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CITY OF SAN MARCOS

THE LOOP 82 (AQUARENA SPRINGS DR) UNION PACIFIC RAIL ROAD OVERPASS PROJECT

ECONOMIC ANALYSIS SUPPLEMENTARY DOCUMENTATION

OCTOBER 14, 2011

TABLE OF CONTENTS

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1. Introduction

This document provides detailed technical information on the economic analyses conducted in support of the Grant Application for the Loop 82 (Aquarena Springs Dr) Union Pacific Rail Road Overpass Project (the Loop 82 project).

- Section 1 provides a structural overview of the Benefit-Cost Analysis (BCA).
- Section 2, Methodological Framework, introduces the conceptual framework used in the Benefit-Cost Analysis (BCA).
- Section 3, Project Overview, provides an overview of the project, including a brief description of existing conditions and proposed alternatives; a summary of cost estimates and schedule; and a description of the types of effects that the Loop 82 Project is expected to generate.
- Section 4, General Assumptions, discusses the general assumptions used in the estimation of project costs and benefits.
- Section 5, Demand Projects provides estimates of travel demand and traffic growth.
- Section 6 provides specific data elements and assumptions pertaining to the long-term outcome selection criteria along with associated benefit estimates.
- Estimates of the project's Net Present Value (NPV), its Benefit/Cost Ratio (BCR) and other project evaluation metrics are introduced in Section 7, Summary of Findings and BCA Outcomes.
- Section 8, BCA Sensitivity Analysis, provides the outcomes of the sensitivity analysis.
- Detailed economic impact estimates can be found in Section 9, Supplementary Data Tables, along with descriptions of the data sources and modeling tools used in the analysis.
- Additional data tables are provided in Section 10, Supplementary Data Tables, including annual estimates of benefits and costs, as well as intermediate values to assist the U.S. Department of Transportation (USDOT) in its review of the application.[1]

2. Methodological Framework

Benefit-Cost Analysis (BCA) is a conceptual framework that quantifies in monetary terms as many of the costs and benefits of a project as possible. Benefits are broadly defined. They represent the extent to which people to whom they accrue are made better-off, as measured by their own willingness-to-pay. In other words, central to BCA is the idea that people are best able to judge what is "good" for them, what improves their well-being or welfare. BCA also adopts the view that a net increase in welfare (as measured by the summation of individual welfare changes) is a good thing, even if some groups within society are made worse-off. And a project or proposal would be rated positively if the benefits to some are large enough to compensate the losses of others. Finally, BCA is typically a forward-looking exercise, seeking to

[1] While the models and software themselves do not accompany this appendix, greater detail can be provided, including spreadsheets presenting additional interim calculations and discussions on model mechanics and coding, if requested.

anticipate the welfare impacts of a project or proposal over its entire life-cycle. Future welfare changes are weighted against today's changes through discounting, which is meant to reflect society's general preference for the present, as well as broader inter-generational concerns.

The specific methodology developed for this application borrows from the above BCA principles and is consistent with the TIGER guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the build and no-build scenarios;
- Assessing benefits with respect to each of the five long-term outcomes identified in the Notice of Funding Availability (NOFA)[2];
- Measuring benefits in dollar terms whenever possible and expressing benefits and costs in a common unit of measurement;
- Using USDOT guidance for the valuation of travel time savings, safety benefits and reductions in air emissions, while relying on industry best practice for the valuation of other effects;
- Discounting future benefits and costs with the real discount rates recommended by the USDOT (7 percent, and 3 percent for sensitivity analysis); and
- Conducting sensitivity analysis to assess the impacts of changes in key estimating assumptions.

3. Project Overview

The proposed Loop 82 project consists of the design of a Grade Separation at the Intersection of Loop 82 and Union Pacific Railroad (UPRR). The proposed facility is a 4-lane roadway (elevated over UPRR) with access roads, connecting city street intersections and a re-alignment of Post Road to an improved UPRR at-grade crossing. The project includes improved pedestrian facilities and connectivity to the Texas State University facilities. The project also includes an extension of Post road enabling a large portion of vehicles to avoid the at-grade Post road crossing. The proposed project improvements are within the San Marcos city limits and located in Hays County, Texas.

The location and limits of the proposed improvements are as follows: Loop 82 – the proposed project begins approximately 0.30 miles west of the intersection of Loop 82 and IH 35 southbound frontage roads and extends to the west to the intersection of Loop 82 and Charles Austin Drive. The total length of the project is approximately 1.15 miles. A map of the project area is provided in Figure 1.

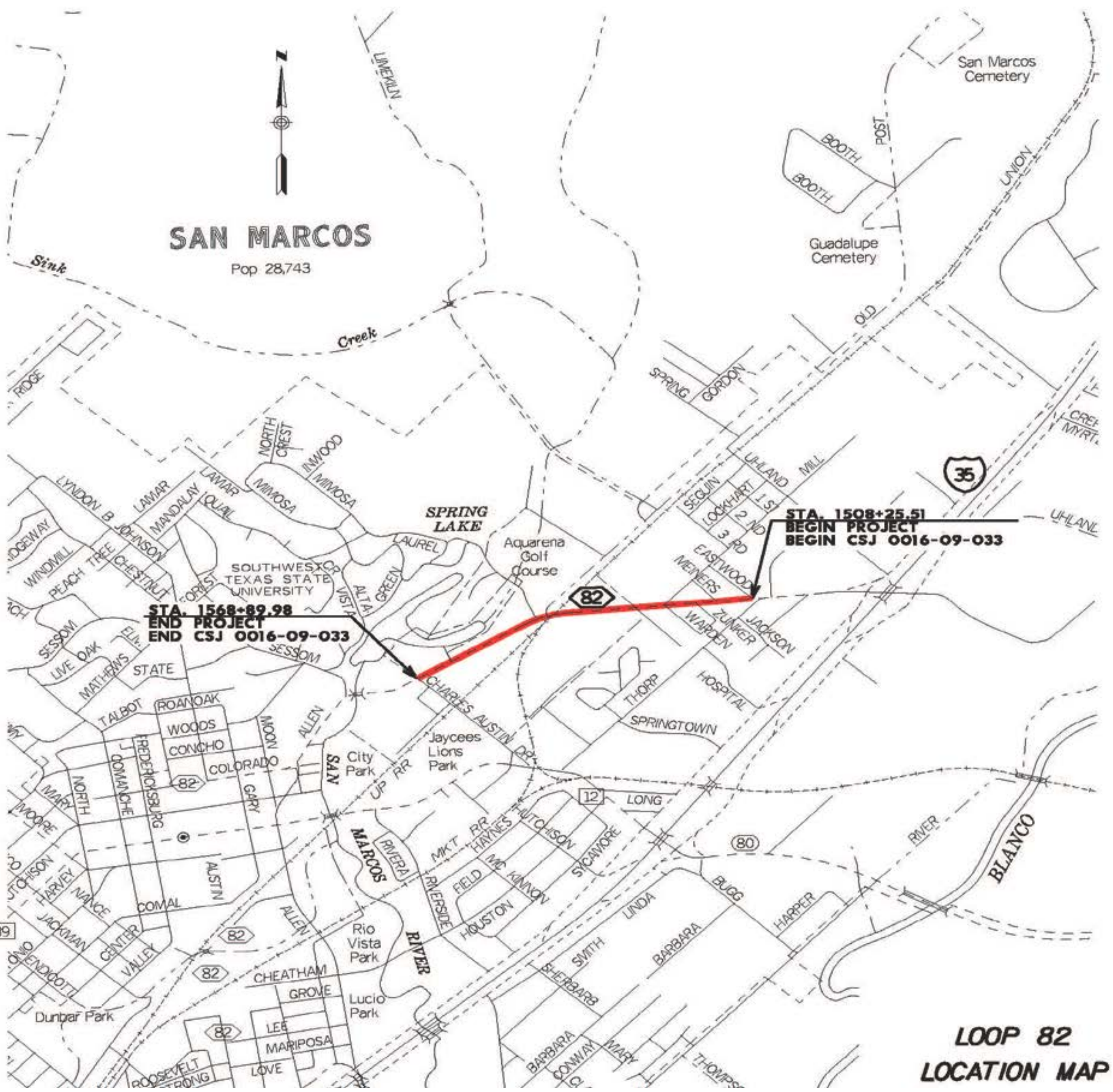
Completion of the proposed improvements will not only increase the mobility in the area, but more importantly will provide a safe, grade-separated crossing of the UPRR in the center of San Marcos. This crossing will provide access to regionally significant facilities such as Texas State University, Bobcat Stadium, the County Courthouse, and the historic downtown of San Marcos

[2] U.S. Federal Register, Federal Register / Vol. 76, No. 156 / Friday, August 12, 2011 / Notices, Notice of Funding Availability for the Department of Transportation's National Infrastructure Investments Under the Full-Year Continuing Appropriations, 2011; and Request for Comments.

while providing emergency services (located mostly to the east of the railroad) uninterrupted access to the residence of San Marcos (residing mostly to the west of the railroad).

The City of San Marcos is literally divided in two by railroads. A north-south railroad line extends through the city parallel to IH 35, and a second east-west railroad line extends west between SH 21 and SH 80 and merges wit the north-south line near the center of town. The City currently has 24 major at-grade railroad crossings within the City limits with only two grade separations. These grade separations are located at the northern City limits at Yarrington Road and to the south of downtown San Marcos at Wonder World Drive. In 2002, the City completed a study of the railroad grade crossings which estimated that vehicles are delayed at these crossings over 656 hours per day. Since that time, traffic and the number of trains on the UPRR line have increased dramatically.

Figure 1: Map of Loop 82 Project Area



The Loop 82 Corridor represents a "gateway" to the City of San Marcos. Located to the west of the UPRR crossing are regionally significant facilities such as Texas State University and the historic downtown San Marcos square. Texas State University services over 32,000 students on the 457-acre campus and 5,038 acres of recreational, instructional, farm and ranch land which is accessed through Loop 82. In addition, Texas State University's Bobcat Stadium is located within the project limits. The stadium is currently in the planning process for a major renovation which will increase its capacity from 15,000 seats to 24,500. The Loop 82 corridor also provides access to San Marcos historic square and downtown area. The square is home to the Hays County Courthouse and is the entertainment and commercial center of San Marcos.

3.1 Base Case and Alternatives

The base case is the no-build scenario with the existing grade crossings still in place. The alternative is the Loop 82 project as discussed above.

3.2 Project Cost and Schedule[3]

The total capital costs for the project are $35.8 Million (M) in constant 2011 dollars. Undiscounted costs by time period (quarter) are provided in Table 1.

