a large employer (over 3,000 employees) and NM Park & Ride's silver route connects the range to central Las Cruces.

Impediments
The Las Cruces – El Paso region encompasses a sufficiently large and growing population and economy to support a commuter rail service. The primary impediments to the establishment of rail service do not lie in the region's support base but in a transportation culture, now expressed in land use and infrastructure patterns, that is deeply auto-oriented. These literally concretized patterns present impediments to change that a public which desires more transit services must overcome. The nature of these impediments, along with plans and actions to address them, are discussed in the following section of this study regarding existing transportation in the Las Cruces – El Paso Corridor.

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[20] http://www.utep.edu/academicprograms/
[21] http://engineering.utep.edu/announcement052715.htm
[22] http://engineering.utep.edu/announcement073115b.htm
[23] Spaceport Business Plan, 2016-2020, http://spaceportamerica.com/media/SA%20Business%20Plan%202016-2020%20FINAL.pdf

IV. Transportation

A. BNSF's El Paso Subdivision Rail Line

The El Paso to Las Cruces passenger rail service would operate on a 43-mile segment of the BNSF Railway's "El Paso Subdivision" line, which runs 288 miles between El Paso, TX and Belen, NM. In El Paso BNSF maintains an intermodal freight terminal and the only rail crossing of the US - Mexican border that it owns; at other rail border crossings, BNSF purchases trackage rights from competitor railroads. In Belen the El Paso Subdivision meets BNSF's Southern Transcon line, this Class I railroad's route between Los Angeles and Chicago and one of its most heavily used corridors.

Figure 7: BNSF's New Mexico Rail System
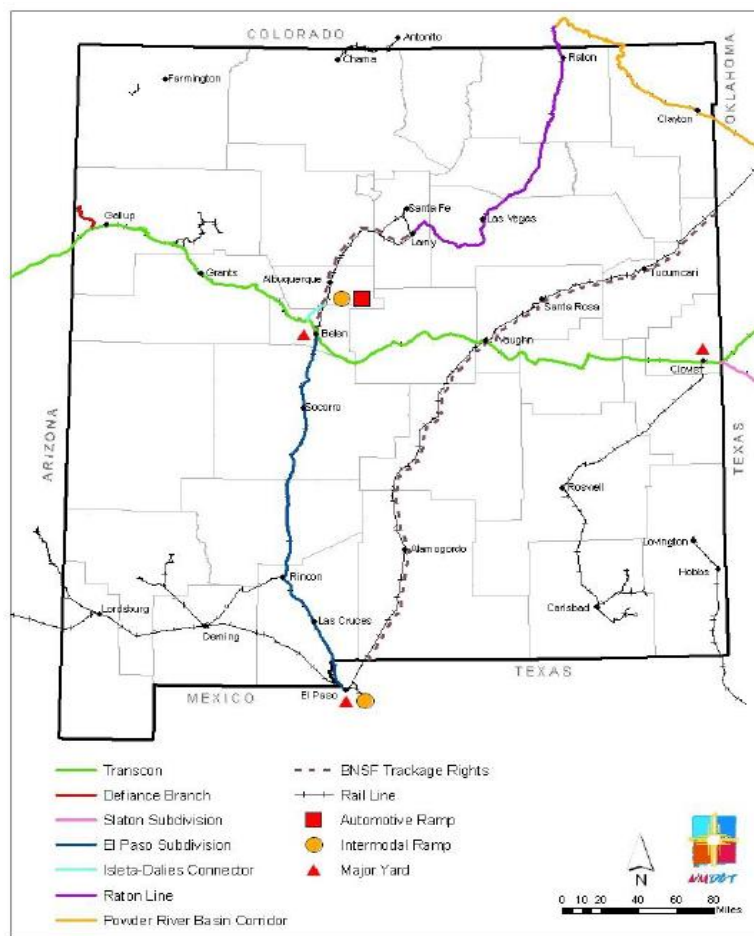
While these features of the El Paso Subdivision suggest strategic importance, in 2014 this line was lightly used, carrying only 4 to 8 freight trains daily, and its annual freight volume was less than 10 million tons, the lightest freight volume category considered in federal rail line classifications. There is no apparent indication that traffic has increased during the last three years. The El Paso Subdivision's length is only single tracked, and it does not employ an automated signaling technology but is controlled by a "Track Warrant Control (TWC)" system. Most of this rail line is

classified by the Federal Rail Administration as Class 4 track, which generally permits a maximum speed of 60 miles per hour (mph) for freight and 80 mph passenger service; rail lines that support freight and commuter service commonly have this classification.[24] However, the New Mexico State Rail Plan states that the El Paso Subdivision line has a maximum speed of 49 mph and that portions of this line (which may or may not be in the El Paso to Las Cruces segment) are Class 3 track which has a maximum speed limit of 40 miles per hour for freight and 60 mph for passenger trains.[25]

Figure 8: Density on Class I Rail Lines in New Mexico
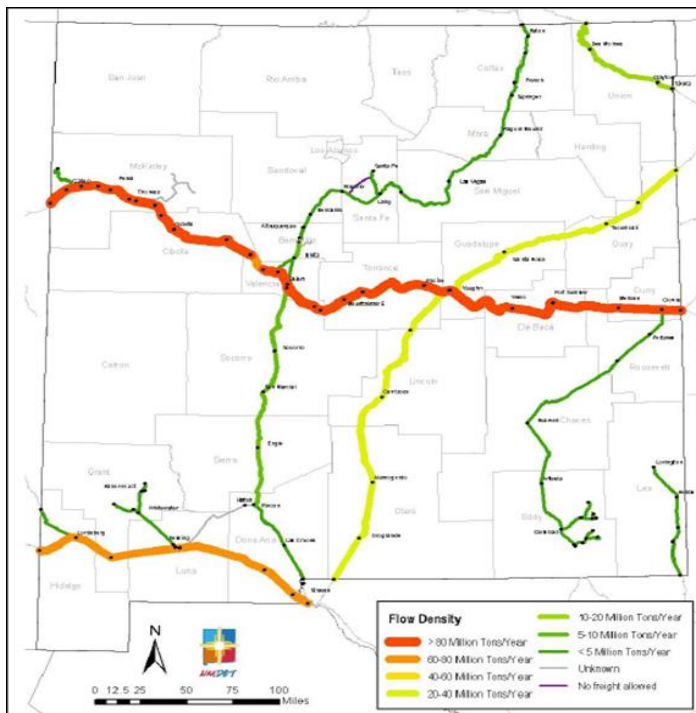
Both the potential strategic importance of BNSF's El Paso Subdivision and its current light use and slim infrastructure are significant factors in estimating the capital investment required to establish the El Paso to Las Cruces passenger rail service, as discussed in Section V.B. of this report.

B. I-10 Corridor

The 40-mile drive from El Paso to Las Cruces via Interstate 10 is the shortest and fastest road connection between the two cities. Traffic data from Texas & New Mexico departments of transportation indicate an increase of 15% to 2.5% in sections of this interstate from 2014 to 2015. This uptick in El Paso traffic can be attributed to the rapid development in the north-western region of the city and to lower gases prices. By 2035, traffic volumes on I-10 are projected to double[26] and could result in congestion if proper planning is not done. In New Mexico, the highway capacity (the ratio of volume of traffic witnessed and the capacity of the roadway) is between 23% and 34% representing reasonably free flow conditions.

The lack of congestion on interstate highways might explain the high number of traffic accidents in Doña Ana County. The county is the second highest in the state for total numbers of crashes in 2014 (3,779)[27]. From 2013 to 2014 the total number of accidents declined but the number of fatalities increased. In public meetings conducted to discuss the proposed rail service, several Doña Ana

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[24] Cornell University Law School, CFR Title 49, Subtitle B Chapter II, Part 213, Subpart A, Section 213.9 – Classes of Track: Operating Speed Limits https://www.law.cornell.edu/uscode/text/49/10701
[25] New Mexico State Rail Plan 2014, pages 39-40, NMDOT, http://dot.state.nm.us/content/dam/nmdot/Transit_Rail/NewMexicoStateRailPlan2014.pdf
[26] Texas DOT - http://www.txdot.gov/apps/statewide_mapping/StatewidePlanningMap.html
[27] New Mexico DOT, New Mexico Traffic Crash Annual Report 2014 - http://tru.unm.edu/Crash-Reports/Annual-Reports/annual-report-2014.pdf

County residents cited fear for their safety on interstate highways as a major reason for wanting train service. The map below shows the location of crashes – I-10 is dotted with crashes from Las Cruces to the Texas state line.

Figure 9: New Mexico Crashes, 2014
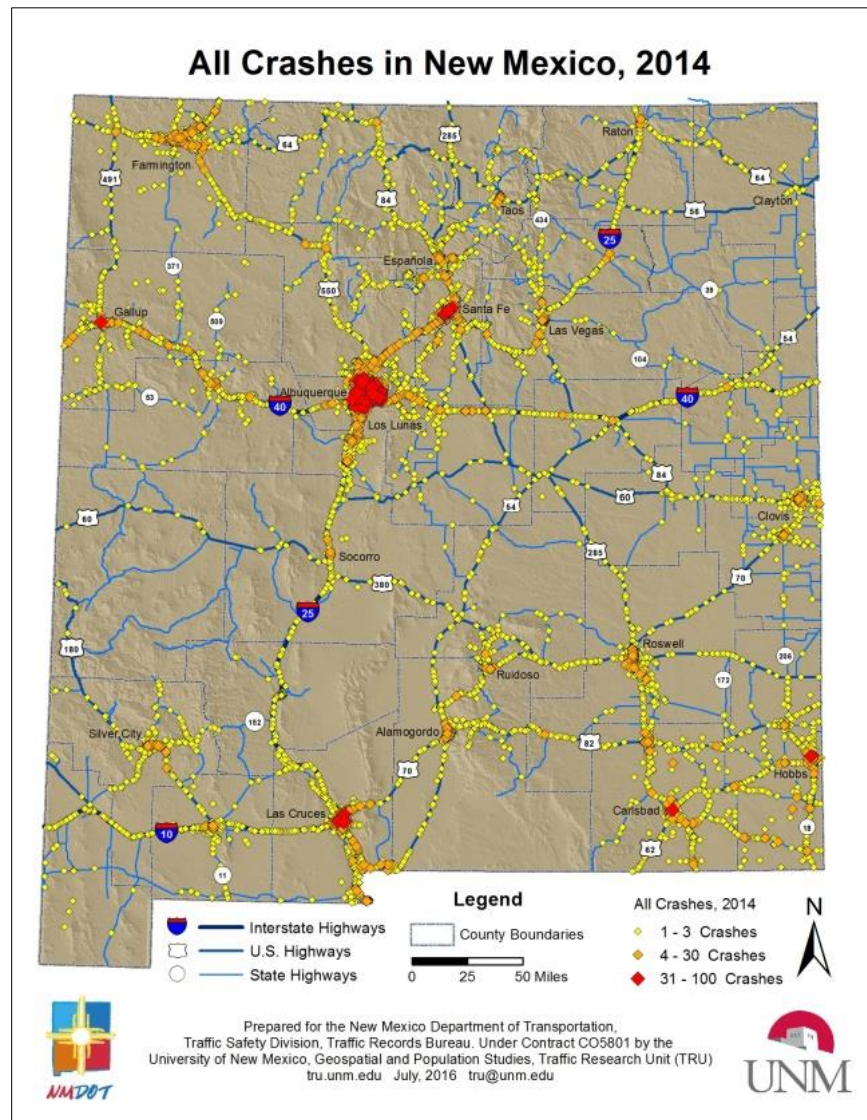
C. Existing public transportation

The cities of El Paso and Las Cruces provide local transit service within the city limits. The New Mexico DOT operates two routes in Doña Ana County (Gold & Silver line), and the South Central Regional Transit District (SCRTD) operates six routes within the county.

NM Park & Ride

New Mexico Park & Ride's Gold Route, which began operations in 2009, provides 6 round trips and 2 one way trips between El Paso and Las Cruces a day. It picks up passengers from the Intermodal Terminal in Las Cruces and makes stops at New Mexico State University and Anthony, Texas before

proceeding to the West Side and Downtown Transit Centers in El Paso, Texas. Both termini are served by local transit buses – RoadRunner and Sun Metro.

Ridership is not reported at route level but is estimated using the average daily boardings data. The Gold Route service is only available on weekdays and does not operate on 10 national holidays.

Table 7: NMDOT Ridership

	Average Daily Boardings	Days of Operation*	Annual Ridership	Trips
2013	244.6	250	61,150	10 round trips
2014	246.9	250	61,725	6 round trip & 2 one-way
2015	241.4	250	60,350	6 round trip & 2 one-way

*Operates on weekdays only; plus 10 holidays

The 2% drop in ridership from 2014 to 2015 might be related to the falling gas prices. Gas prices in Las Cruces averaged around $1.517 in February 2016, a 60 cent per gallon decrease from a year ago ($2.106)[28].

Figure 10: Gold Route

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[28] http://fuelgaugereport.aaa.com/states/new%20mexico/new%20mexico-metro/ - Accessed on February 25, 2016

South Central Regional Transit District (SCRTD)

SCRTD was established in 2014 to provide regional transportation options to the rural areas of Doña Ana County to strengthen the economic well-being of the residents and communities. An extensive public outreach process which gathered information on routes that would best serve the residents, informed SCRTD in designing the six routes that are operational currently.

Six SCRTD routes serve Doña Ana County; four of these originate in Anthony and two in Las Cruces.

- Blue Route – Runs between Anthony and Las Cruces along Highway 28
- Turquoise – Connects Anthony and Chaparral on Highway 404
- Purple – Between Anthony and Sunland Park
- Red – Runs between Anthony and Las Cruces along Interstate 10 and Highway 478
- Green – Between Las Cruces and of Radium Springs, Rincon and Hatch
- Yellow – Originates in Las Cruces and extends east to Organ and Alamogordo in Otero County.

SCRTD ridership reached 13,000 in 2016, and SCRTD projects a doubling of the ridership to 26,000 in 2017.

SCRTD is committed to provide local feeder bus service from the train stations. Connectivity from station areas will enhance ridership and is critical in making the commuter rail service a success.

Figure 11: SCRTD Routes, 2016
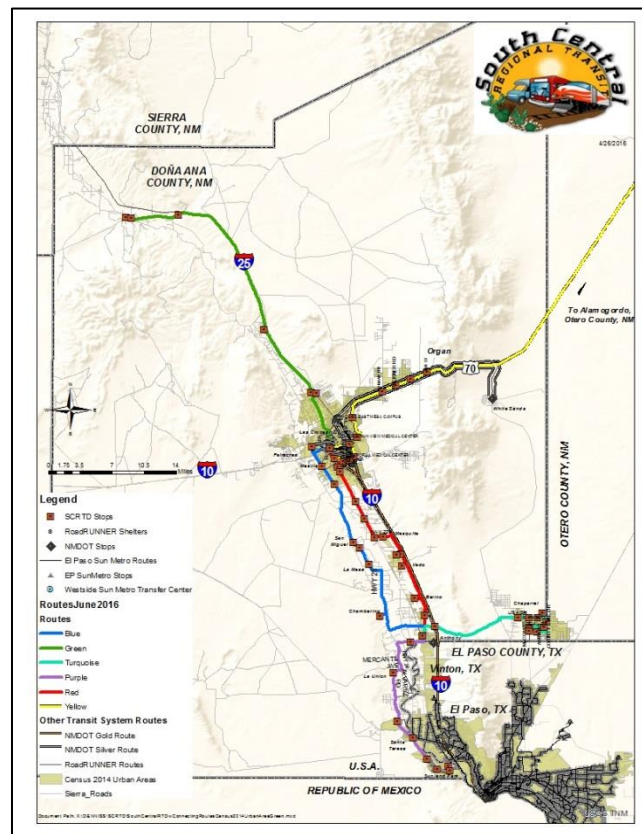
Sun Metro, El Paso

Sun Metro operates 59 fixed routes and serves an area of 255 square miles in El Paso. The agency began operations on a bus rapid transit (BRT) route named "Brio" in 2014. The 8.6 mile "Mesa" BRT route was completed in 2016 and has begun serving customers between the Westside and Downtown transfer centers. The remaining three lines are under construction, with a planned completion date of 2020. All four lines are part of an effort to make El Paso the "least car dependent city in the southwest." [29]These BRT lines all terminate at the Downtown transfer center, a bus center .6 miles from the El Paso Union station. Between 2011 and 2014, the Sun Metro's ridership stayed fairly consistent at around 16.5 million riders. However, ridership fell by more than 1 million trips in 2015. In 2016 ridership dropped again by 7% to 14,387,600 annual riders.

Table 8: Sun Metro Annual Ridership

Sun Metro El Paso Data	Unlinked Passenger Trips
Through December 2016	14,387,600.00
Through December 2015	15,449,100.00
Through December 2014	16,531,400.00
Through December 2013	16,499,100.00
Through December 2012	16,539,400.00
Through December 2011	16,241,600.00
Through December 2010	No data reported

(Unlinked passenger trip data from the APTA Quarterly Ridership Reports)[30]

As Sun Metro's BRT lines are built and begin to operate, it will become apparent if these services, coupled with development along transit corridors, can stabilize system ridership and resume ridership growth.

RoadRunner, Las Cruces

The RoadRunner bus system is operated by the City of Las Cruces' transportation department and is funded by user fees and federal grants. The system currently operates seven main routes and three additional routes for New Mexico State University and Doña Ana Community College. Service consists of bi-directional and one way loops with a 60 minute headway. Timed transfers between routes are made at the Mesilla Valley Intermodal Transit Terminal or Mesilla Valley Mall. Between 2010 and 2015, annual ridership on the RoadRunner fluctuated between 618,000 and 740,000. However, in 2016 the annual ridership fell 17% to 598,200 riders.

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[29] http://www.masstransitmag.com/article/12244908/city-of-el-paso-launches-brio
[30] http://www.apta.com/resources/statistics/Documents/Ridership/2016-q4-ridership-APTA.pdf

Table 9: RoadRunner Annual Ridership

RoadRunner Las Cruces Data	Unlinked Passenger Trips
Through December 2016	598,200.00
Through December 2015	717,400.00
Through December 2014	724,800.00
Through December 2013	No data reported
Through December 2012	740,700.00
Through December 2011	659,000.00
Through December 2010	618,900.00

(Unlinked passenger trip data from the APTA Quarterly Ridership Reports)[31]

AllTransit[TM]

CNT's AllTransit tool examines transit connectivity, frequency and overlays demographic data for census blocks groups served by transit. All geographies are assigned a Transit Performance Score between 0 and 10, zero being the lowest and 10 the highest.

Las Cruces has a score of 3.1 and 71% of commuters live within a ½ mile of transit. A very small percent of residents (.6%) use public transportation to commute to work and hence on average residents pay 29% of their income towards transportation costs. This high cost is mainly due to high auto ownership costs and fuel costs to accommodate longer commutes.

El Paso has a much bigger and more connected transit system, and scores 5.2 on the performance score. Nearly 90% of the city's residents live within a half mile of transit, but only 2% commute to work by transit, resulting in transportation costs that exceed national averages for transportation costs as a percentage of income (29.6% of income).

El Paso to Juarez – Dos Naciones[32]

The Dos Naciones was initiated by Mayor John Cook in 2010, to re-establish transit connections between El Paso and Juarez, similar to the trolley that existed from 1865 to 1973. Juarez agreed to it on the condition that the service is Mexican owned and operated. It serves ten stops in El Paso, runs every 30 minutes between 6 am to 7 pm and has no service on Sundays.

Findings suggest that Dos Naciones does not coordinate with Sun Metro to provide better connections for its riders. In October 2015, El Paso city council approved the leasing of one bay and the use of the transit center at the Union Plaza Transit Center by Dos Naciones. The Downtown Transit Center is the terminus of more than 25 bus routes and is connected to the Union Plaza, 6 blocks away by a downtown circulator bus.

D. **Spaceport & Albuquerque Extensions**

As noted earlier in regard to regional assets (Section II.E), Spaceport America's business plan reports that it welcomes 3,000 visitors per year and has plans to host 61,000 annual visitors by 2017[33]. The

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[31] http://www.apta.com/resources/statistics/Documents/Ridership/2016-q4-ridership-APTA.pdf
[32] http://www.elpasoinc.com/news/local_news/article_bf8dff90-8c7c-11e5-ada9-23f447a39c40.html?mode=story

Spaceport aspires to host ten events per year to build public interest and revenue. In the early framing of this study's scope, the feasibility of a rail service reaching the Spaceport was considered as a subject of analysis. However, the distance of a rail line that would connect the Spaceport to any other destination (55 miles to Las Cruces), and the limited potential ridership of such a rail service (several thousand passengers at most for occasional events) mean that this transportation option would require a very different analysis than a feasibility study for a commuter rail line, which must carry thousands of passengers daily to be feasible. In a future project, a potential passenger rail link to Spaceport America port might be studied as an excursion service, possibly linked to a potential inter-city rail service between El Paso and Albuquerque. The difference between a commuter rail service and a transportation link to Spaceport America, should not be viewed as diminishing the importance of this institution, which brings professional employment and broad public interest to the Las Cruces – El Paso Corridor.

