



Brush College Road/Faries Parkway Project: Grade Separation & Improvements Benefit Cost Analysis

April 2022

Project Type: **Urban Road and Road/Rail Grade Separation**

Applicant: **City of Decatur**

Type of Applicant: **City Government**

RAISE Funding Requested: **\$16 Million**

UEI: **HCL3MP6L8XV5**



Website <https://decaturil.gov/departments/public-works/brush-college-road-project/2022-raise-grant/>

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SUMMARY

Exhibit 1: Analysis Summary

Analysis Item	
Current Status/Baseline & Problem to be Addressed	<ul style="list-style-type: none"> ◆ At-grade railroad/roadway crossing located approximately 40 feet north of existing signalized intersection. ◆ Vehicular traffic has a high percentage of tractor-trailer trucks. ◆ At-grade crossing is located near railroad yard and railroad spurs for loading/unloading. ◆ Safety hazard and excessive delays.
Change to Baseline/Alternatives	<ul style="list-style-type: none"> ◆ No-Build ◆ Eliminate at-grade railroad crossing with construction of overpass and connector roadway to maintain accessibility to minor roadway.
Type of Impacts	<ul style="list-style-type: none"> ◆ Reduce delays for vehicles. ◆ Reduce accidents. ◆ Improve reliability. ◆ Provide multi-use path to connect residential areas to Brush College and employment centers.
Population Affected by Impacts	<ul style="list-style-type: none"> ◆ Drivers along Brush College Road and Faries Parkway ◆ Students at Brush College ◆ Employees at businesses along Brush College Road ◆ Transit patrons ◆ Emergency responders ◆ Residents ◆ Tourists ◆ Prospective businesses utilizing Inland Port
Outcomes	
Economic Benefit	<p><i>Monetized value of:</i></p> <ul style="list-style-type: none"> ◆ Reduced travel time/delays ◆ Reduced emissions ◆ Reduced fuel costs/consumption ◆ Reduced accident costs
Summary of Results	<p><i>Estimated dollar value of:</i></p> <ul style="list-style-type: none"> ◆ Time savings ◆ Reduced pollution ◆ Reduced fuel consumption ◆ Safety benefits
B/C Ratio	<p><i>The results of the BCA are:</i></p> <ul style="list-style-type: none"> ◆ NPV at 7% /3% \$18.4 Million ◆ Discount 7%: 1.3:1

Exhibit 2: Impact Matrix

Brush College Road/Faries Parkway Project: Grade Separation & Improvements	✓	Checkmarks indicate applicable Monetized, Quantified, and Qualitative elements
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Impact #	Long-Term Outcomes	Impact Categories	Description	Monetized	Quantified	Qualitative	Reference Tab
1	Safety	Improved Road Safety	Closing 2 at-grade-crossings will reduce potential traffic accidents and fatalities	✓			Reduced Crashes (Intersection & RR Crossing) on 2020\$-BCA based upon findings on 03-Crashes & Values and Fatalities tab
		Improved Emergency Response	Reduced response time with the completion of the overpass	✓			Reduced Response Time without Train Delays on 2020\$-BCA
2	State of Good Repair	Road Maintenance and Crossing Maintenance	Increased maintenance for the new construction will be reduced by the elimination of maintenance for the crossing closures	✓			2020\$-BCA based upon calculations on 04-Maintenance
3	Economic Competitiveness	Decreased Shipping Costs	Shipper benefits from decreased cost due the reliability of access			✓	N/A discussed in the BCA Narrative
		Travel Time Savings	Benefits to intersection users due to decreased delay from train movements	✓			Travel Time/ Delay Savings on 2020\$-BCA
		Vehicle Operating Costs				✓	N/A discussed in the BCA Narrative
4	Environmental Sustainability	Reduced Carbon Emissions	Removing the idling caused by the traffic waiting at the crossings will reduce carbon emissions on a net basis	✓			Fuel Saved on 2020\$-BCA based upon finding in 02-Traffic Analysis tab
		Reduced Air Emissions	Closure of 2 at-grade crossings eliminate idling at the current crossing locations and reduce other air emissions on a net basis	✓			Reduced NoX 2020\$-BCA based upon findings in 02-Traffic Analysis tab
5	Quality of Life/Mobility	Reduced Congestion Costs	Travel Time Saved by Drivers with the elimination of the grade crossings. Improved mobility is not calculated separately	✓			Travel Time/ Delay Savings on 2020\$-BCA based upon findings in 02-Traffic Analysis tab
		Improved Connectivity	Improved transportation options due to improved transit reliability	✓			Transit Travel Time/ Delay Savings on 2020\$-BCA based upon findings in Transit User Time tab

Cost #	Category	Cost Categories	Description	Monetized	Quantified	Qualitative	Reference Tab
C1	Capital Costs	Capital Costs by Year of Expenditure	Cash flows of all capital expenditures	✓			Assumptions
C2	O&M Costs	O&M Costs by Year of Expenditure	Cash flows of all O&M expenditures	✓			Increased Maintenance is calculated as a Reduction of Benefits 2020\$-BCA

Exhibit 3: Project Benefit Table

Current Status or Baseline & Problems to be Addressed	Changes to Baseline / Alternative	Type of Impacts	Population Affected by Impacts	Economic Benefits	Summary of Results (millions of \$2020)	Worksheet tab
Rail activity at the intersection of Brush College Rd & Faries Parkway is causing extensive traffic delays and traffic accidents	The Project will remove 2 at-grade rail crossing and replace these with an Overpass that will cross over Faries Parkway, allowing for the unimpeded movement of traffic.	Reduction in maintenance costs for the 2 removed crossings	Decatur Tax Payers	Monetized reduction in maintenance repair costs for 2 at-grade crossings that will be eliminated by the project	\$104,651	Crossing Maint Savings on 2020\$-BCA
		Reduction in idling costs	Motorists using the intersection and the Environment	Monetized reduction in fuel cost savings	\$4,372,498	Fuel Saved on 2020\$-BCA based up on finding in 02-Traffic Analysis
		Reduction in environmental emissions resulting from idling by the removal of the crossings	Motorists using the intersection	Monetized reduction in air emissions	\$6,169,396	Emissions Savings on 2020\$-BCA based up on findings in 02-Traffic Analysis
		Reduction in vehicular fatalities	Motorists using the intersection	Monetized reduction in crashes	\$22,167,320	Fatality Savings from Closing 1 RR Crossings on 2020\$-BCA based up on Predictive Accidents in Fatality Costs
		Reduction in non-fatal vehicular accidents	Motorists using the intersection	Monetized reduction in non-fatal accidents	\$54,119,999	Reduced Crashes (Intersection & RR Crossing) on 03A-Crashes and Values based up on findings
		Reduction in losses due to Emergency Response Delays	Property owners/ occupants of local structures	Monetized reduction in losses due to reduction in delay in Emergency Services	\$26,324,012	Reduction in Structural Losses on Emergency Response on 2020\$-BCA
		Decreased Transit Travel Time	Citizens using Transit	Monetized reduction in transit delays on Route 41	\$6,980,791	Transit Time Savings on 2020\$-BCA
		Decreased Travel time	Motorists using the intersection	Monetized reduction in Travel Time	\$65,026,900	Travel Time/ Delay Savings on 2020\$-BCA
					Non-discounted results found on Tab 2020\$-BCA	Discounted results found on Tab BCA 7%

INTRODUCTION

This document provides detailed technical information on the economic analyses conducted in support of a grant application for the project.

The Methodology section introduces the conceptual framework used in the BCA. The Project Overview includes a brief description of existing conditions and the proposed alternative. Assumptions describes the current and future situations used in the analysis. Project Cost and Schedule provides a summary of cost estimates and schedule. The Long-Term Outcomes section discusses the general assumptions used in the estimation of project costs and benefits, Specific data elements and assumptions pertaining to the long-term outcome selection criteria are summarized in this section. Estimates of the project's Net Present Value (NPV), its Benefit/Cost ratio (BCR) and other project evaluation metrics are also discussed. Short and long-term job estimates are found in the Job Creation section.

METHODOLOGY

A 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 impacted by the project 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, i.e. what improves their well-being or welfare. A 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. A project or proposal would be rated positively if the benefits to some are large enough to compensate the losses of others.

Finally, a BCA is typically a forward-looking exercise, seeking to 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 was designed using the above BCA principles and is consistent with the RAISE and INFRA guidelines. 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 Opportunity (NOFO);
- Measuring benefits in dollar terms, whenever possible, and expressing benefits and costs in a common unit of measurement;
- Using U.S. Department of Transportation (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 rate of 7% as recommended by the USDOT.

OVERVIEW

This document provides a description of the input data and the methodological standards utilized for the benefit-cost analysis (BCA) of the Brush College Road/Fairies Parkway Grade Separation

Project as submitted by the City of Decatur, Illinois for the RAISE FY22 Discretionary Grant funding.

A benefit-cost analysis uses a standard 20-year lifecycle to facilitate comparisons across projects. A typical benefit-cost analysis measures five primary categories of user benefits:

- Safety: Improved Road Safety and Improved Emergency Response
- State of Good Repair: Road Maintenance and Crossing Maintenance
- Economic Competitiveness: Decreased Shipping Costs, Travel Time Savings and Vehicle Operating Costs
- Environmental Sustainability: Reduced Carbon Emissions and Reduced Other Air Emissions
- Quality of Life/ Mobility: Reduced Congestion Costs and Improved Connectivity

Project capital costs are estimated annually during the construction period plus any prior incurred costs. Project capital costs include:

- Right of Way acquisition,
- Engineering and design, and
- Construction.

