Appendix A1-
Economic Impact of the 30 Crossing Alternatives

prepared for

Arkansas Department of Transportation

prepared by

Cambridge Systematics, Inc.

report

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Date

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1.0 Introduction

The purpose of the30 Crossing Project is to widen and reconstruct portions of the I-30 and I-40 in the cities of Little Rock and North Little Rock in Pulaski County in the state of Arkansas[1]. The Arkansas Department of Transportation (ARDOT) commissioned a study to examine the economic impacts of the 30 Crossing alternatives. This report documents the methodology, including data sources and key assumptions, employed in conducting the economic assessment and presents the findings for the proposed project alternatives including the No-Action. The overarching objective of the **Economic Impact Assessment of the 30 Crossing Alternatives** is to enable decision-makers within ARDOT to make key decisions that support and enhance one of the most traveled roadways in central Arkansas by providing an objective analysis of the economic impacts associated with proposed 30 Crossing alternatives.

1.1 ARDOT Overview of Study Process

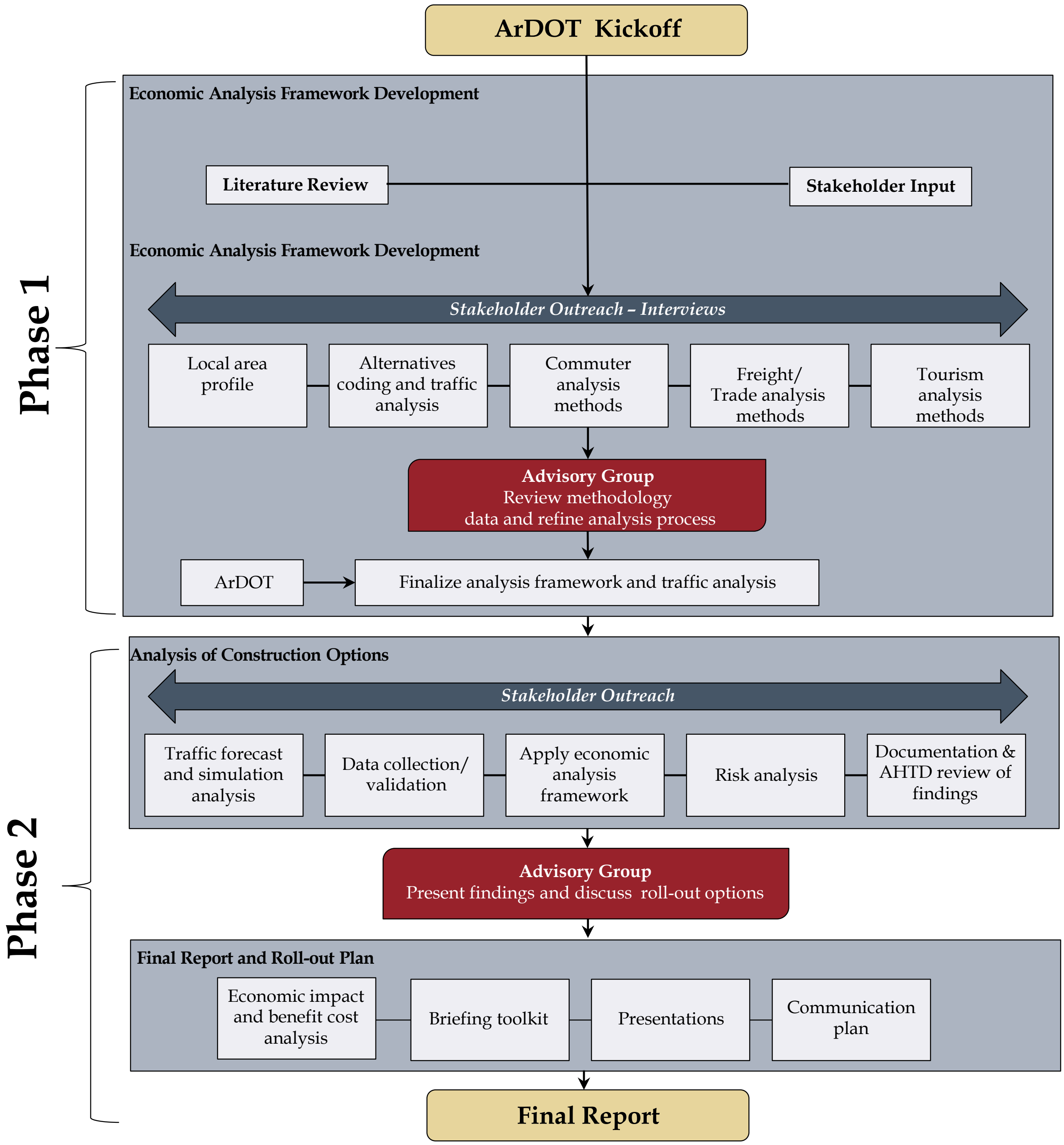
The key methodology elements, designed to promote more informed decision-making process, are built on three guiding principles:

1. **Data-driven, stakeholder-led process** to establish support for findings by ensuring that the study process is:
   a. Transparent,
   b. Objective, and
   c. Defensible;
2. Use **existing data and tools** to the extent possible while maintaining objectivity and defensibility;
3. Define a **few good metrics** that reflect what stakeholders care about; and
4. Address uncertainty by **incorporating risk analysis tools** to assess key assumptions.

This study is executed in two phases (Figure 1.1). Phase 1 corresponds to the development of the economic analysis framework. Phase 2 comprises the estimation of the economic impacts of the 30 Crossing Alternatives (including a No-Action alternative) and the preparation of the final report and roll-out. These two phases involve the integration of stakeholder engagement, data collection and validation, traffic forecasting and economic development assessment.

[1] Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Report (PEL): CA0602, Interstate 530-Highway 67, May 2015.

Figure 1.1 Overview of the Technical Approach



1.2 Overview of the 30 Crossing Project

The project area, defined by a quarter-mile wide buffer along each side of I-30 and I-40, begins at I-530 in the south and extends north to I-40, then runs east along I-40 to its interchange with US Highway 67[2] (Figure 1.2).

Figure 1.2 The 30 Crossing Project Area

[2] This study area comes from the Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Report (PEL): CA0602, Interstate 530-Highway 67, May 2015. The study area was established based on input from the public and agencies, while also building upon the Central Arkansas Regional Transportation Study, Areawide Freeway Study - Phase 1 (2003).

Source: Arkansas State Highway and Transportation Department (AHTD), I-30 Connecting Arkansas Program (CAP)

The project's major components are (1) improvements to approximately 5.0 miles of I-30 from the I-530 interchange north to the I-40 interchange and approximately 1.75 miles of I-40 from Highway 107 east to the Highway 67 interchange, (2) enhancements to the I-630 interchange, and (3) rebuilding the bridge over the Arkansas River that is approximately 66 years old and the piers of which intrude on the main shipping lane of the river.

In the 6.75 mile corridor, there are four system interchanges (i.e., I-40 & US-67, I-40 & I-30, I-30 & I-630, and I-30, I-530 and I-440), seven service interchanges, and eight grade separations of the surface streets. Through most of the I-30 corridor, two one-way frontage roads run parallel to the freeway. Fourteen of the fifteen I-30 interchanges and grade separations within the study area allow pedestrians to cross I-30 and I-40. The land use along southern and northern portions of the corridor is comprised of commercial and residential properties, undeveloped zones, and regulatory floodplains[3].

The population in the Little Rock region is expected to increase by more than 220,000 people between 2015 and 2040, representing an average annual growth of 1.2 percent. However, only 25 percent of the population increase is anticipated to occur in Pulaski County. As a result of the expected population growth outside of Pulaski County, the average daily traffic (ADT) on the corridor is anticipated to increase by between 15 percent and 27 percent by 2041 (Table 1.1). The consequences of not taking action to manage the additional traffic volumes on the corridor are estimated to be: (1) decreased travel speeds, which would increase corridor-wide travel time by between 16-18 minutes, nearly three times that of free flow conditions, by 2040 (2) increased vehicle miles traveled (VMT) by more than 30 percent between 2010 and 2040; and (3) 38 percent increase in traffic crashes between 2012 and 2040.

Table 1.1 Average Daily Traffic (ADT) in the Study Corridor, 2014 and 2041

Location	ADT		ADT Change		CAGR
	2014	2041	Total	%	2014-2041
I-40, west of North Hills Blvd.	124,000	158,000	34,000	27%	0.9%
I-30 on the Arkansas River Bridge	126,000	145,000	19,000	15%	0.5%
I-30, south of Roosevelt Rd.	97,500	122,000	24,500	25%	0.8%

Source: Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Report (PEL): CA0602, Interstate 530-Highway 67, May 2015.

Note: CAGR stands for Cumulative Annual Growth Rate

[3] Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Report (PEL): CA0602, Interstate 530-Highway 67, May 2015.

1.3 Overview of Project Alternatives for the Economic Analysis

The project alternatives to be analyzed as part of this economic impact assessment include[4]:

- **The No-Action Alternative**: The corridor already exhibits severe LOS F congestion over multiple hours of the day in several areas. By 2041, the section of I-30 north of the Arkansas River would operate at LOS F congestion almost continuously throughout the AM peak period. Peak hour travel speeds would be near 20 mph, and crash incidents along the route are likely to continue to increase.

- **Two Build Alternatives**: For all Build Alternatives, the widening will occur within the existing right-of-way (ROW), except for at the Arkansas River Bridge, the proposed southbound frontage road extension over the Union Pacific Railroad, and a few smaller parcels.

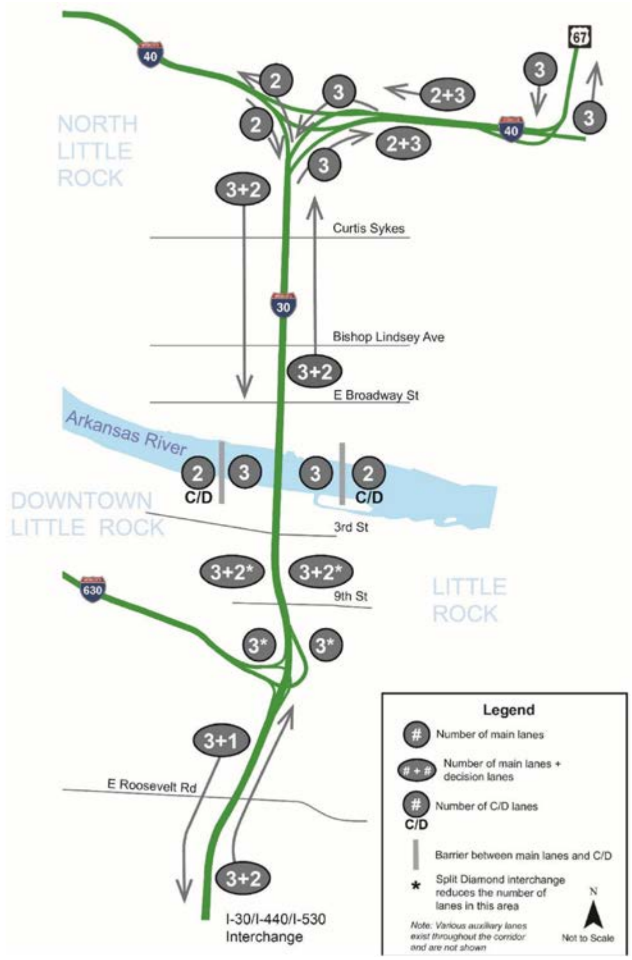
    1. **6-Lane with collector/distributor (C/D) lanes split diamond interchange (SDI)**: The 6-lane alternative includes adding two decision lanes in each direction that ultimately feed into a Collector/Distributor system at the Arkansas River Bridge from Broadway Ave. in North Little Rock to the Highway 10 interchange in Little Rock. Decision lanes are travel lanes that are picked up and dropped by the freeway as it goes through a series of interchanges. This alternative will also include replacement of the I-30 Bridge over the Arkansas River, with the new bridge width extending to the east and west of the existing bridge location. This alternative also includes a split diamond interchange between E 4th St. and E 9th St.