E. Concurrence with MPO & Regional Plans

The Mesilla Valley MPO and the El Paso MPO are the Metropolitan Planning Organizations for the Las Cruces region of New Mexico and the City of El Paso, Texas, respectively. All metropolitan statistical areas with populations over 50,000 people are required by the Federal Aid Highway Act of 1962 to form MPOs in order to plan transportation investments at the regional level. The Mesilla Valley MPO and El Paso MPO are located in different states but, as a part of the same economic corridor, they frequently work in conjunction with the City of Las Cruces, Doña Ana County, the City of El Paso, and the South Central Regional Transit District (SCRTD) to examine the region's transportation needs. Both MPOs and several of these governmental organizations have published transportation plans, outlining the challenges and opportunities for improvement they believe face public transportation in the Las Cruces-El Paso region.

In its 2015 Metropolitan Transportation Plan (MTP), the Mesilla Valley MPO identified improving the public transportation system by increasing connectivity between existing urban and regional bus systems as one of its major priorities.[34] Currently, the RoadRunner fixed route service and the Dial-a-Ride paratransit service provide transportation within the City of Las Cruces. The South Central Regional Transit District (SCRTD) contracts with outside services to provide transportation between counties in south central New Mexico. And the New Mexico Department of Transportation (NMDOT) operates the NMDOT Silver Route connecting the City of Las Cruces to White Sands Missile Range as well as the NMDOT Gold Route, which connects Las Cruces and New Mexico State University to El Paso, Texas. According to the NMDOT Transit and Rail Bureau, the Gold Route saves commuters between $0.46 and $.075 per mile, or $992 per month with the Park and Ride monthly pass.

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[33] Spaceport Business Plan, 2016-2020, http://spaceportamerica.com/media/SA%20Business%20Plan%202016-2020%20FINAL.pdf

[34] http://www.las-cruces.org/~/media/lcpublicwebdev2/site%20documents/article%20documents/community%20development/mesilla%20valley%20mpo%20documents/tac/2015/february/tac020515packet.ashx?la=en

In its objectives, however, the MTP states that the public transit system could be greatly improved and increase its ridership by providing better connections between these local and regional bus services. The Doña Ana County 2040 Comprehensive Plan similarly contends that in order to improve public transit, the region must target specific areas to improve the transportation network and link major transportation routes to job destinations.[35] Both Plans additionally include the potential for new forms of public transit, such as the introduction of Bus Rapid Transit (BRT) as well as a regional commuter rail service between Las Cruces and El Paso.

The El Paso MPO's MTP, *Horizon 2040*, also considers the transportation needs of the entire Las Cruces-El Paso region but, as the City of El Paso does not provide any bus service to Las Cruces, the plan's discussion of public transit primarily focuses the local bus service, Sun Metro, and potential future transit projects, including Bus Rapid Transit and a proposed downtown streetcar.[36] EPMPO's MTP also considers the need to reconstruct sections of I-10, the major highway connection between Las Cruces and El Paso, which is necessary to reduce congestion and ensure effective bus service between the two cities. The current 2015-2018 El Paso Transportation Improvement Program (TIP) includes five projects totaling over $238 million to improve and build capacity to I-10. *Horizon 2040*, however, references the importance of the NMDOT Gold Route to the regional economy and the public commenting process included a discussion of the need to improve public transit between Las Cruces and El Paso.

Thus, the commuter train opportunity would be complementary to the alternative public transportation options that have already been explored by the MPOs for both the Las Cruces and El Paso regions. However, In New Mexico's 2014 Rail Plan, the Department of Transportation (NMDOT) has expressed a disinclination for the state to fund additional passenger rail services, citing large investments already made by the state in rail assets and the need to maintain existing rail holdings in good repair.[37]

V.   Potential Commuter Line

A. Station Areas

El Paso Union Depot
The location of the train station in El Paso is the existing Union Depot Station used by Amtrak's Sunset & Texas Eagle Lines.

The 0.5 mile radius area around the station has more jobs than residents, and the existing residents include 32% in the age groups below 18 or over 65 age. Residents in these age groups are obviously less likely than others to commute to work but more likely to use transit services for other travel.

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[35] https://donaanacounty.org/sites/default/files/pages/One_Valley_One_Vision_2040.pdf
[36] http://www.elpasompo.org/MTPDocs/HorizonMTP_020514.pdf
[37] http://dot.state.nm.us/content/dam/nmdot/Transit_Rail/NewMexicoStateRailPlan2014.pdf

The median income of the 1,266 households is $17,393 which is significantly lower than El Paso's median income of $42,037 and half the households make less than $15,000 per year.

Table 10: El Paso - Station Area Socio-Economic Data

Population	2,800
Jobs	9,801
Population – Under 18	750
Percent Population – Under 18	27%
Population – Over 65	432
Percent Population – Over 65	15%
Households	1,266
Median Income	$17,393
HH making less than 15k Income	617
Percent HH making less than 15k Income	49%
Educational Attainment – HS or less	1,166
Educational Attainment – Percent HS or less	42%

- Land Use – The area surrounding the station is zoned as a mixed-use district and has potential to be developed as a transit-oriented development with lesser parking requirements. The central business district is to the east of this zone, and has a good percent of the 9,800 jobs within a half mile of the station.
- Area plans – The Daniel Burnham designed Union Station building is an icon in El Paso's architecture and the El Paso Plan envisions potentially using the building as a tourist information center, conference center or an anchor to attract mixed-use housing to create an 18-hour downtown.
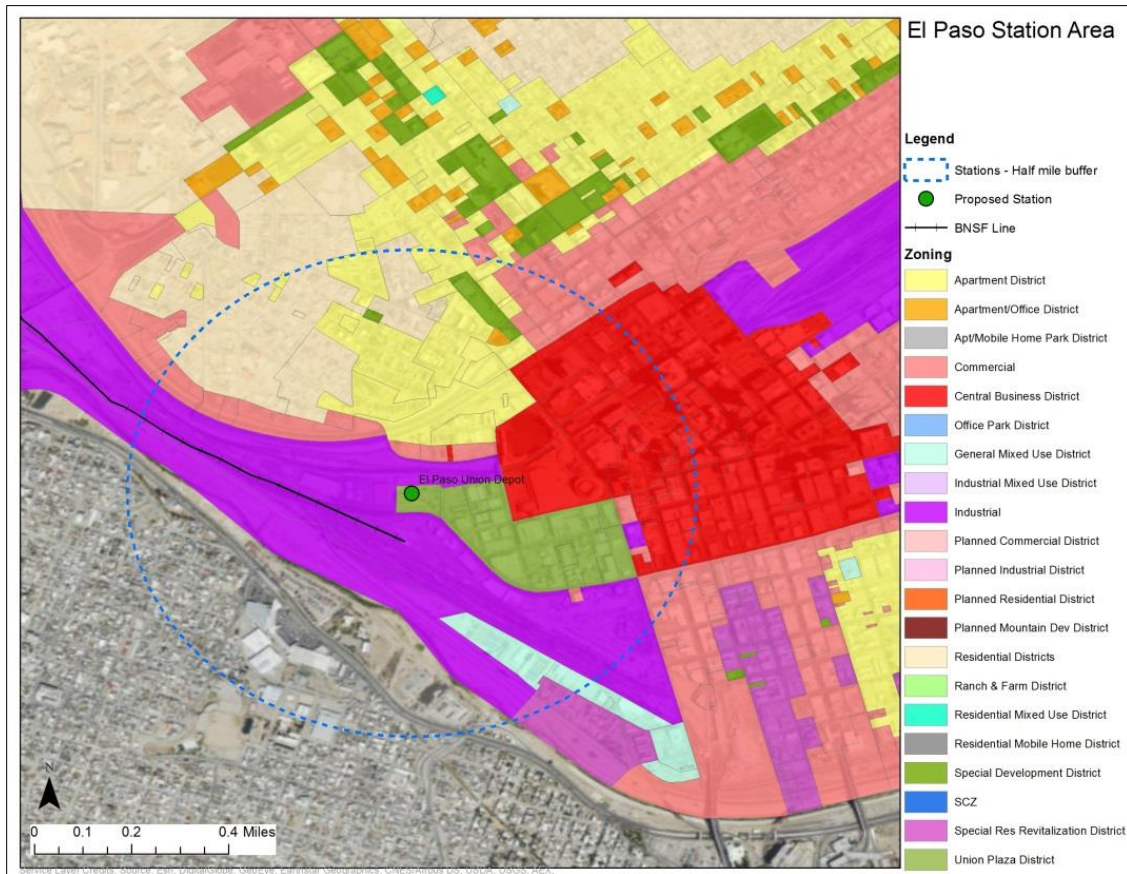
- Connectivity – Union Depot is served by the free Downtown circulator route 4 and is 0.6 miles from the Downtown Transfer Center. The transfer center is served by 26 routes, including the bus rapid transit Brio with connections to UTEP, El Paso Specialty Hospital and El Paso Community College (among other top employers). Union Depot is surrounded by parking lots and is not a pedestrian-friendly environment. Some parking is needed to support the commuter rail, but developing the surrounding area into a dense development with residential, office and retail uses will increase transit usage.

Sunland Park

The location of the proposed train station is at the southwest corner of the intersection of Doniphan Drive and Sunland Park Drive.

The 0.5 mile radius around the station has more jobs than housing. Four out of ten residents in the area are below the age of 18 or above 65. The median income for the area is relatively high for the Las Cruces – El Paso Corridor but 20 percent of households make less than $15,000 per year.

Table 11: Sunland Park- Station Area Socio-Economic Data

Population	682
Jobs	1,008
Population – Under 18	192
Percent Population – Under 18	28%
Population – Over 65	81
Percent Population – Over 65	12%
Households	200
Median Income	$50,739
HH making less than 15k Income	37
Percent HH making less than 15k Income	19%
Educational Attainment – HS or less	221
Educational Attainment – Percent HS or less	32%

- Land Use – The station area is characterized by commercial and retail establishments. Strip malls dominate Sunland Park & Doniphan Drive. Towards the periphery of the 0.5 mile radius there are single-family residential uses. At the southern end of the station area, along Doniphan Drive, there are industrial uses and a spur from the BNSF line serves one of these industrial businesses.
- Area plans – According to the Doña Ana County Comprehensive Plan, the area of Sunland Park between Rio Grande and the border with Texas, especially the Sunland Park Racetrack and Casino, is expected to experience significant economic development. The One Valley, One Vision and the El Paso MPO Plan also points out a significant growth of population in the Sunland Park area.
- Connectivity – The station is along Sun Metro's Route 20 that provides an hourly service between Sunland Park Mall and the Westside Transfer Center. The four-lane Sunland Park Drive and Doniphan Drive do not promote walkability, nor do the current land uses. Parking for the station can be provided by using existing empty lots in the station vicinity.

Figure 13: Sunland Park Station Area
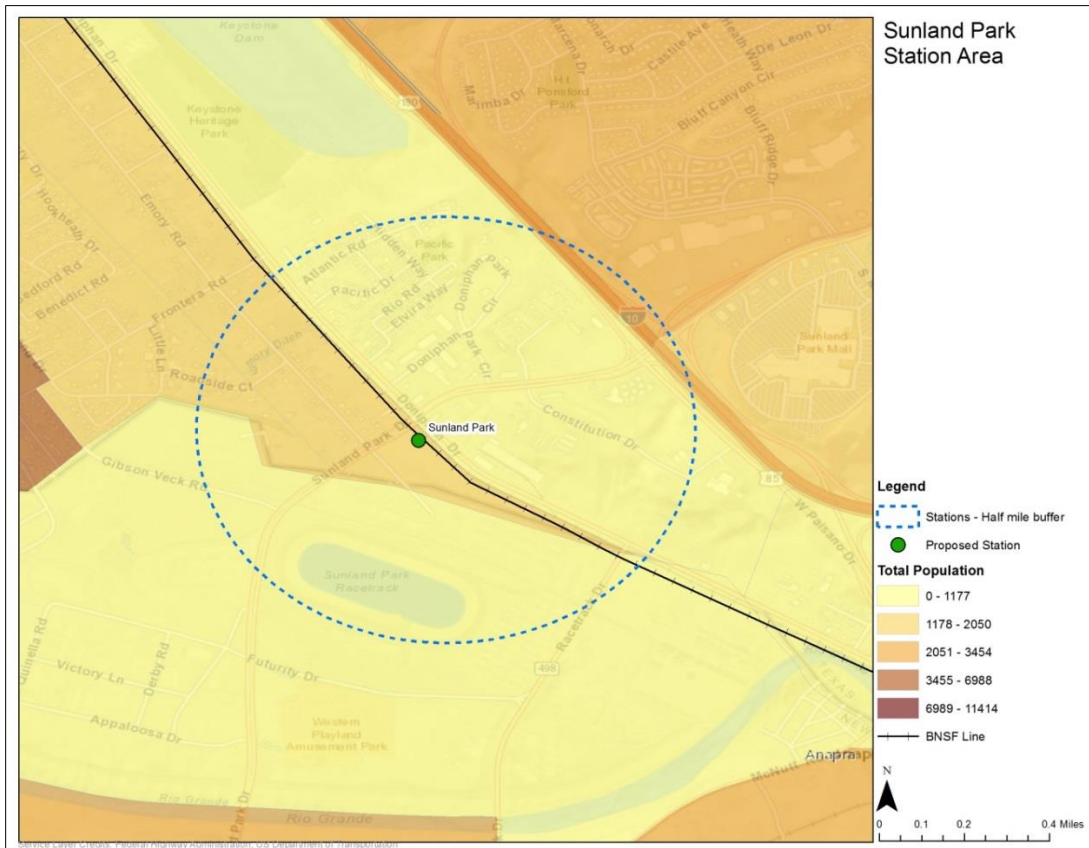
Montoya

The proposed location for the station at Montoya is between Artcraft Road and Montoya Lane on Doniphan Drive.

Table 12: Montoya - Station Area Socio-Economic Data

Population	2,323
Jobs	498
Population – Under 18	737
Percent Population – Under 18	32%
Population – Over 65	181
Percent Population – Over 65	8%
Households	752
Median Income	$52,435
HH making less than 15k Income	87
Percent HH making less than 15k Income	12%
Educational Attainment – HS or less	723
Educational Attainment – Percent HS or less	31%

The station area is mostly residential – there are five times as many residents as number of jobs. Forty percent of the population is under 18 or above 65 years of age, and household sizes are an average of 3.1. Residents make higher incomes than the average for El Paso – $52,435 as compared to $42,037 and a smaller percent of low-income households call the station area home.

- Land Use – Industrial and construction businesses dot Doniphan Drive, and the Artcraft Business Center is also in the 0.5 mile radius of the station. Residential uses include a mix of prefabricated homes, single family homes and apartments.
- Area plans – In the El Paso MPO's projections, the area surrounding the station will experience a doubling of jobs by 2040 and population density is expected to increase to 5 – 10 persons per acre. Neighboring Santa Teresa is expected to grow in the next few years due to the border crossing and surrounding freight served developments.
- Connectivity – Two Sun Metro bus routes (12 & 16) provide service to the station area and provide connections to the shopping, retail, restaurants near the Al Jefferson Transfer Center. Route 16 connects the station area to the dense Valley Creek residential subdivisions in the northwest.

Figure 14: Montoya Station Area
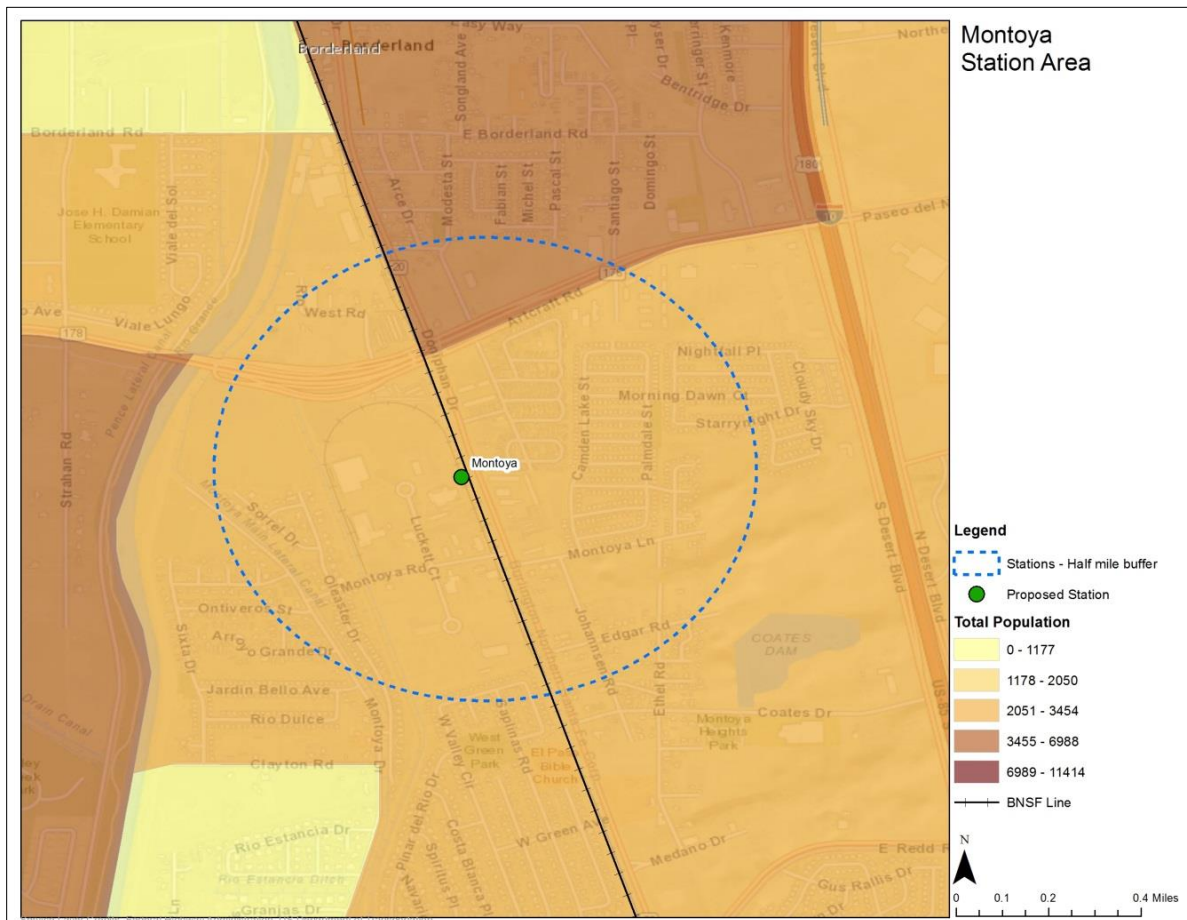
Anthony, New Mexico

The location of the proposed station is at the intersection of Washington Street and Main Street. The station is in the downtown area of Anthony, New Mexico. It is more residential than commercial in nature, and one out of two residents is under 18 years of age or above 65 – age groups that are less likely to commute to work but more likely than others to use transit for non-work travel. Median income of households in the station area is slightly lower than the town of Anthony ($20,333) and less than half of the county's median income ($38,426). Forty five percent of households make less than $15,000 per year and are likely to own no vehicles, creating a need for public transportation.