In addition to project capital costs, the project will have annual costs after construction is completed and the interchange is opened to users. These annual costs include operation and maintenance (O&M) costs. The O&M costs include items such as:

- Electricity for lights and traffic signals
- Sign maintenance
- Traffic signal maintenance
- Right-of-way mowing
- Snow removal
- Pavement maintenance
- Striping maintenance

However, the future O&M costs for the road are not included in the BCA since these costs are already occurring along Brush College Road and Faries Parkway for the existing roadway and intersections. The existing O&M costs will be transferred to the project.

Several sources of input data were consulted. Examples include:

- *Decatur Area Transportation Efficiency Study 2013*
- Federal Railroad Administration Highway–Rail Grade Crossing Accident/Incident Reports
- *Brush College Road Improvement Study – Section 09-00933-00-BR – Combined Design Report*, Approved by IDOT March 2015

- *Long Range Transportation Plan 2035, Approved December 2009*
- *Federal Railroad Administration Accident Prediction Report for Public At-Grade Highway-Rail Crossings*
- *U.S. Energy Information Administration*
- *Crash Reports from the Decatur, Illinois Police Department 2010-2021*
- *Intersection Traffic Signal Pre-Emption Reports from the City of Decatur April 2016*
- *Benefit-Cost Analysis Guidance March 2022-Revised*

ECONOMIC ASSUMPTIONS

This section summarizes the economic assumptions utilized for the BCA for the Brush College Road/Fairies Parkway Project to comply with the March 2022- Revised Guidelines for Benefit-Cost Analysis Guidelines for RAISE Applications. In the cases where the USDOT BCA Discretionary Grant guidelines did not specify value, documented standard values were utilized.

Discount Rate

The guidance in the Federal Register for the discount is 7% for non-CO₂ costs and benefits and 3% for CO₂ benefits

Study Period

The City of Decatur has initiated a Phase I Project Development Report (PDR) for the Brush College Road improvement project that begins at East Lake Shore Drive, just south of William Street (IL 105), and extends north to IL 48, just south of I-72. The PDR includes the Brush College Road overpass at Fairies Parkway to eliminate the at-grade railroad crossing with the Norfolk Southern (NS) railroad. The Brush College Road PDR was approved by IDOT in March 2015.

Due to funding constraints, the Brush College Road project is ready for construction with final funding. The project was let in January 2022 and bids exceeded the available funding. Thus, the City is requested Federal funds to move this project to completion.. The construction of the overpass project is anticipated to begin in 2024 based on available funding this year and to be completed during 2026. The BCA study period is 20 years post- construction, begins in 2027 and runs through 2046.

A Summary of the Total Benefits and Total Costs used to derive the benefit cost analysis for the project is shown in Exhibit 4 below.

Exhibit 4: Summary of Quantified Benefits and Costs

Year	Total Benefits (2020\$)	Total Capital Costs (2020\$)	Maintenance Costs and Residual (2020\$)	Undiscounted Net Benefits (2020\$)	NPV @7%/3%
2014	\$ -	\$ -	\$ -	\$ -	\$ -
2015	\$ -	\$ -	\$ -	\$ -	\$ -
2016	\$ -	\$ (350,746)	\$ -	\$ (350,746)	\$ (350,746)
2017	\$ -	\$ (344,190)	\$ -	\$ (344,190)	\$ (344,190)
2018	\$ -	\$ (1,181,718)	\$ -	\$ (1,181,718)	\$ (1,181,718)
2019	\$ -	\$ (2,277,694)	\$ -	\$ (2,277,694)	\$ (2,277,694)
2020	\$ -	\$ (3,555,599)	\$ -	\$ (3,555,599)	\$ (3,555,599)
2021	\$ -	\$ (2,097,749)	\$ -	\$ (2,097,749)	\$ (1,960,513)
2022	\$ -	\$ -	\$ -	\$ -	\$ -
2023	\$ -	\$ -	\$ -	\$ -	\$ -
2024	\$ -	\$ (14,603,361)	\$ -	\$ (14,603,361)	\$ (11,140,834)
2025	\$ -	\$ (27,420,903)	\$ -	\$ (27,420,903)	\$ (19,550,725)
2026	\$ -	\$ (27,420,903)	\$ -	\$ (27,420,903)	\$ (18,271,705)
2027	\$ 6,911,576	\$ -	\$ (29,767)	\$ 6,881,808	\$ 4,519,328
2028	\$ 7,087,087		\$ (29,767)	\$ 7,057,319	\$ 4,364,981
2029	\$ 7,269,999		\$ (29,767)	\$ 7,240,231	\$ 4,217,347
2030	\$ 7,462,967		\$ (29,767)	\$ 7,433,200	\$ 4,077,651
2031	\$ 7,665,591		\$ (109,767)	\$ 7,555,824	\$ 3,906,968
2032	\$ 7,879,375		\$ (29,767)	\$ 7,849,608	\$ 3,819,386
2033	\$ 8,104,964		\$ (29,767)	\$ 8,075,196	\$ 3,700,483
2034	\$ 8,343,036		\$ (29,767)	\$ 8,313,269	\$ 3,587,891
2035	\$ 8,594,313		\$ (29,767)	\$ 8,564,546	\$ 3,481,257
2036	\$ 8,863,386		\$ (109,767)	\$ 8,753,618	\$ 3,355,536
2037	\$ 9,143,644		\$ (29,767)	\$ 9,113,877	\$ 3,287,017
2038	\$ 9,439,543		\$ (29,767)	\$ 9,409,775	\$ 3,196,419
2039	\$ 9,751,987		\$ (29,767)	\$ 9,722,220	\$ 3,110,565
2040	\$ 10,081,937		\$ (29,767)	\$ 10,052,170	\$ 3,029,195
2041	\$ 10,430,409		\$ (109,767)	\$ 10,320,641	\$ 2,932,743
2042	\$ 10,798,478		\$ (29,767)	\$ 10,768,711	\$ 2,878,943
2043	\$ 11,192,988		\$ (29,767)	\$ 11,163,221	\$ 2,812,504
2044	\$ 11,604,051		\$ (29,767)	\$ 11,574,283	\$ 2,746,834
2045	\$ 12,038,349		\$ (29,767)	\$ 12,008,581	\$ 2,684,560
2046	\$ 12,497,237		\$ 50,684,487	\$ 63,181,724	\$ 11,358,268
Total	\$ 185,160,916	\$ (79,252,861)	\$ 49,878,906	\$ 155,786,961	\$ 18,434,152

Total Benefits before Maintenance and Residual is \$185.2 million. Total Capital Costs are \$79.3 million. Maintenance and Residual equals \$49.7 million, for an Undiscounted Net Benefit of \$155.4 million. Discounted at 7% / 3% equals a Net Present Value of \$18.4 million.

PROJECT OVERVIEW

The project under analysis consists of the construction of a new overpass along Brush College Road at Fairies Parkway which will eliminate the at-grade railroad crossing with the NS Railroad (#328516E) A second crossing (#291384M) along Brush College Road will be closed and a third (No #) will be relocated. The project also includes the construction of a connector

roadway which will maintain full access between Brush College Road and Fairies Parkway.

The purposes of the proposed project are to:

- Eliminate the at-grade railroad/highway crossing and improve safety
- Reduce travel time/delays at the grade crossing due to blockages from trains switching, loading, unloading, etc.
- Enhance and stimulate economic growth along Brush College Road
- Continue development of the Midwest Inland Port
- Improve transit reliability due eliminating trains blocking Brush College Road
- Provide multi-use path along Brush College Road to provide connectivity and accessibility from residential areas to employment centers and Brush College

