Southeast Connector

Southeast 30th Street to U.S. Highway 65

Benefit-Cost Analysis

Introduction

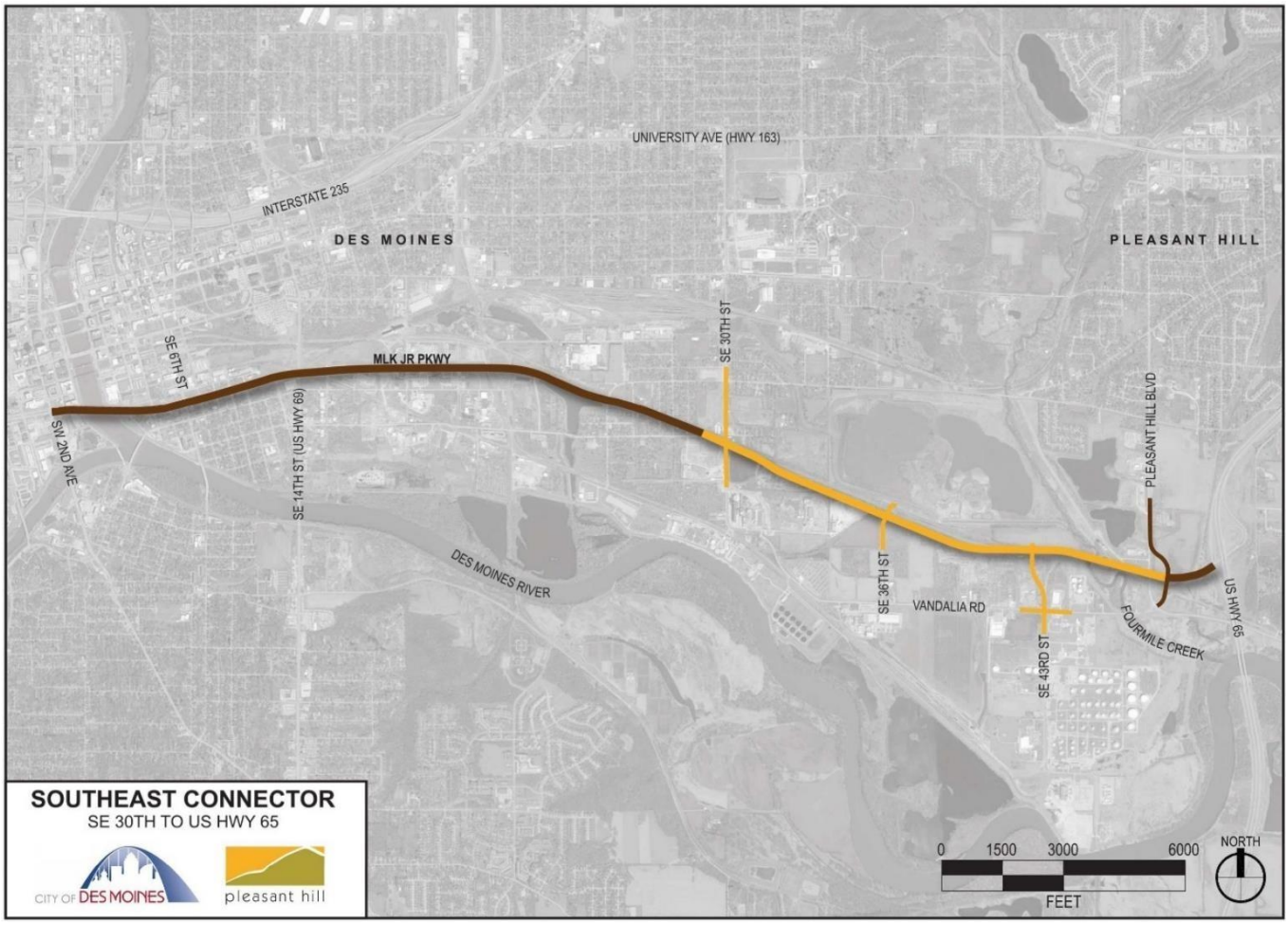
The Cities of Des Moines and Pleasant Hill have proposed a joint project to complete the final phase of the Southeast Connector (SE) between Southeast 30th Street to U.S. Highway 65. The information herein describes the assumptions, calculations, and results of the benefit- cost analysis (BCA) for the Southeast Connector project from Southeast 30th Street to U.S. Highway 65. This analysis was conducted in accordance with the *Benefit-Cost Analysis Guidance for Discretionary Grant Programs (January 2023)*, hereafter known as the Guidance.

The City of Des Moines, as the lead entity, plans to construct the final segment of the SE Connector from SE 30th Street to U.S. Highway 65, completing the decades-long-planned urban arterial from downtown Des Moines (including U.S. Highway 69) to U.S. Highway 65. The SE Connector will complete a critical gap in the existing local and regional transportation network by providing a safe and efficient multi-modal transportation connector.

The 2.2-mile roadway corridor facility will consist of two 12-foot vehicular travel lanes, curb and gutter, street lighting, a 1,515-foot bridge, and a 12-foot shared-use path with a 12-foot green space on the south side. The project includes property acquisition and grading for possible future expansion should traffic demand or development necessitate.

To achieve the project's intended purpose, additional improvements beyond the primary SE Connector route will be necessary. The additional improvements include enhanced connections at SE 30th Street, SE 36th Street, and SE 43rd Street. See **Figure 1** for project area.

Figure 1. Project Area



As shown in **Figure 1**, the segment shown in gold is the portion of the SE Connector being requested for RAISE funding. The segments shown in brown have previously been constructed. The Pleasant Hill Boulevard intersection portion of the SE Connector project, which was led by the City of Pleasant Hill, included construction of the eastern-most segment of the SE Connector, and will connect the SE Connector to U.S. Highway 65. The connection was part of the Pleasant Hill Boulevard/Vandalia Road Intersection project that was completed in May 2021 and was assumed as being complete in the baseline condition of this BCA. Accordingly, the travel demand models (TDM) utilized for this project assumed this completion even in the "base year" 2016 models.

Assumptions and Inputs

The following benefits and costs were quantified and included in the BCA:

- Travel Time Savings
- Vehicle Operating Cost Savings
- Emissions Savings
- Safety Benefits
- Cycling Benefits
- Operations and Maintenance Costs
- Residual Value
- Capital Costs

General BCA assumptions and inputs include the following:

- **Base Year Dollars –** All dollars assume 2021 as the base year per Guidance recommendation.
- **Discount Rate –** All future benefits and costs beyond the base year (2021) are discounted at 7%, except for carbon dioxide emissions that are discounted at 3%. These assumptions are consistent with the Guidance.
- **Analysis Time Period –** The time period begins in 2005, the first year of project expenditures. For future years, the analysis period is capped at 30 years from anticipated completion per Guidance recommendations. Since the project is anticipated to be substantially complete and open to traffic by late 2028, the study time period ends 2057.

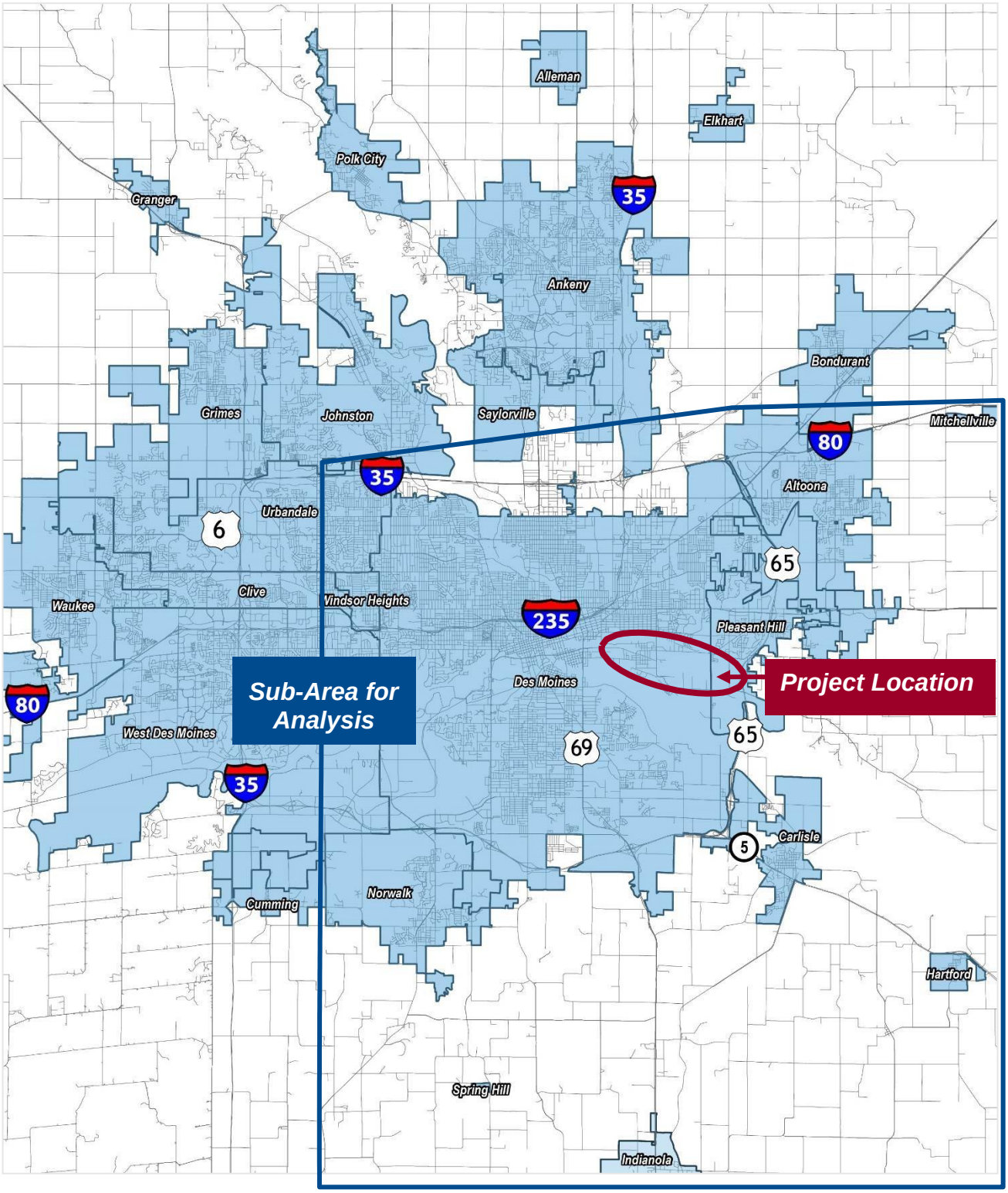
Additional BCA assumptions and inputs that were used in the development of this analysis are provided below.

Travel Demand Forecasting

TDMs were utilized for this project BCA in order to estimate vehicle hours traveled (VHT) and vehicle miles traveled (VMT). The TDMs were provided by the Des Moines Area Metropolitan Planning Organization (MPO). Four model runs were provided as follows: 2016 No-Build, 2016 Build, 2040 No-Build, and 2040 Build. Each TDM contained 10,308 roadway links, representing distinct segments of roadways in the model. The following assumptions were included in these TDMs:

- Because the SE Connector is a critical regional connection, a sub-area of the MPO regional model was defined using Interstates 35 and 80 as the western and northern boundaries, respectively. These boundaries will allow capturing the regional travel demand impacts of the proposed project while limiting it to the southeastern portion of the Des Moines metropolitan region. See **Figure 2** for a depiction of the TDM area used in this BCA.