Table 13: Anthony – Station Area Socio-Economic Data

Population	1,750
Jobs	451
Population – Under 18	745
Percent Population – Under 18	43%
Population – Over 65	148
Percent Population – Over 65	8%
Households	505
Median Income	$18,050
HH making less than 15k Income	226
Percent HH making less than 15k Income	45%
Educational Attainment – HS or less	492
Educational Attainment – Percent HS or less	28%

- Land Use – Current land uses include commercial, institutional and single-family residential uses

Figure 15: Existing Land Use
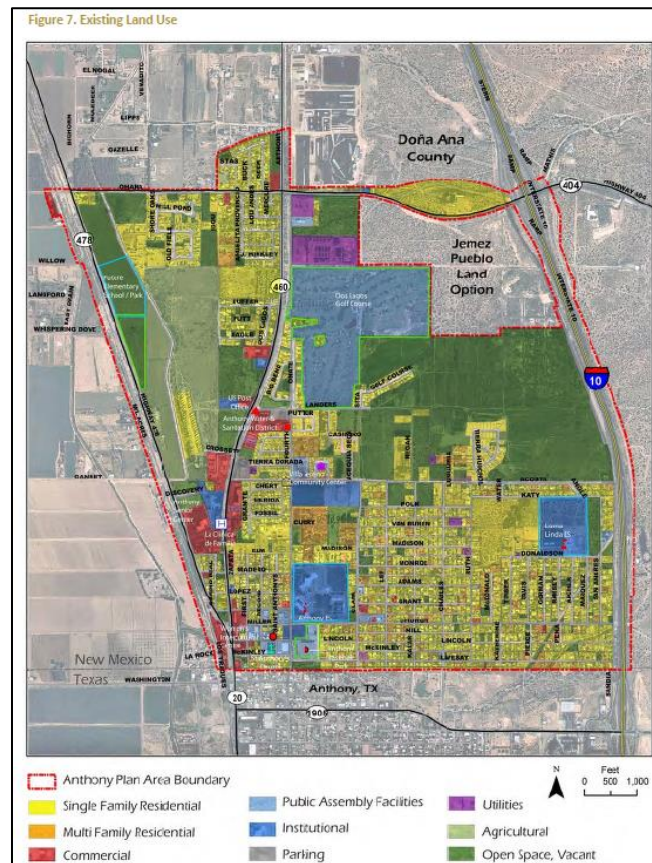
- Area Plans – According to the City's Comprehensive Plan, Anthony Drive (2-3 blocks from proposed station) is to be developed as a Main Street with a revitalized downtown core and commercial and public services activity centers. The plans include creating pedestrian-oriented developments and a potential rail commuter station.
- Connectivity – Both Anthony towns in NM and TX aim at building more walkable friendly streets. The immediate surrounding of the potential station has dedicated sidewalks but the areas are definitely car-oriented. The two restaurants around the potential station have ample parking and substantial empty spaces are in the immediate surrounding to serve as parking lots for the commuters. The NM Park & Ride's Gold Route stop is 1.3 miles from the proposed station and SCRTD's stops are 0.6 miles north of the station.
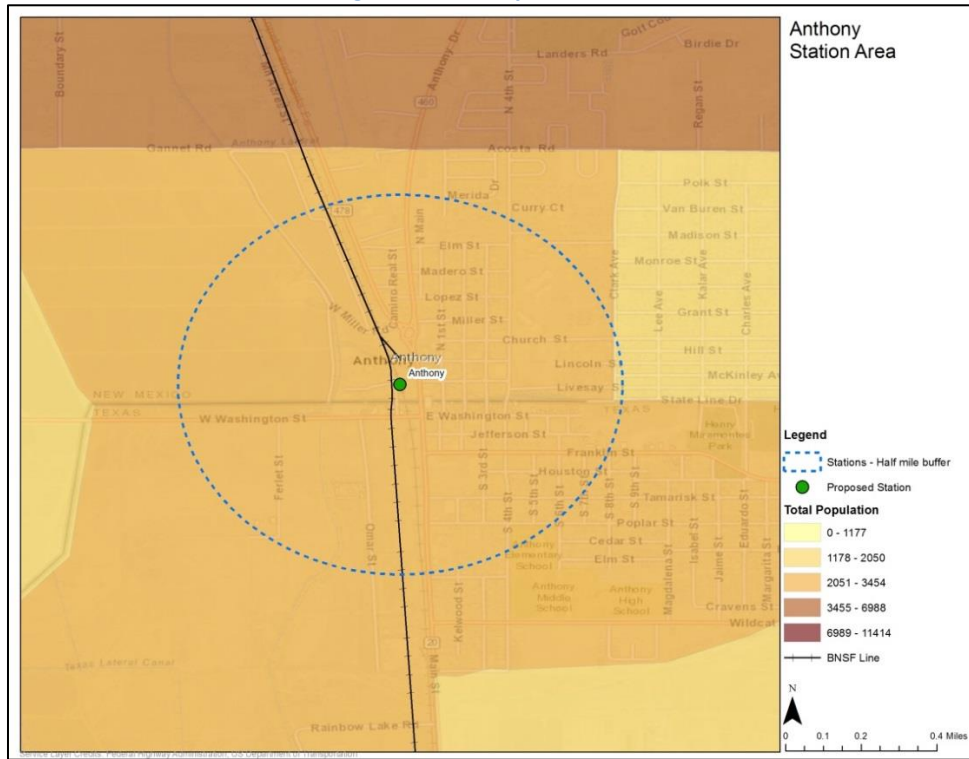
Mesilla Park, Las Cruces

The proposed station location is on Main Street at College Avenue in Mesilla Park at the site of the old train station. The 0.5 mile radius area around the station has more residents than jobs, and the existing residents include 39% in the below 18 or over 65 age groups. The median income of the 746 households is $33,341 which is lower than Las Cruces' median income of $40,658 and one-fourth of the households make less than $15,000 per year.

Table 14: Mesilla Park – Station Area Socio-Economic Data

Population	2,275
Jobs	425
Population – Under 18	710
Percent Population – Under 18	31%
Population – Over 65	180
Percent Population – Over 65	8%
Households	746
Median Income	$33,341
HH making less than 15k Income	185
Percent HH making less than 15k Income	25%
Educational Attainment – HS or less	638
Educational Attainment – Percent HS or less	28%

- Land Use – Industrial, commercial, office, medium & high-density residential and agricultural land uses are within the 0.5 mile radius of the station. The compact residential areas to the west and south-east of the station promote walking, although the wide four-lane Main Street is oriented for cars and not pedestrians.
- Area Plans – The City of Las Cruces has no specific area plans for the Mesilla Park station area but one of the goals of the City's Comprehensive Plan is to work with the SCRTD in establishing a north-south rail line. Emphasis is also placed on creating a walkable and bike-friendly environment to promote safety and accessibility throughout the city. The RoadRunner Short Range Transit Plan mentions this area as currently having a low transit propensity.
- Connectivity – This location is on RoadRunner's Route 4 which connects to Mesilla Valley Intermodal Transit Terminal with service once every hour. New Mexico State University is less than 2 miles from the station but currently there is no direct transit connection between the two. The station has a relatively small number of parking spaces and the low density uses across the street could be converted into parking areas.

Figure 157: Mesilla Park Station Area

Las Cruces-El Paso Commuter Rail Feasibility Study
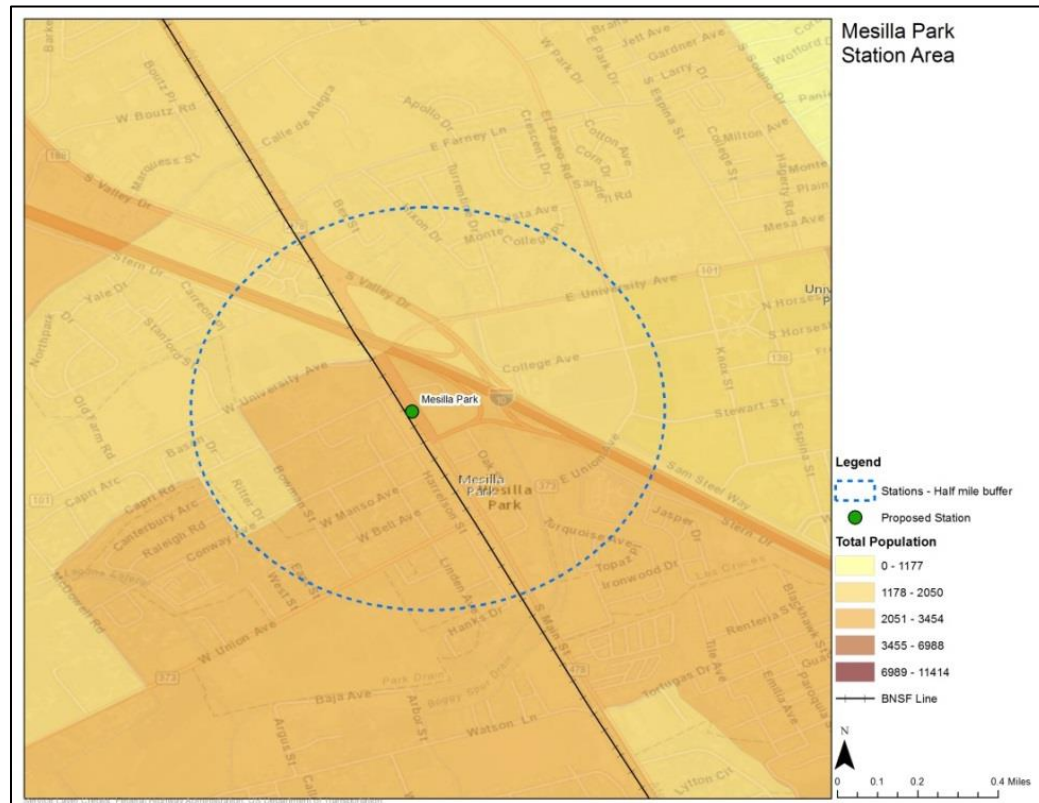
Las Cruces, Central Station

This is the terminal\initial station of the proposed passenger rail system. It is located 5-6 blocks west of the Downtown, at the site of the Las Cruces Railroad Museum, which was previously used as a rail station. Due to the proximity to the central business district, there is twice the number of jobs as residents. Median Income of households in the station areas is much lower than average median income for the city ($24,058 versus $40,658).

Table 15: Las Cruces– Station Area Socio-Economic Data

|	
Population	1,747
Jobs	3,548
Population – Under 18	282
Percent Population – Under 18	16%
Population – Over 65	243
Percent Population – Over 65	14%
Households	792
Median Income	$24,058
HH making less than 15k Income	225
Percent HH making less than 15k Income	28%
Educational Attainment – HS or less	579
Educational Attainment – Percent HS or less	33%

- Land Use – The 0.5 mile radius around the station has industrial, commercial, low-density residential, medium/high density residential and planned unit development uses. A special zone called Alameda Depot Overlay Railroad Corridor is designated to the station corridor between Pittsburgh and Amador Avenues.
- Area Plans – The Alameda Depot Neighborhood Plan outlines a desire to create an overlay/special zoning district for the Alameda neighborhood of Las Cruces. The main historical area of Las Cruces, Alameda Depot, comprises approximately 260 acres and is made up of multiple historically designated structures. The city plans to implement a Flexible Development Standard in order to create a mixed used TOD neighborhood
- Connectivity – The station is not directly served by any bus routes, but several bus routes are within blocks of the station. The Mesilla Valley Intermodal Transit Terminal is 0.5 miles away from the station; so multiple bus connections to the station could be readily established. There are sidewalks along Mesilla Street but no crosswalks or pedestrian connections to access the surrounding blocks. The Railroad Museum has an existing parking lot that can accommodate a few cars. Additional parking will have to be created to cater to the rail commuters.

Figure 18: Las Cruces Station Area
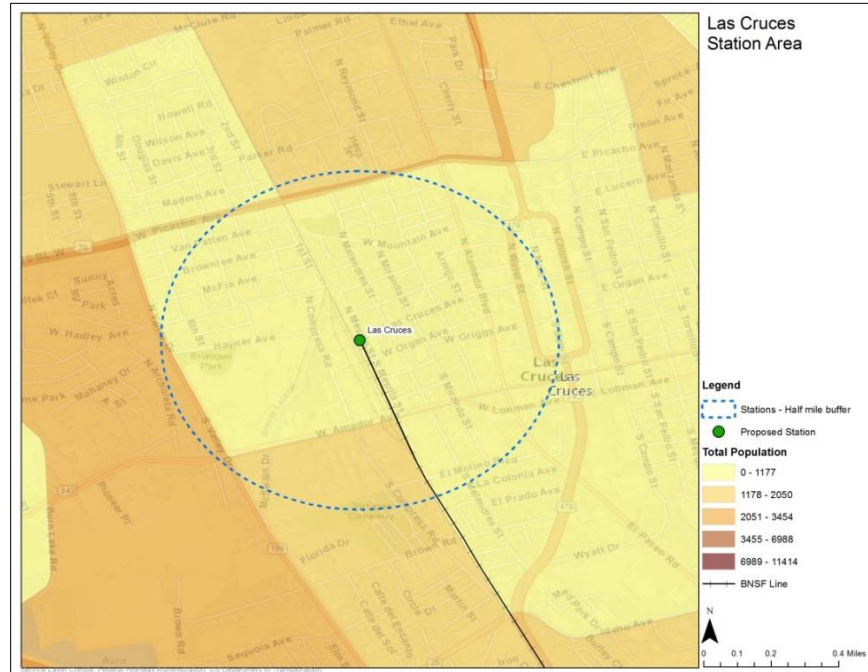
B. **Potential Ridership**

Ridership estimation is a central consideration when assessing the feasibility of a proposed transit line. In this study the CNT primarily used a sketch model to make estimates of ridership, and these estimates were refined were refined in light of the operating experience of comparable commuter rail lines, a survey of Doña Ana County residents, and the professional judgement of members of the CNT team with railroad operating experience.

Sketch Model-Based Ridership Projections

A sketch model is a simplified ridership estimation method used in the initial stages of a project. It is summarized as a mathematical relationship between different local demographic and socio-economic characteristics. Sketch models are effective, time-saving and produce realistic results without requiring complex travel demand modeling.

While numerous region specific models have successfully attempted this task, very few models exist at the national level. We examined two different sketch models endorsed by the Transportation Research Board before deciding on the one used in these estimates. This model has been adapted from the 2006 TRB report "Sketch Model to Forecast Commuter and Light Rail Ridership: Update to

TCRP Report 16"[38]. The model was chosen for two reasons – 1) Large number of inputs used in the estimation, making it more specific to the region 2) Station level ridership provides an opportunity to validate the results based on local knowledge.

Potential ridership is estimated for the current conditions – 2014 population and employment data for the years 2020 and 2030, using employment and population projections from the El Paso MPO and Mesilla Valley MPO long range transportation plans. In each scenario, potential ridership is calculated both as if the terminal stations are transportation centers, and separately as if they are not. A complete description of the methodology and assumptions is provided in Appendix B.

Table 16: Average Daily Ridership

Station	Option 1A - Not a Transit Center, 2014	Option 1B - Transit Center, 2014	Option 2A - Not a Transit Center, 2030	Option 2B - Transit Center, 2030	Option 3A - Not a Transit Center, 2040	Option 3B - Transit Center, 2040
El Paso Union Depot	1871	3115	2313	3851	2628	4376
Sunland Park	600	600	647	647	671	671
Montoya	787	787	843	843	869	869
Canutillo	-	-	-	-	-	-
Anthony	911	911	980	980	1007	1007
Berino/Vado	-	-	-	-	-	-
Mesilla Park	457	457	492	492	505	505
Las Cruces	938	1562	1045	1741	1096	1825
Contingency (-20%)	(1113)	(1487)	(1264)	(1711)	(1355)	(1851)
Total	**4452**	**5947**	**5056**	**6843**	**5422**	**7403**

Ridership increases by approximately 60% if a station is also a transit center or connects to 4+ bus routes. Future planning in El Paso and Las Cruces should consider the consolidation of transit terminals or making the stations the starting points of bus routes to connect local destinations to the commuter line.

Comparable Passenger Rail Services
CNT initially looked at ten comparable existing or under construction commuter rail lines and summarized their characteristics in the table below[39]. These examples were chosen primarily because they represent commuter services that link cities of comparable size to Las Cruces and El Paso, with commuter lines that have been established within the last 15 years, and (with the exception of Boston) regions that have not had continuously operating, extensive, and rail-based public transit systems over the last generation. They include some lines with smaller ridership and some with larger ridership than that projected for the Las Cruces-El Paso line. Several factors such as

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[38] Clayton Lane, Mary DiCarlantonio, Len Usvyat. *Sketch Model to Forecast Commuter and Light Rail Ridership: Update to TCRP Report 16.* Transportation Research Record: Journal of the Transportation Research Board, No. 1986, Transportation Research Board of the National Academies Washington, D.C., 2006.

the population size of the connected cities, proximity to downtowns, availability of local public transportation, and transit attractors such as universities or airports influence the higher ridership.

Name	Santa Cruz-Watsonville	Boston-Manchester, NH, by Lowell project	Denton County A-Train (Dallas to Trinity Hills by Denton)	Front Runner (Salt Lake City)	Altamont Corridor Express (ACE) Stockton - San Jose	Denver to Denver Airport A-line commuter rail line	Capital Metro Greater Austin	Coaster NCTD San Diego-Oceanside	Northstar Northern suburbs to Minneapolis	Music City Star Nashville
Year	Study of 2015 Scenario G	Project, construction in 2017	Opened 2011	Northern Part: 2008 Southern Part: 2012	Opened in 1998	Opened April 22, 2016	Opened 2010	Opened 1995	Opened 2009	Opened 2006
Distance	22 miles 40min	37 miles	28 miles	Northern Part: 50 miles from Ogden to SLC Southern Part: 80 miles from SLC to Provo	86 miles	22 miles 37min other projects in process Gold-line ;11.2 miles, expected summer 2016 Westminster line: 6.2-miles, expected fall 2016	32miles	41 miles	40 miles	32 miles
Population	SC: 270, 000 WL 50,000	B:655,000 M: 110,000	Denton: 123,099 Dallas: 1,258,000	SLC: 200,000 Ogden: 83,000 Provo: 112,000	SJ: 1,000,000 Stockton: 300,000	D: 650,000 Airport: 54 million passengers in 2015 (18th busiest airport in the world)	Austin : 850,000 Northern suburbs: fastest growth in the US	San Diego: 1,350, 000 Oceanside: 170,800	Minneapolis: 400,000 Big Lake: 10,000	Nashville: 650,000 Lebanon (Tennessee) 23,000
Ridership	5,500 per weekday	650,000 per year	1,900 per day	16,800 per day (5,000 for the Northern Part in 2012)	3,700 per day	37,900 – estimated average daily ridership	2,900 per day	5,600 per day	3,100 per day	1,225 per day

Frequency	60 weekday trains	16 train per day	26 train per day	30mn (peak) 60mn (off-peak)	Every Hour 4 round trip per day	15minues	30min (peak) 60min (off-peak)	Mostly SB am – approx. 40 min NB pm – approx. 40min	Only: 5-7.30am SB-approx. 30min 4-6.30pm NB-approx. 30min	60min

As noted in the introduction to this report, Ngage New Mexico conducted a "Commuter Rail Survey" in the Spring of 2016 which was offered online as well as mailed to interested participants. Responses from the 1,000 plus respondents have informed this model and resulted in tweaks to make the model more specific to the Las Cruces-El Paso region. The responses to the commuter rail survey suggest that the populations with the largest ridership potential are:

- Daily commuters
- Occasional recreational riders
- Student commuters
- People traveling to El Paso International Airport

The large majority of respondents (87%) expected that they would travel between the two terminal stations of the proposed line, Las Cruces – El Paso, rather than boarding or leaving the train at intermediate stations. The second most frequently anticipated route was Las Cruces – Sunland Park (7%). Over a third of the respondents cite difficulties traveling to or from the train station as possible obstacles to their ridership. Twelve percent of respondents ranked "no regular access to a car" among the top 5 reasons they would use passenger rail in the first place, which makes intermodal access in Las Cruces a significant consideration.

Given that 37% of respondents cite saving time/avoiding traffic congestion as their primary motivation to ride, express service options during rush hour should be explored because of their ability to capture these time-saving riders. On the other hand, intermediate stops would deter few respondents traveling to El Paso for recreational purposes. With this conjecture in mind, the service hours designed to capture recreational riders can capitalize on the ridership opportunity of intermediate stops while posing little inconvenience to Las Cruces boarders. Results of the survey are provided in full in Appendix A.

C. **Service Plan**

Proposed weekday rail service schedules are provided on the following pages, which would serve the estimated levels of ridership with 8 or 10 round trips per day. These schedules consider several factors, namely ideal service frequency, minimizing the number of train sets, allocation of express and all-station trips, and intermodal riders.

Service frequency is designed primarily for commuters, while also providing midday service to meet the needs of other customers, including university students. Accordingly, headway during peak hours ranges from 30 to 60 minutes, while midday headway is 120 minutes. Given this lesser midday headway, it is only peak service that requires more than 2 trains.

The allocation of express and all-station trips has also been considered. Since the rail should serve those wishing to commute from terminal and non-terminal stations, it is important that morning and evening peak service include both express and all-station options. Accordingly, all proposed schedules include at least one of each service type from both terminal stations.