Exhibit 5: Brush College Road/ Fairies Parkway Grade Separation and Improvements

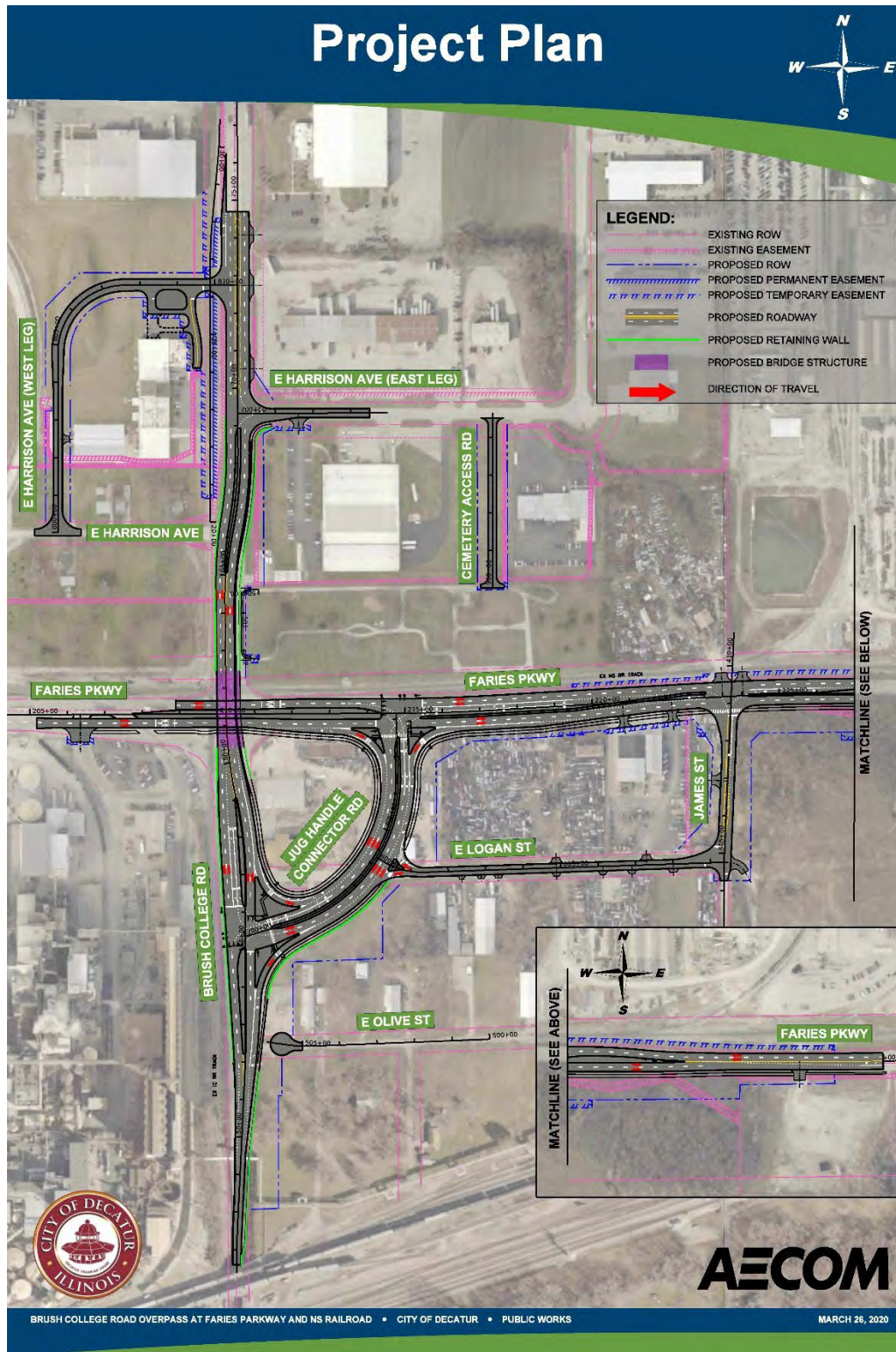


BASE SCENARIO AND ALTERNATIVES

The base or, “no build”, scenario includes the current at-grade configuration of the intersection of Brush College Road with Fairies Parkway and the existing NS railroad at-grade highway/railroad crossing.

The alternative or “build” scenario includes the construction of the overpass along Brush College Road to eliminate the at-grade NS highway-railroad crossing and addition of a connector road to maintain full access to Fairies Parkway from Brush College Road.

Exhibit 6: Project Plan



BCA RESULTS

Exhibit 7: Summary of Long-term Outcomes

Benefit Cost Analysis Summary						
Brush College Rd / Faries Parkway Grade Separation Project						
Long-term Outcomes	Social Benefit	Inputs	Value	Monetized Value	Monetized Value	Monetized Value
				Discount Rate 7%	Discount Rate 3%	Combined 7%/3%
Safety	Reduced fatalities and non-fatalities from closing 2 RR Crossings	Fatality cost savings of reduction of 4 fatalities, 80 non-fatal accidents and 245 property damages only	\$76.3 million saved	\$32,385,712		\$32,385,712
Safety	Reduced Emergency Response Losses due to Closure of 1 RR Crossings	Emergency Cost Savings from Structure Losses	\$26.3million saved	\$9,291,374		\$9,291,374
State of Good Repair	Reduction of crossing maintenance due to closure of 1 at-grade crossings	Maintenance, preservation and upgrade savings of 1 Grade Crossings	2 at-grade crossings closed	included in Maint. below		included in Maint. below
Economic Competitiveness	Fuel savings due to reduced idling time	Savings of delay at crossing	0.4 million gallons of fuel saved by reduced idling	\$1,352,425		\$1,352,425
Economic Competitiveness	Travel Time Saved	Reduced Delay	0.6 million hours saved by reduced delay	\$19,640,992		\$19,640,992
Environmental Sustainability	Environmental Benefits from New Overpass	Gallons of Fuel Saved	81,993 MT of CO ₂ saved		\$3,389,492	\$3,389,492
Environmental Sustainability	Environmental Benefits from New Overpass	Emissions Saved	17 MT of NOx saved	\$95,983		\$95,983
Quality of Life	Increased Mobility and Access	Not Calculated	Not Calculated	\$0		\$0
Quality of Life	Transit Time Saved	Reduced Delay	215,000 hours saved by reduced delay	\$2,473,693		\$2,473,693
Total Social Benefits				\$65,240,180	\$3,389,492	\$68,629,672
Maintenance	Maintenance costs	Maintenance		(\$308,338)		(\$308,338)
Residual of Project	Residual Value in Yr 20	Initial Capital Cost		\$8,746,542		\$8,746,542
Total Benefits				\$73,678,383	\$3,389,492	\$77,067,875
Total Cost				\$58,633,723		\$58,633,723
Net Present Value				\$15,044,661	\$3,389,492	\$18,434,152
Benefit to Cost Ratio						1.3

TRAFFIC ANALYSIS

Utilizing the traffic data in the approved PDR, a Synchro/SimTraffic model was developed for the study area for both the “build” and “no-build” options. The Synchro/SimTraffic models included models for the existing year and the 20-year AM and PM peak hours. The “no-build” models included the at-grade railroad/highway crossing with one train, with a 5-minute duration,

blocking Brush College Road during the study hour. The five-minute duration is the average train duration during the average AM and PM peak hours based upon pre-emption data reports from the traffic signal during April 2016. The pre-emption report included durations ranging from 1-minute to over 20 minutes. Local residents and motorists along Brush College Road have reported that the railroad crossing has been blocked due to trains loading, unloading, or switching for over an hour. For the BCA, the - minute, peak hour, average duration was selected to be incorporated into the traffic models for the analysis as part of the “no build” scenarios.

The results of the traffic models include information regarding the travel delays at the signalized intersection of Brush College Road with Faries Parkway. It also includes travel delays at the at-grade railroad crossing due to the 5-minute duration blocking of the crossing and the fuel consumed and the emissions generated. The results also include length of the queue of traffic due to the railroad crossing being blocked.

Traffic Demands and Models

The existing traffic data and the traffic forecasts for both the Build and No-Build alternatives for the AM and PM peak hours for the study years were taken from the PDR for the project. The PDR also included the intersection turning movement diagrams for the AM and PM peak hours for the study years.

COSTS

The costs for the Brush College Road/Faries Parkway Project include engineering design, right-of-way (ROW) acquisition, and construction. The engineering costs include both Phase I – Project Development and Preliminary Engineering and Phase II – Construction Plans, Specifications, and Estimates. The Phase I engineering has been completed and approved by IDOT. Per the TIGER BCA guidelines, previous incurred costs such as engineering design costs already expended by the City for the project should be included as a “cost” for the BCA. Table 2 includes a summary of the project costs.

Exhibit 8: Project Costs

Project	Cost (\$ Millions)
Pre-incurred costs (Eng and ROW)	\$9.8
Construction management	\$5.1
Construction	\$64.3
Total Engineering, ROW, and Construction Costs	\$79.2

PROJECT SCHEDULE

Exhibit 9: Project Schedule

ACTIVITY	DATE
Phase II Engineering	2017
ROW Acquisition	Began 2017 Completed 2021
Construction Commences	2024
Construction Completion	2026

BENEFITS

Safety

Reduced fatalities and non-fatalities from closing 2 RR crossing

Exhibit 10: Conversion of FRA Predictive Collision Rating to estimate

Conversion of Collision statistics from FRA Predicted Collision Rating									
Collision Type					Annual Average for 2013-2022	Current est. accident costs	Effect on Accidents with Installation of overpass		
KABCO	Severity	Fraction of VSL	Unit value (\$2020)*	Conversion from FRA Predicted Collision Rating	Accident Count by KABCO	# KABCO Accidents Converted to AIS	Current Annual social cost of Accidents	Estimated reduction in injuries by 70 % per Insurance Inst for Highway Safety	Estimated Annual accident costs savings
0	no injury		\$3,900			0	\$0	\$0	\$0
C	Possible injury		\$77,200			0	\$0	\$0	\$0
B	Non-incapacitating		\$151,100			0	\$0	\$0	\$0
A	Incapacitating		\$554,800			0	\$0	\$0	\$0
K	Killed		\$11,600,000			0	\$0	\$0	\$0
U	Injured (Severity Unknown		\$210,300			0	\$0	\$0	\$0
	# Accidents Reported								
	Unknown if injured		\$302,600		5		\$1,513,000	\$1,059,100	\$1,059,100
Property Damage Only			\$4,600		15.3		\$70,380	\$49,266	\$49,266
Annual Non-Fatality Savings							\$1,583,380	\$1,108,366	\$1,108,366
								annual savings	

RAILROAD CROSSING SAFETY									
Crossing	Road	City	County	2020 Rank within County with 141 crossings	2020 Rank within the City of 72 crossings	Predictive Collision	Train Speed	# Tracks	# Trains
328516E	Brush College	Decatur	Macon	1	1	0.203286	10 mph		18
291384M	Harrison	Decatur	Macon		67	0.00031			

Exhibit 11: Reduced Crashes (Intersection and Railroad Crossing)

Brush College Road/Faries Parkway Crashes Over 5-Year Period (2013-March 2022)

Year	Number of Crashes
2013	5
2014	11
2015	10
2016	11
2017	15
2018	6
2019	10
2020	5
2021	3
Feb. 15 2022	3
Total	79

Source: Macon County Sheriff's Office

With growing demands for train, freight and people movement on the corridor, accidents will increase unless the grade separation is constructed

When data for 2011 – 2022 was review, 106 accidents were reported. A review of accident data for the Brush College Road/Faries Parkway intersection shows a total of 79 crashes over the past 10-

year period (see Exhibit 11). Four crashes involved trains, including one where a train hit a car. The accident data suggests that some crashes were related to the at-grade train blockage, and others to improper lane usage when trying to beat the trains entering into the crossing.