Table 1: Summary of Project Costs, Undiscounted, 2011 $

Period	Engineering	ROW	Utilities	Construction	Construction Engineering	Total
Year 2011 - Q3	$325,000					$325,000
Year 2011 - Q4	$325,000					$325,000
Year 2012 - Q1	$325,000					$325,000
Year 2012 - Q2	$325,000					$325,000
Year 2012 - Q3	$325,000					$325,000
Year 2012 - Q4	$325,000					$325,000
Year 2013 - Q1	$325,000	$2,539,000	$157,764			$3,021,764
Year 2013 - Q2	$325,000	$2,539,000	$157,764			$3,021,764
Year 2013 - Q3			$157,764	$3,658,338	$263,688	$4,079,791
Year 2013 - Q4			$157,764	$3,658,338	$263,688	$4,079,791
Year 2014 - Q1				$3,658,338	$263,688	$3,922,026
Year 2014 - Q2				$3,658,338	$263,688	$3,922,026
Year 2014 - Q3				$3,658,338	$263,688	$3,922,026
Year 2014 - Q4				$3,658,338	$263,688	$3,922,026
Year 2015 - Q1				$3,658,338	$263,688	$3,922,026
Total Cost	**$2,600,000**	**$5,078,000**	**$631,057**	**$25,608,367**	**$1,845,817**	**$35,763,241**

Right of way acquisition and final design are underway and are scheduled to be complete in April 2013 and the project will be ready for an obligation of funds by May 2013. Construction

[3] All cost estimates in this section are in millions of dollars of 2011, discounted to 2011 using a 7 percent real discount rate.

will commence in Q3 2013 and the project will be completed by the end of Q1 2015. The opening operational year of the project is 2015 and benefits are estimated for a 20 year period through 2034.

3.3 Effects on Long-Term Outcomes

The projects impacts on the study area are diverse. The project is expected to:

- Improve safety to the traveling public by 1) eliminating a significant number of vehicles utilizing at-grade railroad crossings (Loop 82 and Post Road crossings), and 2) separation of Loop 82 through-traffic and local traffic to and from Post Road;
- Provide greater mobility within the Loop 82 corridor, as well as traffic to and from Texas State University facilities, including Bobcat Stadium;
- Improve mobility and reduces congestion along the Loop 82 corridor;
- Enhance the economic development opportunities in the area; and
- Increase the value, longevity and serviceability of the Loop 82 system through improvements to both the mainlanes of Loop 82 and associated Loop 82 access roads.

The main benefit categories associated with the project are mapped into the five long-term outcome criteria set forth by the USDOT in Table 2.

Table 2: Expected Effects on Long Term Outcomes and Benefit Categories

Long-Term Outcomes	Benefit Categories	Description	Monetized
Economic Competitiveness	Travel Time Savings due to Elimination of Wait Time at Loop 82 Grade Crossing	Loop 82 Grade separation eliminates vehicle delays at level crossings	√
	Reduced Vehicle Operating Costs due to Elimination of Wait Times at Loop 82 Grade Crossing	Eliminated vehicle wait time at Loop 82 crossing results in savings of vehicle operating cost	√
	Travel Time Savings due to Elimination of Wait Time for Reduced Traffic at Post Rd Crossing	Post Rd extension reduces number of vehicles crossing the Post Rd grade crossing resulting in travel time savings	√
	Reduced Vehicle Operating Costs due to Elimination of Wait Times for Reduced Traffic at Post Rd Crossing	Reduced vehicle wait time at Post Rd crossing results in savings of vehicle operating cost	√
Livability	Health Improvement due to Improved Bicycle Facilities	Improved bicycle facilities increases levels of cycling leading to savings in healthcare cost	√
	Mobility Benefit due to Improved Bicycle Facilities	Commuters are willing to spend more time cycling on improved bicycle facilities resulting in mobility benefit	√
	Recreation Benefit due to Improved Bicycle Facilities	Improved bicycle facilities generates outdoor recreational benefits	√
	Reduced Auto Use Benefits due to Improved Bicycle Facilities	Increased bicycle commuters reduced the use of automobiles leading to less congestion, pollution and user costs.	√

Environmental Sustainability	Environmental Savings due to Reduced Vehicle Waiting Times at Loop 82 Grade Crossing	Reduced vehicle wait time at Loop 82 crossing mitigates air emissions	√
	Environmental Savings due to Reduced Vehicle Waiting Times at Post Rd Crossing	Reduced vehicle wait time at Post Rd crossing mitigates air emissions	√
Safety	Reduced Accident Costs due to Elimination of Loop 82 Grade Crossing	Loop 82 Grade separation eliminates the possibility of accidents involving train, vehicle, cyclist and pedestrian	√

4. General Assumptions

The BCA measures benefits against costs throughout a period of analysis beginning at the start of construction and including 20 years of operations. The monetized benefits and costs are estimated in 2011 dollars with future dollars discounted in compliance with TIGER requirements using a 7 percent real rate, and sensitivity testing at 3 percent.

The methodology makes several important assumptions and seeks to avoid overestimation of benefits and underestimation of costs. Specifically:

- Input prices are inflated to 2011 dollars;
- The period of analysis begins in 2011 and ends in 2034. It includes project development and construction years (2011-2015) and 20 years of operations (2015-2034);
- A constant 7 percent real discount rate is assumed throughout the period of analysis. A 3 percent discount rate is used for sensitivity analysis; and,
- Opening year demand is an input to the BCA and is assumed to be fully realized in Year 1 (no ramp-up).

5. Demand Projections

Several projections of “demand” levels are required for this study and these projections are one of the key determinants of the projects impacts. These demand projections related to train crossings per day are based on operational projections of Union Pacific Rail Road and Amtrak. Vehicle traffic levels at the grade crossings are based on data from TxDOT. Growth rates have been established based on analysis of historical data patterns.

5.1 Assumptions

The demand projections are based on historical actual levels of demand and annual growth rates.

Table 3: Assumptions used in the Estimation of Demand

Variable Name	Unit	Value	Source
Expected Annual Traffic Growth - UP - base case	%	3%	TxDOT and UPRR
Expected Annual Traffic Growth - Amtrak - base case	%	3%	TxDOT and UPRR
Annual Vehicle Growth in the Project Area	%	3.0%	TxDOT
Average Daily Traffic (ADT) at the Loop 82 Grade Crossing - 2011	vehicles	33,000	TxDOT
Average Daily Traffic (ADT) on the Post Road heading south on Loop 82 - 2011	vehicles	6,918	HDR calculation based on (i) 11,435 traffic counts on Post Road and (ii) 60.5% traffic from Post Rd turns right on to Loop 82

5.2 Demand Estimates and Projections

The resulting projections for freight rail, passenger rail and vehicle crossings are presented in the table below.

Table 4: Demand Estimates and Projections

	In Project Opening Year (2015)	2019	2024	2029	2034
Number of UP Trains per day at the Grade Crossing	23.6	26.6	30.8	35.8	41.4
Number of Amtrak Trains per day at the Grade Crossing	2.3	2.5	2.9	3.4	3.9
Average Daily Traffic (ADT) at Loop 82 Crossing	37,142	41,803	48,462	56,180	65,128
Average Daily Traffic (ADT) at Post Rd turning onto Loop 82	7,786	8,764	10,160	11,778	13,654

6. Benefits Measurement, Data and Assumptions

This section describes the measurement approach used for each benefit category identified in Table 2 and provides an overview of the associated methodology, assumptions, and estimates.

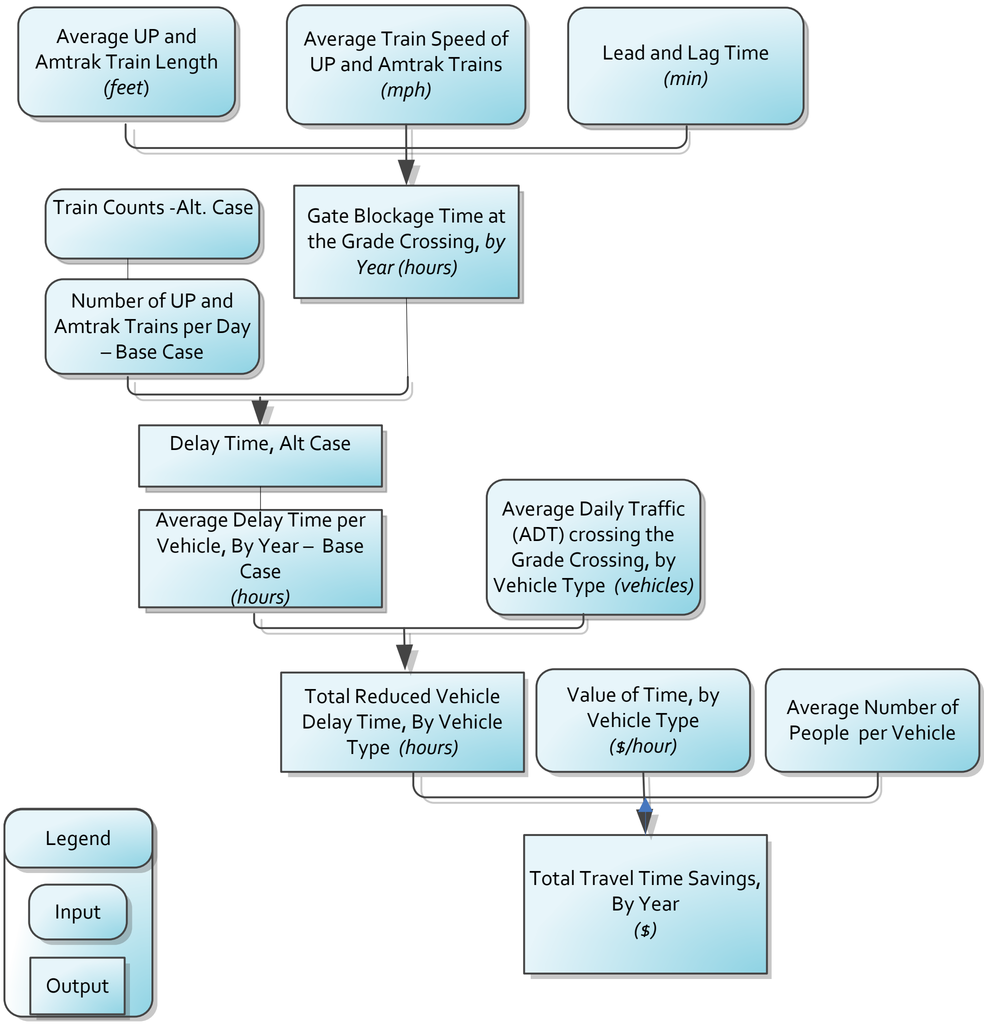
6.1 Economic Competitiveness

The proposed project would contribute to enhancing the economic competitiveness of the Nation through improvements in the mobility of people and goods within the study area. In this analysis, two measures of mobility are presented: travel-time savings and out-of-pocket transportation cost savings.