Figure 2. TDM Area



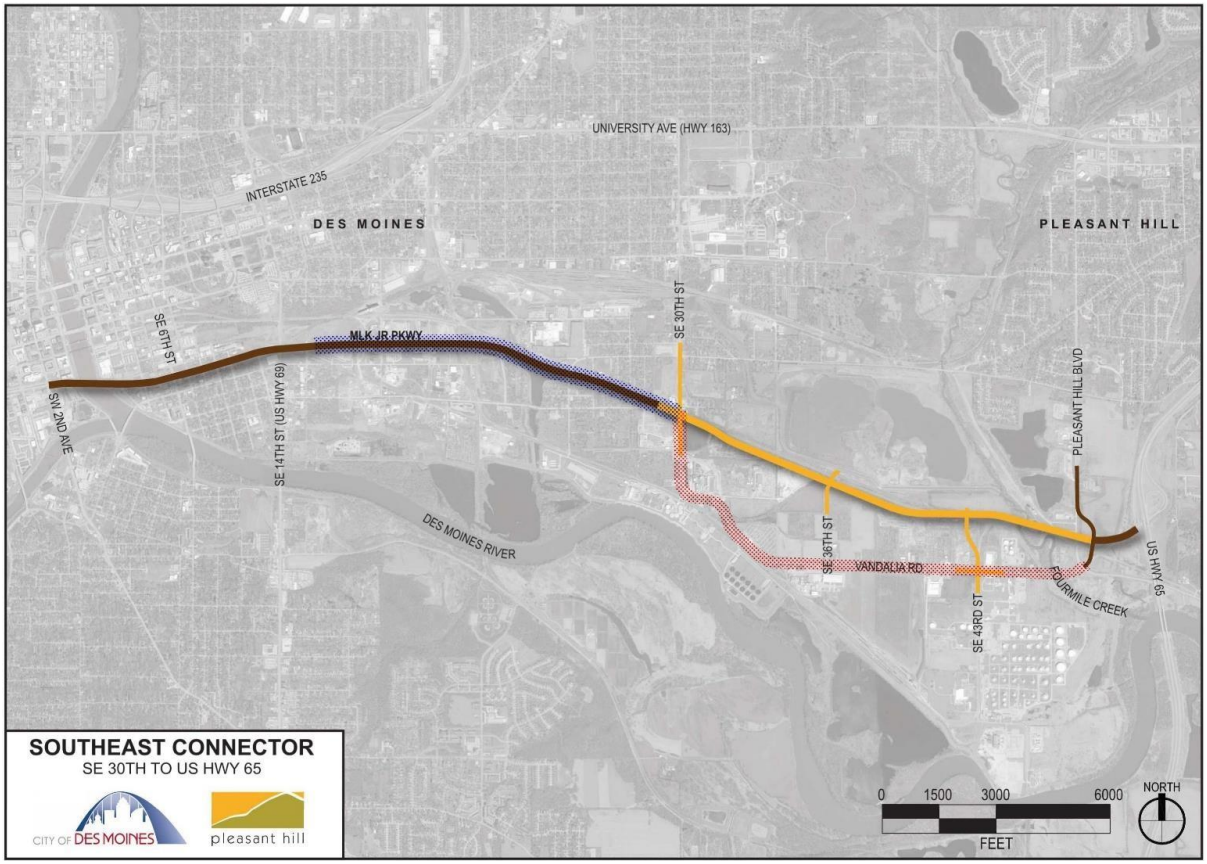
- The 2040 TDMs include projects from the MPO's metropolitan transportation plan (MTP) fiscally constrained project list. The latest MTP, *Mobilizing Tomorrow*, was adopted in 2019 by the MPO.
- The improvements proposed as part of the project are the only difference between the Build and No-Build models for the respective years (2016 and 2040).
- The assumed percentage of truck traffic on the SE Connector is 5.6%, based on the truck percent information taken from the Build 2016 TDM.
- No traffic growth was assumed to occur after the future year modeled (2040), consistent with the Guidance recommendation.
- Travel forecast demands were provided as average annual daily traffic (AADT) from the TDMs.
- Estimated travel times accounted for capacity constraints in addition to posted speed limits and were provided as an average of all time periods (including weekday peak and off-peak, as well as weekends). The travel times for each direction were averaged together unless the roadway link was coded as one-way.
- The TDMs modeled the project improvements, including the SE 30th Street, SE 36th Street, and SE 43rd Street connections. Along with the SE Connector, all links in the Build conditions were modeled as two traveled lanes. The posted speed limit of the SE Connector was assumed to be 40 miles per hour (mph).

Demand Modeling Assumptions for the Safety Analysis

Several routes and links in the TDM area show some level of reduction in traffic due to the project, resulting in less exposure and therefore less crash risk on those routes. A few links, such as portions of SE 30th Street, show a slight increase in traffic in the TDM due to the project. Due to the impracticality of assessing the safety performance of every link in the TDM area, route(s) that experience the greatest traffic impact due to the project that have well-defined origins-destinations were evaluated. Only one route met that criteria—Vandalia Road from its intersection with SE 30th Street and Martin Luther King, Jr. Parkway to Pleasant Hill Boulevard, a length of approximately 2.56 miles. While only the one route was used to calculate the safety benefit, additional safety benefit is expected based on the crash rates of other routes, the design and the condition of existing east-west alternate routes.

In order to estimate the safety performance of the new SE Connector due to the project, the safety performance of the previously completed portion of the SE Connector (Martin Luther King, Jr. Parkway from near SE 15th Street to SE 30th Street), a distance of approximately 1.82 miles, was used as a proxy measure. Specifically, the crash history of this route from the opening date (May 20, 2016) through December 31, 2022 was reviewed. This same time period was also reviewed for the Vandalia Road segment. Crash data was obtained from the Iowa Department of Transportation's Iowa Crash Analysis Tool (ICAT), which includes crash data on local routes from local law enforcement agencies. See **Figure 3** for the study area specific for the safety analysis portion of the BCA.

Figure 3. Safety Analysis Study Area



Travel Time Savings

To determine travel time savings, the VHT for every year from 2028 through 2057 for the No-Build and Build conditions was calculated. Since substantial completion of the project is expected in late 2028, only the last three months of that year are included in the calculations. The calculation is a summation of the VHT for each roadway link, which is calculated by multiplying the travel demand by the travel time provided in the TDM. The VHT for each year between 2028 and 2040 was based on a linear interpolation between the 2016 and 2040 values from the TDMs. The VHT values beyond 2040 were capped at the 2040 values. The difference in the No-Build and Build VHTs for each year was calculated.

The VHT difference was then sub-divided into passenger vehicles and trucks. To calculate the monetary travel time savings, default values for vehicle occupancy and value of time from the Guidance were used with the exception of passenger vehicle occupancy. With Des Moines having participated in the 2017 National Household Travel Survey (NHTS), the local value of 1.72 for passenger vehicle occupancy was used in lieu of the default value of 1.67 provided in the Guidance since the actual local value would provide a higher level of accuracy. The savings for both passenger vehicles and trucks were then discounted at 7%, and then added together. See **Table 1** for VHT calculations, **Table 2** for passenger vehicle calculations, **Table 3** for truck calculations, and **Table 4** for total travel time savings.

Table 1. Change in Annual VHT

Year	Daily VHT No-Build	Daily VHT Build	Annual VHT No-Build[1]	Annual VHT Build[1]	Annual VHT Difference[2]
2005					
2006					
2007					
2008					
2009					
2010	Project Development and Construction Phases[3]				
2011					
2012					
2013					
2014					
2015					
2016	324,251	324,033	118,675,855	118,596,233	(79,622)
2017	331,032	330,783	120,826,677	120,735,784	(90,893)
2018	337,813	337,533	123,301,751	123,199,369	(102,382)
2019	344,594	344,282	125,776,824	125,662,953	(113,870)
2020	351,375	351,032	128,603,272	128,477,569	(125,702)
2021	358,156	357,781	130,726,970	130,590,122	(136,848)
2022	364,937	364,531	133,202,043	133,053,707	(148,336)
2023	371,718	371,280	135,677,116	135,517,291	(159,825)
2024	378,499	378,030	138,530,689	138,358,906	(171,783)
2025	385,280	384,779	140,627,263	140,444,460	(182,802)
2026	392,061	391,529	143,102,336	142,908,045	(194,291)
2027	398,842	398,278	145,577,409	145,371,630	(205,779)
2028	405,623	405,028	148,458,105	148,240,242	(54,466)
2029	412,404	411,778	150,527,555	150,298,799	(228,757)
2030	419,185	418,527	153,002,628	152,762,383	(240,245)
2031	425,966	425,277	155,477,702	155,225,968	(251,734)
2032	432,747	432,026	158,385,522	158,121,578	(263,944)
2033	439,528	438,776	160,427,848	160,153,137	(274,711)
2034	446,309	445,525	162,902,921	162,616,721	(286,200)
2035	453,090	452,275	165,377,994	165,080,306	(297,689)
2036	459,871	459,024	168,312,939	168,002,915	(310,024)
2037	466,652	465,774	170,328,141	170,007,475	(320,666)
2038	473,433	472,523	172,803,214	172,471,059	(332,154)
2039	480,214	479,273	175,278,287	174,934,644	(343,643)
2040	486,996	486,023	178,240,356	177,884,251	(356,105)
2041	486,996	486,023	177,753,360	177,398,228	(355,132)
2042	486,996	486,023	177,753,360	177,398,228	(355,132)
2043	486,996	486,023	177,753,360	177,398,228	(355,132)
2044	486,996	486,023	178,240,356	177,884,251	(356,105)
2045	486,996	486,023	177,753,360	177,398,228	(355,132)
2046	486,996	486,023	177,753,360	177,398,228	(355,132)
2047	486,996	486,023	177,753,360	177,398,228	(355,132)
2048	486,996	486,023	178,240,356	177,884,251	(356,105)
2049	486,996	486,023	177,753,360	177,398,228	(355,132)
2050	486,996	486,023	177,753,360	177,398,228	(355,132)
2051	486,996	486,023	177,753,360	177,398,228	(355,132)
2052	486,996	486,023	178,240,356	177,884,251	(356,105)
2053	486,996	486,023	177,753,360	177,398,228	(355,132)
2054	486,996	486,023	177,753,360	177,398,228	(355,132)
2055	486,996	486,023	177,753,360	177,398,228	(355,132)
2056	486,996	486,023	178,240,356	177,884,251	(356,105)
2057	486,996	486,023	177,753,360	177,398,228	(355,132)

Notes:

[1] Accounts for leap years (2016, 2020, 2024, 2028, etc.).

[2] Project substantial completion anticipated late 2028; therefore, 2028 value adjusted to reflect benefits for last 3 months of year.

[3] Although Project Development and Construction Phases are assumed through 2028, calculations are shown starting in the year 2016 for this table's purpose.