Rear end collisions are the most common types of crashes and, over this period, none of the collisions resulted in a fatality. Unfortunately, the analysis did not have the ability to determine train-related collisions, i.e. crashes related to a train at the crossing, such as rear-end crashes at the end of a queue. However, it's reasonable to assume that trains are a major factor in a large majority of the collisions shown in Exhibit 11.

Crash reports from the City of Decatur Police Department were obtained for the intersection of Brush College Road with Faries Parkway, including the at-grade railroad/highway crossing north of the intersection. As part of the BCA, a crash analysis was prepared for the intersection for the 10-year period from 2013 to February 2022. For the study period, there were 79 crashes. There were no fatalities during the study period. The City crash reports did not report the severity of the injuries so the guidance in the *Benefit-Cost Analysis (BCA) Resource Guide* was utilized.

The benefits of crash reductions were calculated using the 5-year crash data, and on the basis that (1) the at-grade railroad/highway crossing will be eliminated; (2) the large signalized intersection between Brush College Road with Faries Parkway will be reconfigured; and (3) the through movements eliminated from the intersection.

Exhibit 12: Total Annual Saving from Fatal and Non-Fatal Accidents

RAILROAD CROSSING SAFETY			
Annual Savings from reduced potential Fatalities		\$2,361,714	
Annual Savings from reduced Non-Fatal Accidents		\$1,108,366	
Total Annual Savings		\$3,470,080	
20 years before annual growth rate			
Total Non-Fatal Collisions		\$ 22,167,320	
Total Predictive Collisions	0.203596	\$ 47,234,272	4.07 fatalities
		\$ 69,401,592	
Source: http://safetydata.fra.dot.gov U.S. DOT-Crossing inventory information as of 3/7/2022			
http://safetydata.fra.dot.gov/webaps/default.aspx			

Exhibit 13: Combined Crash Savings

Combined Crash Savings			
	Reduced Crashes (Intersection & RR Crossing)	Crash Savings from 2 Crossing Closures	Total Reduction in Crashes
	\$ 1,108,366 per Year	\$ 2,361,714 Per Year	
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027	\$ 1,108,366	\$ 2,391,910	\$ 3,500,276
2028	\$ 1,108,366	\$ 2,422,493	\$ 3,530,859
2029	\$ 1,108,366	\$ 2,453,467	\$ 3,561,833
2030	\$ 1,108,366	\$ 2,484,837	\$ 3,593,203
2031	\$ 1,108,366	\$ 2,516,609	\$ 3,624,975
2032	\$ 1,108,366	\$ 2,548,786	\$ 3,657,152
2033	\$ 1,108,366	\$ 2,581,375	\$ 3,689,741
2034	\$ 1,108,366	\$ 2,614,380	\$ 3,722,746
2035	\$ 1,108,366	\$ 2,647,808	\$ 3,756,174
2036	\$ 1,108,366	\$ 2,681,663	\$ 3,790,029
2037	\$ 1,108,366	\$ 2,715,950	\$ 3,824,316
2038	\$ 1,108,366	\$ 2,750,676	\$ 3,859,042
2039	\$ 1,108,366	\$ 2,785,847	\$ 3,894,213
2040	\$ 1,108,366	\$ 2,821,466	\$ 3,929,832
2041	\$ 1,108,366	\$ 2,857,542	\$ 3,965,908
2042	\$ 1,108,366	\$ 2,894,078	\$ 4,002,444
2043	\$ 1,108,366	\$ 2,931,082	\$ 4,039,448
2044	\$ 1,108,366	\$ 2,968,559	\$ 4,076,925
2045	\$ 1,108,366	\$ 3,006,515	\$ 4,114,881
2046	\$ 1,108,366	\$ 3,044,956	\$ 4,153,322
Total	\$ 22,167,320	\$ 54,119,999	\$ 76,287,319

Total Crash costs were estimated to be a Fatality cost savings of 4.07 fatalities plus reduction in 80 non-fatal accidents totaling \$76.3 million before discounting.

Reduced Emergency Costs – Saving from unimpeded access to Brush College Road

The City of Decatur’s Fire Department is frequently faced with making difficult travel route decisions in emergency response situations. The Department’s 2013 Annual Report shows average response times increased due to Fire Station closures. Route disruptions (i.e. train crossings) worsen the problem by increasing response times.

Exhibit 14: Assumptions for Emergency Response Time Savings

References			
Train induced emergency response delays per month		12	
Average delay time (3.9-5.9 minutes)		4.9 minutes	
Average loss per structure fire (2015 dollars, adjusted for inflation per http://www.usinflationcalculator.com/) Source: http://www.nfpa.org/research/reports-and-statistics/fires-in-the-us/overall-fire-problem/fire-loss-in-the-united-states	\$	20,519	
90th percentile fire response time (US Fire Administration) http://nfa.usfa.dhs.gov/downloads/pdf/statistics/v5i7.pdf		11 minutes	Average response time is 8 minutes, to be conservative we choose the 90th percentile, 11 minutes.
Average loss per response minute	\$	1,865	
Months/year		12	

Exhibit 15: Emergency Time Savings

Brush College Rd/ Faries Parkway Grade Separation BCA					
Emergency Response Time Savings Benefits - Build vs No Build					
Calendar Year	Project Year	Base Condition (minutes)	Preferred Alternative (minutes)	Response Time Savings (minutes)	Annual Savings in Constant Dollars
		Train induced response time delay			
2021					
2022					
2023					
2024					
2025					
2026					
2027	1	706	0	706	\$ 1,316,201
2028	2	706	0	706	\$ 1,316,201
2029	3	706	0	706	\$ 1,316,201
2030	4	706	0	706	\$ 1,316,201
2031	5	706	0	706	\$ 1,316,201
2032	6	706	0	706	\$ 1,316,201
2033	7	706	0	706	\$ 1,316,201
2034	8	706	0	706	\$ 1,316,201
2035	9	706	0	706	\$ 1,316,201
2036	10	706	0	706	\$ 1,316,201
2037	11	706	0	706	\$ 1,316,201
2038	12	706	0	706	\$ 1,316,201
2039	13	706	0	706	\$ 1,316,201
2040	14	706	0	706	\$ 1,316,201
2041	15	706	0	706	\$ 1,316,201
2042	16	706	0	706	\$ 1,316,201
2043	17	706	0	706	\$ 1,316,201
2044	18	706	0	706	\$ 1,316,201
2045	19	706	0	706	\$ 1,316,201
2046	20	706	0	706	\$ 1,316,201
Total Benefits During Project Life (2027-2046)				14,112	\$ 26,324,012

It is estimated that the removal of the at-grade crossing will reduce the potential of 14,112 minutes or 235.4 hours of delay in fire response totally \$26.3 million in undiscounted structural damages over the 20 years of analysis.

State of Good Repair

Eliminated Crossing Maintenance

At-grade railroad/highway crossing maintenance is a substantial annual maintenance cost for railroads. Based upon information in the Grade Crossing Safety 2014 report prepared by BNSF Railway, BNSF Railway spends nearly \$45 million annually on grade crossing maintenance. BNSF Railway maintains nearly 17,200 public crossings which results in an average annual maintenance cost of \$2,616 per public crossing. It is estimated that Norfolk Southern Railway spends a similar amount on grade crossings for maintenance. Since one at-grade crossing will be removed from the Norfolk Southern Railway system, the annual maintenance cost is a benefit to the project.

Exhibit 16: Reduction of Crossing Maintenance due to Closing 2 RR Crossings

Reduction of Crossing Maintenance due Closure of 2 RR Crossings	
Year	\$
	5,233
	<i>Per Xing (2020\$)</i>
2021	
2022	
2023	
2024	
2025	
2026	
2027	\$ 5,233
2028	\$ 5,233
2029	\$ 5,233
2030	\$ 5,233
2031	\$ 5,233
2032	\$ 5,233
2033	\$ 5,233
2034	\$ 5,233
2035	\$ 5,233
2036	\$ 5,233
2037	\$ 5,233
2038	\$ 5,233
2039	\$ 5,233
2040	\$ 5,233
2041	\$ 5,233
2042	\$ 5,233
2043	\$ 5,233
2044	\$ 5,233
2045	\$ 5,233
2046	\$ 5,233
Total	\$104,651

There will be the reduction of \$104,651 in crossing maintenance when 2 crossings are closed.

