MidAmerica Connectivity Project

BCA Narrative

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Benefit-Cost Analysis Narrative

1. Introduction

A benefit-cost analysis (BCA) was conducted for the MidAmerica Connectivity Project, for submission to the U.S. Department of Transportation (USDOT) as a requirement of a discretionary grant application for the 2023 Rural Grant Program. This appendix is organized as follows:

- Section 2 contains the project description.
- Section 3 documents the BCA methodology, including key methodological components, assumptions, and the study scenarios.
- Section 4 contains a detailed explanation and calculation of the project benefits.
- Section 5 contains a detailed explanation and calculation of the project costs.
- Section 6 contains the detailed results of the BCA.
- Section 7 contains the sensitivity analysis and its results.
- Section 8 contains Appendix A.1 with additional information regarding traffic data, inputs, and assumptions.

2. Project Description

The MidAmerica Connectivity Project is a network of projects. It will improve infrastructure that supports the MidAmerica Industrial Park (MAIP) and the surrounding community. MAIP is a public trust with the sole mission of increasing area employment. MAIP is in the process of designing residential and commercial master plans that will provide a variety of new housing and commercial opportunities. Over 1,100 acres of planned residential development ranging from high-density mixed-use apartments to single family subdivisions are planned at the park. The Project is a visionary and comprehensive infrastructure development initiative that seeks to revolutionize accessibility, connectivity, and economic growth within the sprawling expanse of MAIP. It is a strategic investment in the region's future. At its core, the project comprises a symbiotic blend of road and trail improvements that form the backbone of a robust transportation network, facilitating the seamless movement of goods, services, and people within the industrial park and its adjacent communities.

The BCA was run for two scenarios: partial-build, and full-build. The partial build will provide improved access to the park from both US 412 and US 69 and allow for construction of the priority roadways within the park. The full build will complete all planned roadways within the park along with additional intersection improvements on US 69. The reconstruction of SH-412B from Patrol Road to SH-69A is also included in the full build scenario. Table 1 provides an overview of the planned infrastructure improvements and their estimated project costs for both the partial and full build scenarios while Table 2 shows the estimated capital cost per year.

Table 1: Estimated Cost by Project ($2023)

Project	Project Cost
US 412/SH-412B Interchange	$34,282,000
SH-412B – South Widening	$17,250,000
SH-412B - Roundabout	$6,720,000
Patrol Road Improvements	$12,960,000
Williams Street Improvements	$16,320,000
Partial Build Subtotal	**$87,532,000**
SH-412B North Reconstruction	$9,210,000
US 69 / Main Street Intersection	$480,000
Zarrow Street Widening	$7,608,000
Rocket Road Improvements	$8,040,000
Total Project Costs	**$112,870,000**

Table 2: Estimated Cost by Year

Year	($) 2023 - Partial Build	($) 2021 - Partial Build	($) 2023 - Full Build	($) 2021 - Full Build
2022	$2,254,667	$2,021,585	$2,791,917	$2,503,295
2023	$4,604,917	$4,128,872	$6,082,967	$5,454,125
2024	$3,848,917	$3,451,025	$4,789,717	$4,294,568
2025	$26,023,000	$23,332,808	$37,001,950	$33,176,781
2026	$26,023,000	$23,332,808	$37,001,950	$33,176,781
2027	$17,331,000	$15,539,365	$17,755,000	$15,919,533
2028	$7,446,500	$6,676,700	$7,446,500	$6,676,700
Total	**$87,532,000**	**$78,483,162**	**$112,870,000**	**$101,201,783**

The project includes the following improvements:

- Partial-Build
  - Construction of an interchange at SH-412B and US-412 prior to US-412's designation as an interstate.
  - Additional lanes constructed on SH-412B between US-412 and Patrol Road.
  - Roundabout constructed at the intersection of SH-412B and Patrol Road.
  - Reconstruction of Patrol Road.
  - Extension of Williams Street between Patrol Road and US-69.
- Full-Build (In addition to projects listed above.)
  - Reconstruction of SH-412B between Patrol Road and SH 69A to replace asphalt pavement with concrete pavement.
  - Installation of a signal at the intersection of US-69 and Main Street.
  - Additional lanes constructed on Zarrow Street. Installation of a signal at the intersection of Zarrow Street and SH-69A.
  - Construction of Rocket Road between the roundabout and Williams Street.