    2. **6-lanes with C/D lanes single-point urban interchange (SPUI)**: This 6-lane alternative is similar to the 6-lane SDI alternative except that instead of a split diamond interchange, a single-point urban interchange will be constructed between E 2nd St. and E 3rd St.

Figure 1.3 presents the lane configurations for the Build alternatives. The benchmark years of the analysis are the anticipated project opening year of 2023 and the horizon year of 2043. The difference between the SDI and SPUI alternatives is not shown in the figure since it only affects the interchange between 4th and ^{9th} streets.

[4] Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Level 2 and 3 Screening Results: CA0602, Interstate 530-Highway 67, May 2015

Figure 1.3 Lane Configuration for the 30 Crossing Project Alternatives



Source: Arkansas State Highway and Transportation Department (AHTD), Interchange Justification Report, Appendix A – Conceptual Design, CA0602, June 2017.

1.4 Organization of the Report

The remainder of the report consists of two sections. Section 2 details the methodology, assumptions and data sources used in the analysis. Section 3 presents the findings for each alternative including the No-Action. Appendix A provides detail on the economic model used to conduct the analysis.

2.0 Economic Analysis Framework

The economic impact assessment for the 30 Crossing Project is conducted in two phase. The objective of Phase I is to establish an agreed-upon process by which the economic impact assessment is conducted, including defining the metrics to be measured, the data and assumptions to be used and the alternatives to be analyzed. Phase I is conducted in two steps which are detailed in sections 2.1 to 2.7. These two steps include the following:

- Step 1. Compiling background information and organizing the first Advisory Group (AG) meeting
- Step 2: Defining the detailed economic assessment process

2.1 Literature Review

The literature review concentrates on reviewing previous studies and planning efforts conducted by the ARDOT, Metroplan (the regional metropolitan planning organization (MPO)), local transportation planners and representatives from the community such as Chambers of Commerce, downtown associations and/or economic development officials, business developers, community advocates, and other relevant agencies and organizations.

Drawing from relevant background information and work documents pertaining to the "30 Crossing Alternatives" completed to date and individual interviews with members of the Advisory Group (AG) and other key stakeholder group representatives, this section presents the findings from the literature review and stakeholder interviews.

The literature review documents the latest on the potential direct benefits/disbenefits and economic impacts to be generated by the proposed project alternatives. The reviewed sources are listed in Table 2.1 and a listing of the potential impacts is provided in Table 2.2. These findings are used as an organizational tool for the stakeholder interviews.

Table 2.1 Review Sources on Potential Benefits/Disbenefits and Economic Impacts to be Generated by the 30 Crossing Project

ID	Reference	Description
1	Connecting Arkansas Program (CAP). Know the Facts: I-30. Available at https://connectingarkansasprogram.com/know-the-facts-i30/#q5-1.	The fundamental information regarding the 30 Crossing Project by ArDOT
2	Arkansas State Highway and Transportation Department (AHTD), Interchange Justification Report, CA0602, I-30/I-40, June 2017	The interchange justification report provides detailed evaluation of the No-Action and Build alternatives as recommended by the PEL screening process.
3	Arkansas State Highway and Transportation Department (AHTD), Interchange Justification Report: Appendix B – Traffic Results CA0602, I-30/I-40, July 2017	The Traffic and Safety Report provides detailed analysis of the existing and forecasted traffic and safety issues in the study area.
4	Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Report (PEL): CA0602, Interstate 530-Highway 67, May 2015	The PEL report documents the evaluation of a full range of transportation concepts and identified the preferred improvements.
5	Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages Screening Methodology and Results: CA0602, Interstate 530-Highway 67, May 2015	The Screening Methodology and Results Report of the PEL report details the evaluation of the alternatives in the study corridor.
6	Arkansas State Highway and Transportation Department (AHTD), I-30 Corridor Project, TIGER VII 2015 Grant application.	The TIGER grant application provides a detailed analysis of the projects benefits and costs and compares it with the No-Action scenario.
7	Metroplan. Imagine Central Arkansas: Blueprint for a Sustainable Region. The 2040 Long-Range Transportation Plan for Central Arkansas. December 2014.	The 2040 long range plan by Metroplan details both the evaluation of existing and future conditions in the MPO area and the proposed investment scenarios.
8	Metroplan. River Rail Airport Study. Phase II Final Report. 2011. Prepared by URS	The River Rail Airport Study includes a detailed analysis of the feasibility of extending fixed guideway transit service from Downtown Little Rock to the Little Rock National Airport
9	Metroplan. I-630 Fixed Guideway Alignment Study. 2010. Prepared by Jacobs	The I-630 fixed guideway alignment study which was undertaken to determine a suitable mode and transit alignment in the I-630 corridor.
10	Metroplan Long-Range Transportation Plan (2010)	The 2035 long range plan by Metroplan details both the evaluation of existing and future conditions in the MPO area and the proposed investment scenarios.
11	Central Arkansas Regional Transportation Study (CARTS). Areawide Freeway Study, Phases 1 and 2. April 2003. Prepared by the Louis Berger Group.	The purpose of this study was to evaluate and recommend system improvements to over 200-mile existing and committed Central Arkansas Regional Transportation Study (CARTS) freeway system based on anticipated demands and needs for the next 25 years.

Source: Cambridge Systematics (CS)

Table 2.2 Potential Benefits/Costs and Economic Impacts of the 30 Crossing Project

Benefit/Cost Category	Potential Direct or Indirect Economic Benefits	Source
Capital and Operations Expenditures	Economic impacts generated by project capital expenditures	2
	Economic impacts generated by project operations expenditures	2
	Induced traffic demand	1,2
State-of-Good-Repair	Improved roadway conditions and performance ratings	2,4
	Improved I-30 Arkansas River Bridge conditions and functional ratings	2,4
	Reduced vehicle (autos and trucks) maintenance costs for highway users	2
Mobility	Demand shift to alternative transportation modes (e.g., transit, bike)	1,2,8
	Improved mobility of active transportation modes such as public transit, bicycling and walking	1,8
	Improved mobility on I-30 and I-40 by improving travel speed and travel time to downtown North Little Rock and Little Rock and accommodating the expected increase in traffic demand	2,11
	Improved transit mobility by adding bus-on-shoulder in each direction on I-30	2
	Improved biking mobility by providing dedicated bike lanes on side streets	2
	Congestion reduction on the I-30 corridor	2,1
Safety	Addressing the complex merging and weaving of the numerous interchanges in the I-30 corridor.	2,3
	Improved travel safety within and across the I-30 corridor by eliminating and/or improving inadequate design features, e.g., multiple access points with short acceleration and deceleration lanes along the I-30 corridor	2,3
	Reconfiguration of the Cantrell Interchange on between E 2nd St. and E 3rd St.	2,3
	Reconfiguration of the Interchange on 15th St.	2,3
Accessibility/ Connectivity	Improved connectivity between I-30 and other major statewide transportation corridors that serve local and regional travelers and link residential, commercial and employment centers	6,7,10
	The C/D lanes provide more convenient access to and between downtown economic districts and support improved connectivity and cohesion of these financially viable commercial and tourist areas	6,7,9
	Improved access to retail, recreational, and tourism centers	6,7,10
Economic Competitiveness	Increased employment	5,6,9
	Increased property values and subsequent taxes and revenues	5,6,9
	Improved business productivity for employment clusters	5,6,9
	Attraction of businesses/economic development	5,6,9
Maritime Navigability	Improved access for freight movement on the Arkansas River	6
	Improved mobility and access for freight and intermodal facilities	6
Project Delivery	Project cost reduction efficiencies	2
	Project schedule reduction efficiencies	2
	Project quality and design efficiencies	2
Sustainability	Efficient land use and multimodal commuter flow within the existing ROW	4
	Emission impacts	4

Source: Cambridge Systematics (CS)

2.2 Stakeholder Engagement

2.2.1 Advisory Group Meetings

An important factor to consider in assessing the impacts of the alternatives is balancing broader statewide and corridor needs with local priorities. To accomplish this balance, an Advisory Group (AG) consisting of key partners in the project is engaged to inform key assumptions and methods to be used in the study.

The AG is comprised of members that represent groups of stakeholders most directly impacted by the project. Utilizing presently established project working and advisory groups as the basis, the AG members were identified in coordination with ARDOT to ensure a wide cross-section of representations from the public and private sectors. Examples include includes Chambers of Commerce whose members will be impacted by the project, representatives from a variety of businesses located in close proximity to the project area, trade groups, industry representatives such as motor carriers, local and state government officials, and tourism officials.

The purpose of the AG was to provide input on the metrics to be analyzed and the key considerations for the methodology such as sources for critical data, acceptability of previous work, definition of study region and review of perceived traffic impacts. The AG met twice during the conduct of the study and individual members participated in stakeholder interviews discussed below.

2.2.2 Stakeholder Interviews

Stakeholder interviews were conducted in person and over the phone from August 2017 to September 2017. The purpose of the interviews was to seek further input on their primary concerns, anticipated impacts of the project as well as the construction alternatives, and potential ways to mitigate any negative impacts. In addition, several of the interviewees provided data that were directly used in the analysis, specifically for the logistics costs and tourism impacts. The organizations that participated in stakeholder interviews for the economic analysis include the following:

- Little Rock Convention and Visitors Bureau
- North Little Rock Visitors Bureau
- Little Rock Chamber of Commerce
- Downtown Little Rock Partnership
- Arkansas Waterways Commission

The interviews with the five organizations and their representatives resulted in an active and constructive discussion regarding the existing issues and challenges and potential feedback regarding the 30 Crossing Project.

The most important findings of the stakeholder interviews are summarized below.

Congestion in the Project Corridor

During the interviews it was mentioned several times that congestion in the project corridor has negatively affected movement of autos and trucks. Particularly, congestion has negative impacts on jobs accessibility for employers. For freight movement, congestion has resulted in fewer trucks using the I-30 Bridge. There are major freight dependent employers in the project corridor, particularly those in the distribution and warehousing sectors that have to rely on I-430 in the West and I-440 in the East for North/South accessibility. The increased travel time due to congestion has negative impacts on economic competiveness of Little Rock/North Little Rock and Pulaski County in general. The existing congestion challenges will worsen if no action is taken, which may negatively affect quality of life for the area residents and those seeking to access this important part of central Pulaski County. Finally, almost all interviewees noted that they are concerned with the impact of work zones on current users during project construction, such as traffic delays, which can affect economic activity and tourism, and travel time over the project construction period.