These schedules also recognize that commuters using a subsequent mode of transit need to arrive well in advance of business hours. Accordingly, the schedules provide that peak morning trains arrive in El Paso and Las Cruces before 8:00 a.m.

While increased service frequency could be expected to increase ridership, frequency beyond that proposed in these schedules would increase capital and operating costs. So these schedules are designed to serve the levels of ridership projected on demographic and land use bases, with minimum investments in rail equipment. The operating experience of the railroad may demonstrate opportunities to build ridership by increasing service frequency.

Table 18: Eight Round Trips per day

Northbound							
El Paso Union Depot	Sunland	Montoya	Canutillo	Anthony	Berino/Vado	Mesilla Park	Las Cruces
7:00:00	7:10:36			7:29:06			7:52:54
8:30:00	8:40:36	8:50:24	8:58:06	9:09:06	9:22:42	9:40:30	9:42:54
10:30:00	10:40:36	10:50:24	10:58:06	11:09:06	11:22:42	11:40:30	11:42:54
12:30:00	12:40:36	12:50:24	12:58:06	13:09:06	13:22:42	13:40:30	13:42:54
14:30:00	14:40:36	14:50:24	14:58:06	15:09:06	15:22:42	15:40:30	15:42:54
16:15:00	16:25:36			16:44:06			17:07:54
17:30:00	17:40:36	17:50:24	17:58:06	18:09:06	18:22:42	18:40:30	18:42:54
18:45:00	18:55:36			19:14:06			19:37:54

Southbound							
Las Cruces	Mesilla Park	Berino/Vado	Anthony	Canutillo	Montoya	Sunland	El Paso Union Depot
7:00:00			7:28:48			7:47:18	7:52:54
8:00:00	8:07:24	8:25:12	8:38:48	8:49:48	8:57:30	9:07:18	9:12:54
10:30:00	10:37:24	10:55:12	11:08:48	11:19:48	11:27:30	11:37:18	11:42:54
12:30:00	12:37:24	12:55:12	13:08:48	13:19:48	13:27:30	13:37:18	13:42:54
14:30:00	14:37:24	14:55:12	15:08:48	15:19:48	15:27:30	15:37:18	15:42:54
16:00:00			16:28:48			16:47:18	16:52:54
17:00:00	17:07:24	17:25:12	17:38:48	17:49:48	17:57:30	18:07:18	18:12:54
17:45:00			18:13:48			18:32:18	18:37:54

Table 19: Nine Round Trips per day

Northbound							
El Paso Union Depot	Sunland	Montoya	Canutillo	Anthony	Berino/Vado	Mesilla Park	Las Cruces
6:30:00	6:40:36	6:50:24	6:58:06	7:09:06	7:22:42	7:40:30	7:42:54
7:45:00	7:55:36			8:14:06			8:37:54
9:30:00	9:40:36	9:50:24	9:58:06	10:09:06	10:22:42	10:40:30	10:42:54
10:30:00	10:40:36	10:50:24	10:58:06	11:09:06	11:22:42	11:40:30	11:42:54
12:30:00	12:40:36	12:50:24	12:58:06	13:09:06	13:22:42	13:40:30	13:42:54
14:30:00	14:40:36	14:50:24	14:58:06	15:09:06	15:22:42	15:40:30	15:42:54
16:15:00	16:25:36			16:44:06			17:07:54
17:30:00	17:40:36	17:50:24	17:58:06	18:09:06	18:22:42	18:40:30	18:42:54
19:10:00	19:20:36			19:39:06			20:02:54

Southbound							
Las Cruces	Mesilla Park	Berino/Vado	Anthony	Canutillo	Montoya	Sunland	El Paso Union Depot
6:00:00	6:07:24	6:25:12	6:38:48	6:49:48	6:57:30	7:07:18	7:12:54
7:00:00			7:28:48			7:47:18	7:52:54
8:30:00	8:37:24	8:55:12	9:08:48	9:19:48	9:27:30	9:37:18	9:42:54
10:30:00	10:37:24	10:55:12	11:08:48	11:19:48	11:27:30	11:37:18	11:42:54
12:30:00	12:37:24	12:55:12	13:08:48	13:19:48	13:27:30	13:37:18	13:42:54
14:30:00	14:37:24	14:55:12	15:08:48	15:19:48	15:27:30	15:37:18	15:42:54
16:00:00			16:28:48			16:47:18	16:52:54
17:15:00	17:22:24	17:40:12	17:53:48	18:04:48	18:12:30	18:22:18	18:27:54
17:45:00			18:13:48			18:32:18	18:37:54

Table 20: Ten Round Trips per day

Northbound							
El Paso Union Depot	Sunland	Montoya	Canutillo	Anthony	Berino/Vado	Mesilla Park	Las Cruces
6:15:00	6:25:36	6:35:24	6:43:06	6:54:06	7:07:42	7:25:30	7:27:54
7:00:00	7:10:36			7:29:06			7:52:54
8:30:00	8:40:36	8:50:24	8:58:06	9:09:06	9:22:42	9:40:30	9:42:54
9:45:00	9:55:36			10:14:06			10:37:54
11:15:00	11:25:36	11:35:24	11:43:06	11:54:06	12:07:42	12:25:30	12:27:54
13:15:00	13:25:36	13:35:24	13:43:06	13:54:06	14:07:42	14:25:30	14:27:54
15:15:00	15:25:36			15:44:06			16:07:54
17:15:00	17:25:36	17:35:24	17:43:06	17:54:06	18:07:42	18:25:30	18:27:54
18:00:00	18:10:36			18:29:06			18:52:54
19:00:00	19:10:36	19:20:24	19:28:06	19:39:06	19:52:42	20:10:30	20:12:54

Southbound							
Las Cruces	Mesilla Park	Berino/Vado	Anthony	Canutillo	Montoya	Sunland	El Paso Union Depot
6:30:00	6:37:24	6:55:12	7:08:48	7:19:48	7:27:30	7:37:18	7:42:54
7:00:00			7:28:48			7:47:18	7:52:54
8:00:00	8:07:24	8:25:12	8:38:48	8:49:48	8:57:30	9:07:18	9:12:54
9:00:00			9:28:48			9:47:18	9:52:54
10:30:00	10:37:24	10:55:12	11:08:48	11:19:48	11:27:30	11:37:18	11:42:54
12:30:00			12:58:48			13:17:18	13:22:54
14:30:00	14:37:24	14:55:12	15:08:48	15:19:48	15:27:30	15:37:18	15:42:54
16:15:00	16:22:24	16:40:12	16:53:48	17:04:48	17:12:30	17:22:18	17:27:54
17:30:00			17:58:48			18:17:18	18:22:54
19:00:00	19:07:24	19:25:12	19:38:48	19:49:48	19:57:30	20:07:18	20:12:54

The expected running time for a train to complete the full trip from El Paso to Las Cruces will be approximately 1 hour and 12 minutes. Depending on the service plan option selected, trains will run from approximately 6am to 7pm.

VI. Capital Investment Requirements

A. Introduction to Capital Investment Estimates

This study's findings and recommendations regarding the investment required to develop the El Paso – Las Cruces passenger rail service are driven by the estimates of ridership and the service plan for meeting riders' needs, presented in the preceding section. The following sections of this report consider

the investments required to implement the proposed service plan and the net costs entailed in the service plan's operations.

In considering the capital investments for establishing the proposed rail service, it is useful to recognize two categories of required investments:

- *BNSF-Influenced Investments* will depend on the BNSF Railway's corporate strategy re the segment of their "El Paso Subdivision" rail line that would provide the infrastructure for the proposed passenger rail service. Analysis of data on comparable rail services can only indicate the order of magnitude for these investments. Closer estimates of these investments must be determined when SCRTD and its partners begin to negotiate with BNSF.
- *Independently Determined Investments* are investments that the governing authority of the El Paso – Las Cruces passenger service will be free to make based on its best understanding of comparable rail operations and its options. The CNT team has been able to make useful estimates of these investment requirements for the El Paso – Las Cruces line by studying the data of comparable commuter rail services.

Both types of investments are considered in the following sections.

B. BNSF-Influenced Investments

These investments include:

(1) *Operating Rights:* The amount of money BNSF will require to either sell the El Paso to Las Cruces segment of its El Paso Subdivision (reserving its rights to operate a freight rail business on the line) or lease rights to operate a passenger rail service on this segment of their network.

(2) *Rail Line Infrastructure Improvements*: The funds required to upgrade the rail infrastructure of this line segment to a condition that will support both the planned passenger service and the level of freight service BNSF intends to move on this line in the future.

(3) *Maintenance Yard:* The facility that will be required to maintain passenger rail vehicles and equipment may or may not be accommodated in a portion of BNSF's existing maintenance facility.

In regard to each of these types of investments, BNSF's position may depend more on its long-term strategy than its current use of the line.

1. Operating Rights

As discussed in Section III.A. of this report, BNSF's use of the El Paso Subdivision, including the segment between El Paso and Las Cruces, is not intense; only 4 to 8 freight trains per day move on the entire subdivision, and annual freight volume is less than 10 million tons. The infrastructure of the line reflects this light volume; it is single tracked, not controlled by an automated signaling system, and limited to operating speeds as low as 49 miles per hour. If BNSF were to sell the El Paso – Las Cruces segment of the subdivision or lease rights to operate a passenger rail line on it, based on its current contributions to the company, the asking price should be relatively reasonable. BNSF may even have timely incentives to sell or lease rights to a low-volume segment of its network, as its profitability, like to that of other Class I railroads, has been lowered by the declining scale of coal shipments.

If BNSF is prepared to sell a portion of the El Paso Subdivision in consideration of its low current value to the railroad, it may prefer to sell the entire subdivision, extending up to Belen, rather than just the El

Paso to Las Cruces segment, as pointed out by the Connectics Transportation Group in their 2009 study. In this event the asking price of the rail line might be high for the 43-mile commuter line segment but modest for an intercity link of 221 miles. Such a sale would follow the precedent by which a public sector buyer acquired the 270 miles of rail track now used by the Rail Runner passenger rail service (Santa Fe to Belen via Albuquerque) for $75 million. In agreement with the 2009 study on this point, CNT will use $75 million as the low estimate of the cost to acquire rail infrastructure for the El Paso – Las Cruces rail service.

On the other hand, BNSF may have ambitions to compete aggressively for freight business across the Mexican border, challenging its chief rival the Union Pacific (UP) and the Kansas City Southern Railroad for these accounts. If this is BNSF's long-term plan, full control of the El Paso Subdivision may have real strategic value for this railroad. While BNSF has not signaled such an intention, and it is not possible to read the corporate mind on this issue, a place holding estimate of the line segment's strategic value might be three times the sale price of the Rail Runner's infrastructure, as in the heavily qualified estimate of the Connectics study, $250 million.

2. Rail Line Infrastructure Improvements

Investments to upgrade the infrastructure of the El Paso Subdivision so that it can carry passenger as well as freight trains can be estimated largely on the basis of objective conditions rather than corporate strategies. However, if BNSF plans to use the line more intensively in the future, infrastructure investments to upgrade the line for much heavier freight use as well as passenger rail could be considerably higher than only improving the line for passenger service. Furthermore, BNSF would share the information required to make an exact estimate of infrastructure improvements only in an advanced negotiation. So while the CNT team has made a high level estimate of line improvement costs, these improvements are in the category of investments that can only be estimated broadly prior to negotiations with BNSF.

After reviewing public information about the El Paso Subdivision track conditions and viewing segments of the line on site, CNT team member Iowa Pacific Railroad made the following, high-level estimate of items required to bring the El Paso – Las Cruces segment into standard Class 4 condition (permitting top operating speed of 80 mph for passenger trains):

- Installation of Positive Train Control (PTC) to provide adequate signalization, $30,000 per mile, $1.3 million subtotal for the 43-mile line segment
- Three passing sidings to permit the passage of trains on this single track line, $10 million each, $30 million subtotal
- Four miles of double tracking, $1 million per mile, $4 million subtotal
- Total line upgrade: $35.3 million

This estimate is similar to the experience of other railroads that have upgraded lightly used freight rail track to support commuter rail for investments of $1 million to $2 million per mile, for lines that extended over extensive rural or exurban areas. Line improvements to introduce commuter rail in densely populated urban or suburban areas have required investments of up to $10 million per mile;

however, conditions for the El Paso – Las Cruces commuter line are similar to projects that have incurred $1 million to $2 million per mile investments.

Accordingly, CNT has estimated $43 million as the low end of the range of investment required to upgrade rail infrastructure and used a figure three times this amount, $142 million, as the high end of the investment, allowing for the possibility that BNSF might impose special requirements for track improvement, consistent with a corporate strategy for aggressive freight volume growth.

3. Maintenance Yard & Total BNSF-Influenced Investments
BNSF owns and operates a maintenance yard bordering the El Paso station (805 S. Santa Fe Street. Southwest of Paisano Drive and between the US/Mexico Border). Union Pacific also operates a yard in Central El Paso (Interstate 10 and Texas Avenue).[40] CNT proposes that in the general agreement struck with BNSF to establish commuter rail service, a portion of the existing maintenance yard would be allotted for Las Cruces-El Paso trains. In this event, investments required to equip a section of the yard for passenger train maintenance might be as low as $1 million; however, if the passenger rail service is required to purchase land, build rail infrastructure and equip a separate maintenance yard, the necessary investment could be six times this level, or $6 million.

C. Independently Determined Investments
Decisions regarding capital investments to acquire rolling stock (locomotives and passenger cars) and build stations will not be directly influenced by BNSF positions, and the governing body of the Las Cruces-El Paso rail line will be free to make investment decisions re these items based on their best understanding of market choices. Particularly in regard to rolling stock, several fundamental decisions need to be made which will significantly influence feasibility of the proposed rail service:
- To equip the rail service with locomotives pulling passenger cars or with Diesel Multiple Units (DMU) – internally powered passenger cars
- Acquiring the number of vehicles adequate for the anticipated ridership and service plan
- Choosing new or far less expensive used equipment

Through an analysis of comparable commuter rail services the CNT team offers estimates and recommendations regarding these investments.

The accompanying table summarizes information about 11 operational or planned commuter lines that is relevant to several of these investment decisions. This data includes vehicle type, commuter line distance, population, weekday ridership, average passengers per ride, and an estimated peak capacity per ride.

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[40] http://www.bnsf.com/customers/where-can-i-ship/facility-hours-directions/el-paso.html, http://www.city-data.com/forum/el-paso/1675983-downtown-el-pasos-three-railroad-yards.html

1. Rolling Stock

a. Locomotive Powered Trains or Diesel Multiple Units (DMU)

Locomotives pulling passenger cars is an extremely mature technology that provides known levels of reliability and a wide range of vendor options. The relatively new technology of DMUs can offer advantages in some situations. DMUs are widely used in Europe and Japan, where they often cover relatively lightly traveled commuting routes. They are acknowledged to generate substantially less pollution and noise per vehicle mile traveled than locomotive powered commuter rail[41], and DMUs are less expensive to operate per vehicle mile than locomotive powered trains.[42] DMUs may be added to or decoupled from trains easily. So they may be useful for rail services with ridership levels that are uncertain or volatile, including new services.

However, commuter lines that cover mid to long distances (between 40 and 90 miles) tend to use locomotives and passenger cars, while commuter lines that run across shorter distances (20 to 35 miles) use DMU vehicles. Given the information provided in Table 14, it seems that distance traveled and population size have large impacts on the daily ridership and average ridership per train run for commuter rail lines. Commuter lines that use locomotives generally have higher ridership; they also travel greater distances and access larger populations.

There are multiple reasons for this pattern of limited DMU application. One of them is regulatory. FRA regulations re vehicles that travel on rail track shared with freight trains are subject to equipment design regulations meant to promote safety, which require more heavily built vehicles than DMU manufactured for the international market. Some observers regard these regulations as obsolete, and they have been subject to professional review since the 1990s. While a growing number of transit systems have obtained permission to operate DMU on shared track, regulations remain an obstacle.[43] For example, in some cases DMU operations have been permitted to operate on shared track under "time separation" requirements, which prohibit DMUs and freight trains from operating on the same rail segments during the same hours. Clearly such regulations make shared track operations impractical on all but the most lightly used freight lines.[44]

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[41] Federal Railroad Administration, *Diesel Multiple Units, Self-Propelled Passenger Rail Car,* September 15, 2008, file:///C:/Users/david/Downloads/dmu%20(1).pdf

[42] David O. Nelson, Jacobs Engineering Group and Chairman, Transportation Research Board Subcommittee on Self Powered Rail Car Technologies, *Diesel Multiple Units in 21st Century North America,* November 2016, https://drive.google.com/file/d/0ByGG0TLIU2FWazh4NzdPQ3psN3M/view

[43] Christopher W. Jenks, *Supplementing and Updating TCRP Report 52: Joint Operation of Light Rail Transit or Diesel Multiple Unit Vehicles with Railroads,* September 2001, http://www.tcrponline.org/PDFDocuments/TCRP_RRD_43.pdf

[44] Itinerant Urbanist, "DMUs, the FRA, and Environmental Law Reform", October 15, 2016, https://itineranturbanist.wordpress.com/2015/10/15/dmus-the-fra-and-enviromental-law-reform/

Regulatory issues aside, there are sound operational and economic reasons why locomotive powered trains may be more appropriate than DMU commuter rail services that move thousands of passengers per day over distances of more than 40 miles. Although DMUs may be capable of faster speeds, they commonly operate at speeds of less than 30 mph, rather than the 60 mph commonly reached by commuter trains as they travel between stations five or more miles apart. While DMU are more economical and less polluting per vehicle mile, they typically carry only a third to half as many passengers per rail car as locomotive powered commuter trains; so these advantages many vanish or be reversed for commuter trains that carry hundreds of passengers in a typical peak period trip. Professionals who have studied DMUs most intensively regard this transit alternative as a "hybrid" that provides more speed and carrying capacity than light rail systems, but less speed, capacity, and economy than locomotive powered commuter rail.

Accordingly, CNT recommends that the Las Cruces-El Paso service use locomotive powered train sets as its carrying vehicles. The reasons for this recommendation are reinforced by considerations of the specific capacities and prices of the vehicles to be purchased.

b. *Number of Train Sets Required*

Of the 12 comparable commuter railroads whose operational figures are summarized in Table 21, the two railroads that are most similar to the proposed Las Cruces-El Paso line – in terms of projected ridership and distance of the commuter line -- are the San Diego-Oceanside Coaster and the Minneapolis Northstar. The Coaster covers 41 miles, makes 30 trips per day, has an average daily ridership of 5,600 per day, and has an average passenger count of 255 per trip. The Northstar covers 40 miles, makes 12 trips per day, has a daily ridership of 3,100 per day, and has an average passenger count of 258 per trip. For comparison, the proposed Las Cruces-El Paso commuter line, as discussed in Section IV.C, is projected to cover 43 miles, make 16-20 trips per day, have an average daily ridership in its early years of operation between 4,452 and 7,404 passengers, and average between 361 and 481 passengers per ride during peak hours and 278 and 370 passengers per ride during non-peak hours. Both the Coaster and the Northstar use diesel electric locomotive engines and Bombardier bi-level coaches. The bi-level coaches have a greater capacity for seated passengers (between 136 and 162) compared to DMU vehicles (between 91 and 108), which is advantageous for commuter lines with passengers travelling longer distances.

If the Las Cruces-El Paso line is equipped in the same way as the Coaster and the Northstar, the number of locomotives needed to operate its proposed service plan is two for off-peak hours and three for peak hours. A locomotive will be needed as a reserve, to allow for maintenance and possible malfunctions.

Similarly, with an average 278-370 passengers per trip and 361-481 passengers at peak capacity, the Las Cruces-El Paso line will need three bi-level cars per train to allow each train to seat all passengers even during peak hours.[45] Thus, in order to support eight to ten round trips per day with three passenger cars per train, the Las Cruces-El Paso line will need 9 passenger cars, with a reserve set of 3 cars, or 12 bi-level coaches in total.