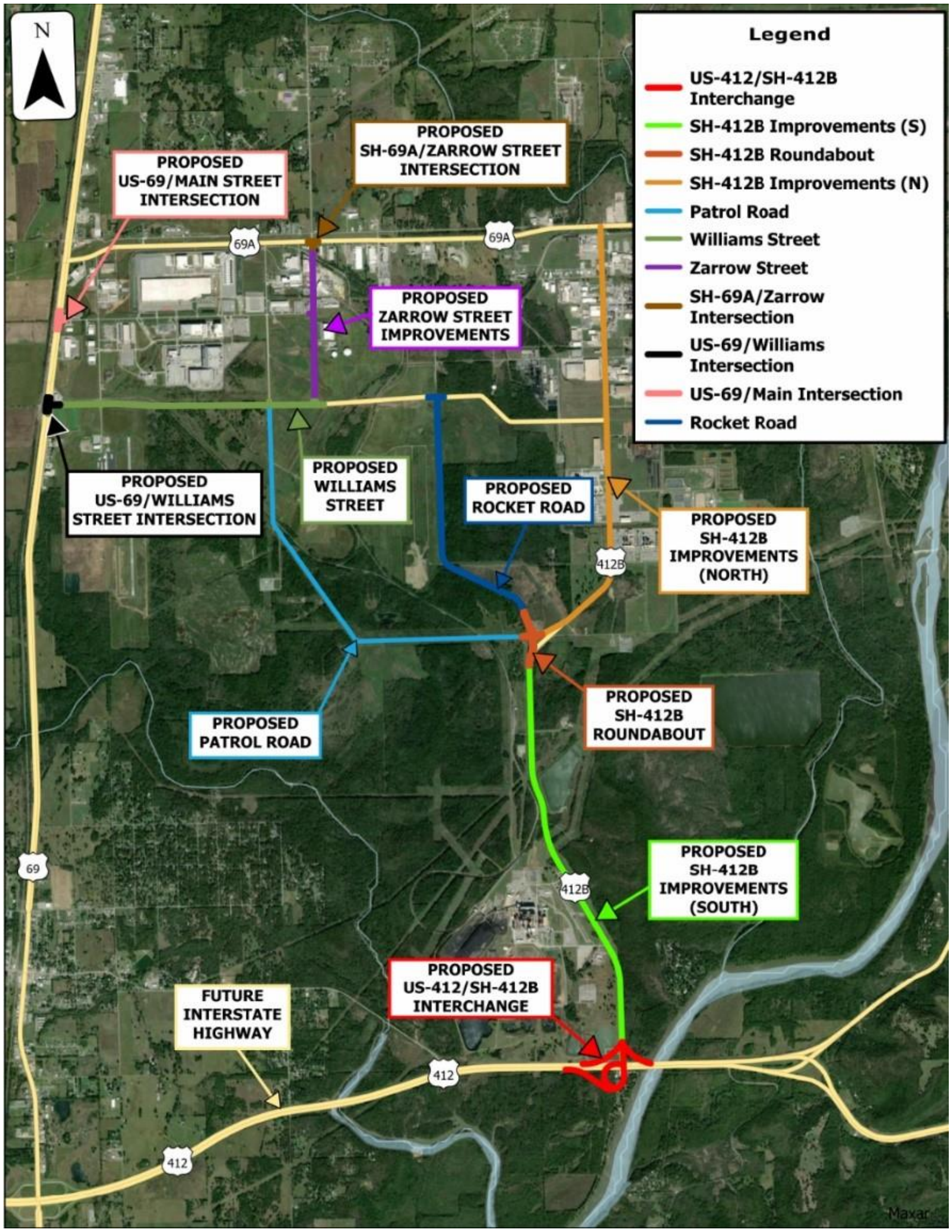

Figure 1: Project Location Map

The improvements shown in the figure above will enhance the pavement quality on the corridors and significantly help with travel time, severity of crashes, emissions, and connectivity within the park. Table 3 shows a summary of benefits for these improvements.

Table 3: Summary of Benefits

Merit Criteria	Benefit Category	Description	Monetized	Qualitative
Economic Competitiveness	Travel Time Savings	Improved travel times from a result of additional roadways inside the MAIP park.	Yes	-
Safety	Safety Benefits	Improved roadway safety by intersection improvments and increasing the number of lanes.	Yes	-
Environmental Sustainability	Emissinon Reduction Benefits	Reduced emissions as a result of fewer miles travelled due to additional roadways.	Yes	-
State of Good Repair	Operating Cost Savings	Reduced incremental O&M from reconstructing infrastructure beyond state of good repair.	Yes	-
	Residual Value of Assets	Residual value of capital assets.	Yes	-
Pedestrian and Bike Elements	Facility and Vechicle Amenity Benefits / Heath Benefits	Addition of hike and bike trails along MAIP local roadways.	-	Yes

3. Benefit Cost Analysis Framework

The BCA provides an evaluation framework to assess the economic advantages (benefits) and disadvantages (costs) of a potential infrastructure project. Project benefits and costs are broadly defined and are quantified in monetary terms to the extent possible. The overall goal of project BCA is to assess whether the expected benefits of the project justify the costs from a national perspective. The BCA framework attempts to capture the net welfare change created by the project, including cost savings and increases in welfare (benefits), as well as disbenefits where costs can be identified (e.g., project capital costs), and welfare reductions where some groups are expected to be made worse off because of the proposed project.

This BCA framework involves defining a Base or "No-Build" scenario, which is compared to the "Partial-Build" and "Full-Build" scenarios. The BCA assesses the incremental difference between these scenarios, which represents the net change in welfare. BCAs seek to assess the incremental change in welfare over a project life cycle. The importance of future changes is determined through discounting, which is meant to reflect the time value of money.

Key Assumptions

General BCA assumptions and inputs include the following:

- All dollars assume 2021 as the base year.
- All benefits and costs beyond the base year are discounted at 7%, except for carbon dioxide emissions that are discounted at 3%.
- The study period begins in 2021, the base year. For future years, the analysis period is capped at 20 years from anticipated completion. Since the project is anticipated to be complete and open to traffic at the beginning of the year 2028, the study period ends at the end of the year 2048.

Additional BCA assumptions and inputs used in this analysis's development are provided below.

Safety Assumptions

To quantify the safety improvements along these roadways, crash modification factors (CMF) were found from the CFM Clearinghouse site based on improvement type. Existing crash data spanning the previous five years were given by ODOT which was used to predict future crashes. It is assumed that the number of crashes will grow at the same rate as the traffic growth rate. No crashes were attributed to SH-412B roundabout or the Williams Street Improvements; thus, no calculation or crash benefits were calculated. However, it is anticipated that there will be an increase in crashes in those locations due to future traffic growth. Safety assumptions and CMFs used can be seen in Tables 4 and 5, respectively.

Table 4: Safety Assumption Values

Variable	Units	Value	Source
Value of a Statistical Life	2021$/Crash	$13,046,800	U.S. DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, Table A-1, "Value of Reduced Fatalities and Injuries" (January 2023)
Cost of Injury	2021$/Crash	$307,800	
Cost of PDO	2021$/Crash	$4,800	
Crash Modification Factor	factor	Varies	CMF Clearinghouse, individual CMFs identified

Table 5: CMFs Used for Calculations

CMF IDs	Sources
462	https://www.cmfclearinghouse.org/study_detail.php?stid=13
7570, 4397, 4399	https://www.cmfclearinghouse.org/detail.php?facid=7570
9157	https://www.cmfclearinghouse.org/study_detail.php?stid=510
2978	https://www.cmfclearinghouse.org/study_detail.php?stid=183
7570	https://www.cmfclearinghouse.org/detail.php?facid=7570
9305	https://www.cmfclearinghouse.org/detail.php?facid=9305
325	https://www.cmfclearinghouse.org/detail.php?facid=325
7570	https://www.cmfclearinghouse.org/detail.php?facid=7570

Travel Time Assumptions

To quantify project benefits for automobile travel, assumptions must be made. Assumptions include:

- Initial AADTs came from ODOT's traffic counts, the Reserve Traffic Study and other recent traffic studies and park development studies.
- Traffic growth from future development was considered in calculating traffic data.