Transit Accessibility

Rock Region METRO has several existing bus lines within the project vicinity that may benefit from improved travel time in the project corridor. The scenario analysis should take into account that the alternative that best utilizes existing transit services and provides the potential for better east-east transit connectivity. While the existing population/job density may not generate adequate transit ridership, it is critical for the 30 Crossing Project to include adequate transit connectivity scenarios for the future, such as bus-on-shoulder and bus rapid transit (BRT). Another important issue raised during the interviews is the lack of street car connectivity to major population centers. In other words, while the existing railcar service helps visitors get around downtown Little Rock and North Little Rock, it lacks connection to the Little Rock Airport and other major residential centers. Finally, the lack of urban development and access east of I-30 has negative impacts on transit ridership.

Bicycle and Pedestrian Accessibility

During the interviews it was mentioned that the existing bicycle and pedestrian (bike-ped) conditions in downtown Little Rock in proximity of the project corridor do not allow for adequate east-west connectivity. Furthermore, the existing I-30 connections to surface streets do not provide accessible and safe connectivity to bike and pedestrian travelers. Among existing connection points the intersections/interchanges with surface streets pose traffic safety challenges and lack of connectivity issues to bike-ped users. Furthermore, bike-ped access helps connect the riverfront area bike paths to existing residential/commercial centers, which can encourage more bike-ped use in the region.

Sense of Community and Urban Livelihood in Downtown Little Rock

Adequate consideration for alternative transportation, such as transit or bike-ped contributes to a sense of livelihood in urban environments. It was mentioned in the interviews that having adequate green spaces and better bike-ped and transit connectivity can help attract more visitors and business to downtown Little Rock and North Little Rock. While the existing venues in both cities host events throughout the year, better urban livelihood and alternative transportation can mitigate congestion and equip the area for more visitors and higher economic activity.

2.3 Economic Assessment Methodology

The elements of the economic analysis framework and the technical approach are described in this section. The proposed economic assessment process, presented in Figure 2.1 Proposed Approach for Estimating the Economic Impacts of the 30 Crossing Alternatives

, uses the outputs of the traffic simulation and the MPO travel demand model to quantify the anticipated direct impacts and estimate the corresponding total (*direct, indirect and induced*) economic impacts using a regional economic model. In addition, the analysis includes the estimation of the economic impacts generated by project construction and operations and maintenance (O&M) expenditures and a discussion of the anticipated qualitative impacts.

The economic impact analysis consists of examining three classes of impacts including:

- **Direct Impacts** which are changes accruing to the users or travelers on the roadways;
- **Indirect Impacts** which are changes in business revenue as a result of transportation cost changes; and
- **Induced Impacts** which result as the direct and indirect impacts change spending patterns across the local economy in multiple industries.

Stakeholder parties to be impacted by the project include:

- **Highway users** who will be impacted as vehicle miles traveled (VMT), vehicle hours traveled (VHT), and delays change. For instance, if cargo is carried by water as opposed to moving the same cargo by trucks, highway users could also benefit from reduced congestion.
- **Active transportation users** who will be impacted by changes in transit services and bicycle and pedestrian infrastructure
- **Freight service providers** who provide the vehicles and logistics services for freight shipments (e.g., trucking companies and logistics service providers) are directly affected by changes in the freight transportation system.
- **Other impacted parties** who may also benefit as a side effect of freight transportation investments in the form of job creation, greater income generation for workers, lower prices for goods, and/or environmental, safety or security benefits. This stakeholder parties include the economic development agencies, chambers of commerce, commercial real estate developers, environmental resource agencies, neighborhood/community organizations, and private property owners.

The implementation of the proposed methodological framework encompasses the following main tasks:

1. Process traffic simulations and traffic demand forecasting for the study alternatives
    a. Process daily model outputs (VMT, VHT, and volume)
    b. Estimate changes between the Build and the No-Action Alternatives
2. Develop itemized unit cost estimates for various parameters, e.g., marginal external pavement cost by vehicle class and highway functional class; hourly value of time by vehicle type and trip purpose;

emission rates of air pollutants by vehicle type and highway functional class; and average internal and external crash costs by vehicle type.

3. For the quantifiable impacts, estimate the direct benefits/disbenefits using the unit costs and the changes in VMT and VHT.

4. Estimate the total (direct, indirect and induced) economic impacts generated by the monetized direct highway user and freight service provider benefits using the IMPLAN economic model for Pulaski County.

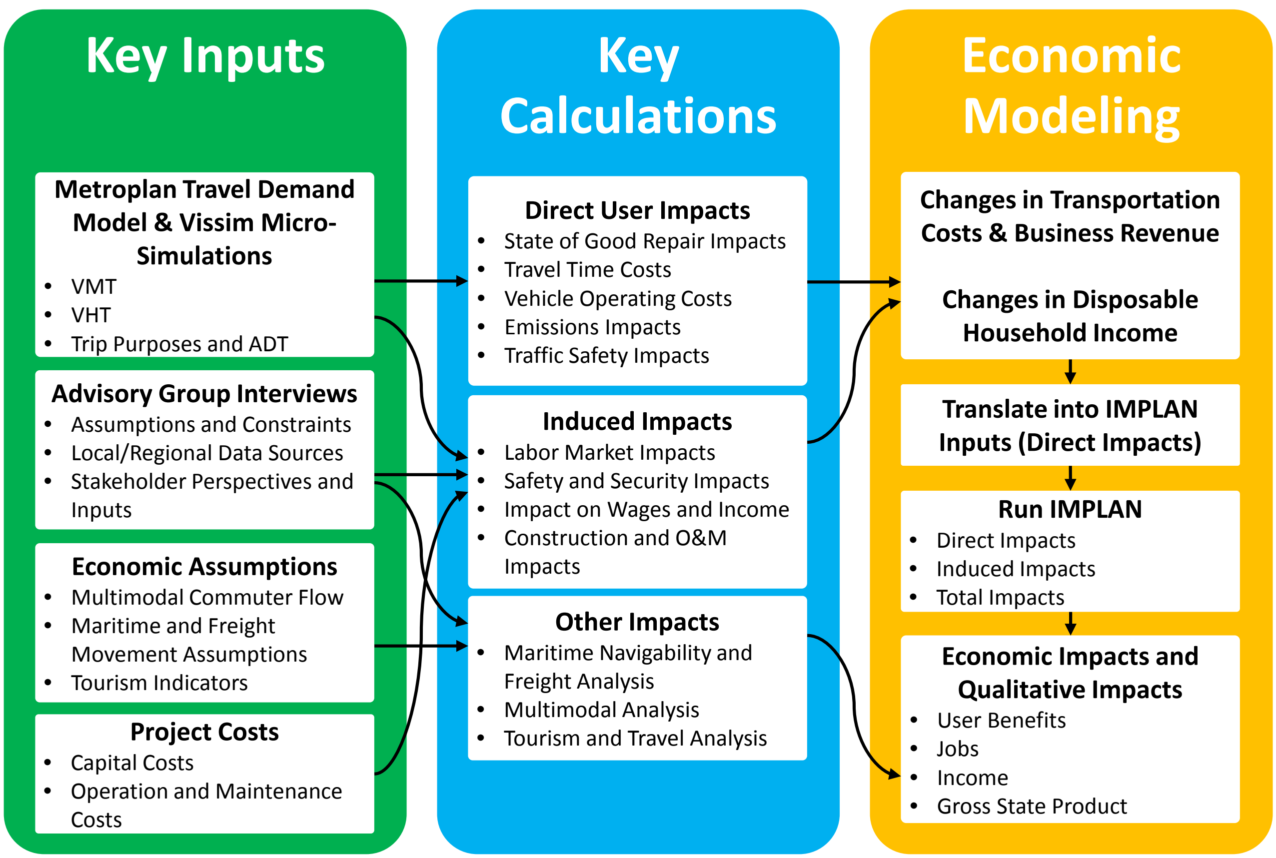
5. Estimate the total (direct, indirect and induced) economic impacts generated by the project construction expenditures using the IMPLAN economic model for Pulaski County.

6. Estimate the total (direct, indirect and induced) economic impacts generated by the project O&M expenditures using the IMPLAN economic model for Pulaski County.

7. Conduct qualitative analysis of the following:

   a. Maritime navigability impacts
   b. Multimodal (public transit and active transportation modes) impacts
   c. Tourism and travel impacts

Figure 2.1 Proposed Approach for Estimating the Economic Impacts of the 30 Crossing Alternatives



2.3.1 Highway User Impacts

This section describes the process for monetizing the direct user impacts for use in the economic modeling simulation. Changes in the transportation system affect the level of economic activity through travel efficiencies.

To better analyze travel patterns at the network level the Build and No-Action alternatives are coded in Metroplan's Central Arkansas Regional Transportation Study (CARTS) regional travel demand model (TDM). The regional TDM can capture traffic shifts as well as the induced demand between routes caused by network improvement. To develop detailed micro-simulations for each alternative at the corridor level, the TDM outputs are then further analyzed in VISSIM (version 7.13). The results of TDM in terms of traffic at each origin point and the routings (i.e. distribution of origin traffic to destination points) were inserted into a VISSIM model that can better estimate the travel time by modeling the capacity restrains and queue formation.

While TDM covers a large area to capture the traffic shift caused by network improvements, the VISSIM model only includes the study corridor as discussed in Section 1.2. For each alternative, an AM and PM peak VISSIM model is developed that can model autos and trucks separately. Vissim model parameters are calibrated for the existing conditions before modeling the future years. The VISSIM micro-simulations are developed for the following analysis years:

- Existing year Base Model 2014;
- No-Action or Baseline Alternative in years 2021 and 2041;
- Four Build Alternatives in years 2021 and 2041

For the existing year model in 2014, AM peak period covers two hours between 6:45 to 8:45, and PM peak period covers two hours between 16:00 to 18:00. After calibrating the model parameters for existing conditions, future year models (year 2021 and year 2041) were developed for each alternative including the four Build alternatives and the No-Action alternative. During the simulation of the future years, it was revealed that congestion does not disappear at the end of the two-hour model period. Therefore, AM and PM peak periods were extended to more than eight hours. After analyzing the simulation results, the outputs of the peak period models were converted to daily metrics using existing traffic count data on two locations along I-30 (North of Arkansas River at I-40 and South of Arkansas River at I-440). Using existing counts, the ratio of model period volumes to daily volumes was calculated. This ratio was then used to convert VMT, VHT, and volume results from VISSIM to daily values for cars and trucks. These metrics were used to compare the Build and the No-Action alternatives. The results of VISSIM micro-simulations yield the following important outputs for the Build and No- Action alternatives:

- Daily vehicle-miles traveled (VMT) by vehicle type (passenger cars and trucks), auto trip purpose (commute, business and other trips), in 2021 and 2041
- Daily vehicle-hours traveled (VHT) by vehicle type (passenger cars and trucks), auto trip purpose (commute, business and other trips), in 2021 and 2041
- Daily traffic volume by vehicle type (passenger cars and trucks), auto trip purpose (commute, business and other trips), in 2021 and 2041

To estimate the project benefits or costs, VMT, VHT, and volume is broken down between business, commute, and leisure trips, using travel rates by trip purpose data from the Metroplan's CART regional travel demand model. Breaking down trip purpose is important for the analysis as commuting trips are annualized using business days per year, and have a higher cost of travel time as indicated in the INFRA/TIGER Benefit-Cost Analysis guidance[5].