Table 2. Travel Time Savings (Passenger Vehicles)

Year	Annual VHT Difference	Occupancy Annual VHT Difference	Annual Travel Time Savings (Undiscount)[1]	Annual Travel Time Savings (7% Discount)[1,2]
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013				
2014				
2015				
2016	Project Development and Construction Phases			
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026				
2027				
2028	(51,416)	(88,435)	$ 1,662,580	$ 1,035,371
2029	(215,946)	(371,428)	$ 6,982,842	$ 4,064,077
2030	(226,792)	(390,082)	$ 7,333,535	$ 3,988,957
2031	(237,637)	(408,735)	$ 7,684,227	$ 3,906,272
2032	(249,163)	(428,560)	$ 8,056,934	$ 3,827,791
2033	(259,327)	(446,043)	$ 8,385,613	$ 3,723,312
2034	(270,173)	(464,697)	$ 8,736,306	$ 3,625,256
2035	(281,018)	(483,351)	$ 9,086,998	$ 3,524,095
2036	(292,663)	(503,380)	$ 9,463,548	$ 3,430,025
2037	(302,709)	(520,659)	$ 9,788,384	$ 3,315,664
2038	(313,554)	(539,313)	$ 10,139,077	$ 3,209,772
2039	(324,399)	(557,966)	$ 10,489,770	$ 3,103,544
2040	(336,163)	(578,200)	$ 10,870,162	$ 3,005,690
2041	(335,244)	(576,620)	$ 10,840,462	$ 2,801,381
2042	(335,244)	(576,620)	$ 10,840,462	$ 2,618,114
2043	(335,244)	(576,620)	$ 10,840,462	$ 2,446,835
2044	(336,163)	(578,200)	$ 10,870,162	$ 2,293,027
2045	(335,244)	(576,620)	$ 10,840,462	$ 2,137,161
2046	(335,244)	(576,620)	$ 10,840,462	$ 1,997,346
2047	(335,244)	(576,620)	$ 10,840,462	$ 1,866,679
2048	(336,163)	(578,200)	$ 10,870,162	$ 1,749,339
2049	(335,244)	(576,620)	$ 10,840,462	$ 1,630,430
2050	(335,244)	(576,620)	$ 10,840,462	$ 1,523,766
2051	(335,244)	(576,620)	$ 10,840,462	$ 1,424,080
2052	(336,163)	(578,200)	$ 10,870,162	$ 1,334,563
2053	(335,244)	(576,620)	$ 10,840,462	$ 1,243,847
2054	(335,244)	(576,620)	$ 10,840,462	$ 1,162,474
2055	(335,244)	(576,620)	$ 10,840,462	$ 1,086,424
2056	(336,163)	(578,200)	$ 10,870,162	$ 1,018,131
2057	(335,244)	(576,620)	$ 10,840,462	$ 948,925

Notes:

[1] Savings shown as positive values.

[2] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 3. Travel Time Savings (Trucks)

Year	Annual VHT Difference	Occupancy Annual VHT Difference	Annual Travel Time Savings (Undiscount)[1]	Annual Travel Time Savings (7% Discount)[1,2]
2005	Project Development and Construction Phases			
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026				
2027				
2028	(3,050)	(3,050)	$ 98,823	$ 61,542
2029	(12,810)	(12,810)	$ 415,056	$ 241,567
2030	(13,454)	(13,454)	$ 435,901	$ 237,101
2031	(14,097)	(14,097)	$ 456,746	$ 232,187
2032	(14,781)	(14,781)	$ 478,900	$ 227,522
2033	(15,384)	(15,384)	$ 498,436	$ 221,312
2034	(16,027)	(16,027)	$ 519,281	$ 215,483
2035	(16,671)	(16,671)	$ 540,126	$ 209,470
2036	(17,361)	(17,361)	$ 562,508	$ 203,879
2037	(17,957)	(17,957)	$ 581,816	$ 197,081
2038	(18,601)	(18,601)	$ 602,661	$ 190,787
2039	(19,244)	(19,244)	$ 623,506	$ 184,473
2040	(19,942)	(19,942)	$ 646,116	$ 178,657
2041	(19,887)	(19,887)	$ 644,351	$ 166,513
2042	(19,887)	(19,887)	$ 644,351	$ 155,619
2043	(19,887)	(19,887)	$ 644,351	$ 145,439
2044	(19,942)	(19,942)	$ 646,116	$ 136,296
2045	(19,887)	(19,887)	$ 644,351	$ 127,032
2046	(19,887)	(19,887)	$ 644,351	$ 118,721
2047	(19,887)	(19,887)	$ 644,351	$ 110,954
2048	(19,942)	(19,942)	$ 646,116	$ 103,980
2049	(19,887)	(19,887)	$ 644,351	$ 96,912
2050	(19,887)	(19,887)	$ 644,351	$ 90,572
2051	(19,887)	(19,887)	$ 644,351	$ 84,647
2052	(19,942)	(19,942)	$ 646,116	$ 79,326
2053	(19,887)	(19,887)	$ 644,351	$ 73,934
2054	(19,887)	(19,887)	$ 644,351	$ 69,097
2055	(19,887)	(19,887)	$ 644,351	$ 64,576
2056	(19,942)	(19,942)	$ 646,116	$ 60,517
2057	(19,887)	(19,887)	$ 644,351	$ 56,404

Notes:

[1] Savings shown as positive values.

[2] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 4. Total Travel Time Savings

Year	Travel Time Savings (7% Discount)
2005	$ -
2006	$ -
2007	$ -
2008	$ -
2009	$ -
2010	$ -
2011	$ -
2012	$ -
2013	$ -
2014	$ -
2015	$ -
2016	$ -
2017	$ -
2018	$ -
2019	$ -
2020	$ -
2021	$ -
2022	$ -
2023	$ -
2024	$ -
2025	$ -
2026	$ -
2027	$ -
2028	$ 1,096,913
2029	$ 4,305,644
2030	$ 4,226,058
2031	$ 4,138,458
2032	$ 4,055,313
2033	$ 3,944,624
2034	$ 3,840,739
2035	$ 3,733,565
2036	$ 3,633,904
2037	$ 3,512,746
2038	$ 3,400,559
2039	$ 3,288,017
2040	$ 3,184,347
2041	$ 2,967,894
2042	$ 2,773,733
2043	$ 2,592,274
2044	$ 2,429,323
2045	$ 2,264,192
2046	$ 2,116,067
2047	$ 1,977,633
2048	$ 1,853,319
2049	$ 1,727,341
2050	$ 1,614,338
2051	$ 1,508,727
2052	$ 1,413,888
2053	$ 1,317,780
2054	$ 1,231,571
2055	$ 1,151,000
2056	$ 1,078,649
2057	$ 1,005,328
TOTAL	**$ 77,383,945**

Vehicle Operating Cost Savings

To calculate vehicle operating cost savings, the annual VMTs for the period of 2028 - 2057 for both the No-Build and Build conditions were calculated. Since substantial completion of the project is expected in late 2028, only the last three months of that year are included in the calculations. The calculation is a summation of the VMT for each roadway link, which is calculated by multiplying the travel demand by the length of the roadway link provided in the TDM. Similar to the VHTs, the VMTs for the period of 2028 - 2040 were based on a linear interpolation between the 2016 and 2040 values from the TDMs. The VMT values beyond 2040 were capped at the 2040 values. The differences in the No-Build VMT and Build VMT for each year were calculated.

The VMT difference was then sub-divided into passenger vehicles and trucks. To calculate the monetary operating cost savings, default values for passenger vehicle and truck operating costs from the Guidance was used. The savings for both passenger vehicles and trucks were discounted at 7% and then added together. See **Table 5** for VMT calculations, **Table 6** for passenger vehicle calculations, **Table 7** for truck calculations, and **Table 8** for total operating cost savings. Because the net VMT increases, the net total operating cost savings is shown as a negative value.

Table 5. Change in Annual VMT

Year	Daily VMT No-Build	Daily VMT Build	Annual VMT No-Build[1]	Annual VMT Build[1]	Annual VMT Difference[2]
2005	Project Development and Construction Phases[3]				
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016	11,206,892	11,204,446	4,101,722,630	4,100,827,324	(895,306)
2017	11,385,973	11,383,683	4,155,880,114	4,155,044,384	(835,730)
2018	11,565,053	11,562,920	4,221,244,491	4,220,465,890	(778,601)
2019	11,744,134	11,742,157	4,286,608,868	4,285,887,397	(721,471)
2020	11,923,214	11,921,394	4,363,896,459	4,363,230,297	(666,162)
2021	12,102,295	12,100,631	4,417,337,622	4,416,730,409	(607,212)
2022	12,281,375	12,279,868	4,482,701,998	4,482,151,915	(550,083)
2023	12,460,456	12,459,105	4,548,066,375	4,547,573,422	(492,954)
2024	12,639,536	12,638,342	4,626,070,288	4,625,633,270	(437,018)
2025	12,818,617	12,817,579	4,678,795,129	4,678,416,434	(378,695)
2026	12,997,697	12,996,816	4,744,159,506	4,743,837,940	(321,565)
2027	13,176,778	13,176,053	4,809,523,882	4,809,259,446	(264,436)
2028	13,355,858	13,355,290	4,888,244,117	4,888,036,243	(51,969)
2029	13,534,939	13,534,527	4,940,252,636	4,940,102,459	(150,177)
2030	13,714,019	13,713,764	5,005,617,013	5,005,523,965	(93,048)
2031	13,893,100	13,893,001	5,070,981,390	5,070,945,471	(35,918)
2032	14,072,180	14,072,238	5,150,417,947	5,150,439,216	21,269
2033	14,251,261	14,251,475	5,201,710,143	5,201,788,484	78,341
2034	14,430,341	14,430,712	5,267,074,520	5,267,209,990	135,470
2035	14,609,422	14,609,949	5,332,438,897	5,332,631,496	192,600
2036	14,788,502	14,789,186	5,412,591,776	5,412,842,189	250,413
2037	14,967,583	14,968,423	5,463,167,650	5,463,474,509	306,858
2038	15,146,663	15,147,660	5,528,532,027	5,528,896,015	363,988
2039	15,325,744	15,326,897	5,593,896,404	5,594,317,521	421,117
2040	15,504,824	15,506,134	5,674,765,605	5,675,245,162	479,557
2041	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2042	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2043	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2044	15,504,824	15,506,134	5,674,765,605	5,675,245,162	479,557
2045	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2046	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2047	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2048	15,504,824	15,506,134	5,674,765,605	5,675,245,162	479,557
2049	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2050	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2051	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2052	15,504,824	15,506,134	5,674,765,605	5,675,245,162	479,557
2053	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2054	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2055	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247
2056	15,504,824	15,506,134	5,674,765,605	5,675,245,162	479,557
2057	15,504,824	15,506,134	5,659,260,781	5,659,739,027	478,247

Notes:

[1] Accounts for leap years (2016, 2020, 2024, 2028, etc.).

[2] Project substantial completion anticipated late 2028; therefore, 2028 value adjusted to reflect benefits for last 3 months of year.

[2] Although Project Development and Construction Phases are assumed through 2028, calculations are shown starting in the year 2016 for this table's purpose.

Table 6. Operating Cost Savings (Passenger Veh.)

Year	Annual VMT Difference	Annual Vehicle Operating Savings (Undiscount)[1]	Annual Vehicle Operating Savings (7% Discount)[1,2]
2005			
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			
2014			
2015			
2016	Project Development and Construction Phases		
2017			
2018			
2019			
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027			
2028	(49,058)	$ 22,567	$ 14,053
2029	(141,767)	$ 65,213	$ 37,954
2030	(87,837)	$ 40,405	$ 21,978
2031	(33,907)	$ 15,597	$ 7,929
2032	20,078	$ (9,236)	$ (4,388)
2033	73,954	$ (34,019)	$ (15,105)
2034	127,884	$ (58,827)	$ (24,411)
2035	181,814	$ (83,634)	$ (32,435)
2036	236,390	$ (108,739)	$ (39,412)
2037	289,674	$ (133,250)	$ (45,136)
2038	343,605	$ (158,058)	$ (50,037)
2039	397,535	$ (182,866)	$ (54,103)
2040	452,702	$ (208,243)	$ (57,581)
2041	451,465	$ (207,674)	$ (53,667)
2042	451,465	$ (207,674)	$ (50,156)
2043	451,465	$ (207,674)	$ (46,875)
2044	452,702	$ (208,243)	$ (43,928)
2045	451,465	$ (207,674)	$ (40,942)
2046	451,465	$ (207,674)	$ (38,264)
2047	451,465	$ (207,674)	$ (35,761)
2048	452,702	$ (208,243)	$ (33,513)
2049	451,465	$ (207,674)	$ (31,235)
2050	451,465	$ (207,674)	$ (29,191)
2051	451,465	$ (207,674)	$ (27,282)
2052	452,702	$ (208,243)	$ (25,567)
2053	451,465	$ (207,674)	$ (23,829)
2054	451,465	$ (207,674)	$ (22,270)
2055	451,465	$ (207,674)	$ (20,813)
2056	452,702	$ (208,243)	$ (19,505)
2057	451,465	$ (207,674)	$ (18,179)

Notes:

[1] Savings shown as positive values.