6.1.1 Methodology

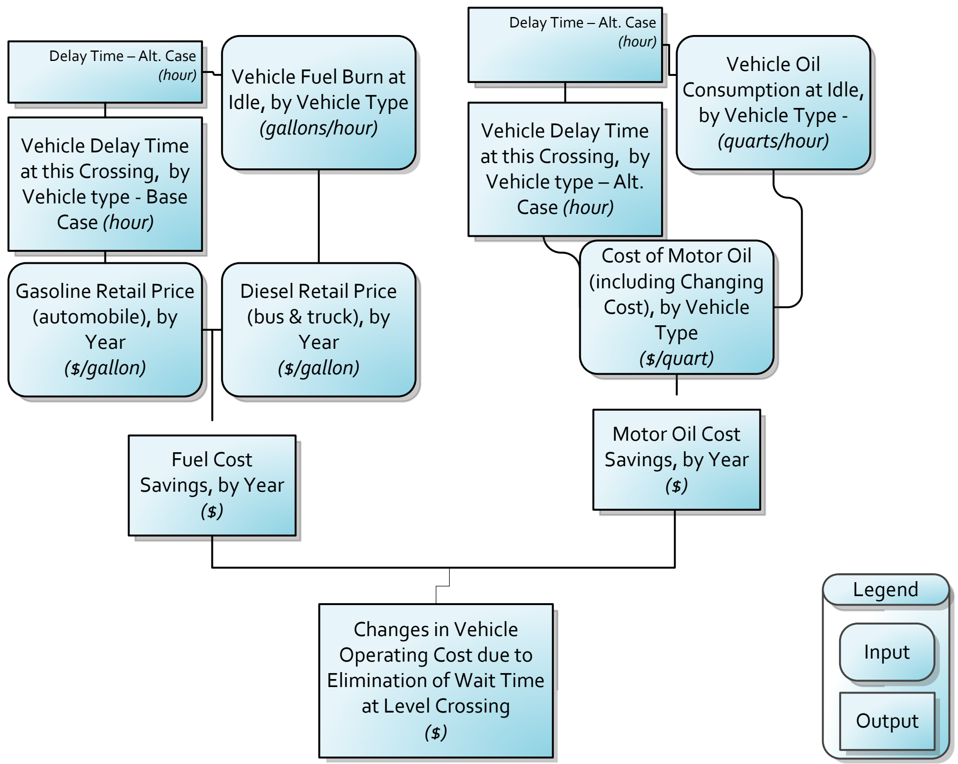
Vehicle travel time savings are derived from projections of trains per day (and duration) at the grade crossing, vehicular traffic and value of time estimates.

Figure 2: Vehicle Travel Time Savings due to Elimination of Wait Times at Grade Crossing



Reduction in vehicle operating costs is derived from projections of delay at grade crossings in the base case and fuel consumption and fuel unit cost estimates.

Figure 3: Reduced Vehicle Operating Costs due to Elimination of Wait Times at Grade Crossing



6.1.2 Assumptions

The assumptions used in the estimation of travel time savings are summarized in the table below.

Table 5: Assumptions used in the Estimation of Travel Time Savings

Variable Name	Unit	Value	Source
Number of days UP Trains Running per year	days	365	UPRR
Number of days Amtrak Trains Running per year	days	365	Amtrak
Average Length of a UP Train	feet	7,000	UPRR
Number of Locomotives of a Amtrak Train	locomotives	2	Amtrak
Number of cars of a Amtrak Train	cars	8	Amtrak
Length of a GE Genesis Locomotive	feet	69	GE Transportation Systems
Average Length of a Amtrak Car	feet	85	Length of a Amtrak Superliner
Average UP Train Speed	mph	35	UPRR
Average Amtrak Train Speed	mph	70	Amtrak
Lead and Lag time	minutes	0.6	Federal Railroad Administration. 2005. GradeDec. Highway-Rail Grade Crossing Investment Decision Support Tool V1.0

Variable Name	Unit	Value	Source
Percentage of Automobiles of Total Traffic	%	92.4%	TxDOT and Texas State University-San Marcos
Percentage of Buses of Total Traffic	%	4.2%	
Percentage of Trucks of Total Traffic	%	3.4%	
Average Number of Persons per Automobile	persons	1.6	Average 1.60 driver and passenger per vehicle sourced from Final Regulatory Impact Analysis Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, March 2010, page 385
Average Number of Passenger per Bus	passengers	31	Source: Texas State University - San Marcos
Value of Time for Automobile Driver and Passenger	2011$/hour	$12.77	USDOT (2011) Revised Departmental Guidance: Valuation of Travel Time in Economic Analysis. Inflated 2009$ to 2011$. For bus passengers, used the lower bound value of time for personal local travel
Value of Time for Bus Passenger	2011$/hour	$8.73	
Value of Time for Truck Driver	2011$/hour	$24.70	
Value of Time for Bus Driver	2011$/hour	$24.60	
Annual Growth Rate in the Value of Time	%	1.6%	USDOT (2011) Revised Departmental Guidance: Valuation of Travel Time in Economic Analysis.

Table 6: Assumptions used in the Estimation of Out-of-Pocket Travel Cost Savings

Variable Name	Unit	Value	Source
Vehicle Fuel Burned at Idle - Automobile	gallons/hr	0.41	California Air Resources Board, Emission Factors (EMFAC) model
Vehicle Diesel Burned at Idle - Bus	gallons/hr	0.39	
Vehicle Diesel Burned at Idle - Truck	gallons/hr	0.39	
Average Consumption of Oil per Hour	quarts/hr	0.04	
Gasoline Retail Price - 2015	2011$/gallon	$3.27	Gasoline sales weighted-average price for all grades. Includes Federal, State, and local taxes. (Source: US EIA Annual Energy Outlook 2011. Converted to 2011$)
Gasoline Retail Price - 2016	2011$/gallon	$3.31	
Gasoline Retail Price - 2017	2011$/gallon	$3.39	
Gasoline Retail Price - 2018	2011$/gallon	$3.44	
Gasoline Retail Price - 2019	2011$/gallon	$3.48	
Gasoline Retail Price - 2020	2011$/gallon	$3.52	
Gasoline Retail Price - 2021	2011$/gallon	$3.53	
Gasoline Retail Price - 2022	2011$/gallon	$3.60	
Gasoline Retail Price - 2023	2011$/gallon	$3.61	
Gasoline Retail Price - 2024	2011$/gallon	$3.67	
Gasoline Retail Price - 2025	2011$/gallon	$3.69	
Gasoline Retail Price - 2026	2011$/gallon	$3.71	
Gasoline Retail Price - 2027	2011$/gallon	$3.77	
Gasoline Retail Price - 2028	2011$/gallon	$3.78	
Gasoline Retail Price - 2029	2011$/gallon	$3.83	
Gasoline Retail Price - 2030	2011$/gallon	$3.79	
Gasoline Retail Price - 2031	2011$/gallon	$3.80	
Gasoline Retail Price - 2032	2011$/gallon	$3.81	
Gasoline Retail Price - 2033	2011$/gallon	$3.82	
Gasoline Retail Price - 2034	2011$/gallon	$3.84	
Diesel Retail Price - 2015	2011$/gallon	$3.21	Diesel fuel for on-road use. Includes Federal and State taxes while excluding county and local taxes. (Source: US EIA Annual Energy Outlook 2011. Converted to 2011$)
Diesel Retail Price - 2016	2011$/gallon	$3.33	
Diesel Retail Price - 2017	2011$/gallon	$3.43	
Diesel Retail Price - 2018	2011$/gallon	$3.52	
Diesel Retail Price - 2019	2011$/gallon	$3.61	
Diesel Retail Price - 2020	2011$/gallon	$3.67	
Diesel Retail Price - 2021	2011$/gallon	$3.69	
Diesel Retail Price - 2022	2011$/gallon	$3.76	
Diesel Retail Price - 2023	2011$/gallon	$3.78	
Diesel Retail Price - 2024	2011$/gallon	$3.86	
Diesel Retail Price - 2025	2011$/gallon	$3.88	
Diesel Retail Price - 2026	2011$/gallon	$3.91	
Diesel Retail Price - 2027	2011$/gallon	$3.96	
Diesel Retail Price - 2028	2011$/gallon	$3.98	
Diesel Retail Price - 2029	2011$/gallon	$4.03	
Diesel Retail Price - 2030	2011$/gallon	$4.00	
Diesel Retail Price - 2031	2011$/gallon	$4.00	

Variable Name	Unit	Value	Source
Diesel Retail Price - 2032	2011$/gallon	$4.01	
Diesel Retail Price - 2033	2011$/gallon	$4.01	
Diesel Retail Price - 2034	2011$/gallon	$4.04	
Cost of Motor Oil - Automobile	2011$/quart	$8.51	US DOT FHA - Highway Economic Requirements System - State Version: Technical Report
Cost of Motor Oil - Bus	2011$/quart	$3.40	Avg Oil Price sourced from HERS model (1997 value) and inflated to 2011$ by Motor Oil CPI (BLS CUUR0000SS47021); assumes the same oil cost for bus and truck.
Cost of Motor Oil - Truck	2011$/quart	$3.40	

*Note: * the fuel cost estimate used in this BCA includes all applicable taxes but does not include any external costs, such as those considered by NHTSA in its regulatory impact analysis of corporate average fuel economy standards.*

6.1.3 Benefit Estimates

The value over the project lifecycle of the travel time savings benefits is one of the major benefits of the Loop 82 project. The combined travel time savings at Loop 82 grade crossing and at Post Road grade crossing are estimated at a present value of $14.4 million.

Table 7: Estimates of Travel Time and Out-of-Pocket Cost Savings, in Millions of 2011 Dollars

	In Project Opening Year	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Travel Time Savings due to Elimination of Wait Time at Loop 82 Grade Crossing	$0.73	$32.57	$11.93
Reduced Vehicle Operating Costs due to Elimination of Wait Times at Loop 82 Grade Crossing	$0.05	$2.02	$0.76
Travel Time Savings due to Elimination of Wait Time for Reduced Traffic at Post Rd Crossing	$0.15	$6.83	$2.50
Reduced Vehicle Operating Costs due to Elimination of Wait Times for Reduced Traffic at Post Rd Crossing	$0.01	$0.42	$0.16