Although traffic projections were analyzed for 2021 and 2041, the economic impact assessment for the 30 Crossing Project was conducted for the 20-year period following the project opening in 2023. Therefore, the estimation of the highway user impacts involved establishing the following scenarios:

- No-Action:
  - 2023 Baseline plus Committed Projects
  - 2043 Baseline plus Committed Projects
- 6-Lane with C/D SPUI:
  - 2023 Baseline plus Committed Projects plus 6-Lane with C/D SPUI
  - 2043 Baseline plus Committed Projects plus 6-Lane with C/D SPUI
- 6-Lane with C/D SDI:
  - 2043 Baseline plus Committed Projects plus 6-Lane with C/D SDI
  - 2043 Baseline plus Committed Projects plus 6-Lane with C/D SDI

[5] U.S. DOT Benefit-Cost Analysis (BCA) Resource Guide for TIGER and INFRA Grant Applications, July 2017. https://www.transportation.gov/sites/dot.gov/files/docs/USDOT%20VOT%20Guidance%202014.pdf

The results provided by the micro-simulation and the travel demand model are then used to estimate the travel efficiencies associated with the Build alternative (relative to the No- Action alternative). The VMT estimates for the analysis years are calculated using the cumulative annual growth rate (CAGR) presented in Equation 1 below. Changes in VMT between the Build and the No- Action over the 2023-2043 analysis period are then estimated based on Equation 2 and Equation 3. Similarly, VHT and volume for the intermittent analysis years are estimated by substituting VMT with VHT and volume in Equation 1, Equation 2 and Equation 3.

Changes in VMT between the Build and the No- Action over the 2023-2043 analysis period are estimated based on Equation 2 and Equation 3. Similarly, VHT and volume for the intermittent analysis years are estimated by substituting VMT with VHT and volume in Equation 1, Equation 2 and Equation 3.

Equation (1):

$$CAGR^{No-Action} = \left(\frac{VMT_{2041}^{No-Action}}{VMT_{2021}^{No-Action}}\right)^{\left(\frac{1}{2041-2021}\right)} - 1$$

$$CAGR^{Build} = \left(\frac{VMT_{2041}^{Build}}{VMT_{2021}^{Build}}\right)^{\left(\frac{1}{2041-2021}\right)} - 1$$

Equation (2):

$$VMT_t^{No-Action} = VMT_{2021}^{No-Action} \times (1 + CAGR^{No-Action})^{(t-2021)} \qquad Where: 2023 \leq t \leq 2043$$

Equation (3):

$$VMT_t^{Build} = VMT_{2021}^{Build} \times (1 + CAGR^{Build})^{(t-2021)} \qquad Where: 2023 \leq t \leq 2043$$

The corresponding changes between the Build and No-Action alternatives are then estimated using Equation 4.

Equation (4):

$$\Delta VMT_t = VMT_t^{Build} - VMT_t^{No-Action} \qquad Where: 2023 \leq t \leq 2043$$

Daily VMT, VHT, and volume in the No-Action and Build alternatives in the project opening year 2023 and the horizon year 2043 are used to estimate annual changes (Table 2.3 and Table 2.5). As shown in the table, both passenger cars and trucks would save time due to the added capacity provided by the Project. However, in spite of decrease in VHT, passenger cars and truck trip VMT will increase in the 2023 to 2043 period. Daily VMT, VHT, and volume accruing to commute and business trips are annualized by assuming 265 working days a year (i.e., 52 weeks excluding weekends). Daily VMT, VHT, and volume for other trips are annualized by multiplying daily values by 315 days (i.e., 52 weeks excluding Sundays). Daily VMT, VHT, and volume for truck trips are annualized by multiplying daily values by 365 days, since these trips occur on every day of the week.

Table 2.3 Daily VMT, VHT, and Volume (2023 to 2043)

	Passenger Cars			Trucks		
Scenarios	VMT	VHT	Volume	VMT	VHT	Volume
No-Action 2023	2,014,038	51,889	536,748	130,171	3,369	31,190
No-Action 2043	2,256,876	102,369	605,382	146,410	6,839	34,647
6-lane with C/D SPUI 2023	2,302,959	48,573	584,957	117,639	2,459	27,363
6-lane with C/D SPUI 2043	2,684,517	69,958	672,749	177,350	4,351	39,445
6-lane with C/D SDI 2023	2,329,808	51,987	592,178	118,676	2,639	27,645
6-lane with C/D SDI 2043	2,706,880	76,398	682,710	177,050	4,747	39,688

Source: VMT, VHT, and volume are estimated based on the outputs from the Metroplan's CARTS Travel Demand Model and VISSIM micro-simulations in 2021 and 2041, assuming a linear growth rate.

Table 2.4 Daily Changes in VMT, VHT, and Volume Compared to No-Action (2023 to 2043)

	Passenger Cars			Trucks		
Scenarios Comparison	VMT	VHT	Volume	VMT	VHT	Volume
6-lane with C/D SPUI 2023 – No-Action 2023	288,921	(3,316)	48,209	(12,532)	(910)	(3,827)
	14.3%	-6.4%	9.0%	-9.6%	-27.0%	-12.3%
6-lane with C/D SPUI 2043 – No-Action 2043	427,640	(32,411)	67,367	30,940	(2,487)	4,798
	18.9%	-31.7%	11.1%	21.1%	-36.4%	13.8%
6-lane with C/D SDI 2023 – No-Action 2023	315,770	97	55,430	(11,494)	(730)	(3,545)
	15.7%	0.2%	10.3%	-8.8%	-21.7%	-11.4%
6-lane with C/D SDI 2043 – No-Action 2043	450,003	(25,970)	77,327	30,640	(2,092)	5,041
	19.9%	-25.4%	12.8%	20.9%	-30.6%	14.6%

Source: Outputs from VISSIM and Metroplan's CARTS Travel Demand Model.

State of Good Repair of the Highway Infrastructure

The expected increase (or decrease) in VMT will lead to an increase (or decrease) in pavement wear and tear over the analysis period. The method to assess highway system state of good repair (SOGR) impacts involves estimation of the marginal external cost associated with pavement maintenance by vehicle type and highway functional class. This analysis uses the average external marginal costs for urban highways provided by the Federal Highway Administration (FHWA) (Table 2.5) which represent the additional spending (or saving) in all costs of maintaining pavements, including resurfacing and reconstruction, resulting from a unit increase/decrease in VMT borne by public agencies responsible for highway maintenance. The marginal pavement cost is multiplied by the annual changes in VMT over the 2023-2043 analysis period.

To find the total value of benefits/disbenefits associated with SOGR, the difference between No-Action and Build VMT by vehicle class is then multiplied by the corresponding unit costs of auto and truck impacts on the pavement. The total impact of SOGR benefits/disbenefits are then estimated for each year of the analysis.

Table 2.5 Marginal External Pavement Cost by Vehicle Class

Vehicle Class	Urban Highways (Average in $2000)	Urban Highways (Average in $2016)
Passenger Cars	0.001	0.001
Trucks	0.182	0.253

Source: FHWA, 1997 Federal Highway Cost Allocation Study, Final Report, Table V-26. (http://www.fhwa.dot.gov/policy/hcas/final/five.cfm.)

Note: The Marginal pavement cost was inflated from 2000 to 2016 dollars based on the Consumer Price Index for all urban consumers (CPI-U).

Travel Time Benefits/Disbenefits

The expected increase in travel speeds under the Build Alternatives (compared to the No-Action Alternative) would result in reduced travel time for highway users. In contrast, lower travel speeds under the Build Alternatives (compared to the No-Action Alternative) would result in additional travel time for highway users. Although VMT may increase due to added capacity, the VHT reduction would result in travel time cost savings for more travelers.

The estimation of travel time cost benefits involves multiplying the value of time (VOT) by trip purpose and average vehicle occupancy (AVO) by the corresponding changes in VHT. Hourly wage rates in the MPO region are applied in the calculations of the dollar value of travel time of highway users (Table 2.6). This study recognizes that both traveling to work and traveling from work have economic value but uses a conservative approach. For commuters, the VOT is estimated by using fifty percent of the hourly wage rate for “all occupations” in the MPO region. This is based on FHWA guidelines[6] for conducting economic analysis of highway projects and considers the fact that while commute times can impact productivity and demand for higher wages, part of the travel time also represents opportunity costs and not real monetary economic costs.

Table 2.6 Hourly Wage Rates in the Little Rock - North Little Rock Metro Area

Occupation	Hourly Wage Rate (in 2016$)	Trip Type	Value of Time (VOT) (in 2016$)	Average Vehicle Occupancy
All Occupations	$20.70	Auto, Commute	$10.35	1.15
		Auto, Business	$20.70	1.15
		Auto, Leisure	$10.35	1.39
Truck Drivers (Average)	$17.51	Truck, Business	$17.51	1.07

Source: Employment wages for the Little Rock - North Little Rock Metro Area provided by the Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES). Period: May 2016.

The VOT associated with business trips made by passenger cars and trucks is valued at one-hundred percent. Travel time associated with leisure and recreational trips are assumed to only represent opportunity

[6] U.S. DOT Benefit-Cost Analysis (BCA) Resource Guide for TIGER and INFRA Grant Applications, July 2017. https://www.transportation.gov/sites/dot.gov/files/docs/USDOT%20VOT%20Guidance%202014.pdf

costs and are not used in this economic impact analysis. However, travel time changes could affect the decision of whether or not to make the trip. This is examined under the tourism analysis in section 3.1.6. For business and truck trips, the total travel time cost is considered out-of-pocket or on-the-clock costs. Travel time cost benefits/disbenefits are estimated by multiplying the VOT by vehicle type and trip purpose by its corresponding annual changes in VHT over the 2023-2043 analysis period.

Vehicle Operating Costs Benefits/Disbenefits

The reduction in VMT also generates savings in the cost associated with the operation and maintenance of passenger cars and trucks. In contrast, increased VMT would lead to increased vehicle operating costs (VOC). VOC include fuel and non-fuel costs. The non-fuel cost component is comprised of all the necessary replacement items on the vehicle and regular maintenance (e.g., oil and fluid changes, tire rotations, tire replacements, and wiper replacement) as well as truck/trailer lease or purchase payments, permits and licenses, and other related costs to owners of commercial vehicles.