[2] Base yr dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 7. Operating Cost Savings (Trucks)

Year	Annual VMT Difference	Annual Vehicle Operating Savings (Undiscount)[1]	Annual Vehicle Operating Savings (7% Discount)[1,2]
2005			
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			
2014			
2015			
2016	Project Development and Construction Phases		
2017			
2018			
2019			
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027			
2028	(2,910)	$ 2,939	$ 1,830
2029	(8,410)	$ 8,494	$ 4,944
2030	(5,211)	$ 5,263	$ 2,863
2031	(2,011)	$ 2,032	$ 1,033
2032	1,191	$ (1,203)	$ (572)
2033	4,387	$ (4,431)	$ (1,967)
2034	7,586	$ (7,662)	$ (3,180)
2035	10,786	$ (10,893)	$ (4,225)
2036	14,023	$ (14,163)	$ (5,133)
2037	17,184	$ (17,356)	$ (5,879)
2038	20,383	$ (20,587)	$ (6,517)
2039	23,583	$ (23,818)	$ (7,047)
2040	26,855	$ (27,124)	$ (7,500)
2041	26,782	$ (27,050)	$ (6,990)
2042	26,782	$ (27,050)	$ (6,533)
2043	26,782	$ (27,050)	$ (6,105)
2044	26,855	$ (27,124)	$ (5,722)
2045	26,782	$ (27,050)	$ (5,333)
2046	26,782	$ (27,050)	$ (4,984)
2047	26,782	$ (27,050)	$ (4,658)
2048	26,855	$ (27,124)	$ (4,365)
2049	26,782	$ (27,050)	$ (4,068)
2050	26,782	$ (27,050)	$ (3,802)
2051	26,782	$ (27,050)	$ (3,553)
2052	26,855	$ (27,124)	$ (3,330)
2053	26,782	$ (27,050)	$ (3,104)
2054	26,782	$ (27,050)	$ (2,901)
2055	26,782	$ (27,050)	$ (2,711)
2056	26,855	$ (27,124)	$ (2,540)
2057	26,782	$ (27,050)	$ (2,368)

Notes:

[1] Savings shown as positive values.

[2] Base yr dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 8. Total Operating Cost Savings

Year	Vehicle Operating Savings (7% Discount)
2005	$ -
2006	$ -
2007	$ -
2008	$ -
2009	$ -
2010	$ -
2011	$ -
2012	$ -
2013	$ -
2014	$ -
2015	$ -
2016	$ -
2017	$ -
2018	$ -
2019	$ -
2020	$ -
2021	$ -
2022	$ -
2023	$ -
2024	$ -
2025	$ -
2026	$ -
2027	$ -
2028	$ 15,884
2029	$ 42,898
2030	$ 24,840
2031	$ 8,961
2032	$ (4,960)
2033	$ (17,072)
2034	$ (27,590)
2035	$ (36,660)
2036	$ (44,546)
2037	$ (51,016)
2038	$ (56,555)
2039	$ (61,150)
2040	$ (65,081)
2041	$ (60,657)
2042	$ (56,689)
2043	$ (52,980)
2044	$ (49,650)
2045	$ (46,275)
2046	$ (43,248)
2047	$ (40,418)
2048	$ (37,878)
2049	$ (35,303)
2050	$ (32,993)
2051	$ (30,835)
2052	$ (28,897)
2053	$ (26,932)
2054	$ (25,171)
2055	$ (23,524)
2056	$ (22,045)
2057	$ (20,547)
TOTAL	**$ (906,086)**

Emissions Savings

The emissions savings were calculated using the VMT difference for each year, based on the methodology from Vehicle Operating Cost Savings. Various conversion factors were then applied to obtain the proper emission units for each of the four emissions (nitrogen oxide, sulfur oxide, fine particulate matter, and carbon dioxide) for both gasoline and diesel vehicles. It was assumed that all passenger vehicles were gasoline powered, while all trucks were diesel powered. Finally, the savings were calculated for each year using a 7% discount rate for all emission except carbon dioxide, which was discounted at 3% per Guidance.

The parameters and assumptions specific to the emissions analysis is shown in **Table 9**. See **Table 10** for nitrogen oxide savings, **Table 11** for sulfur oxide savings, **Table 12** for fine particulate matter savings, **Table 13** for carbon dioxide savings, and **Table 14** for total emissions savings. Because the net VMT increases, the net total emissions savings is shown as a negative value.

Table 9. Emissions Analysis Parameters and Assumptions

Parameter	Value	Notes
Assumed gasoline miles per gallon (mpg)	22.2	Based on EPA website referenced in BCA Guidance https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
Assumed diesel miles per gallon (mpg)	6.1	Based on Iowa specific data from Geotab https://www.geotab.com/truck-mpg-benchmark/
NOx emission rate, gasoline (grams per mile)	0.173	Based on light-duty vehicles (2021) from BTS https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and
NOx emission rate, diesel (grams per mile)	3.822	Based on heavy-duty vehicles (2021) from BTS https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and
SOx emission rate, gasoline (grams per mile)	0.0094	Based on arterials, 45 mph, light duty vehicles from Iowa DOT https://iowadot.gov/systems_planning/Grant-Programs/Iowa-Clean-Air-Attainment-Program-ICAAP
SOx emission rate, diesel (grams per mile)	0.0169	Based on arterials, 45 mph, heavy duty vehicles from Iowa DOT https://iowadot.gov/systems_planning/Grant-Programs/Iowa-Clean-Air-Attainment-Program-ICAAP
PM 2.5 emission rate, gasoline (grams per mile)	0.009	Based on avg. light-duty vehicles/trucks (exhaust+breakwear+tirewear) (2021) from BTS https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and
PM 2.5 emission rate, diesel (grams per mile)	0.103	Based on heavy-duty vehicles/trucks (exhaust+breakwear+tirewear) (2021) from BTS https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and
CO2 emission rate, gasoline (grams per gal)	8,887	Based on EPA website referenced in BCA Guidance https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
CO2 emission rate, diesel (grams per gal)	10,180	Based on EPA website referenced in BCA Guidance https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
Conversion rate grams to metric tons	1.00000 E-06	

Table 10. Nitrogen Oxide Savings

Year	Value per Metric Ton[1]	NOx Diff. - Gasoline (Metric Tons)	NOx Difference - Diesel (Metric Tons)	Savings (Undiscounted)[2]	Savings (7% Discount)[2,3]
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016	Project Development and Construction Phases				
2017					
2018					
2019					
2020					
2021					
2022					
2023					
2024					
2025					
2026					
2027					
2028	$18,200	-0.008	-0.011	$356.90	$ 222
2029	$18,600	-0.025	-0.032	$1,054.03	$ 613
2030	$18,900	-0.015	-0.020	$663.60	$ 361
2031	$18,900	-0.006	-0.008	$256.16	$ 130
2032	$18,900	0.003	0.005	($151.69)	$ (72)
2033	$18,900	0.013	0.017	($558.71)	$ (248)
2034	$18,900	0.022	0.029	($966.15)	$ (401)
2035	$18,900	0.031	0.041	($1,373.58)	$ (533)
2036	$18,900	0.041	0.054	($1,785.90)	$ (647)
2037	$18,900	0.050	0.066	($2,188.45)	$ (741)
2038	$18,900	0.059	0.078	($2,595.89)	$ (822)
2039	$18,900	0.069	0.090	($3,003.33)	$ (889)
2040	$18,900	0.078	0.103	($3,420.11)	$ (946)
2041	$18,900	0.078	0.102	($3,410.76)	$ (881)
2042	$18,900	0.078	0.102	($3,410.76)	$ (824)
2043	$18,900	0.078	0.102	($3,410.76)	$ (770)
2044	$18,900	0.078	0.103	($3,420.11)	$ (721)
2045	$18,900	0.078	0.102	($3,410.76)	$ (672)
2046	$18,900	0.078	0.102	($3,410.76)	$ (628)
2047	$18,900	0.078	0.102	($3,410.76)	$ (587)
2048	$18,900	0.078	0.103	($3,420.11)	$ (550)
2049	$18,900	0.078	0.102	($3,410.76)	$ (513)
2050	$18,900	0.078	0.102	($3,410.76)	$ (479)
2051	$18,900	0.078	0.102	($3,410.76)	$ (448)
2052	$18,900	0.078	0.103	($3,420.11)	$ (420)
2053	$18,900	0.078	0.102	($3,410.76)	$ (391)
2054	$18,900	0.078	0.102	($3,410.76)	$ (366)
2055	$18,900	0.078	0.102	($3,410.76)	$ (342)
2056	$18,900	0.078	0.103	($3,420.11)	$ (320)
2057	$18,900	0.078	0.102	($3,410.76)	$ (299)

Notes:

[1] Based on USDOT BCA Guidance for Discretionary Grant Programs (Jan 2023) Table A-6. Note Table A-6 does not go beyond 2050; therefore, 2050 values are assumed constant through 2057.

[2] Values become negative since VMT increases.

[3] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 11. Sulfur Oxide Savings

Year	Value per Metric Ton[1]	SOx Diff. - Gasoline (Metric Tons)	SOx Difference - Diesel (Metric Tons)	Savings (Undiscounted)[2]	Savings (7% Discount)[2,3]
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016	Project Development and Construction Phases				
2017					
2018					
2019					
2020					
2021					
2022					
2023					
2024					
2025					
2026					
2027					
2028	$49,500	0.000	-0.001	$63.87	$ 40
2029	$50,400	-0.001	-0.002	$187.92	$ 109
2030	$51,300	-0.001	-0.001	$118.51	$ 64
2031	$51,300	0.000	-0.001	$45.75	$ 23
2032	$51,300	0.000	0.000	($27.09)	$ (13)
2033	$51,300	0.001	0.001	($99.78)	$ (44)
2034	$51,300	0.001	0.002	($172.54)	$ (72)
2035	$51,300	0.002	0.003	($245.30)	$ (95)
2036	$51,300	0.002	0.004	($318.94)	$ (116)
2037	$51,300	0.003	0.005	($390.83)	$ (132)
2038	$51,300	0.003	0.006	($463.59)	$ (147)
2039	$51,300	0.004	0.007	($536.35)	$ (159)
2040	$51,300	0.004	0.008	($610.78)	$ (169)
2041	$51,300	0.004	0.008	($609.11)	$ (157)
2042	$51,300	0.004	0.008	($609.11)	$ (147)
2043	$51,300	0.004	0.008	($609.11)	$ (137)
2044	$51,300	0.004	0.008	($610.78)	$ (129)
2045	$51,300	0.004	0.008	($609.11)	$ (120)
2046	$51,300	0.004	0.008	($609.11)	$ (112)
2047	$51,300	0.004	0.008	($609.11)	$ (105)
2048	$51,300	0.004	0.008	($610.78)	$ (98)
2049	$51,300	0.004	0.008	($609.11)	$ (92)
2050	$51,300	0.004	0.008	($609.11)	$ (86)
2051	$51,300	0.004	0.008	($609.11)	$ (80)
2052	$51,300	0.004	0.008	($610.78)	$ (75)
2053	$51,300	0.004	0.008	($609.11)	$ (70)
2054	$51,300	0.004	0.008	($609.11)	$ (65)
2055	$51,300	0.004	0.008	($609.11)	$ (61)
2056	$51,300	0.004	0.008	($610.78)	$ (57)
2057	$51,300	0.004	0.008	($609.11)	$ (53)

Notes:

[1] Based on USDOT BCA Guidance for Discretionary Grant Programs (Jan 2023) Table A-6. Note Table A-6 does not go beyond 2050; therefore, 2050 values are assumed constant through 2057.

[2] Values become negative since VMT increases.