Economic Competitiveness

Fuel Saved

Based upon the traffic analysis for the “build” and “no build” scenarios for the project, the Synchro/SimTraffic reports include a summary of the fuel consumed by the vehicles in the model. The BCA utilizes the fuel savings from the construction of the overpass and connector road as a benefit. The average fuel cost was determined from the annual average Midwest fuel costs for all grades of gasoline and on-highway diesel as of 2/28/2022. Due to the significant volume of tractor-trailer trucks in the traffic stream, the fuel costs included the percentage of trucks and the percentage of passenger vehicles for the unit cost per gallon of fuel.

Exhibit 17: Gallons and CO2 Saved from the reduction in idling

Gallons and CO2 MT Saved due to reduced Idling			
Year	Total gallons save by reduction in idling	Fuel savings due to reduced idling @ \$3.68 / gal	CO2 Reduced (Metric Tons)
	-	\$3.68	-
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027	30,432	\$ 112,013	2,058
2028	32,798	\$ 120,721	2,225
2029	35,262	\$ 129,788	2,398
2030	37,826	\$ 139,226	2,579
2031	40,495	\$ 149,048	2,767
2032	43,271	\$ 159,269	2,963
2033	46,160	\$ 169,901	3,167
2034	49,164	\$ 180,960	3,379
2035	52,289	\$ 192,460	3,599
2036	55,538	\$ 204,418	3,828
2037	58,915	\$ 216,849	4,066
2038	62,426	\$ 229,770	4,313
2039	66,074	\$ 243,199	4,571
2040	69,865	\$ 257,152	4,838
2041	73,803	\$ 271,649	5,115
2042	77,895	\$ 286,708	5,403
2043	82,144	\$ 302,348	5,703
2044	86,557	\$ 318,592	6,014
2045	91,140	\$ 335,458	6,336
2046	95,897	\$ 352,970	6,671
Total	1,187,953	\$ 4,372,501	81,993

It was estimated that 1.2 million gallons of fuel will be saved for a total cost savings of \$4.4 million. Although, not monetized, there will also be a reduction of an estimated 81,993MT of CO₂.

Exhibit 18: Assumption for Travel Time Saved

Assumptions and Factors		Value	Sources
Hourly Value - All Purposes		\$17.80	USDOT Discretionary Grant BCA Guidance, March 2022
Hourly Value - Truck Drivers		\$32.00	
Passenger Veh. Occupancy - All Travel	1.67		
Occupancy - Trucks		1	
Number of Days		365	
Traffic Estimates			
ADT % passenger vehicles	65%	City of Decatur	
ADT % trucks	35%		

Exhibit 19: Travel Time Saved

Travel Time Saved with New Grade Separation						
Year	Total Hours Save	Travel Time Saved @ per hr	Autos		Trucks	
			Total Hours Saved	Travel Time Saved	Total Hours Saved	Travel Time Saved
			65%		35%	
	-	\$30.52		\$ 29.73		\$ 32.00
2020						
2021						
2022						
2023						
2024						
2025						
2026						
2027	49,232	\$ 1,502,655	32,001	\$ 951,256	17,231	\$ 551,399
2028	53,207	\$ 1,623,991	34,585	\$ 1,028,068	18,623	\$ 595,923
2029	57,442	\$ 1,753,236	37,337	\$ 1,109,887	20,105	\$ 643,349
2030	61,952	\$ 1,890,879	40,269	\$ 1,197,022	21,683	\$ 693,857
2031	66,753	\$ 2,037,437	43,390	\$ 1,289,800	23,364	\$ 747,637
2032	71,865	\$ 2,193,458	46,712	\$ 1,388,569	25,153	\$ 804,889
2033	77,306	\$ 2,359,525	50,249	\$ 1,493,698	27,057	\$ 865,827
2034	83,096	\$ 2,536,256	54,013	\$ 1,605,578	29,084	\$ 930,678
2035	89,257	\$ 2,724,307	58,017	\$ 1,724,623	31,240	\$ 999,683
2036	95,812	\$ 2,924,371	62,278	\$ 1,851,274	33,534	\$ 1,073,097
2037	102,785	\$ 3,137,188	66,810	\$ 1,985,998	35,975	\$ 1,151,190
2038	110,201	\$ 3,363,540	71,631	\$ 2,129,290	38,570	\$ 1,234,250
2039	118,088	\$ 3,604,256	76,757	\$ 2,281,676	41,331	\$ 1,322,581
2040	126,474	\$ 3,860,219	82,208	\$ 2,443,713	44,266	\$ 1,416,506
2041	135,390	\$ 4,132,363	88,004	\$ 2,615,994	47,387	\$ 1,516,369
2042	144,869	\$ 4,421,679	94,165	\$ 2,799,146	50,704	\$ 1,622,534
2043	154,945	\$ 4,729,221	100,714	\$ 2,993,835	54,231	\$ 1,735,386
2044	165,655	\$ 5,056,103	107,676	\$ 3,200,768	57,979	\$ 1,855,335
2045	177,037	\$ 5,403,512	115,074	\$ 3,420,695	61,963	\$ 1,982,817
2046	189,133	\$ 5,772,703	122,937	\$ 3,654,412	66,197	\$ 2,118,291
Total	2,130,500	\$ 65,026,900	1,384,825	\$ 41,165,303	745,675	\$ 23,861,597

Travel Time/Travel Delay Savings

The Synchro/SimTraffic models were the basis for the traffic demands, intersection operating capacities, and travel delays for the AM and PM peak hours for the “no build” and “build” scenarios. The “no build” alternative includes a train blocking the at-grade railroad/highway crossing for 5 minutes during the AM and PM peak hour. The 5-minute duration of the blockage corresponds to the average pre-emption length provided by the City from April 2016. The base year and the 20-year design year were analyzed and the results were extrapolated for the intermediate years. The “build” alternative includes the elimination of the at-grade railroad crossing, the inclusion of the Brush College Road overpass over Faries Parkway, and the connector road between Brush College Road and Faries Parkway.

From this traffic analysis, the total delay for the AM and PM peak hours for the “no build” and “build” were compared to calculate the time savings by the elimination of the at-grade railroad crossing due to the proposed overpass and connector road. The AM and PM peak hour traffic volumes typically represent approximately 20% of the average daily traffic volume. However, the delays in the AM and PM peak hour represent approximately 30% of the average daily delays in the system., in Exhibit 24 of this BCA, includes the traffic analysis with the travel time/delay savings. Based upon these calculations, it is estimated that 2.1 million hours are saved over the 20-year analysis period for an undiscounted savings of \$65.0 million in travel time.

Environmental Sustainability

Reduced Emissions

The Synchro/SimTraffic traffic analysis also reports the emissions for the study network for the “build” and “no build” alternatives. The construction of the overpass and connector roadway to eliminate the at-grade railroad/highway crossing results in an emissions savings. The unit price for the emissions was obtained from the *Benefit-Cost Analysis (BCA) Resource Guide*. CO₂ emissions were calculated in Exhibit 17 above. The summary of the other emissions savings is Exhibit 20 below.

Exhibit 20: Reduction in Other Environmental Emissions

Reduction in Other Environmental Emissions								
Year	Total Nox Saved (Tons)	Monitized Value of Total Nox Saved	Total Vox Saved (Tons)	Monitized Value of Total NOX Saved	Monitized Value of Total VOC Saved	Monitized Value NOx	Monitized Value SOx	Monitized Value PM _{2.5}
					\$ -			
2020								
2021					\$ -	\$ 15,600	\$ 41,500	\$ 748,600
2022					\$ -	\$ 15,800	\$ 42,300	\$ 761,600
2023					\$ -	\$ 16,000	\$ 43,100	\$ 774,700
2024					\$ -	\$ 16,200	\$ 44,000	\$ 788,100
2025					\$ -	\$ 16,500	\$ 44,900	\$ 801,700
2026					\$ -	\$ 16,800	\$ 45,700	\$ 814,500
2027	0.43	\$ 7,304			\$ -	\$ 17,100	\$ 46,500	\$ 827,400
2028	0.46	\$ 8,058			\$ -	\$ 17,400	\$ 47,300	\$ 840,600
2029	0.50	\$ 8,860			\$ -	\$ 17,700	\$ 48,200	\$ 854,000
2030	0.54	\$ 9,766			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2031	0.58	\$ 10,500			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2032	0.62	\$ 11,264			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2033	0.67	\$ 12,058			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2034	0.71	\$ 12,885			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2035	0.76	\$ 13,744			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2036	0.81	\$ 14,637			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2037	0.86	\$ 15,566			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2038	0.91	\$ 16,531			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2039	0.97	\$ 17,533			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2040	1.03	\$ 18,575			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2041	1.09	\$ 19,657			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2042	1.15	\$ 20,781			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2043	1.21	\$ 21,949			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2044	1.28	\$ 23,161			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2045	1.35	\$ 24,419			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
2046	1.42	\$ 25,725			\$ -	\$ 18,100	\$ 49,100	\$ 867,600
Total	17.34	\$ 312,975	-		\$ -			

It is estimated that 17.34 Tons of NOx will be saved for a total benefit of \$312,975 undiscounted.