The method to assess VOC benefits/disbenefits involves estimation of the VOC per vehicle type. In this sense the fuel costs are separated from the remainder of VOCs. Average per-mile VOC for passenger vehicles is estimated based on the VOC for three size categories of sedans (i.e., small, medium and large sedans), four wheel-drive sport utility vehicles (SUV) and minivans provided by the American Automobile Association (AAA) (Table 2.7). This analysis uses the average auto VOC resulting from 15,000 miles traveled per year. Average per-mile VOC for trucks is estimated using published analyses of the operational costs for trucking based on information provided directly by motor carriers to the American Transportation Research Institute (ATRI) (Table 2.8). The VOC for autos and trucks are provided in 2016 dollars. It should be noted that the average cost of fuel is subtracted from these values to estimate non-fuel VOCs.

VOC benefits/disbenefits are estimated by multiplying the average marginal VOC by vehicle type by its corresponding annual changes in VMT over the 2023-2043 analysis period. The fuel cost component on the other hand is estimated by evaluating the fuel consumption of vehicles in each alternative using the average trip distance and speed values. The average speed determines the fuel consumption on a gallon per vehicle miles basis, whereas the average trip distance determines total fuel consumption for different trip purposes. The change in fuel consumption across the alternatives in the analysis period is multiplied by gas and diesel prices in Arkansas, which yields total benefits/disbenefits of fuel consumed. This fuel cost component is then added to the rest of the VOCs.

Table 2.7 Average Marginal Vehicle Operating Cost for Passenger Vehicles, 2016

Auto Type	VOC (in Cent per Mile) $ 2016		
	10,000	**15,000**	**20,000**
Small Sedan	58.1	44.5	37.4
Medium Sedan	76.8	58.1	48.4
Large Sedan	94.3	70.8	58.7
Sedan (Composite Average)	76.4	57.8	48.2
4WD Sport Utility Vehicle	91.7	69.3	58.0
Minivan	83.1	62.6	52.2
Average (in 2016$)	**83.8**	**63.2**	**52.8**

Notes: (1) The source of the data is the American Automobile Association (AAA). Your Driving Costs, 2016 Edition. Available at http://exchange.aaa.com/automobiles-travel/automobiles/driving-costs/. (2) VOC per mile derived from a popular model of each type listed assuming ownership of more than 5 years or 75,000 miles before replacement. (3) VOC per mile includes costs for fuel, maintenance, tires, full-coverage insurance, fees (license, registration and taxes), depreciation, and financing.

Source: The Marginal pavement cost was inflated from 2015 to 2016 dollars based on the Consumer Price Index for all urban consumers (CPI-U).

Table 2.8 Average Marginal Vehicle Operating Cost for Trucks in the Southeast Region

Operating Cost	VOC ($ per Mile) in 2016
Fuel Costs	$0.41
Truck/Trailer Lease or Purchase Payments	$0.25
Repair & Maintenance	$0.15
Truck Insurance Premiums	$0.07
Permits and Licenses	$0.02
Tires	$0.04
Tolls	$0.03
Total =	**$0.960**

Source: American Transportation Research Institute (ATRI), An Analysis of the Operational Costs of Trucking: 2016 Update (ATRI, September 2016), Table 18, p. 29. Available at: http://atri-online.org/2016/09/26/an-analysis-of-the-operational-costs-of-trucking-2016-update.

2.3.2 Community Impacts

Non-Carbon Emissions Cost Benefits/Disbenefits

This category of project benefits (disbenefits) captures the savings (or additional expenditures) in emission damage costs resulting from reduced (increased) VMT and changes in average speeds under the Build alternatives (compared to the No-Action). This analysis applies the running emission rates to Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), Particular Matter (PM) and Sulfur Dioxide (SOx) for passenger cars and trucks on urban restricted access roads estimated by Cambridge Systematics (CS) using MOVES2014 (Table 2.9). The 2015 running emission rates are used to estimate the emission damage costs over the 2023-2024 period and the 2025 running emission rates are used to estimate the emission damage costs over the 2025-2043 period.

Table 2.9 Running Emission Rates in 2015 and 2025

2015 Running Emission Rates (g/mile)				2025 Running Emission Rates (g/mile)			
Pollutant	Speed (mph)	Light Duty	All Trucks	Pollutant	Speed (mph)	Light Duty	All Trucks
		4-Urban Restricted Access	4-Urban Restricted Access			4-Urban Restricted Access	4-Urban Restricted Access
NOx	2.5	1.43	35.33	NOx	2.5	0.0913	2.7348
NOx	5	1.04	18.82	NOx	5	0.0705	1.4759
NOx	10	0.81	11.15	NOx	10	0.0566	0.8743
NOx	15	0.69	9.27	NOx	15	0.0472	0.7189

2015 Running Emission Rates (g/mile)				2025 Running Emission Rates (g/mile)			
Pollutant	**Speed (mph)**	**Light Duty**	**All Trucks**	**Pollutant**	**Speed (mph)**	**Light Duty**	**All Trucks**
		4-Urban Restricted Access	**4-Urban Restricted Access**			**4-Urban Restricted Access**	**4-Urban Restricted Access**
NOx	20	0.61	8.04	NOx	20	0.043	0.6142
NOx	25	0.61	7.29	NOx	25	0.044	0.5526
NOx	30	0.63	7.05	NOx	30	0.0467	0.5268
NOx	35	0.67	6.19	NOx	35	0.0534	0.4569
NOx	40	0.71	6.01	NOx	40	0.0582	0.4363
NOx	45	0.73	5.87	NOx	45	0.0616	0.4206
NOx	50	0.74	5.7	NOx	50	0.063	0.4012
NOx	55	0.74	5.52	NOx	55	0.0635	0.3838
NOx	60	0.75	5.48	NOx	60	0.0649	0.3855
NOx	65	0.78	5.78	NOx	65	0.0703	0.4004
NOx	70	0.84	6.04	NOx	70	0.0802	0.4133
NOx	75	0.92	6.34	NOx	75	0.0929	0.4314
$PM_{2.5}$	2.5	0.0759	2.1363	$PM_{2.5}$	2.5	0.0368	0.0862
$PM_{2.5}$	5	0.0455	1.26	$PM_{2.5}$	5	0.0217	0.073
$PM_{2.5}$	10	0.0295	0.7296	$PM_{2.5}$	10	0.014	0.0425
$PM_{2.5}$	15	0.0234	0.582	$PM_{2.5}$	15	0.0113	0.0298
$PM_{2.5}$	20	0.0187	0.4925	$PM_{2.5}$	20	0.0089	0.0228
$PM_{2.5}$	25	0.0162	0.4456	$PM_{2.5}$	25	0.0074	0.0204
$PM_{2.5}$	30	0.0152	0.4107	$PM_{2.5}$	30	0.0066	0.0178
$PM_{2.5}$	35	0.016	0.3295	$PM_{2.5}$	35	0.0063	0.0142
$PM_{2.5}$	40	0.0166	0.3032	$PM_{2.5}$	40	0.0061	0.0125
$PM_{2.5}$	45	0.0168	0.2825	$PM_{2.5}$	45	0.0059	0.0111
$PM_{2.5}$	50	0.0161	0.2507	$PM_{2.5}$	50	0.0054	0.0095
$PM_{2.5}$	55	0.0145	0.216	$PM_{2.5}$	55	0.0048	0.0079
$PM_{2.5}$	60	0.0133	0.1968	$PM_{2.5}$	60	0.0044	0.007
$PM_{2.5}$	65	0.0127	0.1978	$PM_{2.5}$	65	0.0041	0.0069
$PM_{2.5}$	70	0.0126	0.198	$PM_{2.5}$	70	0.004	0.0068
$PM_{2.5}$	75	0.0132	0.2031	$PM_{2.5}$	75	0.0042	0.0068
VOC	2.5	2.38	3.76	VOC	2.5	0.26	0.33
VOC	5	1.28	2.11	VOC	5	0.14	0.19
VOC	10	0.72	1.13	VOC	10	0.08	0.1
VOC	15	0.53	0.8	VOC	15	0.06	0.08
VOC	20	0.42	0.62	VOC	20	0.04	0.06
VOC	25	0.36	0.53	VOC	25	0.04	0.05
VOC	30	0.32	0.47	VOC	30	0.03	0.05
VOC	35	0.3	0.42	VOC	35	0.03	0.04
VOC	40	0.29	0.38	VOC	40	0.03	0.04
VOC	45	0.28	0.36	VOC	45	0.03	0.04
VOC	50	0.26	0.34	VOC	50	0.03	0.03
VOC	55	0.25	0.32	VOC	55	0.03	0.03
VOC	60	0.24	0.3	VOC	60	0.03	0.03
VOC	65	0.24	0.29	VOC	65	0.03	0.03
VOC	70	0.25	0.28	VOC	70	0.03	0.03
VOC	75	0.27	0.27	VOC	75	0.03	0.03
SOx	2.5	0.0427	0.073	SOx	2.5	0.0091	0.0598
SOx	5	0.0237	0.0406	SOx	5	0.005	0.0334
SOx	10	0.014	0.0253	SOx	10	0.003	0.0206
SOx	15	0.0111	0.0224	SOx	15	0.0024	0.0182

2015 Running Emission Rates (g/mile)				2025 Running Emission Rates (g/mile)			
Pollutant	Speed (mph)	Light Duty	All Trucks	Pollutant	Speed (mph)	Light Duty	All Trucks
		4-Urban Restricted Access	4-Urban Restricted Access			4-Urban Restricted Access	4-Urban Restricted Access
SOx	20	0.0093	0.0198	SOx	20	0.002	0.016
SOx	25	0.0083	0.0185	SOx	25	0.0018	0.015
SOx	30	0.0078	0.0182	SOx	30	0.0017	0.0147
SOx	35	0.0076	0.0157	SOx	35	0.0016	0.0126
SOx	40	0.0075	0.0154	SOx	40	0.0016	0.0123
SOx	45	0.0074	0.0152	SOx	45	0.0016	0.0121
SOx	50	0.0072	0.0147	SOx	50	0.0015	0.0116
SOx	55	0.0071	0.0141	SOx	55	0.0015	0.0111
SOx	60	0.007	0.014	SOx	60	0.0015	0.0112
SOx	65	0.0071	0.0149	SOx	65	0.0015	0.0118
SOx	70	0.0073	0.0156	SOx	70	0.0016	0.0123
SOx	75	0.0077	0.0166	SOx	75	0.0016	0.013

Sources: 1) U.S. DOT, Federal Transit Administration. New and Small Starts Evaluation and Rating Process. Final Policy Guidance. August 2013. 2) Emission rates estimated by Cambridge Systematics using MOVES2014.

The average speed based emissions rates (in grams per mile) of non-carbon emissions (VOC, NOx, PM and SOx) are multiplied by the annual changes in VMT resulting from the implementation of the Project, converted to short tons and then, multiplied by the emission cost per short ton depicted in Table 2.10.

Table 2.10 Emission Damage Cost Rates for Major Pollutants

Emission Type	Emission Damage Cost ($ per Short Ton) in $2016
VOCs	1,872
NOx	7,377
PM	337,459
SOx	43,600

Source: Source: U.S. DOT Benefit-Cost Analysis (BCA) Resource Guide for TIGER and INFRA Grant Applications, July 2017; Corporate Average Fuel Economy for MY2017-MY2025 Passenger Cars and Light Trucks (August 2012), page 922, Table VIII 16, “Economic Values Used for Benefits Computations (2010 dollars). Available at https://www.transportation.gov/fastlanegrants/bca-resource-guide.