[3] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 12. Fine Particulate Matter Savings

Year	Value per Metric Ton[1]	PM 2.5 Diff. - Gasoline (Metric Tons)	PM 2.5 Difference - Diesel (Metric Tons)	Savings (Undiscounted)[2]	Savings (7% Discount)[2,3]
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016	Project Development and Construction Phases				
2017					
2018					
2019					
2020					
2021					
2022					
2023					
2024					
2025					
2026					
2027					
2028	$879,400	0.000	0.000	$651.88	$ 406
2029	$893,400	-0.001	-0.001	$1,913.77	$ 1,114
2030	$907,600	-0.001	-0.001	$1,204.59	$ 655
2031	$907,600	0.000	0.000	$465.00	$ 236
2032	$907,600	0.000	0.000	($275.35)	$ (131)
2033	$907,600	0.001	0.000	($1,014.20)	$ (450)
2034	$907,600	0.001	0.001	($1,753.80)	$ (728)
2035	$907,600	0.002	0.001	($2,493.40)	$ (967)
2036	$907,600	0.002	0.001	($3,241.85)	$ (1,175)
2037	$907,600	0.003	0.002	($3,972.59)	$ (1,346)
2038	$907,600	0.003	0.002	($4,712.19)	$ (1,492)
2039	$907,600	0.004	0.002	($5,451.79)	$ (1,613)
2040	$907,600	0.004	0.003	($6,208.35)	$ (1,717)
2041	$907,600	0.004	0.003	($6,191.39)	$ (1,600)
2042	$907,600	0.004	0.003	($6,191.39)	$ (1,495)
2043	$907,600	0.004	0.003	($6,191.39)	$ (1,397)
2044	$907,600	0.004	0.003	($6,208.35)	$ (1,310)
2045	$907,600	0.004	0.003	($6,191.39)	$ (1,221)
2046	$907,600	0.004	0.003	($6,191.39)	$ (1,141)
2047	$907,600	0.004	0.003	($6,191.39)	$ (1,066)
2048	$907,600	0.004	0.003	($6,208.35)	$ (999)
2049	$907,600	0.004	0.003	($6,191.39)	$ (931)
2050	$907,600	0.004	0.003	($6,191.39)	$ (870)
2051	$907,600	0.004	0.003	($6,191.39)	$ (813)
2052	$907,600	0.004	0.003	($6,208.35)	$ (762)
2053	$907,600	0.004	0.003	($6,191.39)	$ (710)
2054	$907,600	0.004	0.003	($6,191.39)	$ (664)
2055	$907,600	0.004	0.003	($6,191.39)	$ (620)
2056	$907,600	0.004	0.003	($6,208.35)	$ (581)
2057	$907,600	0.004	0.003	($6,191.39)	$ (542)

Notes:

[1] Based on USDOT BCA Guidance for Discretionary Grant Programs (Jan 2023) Table A-6. Note Table A-6 does not go beyond 2050; therefore, 2050 values are assumed constant through 2057.

[2] Values become negative since VMT increases.

[3] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 13. Carbon Dioxide Savings

Year	Value per Metric Ton[1]	CO2 Diff. - Gasoline (Metric Tons)	CO2 Difference - Diesel (Metric Tons)	Savings (Undiscounted)[2]	Savings (3% Discount)[2,3]
2005					
2006					
2007					
2008					
2009					
2010					
2011					
2012					
2013					
2014					
2015					
2016	Project Development and Construction Phases				
2017					
2018					
2019					
2020					
2021					
2022					
2023					
2024					
2025					
2026					
2027					
2028	$62	-19.639	-4.857	$1,518.73	$ 1,235
2029	$63	-56.752	-14.035	$4,459.55	$ 3,520
2030	$65	-35.162	-8.696	$2,850.79	$ 2,185
2031	$66	-13.573	-3.357	$1,117.39	$ 831
2032	$67	8.038	1.988	($671.70)	$ (485)
2033	$68	29.605	7.321	($2,510.98)	$ (1,761)
2034	$69	51.194	12.660	($4,405.95)	$ (3,000)
2035	$70	72.783	18.000	($6,354.77)	$ (4,201)
2036	$72	94.631	23.403	($8,498.38)	$ (5,455)
2037	$73	115.961	28.678	($10,558.63)	$ (6,580)
2038	$74	137.550	34.017	($12,695.95)	$ (7,681)
2039	$75	159.139	39.356	($14,887.13)	$ (8,745)
2040	$76	181.223	44.817	($17,179.10)	$ (9,797)
2041	$78	180.728	44.695	($17,583.01)	$ (9,735)
2042	$79	180.728	44.695	($17,808.44)	$ (9,573)
2043	$80	180.728	44.695	($18,033.86)	$ (9,412)
2044	$81	181.223	44.817	($18,309.31)	$ (9,277)
2045	$82	180.728	44.695	($18,484.71)	$ (9,093)
2046	$84	180.728	44.695	($18,935.55)	$ (9,044)
2047	$85	180.728	44.695	($19,160.98)	$ (8,885)
2048	$86	181.223	44.817	($19,439.51)	$ (8,751)
2049	$87	180.728	44.695	($19,611.82)	$ (8,572)
2050	$88	180.728	44.695	($19,837.25)	$ (8,418)
2051	$88	180.728	44.695	($19,837.25)	$ (8,173)
2052	$88	181.223	44.817	($19,891.59)	$ (7,956)
2053	$88	180.728	44.695	($19,837.25)	$ (7,704)
2054	$88	180.728	44.695	($19,837.25)	$ (7,479)
2055	$88	180.728	44.695	($19,837.25)	$ (7,261)
2056	$88	181.223	44.817	($19,891.59)	$ (7,069)
2057	$88	180.728	44.695	($19,837.25)	$ (6,844)

Notes:

[1] Based on USDOT BCA Guidance for Discretionary Grant Programs (Jan 2023) Table A-6. Note Table A-6 does not go beyond 2050; therefore, 2050 values are assumed constant through 2057.

[2] Values become negative since VMT increases.

[3] Base yr dollars is 2021 per USDOT BCA Guidance (Mar 2023). Only 3% will be used per Guidance.

Table 14. Total Emissions Savings

Year	Emissions Savings (7% Discount for NOx, SOx, PM 2.5; 3% Discount for CO2)
2005	$ -
2006	$ -
2007	$ -
2008	$ -
2009	$ -
2010	$ -
2011	$ -
2012	$ -
2013	$ -
2014	$ -
2015	$ -
2016	$ -
2017	$ -
2018	$ -
2019	$ -
2020	$ -
2021	$ -
2022	$ -
2023	$ -
2024	$ -
2025	$ -
2026	$ -
2027	$ -
2028	$ 1,903
2029	$ 5,357
2030	$ 3,266
2031	$ 1,221
2032	$ (701)
2033	$ (2,504)
2034	$ (4,201)
2035	$ (5,796)
2036	$ (7,393)
2037	$ (8,799)
2038	$ (10,142)
2039	$ (11,405)
2040	$ (12,628)
2041	$ (12,374)
2042	$ (12,039)
2043	$ (11,717)
2044	$ (11,437)
2045	$ (11,106)
2046	$ (10,925)
2047	$ (10,643)
2048	$ (10,399)
2049	$ (10,108)
2050	$ (9,853)
2051	$ (9,514)
2052	$ (9,213)
2053	$ (8,875)
2054	$ (8,574)
2055	$ (8,285)
2056	$ (8,028)
2057	$ (7,738)
TOTAL	**$ (222,651)**

Safety Benefits

As stated earlier, a refined area was considered for the safety benefits analysis. The safety performance of Vandalia Road from its intersection with SE 30th Street and Martin Luther King, Jr. Parkway to U.S. Highway 65, a length of approximately 2.56 miles, was evaluated. In order to estimate the safety performance of the new SE Connector due to the project, the safety performance of the previously completed portion of the SE Connector (Martin Luther King, Jr. Parkway from near SE 15th Street to SE 30th Street), a distance of approximately 1.82 miles, was used as a proxy measure.

Specifically, the crash history of this route from the opening date (May 20, 2016) through December 31, 2022 was reviewed. This same time period was also reviewed for the Vandalia Road segment. Crash data was obtained from the Iowa Department of Transportation's Iowa Crash Analysis Tool (ICAT), which includes crash data on local routes from local law enforcement agencies. See **Figure 3** for the study segments for the safety analysis. As shown in **Table 15**, the calculated crash rates for all severity levels within the study time period are lower on the SE Connector than on Vandalia Road.

Table 15. Crash Rates by Severity

Segment	Fatal (K)	Incapacitating Injury (A)	Non-Incapacitating Injury (B)	Possible Injury (C)	No Injury (O)
Vandalia Rd	0.023	0.070	0.117	0.070	0.633
SE Connector (Existing 2-lane portion), aka M.L.K., Jr. Pkwy	0.000	0.020	0.082	0.164	0.246

Crashes per million VMT per year, based on crash history from 5/20/2016 thru 12/31/2022.

To calculate the safety benefits of the anticipated VMT reduction on Vandalia Road, an approach similar to the Vehicle Operating Cost Savings was utilized. The VMTs for the period of 2028 - 2057 for the No-Build and Build conditions were calculated for Vandalia Road. Since substantial completion of the project is expected in late 2028, only the last three months of that year are included in the calculations. The VMTs for the period of 2026 - 2040 was based on a linear interpolation between the 2016 and 2040 values from the TDMs. The VMT values beyond 2040 were capped at the 2040 values. The differences in the No-Build and Build VMTs for each year were then calculated. This VMT difference was then multiplied by the Vandalia Road crash rate for each severity from **Table 15** and the monetary value for a crash in each severity category, then divided by 1,000,000. These calculated values were then summed for each year using a 7% discount rate. Default monetary values of fatalities and injuries provided in the Guidance were used for the calculations and are shown in **Table 16**.

Table 16. Safety Analysis Parameters and Assumptions

Parameter	Value	Notes
Fatal (K)	$11,800,000	Based on USDOT BCA Guidance for Discretionary Grant Programs (Jan 2023) Table A-1, in base year (2021) dollars.
Incapacitating Injury (A)	$ 563,300	
Non-Incapacitating Injury (B)	$ 153,700	
Possible Injury (C)	$ 78,500	
No Injury (O)	$ 4,000	
Average annual daily traffic diverted from Vandalia to SE Connector	5,065	Based on TDM Model Output (see Safety Assumptions tab in the BCA spreadsheet).
Length of Vandalia Study Area (mi)	2.56	
Length of SE Connector Project Study Area (mi)	2.2	

Next, the anticipated safety performance of the new SE Connector project was calculated. As previously discussed, because the project will essentially be identical to the portion immediately to the west that was opened in 2016, the safety performance of that existing portion was used to estimate the safety performance of the project area. First, the AADT diverted from Vandalia Road to the SE Connector in the project area was estimated for each year. Then, for each severity category the AADT was multiplied by the length of the project area, the crash rate and monetary value for the severity category, the number of days in the year, and then divided by 1,000,000. These calculated values were then summed for each year using a 7% discount rate.

Finally, the sum of the Vandalia safety benefits and the SE Connector project area safety benefits (or more accurately, disbenefits) for each year was made, then summed. See **Table 17** for VMT and AADT changes for Vandalia Road, **Table 18** for Vandalia Road safety benefits, **Table 19** for SE Connector project area safety benefits (or disbenefits), and **Table 20** for total safety benefits.