Quality of Life / Improved Mobility

The users of the new overpass will gain increased Mobility and Access without worrying about potentially being delayed by a train at the crossings. This has not been monetized.

Transit Time Saved

Exhibit 21: Assumption for Transit Time Saved

Assumptions and Factors	Value	Source
Days per year	365	
Waiting, Standing and Transfer Time	\$32.40	USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, March 2022 Table A-3 Value of Travel Time Savings
Bus Driver Travel per Hour	\$33.60	
Average Travel Cost per Hour	\$ 697.80	
Annual transit runs affected by train delays	507	2016 MATBUS operations; and 2012 Transit Development Plan for the FM Metropolitan area. Note: this assumes worst case conditions; in recent years routes have been dramatically altered to avoid at grade crossings; however this represents total impact to users of MATBUS. In many cases the reroutes are even more impactful as they now avoid key destinations in the core of Moorhead.
Average ridership per run	20.5	
Drivers per run	1	
Time delay between runs (minutes)	60	
Minutes per hour	60	
Hours per missed run	1	

Exhibit 22: Transit Time Saved

Transit Time Saved with New Grade Separation		
Year	Total Runs Save	Travel Time Saved @ per hr
	-	\$ 697.80
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027	507	\$ 353,785
2028	507	\$ 353,785
2029	507	\$ 353,785
2030	507	\$ 353,785
2031	506	\$ 353,087
2032	505	\$ 352,389
2033	504	\$ 351,691
2034	503	\$ 350,993
2035	502	\$ 350,296
2036	501	\$ 349,598
2037	500	\$ 348,900
2038	499	\$ 348,202
2039	498	\$ 347,504
2040	497	\$ 346,807
2041	496	\$ 346,109
2042	495	\$ 345,411
2043	494	\$ 344,713
2044	493	\$ 344,015
2045	492	\$ 343,318
2046	491	\$ 342,620
Total	10,004	\$ 6,980,791

While drivers are currently delayed at the crossings, transit is also delayed. It is estimated that there are 26 buses each week day that have a 7.5% chance of being stopped at the crossing. Since service is only hourly this can be very disruptive to the transit passengers as they miss other bus connections, scheduled start times at work or school or a medical appointment. Exhibit 22 estimates the annual transit time saved by the removal of the Brush College Road/ Faries Parkway at- grade crossing.

Exhibit 23: Detailed Cost and Benefits

Year	Costs		Benefits										Total Societal Benefits Before Maint and Residual	Total Societal Benefits less Maint plus Residual	Total Capital Costs	Net Total Benefits less Capital Costs	
	Quality of Life		Safety			Environmental Sustainability			Maintenance and Residual								
	Travel Time Savings	Transit Users Travel Time Savings	Crash Savings from 2 Crossing Closures	Reduced Crashes (Intersection & RR Crossing)	Emergency Response Cost Savings	Fuel Saved	Reduced CO Emissions	Reduced Nox Emissions	Reduced VOCs	Eliminated Crossing Maintenance	Increased Maint for New Overpass	Residual Value					
	\$30.52 per Hour	\$ 697.80 per Hour	\$ - per Year	\$ 1,108,366 Per Year	\$ - Per Year	\$ 3.681 Per Gallon	Varies	Per Ton	Per Ton	\$ 5,233 Per Xing (2020S)	04-Maint.	05-Residual					
2014	\$ -														\$ -	\$ -	
2015	\$ -														\$ -	\$ -	
2016	\$ 350,746														\$ (350,746)	\$ (350,746)	
2017	\$ 344,190														\$ (344,190)	\$ (344,190)	
2018	\$ 1,181,718														\$ (1,181,718)	\$ (1,181,718)	
2019	\$ 2,277,694														\$ (2,277,694)	\$ (2,277,694)	
2020	\$ 3,555,599														\$ (3,555,599)	\$ (3,555,599)	
2021	\$ 2,097,749														\$ (2,097,749)	\$ (2,097,749)	
2022	\$ -														\$ -	\$ -	
2023	\$ -														\$ -	\$ -	
2024	\$ 14,603,361														\$ (14,603,361)	\$ (14,603,361)	
2025	\$ 27,420,903														\$ (27,420,903)	\$ (27,420,903)	
2026	\$ 27,420,903														\$ (27,420,903)	\$ (27,420,903)	
2027		\$ 1,502,655	\$ 353,785	\$ 2,391,910	\$ 1,108,366	\$ 1,316,201	\$ 112,013	\$ 119,342	\$ 7,304	\$ -	\$ 5,233	\$ (35,000)	\$ 6,911,576	\$ 6,881,808	\$ -	\$ 6,881,808	
2028		\$ 1,623,991	\$ 353,785	\$ 2,422,493	\$ 1,108,366	\$ 1,316,201	\$ 120,721	\$ 133,472	\$ 8,058	\$ -	\$ 5,233	\$ (35,000)	\$ 7,087,087	\$ 7,057,319	\$ -	\$ 7,057,319	
2029		\$ 1,753,236	\$ 353,785	\$ 2,453,467	\$ 1,108,366	\$ 1,316,201	\$ 129,788	\$ 146,296	\$ 8,860	\$ -	\$ 5,233	\$ (35,000)	\$ 7,269,999	\$ 7,240,231	\$ -	\$ 7,240,231	
2030		\$ 1,890,879	\$ 353,785	\$ 2,484,837	\$ 1,108,366	\$ 1,316,201	\$ 139,226	\$ 159,908	\$ 9,766	\$ -	\$ 5,233	\$ (35,000)	\$ 7,462,967	\$ 7,433,200	\$ -	\$ 7,433,200	
2031		\$ 2,037,437	\$ 353,087	\$ 2,516,609	\$ 1,108,366	\$ 1,316,201	\$ 149,048	\$ 174,344	\$ 10,500	\$ -	\$ 5,233	\$ (115,000)	\$ 7,665,591	\$ 7,555,824	\$ -	\$ 7,555,824	
2032		\$ 2,193,458	\$ 352,389	\$ 2,548,786	\$ 1,108,366	\$ 1,316,201	\$ 159,269	\$ 189,643	\$ 11,264	\$ -	\$ 5,233	\$ (35,000)	\$ 7,879,375	\$ 7,849,608	\$ -	\$ 7,849,608	
2033		\$ 2,359,525	\$ 351,691	\$ 2,581,375	\$ 1,108,366	\$ 1,316,201	\$ 169,901	\$ 205,846	\$ 12,058	\$ -	\$ 5,233	\$ (35,000)	\$ 8,104,964	\$ 8,075,196	\$ -	\$ 8,075,196	
2034		\$ 2,536,256	\$ 350,993	\$ 2,614,380	\$ 1,108,366	\$ 1,316,201	\$ 180,960	\$ 222,995	\$ 12,885	\$ -	\$ 5,233	\$ (35,000)	\$ 8,343,036	\$ 8,313,269	\$ -	\$ 8,313,269	
2035		\$ 2,724,307	\$ 350,296	\$ 2,647,808	\$ 1,108,366	\$ 1,316,201	\$ 192,460	\$ 241,133	\$ 13,744	\$ -	\$ 5,233	\$ (35,000)	\$ 8,594,313	\$ 8,564,546	\$ -	\$ 8,564,546	
2036		\$ 2,924,371	\$ 349,598	\$ 2,681,663	\$ 1,108,366	\$ 1,316,201	\$ 204,418	\$ 264,133	\$ 14,637	\$ -	\$ 5,233	\$ (115,000)	\$ 8,863,386	\$ 8,753,618	\$ -	\$ 8,753,618	
2037		\$ 3,137,188	\$ 348,900	\$ 2,715,950	\$ 1,108,366	\$ 1,316,201	\$ 216,849	\$ 284,624	\$ 15,566	\$ -	\$ 5,233	\$ (35,000)	\$ 9,143,644	\$ 9,113,877	\$ -	\$ 9,113,877	
2038		\$ 3,363,540	\$ 348,202	\$ 2,750,676	\$ 1,108,366	\$ 1,316,201	\$ 229,770	\$ 306,257	\$ 16,531	\$ -	\$ 5,233	\$ (35,000)	\$ 9,439,543	\$ 9,409,775	\$ -	\$ 9,409,775	
2039		\$ 3,604,256	\$ 347,504	\$ 2,785,847	\$ 1,108,366	\$ 1,316,201	\$ 243,199	\$ 329,081	\$ 17,533	\$ -	\$ 5,233	\$ (35,000)	\$ 9,751,987	\$ 9,722,220	\$ -	\$ 9,722,220	
2040		\$ 3,860,219	\$ 346,807	\$ 2,821,466	\$ 1,108,366	\$ 1,316,201	\$ 257,152	\$ 353,151	\$ 18,575	\$ -	\$ 5,233	\$ (35,000)	\$ 10,081,937	\$ 10,052,170	\$ -	\$ 10,052,170	
2041		\$ 4,132,363	\$ 346,109	\$ 2,857,542	\$ 1,108,366	\$ 1,316,201	\$ 271,649	\$ 378,523	\$ 19,657	\$ -	\$ 5,233	\$ (115,000)	\$ 10,430,409	\$ 10,320,641	\$ -	\$ 10,320,641	
2042		\$ 4,421,679	\$ 345,411	\$ 2,894,078	\$ 1,108,366	\$ 1,316,201	\$ 286,708	\$ 405,254	\$ 20,781	\$ -	\$ 5,233	\$ (35,000)	\$ 10,798,478	\$ 10,768,711	\$ -	\$ 10,768,711	
2043		\$ 4,729,221	\$ 344,713	\$ 2,931,082	\$ 1,108,366	\$ 1,316,201	\$ 302,348	\$ 439,109	\$ 21,949	\$ -	\$ 5,233	\$ (35,000)	\$ 11,192,988	\$ 11,163,221	\$ -	\$ 11,163,221	
2044		\$ 5,056,103	\$ 344,015	\$ 2,968,559	\$ 1,108,366	\$ 1,316,201	\$ 318,592	\$ 469,054	\$ 23,161	\$ -	\$ 5,233	\$ (35,000)	\$ 11,604,051	\$ 11,574,283	\$ -	\$ 11,574,283	
2045		\$ 5,403,512	\$ 343,318	\$ 3,006,515	\$ 1,108,366	\$ 1,316,201	\$ 335,458	\$ 500,561	\$ 24,419	\$ -	\$ 5,233	\$ (35,000)	\$ 12,038,349	\$ 12,008,581	\$ -	\$ 12,008,581	
2046		\$ 5,772,703	\$ 342,620	\$ 3,044,956	\$ 1,108,366	\$ 1,316,201	\$ 352,970	\$ 533,696	\$ 25,725	\$ -	\$ 5,233	\$ (115,000)	\$ 50,794,255	\$ 12,497,237	\$ 63,181,724	\$ 63,181,724	
Total	\$ 79,252,861	\$ 65,026,900	\$ 6,980,791	\$ 54,119,999	\$ 22,167,320	\$ 26,324,012	\$ 4,372,498	\$ 5,856,421	\$ 312,975	\$ -	\$ 104,651	\$ (1,020,000)	\$ 50,794,255	\$ 185,160,916	\$ 235,039,822	\$ (79,252,861)	\$ 155,786,961