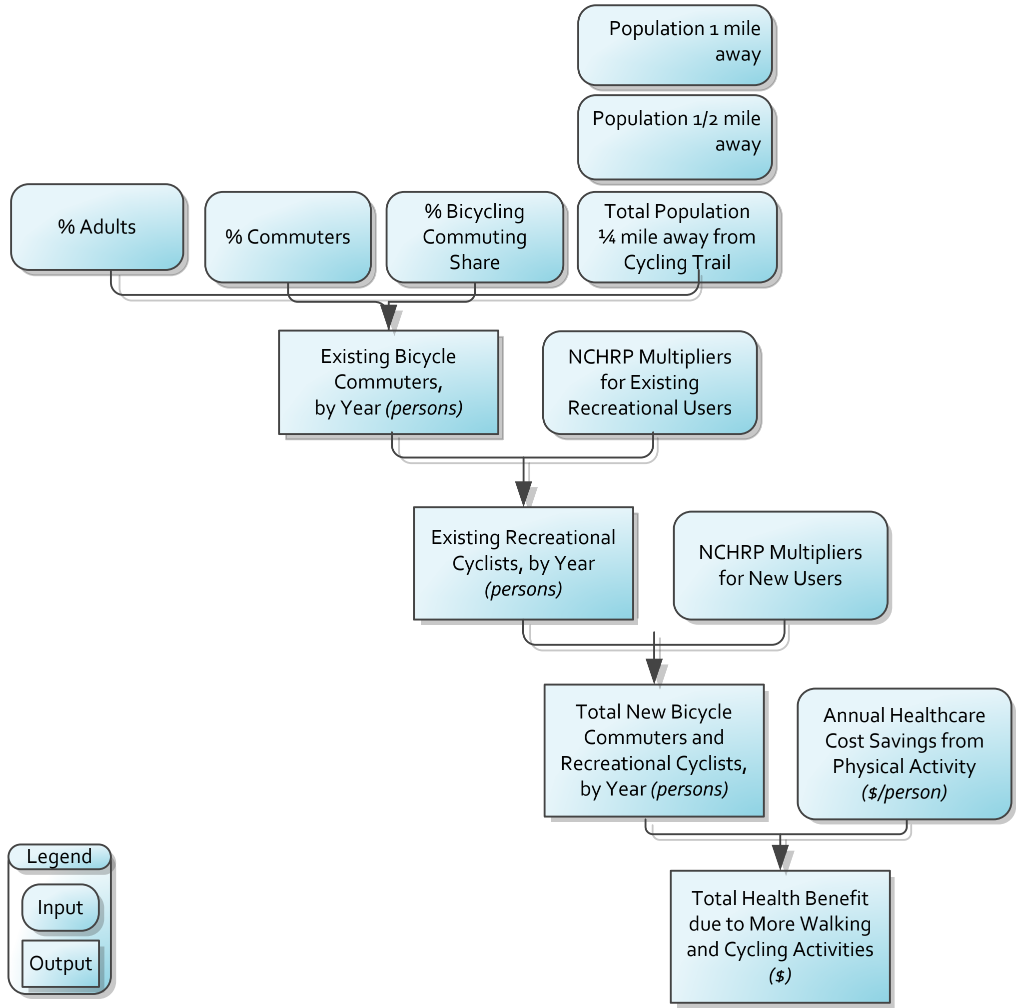
6.2 Livability

The proposed project would contribute to enhancing livability and quality of life in the study area through health Improvement, mobility benefits, recreational benefits and reduced automobile use benefits due to improved bicycle facilities.

6.2.1 Methodology

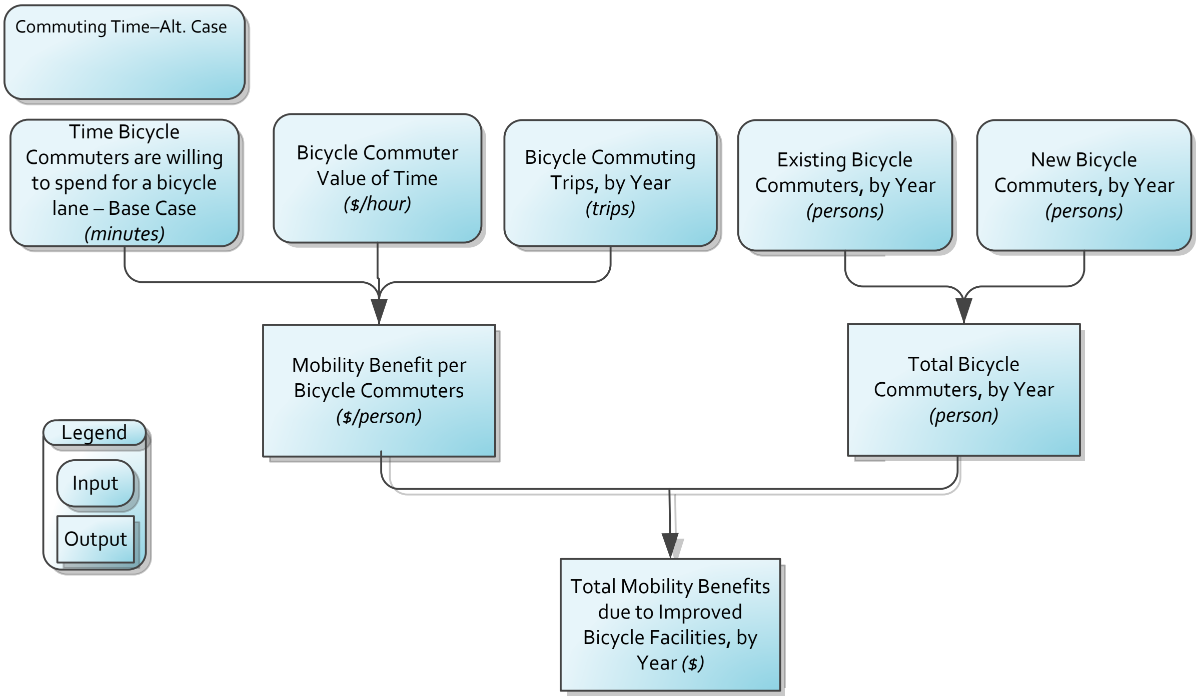
The Loop 82 project will provide more cycling opportunities for people providing more physical activity and health related benefits reducing health care costs.

Figure 4: Health Improvement due to more Cycling Activities



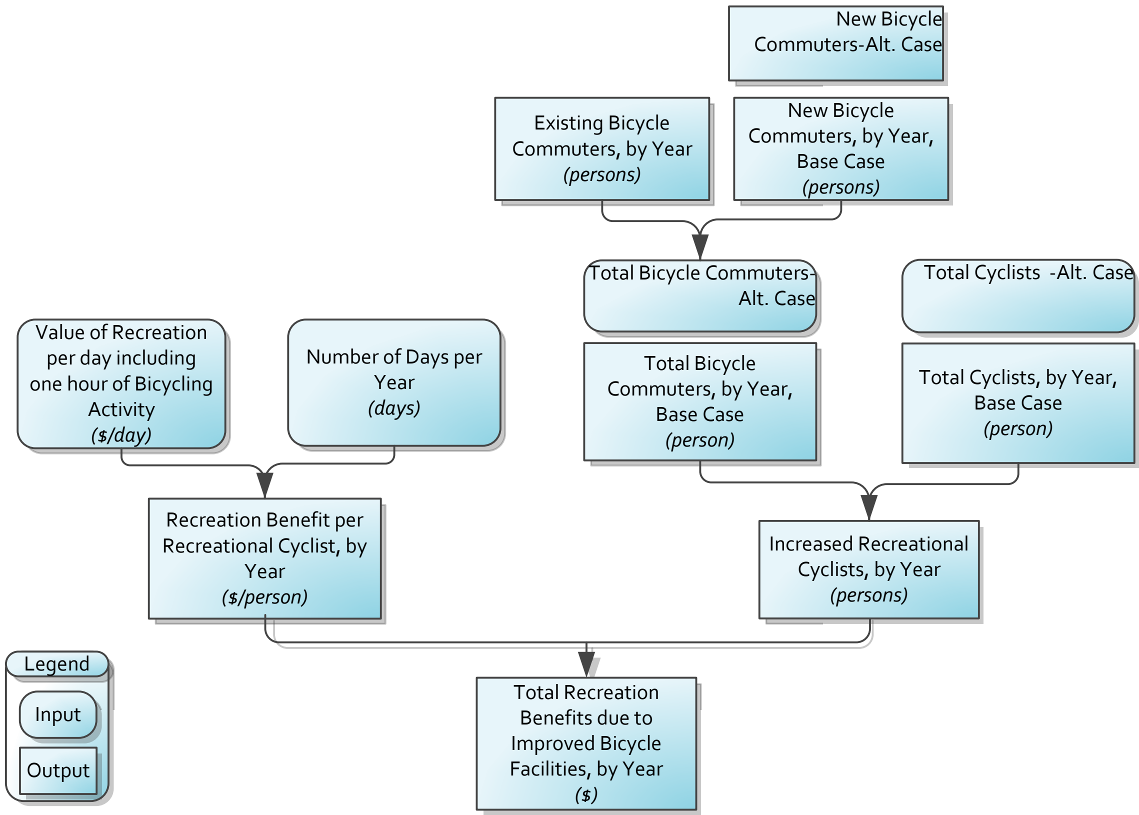
The Loop 82 project will provide mobility benefits for cyclists and induce more people to bicycle.

Figure 5: Mobility Benefit due to Improved Bicycle Facilities



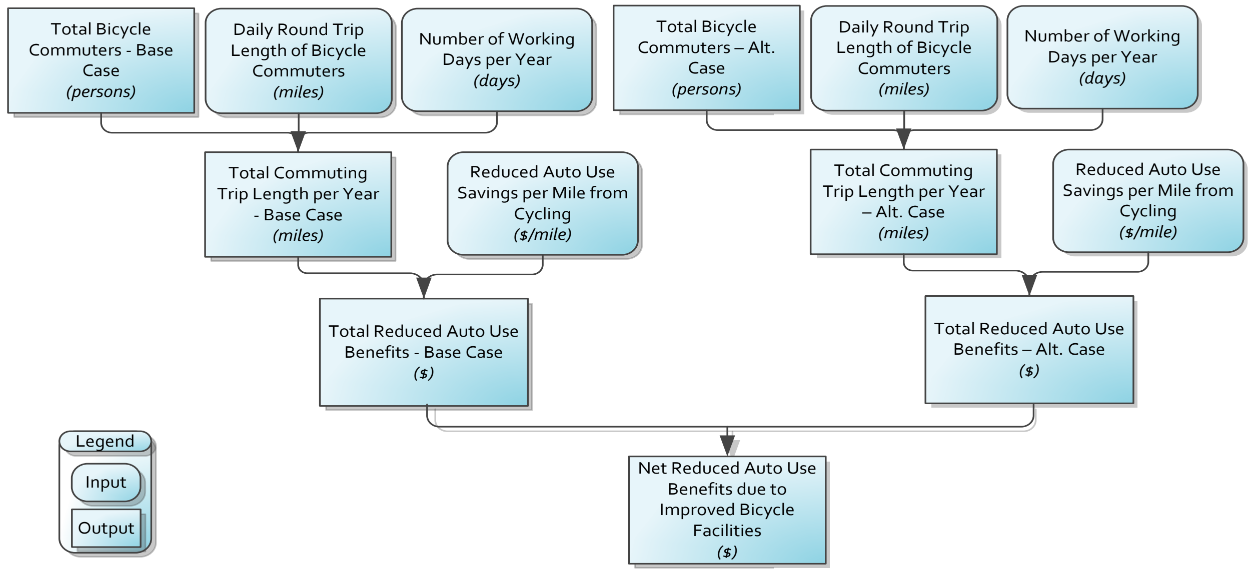
The Loop 82 project will provide enhanced recreational opportunities for residents.