Table 17. Changes in VMT & AADT for Vandalia

Year	Daily VMT No-Build	Daily VMT Build	Daily VMT Difference	AADT Diverted from Vandalia	Annual VMT No-Build[1]	Annual VMT Build[1]	Annual VMT Difference[2]
2005	Project Development and Construction Phases[3]						
2006							
2007							
2008							
2009							
2010							
2011							
2012							
2013							
2014							
2015							
2016	17,660	4,693	(12,967)	5,065	6,463,566	1,717,782	(4,745,784)
2017	18,253	5,318	(12,936)	5,053	6,662,473	1,940,912	(4,721,561)
2018	18,847	5,942	(12,905)	5,041	6,879,039	2,168,735	(4,710,304)
2019	19,440	6,566	(12,874)	5,029	7,095,606	2,396,558	(4,699,048)
2020	20,033	7,190	(12,843)	5,017	7,332,206	2,631,572	(4,700,634)
2021	20,627	7,814	(12,812)	5,005	7,528,739	2,852,205	(4,676,534)
2022	21,220	8,438	(12,782)	4,993	7,745,306	3,080,028	(4,665,278)
2023	21,813	9,063	(12,751)	4,981	7,961,872	3,307,851	(4,654,021)
2024	22,407	9,687	(12,720)	4,969	8,200,846	3,545,361	(4,655,485)
2025	23,000	10,311	(12,689)	4,957	8,395,005	3,763,497	(4,631,508)
2026	23,593	10,935	(12,658)	4,945	8,611,572	3,991,320	(4,620,252)
2027	24,187	11,559	(12,627)	4,933	8,828,139	4,219,143	(4,608,995)
2028	24,780	12,183	(12,597)	4,921	9,069,485	4,459,150	(1,152,584)
2029	25,373	12,808	(12,566)	4,908	9,261,272	4,674,790	(4,586,482)
2030	25,967	13,432	(12,535)	4,896	9,477,839	4,902,613	(4,575,226)
2031	26,560	14,056	(12,504)	4,884	9,694,405	5,130,436	(4,563,969)
2032	27,153	14,680	(12,473)	4,872	9,938,125	5,372,939	(4,565,186)
2033	27,747	15,304	(12,442)	4,860	10,127,538	5,586,082	(4,541,456)
2034	28,340	15,929	(12,412)	4,848	10,344,105	5,813,905	(4,530,200)
2035	28,933	16,553	(12,381)	4,836	10,560,672	6,041,728	(4,518,943)
2036	29,527	17,177	(12,350)	4,824	10,806,765	6,286,728	(4,520,036)
2037	30,120	17,801	(12,319)	4,812	10,993,805	6,497,375	(4,496,430)
2038	30,713	18,425	(12,288)	4,800	11,210,371	6,725,198	(4,485,174)
2039	31,307	19,049	(12,257)	4,788	11,426,938	6,953,021	(4,473,917)
2040	31,900	19,674	(12,226)	4,776	11,675,405	7,200,518	(4,474,887)
2041	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2042	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2043	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2044	31,900	19,674	(12,226)	4,776	11,675,405	7,200,518	(4,474,887)
2045	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2046	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2047	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2048	31,900	19,674	(12,226)	4,776	11,675,405	7,200,518	(4,474,887)
2049	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2050	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2051	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2052	31,900	19,674	(12,226)	4,776	11,675,405	7,200,518	(4,474,887)
2053	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2054	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2055	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)
2056	31,900	19,674	(12,226)	4,776	11,675,405	7,200,518	(4,474,887)
2057	31,900	19,674	(12,226)	4,776	11,643,505	7,180,844	(4,462,661)

Notes:

[1] Accounts for leap years (2016, 2020, 2024, 2028, etc.).

[2] Project substantial completion anticipated late 2028; therefore, 2028 value adjusted to reflect benefits for last 3

[3] Although Project Development and Construction Phases are assumed through 2028, calculations are shown starting in the year 2016 for this table's purpose.

Table 18. Safety Benefits – Vandalia

Year	K	A	B	C	O	Safety Savings (7% Discount)[1,2]
2005	Project Development and Construction Phases					
2006						
2007						
2008						
2009						
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						
2019						
2020						
2021						
2022						
2023						
2024						
2025						
2026						
2027						
2028	$ (318,867)	$ (45,747)	$ (20,767)	$ (6,364)	$ (2,918)	$ 245,776
2029	$ (1,268,869)	$(182,040)	$ (82,638)	$ (25,324)	$ (11,613)	$ 914,035
2030	$ (1,265,754)	$(181,593)	$ (82,435)	$ (25,261)	$ (11,585)	$ 852,142
2031	$ (1,262,640)	$(181,146)	$ (82,232)	$ (25,199)	$ (11,556)	$ 794,435
2032	$ (1,262,977)	$(181,194)	$ (82,254)	$ (25,206)	$ (11,559)	$ 742,661
2033	$ (1,256,412)	$(180,253)	$ (81,826)	$ (25,075)	$ (11,499)	$ 690,468
2034	$ (1,253,298)	$(179,806)	$ (81,624)	$ (25,013)	$ (11,471)	$ 643,697
2035	$ (1,250,184)	$(179,359)	$ (81,421)	$ (24,951)	$ (11,442)	$ 600,092
2036	$ (1,250,486)	$(179,402)	$ (81,441)	$ (24,957)	$ (11,445)	$ 560,969
2037	$ (1,243,955)	$(178,465)	$ (81,015)	$ (24,826)	$ (11,385)	$ 521,532
2038	$ (1,240,841)	$(178,019)	$ (80,812)	$ (24,764)	$ (11,357)	$ 486,193
2039	$ (1,237,727)	$(177,572)	$ (80,610)	$ (24,702)	$ (11,328)	$ 453,245
2040	$ (1,237,995)	$(177,610)	$ (80,627)	$ (24,707)	$ (11,331)	$ 423,686
2041	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 394,886
2042	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 369,052
2043	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 344,909
2044	$ (1,237,995)	$(177,610)	$ (80,627)	$ (24,707)	$ (11,331)	$ 323,228
2045	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 301,257
2046	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 281,548
2047	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 263,129
2048	$ (1,237,995)	$(177,610)	$ (80,627)	$ (24,707)	$ (11,331)	$ 246,589
2049	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 229,827
2050	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 214,792
2051	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 200,740
2052	$ (1,237,995)	$(177,610)	$ (80,627)	$ (24,707)	$ (11,331)	$ 188,122
2053	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 175,334
2054	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 163,864
2055	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 153,144
2056	$ (1,237,995)	$(177,610)	$ (80,627)	$ (24,707)	$ (11,331)	$ 143,517
2057	$ (1,234,613)	$(177,125)	$ (80,407)	$ (24,640)	$ (11,300)	$ 133,762

Notes:

[1] Savings shown as positive values.

[2] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 19. Safety Benefits – SE Connector

Year	K[1]	A[1]	B[1]	C[1]	O[1]	Safety Savings (7% Discount)[2,3]
2005	Project Development and Construction Phases					
2006						
2007						
2008						
2009						
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						
2019						
2020						
2021						
2022						
2023						
2024						
2025						
2026						
2027						
2028	$ -	$ 11,268	$ 12,277	$ 12,540	$ 958	$ (23,069)
2029	$ -	$ 44,963	$ 48,987	$ 50,038	$ 3,825	$ (86,028)
2030	$ -	$ 44,853	$ 48,866	$ 49,916	$ 3,815	$ (80,203)
2031	$ -	$ 44,742	$ 48,746	$ 49,793	$ 3,806	$ (74,772)
2032	$ -	$ 44,754	$ 48,759	$ 49,806	$ 3,807	$ (69,899)
2033	$ -	$ 44,521	$ 48,506	$ 49,547	$ 3,787	$ (64,986)
2034	$ -	$ 44,411	$ 48,386	$ 49,424	$ 3,778	$ (60,584)
2035	$ -	$ 44,301	$ 48,265	$ 49,302	$ 3,768	$ (56,480)
2036	$ -	$ 44,312	$ 48,277	$ 49,314	$ 3,769	$ (52,798)
2037	$ -	$ 44,080	$ 48,025	$ 49,056	$ 3,750	$ (49,086)
2038	$ -	$ 43,970	$ 47,905	$ 48,933	$ 3,740	$ (45,760)
2039	$ -	$ 43,859	$ 47,784	$ 48,810	$ 3,731	$ (42,659)
2040	$ -	$ 43,869	$ 47,795	$ 48,821	$ 3,732	$ (39,877)
2041	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (37,166)
2042	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (34,735)
2043	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (32,463)
2044	$ -	$ 43,869	$ 47,795	$ 48,821	$ 3,732	$ (30,422)
2045	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (28,354)
2046	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (26,499)
2047	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (24,766)
2048	$ -	$ 43,869	$ 47,795	$ 48,821	$ 3,732	$ (23,209)
2049	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (21,631)
2050	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (20,216)
2051	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (18,894)
2052	$ -	$ 43,869	$ 47,795	$ 48,821	$ 3,732	$ (17,706)
2053	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (16,502)
2054	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (15,423)
2055	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (14,414)
2056	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (13,471)
2057	$ -	$ 43,749	$ 47,664	$ 48,688	$ 3,721	$ (12,590)

Notes:

[1] Safety performance based on existing 2-lane portion of SE Connector (MLK Jr Pkwy).

[2] Savings shown as negative values due to additional traffic from Vandalia.

[2] Base year dollars is 2021 per USDOT BCA Guidance (Jan 2023).

Table 20. Total Safety Benefits

Year	Safety Savings (7% Discount)
2005	$ -
2006	$ -
2007	$ -
2008	$ -
2009	$ -
2010	$ -
2011	$ -
2012	$ -
2013	$ -
2014	$ -
2015	$ -
2016	$ -
2017	$ -
2018	$ -
2019	$ -
2020	$ -
2021	$ -
2022	$ -
2023	$ -
2024	$ -
2025	$ -
2026	$ -
2027	$ -
2028	$ 222,707
2029	$ 828,007
2030	$ 771,939
2031	$ 719,663
2032	$ 672,762
2033	$ 625,481
2034	$ 583,113
2035	$ 543,611
2036	$ 508,171
2037	$ 472,446
2038	$ 440,433
2039	$ 410,586
2040	$ 383,809
2041	$ 357,720
2042	$ 334,317
2043	$ 312,446
2044	$ 292,806
2045	$ 272,903
2046	$ 255,049
2047	$ 238,364
2048	$ 223,380
2049	$ 208,196
2050	$ 194,576
2051	$ 181,847
2052	$ 170,416
2053	$ 158,832
2054	$ 148,441
2055	$ 138,730
2056	$ 130,046
2057	$ 121,172
TOTAL	**$ 10,921,969**

Cycling Benefits

The project will construct a 12-foot shared use path that will connect to the regional trail network, completing an important missing link to the area bicycle infrastructure. Because there are no comparable bicycle facilities nearby, it is expected that estimated bicycle usage can be quantified consistent with the Guidance assumptions. The benefits of the estimated usage are captured in the BCA.

To calculate the cycling benefits, first a methodology to estimate bicycle usage as a result of the project was developed. The existing shared use path along existing Martin Luther King, Jr. Parkway has bicycle counts as part of the National Bicycle and Pedestrian Documentation Project. Des Moines is a participant in this volunteer led effort to count bicyclists at 28 locations throughout the area. The most recent counts at this location (May 2016 through September 2021) were averaged to produce annual average bicycle usage along the existing Martin Luther King, Jr. Parkway. These counts were then used as a proxy estimate for the bicycle usage along the new shared-use path that will be constructed; however, we anticipate the future counts along this shared-use path to be significantly higher than the proxy estimate once the connection between the Martin Luther King, Jr. Trail and Gay Lea Wilson Trail is made since both trail sections currently terminate with "dead ends". This proxy value was then multiplied by the Guidance value per cycling mile for "cycle path with at-grade crossings", and then multiplied by the length of the project. Finally, the benefits were calculated for each year using a 7% discount rate.

The total cycling benefits are shown in **Table 21**.