Traffic Safety Benefits/Disbenefits

The change in traffic accidents depends on the change in VMT by passenger cars and trucks, the average crash cost per VMT as a function of vehicle type, and crash reduction improvements for proposed alternatives. The assessment of the safety benefits/disbenefits involves collecting crash costs by crash types and applying crash reduction factors due to changes in Build alternatives. This analysis uses the crash costs values depicted in Table 2.11. The changes in crash rates per VMT across the proposed alternatives represent different estimated crash numbers in a given year. Hence, annual crash rates for each alternative are compared with the base alternative (No-Action). The changes in crashes across the KABCO categories are then multiplied by dollar value of crash costs to yield the total benefits/disbenefits of each alternative.

Table 2.11 Recommended Monetized Values for Various Crash Types (KABCO)

Crash Type	Description	Monetized Value ($2016)
K	Fatal Accident	9,600,000
A	Incapacitating Injury	459,100
B	Non-incapacitating Injury	125,000
C	Possible Injury	63,900
O	Property Damage Only (PDO)	4,252
U	Injured (Severity Unknown)	174,000

Source: U.S. DOT Benefit-Cost Analysis (BCA) Resource Guide for TIGER and INFRA Grant Applications, July 2017.

2.4 Tourism and Travel Analysis

Tourism is a major economic contributor for the study area. In addition to recreational tourism, the combined Little Rock and North Little Rock region attracts significant business travel with conventions and conferences and residential travel to major shopping and event venues. The following aspects of the tourism impacts in the study area are analyzed:

- Major tourist attraction
- Demographic tourism statistics, such as:
    1. Tax revenues
    2. Annual tourism expenditures
    3. Estimated number of annual visitors
- Travel and tourism related employment (direct and indirect); and
- Travel dependent worker flow in the study area

The tourism analysis relies on the data provided by the Arkansas Department of Parks and Tourism. The 2015 survey of Arkansas visitor centers as well as the 2015 tourism statistics for Arkansas provided by the U.S. Travel Association aids in estimating annual visitor trips, average annual expenditures by visitors, and local and state tax revenues from tourism. In addition, the tourism analysis relies on the U.S Census Bureau data which provide detailed statistics of tourism related employment in Pulaski County and the study corridor that may be affected by the project.

The tourism analysis estimates the impact of the proposed alternatives on tourism expenditures as well as state and local tax revenues. To estimate the economic benefits of tourism, first the potential number of visitors (per person-trips) that are impacted by the project have to be determined using the following equation:

$$Potential\ number\ of\ visitors\ (per\ person-trips) impacted\ =\ Project\ Corridor\ Visitors\ (per\ person-trips) \times (Percent\ Day\ Trips)$$

Increased visitor trips (per person-trips) were estimated by applying the vehicle travel elasticities with respect to travel-time, which is estimated at -0.27 on urban roads[7]. The travel time elasticity value of -0.27 means that for 1 unit reduction in travel time, the number of leisure trips will increase by 0.27. On the other hand for 1 unit increase in travel time, the number of leisure trips will decrease by 0.27. The percentage change in average leisure trip length is multiplied by the number of potentially impacted trips as shown below:

$$Increased\ tourism\ trips =$$
$$0.27\ X\ \%\Delta Travel\ time\ arising\ from\ project\ alternatives\ X\ number\ of\ potentially\ impacted\ trips$$

An increase in tourism trips is anticipated to positively impact the project corridor travel and leisure sector, while a decrease would negatively impact the region. Using historical data, the tourism expenditures, tourism payroll, state and local taxes are estimated on a per visitor (person-trip) basis. Then these unit costs are multiplied by the total increase in tourism trips in the project corridor. The sum of these monetary changes due to increased tourism activity yields the total dollar value of economic impacts to the project corridor.

2.5 Freight Navigability Analysis

An important component of the economic assessment is understanding how maritime navigability and freight flows will be impacted. Unlike auto and transit commuter flow that can be estimated through traffic simulations, the impact of the Build alternatives on maritime shipping flows cannot be estimated through travel demand modeling. There are several freight dependent industries in the study area, among them the Union Pacific Railroad, Goff Distribution Inc., the Little Rock Airport, and multiple ports along the Arkansas River in the region.

The freight analysis entails historical analysis of maritime freight transportation and existing safety challenges through the Arkansas River and evaluating Arkansas River closure impacts on industry. The evaluation of maritime movement by major commodity types and major origin and destination points within the study area will aid in characterizing the changes in commodity flows (tonnage) that may be impacted by the 30 Crossing Project.

2.6 Multimodal Analysis

The study region is served by Rock Region METRO’s street car and bus systems. One of the major goals of the 30 Crossing Project is to enhance active transportation on the surface streets within the project corridor. The 30 Crossing Project will have direct impacts on multiple bus routes serving North Little Rock and Downtown Little Rock that use the I-30 corridor or its adjacent surface streets. Furthermore, the project will impact the blue and green street car routes in downtown Little Rock. It is anticipated that enhanced auto and truck movement in the study region will improve bus and street car service. An important component of the economic assessment is to understand how commuter flows will be impacted. While auto and transit commuter flow can be estimated through traffic simulations, this qualitative analysis entails evaluating the impacts of proposed Build alternatives as well as the No-Action alternative on businesses that rely on public transit, bicycling and walking for employees and customers.

[7] Litman, T. (2013). Understanding Transport Demand and Elasticities: How Prices and other Factors Affect Travel Behavior. Victoria Transport Policy Institute. Accessed from http://www.vtpi.org/elasticities.pdf

2.7 Construction, Operations and Maintenance Costs

The initial design and construction costs of the project are estimated to be $631.7 million in 2016 dollars as noted in Metroplan's Long Range Metropolitan Transportation Plan (LRMTP) and latest Transportation Improvement Program (TIP). Although the project is included in the TIP, the final project cost estimate will be determined following the completion of NEPA analysis. In this analysis the existing estimate of $631.7 million is used to develop a detailed life cycle cost analysis. Construction is expected to start in 2019 and be completed in phases by 2022. Since the project is being planned as a design-build project, the design and engineering costs are included in the original project estimate.

In addition to design and construction costs, the proposed Build alternatives will also involve operations and maintenance (O&M) expenditures in the 2023 to 2043 analysis period. In order to estimate O&M expenditures, the total lanes-miles of highways for each alternative is calculated using the latest project environmental analysis report[8]. The unit cost for maintenance and rehabilitation items are derived from ARDOT estimates in 2014 on a per lane-mile basis. Table 2.12 presents the unit cost of maintenance and rehabilitation items as well as their schedule of occurrence.

Table 2.12 O&M Unit Costs

O&M Items	Unit Cost ($2014)	Unit Cost ($2016)	Occurrence Interval	Occurrence Years (Build)
Maintenance (Overlays)	$110,000	$111,536	7-10 years	2029, 2036, 2043
Rehabilitation (Patchwork)	$895,000	$709,775	15-20 years	Not Required due to maintenance intervention and new construction
Reconstruction (Freeway-Urban)	1,600,000	$1,622,342	20+ years	Not Required due to maintenance intervention and new construction

Source: ARDOT Highway Construction Cost Estimate 2014.

Note: The O&M unit costs were inflated from 2014 to 2016 dollars based on the Consumer Price Index for all urban consumers (CPI-U).

The project life cycle costs for the Build alternatives are evaluated using the total lane-mile estimates for each alternative. The construction and O&M expenditures are also used as basis for the estimation of the total number of jobs created by the project construction activities and maintaining the facility over the analysis period. Although the No-Action alternative does not involve major construction, the study corridor will need O&M expenditures to preserve existing conditions. The No-Action O&M activities will include major resurfacing on I-30 as well as the Arkansas River Bridge replacement. The O&M costs of the No-Action alternative are estimated by ARDOT, and if traffic projections persist in the future the No-Action alternative may result in significantly higher O&M costs compared to the Build alternatives.

[8] ARDOT, Interchange Justification Report, CA0602, I-30/I-40, June 2017

2.8 Asset Residual Value

Major infrastructure projects such as bridges and tunnels have a useful lifespan that lasts beyond the 2-year analysis timeframe used in this economic analysis. For the purpose of this economic impacts analysis a useful service life of 50 years is selected for the I-30 Bridge. Residual value for the bridge infrastructure are not included in the analysis based on an assumption that over 20 years, the cumulative operations and maintenance costs will approach the value of the asset. The formula for estimating the residual value of a major asset, such as a bridge or tunnel is provided by the U.S. DOT Guidance for TIGER/INFRA benefit cost analysis[9]:

$$Residual\ Value = \left(\frac{Bridge\ Service\ Life - Analysis\ Period}{Bridge\ Service\ Life}\right) \times (Bridge\ Cost\ in\ \$2016) - (Total\ Estiamted\ O\&M\ Costs\ for\ the\ Remaing\ Service\ Life)$$

[9] U.S. DOT Benefit-Cost Analysis (BCA) Resource Guide for TIGER and INFRA Grant Applications, July 2017. https://www.transportation.gov/sites/dot.gov/files/docs/USDOT%20VOT%20Guidance%202014.pdf

3.0 Economic Analysis Findings

This chapter presents the potential direct effects and the total economic (direct, indirect and induced) impacts resulting from each of the 30 Crossing Project alternatives. The first section (3.1) provides the direct qualitative project benefits/disbenefits under the following categories:

- Highway user impacts measured in terms of the state of good repair of the highway infrastructure, travel time costs and vehicle operating costs;
- Community impacts measured by broader societal benefits such as air quality and highway safety; and
- Tourism impacts.

The second section (3.2) provides the direct quantitative project benefits/disbenefits under the following categories:

- Maritime navigability impacts; and
- Multimodal transportation impacts measured in terms of benefits accruing to transit and active transportation users.

The third section (3.3) presents the construction, operation, and maintenance costs of the project alternatives.

The fourth section presents the total (*direct*, *indirect* and *induced*) economic impacts that are expected to be generated by the 30 Crossing Project alternatives as a result of the quantifiable direct impacts accruing to highway users (over the 2023-2043 analysis period), project construction expenditures (over the project construction time frame), and project operating expenses (over the 2023-2043 analysis period).

3.1 Direct and Indirect Quantitative Impacts

Direct transportation system user impacts, including value of travel-time, state of good repair cost impacts, vehicle operating costs, emissions and safety, represent the key inputs into the economic modeling. This chapter presents the results of economic impact analysis and details of economic modeling simulation. The economic impacts analysis results are reported for the 2023 to 2043 period following the completion of project construction. The quantitative impacts are reported in 2016 dollars as well as net present value basis using a 3 percent a 7 percent discount rate.

3.1.1 State of Good Repair of the Highway Infrastructure

The results of VISSIM micro-simulations shows an increase in VMT for all Build alternatives. This increase in VMT will potentially result in increased SOGR costs. Using the marginal external pavement cost of autos and trucks, the impacts of Build alternatives are capitalized for the 2023 to 2043 period. The monetary value of reduced/additional pavement maintenance costs are reported in 2016 dollars and are also discounted using a 3 percent and 7 percent discount rate. Table 3.1 presents the SOGR benefits/disbenefits for the Build alternatives.