Table 21: Rolling Stock across comparable rail lines including predictions for Las Cruces-El Paso line

Name	Santa Cruz-Watsonville	Boston-Manchester, NH, by Lowell project	Denton County A-Train (Dallas, to Trinity Hills by Denton)	Front Runner (Salt Lake City)	Altamont Corridor Express (ACE) Stockton - San Jose	Denver to Denver Airport A-line commuter rail line	Capital Metro Greater Austin	Coaster NCTD San Diego-Oceanside	Northstar Northern suburbs to Minneapolis	Music City Star Nashville	Fort Worth and Dallas TRE (Trinity Railway Express)	New London and New Haven Shoreline East	Las Cruces-El Paso Commuter Rail Estimates

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[45] It should be noted that adding a third car to accommodate for peak hours would likely increase fuel costs. If feasible, one advantage of using DMU vehicles would be that cars can be added as needed during service, thereby resolving this problem and reducing energy costs. https://sccrtc.org/wp-content/uploads/2016/02/RailTransitStudy_FullDoc.pdf

Las Cruces-El Paso Commuter Rail Feasibility Study

Locomotive (LMV) or Multiple Unit (DMU)?*	DMU (maybe FRA compliant)	LMV	DMU	LMV	LMV	EMU	DMU	LMV	LMV	LMV	LMV	LMV	LMV
Type of Locomotive (LMV)/DMU	Diesel-electric multiple unit *studied*	Diesel-electric locomotive engine *studied*	Diesel-electric multiple unit engine	Diesel-electric locomotive engine	Diesel-electric locomotive engine	Electric multiple unit	Diesel-electric multiple unit engine	Diesel-electric LMV engine	Diesel-electric LMV engine	Diesel-electric LMV engine	Diesel-LMV engine and Diesel electric multiple units	Diesel-electric LMV engine	Diesel LMV Engine *recommended*
Carriage Car Manufacturer/Fleet Size			(11) Stadler GTW (motor and carriage in same vehicle)	(22) bi-level Bombardier coaches (25) refurbished ex-New Jersey Comet Is (16) locomotives	(30) bi-level Bombardier coaches (5) F40PH-2C engines (1) F40PH-3C engine	(37) Hyundai-Rotem EMU (motor and carriage in same vehicle)	(6) Stadler GTW (motor and carriage in same vehicle)	(28) Bombardier bi-level coaches (7) locomotives	(17) Bombardier bi-level coaches (6) locomotives	(7) former Metra bi-level gallery cars (likely Nippon Sharyo) (4) locomotives	(7) EMD F59PH IV and (2) EMDF59PHI Locomotives. (13) DMU: Budd Rail Diesel (15) Bombardier Transportation bi-level cabs, (10) Hawker-Siddeley bi-level	(6) GH40-2H and (12) GE-P40DC Locomotives (10) Bombardier Transportation bi-level cabs, (33) Mafersa Coaches	Likely 4 locomotives, 8-12 passenger cars *recommended*
Car-locomotive cost	DMU: $8-10M Locomotives & trailer cars: $3M (used); $12-16M (new)	$23.3 million est. for purchase of rolling stock	$7.5 million each vehicle	Bombardier coaches: $2.2 M each	Bombardier coaches: ~$2.2 M each		$36.04 M total (~$6M each vehicle)						$3.465M (used); $14.2-$19.2M (new)
Car-locomotive (LMV) train configuration	DMU: Married pair LMV: one loc. + two trailers	One LMV + four coaches			One LMV + six-seven passenger cars	DMU Married pair	Likely DMU married pair		One LMV, three or four cars	One LMV, two cars	One LMV, three cars	One LMV, four cabs	One LMV, two-three cars *recomme*

													nded
Carriage Car Capacity			200 passengers each, 108 seated and 92 standing	Bombardier cars: 136-162 seated; up to 360 total with standing Comet Is: N/A	Bombardier cars: 136-162 seated; up to 360 total with standing	91 seated passengers and 78 standing; will be in "married pair" configuration	200 passengers each, 108 seated and 92 standing	Bombardier cars: 136-162 seated; up to 360 total with standing	Bombardier cars: ~140 seated; up to 355 with standing	Gallery cars: 155-169 passengers	Bombardier cars: 136-162 seated; up to 360 total with standing, Budd RDC's: 96 seated	Bombardier cars: 136-162 seated; up to 360 total with standing, Mafersa cabs: 100 seated	
Rail Distance	32 miles *proposed*	53-46 miles *proposed*	21 miles	88 miles	85 miles	23.5 miles	32 miles	41 miles	40 miles	32 miles	34 miles	45 miles (est.)	43-48 miles *proposed*
Population	SC: 270,000 WL 50,000	B:655,000 M: 110,000	Denton: 123,099 Dallas: 1,258,000	SLC: 200,000 Ogden: 83,000 Provo: 112,000	SJ: 1,000,000 Stockton: 300,000	D: 650,000 Airport: 54 million passengers in 2015 (18th busiest airport in the world)	Austin : 850,000 Northern suburbs: fastest growth in the US	San Diego: 1,350,000 Oceanside: 170,800	Minneapolis: 400,000 Big Lake: 10,000	Nashville: 650,000 Lebanon (Tennessee) 23,000	Dallas: 1,258,000 Fort Worth: 792,727	New London: 27,545 New Haven: 130,660	Las Cruces-El Paso Corridor: 456,885
Number of Daily Trips	Scenario G :60 trips daily - 30 round trip	50 trips daily -25 roundtrip (Manchester commuter plan); 16 trips daily (Nashua plan)	60 trips daily – 30 roundtrip	56 trips daily – 28 roundtrip	8 trips daily	144 trips daily	38 trips daily	22 trips daily – 11 roundtrip	12 trips daily	12 trips daily – 6 roundtrip	70 trips daily - 35 round trip	42 trips- 21 round trip	16 to 20 trips daily – 8 to 10 roundtrip *proposed*
Fares (one way)	N/A	N/A	$1.50	$2.50	$4.50-$13.75	$2.60-$9	$2.75	$4-$5.50	$3-$6	$5.25	$4.15	$2.89	TBD
Ridership	5,500 per weekday estimated	3,230 (Manchester); 1,170 (Nashua)	1,900 per day	16,800 per day (5,000 for the Northern Part in	3,700 per day	37,900 – estimated average daily ridershi	2,900 per day	5,600 per day	3,100 per day	1,225 per day	6900 per day	2,200 per day	4,452 (*low estimate with 20% contingency*) – 7404 (*high*

				2012)		p							estimate with 20% contingency) per day*
Average Passengers per Trip (ridership divided by number of daily trips)	92	65 (Manchester) 73 (Nashua)	31	300	463	263	76	255	258	102	95	52	278-370
Estimated Peak Capacity per Trip (130% of Avg. rounded)	120	85 (Manchester) 95 (Nashua)	40	390	602	342	99	332	335	133	128	68	361-481
Relation of Capacity to type of vehicle	Short distance Mid-sized population DMU - fewer seats	Mid distance Mid-sized commuter population Locomotive (other commuter lines out of Boston also use locomotive)	Short distance Small commuter population DMU - seems to run too many trains per day for ridership	Long distance Large commuter population Locomotive - UTA owns most of track but shares right of way with UP for a portion	Long Distance Mid-sized commuter population Locomotive with limited service → more passengers per trip	Short Distance Large commuter population DMU with frequent service and high ridership	Short distance Small-midsized population DMU better ridership than Denton, perhaps still too frequent	Mid distance Midsized commuter population Locomotive with decent daily ridership	Mid distance Midsized commuter population Locomotive with good daily ridership	Short distance Small commuter population Locomotive – frequency of trips seem appropriate to ridership	Short distance Large population. High frequency trips with large seating ability	Mid distance Small commuter population Locomotive with low daily ridership	Mid distance Midsized commuter population Most similar to San Diego-Oceanside and Minneapolis

Based on the comparable lines analyzed above and using predictions for the proposed Las Cruces-El Paso rail line, CNT recommends that the Las Cruces – El Paso passenger rail service acquire 4 train sets (each of one locomotive and 3 passenger cars) in order to serve the passenger volume, trip frequency, and distance of this line.

c. Cost to purchase locomotives and passenger cars

The information from 12 comparable rail systems summarized in the preceding chart, and particularly research performed for the Santa-Cruz Watsonville Rail feasibility study, provides a basis for estimating of the range of costs for purchasing the 4 train sets recommended for the Las

Cruces – El Paso passenger service (in this example, an MP36 locomotive + 3 bi-level passenger cars). The range of costs for the purchase of new equipment is $3.5 Million to $4.7 Million per train set, while the purchase price for each train set of new equipment will range between $14.2 Million and $19.2 Million.

Table 22: Las Cruces-El Paso Commuter Line Equipment Summary Chart - Locomotive

Estimated Number Passengers per trip during Peak Hours	# of locomotives	Total # of Passenger Cars (3 per train set)	Estimated Cost, New Equipment per unit (train set)	Estimated Cost, Used Equipment per unit (train set)	Estimated Cost, New Equipment total (unit cost multiplied by # train sets)	Estimated Cost, Used Equipment total (unit cost multiplied by # train sets)
361-481	4	12	$14.2 M (min) -$19.2 M (max)	$3.5M (min) $4.7M (max)	$56.8M (min)-$76.8M (max)	$14.0 M (min) – $18.8 M (max)

The large cost differential indicated by this data argues for the purchase of used equipment, but such a decision requires consideration of the reliability and potential maintenance costs of used rail equipment. Accordingly, CNT conducted research to determine whether there is a relationship between the percent of a transportation agency's fleet that was made up of used vehicles, and the percentage of the agency's annual operating costs that went towards vehicle maintenance. Data was gathered from the National Transit Database's 2015 Operating costs report, the 2015 Revenue vehicle inventory report, the 2015 Vehicle maintenance report, and the 2014 Agency snapshot reports. Data was compiled comparing 14 commuter rail routes that are similar to the proposed Las Cruces-El Paso line. A summary of the important statistics for each rail line is included in Table 23 below. The label "used locomotives" was given to locomotives that were either built before 2000 or have been rebuilt at any point since their original manufacturing date.

Table 23: Route comparison for used vs. new locomotive costs

Line	Denton (60101)	Frontrunner (80001)	Altamont (90182)	Capital Metro (60048)	Coaster (90030)	Northstar (50027)	Music City Star (40159)	Dallas Fort Worth (60056)	New Haven-London (10102)	Caltrain (90134)	Tri-Rail (40077)	Virginia Railway Express (30073)	Sounder Commuter Rail (00040)	Sun Rail (40323)

Annual vehicle maintenance costs	174,385	8,894,427	1,773,639	1,762,692	2,908,451	2,789,240	1,347,815	7,513,068	9,293,728	19,697,796	16,009,187	8,651,572	10,930,611	6,512,613
Total annual operating costs	13,429,333	39,332,755	16,673,422	14,795,764	19,741,329	15,709,365	4,680,864	24,006,522	33,944,106	115403592	76373773	65808345	40517405	33667907
Ratio of maintenance to total operations cost	1%	23%	11%	12%	15%	18%	29%	31%	27%	17%	21%	13%	27%	19%
Description	DMU (11)	Two types of NEW locomotives, 2007 and 2009 (18 Total)	6 types of Locomotive (1 new 5 old),	DMU (6)	two types of Units (1 old one new)	Two types of NEW locomotive, 2008 and 2009 (6 Total)	Two types of OLD Locomotives, 1985 refurb. in 2000 and 1985 refurb. in 2011 (4 units)	Three types of locomotives, 2 new (5) and 1 old (4)	Two types of OLD Locomotives, 1967 and 1993 (14 units)	2 types of old locomotives, 1985 and 1998 (23), 1 new type (6)	4 types of old locomotives (12), 1 new type (11)	3 types of new Locomotives (20)	4 types of old Locomotives (8) 3 types of new locomotives (6)	1 type of old locomotive (10)
Metric (% of the fleet that is used)	N/A	0% (18 units are all new)	83% (5/6 units are old)	N/A	71.4% (5/7 is old)	0% (6/6 are new)	100% (4/4 are old)	44.4% (4/9 are old)	100% (14/14 are old)	79% is old (23/29)	52% are old (12/23)	0% (20 new units)	57% are old (8/14)	100% (10 old units)
Percent of the fleet that is used	N/A	0%	83%	N/A	71%	0%	100%	44%	100%	79%	52%	0%	57%	100%
Number of failures	2	90	3	31	128	0	0	6	158	69	66	1	14	2

Number of failures/number of locomotives	0.181818182	5	0.5	5.166666667	18.28571429	0	0	0.666666667	11.28571429	2.379310345	2.869565217	0.05	1	0.2
Decimal for Percent of the fleet that is used		0	0.83	0	0.71	0	1	0.44	1	0.79	0.52	0	0.57	1

Data from these examples was used to conduct three regression analyses, which each indicated small but predictable effects in maintenance costs or service disruptions. In summary:

- For every 1% increase in the percentage of the vehicle fleet that consists of used equipment, an increase of .03% should be expected in terms of the ratio of vehicle maintenance costs to total operating costs.
- For every 1% increase in the proportion of the fleet made up of used locomotives, an agency's ratio of locomotive failures to fleet size will increase by .0297 units. In other words, for every one percent increase in the proportion of the fleet made up of used vehicles, the number of annual failures is expected to rise by .272.

While the sample size for these analyses is small, and therefore their predictive value is not strong, the regressions point to hidden costs both in terms of service disruption as well as maintenance costs when operating used locomotives rather than new units. A more detailed presentation of this analysis is provided in Appendix C to this report.

The important decision to purchase new or used equipment in the operation of the Las Cruces - El Paso will not be based entirely on financial considerations. Because the use of used equipment carries small but predictable risk of service disruptions, Management will need to assess its capacity to manage occasional disruptions and the tolerance of its public for such events. On the basis of information revealed by research, CNT recommends that the business plan for the proposed service should anticipate judicious purchases of used equipment, with the guidance of an experienced rail operator for specific purchases, and a maintenance budget that anticipates additional maintenance costs in proportion the additional risk indicated by regression analysis.

2. Station Construction Costs

The proposed station locations are: El Paso Union Depot, Sunland, Montoya, Canutillo, Anthony, Berino/Vado, Mesilla Park, and Las Cruces. Based on costs associated with the construction of New Mexico's Rail Runner line, it is estimated that station construction would cost $2 million per station. Commuter rail lines often have stations spaced 1-5 miles from each other. Under this guideline the station locations were selected. However, in order to lower the capital costs, intermediate stations can be removed. This line would connect the two centers of El Paso and Las Cruces. Looking at the employment data for these two populations, over 50% of the riders will likely be taking the train from terminal to terminal. As a result, a cost benefit analysis can be completed for the intermediate stops that will help determine whether they are necessary or not.

There is wide variation in cost for station construction, as stations can vary from large structures with amenities to simple concrete covered platforms. Taking into account the majority end terminal to end terminal trips, CNT recommends that intermediate stations be constructed in such a way as to minimize capital costs. Using data from the National Transit Database, station capital costs for the 9 comparable lines was compiled.

Table 24: Station construction costs

	Denton County A-Train	FrontRunner Salt Lake City	Altamont Corridor Express	Capital Metro Greater Austin	Coaster NCTD San Diego-Oceanside	Northstar Minneapolis	Music City Star Nashville	Fort Worth-Dallas Trinity Railway Express	New London and New Haven Shoreline east
Station Capital Cost	$57,983			$112,221	$293,714	$1,194,920	$933,530	$945,039	

Source: National Transit Database Capital 2015 Capital use report

As the Northstar Minneapolis is considered the most similar to the Las Cruces-El Paso proposed line, we estimate average per station costs to be less than the Rail Runner value, and closer to $1 million per station.

D. Summary of Capital Requirements

The following table summarizes the estimated capital requirements to establish the Las Cruces – El Paso passenger rail service detailed in Sections V.A-C of this report. This summary distinguishes between investments that will be heavily determined by the negotiating position of the BNSF Railway, which fall within a range of $120M to $430.6M, in total, and investments that are estimated more closely on the basis of analyzing data from comparable rail services, which fall within a range of $22.6M to $74.8M in total.

Item			2009 Study (Based on Rail Runner)		NorthStar MN		El Paso - Las Cruces	
Right of Way								
Low			$ 75,000,000		$ 110,900,000		$ 75,000,000	
High			$ 250,000,000		$ 110,900,000		$ 250,000,000	
Trackwork, Signals								
Cost per Mile								
Low			$ 1,000,000		$ 2,017,500		$ 1,000,000	
High			$ 10,000,000		$ 2,017,500		$ 4,000,000	
# Miles								
Low			43		40		43	
High			43		40		43	
Subtotal								
Low			$ 43,000,000		$ 80,700,000		$ 43,000,000	
High			$ 430,000,000		$ 80,700,000		$ 172,000,000	
Locomotives								
Cost per Vehicle								
Low			$ 2,200,000		$ 5,050,000		$ 2,000,000	(used)
High			$ 2,200,000		$ 5,050,000		$ 7,600,000	(new)
# Vehicles								
Low			5		6		4	(used)
High			5		6		4	(new)
Subtotal								
Low			$ 11,000,000		$ 30,300,000		$ 8,000,000	(used)
High			$ 11,000,000		$ 30,300,000		$ 30,400,000	(new)
Passenger Rail Cars								
Cost per Vehicle								
Low			$ 2,500,000		$ 2,200,000		$ 465,000	(used)
High			$ 2,500,000		$ 2,200,000		$ 2,200,000	(new)
# Vehicles								
Low			10		$ 17		12	(used)
High			10		$ 17		12	(new)
Subtotal								
Low			$ 25,000,000		$ 37,400,000		$ 5,580,000	(used)

High			$	25,000,000		$	37,400,000		$ 26,400,000	(new)
Stations									
Cost per Station									
Low			$	2,000,000				$ 1,000,000	
High			$	2,000,000				$ 2,000,000	
# Stations									
Low			8					8	
High			8					8	
Subtotal									
Low			$	16,000,000		$	27,800,000	$ 8,000,000	
High			$	16,000,000		$	27,800,000	$ 16,000,000	
Maintenance Facility									
Low			$	6,000,000				$ 1,000,000	
High			$	6,000,000				$ 6,600,000	
Other									
Low			$	-		$	54,200,000	$ 1,000,000	
High			$	-		$	54,200,000	$ 2,000,000	
Subtotal, Estimates Based on Analysis of Comparables									
Low			$	52,000,000		$	95,500,000	$ 22,580,000	
High			$	52,000,000		$	95,500,000	$ 74,800,000	
Subtotal, Estimates Heavily Influenced by BNSF Positions									
Low			$	124,000,000		$	245,800,000	$ 120,000,000	
High			$	686,000,000		$	245,800,000	$ 430,600,000	
Total Capital Cost Estimate									
Low			$	176,000,000		$	341,300,000	$ 142,580,000	
High			$	738,000,000		$	341,300,000	$ 505,400,000	

VII.   Net Operating Costs

Estimates for Operations and Maintenance costs were made through comparison of 9 comparable rail lines. These data points were found from the National Transit Database 2015 agency snapshots, the Santa Cruz-Watsonville Feasibility Study, and the American Public Transportation Association 2015 Q4 ridership report. Data from these sources was processed in four ways to estimate:

- Costs per unlinked passenger trip
- Costs per transit revenue mile
- Total costs of the operating budget
- Revenue from fare box recovery, used to derive estimates of net operating costs

<div align="center">Table 26: Operation and Maintenance Costs</div>

Name	Denton County A-Train	FrontRunner Salt Lake City	Altamont Corridor Express	Capital Metro Greater Austin	Coaster NCTD San Diego-Oceanside	Northstar Minneapolis	Music City Star Nashville	Fort Worth-Dallas Trinity Railway Express	New London and New Haven Shoreline east	Commuter Rail NTD Annual Average [46]
Locomotive or Multiple Unit?	DMU	Locomotive	Locomotive	DMU	Locomotive	Locomotive	Locomotive	Locomotive	Locomotive	
Annual Commuter Rail Capital Costs										
Annual Operating Expenses	$13.4M	$39.3M	$16.7M	$14.8M	$19.7M	$15.7M	$4.7M	$24M	$30.9M	
Annual Ridership[47]	494K	4.6M	1.3M	728K	1.2M	650K	200K	2.1M	520K	
Annual Unlinked Passenger Trips	555,423	4,645,307	1,209,755	833,195	1,641,525	722,637	265,527	2,283,895	889,598	
Operating Cost per Unlinked Passenger Trip	$24.18	$8.47	$13.78	$17.76	$12.03	$21.74	$17.63	$11.04	$34.80	$11.12
Operating Cost per Vehicle Revenue Mile	$21.51	$7.38	$17.54	$52.89	$14.15	$29.71	$ 23.42	$20.84	$16.56	
Fare Revenue	$806K	$7.1M	$8M	$2.5M	$7.4M	$2.5M	$786K	$9.4M	$2.6M	
Farebox Recovery	6%	18%	47.9%	16.9%	37.6%	15.9%	16.7%	39%	8%	50.8%

[46] https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/2013_NTST_Storylines.pdf ; http://www.apta.com/resources/statistics/Documents/FactBook/2015-APTA-Fact-Book.pdf

[47] Values were estimated using average weekday ridership multiplied by 260 (Number of weekdays in a calendar year) (http://www.apta.com/resources/statistics/Documents/Ridership/2015-q4-ridership-APTA.pdf)

A. Operating Cost Estimate from Ridership Level

From the sketch model calculations and comparable railroad comparisons discussed in Section IV.B., we developed low, medium, and high estimates for daily and annual ridership on the Las Cruces – El Paso passenger rail service. In order to see the impact of ridership on operating expenses, we graphed annual ridership vs. annual operating expense for the comparable commuter rail lines. Generally, the higher the annual trip volume, the higher the annual operating expense becomes. The linear trend line relating these values generated a slope of 5.8867. Using this regression output, we calculated the predicted annual operating expenses for the Las Cruces-El Paso line by entering our predictions for annual ridership into the regression equation. The final step in this analysis was generating a prediction for O&M cost per passenger ride. In order to generate this data point, our predictions for annual operating expenses were divided by our predictions for annual ridership. The estimates for annual ridership, predicted annual operating expenses, and O&M cost per ride are summarized below.