Table 21. Cycling Benefits

Year	Cycling Benefits (7% Discount)
2005	$ -
2006	$ -
2007	$ -
2008	$ -
2009	$ -
2010	$ -
2011	$ -
2012	$ -
2013	$ -
2014	$ -
2015	$ -
2016	$ -
2017	$ -
2018	$ -
2019	$ -
2020	$ -
2021	$ -
2022	$ -
2023	$ -
2024	$ -
2025	$ -
2026	$ -
2027	$ -
2028	$ 20,076
2029	$ 75,050
2030	$ 70,141
2031	$ 65,552
2032	$ 61,263
2033	$ 57,256
2034	$ 53,510
2035	$ 50,009
2036	$ 46,738
2037	$ 43,680
2038	$ 40,822
2039	$ 38,152
2040	$ 35,656
2041	$ 33,323
2042	$ 31,143
2043	$ 29,106
2044	$ 27,202
2045	$ 25,422
2046	$ 23,759
2047	$ 22,205
2048	$ 20,752
2049	$ 19,394
2050	$ 18,126
2051	$ 16,940
2052	$ 15,832
2053	$ 14,796
2054	$ 13,828
2055	$ 12,923
2056	$ 12,078
2057	$ 11,288
TOTAL	**$ 1,006,021**
Note:	
Project substantial completion anticipated late 2028; therefore, 2028 value adjusted to reflect benefits for last 3 months of year.	

Operations & Maintenance

The additional operations and maintenance (O&M) costs due to the project were included in the BCA. Consistent with the Guidance, this cost was included in the numerator along with other benefits. The O&M estimated costs were based on the City of Des Moines' historical costs for similar facilities. Routine O&M costs were estimated on an average annual basis for both the roadway/pavement, which includes activities such as mowing, plowing, and sweeping, and for bridge structures, which includes activities such as joint repair and sealing. More intensive regular rehabilitation activities for both the roadway/pavement and bridge structures were also included with assumed intervals. O&M costs for each year were then calculated using a 7% discount rate, then summed. See **Table 22** for O&M assumptions and **Table 23** for total O&M costs.

Table 22. O&M Assumptions

Parameter	Value	Notes
Pavement - Avg. Annual Cost for Routine O&M (per lane-mile)	$ 5,703	Cost includes mowing, plowing, sweeping, re-striping, etc., based on city historical spending
Pavement - Cost for Routine Maintenance (per lane-mile)	$ 22,406	Cost includes grinding, joint repair, pavement repair, etc., based on city historical spending
Pavement - Routine Maintenance Activity Interval (years)	6	
Bridge - Avg. Annual Cost for Routine Maintenance (per sf)	$ 0.12	Cost based on city historical spending
Bridge - Cost for Deck Rehabilitation (per sf)	$ 11	Cost includes maintenance activities such as joint repair and deck overlay, based on city historical spending
Bridge - Deck Rehabilitation Activity Interval (years)	25	
Length of New SE Connector (mi)	2.17	
Number of Equivalent Lanes - SE Connector (pavement width=33 ft)	3	
Length of Improvement to SE 30th St - N (mi)	0.34	North of SE Connector
Number of Additional Lanes - SE 30th St - N	1	Widening from 2 lanes to 3 lanes north of SE Connector
Length of Improvement to SE 30th St - S (mi)	0.18	South of SE Connector
Number of Additional Lanes - SE 30th St - S	1	Widening from 2 lanes to 3 lanes south of SE Connector
Length of New Extension of SE 36th St (mi)	0.19	
Number of Lanes - SE 36th St	2	
Length of New Extension of SE 43rd St (mi)	0.29	
Number of Lanes - SE 43rd St	3	
Length of Additional Lanes - SE 43rd St - Vandalia Intersection Improvement (mi)	0.2	Includes Improvements to the intersection with Vandalia Rd (turn lanes + half of taper length)
Number of Additional Lanes - SE 43rd St - Vandalia Intersection Improvement	1	Includes Improvements to the intersection with Vandalia Rd (turn lanes + half of taper length)
Bridge Deck Area (sf)	79,295	New bridge west of Pleasant Hill Blvd
Annual Pavement Cost	**$ 48,360**	**in base year 2021 dollars**
Annual Bridge Cost	**$ 9,246**	**in base year 2021 dollars**
Pavement Routine Maintenance Cost	**$ 190,005**	**in base year 2021 dollars**
Bridge Routine Maintenance Cost	**$ 840,527**	**in base year 2021 dollars**

Table 23. O&M Costs

Year	O&M Costs (7% Discount)
2005	$ -
2006	$ -
2007	$ -
2008	$ -
2009	$ -
2010	$ -
2011	$ -
2012	$ -
2013	$ -
2014	$ -
2015	$ -
2016	$ -
2017	$ -
2018	$ -
2019	$ -
2020	$ -
2021	$ -
2022	$ -
2023	$ -
2024	$ -
2025	$ -
2026	$ -
2027	$ -
2028	$ (8,968)
2029	$ (33,527)
2030	$ (31,334)
2031	$ (29,284)
2032	$ (27,368)
2033	$ (25,578)
2034	$ (23,904)
2035	$ (96,028)
2036	$ (20,879)
2037	$ (19,513)
2038	$ (18,236)
2039	$ (17,043)
2040	$ (15,928)
2041	$ (63,987)
2042	$ (13,912)
2043	$ (13,002)
2044	$ (12,152)
2045	$ (11,357)
2046	$ (10,614)
2047	$ (42,637)
2048	$ (9,270)
2049	$ (8,664)
2050	$ (8,097)
2051	$ (7,567)
2052	$ (7,072)
2053	$ (28,411)
2054	$ (96,311)
2055	$ (5,773)
2056	$ (5,396)
2057	$ (5,043)
TOTAL	**$ (716,857)**
Note:	
Project substantial completion anticipated late 2028; therefore, 2028 value adjusted to reflect benefits for last 3 months of year.	

Residual Value

Because many transportation assets are designed for long-term use and, therefore, have an expected life that exceeds the analysis period, the residual value (a.k.a. salvage value or remaining service life) may be quantified and included in the BCA. The residual value of the project was estimated based on the cost estimates of the project components and useful life assumptions, using a 7% discount rate. See **Table 24** for assumed remaining residual value factors from the neighboring state of Minnesota, which is considered more relevant for this project. See also **Table 25** for parameters and assumptions, and **Table 26** for total residual value.

Table 24. Remaining Residual Value Factors

Analysis Period (years)	Expected Remaining Life* at:				
	25	40	50	60	100
30	0.00	0.27	0.44	0.55	0.76

**Based on MnDOT Benefit-Cost Analysis for Transportation Projects, Appendix A https://www.dot.state.mn.us/planning/program/benefitcost.html*

Table 25. Parameters and Assumptions

Parameter	Value	Notes
Useful Life (yrs) - Major Structures	60	Based on MnDOT Benefit-Cost Analysis for Transportation Projects https://www.dot.state.mn.us/planning/program/benefitcost.html
Useful Life (yrs) - Grading & Drainage	50	
Useful Life (yrs) - Sub-Base and Base	40	
Useful Life (yrs) - Surface	25	
Useful Life (yrs) - Pavements	40	Weighted average assuming 50% grading and drainage; 25% sub-base and base; 25% surface. Rounded to nearest 10.
Residual Value - Pavements	**$ 9,720,000**	**Applying factor from Table 24 with est. pavement cost from Table 28.**
Useful Life (yrs) - Structures	60	
Residual Value - Structures	**$ 12,100,000**	**Applying factor from Table 24 with est. structures cost from Table 28.**

Table 26. Residual Value

Parameter	Residual Value
Residual Value - Pavements	$ 9,720,000
Residual Value - Structures	$ 12,100,000
Total Residual Value	$ 21,820,000
Total Residual Value (2057) (7% Discount)	**$ 1,910,024**

Capital Costs

Project costs previously expended and anticipated in the future for various project development activities were obtained by year of activity. Previously expended costs were adjusted to real dollars using inflation adjustment factors provided in the Guidance. Future anticipated costs were adjusted using 7% discount rate. All capital costs were then summed. See **Table 27** for capital cost breakdown by activity, **Table 28** for construction cost breakdown by activity (used for residual value calculation), and **Table 29** for costs by activity for each year along with total capital cost.

Table 27. Capital Cost by Activity

Activity	Previous	Future
PE - Surveys	$ 155,000	$ -
PE - Environmental	$ 1,288,534	$ -
PE - Design	$ 4,298,000	$ 500,000
Right-of-Way (ROW)	$ 1,000,000	$ 4,500,000
Engineering and Inspection	$ -	$ 5,000,000
Construction	$ -	$ 58,000,000

Table 28. Construction Cost Breakout

Activity	Future
Pavement	$ 36,000,000
Structures	$ 22,000,000

Table 29. Capital Costs

Year	Preliminary Engineering (PE) - Surveys	Preliminary Engineering (PE) - Environmental[1]	Preliminary Engineering (PE) - Design	Right-of-Way (ROW)	Construction Engineering & Inspection	Construction	Total Capital Costs (Nominal $, Undiscounted)[2]	Total Capital Costs (Real $, Undiscounted)[3]	Capital Costs (7% Discount)
2005	$ -	$ 130,217	$ -	$ -	$ -	$ -	$ 130,217	$ 177,095	$ 177,095
2006	$ -	$ 236,227	$ -	$ -	$ -	$ -	$ 236,227	$ 311,819	$ 311,819
2007	$ -	$ 384,345	$ -	$ -	$ -	$ -	$ 384,345	$ 491,962	$ 491,962
2008	$ -	$ 116,435	$ -	$ -	$ -	$ -	$ 116,435	$ 146,709	$ 146,709
2009	$ -	$ 112,066	$ -	$ -	$ -	$ -	$ 112,066	$ 140,083	$ 140,083
2010	$ -	$ 26,339	$ -	$ -	$ -	$ -	$ 26,339	$ 32,660	$ 32,660
2011	$ -	$ 3,863	$ -	$ -	$ -	$ -	$ 3,863	$ 4,674	$ 4,674
2012	$ -	$ 8,594	$ -	$ -	$ -	$ -	$ 8,594	$ 10,227	$ 10,227
2013	$ -	$ 448	$ -	$ -	$ -	$ -	$ 448	$ 525	$ 525
2014	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2015	$ 100,000	$ -	$ -	$ 70,450	$ -	$ -	$ 170,450	$ 194,313	$ 194,313
2016	$ -	$ 95,000	$ 480,000	$ 17,669	$ -	$ -	$ 592,669	$ 663,789	$ 663,789
2017	$ 15,000	$ 145,000	$ 615,000	$ 35,446	$ -	$ -	$ 810,446	$ 891,491	$ 891,491
2018	$ -	$ -	$ 522,000	$ 24,682	$ -	$ -	$ 546,682	$ 590,417	$ 590,417
2019	$ 25,000	$ -	$ 1,200,000	$ 132,550	$ -	$ -	$ 1,357,550	$ 1,439,003	$ 1,439,003
2020	$ 15,000	$ 30,000	$ 580,000	$ 58,375	$ -	$ -	$ 683,375	$ 710,710	$ 710,710
2021	$ -	$ -	$ 401,000	$ 530,345	$ -	$ -	$ 931,345	$ 931,345	$ 931,345
2022	$ -	$ -	$ 500,000	$ 130,483	$ -	$ -	$ 630,483	$ 630,483	$ 589,236
2023	$ -	$ -	$ 500,000	$ 4,500,000	$ -	$ -	$ 5,000,000	$ 5,000,000	$ 4,367,194
2024	$ -	$ -	$ -	$ -	$ 1,000,000	$ 13,000,000	$ 14,000,000	$ 14,000,000	$ 11,428,170
2025	$ -	$ -	$ -	$ -	$ 1,000,000	$ 13,000,000	$ 14,000,000	$ 14,000,000	$ 10,680,533
2026	$ -	$ -	$ -	$ -	$ 1,000,000	$ 12,000,000	$ 13,000,000	$ 13,000,000	$ 9,268,820
2027	$ -	$ -	$ -	$ -	$ 1,000,000	$ 10,000,000	$ 11,000,000.00	$ 11,000,000.00	$ 7,329,764.46
2028	$ -	$ -	$ -	$ -	$ 1,000,000	$ 10,000,000	$ 11,000,000.00	$ 11,000,000.00	$ 6,850,247.16
2029	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2030	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2031	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2032	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2033	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2034	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2035	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2036	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2037	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2038	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2039	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2040	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2041	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2042	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2043	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2044	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2045	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2046	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2047	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2048	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2049	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2050	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2051	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2052	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2053	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2054	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2055	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2056	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2057	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
								TOTAL	$ 57,250,785

Notes:

[1] 2005-2013 expenses related to NEPA documentation, pro-rated to account for project area (2.2 miles of 4.84 mile NEPA study corridor).