Figure 6: Recreation Benefit due to more Cycling Activities



The Loop 82 project will result in increased bicycle use and therefore less automobile use.

Figure 7: Reduced Auto Use Benefits due to Improved Bicycle Facilities



6.2.2 Assumptions

The assumptions used in the estimation of livability benefits are summarized in the table below.

Table 8: Assumptions used in the Estimation of Health Improvement Benefits

Variable Name	Unit	Value	Source
Population Density in the Project Area per square mile in 2011	persons/ square mile	2,453	City of San Marcos average population density, US Census 2010
Annual Population Growth	%	2.9%	HDR calculation based on historical Census Data (1990-28,743 2000-34,733 2010-44,894)
Length of the Bicycle Facility	mile	0.5	Project Length (source: TxDOT)
Bicycle Facility Type	type	Type (2)	(1) On-Street Bicycle Lane with Parking; (2) On-Street Bicycle Lane without Parking; (3) Off-Street Bicycle Trail
Percentage of Adult Residents in Study Area	%	79.4%	National average US Census Bureau
Percentage of Commuters	%	50%	TRB NCHRP (National Cooperative Highway Research Program) (2006) Guidelines for Analysis of Investments in Bicycle Facilities.
Percentage of Bicycle Commute Share	%	0.5%	Statistics of El Dorado County (US census bureau)
Percentage of Children who ride a bike on a given day	%	5.0%	2001 National Household Travel Survey (NHTS)
NCHRP Biking Likelihood Multiplier of Population living within 1/2 mile of a Bike Trail	unit	2.11	TRB NCHRP (2006) Guidelines for Analysis of Investments in Bicycle Facilities.
NCHRP Biking Likelihood Multiplier of Population living within 1/2 - 1 mile away of a Bike Trail	unit	1.39	
NCHRP Biking Likelihood Multiplier of Population living with 1 - 1 1/2 miles away of a Bike Trail	unit	0.15	
Annual Healthcare Cost Savings from Physical Activity	2011$/person	$141.97	NCHRP Guidelines (2006) - the median value of 10 studies

Table 9: Assumptions used in the Estimation of Mobility Benefits

Variable Name	Unit	Value	Source
Time Bicycle Commuters are willing to spend for a bicycle lane	minutes	18	NCHRP Guidelines (2006) for Type (2) bike lane
Value of Time for Cyclist	2011$/hour	$12.77	Assumed to be same as a automobile driver
Cyclist Commuting Trips Per Day	trips	2	NCHRP Guidelines (2006)
Number of Working Days per Year	days/year	250	HDR Calculation: 5 days per week multiplied by 50 working weeks per year

Table 10: Assumptions used in the Estimation of Recreational Benefits

Variable Name	Unit	Value	Source
Value of Recreation per day including one hour of Bicycling Activity	2011$/day	$6.45	HDR calculation based on Hopkinson & Wardman (1996) Evaluating the demand for new cycle facilities. Transport Policy 3 (4), 241–249.

Table 11: Assumptions used in the Estimation of Reduced Automobile Use Benefits

Variable Name	Unit	Value	Source
Reduced Auto Use Savings per Mile from Cycling	2011$/mile	$0.13	NCHRP Guidelines (2006) for urban areas
Daily Round Trip Length of Bicycle Commuters	mile	1.00	HDR calculated as twice the length of the bike trail

6.2.3 Benefit Estimates

The predominant livability benefit is the recreational use benefits over the project lifecycle which are valued at approximately $8 million. Other livability benefits exceed $2 million in total over the project lifecycle.

Table 12: Estimates of Livability Benefits, in Millions of 2011 Dollars

	In Project Opening Year	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Health Improvement due to Improved Bicycle Facilities	$0.05	$1.39	$0.56
Mobility Benefit due to Improved Bicycle Facilities	$0.17	$4.43	$1.80
Recreation Benefit due to Improved Bicycle Facilities	$0.77	$20.56	$8.34
Reduced Auto Use Benefits due to Improved Bicycle Facilities	$0.001	$0.03	$0.01

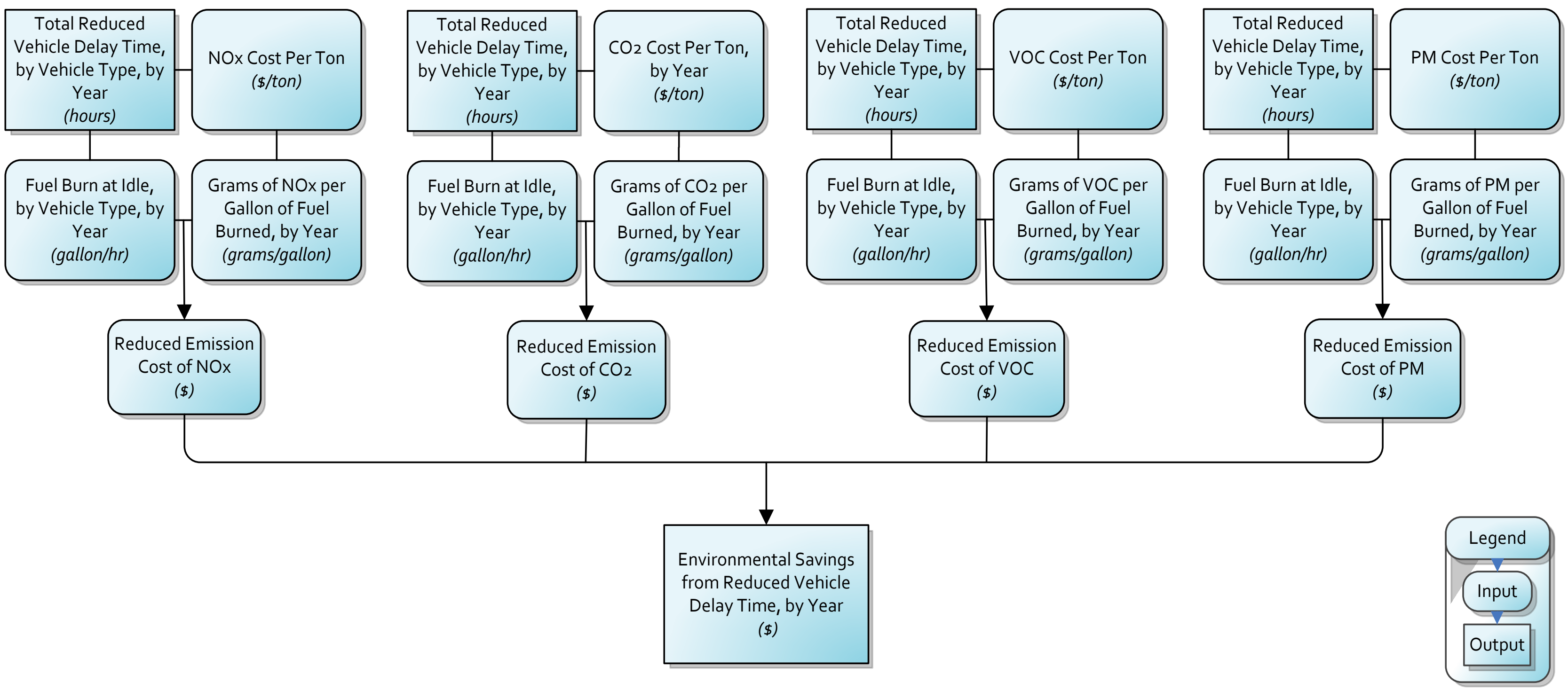
6.3 Environmental Sustainability

The proposed project would contribute to environmental sustainability through reduced air emissions related to a reduction in time waiting at grade crossings.

6.3.1 Methodology

The value of reduced emissions from delay at grade crossings under the base case are derived from estimates of vehicle delay time, fuel burn rates, grams of pollutant per volume of fuel burned and the cost of pollutant per ton.

Figure 8: Reduction in Air Emissions



6.3.2 Assumptions

The assumptions used in the estimation of sustainability benefits are summarized in the table below.

Table 13: Assumptions used in the Estimation of Reduced Emissions Benefits

Variable Name	Unit	Value	Source
CO2 per Gallon of Fuel Burned	grams/gallon	10,115	HDR Calculation based on EPA Publication AP-42 (on-line): an emission factor for No. 2 fuel oil (equivalent to diesel) of 22,300 lb/1000 gallons, or 22.3 lb/gallon Multiplying by 453.6 grams/lb gives a factor of 10,115 grams/gallon.
NOx per Gallon of Fuel Burned - 2015	grams/gallon	125	HDR Calculation based on "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder" (EPA Publication EPA420-R-08-001, March 2008, page 1-58).
NOx per Gallon of Fuel Burned - 2016	grams/gallon	118	
NOx per Gallon of Fuel Burned - 2017	grams/gallon	113	
NOx per Gallon of Fuel Burned - 2018	grams/gallon	108	
NOx per Gallon of Fuel Burned - 2019	grams/gallon	103	
NOx per Gallon of Fuel Burned - 2020	grams/gallon	99	
NOx per Gallon of Fuel Burned - 2021	grams/gallon	94	
NOx per Gallon of Fuel Burned - 2022	grams/gallon	89	
NOx per Gallon of Fuel Burned - 2023	grams/gallon	84	
NOx per Gallon of Fuel Burned - 2024	grams/gallon	79	
NOx per Gallon of Fuel Burned - 2025	grams/gallon	74	
NOx per Gallon of Fuel Burned - 2026	grams/gallon	70	
NOx per Gallon of Fuel Burned - 2027	grams/gallon	65	
NOx per Gallon of Fuel Burned - 2028	grams/gallon	61	
NOx per Gallon of Fuel Burned - 2029	grams/gallon	56	
NOx per Gallon of Fuel Burned - 2030	grams/gallon	53	
NOx per Gallon of Fuel Burned - 2031	grams/gallon	49	
NOx per Gallon of Fuel Burned - 2032	grams/gallon	42	
NOx per Gallon of Fuel Burned - 2033	grams/gallon	37	
NOx per Gallon of Fuel Burned - 2034	grams/gallon	33	
VOC per Gallon of Fuel Burned - 2015	grams/gallon	5.41	HDR Calculation based on "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder" (EPA Publication EPA420-R-08-001, March 2008, page 1-58).
VOC per Gallon of Fuel Burned - 2016	grams/gallon	4.88	
VOC per Gallon of Fuel Burned - 2017	grams/gallon	4.52	
VOC per Gallon of Fuel Burned - 2018	grams/gallon	4.18	
VOC per Gallon of Fuel Burned - 2019	grams/gallon	3.93	
VOC per Gallon of Fuel Burned - 2020	grams/gallon	3.74	
VOC per Gallon of Fuel Burned - 2021	grams/gallon	3.55	
VOC per Gallon of Fuel Burned - 2022	grams/gallon	3.35	
VOC per Gallon of Fuel Burned - 2023	grams/gallon	3.16	
VOC per Gallon of Fuel Burned - 2024	grams/gallon	2.96	
VOC per Gallon of Fuel Burned - 2025	grams/gallon	2.78	
VOC per Gallon of Fuel Burned - 2026	grams/gallon	2.60	
VOC per Gallon of Fuel Burned - 2027	grams/gallon	2.43	