Figure 19: Annual Operating Expenses vs. Annual Ridership
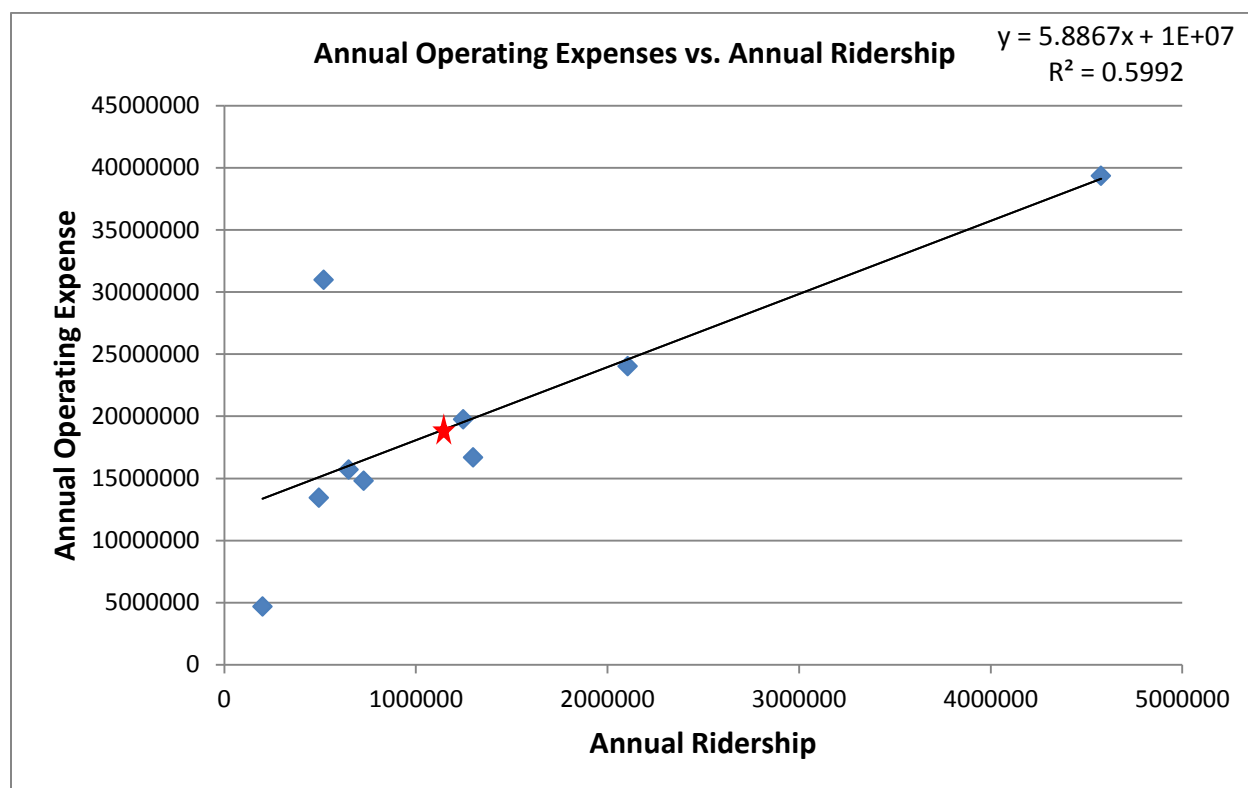
From this study's Estimated Ridership and Proposed Service Plan, CNT has estimated the ridership under several basic assumptions and service plans. Using these estimates, we can predict annual ridership as well as O&M cost per ride. As shown in the following table, these estimated costs fall within a range of $16.8 M to $21.3M, depending on the selected basic ridership assumptions and service plan alternative.

Las Cruces-El Paso	Av Daily Ridership	Annual Ridership	Annual O & M Cost	O & M Cost\Ride
El Paso - Las Cruces Low	4452	1,157,520	$16,813,972.98	$14.53
El Paso - Las Cruces Median	5056	1,314,560	$17,738,420.35	$13.49
El Paso - Las Cruces High	7404	1,925,040	$21,332,132.97	$11.08

B. Operating Cost Estimate from Annual Vehicle Revenue Miles

Data from comparable operating railroads provides an alternative method of estimating the Las Cruces-El Paso Line's operating and maintenance costs. This data, as summarized in Table 26 above, includes a record of the annual vehicle revenue miles for each of the comparable commuter rail lines. When the "Annual operating expense" items are graphed against "Annual Vehicle Revenue Miles", they show the rate of operating expenses expanding with the number of revenue miles.

Figure 20: Annual Operating Expenses vs. Annual Vehicle Revenue Miles
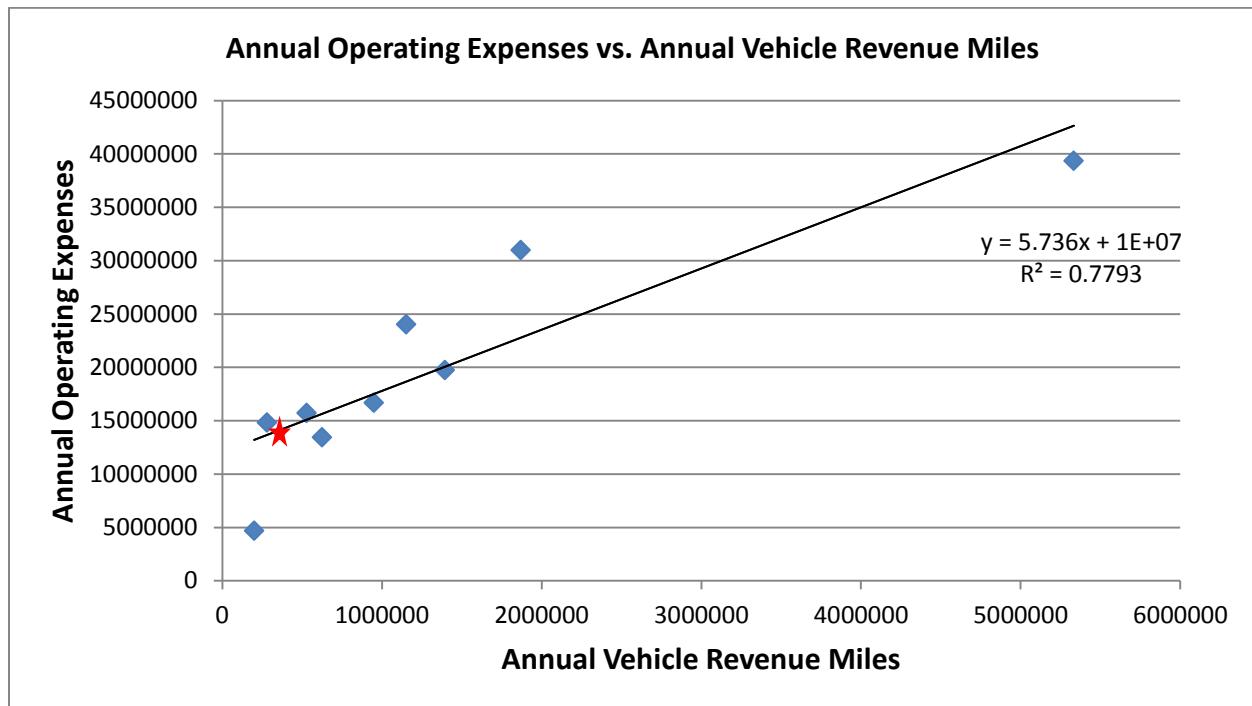
Per the selected information from the Estimated Ridership and Proposed Service Plan, we can estimate the average daily vehicle service miles that will be performed under each of the basic service alternatives for the El Paso – Las Cruces Line, involving 16 or 18 or 20 trips along the 43 mile rail route. Using these estimates for daily revenue miles we can follow a similar process as in Section A. An estimate for annual vehicle revenue miles can be made by multiplying our daily estimates by 260. Using

the regression output shown on the graph, we can plug in values for annual vehicle revenue miles and obtain an estimate for annual operating expenses. Finally, by dividing the estimates for annual operating expense by the annual number of vehicle revenue miles, we obtain an estimate for O&M cost per revenue mile. The results are summarized below.

Table 28: Operating Costs Estimated from Annual Revenue Miles and Cost per Revenue Mile

Las Cruces-El Paso	Daily Vehicle Revenue miles	Annual Vehicle Revenue miles	Annual O & M Cost	O & M Cost/ Vehicle Revenue Mile
Option 1 (16 trips)	1755	456,300	$12,617,336.80	$27.65
Option 2 (18 trips)	1980	514,800	$12,952,892.80	$25.16
Option 3 (20 trips)	2205	573,300	$13,288,448.80	$23.18

As the measure for daily revenue miles depends both on physical distance covered as well as number of passenger cars covering that distance, predictions were made for the number of cars necessary at different times during the day. Based on these daily trips and passenger car numbers, the O & M cost per revenue mile value was calculated for each scenario. By then multiplying these values by the predicted number of revenue miles per year, we can arrive at an estimate of the overall annual cost of operating the rail service.

C. Total Operating Budget

As shown in Tables 18 and 19, the estimates for annual O&M cost for the Las Cruces-El Paso line varies. The range of values we calculated for our estimates comes from the multiple potential ridership scenarios: low, medium, and high. The minimum-maximum range is from $12,528,401 to $22,197,497. Taking these estimates into account we turned to the comparable lines to see if this O&M range appeared reasonable. The mean O&M cost for the 9 comparable lines is 19.9 million, further supporting our estimates. As outlined in the operational statistics section, CNT generated these O&M estimates by using both "Operating Cost per Vehicle Revenue mile" and "Operating cost per Unlinked Passenger Trip" from our nine select comparable rail lines. By generating a graph that relates these variables and "Annual Vehicle Revenue Miles" and "Annual Unlinked Passenger Trips" respectively, we were able to estimate the expected values for the Las Cruces-El Paso line.

Table 29: Annual Operating Expenses

Name	Denton County A-Train	Front-runner Salt Lake City	Altamont Corridor Express	Denver Airport A-line	Capital Metro Greater Austin	Coaster NCTD San Diego-Oceanside	North-star Minnea polis	Music City Star Nashvill e	Fort Worth-Dallas Trinity Railway Express	New London and New Haven Shorelin e east
Wages & Salaries	$357K	$12.65M	$2.1M	$33M	$1.7M	$1.8M	$2.9M		$1.7M	
Fuel	$2K	$4.58M	$1.48M	$127K	$0	$2.1M	$993K	$708K		

Service Costs	$1.3M		$1.27M	$34.8M	$3.4M	$3.4M	$2.1M	$888K	$2.25M	$2.11M
Materials & Supplies	$122K		$846K	$10.28M	$482K	$150K	$669K	$25K	$94K	$1.8K
Total Annual Operating Expense	$13.2M	$39.3M	$16.67M	$111M	$14.79M	$19.7M	$15.7M	$4.68M	$24M	$33.9M

National Transit Database 2015 Operating Expense Report

D. Farebox Recovery Estimate from Annual Ridership

A further way of quantify the expected performance of the Las Cruces-El Paso line is through the use of the Farebox Recovery statistic. Using data from the National Transit Database, farebox recovery values were found for the comparable commuter rail lines. By graphing farebox recovery (as a percent) vs. annual ridership, we see a positive relationship between ridership values and farebox recovery. In other words, the more annual riders a line services, the higher their percentage of farebox recovery becomes. An outlier in this dataset is the Utah Frontrunner line, a line for which the ridership would predict a much stronger farebox recovery value. By removing this data point, the R^2 value for the trend line increased from .05 to .65. As a result, the amended data set and figure were used for this analysis. Figure 21 reflects the removal of this data point. By entering the estimates for daily and annual ridership (outlined in sections A and B) into the regression output for the figure relating ridership and farebox recovery, we were able to estimate the value for farebox recovery for the proposed commuter line. The results are summarized below.

Figure 21: Farebox Recovery vs. Annual Ridership

$$y = 2E\text{-}07x + 0.0487$$
$$R^2 = 0.647$$

Las Cruces-El Paso	Daily Ridership	Annual Ridership	Farebox Recovery
El Paso - Las Cruces Low	4452	1,157,520	28.0%
El Paso - Las Cruces Median	5056	1,314,560	31.2%
El Paso - Las Cruces High	7404	1,925,040	43.4%

E. Fare Estimate from Annual Fare Revenue

CNT conducted a further regression in order to estimate the predicted fare that should be charged in order to achieve the performance values listed throughout this report. By running a regression relating Fare to Annual Fare Revenue, we were able to look at comparable lines in order to obtain an estimate for the ticket cost for the proposed Las Cruces-El Paso rail line. Using the regression output listed on Figure 22, we were able to calculate estimated Fare prices for the three different ridership scenarios. The results are summarized in Table 31.

Figure 22: Fare vs. Annual Fare Revenue

Fare vs. Annual Fare Revenue

$y = -5E\text{-}08x + 3.894$
$R^2 = 0.0163$
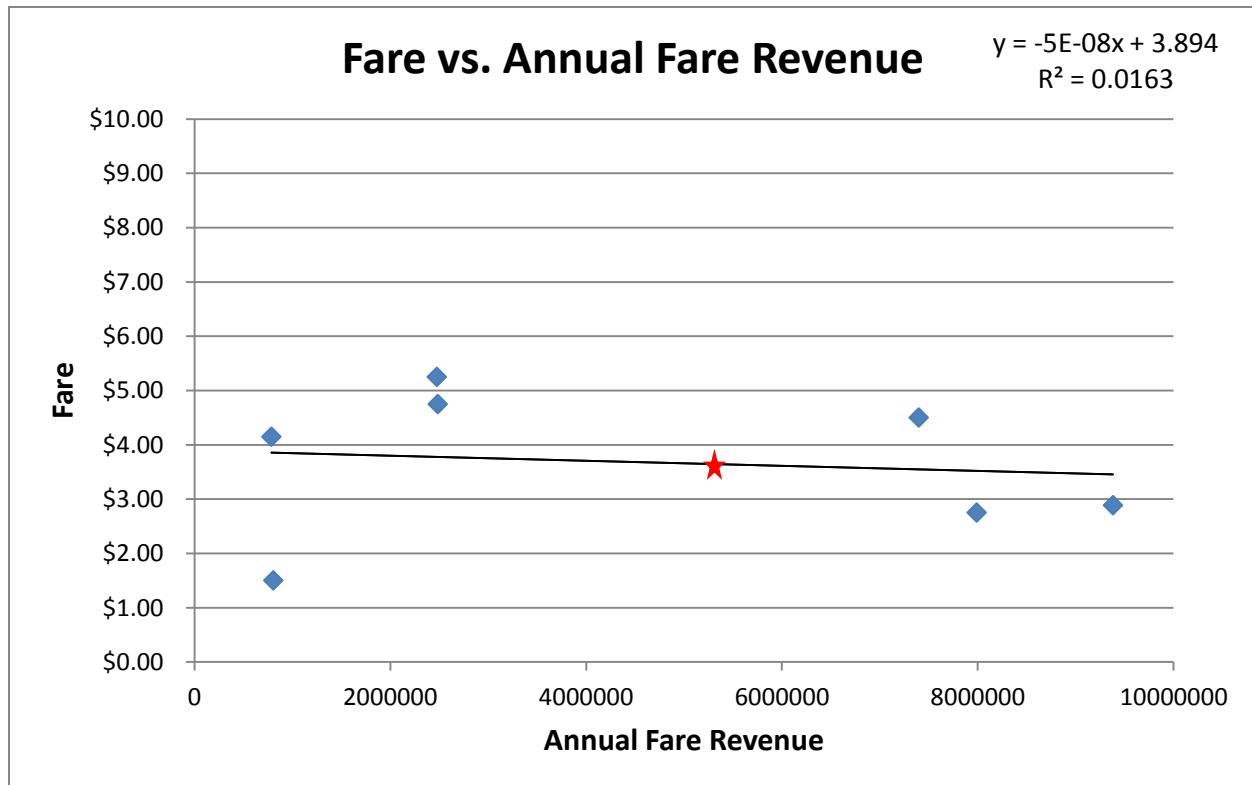
Table 31: Fare Estimated from Annual Fare Revenue

Las Cruces-El Paso	Annual Fare Revenue	Fare
El Paso - Las Cruces Low	$ 5,061,254.00	$ 3.64
El Paso - Las Cruces Median	$ 5,689,414.00	$ 3.61
El Paso - Las Cruces High	$ 8,131,334.00	$ 3.49

VIII.   Collateral Benefits

A. Public Benefits of Avoided Driving

The benefits of building the proposed commuter rail line along the El Paso-Las Cruces corridor are numerous. In order to fully quantify the positive impact, economic re-development plans must be created for the route's station areas. However, a fraction of the benefits can be shown quantitatively by measuring the transportation costs saved. While the capital and operations costs are large for installing a commuter rail line, there are numerous economic and environmental benefits that offset the initial investment. Using data from most recent US Department of Transportation Federal Highway Cost Allocation Study (1997), values for the marginal costs of road maintenance, congestion, accidents, and air pollution were calculated. The marginal cost refers to the cost of adding an additional unit. Using this data, CNT was able to estimate the expected savings from one commuter, who otherwise would have used a car to traverse the route, instead turning to public transit. The values for costs avoided per mile were adjusted to 2016 dollars, allowing for accurate cost estimation. In order to calculate the costs for the proposed commuter rail line, low, median, and high ridership estimates were used. These estimates were previously calculated by CNT using the sketch model for this project. Next, CNT's All Transit application was used to determine the percentage of citizens in Las Cruces and El Paso that already take public transit to work. These percentages were averaged, generating a proportion of 1.2% for the number of potential riders who would take public transit even without the construction of the proposed line. As such, 98.8% of the predicted ridership was used to determine the costs avoided by converting these citizens to public transit. For every ridership estimate, CNT predicted that 80% of commuters would ride the entirety of the 43 mile line, while 20% of commuters would only ride half of the length of the route.

Using the proportions listed above, a final prediction was made for the number of miles spent annually on public transit rather than in a personal vehicle. These estimates were multiplied by the marginal costs for additional drivers on the road, allowing CNT to predict the savings generated by a commuter rail line from El Paso to Las Cruces. A sample calculation is included below in Figure 1. As a result of the analysis outlined above, the predicted economic as well as environmental savings that will accrue for the states of New Mexico and Texas from the construction of this commuter rail line vary from $15,362,943 to $25,549,693 annually.

	Calculating Riders who are forgoing the use of a personal vehicle	Calculating Daily Miles on transit instead of driving for all riders	Calculating Annual Miles on transit instead of driving for all riders
Low Ridership Estimate			
Proportion of riders who would otherwise be driving	4,452-(4,452*.00128)=4395		
Riders on the full route	4,395*(.80)=3,516	3,516*43= 151,188	151,188*260= 39,308,880
Riders on the half route	4,395*(.20)=879	879*21.5= 18,898.5	18,895.5*260= 4,912,830
			Total= 44,222,635

Calculating Annual Savings from using Public Transit	Cost Saving Estimates	
44,222,635*.01=	$442,226	Public Road Construction & Maintenance Costs
44,222,635*.25=	$11,055,659	Congestion Reduction Costs
44,222,635*.06=	$2,653,358	Accident Reduction Costs
44,222,635*.027=	$1,211,700	Air Pollution Health Impact Costs
	$15,362,943	**Total Cost Avoided**

B. Household Benefits of Avoided Driving

As mentioned above, the macroscale positive impacts of constructing a passenger rail line are numerous, but there are benefits for individual level commuters as well. The analysis below demonstrates a rough estimate at the economic benefit that an individual would accrue by riding the proposed rail line instead of making the same trip via automobile. Using the IRS reimbursement rate for mile driven in a car of $.54 and the distance of the round trip, 86 miles, we were able to estimate the annual cost of driving the length of the line ($11,610). Using our estimates for ticket price, we were able to conduct a similar analysis for the annual cost of riding on the proposed rail line. Using the median one-way ticket price of $3.61 and the expected number of trips per year, we were able to estimate the annual rail cost at $1,805. Subtracting this value for the expected annual cost of driving, we obtain a value of $9,805 for the amount of money saved by an individual who forgoes driving and instead uses the newly constructed passenger rail line.