[2] Nominal, or year-of-expenditure, dollars.

[3] Previously expended costs are shown in 2021 dollars using inflation adjustment values provided in USDOT BCA Guidance Table A-7.

Benefits by Selection Criteria

The Southeast Connector has considerable benefits to the region – some that can be monetized and included in the BCA and many that are qualitative and contribute directly to the overall selection criteria: safety, environmental sustainability, quality of life, economic competitiveness and state of good repair. The more qualitative benefits are noted below.

Selection Criteria	Benefit
Safety	
Crash reduction (fatality, injury)	$10,921,969
Improved emergency response	Qualitative++
Avoids three railroad crossings/reduce exposure. See **Table 30**.	Qualitative
Provides alternate route with lower crash rate due to access control, paved shoulders, and shared use trail. See **Table 31**.	Qualitative
Reduces traffic volumes on parallel routes/local streets	Qualitative
Improved access for transport of hazardous materials, reducing risk	Qualitative
Improves flood protection system	Qualitative
Provides safe roadway network during 100-year flood event	Qualitative
Improves drainage system for adjacent areas	Qualitative
Environmental Sustainability	
Emissions reduction	($222,651)
Trail usage	Qualitative
Infill development (vs. suburban)	Qualitative
Levee improvements/flood risk reduction	Qualitative
Access to environmental justice populations	Qualitative
Provides multi-modal options for travel/commuting	Qualitative

Detention Basin Areas provide Groundwater Recharging Opportunities	Qualitative
Improving Storm Water Management for surrounding area	Qualitative
Project Aligns with Des Moines Climate Action Plan	Qualitative
Quality of Life	
Increased bicycle use (multi-modal)	$1,006,021
Improved access for disadvantaged groups	Qualitative
Property values	Qualitative, but measurable post-project
Reduced flood risk	Qualitative
Completes the trail gap connection, providing direct access to Central Iowa trails System for improved physical and mental health	Qualitative
Recreational opportunity	Qualitative
Direct access for rural communities to Downtown Des Moines amenities	Qualitative
Recreation access to the lake at Pleasant Hill Boulevard	Qualitative
Economic Competitiveness	
Travel Time Savings	$77,383,945
Vehicle Operating Savings	($906,086)
Employment	Qualitative
Re-Development and infill opportunity	Qualitative
Increased property values/ tax revenue	Qualitative
Freight enhancement with access to highways/transload	Qualitative
Avoid at-grade railroad crossings	Qualitative
Businesses along the corridor will have greater flood protection with the improved levee system	Qualitative

Provides rural areas and surrounding communities better access to jobs at major corporations in Des Moines metro	Qualitative
State of Good Repair	
Transportation network – roads & trails	Qualitative
Flood risk reduction	Qualitative
Maintenance, repair and inspection	($716,857)
Better condition long-term and reduced costs to maintain alternate routes and railroad crossings due to diverted truck traffic	Qualitative
Improving the height and the condition of the levee system to United State Army Corp of Engineers Standards	Qualitative

++ Qualitative benefits not calculated but anticipated to be positive.

Table 30. Existing At-Grade Railroad Crossing Crashes

USDOT Crossing Number	Location Description	Protection Type	Number of Crashes[1]
864243N	SE 30th Street South of M.L.K., Jr. Parkway	Flashing Lights	7
484126T	Vandalia Road near 43rd Street	Flashing Lights	2
072963T[2]	Pleasant Hill Boulevard	Flashing Lights	0
484125L[2]	Vandalia Road	Flashing Lights	0

[1] Based on available crash data through Federal Railroad Administration (FRA) https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/crossing/crossing.aspx, accessed 1/11/2023

[2] Crossings have been closed due to recently completed portion of the SE Connector and replaced with at-grade railroad crossing USDOT Number 974174L that was opened to traffic May 2021.

Table 31. Safety Performance of Other Nearby Roadway Segments

Route	Segment Description	Length (mi)	AADT[1]	No. of Crashes[2]	Crash Rate[2,3]	Statewide Crash Rate[3,5]
M.L.K., Jr. Pkwy.	SE 15th to SE 30th (2-lane)	1.82	11,100	25	51	271
Vandalia Rd.[4]	M.L.K., Jr. Pkwy. to Pleasant Hill Blvd.	2.56	6,898	39	91	207
Scott Ave.[6]	SE 30th to Oakwood Dr.	1.42	3,841	40	303	151
E. University Ave.[6]	SE 30th to Pleasant Hill Blvd.	2.00	18,969	399	435	271

[1] Value based on weighted average of 2016 No-Build Output from the MPO travel demand model because no consistent AADT data source within the safety analysis time period is available (https://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=0cce99afb78e4d3b9b24f8263717f910).

[2] Based on crash history from 5/20/2016 through 12/31/2022 (2,417 days).

[3] Crashes per 100 million VMT per year.

[4] Portion that connects with Martin Luther King, Jr. Pkwy. is technically SE 30th St.

[5] Statewide 10-year average crash rate by functional classification - https://iowadot.gov/traffic/pdfs/crash_rate- density_comparables_segments_2007-2016_20170828_secondary_functionalclass.pdf

[6] These segments are alternate east-west routes, but do not have common endpoints and origin-destination information

Summary

The BCA summary includes all benefits compared with the capital costs and is expressed as a ratio. As shown in **Table 32**, the benefit-cost ratio using the discount rates required by the Guidance is **1.56**.

BCA Worksheet Excel Spreadsheets and BCA Benefit Calculations Excel Spreadsheets are available on the SE Connector Website:

https://seconnector.com/2023-raise-grants/

Table 32. Benefit-Cost Analysis Summary

Year	Travel Time Savings (7% Discount)	Vehicle Operating Savings (7% Discount)	Emissions Savings (7%/3% Discount)*	Safety Benefits (7% Discount)	Cycling Benefits (7% Discount)	O&M (7% Discount)	Residual Value (7% Discount)	Capital Costs (7% Discount)
2005	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 177,095
2006	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 311,819
2007	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 491,962
2008	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 146,709
2009	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 140,083
2010	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 32,660
2011	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,674
2012	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,227
2013	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 525
2014	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
2015	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 194,313
2016	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 663,789
2017	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 891,491
2018	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 590,417
2019	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,439,003
2020	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 710,710
2021	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 931,345
2022	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 589,236
2023	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,367,194
2024	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,428,170
2025	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,680,533
2026	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,268,820
2027	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,329,764
2028	$ 1,096,913	$ 15,884	$ 1,903	$ 222,707	$ 20,076	$ (8,968)	$ -	$ 6,850,247
2029	$ 4,305,644	$ 42,898	$ 5,357	$ 828,007	$ 75,050	$ (33,527)	$ -	$ -
2030	$ 4,226,058	$ 24,840	$ 3,266	$ 771,939	$ 70,141	$ (31,334)	$ -	$ -
2031	$ 4,138,458	$ 8,961	$ 1,221	$ 719,663	$ 65,552	$ (29,284)	$ -	$ -
2032	$ 4,055,313	$ (4,960)	$ (701)	$ 672,762	$ 61,263	$ (27,368)	$ -	$ -
2033	$ 3,944,624	$ (17,072)	$ (2,504)	$ 625,481	$ 57,256	$ (25,578)	$ -	$ -
2034	$ 3,840,739	$ (27,590)	$ (4,201)	$ 583,113	$ 53,510	$ (23,904)	$ -	$ -
2035	$ 3,733,565	$ (36,660)	$ (5,796)	$ 543,611	$ 50,009	$ (96,028)	$ -	$ -
2036	$ 3,633,904	$ (44,546)	$ (7,393)	$ 508,171	$ 46,738	$ (20,879)	$ -	$ -
2037	$ 3,512,746	$ (51,016)	$ (8,799)	$ 472,446	$ 43,680	$ (19,513)	$ -	$ -
2038	$ 3,400,559	$ (56,555)	$ (10,142)	$ 440,433	$ 40,822	$ (18,236)	$ -	$ -
2039	$ 3,288,017	$ (61,150)	$ (11,405)	$ 410,586	$ 38,152	$ (17,043)	$ -	$ -
2040	$ 3,184,347	$ (65,081)	$ (12,628)	$ 383,809	$ 35,656	$ (15,928)	$ -	$ -
2041	$ 2,967,894	$ (60,657)	$ (12,374)	$ 357,720	$ 33,323	$ (63,987)	$ -	$ -
2042	$ 2,773,733	$ (56,689)	$ (12,039)	$ 334,317	$ 31,143	$ (13,912)	$ -	$ -
2043	$ 2,592,274	$ (52,980)	$ (11,717)	$ 312,446	$ 29,106	$ (13,002)	$ -	$ -
2044	$ 2,429,323	$ (49,650)	$ (11,437)	$ 292,806	$ 27,202	$ (12,152)	$ -	$ -
2045	$ 2,264,192	$ (46,275)	$ (11,106)	$ 272,903	$ 25,422	$ (11,357)	$ -	$ -
2046	$ 2,116,067	$ (43,248)	$ (10,925)	$ 255,049	$ 23,759	$ (10,614)	$ -	$ -
2047	$ 1,977,633	$ (40,418)	$ (10,643)	$ 238,364	$ 22,205	$ (42,637)	$ -	$ -
2048	$ 1,853,319	$ (37,878)	$ (10,399)	$ 223,380	$ 20,752	$ (9,270)	$ -	$ -
2049	$ 1,727,341	$ (35,303)	$ (10,108)	$ 208,196	$ 19,394	$ (8,664)	$ -	$ -
2050	$ 1,614,338	$ (32,993)	$ (9,853)	$ 194,576	$ 18,126	$ (8,097)	$ -	$ -
2051	$ 1,508,727	$ (30,835)	$ (9,514)	$ 181,847	$ 16,940	$ (7,567)	$ -	$ -
2052	$ 1,413,888	$ (28,897)	$ (9,213)	$ 170,416	$ 15,832	$ (7,072)	$ -	$ -
2053	$ 1,317,780	$ (26,932)	$ (8,875)	$ 158,832	$ 14,796	$ (28,411)	$ -	$ -
2054	$ 1,231,571	$ (25,171)	$ (8,574)	$ 148,441	$ 13,828	$ (96,311)	$ -	$ -
2055	$ 1,151,000	$ (23,524)	$ (8,285)	$ 138,730	$ 12,923	$ (5,773)	$ -	$ -
2056	$ 1,078,649	$ (22,045)	$ (8,028)	$ 130,046	$ 12,078	$ (5,396)	$ -	$ -
2057	$ 1,005,328	$ (20,547)	$ (7,738)	$ 121,172	$ 11,288	$ (5,043)	$ 1,910,024	$ -
TOTAL	**$ 77,383,945**	**$ (906,086)**	**$ (222,651)**	**$ 10,921,969**	**$ 1,006,021**	**$ (716,857)**	**$ 1,910,024**	**$ 57,250,785**

Notes:

*All emission types are discounted at 7% except for CO2, which is discounted at 3%, per USDOT BCA Guidance (Jan 2023).

Sum of Benefits	**$ 89,376,365**
Sum of Costs	**$ 57,250,785**
Benefit-Cost Ratio	**1.56**