Variable Name	Unit	Value	Source
VOC per Gallon of Fuel Burned - 2028	grams/gallon	2.27	
VOC per Gallon of Fuel Burned - 2029	grams/gallon	2.11	
VOC per Gallon of Fuel Burned - 2030	grams/gallon	1.97	
VOC per Gallon of Fuel Burned - 2031	grams/gallon	1.84	
VOC per Gallon of Fuel Burned - 2032	grams/gallon	1.42	
VOC per Gallon of Fuel Burned - 2033	grams/gallon	1.21	
VOC per Gallon of Fuel Burned - 2034	grams/gallon	1.00	
PM per Gallon of Fuel Burned - 2015	grams/gallon	3.9	HDR Calculation based on "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder" (EPA Publication EPA420-R-08-001, March 2008, page 1-58).
PM per Gallon of Fuel Burned - 2016	grams/gallon	3.6	
PM per Gallon of Fuel Burned - 2017	grams/gallon	3.5	
PM per Gallon of Fuel Burned - 2018	grams/gallon	3.2	
PM per Gallon of Fuel Burned - 2019	grams/gallon	3.1	
PM per Gallon of Fuel Burned - 2020	grams/gallon	2.9	
PM per Gallon of Fuel Burned - 2021	grams/gallon	2.7	
PM per Gallon of Fuel Burned - 2022	grams/gallon	2.6	
PM per Gallon of Fuel Burned - 2023	grams/gallon	2.4	
PM per Gallon of Fuel Burned - 2024	grams/gallon	2.2	
PM per Gallon of Fuel Burned - 2025	grams/gallon	2.1	
PM per Gallon of Fuel Burned - 2026	grams/gallon	1.9	
PM per Gallon of Fuel Burned - 2027	grams/gallon	1.8	
PM per Gallon of Fuel Burned - 2028	grams/gallon	1.6	
PM per Gallon of Fuel Burned - 2029	grams/gallon	1.5	
PM per Gallon of Fuel Burned - 2030	grams/gallon	1.4	
PM per Gallon of Fuel Burned - 2031	grams/gallon	1.3	
PM per Gallon of Fuel Burned - 2032	grams/gallon	1.0	
PM per Gallon of Fuel Burned - 2033	grams/gallon	0.8	
PM per Gallon of Fuel Burned - 2034	grams/gallon	0.7	
CO2 cost per short ton - 2015	2011$/short ton	$25.60	HDR calculation based on Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (February 2010), pp. 39, Table A-1 "Annual SCC Values 2010-2050 (in 2007 dollars)" www.epa.gov/oms/climate/regulations/scc-tsd.pdf; adjusted to 2011$ per short ton.
CO2 cost per short ton - 2016	2011$/short ton	$26.14	
CO2 cost per short ton - 2017	2011$/short ton	$26.69	
CO2 cost per short ton - 2018	2011$/short ton	$27.25	
CO2 cost per short ton - 2019	2011$/short ton	$27.82	
CO2 cost per short ton - 2020	2011$/short ton	$28.41	
CO2 cost per short ton - 2021	2011$/short ton	$29.03	
CO2 cost per short ton - 2022	2011$/short ton	$29.67	
CO2 cost per short ton - 2023	2011$/short ton	$30.33	
CO2 cost per short ton - 2024	2011$/short ton	$30.99	
CO2 cost per short ton - 2025	2011$/short ton	$31.67	
CO2 cost per short ton - 2026	2011$/short ton	$32.37	
CO2 cost per short ton - 2027	2011$/short ton	$33.08	
CO2 cost per short ton - 2028	2011$/short ton	$33.81	
CO2 cost per short ton - 2029	2011$/short ton	$34.55	
CO2 cost per short ton - 2030	2011$/short ton	$35.32	

Variable Name	Unit	Value	Source
CO_2 cost per short ton - 2031	2011$/short ton	$35.95	
CO_2 cost per short ton - 2032	2011$/short ton	$36.60	
CO_2 cost per short ton - 2033	2011$/short ton	$37.26	
CO_2 cost per short ton - 2034	2011$/short ton	$37.93	
NOx cost per short ton	2011$/short ton	$5,720	Final Regulatory Impact Analysis Corporate Average Fuel Economy for MY 2012-MY 2016 Passenger Cars and Light Trucks, March 2010,Table VIII-8 Economic Values Used for Benefits Computations (2007 Dollars); adjusted to 2011$ per short ton
VOC cost per short ton	2011$/short ton	$1,400	
PM cost per short ton	2011$/short ton	$312,740	

6.3.3 Benefit Estimates

The Loop 82 project will result in reduced air emissions with a monetized value of $0.4 million over the project lifecycle.

Table 14: Estimates of Reduced Air Emissions Benefits, in Millions of 2011 Dollars

	In Project Opening Year	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Environmental Savings due to Reduced Vehicle Waiting Times at Loop 82 Grade Crossing	$0.03	$0.65	$0.32
Environmental Savings due to Reduced Vehicle Waiting Times at Post Rd Crossing	$0.01	$0.14	$0.07

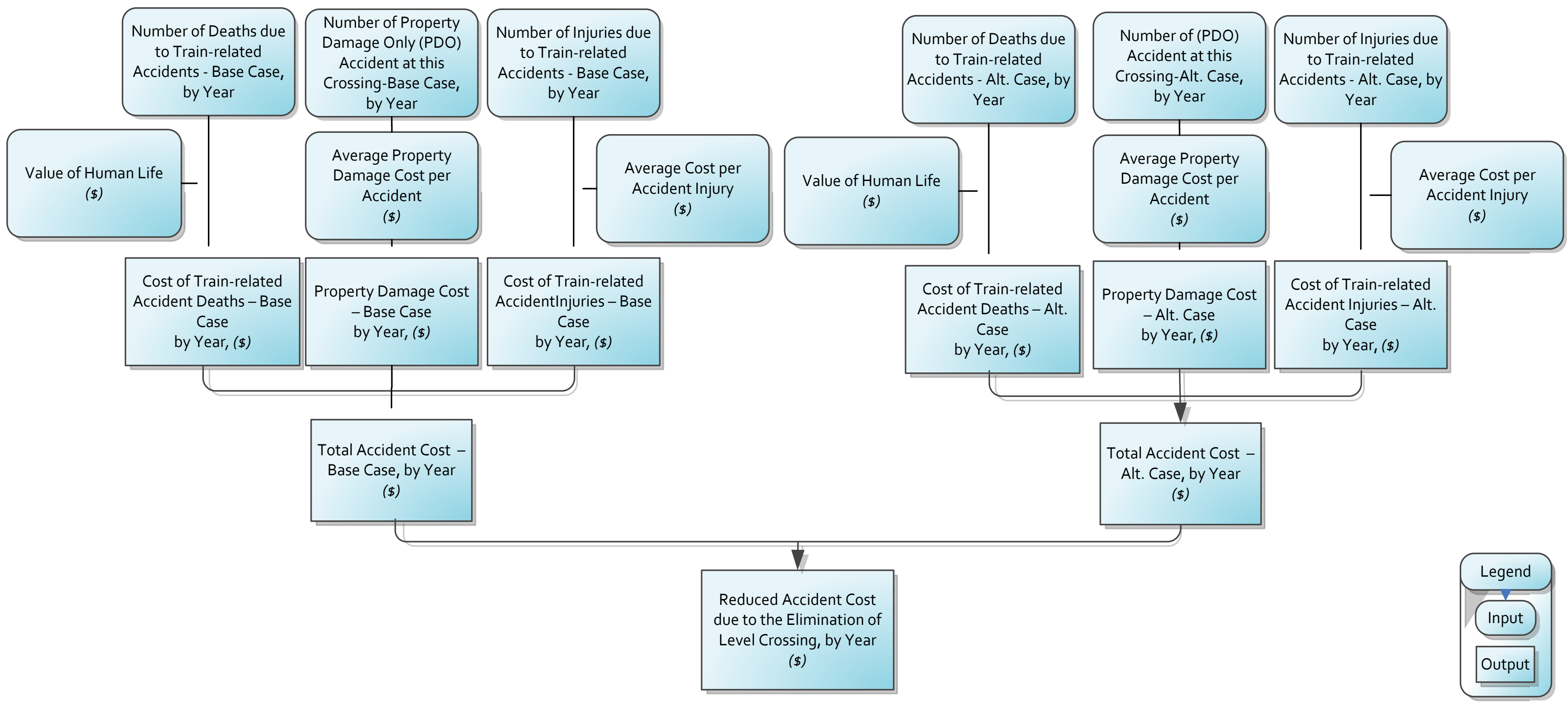
6.4 Safety

The proposed project would contribute to promoting DOT's safety long-term outcome through reducing accidents at grade crossings.

6.4.1 Methodology

Safety related benefits are estimates based on estimates of train related accidents at the grade crossings in the base case and unit cost estimates for the value of life, injury costs and property damage.

Figure 9: Monetization of Safety Related Benefits



6.4.2 Assumptions

The assumptions used in the estimation of safety benefits are summarized in the table below.

Table 15: Assumptions used in the Estimation of Reduced Accident Benefits

Variable Name	Unit	Value	Source
Crash Fatalities within the Project Limits - Base Case	deaths	0.0	TxDOT crash data
Accident Injuries within the Project Limits - Base Case	injuries	5.7	
Number of PDO Accidents within the Project Limits - Base Case	accidents	25.3	
Combined Crash Modification Factor due to the Grade Separation	unit	0.83	TxDOT calculation based on TTI Roadway Safety Design Model
Value of a Statistical Life	2011$	$6,200,000	Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses - 2011 Revision (2011) http://ostpxweb.dog.gov/policy
Average Cost per Accident Injury	2011$	$1,257,360	Average Cost of AIS 1 to AIS 5 Accidents. Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses - 2011 Revision (2011) http://ostpxweb.dog.gov/policy
Cost of a Property Damage Only (PDO) Accident	2011$	$3,368	NHTSA (2000), The Economic Impact of Motor Vehicle Crashes 2000; adjusted to 2011$ by CPI

6.4.3 Benefit Estimates

The value of safety related benefits is approximately $12 million over the Loop 82 project lifecycle.

Table 16: Estimates of Safety Benefits, in Millions of 2010 Dollars

	In Project Opening Year	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Reduced Accident Costs due to Elimination of Loop 82 Grade Crossing	$1.28	$27.78	$11.78

7. Summary of Findings and BCA Outcomes

The tables below summarize the BCA findings. Annual costs and benefits are computed over the lifecycle of the project (25 years). As stated earlier, construction is expected to be completed by 2015 Q1. Benefits accrue during the full operation of the project.