In this BCA analysis, estimates were made about the regions near the proposed improvements that would benefit from the reduced travel time afforded by the increased access. Origin-Destination Road segments were modeled to represent the approximate reduced travel distances that travelers in those regions would achieve because of the construction of the new corridors. Refer to Appendix A.1 for more information regarding traffic generation and origin-destination road segments.

Values for calculating travel time benefits can be found in Table 6 while vehicle distribution assumptions can be found in Table 7.

Table 6: Travel Time Savings Assumptions

Variable	Units	Value	Source
Value of Travel Time Savings – Automobiles	2021$/hour	$18.80	Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis (2016). Obtained from: U.S. DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023.
Value of Travel Time Savings – Trucks	2021$/hour	$32.40	
Vehicle Occupancy – Automobiles	persons/vehicle	1.67	2017 National Household Travel Survey. Obtained from: U.S. DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023
Vehicle Occupancy – Trucks	persons/vehicle	1	Assumption
Number of Peak Period Hours – AM	hours	2	Assumption
Number of Peak Period Hours – PM	hours	2	
Number of Non-Peak Period Hours	hours	14	Assumed that volume is negligible for 6 hours each day (e.g., 12 AM to 6 AM); remaining 18 hours minus the peak period hours is the number of non-peak period hours.
Percent of Daily Travel during Peak Hours	%	32.80%	California DOT, Cal-B/C v8.1 Table: Demand for Travel during Peak Period. (2021)
Percent of Daily Travel during Non-Peak Hours	%	67.20%	Calculated

Table 7: Assumed Vehicle Distribution by Roadway

Roadway	Trucks	Autos	Source
US 412	22%	78%	US 69 and US 412 Data from ODOT interactive AADT map. Other roadways are assumed.
SH 412B	20%	80%	
Patrol Rd	20%	80%	
Williams St	20%	80%	
US 69	28%	72%	
Zarrow Rd	20%	80%	
Rocket Rd	20%	80%	
Armin Rd	20%	80%	
SH 69A	20%	80%	

Operating Cost Assumptions

It was assumed that asphalt pavement would need to be resurfaced every 20 years and concrete pavement to have a lifespan of 30 years before additional work is required. In our no build scenario, gravel or unpaved roads have a lifespan of 10 years before needing rehabilitation. In all scenarios, it is assumed that the roadway will be restriped every five years. The useful life of the project is for residual value calculations is estimated to be 30 years.

Emissions Assumptions

It was assumed that all passenger vehicles were gasoline powered, while all trucks were diesel powered. The other parameters and assumptions specific to the emissions analysis are shown in Table 8.

Table 8: Emission Assumption Values

	Unit	Value	Source
Nitrogen Oxides (NOx)	$/metric ton	Varies by year	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grants Program, January 2023; Table A-6.
Sulfur Oxides (SOx)	$/metric ton	Varies by year	
Fine Particulate Matter (PM2.5)	$/metric ton	Varies by year	
Carbon Dioxide (CO2)	$/metric ton	Varies by year	
Truck - NOx Emission Rate	grams/mile	4.169	Estimates from various EPA sources.
Truck - SOx Emission Rate	ppm / gallon diesel	15	
Truck - PM2.5 Emission Rate	grams/mile	0.119	
Truck - CO2 Emission Rate	grams/mile	10180	
Auto - NOx Emission Rate	grams/mile	0.192	
Auto - SOx Emission Rate	ppm / gallon gasoline	10	
Auto - PM2.5 Emission Rate	grams/mile	0.01	
Auto - CO2 Emission Rate	grams/mile	8887	

4. Project Benefits

Safety Benefits

Based on the safety assumptions outlined earlier, Table 9 the expected number of crashes that could be reduced by severity level (using the same severity distribution as the before condition) to quantify benefits. Severity level 1 are for PDO crashes, levels 2-4 are for injury crashes, and level 5 crashes signify fatalities.

Table 9: Overall Reduction in Crashes

	Over the Study Period	
	Partial-Build	Full-Build
Avoided Fatality Crashes	0	5
Avoided Injury Crashes	113	414
Avoided PDO Crashes	20	423
Total Safety Benefits	**132**	**842**

The expected number of crashes per year was multiplied by the crash value for each severity in accordance with Table A-1 (for fatal and injury) and Table A-2 (for PDO) in the Guidance. The crash costs for each severity for the no-build, partial-build, and full-build scenario were calculated. The undiscounted dollars for each year were discounted at 7% per year for each scenario. Finally, the difference in cost was found from the no build to the partial and full build scenarios. The results of those calculations are summed up in Table 10.

Table 10: Overall Cost Savings from Reduced Crashes

	Over the Study Period			
	Undiscounted (Partial Build)	Discounted (Partial Build)	Undiscounted (Full Build)	Discounted (Full Build)
Avoided Fatality Costs	$0	$0	$67,689,863	$18,853,861
Avoided Injury Costs	$34,674,266	$8,658,926	$127,363,658	$29,056,961
Avoided PDO Costs	$94,948	$27,035	$2,028,249	$455,332
Total Safety Benefits	**$34,769,214**	**$8,685,961**	**$197,081,770**	**$48,366,154**

Travel Time Benefits

To measure the benefits in terms of travel time, the vehicle miles traveled must be calculated prior to getting vehicle hours travelled. Volume estimates were estimated based on the traffic assumptions outlined above and in Appendix A.1. The parameters used for VMT and VHT calculations include daily traffic volume utilizing the segments modeled and estimated travel times. To determine travel time savings, the VHT for each year from 2023 through 2048 for the three scenarios were calculated. To calculate the monetary travel time savings, default values for vehicle occupancy and value of time from the Guidance were used. In the Guidance, Tables A-3 and A-4, show values for persons per vehicle type and time cost per person. The value of time was multiplied with the occupancy annual VHT difference by year to estimate the total travel time savings benefits for passenger vehicles and trucks. The undiscounted dollars for each year were discounted at 7% per Guidance. See Table 11 for a summary of travel time savings.