Exhibit 24 :Analysis of Difference

Note: The values shown in this table are the result of the traffic analysis for the AM and PM peak hours only!

The AM and PM traffic volumes are typically 10% each of the average daily traffic volumes (ADT). But this only accounts for 2 hours of the day for the BCA.

For this analysis, let AM+PM results represent 30% of the average daily delay, fuel, and emissions. In order to determine the total daily values, divide the AM+PM total by 0.30.

Difference (No Build with Build - 5 Min Train)																				
Year	Total Delay (hrs - 2 hours per day)				Fuel Consumed (Gal)				Emissions											
	AM	PM	AM+PM	Daily	AM	PM	AM+PM	Daily	CO (kg)				NOx (kg)				VOCs (kg)			
									AM	PM	AM+PM	Daily	AM	PM	AM+PM	Daily	AM	PM	AM+PM	Daily
2015	6.00	8.00	14.00	46.7	2.00	5.00	7.00	23.33	0.08	0.34	0.42	1.40	0.01	0.06	0.07	0.23	0.01	0.08	0.09	0.30
2016	6.49	9.42	15.91	53.0	2.39	6.66	9.04	30.15	0.11	0.46	0.56	1.88	0.02	0.08	0.10	0.33	0.02	0.11	0.12	0.41
2017	7.01	10.98	17.99	60.0	2.79	8.41	11.20	37.32	0.14	0.58	0.71	2.38	0.02	0.11	0.13	0.42	0.02	0.14	0.16	0.53
2018	7.56	12.69	20.24	67.5	3.20	10.26	13.46	44.87	0.17	0.71	0.87	2.91	0.03	0.13	0.16	0.53	0.03	0.17	0.20	0.65
2019	8.14	14.55	22.69	75.6	3.63	12.21	15.85	52.82	0.20	0.84	1.04	3.47	0.03	0.16	0.19	0.64	0.04	0.20	0.23	0.78
2020	8.75	16.60	25.34	84.5	4.08	14.27	18.35	61.17	0.23	0.98	1.22	4.06	0.04	0.19	0.23	0.75	0.05	0.23	0.28	0.92
2021	9.39	18.83	28.21	94.0	4.54	16.44	20.99	69.95	0.27	1.14	1.40	4.67	0.05	0.21	0.26	0.87	0.05	0.27	0.32	1.06
2022	10.07	21.26	31.33	104.4	5.02	18.73	23.75	79.18	0.30	1.29	1.60	5.32	0.05	0.25	0.30	1.00	0.06	0.30	0.36	1.21
2023	10.78	23.92	34.70	115.7	5.52	21.15	26.66	88.88	0.34	1.46	1.80	6.00	0.06	0.28	0.34	1.13	0.07	0.34	0.41	1.37
2024	11.54	26.82	38.36	127.9	6.03	23.69	29.72	99.06	0.38	1.64	2.01	6.72	0.07	0.31	0.38	1.27	0.08	0.38	0.46	1.54
2025	12.33	29.99	42.32	141.1	6.56	26.36	32.93	109.75	0.42	1.82	2.24	7.47	0.08	0.35	0.42	1.42	0.09	0.43	0.51	1.71
2026	13.17	33.43	46.60	155.3	7.11	29.18	36.29	120.97	0.46	2.02	2.48	8.25	0.08	0.39	0.47	1.57	0.10	0.47	0.57	1.90
2027	14.05	37.19	51.24	170.8	7.68	32.14	39.82	132.75	0.50	2.23	2.72	9.08	0.09	0.43	0.52	1.73	0.11	0.52	0.63	2.09
2028	14.98	41.28	56.26	187.5	8.27	35.26	43.53	145.10	0.54	2.44	2.98	9.95	0.10	0.47	0.57	1.90	0.12	0.57	0.69	2.29
2029	15.96	45.74	61.69	205.6	8.88	38.53	47.42	158.06	0.59	2.67	3.26	10.85	0.11	0.51	0.62	2.08	0.13	0.62	0.75	2.50
2030	16.99	50.58	67.57	225.2	9.51	41.98	51.49	171.64	0.63	2.91	3.54	11.81	0.12	0.56	0.68	2.26	0.14	0.68	0.82	2.72
2031	18.07	55.86	73.93	246.4	10.16	45.60	55.76	185.88	0.68	3.16	3.84	12.81	0.13	0.61	0.74	2.46	0.15	0.74	0.89	2.96
2032	19.21	61.60	80.81	269.4	10.84	49.40	60.24	200.81	0.73	3.43	4.16	13.85	0.14	0.66	0.80	2.66	0.16	0.80	0.96	3.20
2033	20.41	67.84	88.25	294.2	11.54	53.40	64.93	216.45	0.78	3.70	4.48	14.95	0.15	0.71	0.86	2.87	0.17	0.86	1.04	3.45
2034	21.67	74.63	96.30	321.0	12.26	57.59	69.85	232.84	0.84	3.99	4.83	16.10	0.16	0.77	0.93	3.10	0.19	0.93	1.12	3.72
2035	23	82	105	350.0	13.00	62.00	75.00	250.00	0.89	4.30	5.19	17.30	0.17	0.83	1.00	3.33	0.20	1.00	1.20	4.00
2036	24.40	90.01	114.41	381.4	13.77	66.62	80.39	267.98	0.95	4.62	5.57	18.56	0.18	0.89	1.07	3.58	0.21	1.07	1.29	4.29
2037	25.86	98.72	124.59	415.3	14.56	71.48	86.04	286.80	1.01	4.96	5.96	19.88	0.19	0.96	1.15	3.84	0.23	1.15	1.38	4.60
2038	27.41	108.18	135.59	452.0	15.38	76.57	91.95	306.50	1.07	5.31	6.38	21.26	0.20	1.03	1.23	4.10	0.24	1.23	1.48	4.92
2039	29.03	118.45	147.48	491.6	16.23	81.91	98.14	327.13	1.13	5.68	6.81	22.70	0.22	1.10	1.32	4.39	0.26	1.32	1.58	5.25
2040	30.74	129.61	160.34	534.5	17.10	87.51	104.61	348.72	1.19	6.07	7.26	24.22	0.23	1.17	1.40	4.68	0.27	1.41	1.68	5.61
2041	32.53	141.72	174.25	580.8	18.01	93.38	111.39	371.30	1.26	6.48	7.74	25.80	0.24	1.25	1.50	4.99	0.29	1.50	1.79	5.97

Per BCA Guidance, unit prices for emissions are in Short Tons (1 T = 2000 lbs), convert KG to T 1 Ton = 907.18 Kg

Conversion rate to convert AM+PM to Daily total: 0.3
 Conversion rate to convert AM+PM to Daily total: 0.3

Since this intersection has a large percentage of trucks in its daily traffic volume, use:

Diesel	35%	FY 22 BCA
Gas-All Grades	65%	
Total		3.526
		3.968
		1.389
Trucks		2.292
Autos		3.681

CAPITAL COSTS

This section identifies the basis of the capital cost estimates used in this BCA.

Construction Cost

The final design and construction cost associated with infrastructure improvements are estimated to be \$79.2 million in \$2020. This equates to \$58.6 million when discounted at 7%. These figures are based on the detailed construction cost estimates provided as part of the Discretionary Grant application.