Considering all monetized benefits and costs, the estimated internal rate of return of the project is 9.7 percent. With a 7 percent real discount rate, the Loop 82 project would result in $38.2 million in total benefits and a Benefit/Cost ratio of approximately 1.24.

With a 3 percent real discount rate, the Net Present Value of the project would increase to $19.5 million, for a Benefit/Cost ratio of 1.58.

Table 17: Overall Results of the Benefit Cost Analysis in Millions of 2011 Dollars unless Specified Otherwise

Project Evaluation Metric	7% Discount Rate	3% Discount Rate
Total Discounted Benefits	$38.24	$53.01
Total Discounted Costs	$30.76	$33.50
Net Present Value	$7.47	$19.50
Benefit / Cost Ratio	1.24	1.58
Internal Rate of Return (%)	9.7%	
Payback Period (years)	9.4	

The Loop 82 project provides significant benefits across four distinct long-term outcomes: economic competitiveness; livability; environmental sustainability; and, safety.

Table 18: Benefit Estimates by Long-Term Outcome for the Full Alignment

Long-Term Outcomes	Benefit Categories	7% Discount Rate	3% Discount Rate
Economic Competitiveness	Travel Time Savings due to Elimination of Wait Time at Loop 82 Grade Crossing	$11.93	$20.63
	Reduced Vehicle Operating Costs due to Elimination of Wait Times at Loop 82 Grade Crossing	$0.76	$1.29
	Travel Time Savings due to Elimination of Wait Time for Reduced Traffic at Post Rd Crossing	$2.50	$4.32
	Reduced Vehicle Operating Costs due to Elimination of Wait Times for Reduced Traffic at Post Rd Crossing	$0.16	$0.27
Livability	Health Improvement due to Improved Bicycle Facilities	$0.56	$0.92
	Mobility Benefit due to Improved Bicycle Facilities	$1.80	$2.93
	Recreation Benefit due to Improved Bicycle Facilities	$8.34	$13.61
	Reduced Auto Use Benefits due to Improved Bicycle Facilities	$0.01	$0.02
Environmental Sustainability	Environmental Savings due to Reduced Vehicle Waiting Times at Loop 82 Grade Crossing	$0.32	$0.44
	Environmental Savings due to Reduced Vehicle Waiting Times at Post Rd Crossing	$0.07	$0.09
Safety	Reduced Accident Costs due to Elimination of Loop 82 Grade Crossing	$11.78	$8.48
Total Benefit Estimates		**$38.24**	**$53.01**

8. BCA Sensitivity Analysis

The BCA outcomes presented in the previous sections rely on a large number of assumptions and long-term projections; both of which are subject to considerable uncertainty.

The primary purpose of the sensitivity analysis is to help identify the variables and model parameters whose variations have the greatest impact on the BCA outcomes: the "critical variables."

The sensitivity analysis can also be used to:

- Evaluate the impact of changes in the critical variables, of reasonable departures from their "preferred" values; and
- Assess the robustness of the BCA and evaluate, in particular, whether the conclusions reached under the "preferred" set of input values are significantly altered by reasonable departures from those values.

The outcomes of the quantitative analysis for the Loop 82 project using a 7 percent discount rate are summarized in the table below. The table provides the percentage changes in project NPV associated with variations in variables or parameters (listed in row), as indicated in the column headers.

The Loop 82 project BCA outcomes are sensitive to the key input variables as provided below. Variances in key inputs, however, do not change the Net Present Value of the project to a negative value.

Table 19: Quantitative Assessment of Sensitivity, Summary

Parameters	Change in Parameter Value	New NPV	Change in NPV	New B/C Ratio
Accident Injury Cost	45% Increase in Injury Cost	$12.71	70%	1.41
	45% Decrease in Injury Cost	$2.23	-70%	1.07
Value of Recreation per day including one hour of Bicycling Activity	50% Increase in Recreation Value	$11.65	55.8%	1.38
	50% Decrease in Recreation Value	$3.30	-55.8%	1.11

9. Economic Impact Analysis

9.1 Short-Term Economic Impacts from Project Development and Construction Spending

The Minnesota IMPLAN Group's input-output model has been used to estimate the direct, indirect and induced effects of the Loop 82 project in terms of employment, value added and labor income. Employment represents full-time and part-time jobs created for a full year.

Value added represents total business sales (output) minus the cost of purchasing intermediate products and is roughly equivalent to gross regional/domestic product. Labor income consists of employee compensation (wage and salary payments as well as health and life insurance, retirement payments and any other non-cash compensation) and proprietary income (payments received by self-employed individuals as income).

The project is expected to generate 592 job-years during the development phase. It is also expected to create $45.4 million in value added, including $30.8 million in labor income. A breakdown of short-term impacts by type of effect (direct, indirect and induced) is provided in Table below. Note that the purchasing cost of the Right of Way (ROW) is not included in the total spending for the Economic Impact Analysis. ROW is regarded as a transfer from one entity to another.

Table 20: Direct, Indirect and Induced Impacts during Project Development Phase

	Spending (Millions of 2011 Dollars)	Direct	Indirect	Induced	Total
Employment*	$30.69	239.3	128.9	224.0	592.2
Labor Income**		$12.34	$7.94	$10.53	$30.81
Value Added**		$14.03	$12.70	$18.70	$45.42

*Note: * Employment impacts from IMPLAN should not be interpreted as full-time equivalent (FTE) as they reflect the mix of full and part time jobs that is typical for each sector. On average, the ratio of FTE to full- and part-time jobs is estimated at 90 percent. **Millions of Dollars of 2011.*

Another method to estimate job-years from additional spending uses the Council of Economic Advisors' (CEA) methodology[4]. This assumes that for every $92,000 of government spending, one job-year is created. The following table shows the difference in job-year estimates using the IMPLAN and CEA methodologies. Note that the employment impacts are lower when using CEA's approach.

[4] Executive Office of the President, Council of Economic Advisers, "Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009," Washington, D.C., May 11, 2009.

Table 21: Job Year Estimates with IMPLAN and CEA Methodology

	Spending (Millions of 2010 Dollars)	Direct	Indirect	Induced	Total
IMPLAN *	$30.69	239.3	128.9	224.0	592.2
CEA		213.5		120.1	333.5

*Note: * Employment impacts from IMPLAN should not be interpreted as full-time equivalent (FTE) as they reflect the mix of full and part time jobs that is typical for each sector.*

A breakdown of short-term economic impacts (IMPLAN estimates) in terms of employment (job-hours), labor income and value added is provided by quarter in Table below.

Table 22: Short-Term Economic Impacts Resulting from Project Development

Period	Spending (Millions of 2010 Dollars)*	Total Job-Hours**	Direct Job-Hours**	Total Labor Income (Millions of 2010 Dollars)	Total Value Added (Millions of 2010 Dollars)
Year 2011 - Q3	$0.33	2,813	1,137	$0.33	$0.48
Year 2011 - Q4	$0.33	2,813	1,137	$0.33	$0.48
Year 2012 - Q1	$0.33	2,813	1,137	$0.33	$0.48
Year 2012 - Q2	$0.33	2,813	1,137	$0.33	$0.48
Year 2012 - Q3	$0.33	2,813	1,137	$0.33	$0.48
Year 2012 - Q4	$0.33	2,813	1,137	$0.33	$0.48
Year 2013 - Q1	$0.48	4,179	1,689	$0.48	$0.71
Year 2013 - Q2	$0.48	4,179	1,689	$0.48	$0.71
Year 2013 - Q3	$4.08	35,315	14,272	$4.10	$6.04
Year 2013 - Q4	$4.08	35,315	14,272	$4.10	$6.04
Year 2014 - Q1	$3.92	33,949	13,720	$3.94	$5.81
Year 2014 - Q2	$3.92	33,949	13,720	$3.94	$5.81
Year 2014 - Q3	$3.92	33,949	13,720	$3.94	$5.81
Year 2014 - Q4	$3.92	33,949	13,720	$3.94	$5.81
Year 2015 - Q1	$3.92	33,949	13,720	$3.94	$5.81
Total	**$30.69**	**265,613**	**107,346**	**$30.81**	**$45.42**

*Notes: * includes engineering ($4.45 million) and construction ($26.34 million); ** assuming average weekly hours of 34.5 (Bureau of Labor Statistics estimate).*

Table 23 below presents the short-term increase in employment and labor income resulting from the project development in key industries employing low-income people. 353 cumulative job-years are expected to be created in those industries by the end of 2015, bringing in an additional $16.6 million in labor income.

Table 23: Short-Term Impacts in Key Industries Employing Low-Income People

Sectors	Employment (Job-Years)	Labor Income (Millions of 2010 Dollars)
Agriculture, forestry, fishing and hunting	0.0	$0.19
Construction	242.4	$12.50
Retail trade	36.8	$1.40
Truck transportation	6.1	$0.33
Administrative and support and waste management and remediation services	21.5	$0.87
Nursing and residential care facilities, home health care services	15.3	$0.51
Accommodation and food services	27.6	$0.64
Personal and laundry services	3.1	$0.20
Total	**352.9**	**$16.64**

10. Supplementary Data Tables

This section breaks down all benefits associated with the long-term outcome criteria (Economic Competiveness, Livability, Sustainability, and Safety) in annual form for the Loop 82 project.

10.1 Annual Estimates of Total Project Benefits and Costs

Calendar Year	Project Year	Total Benefits ($2010)	Total Costs ($2010)	Undiscounted Net Benefits ($2010)	Discounted Net Benefits at 7%	Discounted Net Benefits at 3%
2011	1	$0	$650,000	-$650,000	-$650,000	-$650,000
2012	2	$0	$1,300,000	-$1,300,000	-$1,245,056	-$1,275,986
2013	3	$0	$14,203,110	-$14,203,110	-$12,658,072	-$13,515,186
2014	4	$0	$15,688,105	-$15,688,105	-$13,077,984	-$14,504,827
2015 (opening)	5	$3,246,128	$3,922,026	-$675,898	-$653,161	-$943,783
2016	6	$3,359,047	$0	$3,359,047	$2,395,622	$2,578,689
2017	7	$3,479,910	$0	$3,479,910	$2,319,639	$2,551,338
2018	8	$3,607,030	$0	$3,607,030	$2,247,275	$2,530,845
2019	9	$3,741,854	$0	$3,741,854	$2,178,971	$2,517,621
2020	10	$3,884,666	$0	$3,884,666	$2,114,370	$2,511,115
2021	11	$4,035,431	$0	$4,035,431	$2,052,981	$2,510,568
2022	12	$4,196,892	$0	$4,196,892	$1,995,702	$2,517,291
2023	13	$4,366,666	$0	$4,366,666	$1,940,870	$2,528,823
2024	14	$4,547,948	$0	$4,547,948	$1,889,498	$2,546,750
2025	15	$4,739,732	$0	$4,739,732	$1,840,669	$2,569,678
2026	16	$4,944,228	$0	$4,944,228	$1,794,808	$2,598,404
2027	17	$5,162,149	$0	$5,162,149	$1,751,681	$2,632,680
2028	18	$5,392,997	$0	$5,392,997	$1,710,674	$2,671,520
2029	19	$5,640,374	$0	$5,640,374	$1,672,497	$2,716,431
2030	20	$5,900,988	$0	$5,900,988	$1,635,730	$2,764,793
2031	21	$6,180,234	$0	$6,180,234	$1,601,494	$2,819,061
2032	22	$6,474,390	$0	$6,474,390	$1,568,419	$2,876,486
2033	23	$6,790,612	$0	$6,790,612	$1,537,884	$2,940,280
2034	24	$7,128,754	$0	$7,128,754	$1,509,346	$3,009,559
Total		**$96,820,031**	**$35,763,241**	**$61,056,790**	**$7,473,860**	**$19,502,150**