Table 11: Overall Travel Time Savings

	Over the Study Period			
	Undiscounted (Partial Build)	Discounted (Partial Build)	Undiscounted (Full Build)	Discounted (Full Build)
Travel Time Savings (Hours of Time)	20,854,419	N/A	25,408,628	N/A
Travel Time Savings (Monetized)	$584,929,779	$181,458,605	$714,347,623	$214,481,432

Emissions Benefits

Based on the methodology from the vehicle operating cost savings, the emissions savings were calculated using the VMT difference for each year. The Guidance recommends the evaluation of four emissions (nitrogen oxide, sulfur oxide, fine particulate matter, and carbon dioxide). As shown in the assumptions section, various conversion factors were then applied to obtain the proper emission units for each of the four emission types. In addition, the savings were calculated for each year using a 7% discount rate for all emissions except carbon dioxide, which was discounted at 3% per Guidance. See Table 12 for emission reduction and Table 13 for cost savings.

Table 12: Emission Reduction

	Over the Study Period	
	Partial Build	Full Build
Avoided NOx Emissions (Metric Tons)	223	266
Avoided SOx Emissions (Metric Tons)	0.31	0.37
Avoided PM 2.5 Emissions (Metric Tons)	6.89	8.23
Avoided CO2 Emissions (Metric Tons)	1,542,995	1,861,763

Table 13: Emission Cost Savings

	Over the Study Period			
	Undiscounted (Partial Build)	Discounted (Partial Build)	Undiscounted (Full Build)	Discounted (Full Build)
Avoided Cost of NOx Emissions	$4,194,896	$1,324,547	$5,015,221	$1,485,733
Avoided Cost of SOx Emissions	$15,633	$4,727	$18,967	$5,316
Avoided Cost of PM 2.5 Emissions	$6,238,386	$1,962,930	$7,466,743	$2,201,149
Avoided Cost of CO2 Emissions	$117,258,053	$67,528,279	$143,335,509	$80,550,394
Total Env. Sustainability Benefits	**$127,706,967**	**$70,820,483**	**$155,836,439**	**$84,242,592**

Other Non-Quantified Benefits

Several potential benefits have been identified while preparing this application, but the benefits have not been quantified. The following are included for consideration of the other potential benefits not captured in the BCA estimates.

- Future US-412 interstate designation – US-412 is planned to be designated as an interstate from I-35 to I-49. The construction of the US-412 / SH-412B interchange is a required improvement prior to the change to interstate designation.
- Mode Shift – While the benefits for the use of more active modes was accounted for in this BCA, the estimated reduction in vehicular trips due to any mode shift toward more active modes was not assumed when calculating vehicular benefits to travel time, emissions, or operating costs.
- Development – The investment in improved infrastructure within and surrounding the park is vital to supporting the existing commerce and continued future growth.
- Shared Use Path – A ten foot shared use path will be added along the MAIP park roadways. These will tie into other trails that cross through the park giving health and transportation benefits to pedestrians and cyclists.

5. Project Costs

Capital Expenditures and O&M (Operation and Maintenance)

The capital expenditures for the project include construction, construction management, design, right of way, and utility relocations. It is assumed that design, construction management, and utility relocations are estimated at nine, six, and five percent of construction cost, respectively. Capital costs are expected to span from 2022 to 2028, which include some previously incurred costs. See Table 14 below for a summary of the cost breakdown.

Table 14: Project Cost by Location and Expenditure

Location	Construction	Eng. & Construction Management	Design	Right of Way	Utilities Relocation	Total Costs
US-412/SH-412B Interchange	$28,100,000	$1,686,000	$2,529,000	$562,000	$1,405,000	$34,282,000
SH-412B South Widening	$14,375,000	$862,500	$1,293,750	$0	$718,750	$17,250,000
SH-412B Roundabout	$5,600,000	$336,000	$504,000	$0	$280,000	$6,720,000
Patrol Road Improvements	$10,800,000	$648,000	$972,000	$0	$540,000	$12,960,000
Williams Street Improvements	$13,600,000	$816,000	$1,224,000	$0	$680,000	$16,320,000
Partial Build Subtotal	**$72,475,000**	**$4,348,500**	**$6,522,750**	**$562,000**	**$3,623,750**	**$87,532,000**
SH-412B North Reconstruction	$7,675,000	$460,500	$690,750	$0	$383,750	$9,210,000
US-69 / Main Street Intersection	$400,000	$24,000	$36,000	$0	$20,000	$480,000
Zarrow Street Widening	$6,340,000	$380,400	$570,600	$0	$317,000	$7,608,000
Rocket Road Improvements	$6,700,000	$402,000	$603,000	$0	$335,000	$8,040,000
Total	**$93,590,000**	**$5,615,400**	**$8,423,100**	**$562,000**	**$4,679,500**	**$112,870,000**

The Operations and Maintenance costs (O&M) for the assets constructed under this project will be less than the O&M costs for the "No Build" scenario. Below a breakdown can be seen for each build scenario. All project costs shown below are in 2023 dollars.

- 25-year O&M Costs under the "No Build' scenario:
  - 12 lane-miles of asphalt resurface in 2025 (6 lane miles in 2045)
  - 3.5 miles of gravel road rehab (Future Patrol Road) every 10 years
  - Reconstruct 412B (Northern Segment) within 10 years

  - Restriping every 5 years
  - Annual / Routine Maintenance of $40,000
  - Total 25-year O&M = $12,875,000
- 25-year O&M Costs under the "Partial-Build" Scenario:
  - 27 lane-miles of asphalt resurface every 20 years.
  - Restriping every 5 years
  - Annual / Routine Maintenance of $45,000
  - Total 25-year O&M = $5,050,000
- 25-year O&M Costs under the "Full-Build" Scenario:
  - 35 lane-miles of asphalt resurface every 20 years
  - 5 lane miles of concrete replacement every 30 years (outside study window)
  - Restriping every 5 years
  - Annual / Routine Maintenance of $50,000
  - Total 25-year O&M = $6,450,000

Once O&M cost were figured, they were deflated back to the base year of 2021. The O&M cost by year can be seen in Table 15 below.