Exhibit 25 Project Costs

Costs		
Year	\$2020	Discounted 7%
2014		
2015	-	
2016	350,746	350,746
2017	344,190	344,190
2018	1,181,718	1,181,718
2019	2,292,194	2,292,194
2020	3,555,599	\$3,555,599
2021	2,032,658	\$1,899,681
2022	-	\$0
2023	-	\$0
2024	14,603,361	\$11,140,834
2025	27,420,903	\$19,550,725
2026	27,420,903	\$18,271,705
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
2036		
2037		
2038		
2039		
2040		
2041		
2042		
2043		
2044		
2045		
2046		
Total	79,202,270	\$ 58,587,390

The Brush College Road/Faries Parkway Project began in 2016, Right of Way purchases were completed in 2021. Construction can begin within 4 months of funding obligation with completion within 30 months.

Exhibit 26: Brush College Road/Faries Parkway Project Proposed Schedule

ACTIVITY	DATE
Phase II Engineering	Complete
ROW Acquisition	Complete
Award Announcement	Fall 2022
Award Obligation	Spring 2024
Bid/ Contract Award	Spring 2024
Construction Commences	July 2024
Construction Completion	December 2026
Close-out	March 2027

Key milestones are referenced in Exhibit 26, demonstrates that the pre-construction actives are complete with the ability to obligate funds as soon as possible but not later Sept. 30,2026 and adhere to the proposed completion date, meeting all RAISE FY22 requirements.

Life Cycle Costs

Life Cycle costs have been estimated based upon the City’s Asset Management Plan and input from the railroads on the closing of the 2 crossings. Total life-cycle costs are estimated at \$1.0 million for the Grade Separation as the other improvements surrounding the are already in the Asset Management Schedule. Additional saving of \$104,651 is estimated with the removal of 2 rail crossings. Total net maintenance over the 20 years post construction is estimate to be \$0.9 million in 2020\$ or \$0.3 million when discounted at 7t-construction

Exhibit 27: Life Cycle Costs

New Overpass + Improvements				Reduction of Crossing Maintenance due Closure of 2 RR Crossings			
Year	Annual Maint	5 yr Maint	Total	Year	\$	Total	Disc 7%
2021				2021			
2022				2022			
2023				2023			
2024				2024			
2025				2025			
2026				2026			
2027	\$ 35,000		\$ 35,000	2027	\$ 5,233	\$ 29,767	\$ 18,538
2028	\$ 35,000		\$ 35,000	2028	\$ 5,233	\$ 29,767	\$ 17,325
2029	\$ 35,000		\$ 35,000	2029	\$ 5,233	\$ 29,767	\$ 16,192
2030	\$ 35,000		\$ 35,000	2030	\$ 5,233	\$ 29,767	\$ 15,132
2031	\$ 35,000	\$ 80,000	\$ 115,000	2031	\$ 5,233	\$ 109,767	\$ 52,150
2032	\$ 35,000		\$ 35,000	2032	\$ 5,233	\$ 29,767	\$ 13,217
2033	\$ 35,000		\$ 35,000	2033	\$ 5,233	\$ 29,767	\$ 12,352
2034	\$ 35,000		\$ 35,000	2034	\$ 5,233	\$ 29,767	\$ 11,544
2035	\$ 35,000		\$ 35,000	2035	\$ 5,233	\$ 29,767	\$ 10,789
2036	\$ 35,000	\$ 80,000	\$ 115,000	2036	\$ 5,233	\$ 109,767	\$ 37,182
2037	\$ 35,000		\$ 35,000	2037	\$ 5,233	\$ 29,767	\$ 9,424
2038	\$ 35,000		\$ 35,000	2038	\$ 5,233	\$ 29,767	\$ 8,807
2039	\$ 35,000		\$ 35,000	2039	\$ 5,233	\$ 29,767	\$ 8,231
2040	\$ 35,000		\$ 35,000	2040	\$ 5,233	\$ 29,767	\$ 7,692
2041	\$ 35,000	\$ 80,000	\$ 115,000	2041	\$ 5,233	\$ 109,767	\$ 26,510
2042	\$ 35,000		\$ 35,000	2042	\$ 5,233	\$ 29,767	\$ 6,719
2043	\$ 35,000		\$ 35,000	2043	\$ 5,233	\$ 29,767	\$ 6,279
2044	\$ 35,000		\$ 35,000	2044	\$ 5,233	\$ 29,767	\$ 5,869
2045	\$ 35,000		\$ 35,000	2045	\$ 5,233	\$ 29,767	\$ 5,485
2046	\$ 35,000	\$ 80,000	\$ 115,000	2046	\$ 5,233	\$ 109,767	\$ 18,901
Total	\$ 700,000	\$ 320,000	\$ 1,020,000	Total	\$104,651	\$915,349	\$308,338

Residual At Year 2046

Exhibit 28: Assumptions for the Calculation of Residual Value

Remaining Service Life					
Cost Category	Initial Capital Costs in 2020 Dollars	Asset Life	Factor	Remaining Value in 2020 Dollars	Present Value of Remaining Capital (2046 7% discount)
Preliminary Engineering / Env	\$ 3,925,745	5			
Final Engineering	\$ 5,141,821	60	67%	\$ 3,427,881	\$ 590,266
ROW	\$ 5,749,409	100	100%	\$ 5,749,409	\$ 990,022
Construction Elements:					
Major Structures	\$ 62,425,447	60	67%	\$ 41,616,965	\$ 7,166,254
Removal		60	67%	\$ -	\$ -
Utilities and Stormwater		50	60%	\$ -	\$ -
Subbase		40	50%	\$ -	\$ -
Surface		25	20%	\$ -	\$ -
Subtotal Construction elements	\$ 62,425,447				
Total Remaining Capital Value	\$ 77,242,422			\$ 50,794,255	\$ 8,746,542
Note: the contingency has been included in the Construction line item					
Life value of the asset	varies	Years			

It is expected that the project improvements are assumed to have a 60-year asset life. Hence, by year 20 post-construction, it is assumed that the residual value of assets will equate to 2/3 of the capital investment, equaling \$50.8 million in 2020 dollars. This amount has been discounted at 7% in the BCA Summary which is estimated at \$8.7 million in Year 2046.

BENEFIT COST SUMMARY

A favorable Benefit- Cost Ratio is one that exceeds 1.0, indicating that the 20-year analysis of the benefits, life-cycle costs and residual value of the asset exceed the capital costs expended during that same time period. As Exhibit 29 shows, the Project, when discounted Non-CO₂ costs and benefits are 7 percent and CO₂ benefits discounted at 3%, generates \$68.6 million in societal benefits before life-cycle costs of \$0.3 million and a residual value of \$8.7 million, for a total benefit of \$77.1 million. Project costs are \$58.6 million when discounted at 7 percent. The Benefit Cost Ratio is estimated to be over 1.3:1 with a Net Present Value of \$88.8 million.

- Safety Benefits account for 61 percent when discounted of the total benefit, or \$41.7million .
- Economic Competitiveness accounts for 31 percent when discounted of the total societal benefit, or \$20.9million.
- Environmental Benefits account for the 3.5 million when discounted and Quality of Life as measured by transit time savings is \$2.5 million when discounted.

Exhibit 29: Selection Criteria Summary

Benefit Cost Analysis Summary						
Brush College Rd / Faries Parkway Grade Separation Project						
Long-term Outcomes	Social Benefit	Inputs	Value	Monetized Value	Monetized Value	Monetized Value
				Discount Rate 7%	Discount Rate 3%	Combined 7%/3%
Safety	Reduced fatalities and non-fatalities from closing 2 RR Crossings	Fatality cost savings of reduction of 4 fatalities, 80 non-fatal accidents and 245 property damages only	\$76.3 million saved	\$32,385,712		\$32,385,712
Safety	Reduced Emergency Response Losses due to Closure of 1 RR Crossings	Emergency Cost Savings from Structure Losses	\$26.3million saved	\$9,291,374		\$9,291,374
State of Good Repair	Reduction of crossing maintenance due to closure of 1 at-grade crossings	Maintenance, preservation and upgrade savings of 1 Grade Crossings	2 at-grade crossings closed	included in Maint. below		included in Maint. below
Economic Competiveness	Fuel savings due to reduced idling time	Savings of delay at crossing	0.4 million gallons of fuel saved by reduced idling	\$1,352,425		\$1,352,425
Economic Competiveness	Travel Time Saved	Reduced Delay	0.6 million hours saved by reduced delay	\$19,640,992		\$19,640,992
Environmental Sustainability	Environmental Benefits from New Overpass	Gallons of Fuel Saved	81,993 MT of CO ₂ saved		\$3,389,492	\$3,389,492
Environmental Sustainability	Environmental Benefits from New Overpass	Emissions Saved	17 MT of NOx saved	\$95,983		\$95,983
Quality of Life	Increased Mobility and Access	Not Calculated	Not Calculated	\$0		\$0
Quality of Life	Transit Time Saved	Reduced Delay	215,000 hours saved by reduced delay	\$2,473,693		\$2,473,693
Total Social Benefits				\$65,240,180	\$3,389,492	\$68,629,672
Maintenance	Maintenance costs	Maintenance		(\$308,338)		(\$308,338)
Residual of Project	Residual Value in Yr 20	Initial Capital Cost		\$8,746,542		\$8,746,542
Total Benefits				\$73,678,383	\$3,389,492	\$77,067,875
Total Cost				\$58,633,723		\$58,633,723
Net Present Value				\$15,044,661	\$3,389,492	\$18,434,152
Benefit to Cost Ratio						1.3