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10.2 Annual Demand Projections

Calendar Year	Project Year	Number of UP Trains per day at the Grade Crossing	Number of Amtrak Trains per day at the Grade Crossing	Average Daily Traffic at Loop 82 Crossing	Average Daily Traffic at Post Rd turning onto Loop 82
2015 (opening)	5	23.6	2.3	37,142	7,786
2016	6	24.3	2.3	38,256	8,020
2017	7	25.1	2.4	39,404	8,261
2018	8	25.8	2.5	40,586	8,508
2019	9	26.6	2.5	41,803	8,764
2020	10	27.4	2.6	43,058	9,027
2021	11	28.2	2.7	44,349	9,297
2022	12	29.1	2.8	45,680	9,576
2023	13	29.9	2.9	47,050	9,864
2024	14	30.8	2.9	48,462	10,160
2025	15	31.8	3.0	49,915	10,464
2026	16	32.7	3.1	51,413	10,778
2027	17	33.7	3.2	52,955	11,102
2028	18	34.7	3.3	54,544	11,435
2029	19	35.8	3.4	56,180	11,778
2030	20	36.8	3.5	57,866	12,131
2031	21	37.9	3.6	59,602	12,495
2032	22	39.1	3.7	61,390	12,870
2033	23	40.2	3.8	63,231	13,256
2034	24	41.4	3.9	65,128	13,654

10.3 Economic Competitiveness: Annual Benefit Estimates

Calendar Year	Project Year	Travel Time Savings at Loop 82 Crossing- Undiscounted Benefits	Vehicle Operating Cost Savings at Loop 82 Crossing - Undiscounted Benefits	Travel Time Savings at Post Rd Crossing- Undiscounted Benefits	Vehicle Operating Cost Savings at Post Rd Crossing - Undiscounted Benefits	Total Undiscounted Benefits	Total Discounted Benefits at 7%	Total Discounted Benefits at 3%
2015 (opening)	5	$728,719	$49,358	$152,770	$10,347	$941,194	$718,032	$836,238
2016	6	$785,467	$52,935	$164,667	$11,097	$1,014,167	$723,087	$874,829
2017	7	$846,635	$57,230	$177,490	$11,998	$1,093,353	$728,547	$915,666
2018	8	$912,566	$61,441	$191,312	$12,881	$1,178,200	$733,724	$957,985
2019	9	$983,632	$65,828	$206,210	$13,800	$1,269,470	$738,843	$1,002,132
2020	10	$1,060,232	$70,478	$222,269	$14,775	$1,367,753	$743,967	$1,048,269
2021	11	$1,142,797	$74,950	$239,578	$15,713	$1,473,037	$748,817	$1,096,078
2022	12	$1,231,791	$80,742	$258,235	$16,927	$1,587,695	$754,302	$1,146,984
2023	13	$1,327,716	$85,941	$278,345	$18,017	$1,710,018	$759,269	$1,199,372
2024	14	$1,431,111	$92,308	$300,021	$19,352	$1,842,791	$764,693	$1,254,851
2025	15	$1,542,558	$98,356	$323,384	$20,620	$1,984,918	$769,786	$1,312,265
2026	16	$1,662,684	$104,942	$348,568	$22,000	$2,138,195	$774,980	$1,372,426
2027	17	$1,792,165	$112,624	$375,712	$23,611	$2,304,112	$780,483	$1,435,847
2028	18	$1,931,728	$119,887	$404,971	$25,133	$2,481,720	$785,649	$1,501,481
2029	19	$2,082,161	$128,529	$436,508	$26,945	$2,674,142	$791,182	$1,570,777
2030	20	$2,244,308	$135,239	$470,500	$28,352	$2,878,399	$795,901	$1,641,511
2031	21	$2,419,082	$143,573	$507,140	$30,099	$3,099,894	$801,072	$1,716,336
2032	22	$2,607,466	$152,655	$546,634	$32,003	$3,338,758	$806,354	$1,794,747
2033	23	$2,810,521	$162,273	$589,202	$34,019	$3,596,016	$811,668	$1,876,734
2034	24	$3,029,389	$173,186	$635,086	$36,307	$3,873,967	$817,201	$1,962,907
Total		**$32,572,728**	**$2,022,475**	**$6,828,601**	**$423,995**	**$41,847,799**	**$15,347,557**	**$26,517,434**

10.4 Livability: Annual Benefit Estimates

Calendar Year	Project Year	Health Improvement - Undiscounted Benefits	Mobility Benefit - Undiscounted Benefits	Recreation Benefit - Undiscounted Benefits	Reduced Auto Use Costs - Undiscounted Benefits	Total Undiscounted Benefits	Total Discounted Benefits at 7%	Total Discounted Benefits at 3%
2015 (opening)	5	$52,317	$166,571	$772,785	$1,303	$992,976	$757,537	$882,246
2016	6	$53,834	$171,402	$795,195	$1,341	$1,021,772	$728,510	$881,390
2017	7	$55,395	$176,372	$818,256	$1,380	$1,051,404	$700,595	$880,534
2018	8	$57,002	$181,487	$841,985	$1,420	$1,081,894	$673,749	$879,679
2019	9	$58,655	$186,750	$866,403	$1,461	$1,113,269	$647,933	$878,825
2020	10	$60,356	$192,166	$891,529	$1,504	$1,145,554	$623,106	$877,972
2021	11	$62,106	$197,739	$917,383	$1,547	$1,178,775	$599,230	$877,119
2022	12	$63,907	$203,473	$943,987	$1,592	$1,212,960	$576,268	$876,268
2023	13	$65,761	$209,374	$971,363	$1,638	$1,248,136	$554,187	$875,417
2024	14	$67,668	$215,446	$999,532	$1,686	$1,284,331	$532,952	$874,567
2025	15	$69,630	$221,694	$1,028,519	$1,735	$1,321,577	$512,530	$873,718
2026	16	$71,649	$228,123	$1,058,346	$1,785	$1,359,903	$492,891	$872,870
2027	17	$73,727	$234,738	$1,089,038	$1,837	$1,399,340	$474,005	$872,022
2028	18	$75,865	$241,546	$1,120,620	$1,890	$1,439,921	$455,842	$871,176
2029	19	$78,065	$248,551	$1,153,118	$1,945	$1,481,679	$438,375	$870,330
2030	20	$80,329	$255,759	$1,186,558	$2,001	$1,524,647	$421,578	$869,485
2031	21	$82,659	$263,176	$1,220,968	$2,059	$1,568,862	$405,424	$868,641
2032	22	$85,056	$270,808	$1,256,376	$2,119	$1,614,359	$389,889	$867,798
2033	23	$87,522	$278,661	$1,292,811	$2,180	$1,661,175	$374,949	$866,955
2034	24	$90,061	$286,742	$1,330,303	$2,244	$1,709,350	$360,582	$866,113
Total		**$1,391,565**	**$4,430,577**	**$20,555,074**	**$34,669**	**$26,411,885**	**$10,720,131**	**$17,483,126**

10.5 Environmental Sustainability: Annual Benefit Estimates

Calendar Year	Project Year	Environmental Savings at Loop 82 Crossing	Environmental Savings at Post Rd Crossing	Total Undiscounted Benefits	Total Discounted Benefits at 7%	Total Discounted Benefits at 3%
2015 (opening)	5	$29,161	$6,113	$35,275	$27,429	$31,341
2016	6	$29,123	$6,105	$35,229	$25,786	$30,389
2017	7	$29,746	$6,236	$35,981	$24,804	$30,134
2018	8	$30,069	$6,304	$36,372	$23,649	$29,574
2019	9	$30,637	$6,423	$37,059	$22,747	$29,255
2020	10	$31,176	$6,536	$37,712	$21,881	$28,903
2021	11	$31,644	$6,634	$38,278	$21,031	$28,482
2022	12	$32,323	$6,776	$39,099	$20,364	$28,246
2023	13	$32,633	$6,841	$39,474	$19,545	$27,686
2024	14	$32,888	$6,895	$39,782	$18,770	$27,090
2025	15	$33,137	$6,947	$40,084	$18,065	$26,500
2026	16	$33,697	$7,064	$40,761	$17,567	$26,163
2027	17	$33,899	$7,107	$41,005	$16,972	$25,553
2028	18	$34,088	$7,146	$41,234	$16,443	$24,947
2029	19	$34,630	$7,260	$41,890	$16,108	$24,606
2030	20	$35,241	$7,388	$42,629	$15,845	$24,311
2031	21	$35,881	$7,522	$43,404	$15,621	$24,032
2032	22	$33,337	$6,989	$40,326	$14,509	$21,677
2033	23	$32,645	$6,844	$39,488	$14,067	$20,609
2034	24	$31,749	$6,656	$38,405	$13,659	$19,459
Total		**$647,703**	**$135,785**	**$783,488**	**$384,861**	**$528,957**

10.6 Safety: Annual Benefit Estimates

Calendar Year	Project Year	Undiscounted Benefits	Discounted Benefits at 7%	Discounted Benefits at 3%
2015 (opening)	5	$1,276,684	$973,976	$1,134,317
2016	6	$1,287,878	$918,240	$1,110,935
2017	7	$1,299,171	$865,693	$1,088,036
2018	8	$1,310,563	$816,153	$1,065,608
2019	9	$1,322,055	$769,448	$1,043,642
2020	10	$1,333,647	$725,416	$1,022,130
2021	11	$1,345,342	$683,903	$1,001,061
2022	12	$1,357,138	$644,767	$980,426
2023	13	$1,369,038	$607,869	$960,216
2024	14	$1,381,043	$573,084	$940,423
2025	15	$1,393,153	$540,289	$921,038
2026	16	$1,405,369	$509,370	$902,053
2027	17	$1,417,692	$480,221	$883,459
2028	18	$1,430,123	$452,740	$865,248
2029	19	$1,442,663	$426,832	$847,412
2030	20	$1,455,313	$402,406	$829,945
2031	21	$1,468,074	$379,378	$812,837
2032	22	$1,480,947	$357,668	$796,082
2033	23	$1,493,933	$337,200	$779,672
2034	24	$1,507,032	$317,904	$763,601
Total		**$27,776,859**	**$11,782,557**	**$18,748,140**