Table 15: Operation and Maintenance Cost Estimated by Year ($2021)

Year	No Build		Partial Build		Full Build	
	Pavement	Annual Routine Cost	Pavement	Annual Routine Cost	Pavement	Annual Routine Cost
2024	$0	$0	$0	$0	$0	$0
2025	$2,263,972	$0	$0	$0	$0	$0
2026	$0	$0	$0	$0	$0	$0
2027	$0	$0	$0	$0	$0	$0
2028	$0	$35,865	$0	$40,348	$0	$44,831
2029	$0	$35,865	$0	$40,348	$0	$44,831
2030	$112,078	$35,865	$224,156	$40,348	$268,987	$44,831
2031	$0	$35,865	$0	$40,348	$0	$44,831
2032	$0	$35,865	$0	$40,348	$0	$44,831
2033	$0	$35,865	$0	$40,348	$0	$44,831
2034	$0	$35,865	$0	$40,348	$0	$44,831
2035	$7,531,629	$35,865	$224,156	$40,348	$268,987	$44,831
2036	$0	$35,865	$0	$40,348	$0	$44,831
2037	$0	$35,865	$0	$40,348	$0	$44,831
2038	$0	$35,865	$0	$40,348	$0	$44,831
2039	$0	$35,865	$0	$40,348	$0	$44,831
2040	$112,078	$35,865	$224,156	$40,348	$268,987	$44,831
2041	$0	$35,865	$0	$40,348	$0	$44,831
2042	$0	$35,865	$0	$40,348	$0	$44,831
2043	$0	$35,865	$0	$40,348	$0	$44,831
2044	$0	$35,865	$0	$40,348	$0	$44,831
2045	$1,524,258	$35,865	$1,927,738	$40,348	$2,488,127	$44,831
2046	$0	$35,865	$1,927,738	$40,348	$2,488,127	$44,831
2047	$0	$35,865	$0	$40,348	$0	$44,831
2048	$0	$35,865	$0	$40,348	$0	$44,831
Total	**$11,544,015**	**$753,163**	**$4,527,944**	**$847,308**	**$5,783,215**	**$941,454**
Grand Total		**$12,297,178**		**$5,375,252**		**$6,724,669**

Residual value

Construction cost and ROW purchases are considered when calculating residual value. The construction and ROW cost were discounted from the time constructed 7% per year until 2048. In the partial build an estimated discounted residual value of $3,566,991 is estimated while a full build is estimated to have $4,582,578 in residual value.

Table 16 shows the estimated state of good repair benefits. The table includes residual value of assets in addition to savings in O&M cost over the project to show a summation of the potential savings.

Table 16: State of Good Repair Benefits

	Over the Study Period			
	Undiscounted (Partial-Build)	Discounted (Partial-Build)	Undiscounted (Full-Build)	Discounted (Full-Build)
Incremental O&M Savings	$6,921,926	$4,002,086	$5,572,509	$3,701,820
Residual Value of Assets	$22,164,807	$3,566,991	$28,475,536	$4,582,578
Total State of Good Repair Benefits	**$29,086,733**	**$7,569,077**	**$34,048,045**	**$8,284,398**

6. Summary of Results

Table 17 shows a summary of all benefit cost for all scenarios. The overall BCA summary table includes all benefits compared with the capital costs and is expressed as a ratio. As shown in Table 18, the benefit-cost ratio using the discount rates required by the Guidance is 4.69 for the partial-build and 4.78 for the full-build.

Table 17: Summary of Benefits

Merit Criteria	Benefit Category	Undiscounted (Partial Build)	Discounted (Partial Build)	Undiscounted (Full Build)	Discounted (Full Build)
Economic Competitiveness	Travel Time Savings	$584.9	$181.5	$714.3	$214.5
Safety	Safety Benefits	$34.8	$8.7	$197.1	$48.4
Environmental Sustainability	Emissinon Reduction Benefits	$127.7	$70.8	$155.8	$84.2
State of Good Repair	Operating Cost Savings	$6.9	$4.0	$5.6	$3.7
	Residual Value of Assets	$22.2	$3.6	$28.5	$4.6
Pedestrian and Bike Elements	Facility and Vechicle Amenity Benefits / Heath Benefits	N/A	N/A	N/A	N/A
Total (Millions of Dollars)		**$776.5**	**$268.5**	**$1,101.3**	**$355.4**

Table 18: Overall BCA Summary Table

Evaluation Metrics	Undiscounted (Partial Build)	Discounted (Partial Build)	Undiscounted (Full Build)	Discounted (Full Build)
Total Benefits	$776,492,694	$268,534,126	$1,101,313,877	$355,374,577
Total Costs	$78,483,162	$57,261,618	$101,201,783	$74,339,783
Net Present Value (NPV)	$698,009,532	$211,272,508	$1,000,112,093	$281,034,794
Benefit-Cost Ratio (BCR)	9.89	4.69	10.88	4.78
Payback Period (years)	12.62	13.50	12.00	12.80
Return on Investment (ROI)	8.89	3.69	9.88	3.78
Internal Rate of Return (IRR)	24.12%		22.06%	

7. Sensitivity Analysis

The BCA analysis relies on several assumptions and long-term projections which contribute to uncertainty in the model. This sensitivity analysis will help to identify the critical variables in the model to determine what variables have the greatest effect on outcomes. The results in the Table 19 and Table 20 below show how adjusting variables change the BCR for the partial-build and full-build scenarios, respectively.

Table 19: Sensitivity Analysis (Partial Build)

Parameters	Change in Parameter	NPV	Change in NPV	BCR
Baseline	**No Change**	**$211,272,508**	**-**	**4.69**
Discount Rate	Change discount rate to 3%	$383,708,636	82%	6.62
Capital Cost (Discounted)	Increase capital cost by 20%	$199,820,185	-5%	3.91
	Decrease capital cost by 20%	$222,724,832	5%	5.86
Development Generated Traffic	Increase development traffic	$385,948,395	83%	7.74
	Reduce development traffic by 40%	$145,686,418	-31%	3.54
Peak Hours	Increase total number of peak hours to 6 with 40% share of traffic	$234,285,591	11%	5.09
	Decrease total number of peak hours to 2 with 20% share of traffic	$195,739,549	-7%	4.42
Vehicle Miles Travelled (VMT)	Increase VMT by 25%	$402,216,953	90%	8.02
	Decrease VMT by 25%	$148,931,942	-30%	3.60

Table 20: Sensitivity Analysis (Full Build)

Parameters	Change in Parameter	NPV	Change in NPV	BCR
Baseline	**No Change**	**$281,034,794**	**-**	**4.78**
Discount Rate	Change discount rate to 3%	$537,072,334	91%	7.08
Capital Cost (Discounted)	Increase capital cost by 20%	$266,166,837	-5%	3.98
	Decrease capital cost by 20%	$295,902,750	5%	5.98
Development Generated Traffic	Increase development traffic	$527,684,172	88%	8.10
	Reduce development traffic by 40%	$156,280,373	-44%	3.10
Peak Hours	Increase total number of peak hours to 6 with 40% share of traffic	$310,336,942	10%	5.17
	Decrease total number of peak hours to 2 with 20% share of traffic	$254,328,046	-10%	4.42
Vehicle Miles Travelled (VMT)	Increase VMT by 25%	$452,521,567	61%	7.09
	Decrease VMT by 25%	$190,159,359	-32%	3.56

These results show that the project was able to maintain a BCR greater than 1.0 while adjusting multiple variables within the model.