Input	Cost
Total Cost per mile of driving	$0.54
Daily miles per line round trip	86
Annual Miles (250 days)	21,500
Annual Cost of Driving	$11,610
Daily Transit Fare (round trip)	$7.22
Annual Trips	250
Annual Cost on transit	$1,805
Gross savings	$9,805

(https://www.irs.gov/uac/newsroom/2016-standard-mileage-rates-for-business-medical-and-moving-announced)

If savings at this scale were realized by some 3,500 regional workers who would become rail commuters on this line, nearly $35 million per year would be added to the net income of regional households.

C. Benefits of Transit-Oriented Development (TOD)

In order to fully quantify the expected economic effect of the construction of this rail line, an in depth analysis must be conducted. However, CNT would expect that more intensive development, in keeping with the tenants of TOD, in 1-mile diameter areas surrounding rail stations in in two major cities and six intermediate towns will be of substantial scale. On an order of magnitude it will generate hundreds of millions of dollars of public and private investment, the construction of thousands of housing units, and the creation of thousands of jobs. As evidenced in this section on collateral benefits, not only will this rail line improve the commute for thousands of citizens every day, but it will also bring sizeable environmental and economic effects that would drive the regional economy for years to come.

IX.   Conclusion: Recommended Financing and Development Steps

CNT's analysis indicates that the Las Cruces-El Paso rail service could operate successfully on a basis similar to comparable commuter rail services if the large capital requirement, including compensation to BNSF can be managed. At this stage, which is still early in the planning of the passenger rail system, CNT recommends that the SCRTD take the following strategic and inter-related steps to meet the capital requirements and other challenges of developing this service.

Establish a partnership for the development of the passenger rail line with the governmental and transportation management institutions of El Paso.

Such a partnership appears desirable in light of several facts: El Paso has as much or more to gain from the creation of the proposed service and substantially more resources to move toward its implementation. El Paso shares Doña Ana County's commitment to sustainable development and is implementing fixed guideway transit services. Bi-state transit authorities have record of successfully operating commuter rail services, as exemplified by the Southeastern Pennsylvania Transportation Authority (SEPTA) and the Downeaster Railroad of the Northern New England Passenger Rail Authority (NNEPRA). In some cases interstate cooperation encouraged by the federal government can provide a competitive advantage in the pursuit of funding.

Make collateral transit-oriented development (TOD) an integral part of passenger rail development; explore value-capture financing.
The analysis of this study has underscored the well-known relationship between station area development, including access to jobs, and the successful rail transit operations. Station areas in the Las Cruces – El Paso corridor are now consistently under-developed but have strong TOD potential, given establishment of the proposed rail service. Linking station area development to transit development is not only necessary to build ridership, but it generates multiple opportunities for public and private funding and financing. In an optimal development financing scenario, station areas across the corridor would be integrated in a zone within which some part of the incremental economic value generated by the rail service would be used to finance the development of that service. SCRTD and its partners should consider engaging legal counsel to consider how an approximation of such a value capture scenario could be implemented in light of the Anti-Donation Clause in New Mexico's state constitution.

Consider engaging a shortline railroad as a negotiating and operating partner. Shortline railroads today include rail holding companies that operate both passenger and freight services. Such a company might be a valuable partner in the negotiations of SCRTD and its partners with BNSF. Under some scenarios that could include BNSF's sale of the rail line segment, a shortline railroad might be an operator of both freight and passenger services, ensuring smooth connections between these functions.

Position the passenger rail service for the broadest range of opportunities in federal and state funding. SCRTD and its partners should, of course, pursue federal transportation funding opportunities including the Federal Transit Administration's Small Starts program and other FTA funding opportunities. SCRTD and its partners should also develop positions to apply for TIGER and Fast Lane funding or such programs with similar goals as may emerge from Congress in the near future. While the New Mexico DOT has expressed a disinterest in making further investments in the rail network, particularly if these would encumber NMDOT resources in rail ownership or management, the State may be a valuable and willing partner in the pursuit of federal funding for transportation improvement projects. By linking passenger rail development to TOD and potentially freight operations, the SCRTD partnership would potentially gain access to a broader range of funding opportunities, including programs of the Economic Development Administration (EDA), Housing and Urban Development Administration (HUD), and the Environmental Protection Association (EPA). Through public private partnerships, SCRTD and its associates may also qualify for federal financing on extremely favorable terms through the

undersubscribed and potentially expanding programs of the Railroad Rehabilitation & Improvement Financing (RRIF) and the Transportation Infrastructure Finance and Innovation Act (TIFIA).

Creatively Pursue Niche Ridership Markets. Certainly finance and development come before rider marketing, but the Las Cruces-El Paso service would have a rich range of special market opportunities, and the incorporation of marketing programs to reach these audiences the commuter service's business plan could strengthen its case for development resources. Niche opportunities include:

- College students who might be engaged through U-Pass programs in which universities provide transit access as a student amenity, providing the transit agency with institutional customers and building the ridership base
- Mexican nationals who might benefit from the recent expansion of the border area zone allowing free access as far into the US as Las Cruces
- Special service offerings for the elderly, a rapidly growing segment of the corridor's population
- Mobilization of the strong public interest in passenger rail into a booster organization that would encourage ridership and contribute to positive rider experiences

X. Appendices

A. Appendix A: Proposed Commuter Rail Service Resident/Stakeholder Survey

The South Central Regional Transit District (SCRTD) has commissioned a feasibility study of a commuter rail service between El Paso and Las Cruces, stopping at as many six towns in between, and possibly extending to Space Port America. By answering the following questions, you will help to determine whether or not this service would be viable.

1. Would you use a passenger train service between El Paso and Las Cruces, stopping at intermediate towns?

_____ Yes; _____ No
If yes, please answer the following questions.
2. **Between what towns would you be most likely to travel by train?**

a. To and from Las Cruces and El Paso

b. To and from Las Cruces and Anthony

c. To and from Las Cruces and Sunland Park

d. Between other cities

e. If so, please describe

3. **For what purpose would you travel by train, and how often?** Check all that apply:

a. Commute to work: Daily _____ , Weekly _____

b. Recreation and/or fun: Daily ____, weekly

c. College (NMSU, DACC or UTEP): Daily __, weekly

d. Other

e. _____ Business trips: Daily _____ , Weekly _____, Monthly _____, Several times a year ____ ____

f. _____ Medical or other service appointments : Daily _____ , Weekly _____, Monthly _____,

g. Several times a year _____

4. **What would be a reasonable price for a round trip ticket from Las Cruces to El Paso and back again**

a. $4.00

b. $6.00

c. $8.00

d. Other, please describe

5. **Why would you travel by train?** Please rank the following, with 1 being the reason that is most important to you, and highest number being the least important.
a. _____ No regular access to a car
b. _____Save money through fewer car trips, possibly having one less car in the household

c. _____ Save time, possibly avoiding congestion

d. _____ Help the environment

h. _____ Help the economy of the towns through which I travel

i. _____ For fun

j. _____ I do not have a driver's license

k. _____ Other: _____

6. What possible difficulties might discourage you from traveling by train? Please mark all that apply:

a. _____ Too long in travel time

b. _____ Ticket price too high

c. _____ Traveling to or from train stations

d. _____ Love my car too much

e. Never used public transportation before

f. _____ Other: _____

7. Would you use a passenger train service to Space Port America?
_____ Yes; _____ No
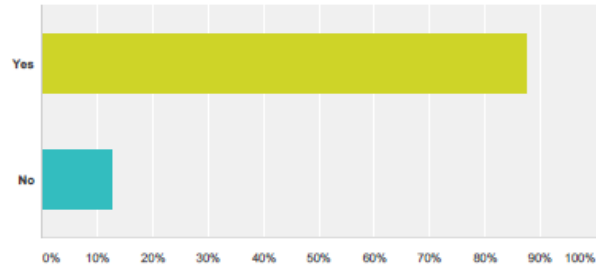
Thank you for taking the time to complete this survey and helping to answer the questions of feasibility for the proposed passenger train service.

Q1 Would you use a commuter train services between El Paso and Las Cruces, stopping at intermediate towns?
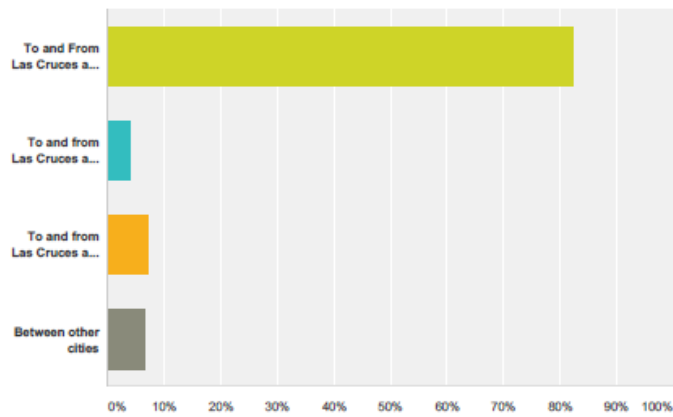
Answered: 999   Skipped: 6

Answer Choices	Responses	
Yes	87.39%	873
No	12.61%	126
Total		999

Q2 Between what towns would you be most likely to travel by train?
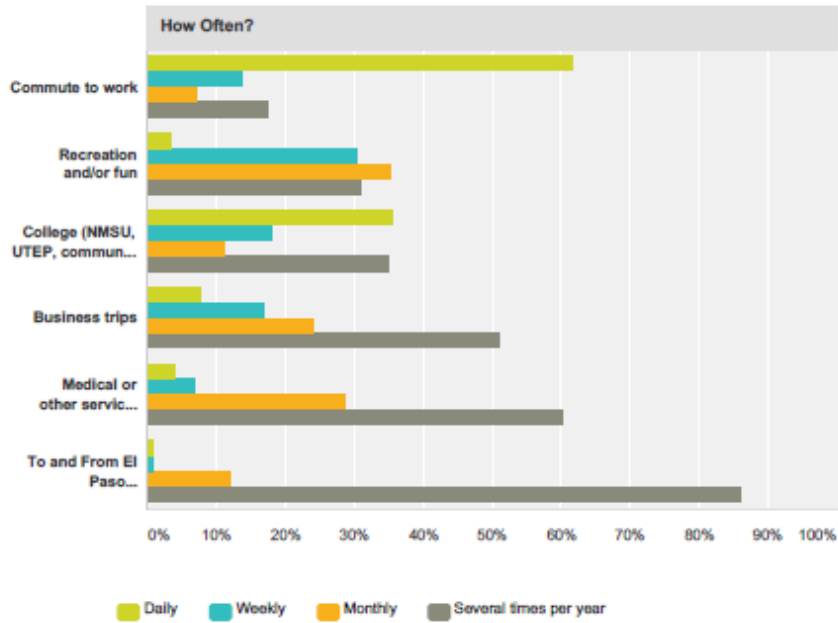
Answered: 925   Skipped: 80

Answer Choices	Responses	
To and From Las Cruces and El Paso	82.49%	763
To and from Las Cruces and Anthony	3.89%	36
To and from Las Cruces and Sunland Park	7.03%	65
Between other cities	6.59%	61
Total		925

## Q3 For what purpose would you travel by train?

Answered: 915   Skipped: 90

How Often?	Daily	Weekly	Monthly	Several times per year	Total
Commute to work	61.57% 173	13.88% 39	7.12% 20	17.44% 49	281
Recreation and/or fun	3.41% 28	30.45% 250	35.32% 290	30.82% 253	821
College (NMSU, UTEP, community college)	35.45% 78	18.18% 40	11.36% 25	35.00% 77	220
Business trips	7.79% 25	16.82% 54	24.30% 78	51.09% 164	321
Medical or other service appointments	3.94% 15	6.82% 26	28.87% 110	60.37% 230	381
To and From El Paso International Airport	0.92% 6	0.92% 6	12.08% 79	86.09% 563	654

Q4 What would be a reasonable price for a round-trip ticket from Las Cruces to El Paso and back again?

Answered: 966 Skipped: 39
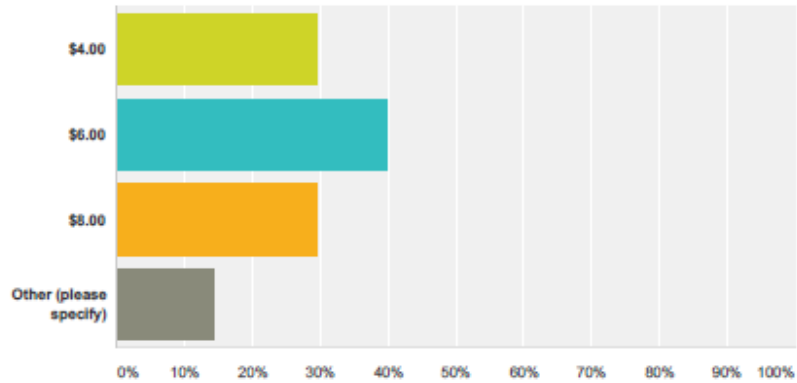
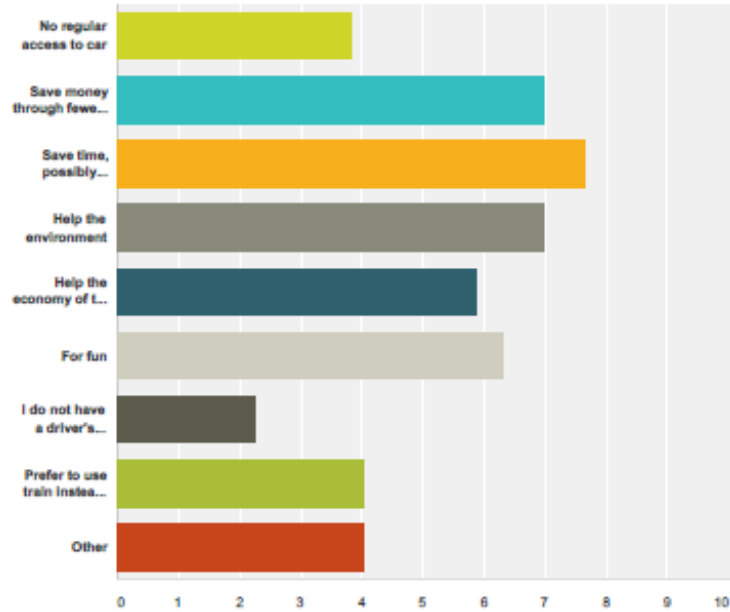| Answer Choices	Responses	
$4.00	29.50%	285
$6.00	39.96%	386
$8.00	29.71%	287
Other (please specify)	14.39%	139
Total Respondents: 966		

Q5 Why would you travel by train? Please rank the following, with 1 being the reason that is most important to you, and the highest number being least important

Answered: 935   Skipped: 70

	1	2	3	4	5	6	7	8	9	Total	Score
No regular access to car	9.28% 36	4.38% 17	6.70% 26	2.32% 9	7.22% 28	10.05% 39	20.88% 81	24.23% 94	14.95% 58	388	3.82
Save money through fewer car trips, possibly having one less car in the household	29.84% 182	20.00% 122	16.23% 99	10.82% 66	11.97% 73	4.59% 28	2.30% 14	2.46% 15	1.80% 11	610	6.99
Save time, possibly avoiding traffic congestion	36.69% 266	31.59% 229	14.90% 108	6.76% 49	4.97% 36	1.38% 10	1.52% 11	1.24% 9	0.97% 7	725	7.66
Help the environment	20.49% 141	23.98% 165	24.42% 168	15.55% 107	6.69% 46	2.76% 19	3.05% 21	1.74% 12	1.31% 9	688	6.99
Help the economy of the towns through which I travel	6.43% 38	10.49% 62	16.75% 99	25.38% 150	23.86% 141	8.80% 52	5.25% 31	2.37% 14	0.68% 4	591	5.87
For fun	16.97% 122	13.63% 98	17.25% 124	18.08% 130	17.66% 127	9.04% 65	3.62% 26	1.81% 13	1.95% 14	719	6.32
I do not have a driver's license	2.16% 8	1.35% 5	2.43% 9	1.35% 5	1.62% 6	3.77% 14	16.71% 62	26.15% 97	44.47% 165	371	2.25
Prefer to use train instead of driving- due to health reasons or age	6.21% 29	3.85% 18	5.14% 24	7.71% 36	10.06% 47	23.55% 110	15.42% 72	15.85% 74	12.21% 57	467	4.04
Other	15.22% 49	4.04% 13	4.66% 15	4.97% 16	8.39% 27	10.87% 35	13.04% 42	6.83% 22	31.99% 103	322	4.02

Q6 What possible difficulties might discourage you from traveling by train? Please mark all that apply.

Answered: 910   Skipped: 95
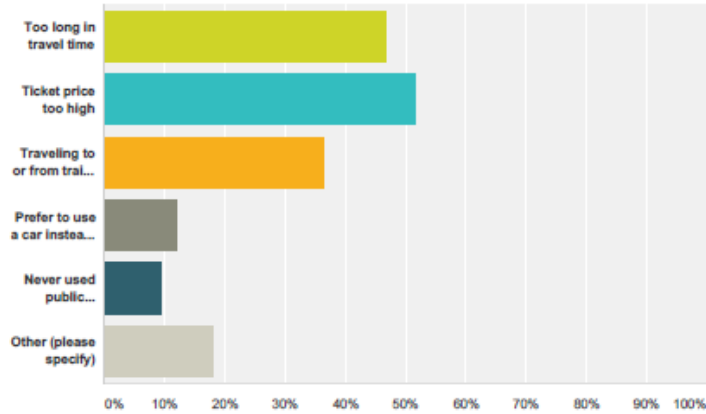
Answer Choices	Responses	
Too long in travel time	46.70%	425
Ticket price too high	51.65%	470
Traveling to or from train stations	36.48%	332
Prefer to use a car instead of train	11.98%	109
Never used public transportation before	9.45%	86
Other (please specify)	18.02%	164
Total Respondents: 910		

Q7 Would you use a passenger train service to Space Port America?

Answered: 952   Skipped: 53
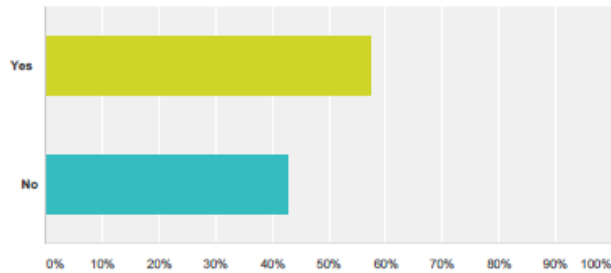
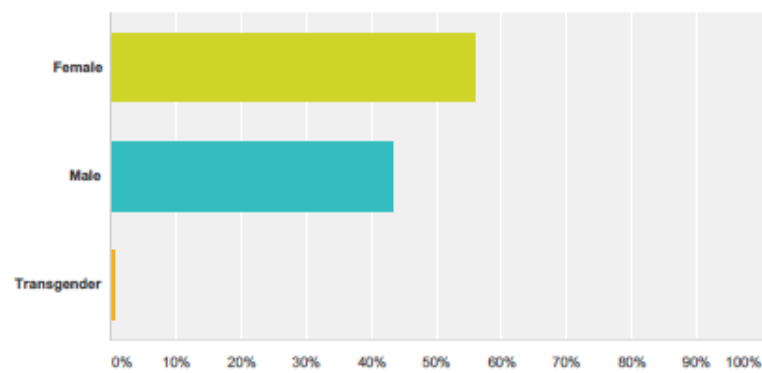| Answer Choices	Responses	
Yes	57.35%	546
No	42.65%	406
Total		952

Q8 Any additional comments/concerns about the proposed commuter rail services?