Table 3.1 Cumulative SOGR Benefits/Disbenefits (2023-2043)

SOGR Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Changes in Auto Miles Traveled	2,327,871,587	2,484,499,113
Changes in Truck Miles Traveled	77,578,453	80,421,271
Changes in SOGR Maintenance Costs (in 2016$)	$(22,870,784)	$(23,808,286)
NPV of SOGR Maintenance Costs Changes (3%)	$(10,848,243)	$(11,524,699)
NPV of SOGR Maintenance Costs Changes (7%)	$(3,889,591)	$(4,335,172)

Source: Cambridge Systematics Economic Modeling.
Note: Positive $ values represent savings and negative $ values represent losses

3.1.2 Travel Time and Truck Travel Reliability Benefits/Disbenefits

Changes in VMT along the corridor will affect VHT and travel time. The proposed Build alternatives are expected to have positive impacts on travel speeds. The reduction of travel time and improved speeds will result in travel time savings across various trip types. Using the value of travel time (VOT) unit costs, the impact of travel time savings is capitalized for the 2023 to 2043 period. The monetary value of reduced/additional travel time costs are reported in 2016 dollars and are also discounted using a 3 percent and 7 percent discount rate. Table 3.2 presents the travel time cost savings benefits/disbenefits for the Build alternatives.

In addition to travel time benefits/disbenefits, truck travel times are also affected by reliability of travel. In instances where there are travel time savings, truck travel also realizes additional benefits due to congestion relief. Practically for shippers and freight dependent industries, congestion relief and travel time savings has added benefits of more travel time reliability. The impact of congestion relief is estimated to be an additional 15% travel time savings for truck traffic[10]. Table 3.3 presents the impact of reliability on truck travel time cost savings benefits/disbenefits for the Build alternatives.

Table 3.2 Cumulative Travel Time Benefits/Disbenefits (2023-2043)

Travel Time Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Changes in Travel Time (in hours)	-126,482,236	-92,347,760
Travel Time Cost Changes (in 2016$)	$1,990,195,707	$1,457,899,826
NPV of Travel Time Costs Changes (3%)	$1,105,537,056	$790,779,101
NPV of Travel Time Costs Changes (7%)	$539,206,725	$371,617,197

[10] FHWA, Travel Time Reliability: Making It There On Time, All The Time. Available at: https://ops.fhwa.dot.gov/publications/tt_reliability/TTR_Report.htm

Source: Cambridge Systematics Economic Modeling.
Note: Positive $ values represent savings and negative $ values represent losses

Table 3.3 Cumulative Truck Travel Time Reliability Benefits/Disbenefits (2023-2043)

Truck Travel Time Reliability Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Changes in Truck Travel Time (in hours)	-1,950,588	-1,617,527
Changes in Truck Travel Time Cost (in 2016$)	$36,545,629	$30,305,497
NPV of Truck Travel Time Costs Changes (3%)	$21,175,670	$17,514,536
NPV of Truck Travel Time Costs Changes (7%)	$10,976,273	$9,046,660

Source: Cambridge Systematics Analysis.

Note: Positive $ values represent savings and negative $ values represent losses

3.1.3 Vehicle Operating Costs Benefits/Disbenefits

Changes in VMT will have a direct impact on vehicle operating costs (VOCs) of users. Similarly, changes in travel speeds will have an impact on fuel consumption and fuel costs for autos and trucks alike. In this analysis the fuel-based and non-fuel-based components of VOCs are calculated separately. The non-fuel component of VOCs is calculated using the changes in VMT and Average Marginal Vehicle Operating Costs of auto and trucks.

The fuel component of VOCs is calculated using estimated fuel consumption for autos and trucks and average gas and diesel prices in central Arkansas. The gas and diesel prices for central Arkansas are provided by AAA[11]. The fuel and non-fuel component of VOCs are then capitalized for the 2023 to 2043 period. The monetary value of reduced/additional VOCs are reported in 2016 dollars and are also discounted using a 3 percent and 7 percent discount rate. Table 3.4 presents the VOC benefits/disbenefits for the Build alternatives.

Table 3.4 Cumulative Vehicle Operating Costs Benefits/Disbenefits (2023-2043)

Vehicle Operating Costs Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Changes in Miles Traveled (Normalized by VMT)	756,901,527	527,964,929
Changes in Fuel Consumed (Normalized by Volume)	-100,263,506	-68,874,728
Changes in Non-Fuel Based VOCs (in 2016$)	($418,156,688)	$(292,680,672)

[11] American Automobile Association (AAA) State Gas Prices, http://gasprices.aaa.com/

Vehicle Operating Costs Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Changes in Fuel Based VOCs (in 2016$)	$207,298,484	$143,041,688
Changes in VOCs (in 2016$)	($210,858,204)	$(149,638,983)
NPV of VOCs Changes (3%)	($143,110,962)	$(105,603,959)
NPV of VOCs Changes (7%)	($89,061,573)	$(68,129,200)

Source: Cambridge Systematics Economic Modeling

Note: Positive $ values represent savings and negative $ values represent losses

3.1.4 Non-Carbon Emission Costs Benefits/Disbenefits

The emission cost category captures the changes in emissions generated by autos and trucks for the Build alternatives in comparison to the No-Action alternative. The emission amounts for various pollutants are first estimated using travel speeds and VMT for each alternative. The change in emission amounts are then multiplied by unit cost of impacts for different pollutants. The total cost of emissions are then capitalized for the 2023 to 2043 period. The monetary value of reduced/additional emissions costs are reported in 2016 dollars and are also discounted using a 3 percent and 7 percent discount rate. Table 3.5 presents the emission costs benefits/disbenefits for the Build alternatives.

Table 3.5 Cumulative Non-Carbon Emission Costs Benefits/Disbenefits (2023-2043)

Emission Costs Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Change in Non-Carbon Emissions Costs	$5,650,344	$3,485,609
NPV of Emission Costs Changes (3%)	$3,963,851	$2,520,765
NPV of Emission Costs Changes (7%)	$2,685,759	$1,782,190

Source: Cambridge Systematics Economic Modeling

Note: Positive $ values represent savings and negative $ values represent losses

3.1.5 Traffic Safety Benefits/Disbenefits

The reduction (or increase) of traffic accidents depends on the reduction (or increase) of crashes that is dependent on VMT and crash reduction factors. The proposed Build alternatives make substantial design safety changes to the corridor that will impact crash reduction in a positive way. The expected crash reduction by crash types is provided on a per million VMT units and is presented in Table 3.6. These crash rates are then multiplied by VMT to estimate number of crashes for each alternative. The change in crash rates will affect estimated number of crashes, which in turn will impact traffic safety costs.

Table 3.6 Crash Rates per Million VMT (2040)

Alternative/Crash Rates	K	A	B	C	U	O
No-Action	0.011	0.033	0.186	0.349	0.000	1.442
6-Lane with C/D SPUI	0.008	0.025	0.141	0.284	0.000	0.914
6-Lane with C/D SDI	0.008	0.025	0.143	0.294	0.000	0.897

Source: ARDOT, Interchange Justification Report: Appendix B – Traffic Results CA0602, I-30/I-40, July 2017

The estimated traffic safety costs for each alternative are then capitalized for the 2023 to 2043 period. The monetary value of reduced/additional crash costs are reported in 2016 dollars and are also discounted using a 3 percent and 7 percent discount rate. Table 3.7 presents the traffic costs benefits/disbenefits for the Build alternatives.

Table 3.7 Cumulative Traffic Safety Benefits/Disbenefits (2023-2043)

Traffic Safety Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Change in Motor Vehicle Crash Costs (in 2016$)	$332,450,280	$308,516,104
NPV of Change in Traffic Crash Costs (3%)	$207,480,868	$192,603,339
NPV of Change in Traffic Crash Costs (7%)	$118,148,310	$109,716,723

Source: Cambridge Systematics Economic Modeling

Note: Positive $ values represent savings and negative $ values represent losses

3.1.6 Tourism and Travel Impacts

Tourism is a major economic contributor for the study area. In addition to recreational tourism, the study area also attracts significant business travel with conventions and conferences and residential travel to major shopping and event venues. The Arkansas tourism industry in general has experienced significant growth. Based on the data provided by the U.S. Travel Association, in the 2000 to 2005 period tourism expenditures increased by at an annual rate of 4.4 percent from $3.8 billion to $7.2 billion. The total number of visitors in the same period increased at an annual rate of 2.2 percent from 20.3 million to 28.1 million person-trips[12]. Table 3.8 presents general tourism statistics for Arkansas as well as annual growth rates for the 2000-2015 period. The CAGR was used to forecast the tourism expenditures and the annual number of visitors for the state.

[12] A person-trip occurs, for the purpose of this study, every time one person goes to a place 50 miles or more, each way, from home in one day or is out of town one or more nights in paid or unpaid accommodations and returns to his/her origin. These trips do not include work commute or school trips.

Table 3.8 Arkansas Tourism Statistics

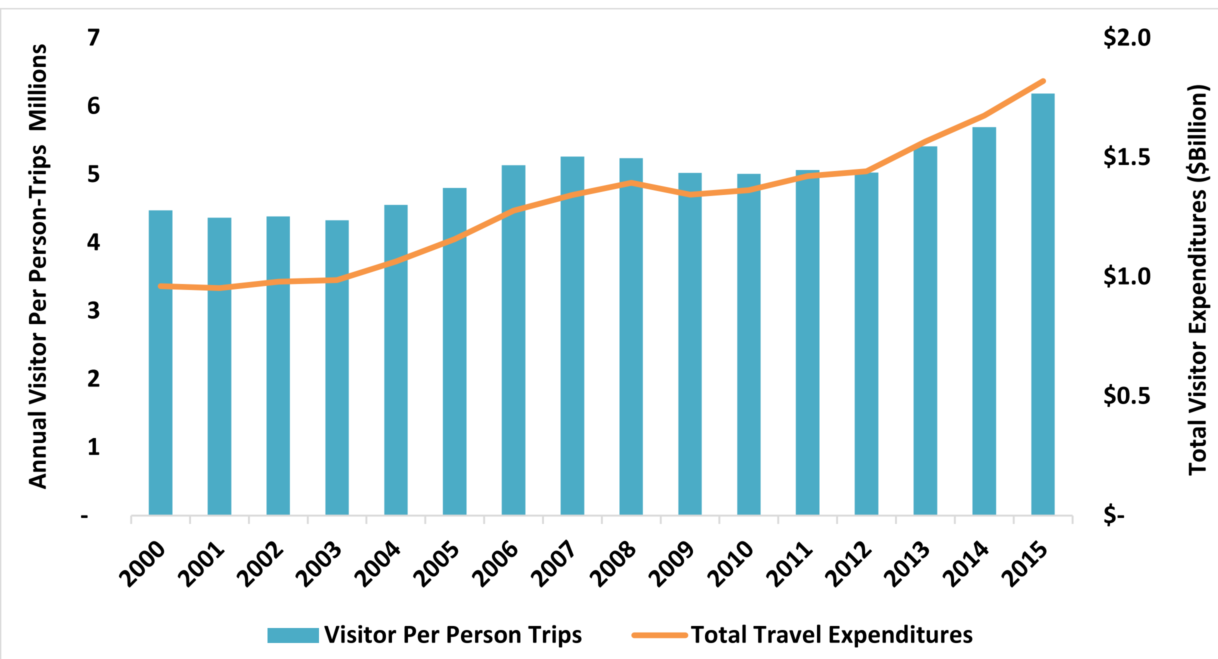
Tourism Statistics	2000	2015	2023	2043	CAGR (2000-2015)
Total Travel Expenditures ($Million)	$3,843	$7,281	$10,237	$23,995	4.4%
Travel Generated Payroll ($Million)	$661	$1,315	$1,898	$4,748	4.7%
Travel generated Employment	49,381	64,679	74,692	107,039	1.8%
Travel Generated State Tax ($Million)	$173	$374	$565	$1,580	5.3%
Travel Generated Local Tax ($Million)	$73	$138	$193	$450	4.3%
Visitor Per Person Trips	20,336,000	28,118,000	33,422,159	51,482,508	2.2%
Average Per Person-Trip Travel Expenditures	$188.98	$258.93	$306.28	$466.10	2.1%

Source: U.S. Travel Association 2015, Forecasts by Cambridge Systematics

A survey of state visitor centers in 2015 found that Texas, Missouri, Arkansas, Louisiana, and Oklahoma are among the top states of origin for Arkansas visitors[13]. The top five Arkansas counties listed as a final destinations are Garland, Pulaski, Benton, Carroll and Fulton.