8. Appendix A.1 – Traffic Study

This brief traffic study was developed to support the documentation and compilation of existing traffic volumes for the MidAmerica Industrial Park (MAIP) study area as well as the general traffic growth assumptions and methodology used to define projected traffic volumes in the future. The volumes as described herein for the no-build, partial build and full build scenarios form the basis of the VMT and VHT calculations as performed in the BCA model spreadsheet. The information and assumptions included in this traffic study were developed based on the following:

- prior traffic studies performed for MAIP, ODOT, and private companies planning to develop land within or adjacent to MAIP
- economic development plans for MAIP and surrounding areas
- site investigation reports and/or schematic design narrative reports for private entities conducting detailed evaluations prior to (and in the beginning stages of) acquiring property within MAIP
- conversations with MAIP officials, ODOT representatives, Mayes County officials, and other private and public stakeholders
- the Institute of Transportation Engineers (ITE) *Multimodal Transportation Impact Analysis for Site Development (MTIASD), Trip Generation (11th Edition), Trip Generation Handbook (3rd Edition)*
- engineering judgment (based on 18 years of professional experience in traffic engineering and transportation planning by lead engineer)

The study area for the project and the sum of its components, as defined in the grant application narrative, is illustrated in **Figure A.1-1**. MAIP is the 3rd largest industrial park in the United States and is in a prime location for large industrial and manufacturing companies looking for expanded or central facility space:

- in the Central region of the United States
- located in close proximity to primary freight highway corridors such as I-35, I-40, and I-44
- located near inland ports like the Port of Catoosa and Port of Inola
- with ready access to rail lines
- with corporate jet access (located within an industrial park)
- positioned to tap into substantial employment bases such as those available in Mayes County, in the greater Tulsa metro area, in Pryor Creek to the north, and in Choteau to the south
- interested in large areas of industrial use space up to, and including, industrial and mixed-use megasites (defined as 750+ acres)

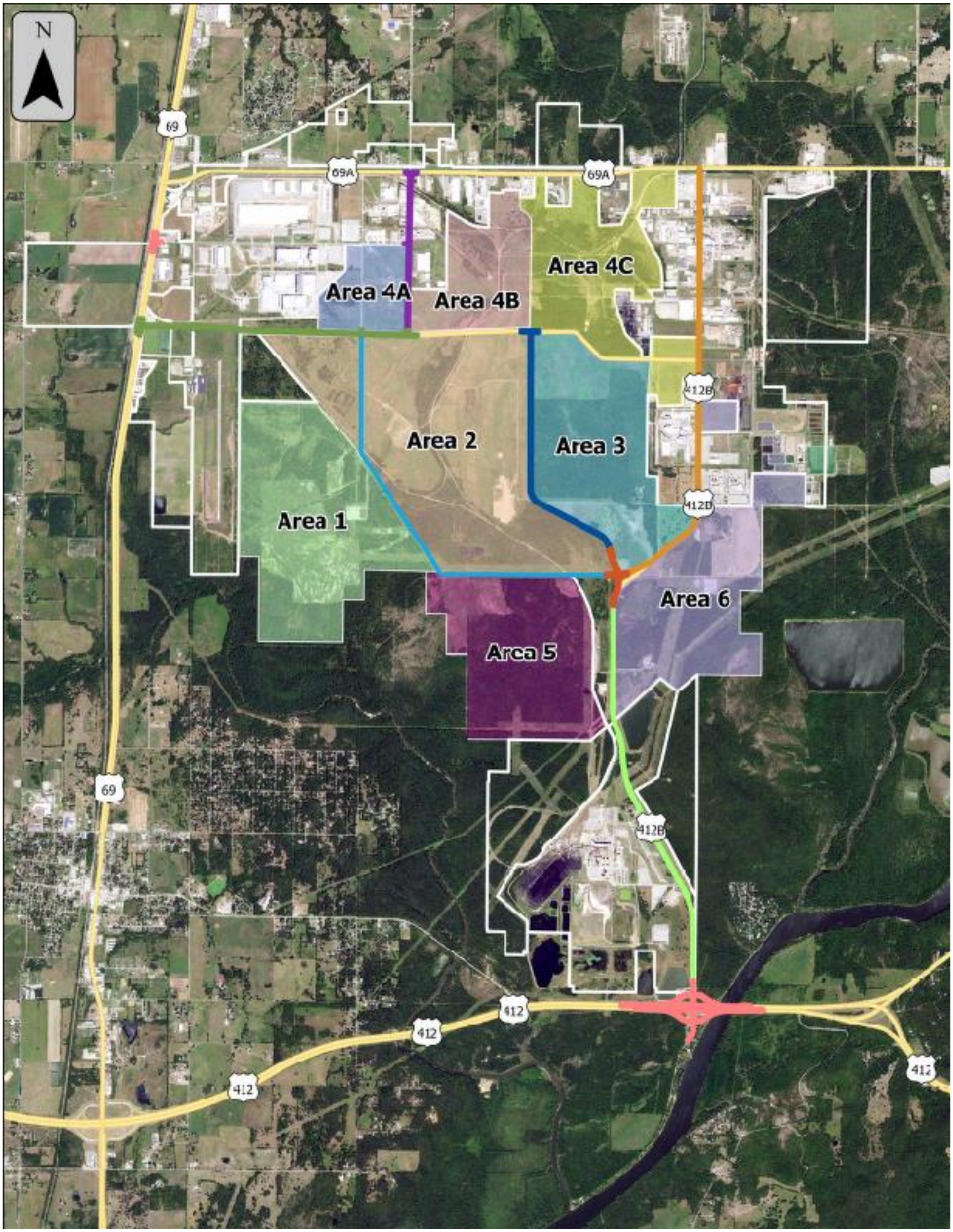

Figure A.1-1: MAIP Developable Areas (August 2023)

Development Growth Assumptions

As noted previously, MAIP is primed for megasite and sustained small and medium site developments, with many of the planned developments being currently underway. In total, nearly one-third of the developed area shown in **Figure A.1-1** is currently spoken for.