Answered: 262   Skipped: 743

Commuter Rail Survey
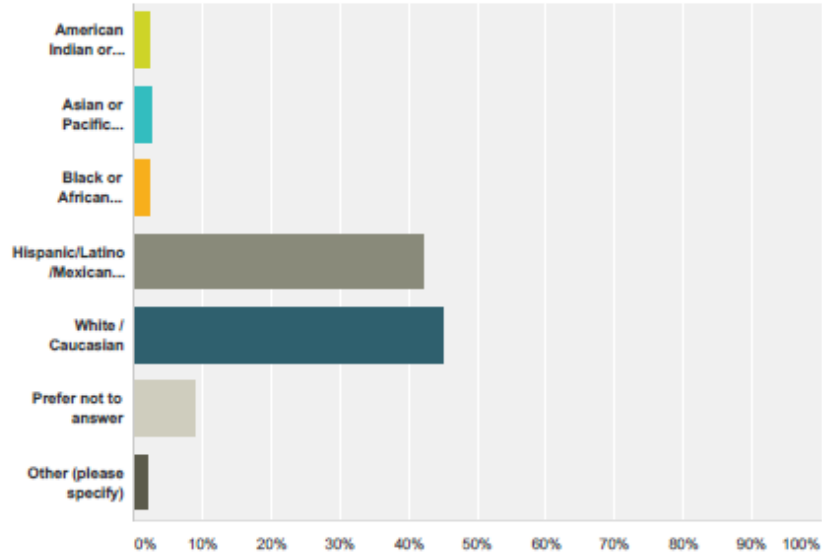
Q9 What is your gender?

Answered: 895   Skipped: 110

Answer Choices	Responses	
Female	55.98%	501
Male	43.46%	389
Transgender	0.56%	5
Total		895

Q10 What is your ethnicity? (Please select all that apply.)
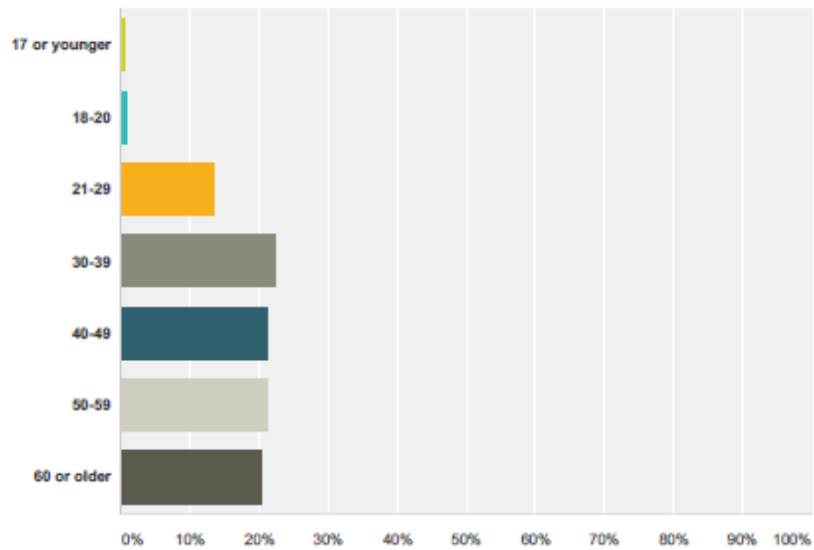
Answered: 890   Skipped: 115

Answer Choices	Responses	
American Indian or Alaskan Native	2.36%	21
Asian or Pacific Islander	2.58%	23
Black or African American	2.25%	20
Hispanic/Latino/Mexican American/Chicano	42.13%	375
White / Caucasian	44.94%	400
Prefer not to answer	8.76%	78
Other (please specify)	1.91%	17
Total Respondents: 890		

Q11 What is your age?

Answered: 895   Skipped: 110

Answer Choices	Responses	
17 or younger	0.34%	3
18-20	0.78%	7
21-29	13.63%	122
30-39	22.35%	200
40-49	21.12%	189
50-59	21.34%	191
60 or older	20.45%	183
Total		**895**

Q12 What is the highest level of school you have completed or the highest degree you have received?

Answered: 893   Skipped: 112
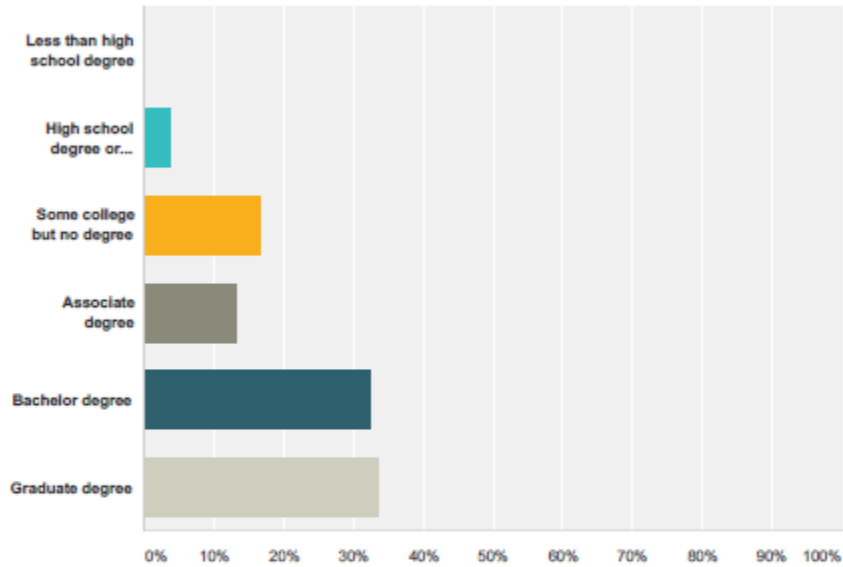
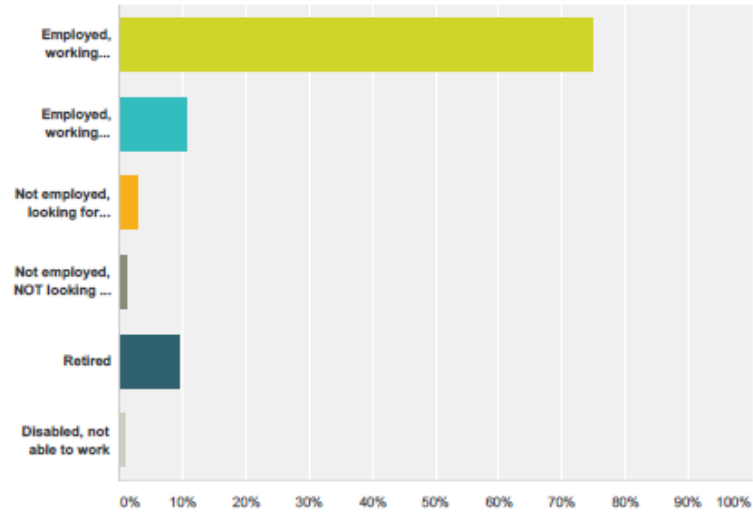| Answer Choices	Responses	
Less than high school degree	0.22%	2
High school degree or equivalent (e.g., GED)	3.81%	34
Some college but no degree	16.80%	150
Associate degree	13.10%	117
Bachelor degree	32.36%	289
Graduate degree	33.71%	301
Total		893

Q13 Which of the following categories best describes your employment status?

Answered: 896   Skipped: 109

Answer Choices	Responses	
Employed, working full-time	74.89%	671
Employed, working part-time	10.60%	95
Not employed, looking for work	2.90%	26
Not employed, NOT looking for work	1.34%	12
Retired	9.49%	85
Disabled, not able to work	0.78%	7
Total		896

Q14 What is your approximate average household income?

Answered: 857   Skipped: 148
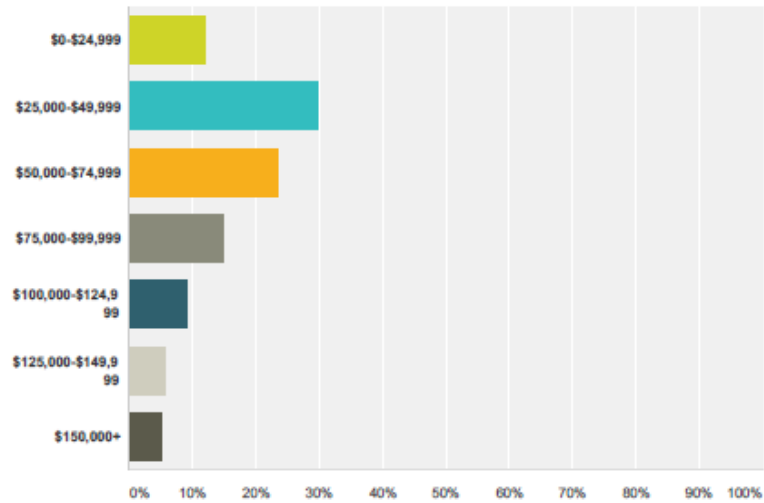
Answer Choices	Responses	
$0-$24,999	12.02%	103
$25,000-$49,999	29.75%	255
$50,000-$74,999	23.57%	202
$75,000-$99,999	14.94%	128
$100,000-$124,999	9.10%	78
$125,000-$149,999	5.60%	48
$150,000+	5.02%	43
Total		857

Q15 Where do you currently live?

Answered: 866   Skipped: 139
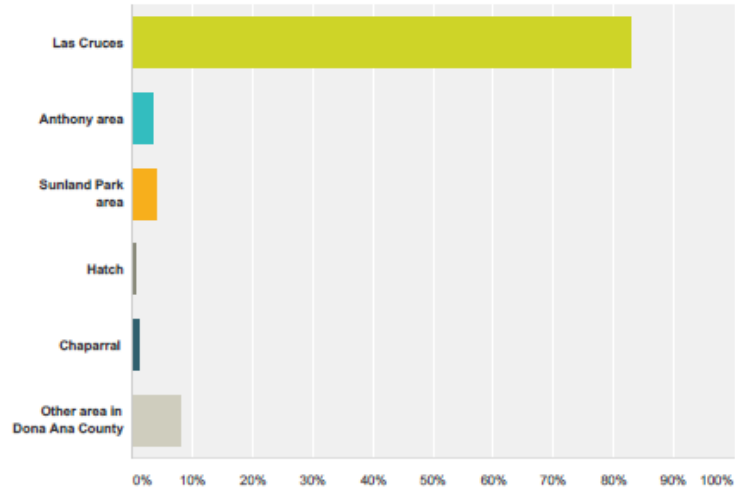
Answer Choices	Responses	
Las Cruces	82.91%	718
Anthony area	3.35%	29
Sunland Park area	4.04%	35
Hatch	0.46%	4
Chaparral	1.15%	10
Other area in Dona Ana County	8.08%	70
Total		866

B. Appendix B: Explanation of the Sketch Model

The proposed 43-mile commuter line will connect Las Cruces to El Paso with six intermediate stops in the all-station service option. The eight stations are listed - El Paso Union Depot, Sunland Park, Montoya, Canutillo, Anthony, Berino/Vado, Mesilla Park and Las Cruces. The express service will connect El Paso Union Depot, Sunland Park, Anthony and Las Cruces.

Figure 1: Proposed Station Locations

The sketch model for estimating commuter rail ridership includes several parameters such as population, employment, presence of parking and characteristics of the station area, distance & speed to downtown, household vehicle ownership, number and proximity of other stations on the line and midday headway. The variables are listed by their decreasing sensitivity on ridership in the model below.

$$
\begin{aligned}
\text{commuter rail station boardings} = \ 13.9031 & \\
\times\ 2.9125 \quad & \text{[if parking is present]} \\
\times\ 1.6653 \quad & \text{[if transportation center or rail trunk]} \\
\times \exp \quad & [0.052 \times \text{speed to downtown (miles/hour)}] \\
\times \exp \quad & [-0.015 \times \text{time to downtown in minutes}] \\
\times \exp \quad & [-0.0083 \times \text{midday headway in minutes; 0 if none}] \\
\times \exp \quad & [-.002 \times \text{total stations on the entire CR network in the} \\
& \text{metro area}] \\
\times \exp \quad & [0.0263 \times \text{millions of people in the metro area}] \\
\times \quad & (\text{population within 2 miles of the station})^{0.265} \\
\times \exp \quad & [-1.173 \times \text{zero-car households} \div \text{households with cars,} \\
& \text{within 2 miles of the station}] \\
\times \exp \quad & [0.06828 \times 1{,}000\text{s of jobs within 0.5 mile of the station}] \\
\times \exp \quad & [0.087 \times \text{distance to the nearest station}]
\end{aligned}
$$

Availability of parking is critical, followed by the station designation as a "transportation center". A station is a transportation center if it connects to an airport or seaport, connects to 4+ bus routes, serves more than one rail route or is designated a transit center by the local transit agency. The stations in El Paso and Las Cruces do not qualify per this definition as a transportation center. Both stations are in proximity to transit centers (Sun Metro Downtown Transit Center and Mesilla Valley Intermodal Transit Terminal) with significant local bus services but service at the station is less than desirable to support a commuter rail line currently. CNT has estimated ridership for two scenarios – the current scenario in which terminal stations are not transportation centers and the scenario that would see increased bus service to the commuter rail station or the consolidation of the transit center to the terminal station areas qualifying them as transportation centers.

The sketch model does a good job of evaluating the feasibility of the commuter line without requiring complex and expensive travel demand modeling. The simplicity of the model also comes with limitations. The model only looked at commuter lines in big cities, and this model is most applicable in bigger cities.

The model is generalized for application to regions across the county and does not account for special attractors such as universities. CNT in partnership with Ngage New Mexico conducted a ridership survey and found that, other than commuting for work, the leading destinations for likely daily commuters were the colleges in the area (UTEP, NMSU and community colleges). To account for the large student body, each student is considered to be equivalent to half a job. The students at UTEP were assigned to the El Paso station and the NMSU students to Las Cruces.

The average ridership for a commuter rail station for which this model is calibrated is 719, so the model can over predict ridership in some areas where built environment characteristics do not support transit. On examination of the ridership at station level, two station areas were eliminated from the commuter line ridership as they were either yielding very small ridership numbers or were over predicting it. The two stations – Canutillo and Berino/Vado will still be served but the overall ridership will account for the few riders from these stations.

The sketch model's relationship of car ownership to ridership is unintuitive for the Las Cruces – El Paso corridor. The car ownership variable considered in the model is the ratio of zero car households/households with cars, and this ratio is inversely proportional to the ridership, i.e. the smaller the ratio the higher is the ridership and vice versa. The model apparently assumes that people will likely drive to the commuter station, and households without cars would not be able to do so. However, in the Las Cruces – El Paso corridor, most of the proposed stations have some public transit connection currently, and transit connections will increase with planned additional bus service. Also the stations in smaller towns are walkable for a majority of the population, and both Las Cruces and El Paso have ambitious plans to increase the density of residential and commercial development in their terminal rail station areas. Consequently, a currently significant and growing population of residents who live or work within walking distance of the proposed rail stations will not own cars and will be likely transit riders. So by counting this population as a negative factor, the model tends to under-estimate potential ridership and is, to this extent, conservative in its ridership projections.

C.   Appendix C: Narrative for the reliability of used vs. new locomotives

As mentioned previously in this report, CNT recommends the purchase of used locomotives in order to ensure that capital costs for this project remain as low as possible. The up-front financial incentive to purchase used locomotive units is dramatic, with the expected cost of purchasing new locomotives ranging from three to five times more expensive than used vehicles. However, CNT thought it pertinent to try and quantify the reliability of used vehicles to ensure that it makes financial sense as well as business sense to invest in used locomotive units. As such, research was conducted to determine whether there was a relationship between the percentage of annual operating costs going towards vehicle maintenance, and the percent of a transportation agency's fleet that was made up of used vehicles. Data was gathered from the National Transit Database's 2015 Operating costs report, the 2015 Revenue vehicle inventory report, the 2015 Vehicle maintenance report, and the 2014 Agency snapshot reports. Data was compiled comparing the nine commuter rail routes that have been explored throughout this document, as well as expanding to include five new rail lines that were similar to the proposed Las Cruces-El Paso line. A summary of the important statistics for each rail line is included below in Table 1. The addition of these comparable routes helped outline a more robust relationship between percent of the fleet that is made up of used locomotives and percent of operating costs used for vehicle maintenance. The label "used locomotives" was given to locomotives that were either built before 2000, or have been rebuilt before 2017. As Figure 1 shows, there is a positive relationship between the percent of the locomotive fleet made up of used vehicles and the percent of an agency's annual operating cost that goes towards vehicle maintenance. The slope of the linear trend line suggests that a one percent increase in the proportion of the fleet made up of used locomotives will lead to an increase of .03% in terms of the ratio of vehicle maintenance costs to total operating costs. This is a small effect, but the regression does seem to indicate that while the purchase of used vehicles is more cost effective in the short term, over time costs may rise when taking into account the capital required for upkeep of these used locomotives. A second regression was conducted relating the incidence of major locomotive failure with the percent of the fleet made up of used vehicles (Figure 2). Data for the number of failures by transit agency was compiled from the sources listed above. In order to control for size of the fleet having an inherent impact on the number of annual failures, the ratio of annual failures to size of the fleet was used as a more robust statistic. Running a regression relating the ratio of annual locomotive failures to percent of the fleet that is made up of used vehicles, generated a slope of 2.97. This means that it is predicted that for a 1 percent increase in the proportion of the fleet made up of used locomotives, the agency will suffer approximately three more locomotive failures a year. While the sample size for both of these analyses is small, and therefore the R^2 value is not strong, both regressions point to hidden costs when using used locomotives rather than new units. As

such, the type of locomotive purchased remains an important consideration for SCRTD. CNT continues to recommend the purchase of used locomotives as it seems like the minimal upfront cost outweighs both any potential rise in operational costs as well as any mechanical issues with the locomotives. However, SCRTD must be vigilant and thorough in their investigation of the record of reliability for the locomotives that they select.

Table 1: Route comparison for used vs. new locomotive costs

Line	Denton (60101)	Frontrunner (80001)	Altamont (90182)	Capital Metro (60048)	Coaster (90030)	Northstar (50027)	Music City Star (40159)	Dallas Fort Worth (60056)	New Haven-London (10102)	Caltrain (90134)	Tri-Rail (40077)	Virginia Railway Express (30073)	Sounder Commuter Rail (00040)	Sun Rail (40323)
Annual vehicle maintenance costs	174,385	8,894,427	1,773,639	1,762,692	2,908,451	2,789,240	1,347,815	7,513,068	9,293,728	19,697,796	16,009,187	8,651,572	10,930,611	6,512,613
Total annual operating costs	13,429,333	39,332,755	16,673,422	14,795,764	19,741,329	15,709,365	4,680,864	24,006,522	33,944,106	11540359 2	76373773	65808345	40517405	33667 907
Ratio of maintenance to total operations cost	1%	23%	11%	12%	15%	18%	29%	31%	27%	17%	21%	13%	27%	19%
Description	DMU (11)	Two types of NEW locomotives, 2007 and 2009 (18 Total)	6 types of Locomotive (1 new 5 old),	DMU (6)	two types of Units (1 old one new)	Two types of NEW locomotive, 2008 and 2009 (6 Total)	Two types of OLD Locomotives, 1985 refurb. in 2000 and 1985 refurb. in 2011 (4 units)	Three types of locomotives, 2 new (5) and 1 old (4)	Two types of OLD Locomotives, 1967 and 1993 (14 units)	2 types of old locomotives, 1985 and 1998 (23), 1 new type (6)	4 types of old locomotives (12), 1 new type (11)	3 types of new Locomotives (20)	4 types of old Locomotives (8) 3 types of new locomotives (6)	1 type of old locomotive (10)

Metric (% of the fleet that is used)	N/A	0% (18 units are all new)	83% (5/6 units are old)	N/A	71.4% (5/7 is old)	0% (6/6 are new)	100% (4/4 are old)	44.4% (4/9 are old)	100% (14/14 are old)	79% is old (23/29)	52% are old (12/23)	0% (20 new units)	57% are old (8/14)	100% (10 old units)
Percent of the fleet that is used	N/A	0%	83%	N/A	71%	0%	100%	44%	100%	79%	52%	0%	57%	100%
Number of failures	2	90	3	31	128	0	0	6	158	69	66	1	14	2
Number of failures/number of locomotives	0.181818182	5	0.5	5.16666667	18.28571429	0	0	0.666666667	11.28571429	2.379310345	2.869565217	0.05	1	0.2
Decimal for Percent of the fleet that is used		0	0.83	0	0.71	0	1	0.44	1	0.79	0.52	0	0.57	1

Ratio of vehicle maintenance costs to total operation costs vs. Percent of the fleet that is used

Las Cruces-El Paso Commuter Rail Feasibility Study

Figure 2:

Las Cruces-El Paso Commuter Rail Feasibility Study