MidAmerica Industrial Park (MAIP) has seen substantial growth in development plans and site construction in recent years both at the park's core and around its exterior boundaries. The District Mixed-Use Development, along the north frontage of SH-69A, began construction in 2020 and is currently over 50% built out. The Reserve Mixed-Use Development is summarized as follows:

- 32,000 gross square feet of centrally located commercial property
- 4 commercial use outparcels of 5,000 gross square feet each (20,000 gross square feet total)
- 270 multi-family dwelling unit townhomes
- 248 single-family residential homes

There are an additional 200 single-family residential lots in the planning stage for land area north of SH-69A. In addition, there are two development phases in the planning and design phases that will include an additional 800 single-family residential lots to be located east of SH-412B. Full buildout for the Reserve and the additional 1,000 total single-family residential units is currently anticipated to be 2030.

In addition to the residential and supportive commercial uses, MAIP has received a lot of interest from various international companies who are interested in potentially locating at the park, with several of these organizations being primarily interested in megasite development within the central core of the park's available land mass. The availability of large and megasite-scale industrial use land is generally limited across the central United States. The availability of such sites that also provide ready access to rail lines, a private-use air strip, nearby ports (such as Ports of Catoosa and Inola), and freight corridor access to facilities like I-40, I-35, I-44, US-69, and future interstate route along US-412 or similar economic advantages are further limited and arguably unparalleled.

Figures A.1-2 and **A.1-3** illustrate developed vs. undeveloped conditions in 2003 and 2021, respectively. From 2003 to 2021, MAIP has averaged nearly 50 acres of industrial park development per year. A large percentage of the developed area from 2003 to 2021 is associated with a single large commercial entity who currently owns an additional 700 acres of land that is anticipated to be developed within the next five years – the area south of Williams St, east of the airport and west of Patrol Rd. Two additional large areas of land have development plans that are in the process of being negotiated with MAIP, totaling 1,250 acres between the two areas. The rate of development will increase well beyond the historic rates based as these large area development plans move forward.

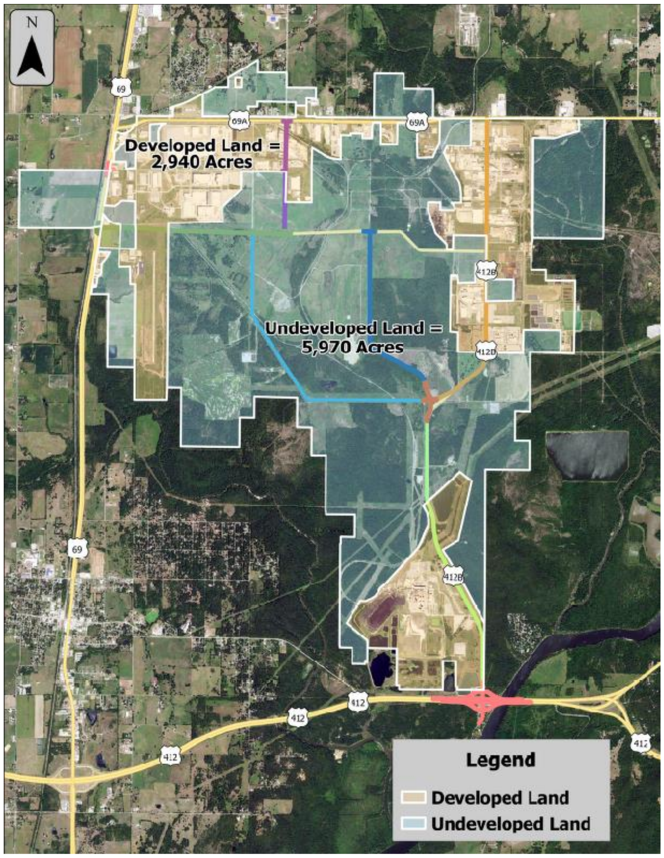

Figure A.1-2: MAIP Developed Area (2003)

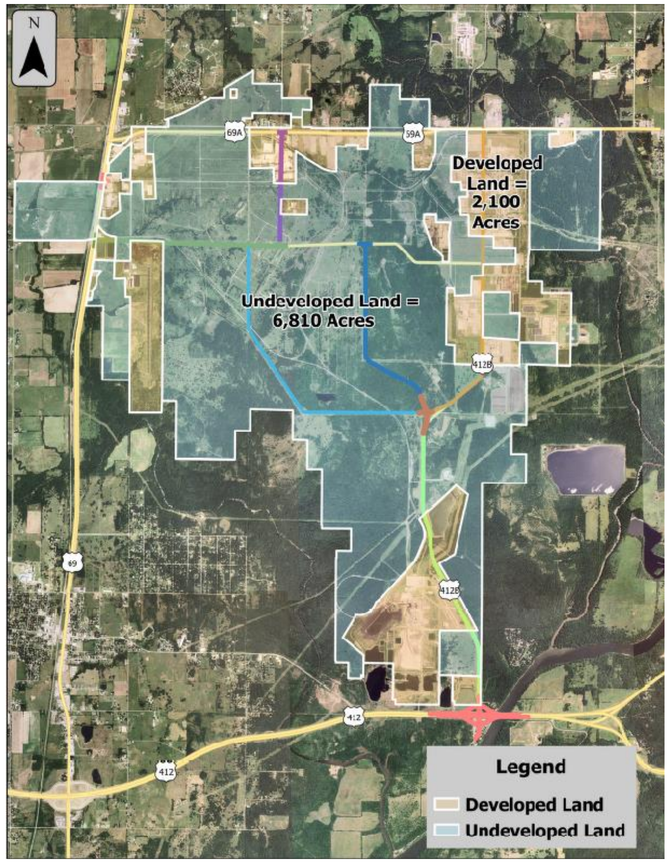

Figure A.1-3: MAIP Developed Area (2021)

Areas 1, 2, and 5 (as illustrated in **Figure A.1-1**) yield a total area of 1,950 acres and are expected to be developed to full buildout by 2030. Development for Areas 4A, 4B, 4C, and 6 is expected to be more focused on smaller and medium-sized sites (generally of 250 acres or less per parcel of developed land) and is anticipated to occur consistent with historic growth rates observed for MAIP – approximately 50 acres per year. While Area 3 is not currently being considered by a potential megasite developer, it has recently been carefully considered by at least two interested private entities. Based on current information and development prospects, development of Area 3 within the 2048 study horizon is considered to be highly likely. The development of Areas 1, 2, and 5 are generally anticipated to accelerate the development of the small and medium sites (typified by Areas 4A, 4B, 4C, and 6) and the remaining megasite (Area 3).

Based on the proceeding information supporting the development prospects of MAIP going forward, initial construction and full buildout (90%+) horizons are assumed to occur as illustrated in **Table A.1-1**.

Table A.1-1. Future Development Buildout Horizons and Characteristics

Development Area	Construction Start (year)	50% Buildout Horizon (year)	Full Buildout Horizon (year)	Development/ Buildout Type
1	2024	2027	2030	Megasite (previously sold)
2	2025	2030	2035	Megasite (development plan in negotiation)
3	2030	2033	2036	Megasite (no current known prospects)
4A	2023	2036	2048	Small and Medium Sites consistent with Historic Growth
4B	2023	2036	2048	Small and Medium Sites consistent with Historic Growth
4C	2023	2036	2048	Small and Medium Sites consistent with Historic Growth
5	2025	2030	2035	Megasite (development plan in negotiation)
6	2023	2036	2048	Small and Medium Sites consistent with Historic Growth

Of the gross land areas available, much of the land will be required for drainage, parking, green space, general industrial storage, and other uses. A relatively small percentage of the available land area will ultimately be able to be converted into gross square footage of industrial building space. For the traffic growth assumptions in this traffic study, it was assumed that **10.0%** of the total available industrial park area space per area would be able to be finished out as gross square footage of developed industrial use.

Table A.1-2. MAIP Industrial Land Use Trip Generation

Land Use Code	Land Use Description	Percentage of Land Use (assumed)	Daily Trip Gen Rate (vpd)	Aggregated Daily Trip Gen Rate (vpd)
110	General Light Industrial	10	4.87	0.49
130	Industrial Park	15	3.37	0.51
140	Manufacturing	10	4.75	0.48
150	Warehousing	20	1.71	0.34
154	High-cube Warehouse	20	1.4	0.28
160	Data Center	25	0.99	0.25
Total		**100**		**2.34**

Baseline Traffic

Current daily traffic volumes (vpd) based on ODOT-counted 24-hour traffic volumes and recent traffic counts, daily traffic volumes are provided in **Table A.1-3**.

Table A.1-3. Baseline (2023) ADT Volumes at Critical Study Locations

Corridor	Segment Start	Segment End	ADT (vpd)
US-412	W. of US-69	US-69 Interchange	16,000
	US-69 Interchange	SH-412B Intersection	13,500
	SH-412B Intersection	E. of SH-412B	12,000
SH-412B	US-412 Intersection	Patrol Rd	4,000
	Patrol Rd	SH-69A	6,000
US-69	South of US-412	US-412 Interchange	14,000
	E 16th St	Williams St	28,000
	Williams St	Main St	28,000
	Main St	SH-69A	28,000
	SH-69A	North of SH-69A	32,000
SH-69A	US-69	Armin Rd	10,000
	Zarrow St	SH-412B	6,000
	SH-412B	E. of SH-412B	2,400
Patrol Rd	SH-412B	Williams St	20
Williams St	US-69	Patrol Rd	100
	Patrol Rd	Zarrow St	220
	Zarrow St	Rocket Rd	300
	Rocket Rd	SH-412B	300
Zarrow St	Williams St	SH-69A	1,800
Rocket Rd	SH-412B	Williams St	0 [N/A]
Armin Rd	SH-69A	Williams St	3,600

Base traffic was projected at the following background growth rates based on facility:

- US-412 (to be converted to Interstate Freeway): 3.50% linear annual growth
- Other Highways: 2.00% linear annual growth
- Interior Roadways (non-highway): 0.00%

Site-Generated Traffic Distribution

Site-generated traffic was distributed for the no-build, partial-build, and full-build facility networks based on primary access points to key developments and the ability of traffic streams to connect as directly as possible to O-D points. As the transportation network is built out (i.e. partial build and full-build networks), O-D streams are able to be accommodated more directly as compared with no-build conditions. Traffic distributions were developed starting outside of the study influence boundary through assumed access points within the MAIP property. The study influence boundary is generally defined as:

- US-412 just west of US-69

- US-412 just east of SH-412B
- US-69 just south of US-412
- US-69 just north of SH-69A
- SH-69A just east of SH-412B
- Elliott St. / Zarrow St. just north of SH-69A

Origins-destinations that do not extend beyond these exterior boundary points were considered as internal capture. Approximately 10% of the total development traffic is expected to be captured internally with the majority of that volume anticipated to have O-D points either at the Reserve development or at the planned residential development to be located east of SH-412B.

Prospects for the continued development of MAIP are considered to be steady – so the same development buildout horizons were utilized for the no-build, the partial build, and the full buildout scenarios. It is possible that the proposed roadway network investments will accelerate development and corresponding traffic growth for the area. Accordingly, constant development buildout horizons across the no-build, partial build, and full buildout scenarios is considered to be a conservative assumption in that prospective benefits are likely to be understated or unclaimed with this assumption.

Base plus Site-Generated Traffic Volumes

The base projected traffic volumes were developed with the annual linear rates utilized under the Baseline Traffic section.

Site-generated traffic was developed on a 24-hour traffic volume basis for the development buildout horizons as illustrated in Table A.1-1 and the distribution assumptions as outlined in the previous section.

The site-generated traffic was then added to the baseline traffic volumes per year from 2023 (current year) through 2048 (the study buildout horizon). The results are summarized in the BCA model spreadsheet, with initial input data as provided in the 'Trip Gen' tab.