At the center of the tourism activity, Pulaski County received over 25 percent of the tourism expenditures and 22 percent of the annual visitors (per person-trips). Figure 3.1 presents the annual Pulaski County visitors and visitor expenditures from 2000 to 2015. The 30 Crossing project serves as a major connector for the attractions in Downtown Little Rock and North Little Rock. Table 3.9 presents the summary of Pulaski county tourism statistics. The 2023 and 2043 values are forecasted using CAGR from Arkansas statistics.

Figure 3.1 Pulaski County Travel Volume and Visitor Expenditures (2000-2015)



Source: U.S. Travel Association 2015

[13] Arkansas Department of Parks and Tourism 2015 Survey.

Table 3.9 Pulaski County Tourism Statistics

Tourism Statistics	2000	2015	2023	2043
Total Travel Expenditures ($Million)	$961	$1,821	$2,560	$6,000
Travel Generated Payroll ($Million)	$173	$345	$497	$1,244
Travel generated Employment	10,333	13,534	15,630	22,398
Travel Generated State Tax ($Million)	$32	$69	$105	$292
Travel Generated Local Tax ($Million)	$16	$31	$44	$101
Visitor Per Person Trips	4,475,655	6,188,359	7,355,727	11,330,544
Average Per Person-Trip Travel Expenditures	$214.73	$294.21	$348.01	$529,58

Source: U.S. Travel Association 2015, Forecasts by Cambridge Systematics

The tourism analysis is based on the assumption that only day-trip tourists will be affected by the 30 Crossing project and out of state travel will not significantly benefit from travel time savings. Since out-of-state visitors travel several hours to access central Arkansas attractions among other destinations. Particularly, for some visitors Arkansas may not be their final destination, and the 30 Crossing project may not significantly affect their trip patterns. The process used to estimate the potential number of visitor trips impacted by the 30 Crossing Project is described below (Figure 3.2):

- **Step 1. Estimate Study Corridor Visitors (per person-trips):** To estimate study corridor visitors (per person-trips), this study uses the annual number of visitors visiting downtown Little Rock and North Little Rock. For Downtown Little Rock the number of annual visitors attending the Little Rock Convention Center and the River Market area is included in the analysis. For North Little Rock the annual visitors visiting the Verizon Arena, Arkansans Inland Maritime Museum, North Little Rock RV Park, and other parks in the study area vicinity. The visitor estimates are provided by the Little Rock and North Little Rock Visitors and Convention Bureaus.

- **Step 2. Estimate Study Corridor Visitors from Arkansas:** According to the Arkansas Department of Parks and Tourism, 58.6 percent of tourist trips in Arkansas are day trippers and they are likely to be impacted by the 30 Crossing Project. It is assumed that changes in traffic condition in the 30 Crossing Projects will impact tourism originating from within Arkansas. Hence, the I-30 travel efficiencies will not affect out-of-state travelers[14]. Day trip is defined as travel more than 50 miles from home.

- **Step 3. Estimate Travel Time Changes:** Travel time savings and changes in travel have a direct effect on the number of trips. The percent increase or decrease in average trip length between the Build and No-Action alternatives will affect the number of visitor trips on the project corridor. Hence, the percent change in average leisure trip length is estimated for all proposed Build alternatives as well as the No-Action alternative.

- **Step 4. Estimate Annual Increased/Decreased Visitor Trips:** To estimate the number of increased/decreased visitor trips, the vehicle travel elasticity with respect to travel-time is multiplied by the travel time changes for all visitor person-trips in the project corridor. The travel time elasticity (-0.27 for this study) times percent change in average trip length times per visitor person-trips yields total annual changes in visitor person-trips.

[14] Little Rock Convention and Visitors Bureau 2016 Annual Report.

- **Step 5. Estimate Annual Increased/Decreased Visitor Expenditures:** According to the Arkansas Department of Parks and Tourism, day-trippers spend on average $65 in Arkansas. Using historical data for Pulaski county, the average state and local tax rates for visitor expenditures are estimated on a per tourist spending dollar. Using the total estimated change in visitor day trips, the total change in tourism spending as well as local and state tax revenues are calculated for the study corridor.

This process is repeated for every year of the analysis from 2023 to 2043 for all the Build and No-Action alternatives. The difference in visitor expenditures as well as state and local taxes are then quantified and reported in 2016 dollars and are discounted using a 3 percent and 7 percent discount rate. Table 3.10 presents the tourism benefits/disbenefits for the Build alternatives. The Build alternatives are projected to lead to a net increase in tourism day trips and associated expenditures relative to the no-action alternative.

Figure 3.2 Process for Calculating the Potential Number of Annual Visitors to the Study Corridor Due to Travel Time Saving Elasticity

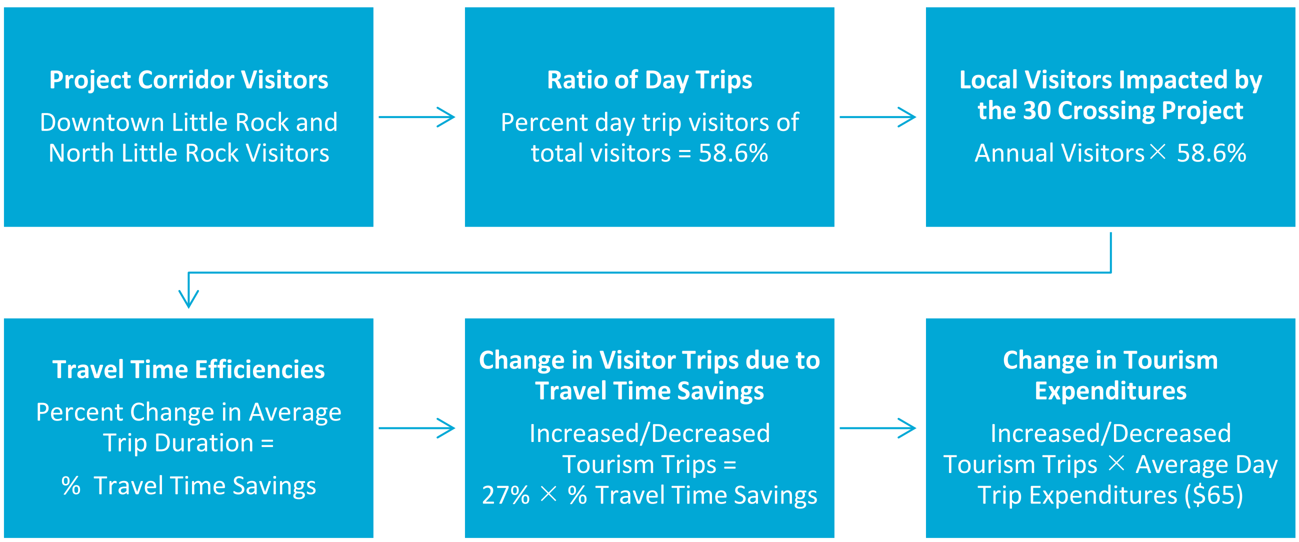


Table 3.10 Cumulative Travel and Tourism Benefits/Disbenefits (2023-2043)

Travel and Tourism Benefits/Disbenefits	6-Lane C/D SPUI	6-Lane C/D SDI
Change in Tourism Trips	1,344,036	1,182,540
Change in Tourism Expenditures (in 2016$)	$87,362,368	$76,865,115
NPV of Change in Tourism Expenditures (3%)	$49,745,299	$43,420,158
NPV of Change in Tourism Expenditures (7%)	$25,129,486	$21,679,778

Source: Cambridge Systematics Economic Modeling

Note: Positive $ values represent savings and negative $ values represent losses

3.1.7 Maritime Navigability Impacts

The Arkansas inland waterways system links the state to coastal ports in the Gulf of Mexico like Mobile, New Orleans, Morgan City, Houston, and Brownsville. The Arkansas River (McClellan-Kerr Arkansas River Navigation System, MKARNS) provides navigation through Arkansas from its connection to the Mississippi River south of Helena to Catoosa, Oklahoma. Three hundred eight (308) miles of channel are located in Arkansas. The river is currently navigable with a 9-foot draft; however, it is authorized, but not funded, for 12-foot navigation. Public ports are located on the Arkansas River at Little Rock adjacent to the study corridor. In Arkansas, thirteen locks and dams are located on the MKARNS. The majority of the locks and dams have a relatively equal amount of tonnage moving upbound and downbound, with slightly more downbound traffic. Traffic volumes increase moving downriver and as the MKARNS locks and dams approach the confluence of the Arkansas and Mississippi Rivers. Downbound traffic is dominated by grains destined for Louisiana and upbound traffic is dominated by chemical fertilizer originating at Gulf Coast terminals and destined for Oklahoma.

One major component of the 30 Crossing Project is the bridge over the Arkansas River, which has an impact on maritime navigability throughout the MKARNS. Many of Arkansas' major shippers, including Tyson Foods, Riceland Foods and Oakley Grain, rely on the waterways for transporting their products. It is estimated that 17.4 million tons of goods move on these waterways annually. The top commodities moving via the Arkansas Waterways are presented in Table 3.11. The freight tonnage moved by water in Arkansas is expected to grow by 14 percent from 17.4 million tons in 2013 to 19.8 million tons in 2040. Of this total, 12.2 million tons are moved through the MKARNS waterways.

Table 3.11 Top Commodities Moving via the Arkansas Waterways, 2013

Commodity	Inbound (Kilo Tons)	Outbound (Kilo Tons)	Intra (Kilo Tons)	Total (Kilo Tons)	Percent of Total
Farm Products	9	6,408	1	6,418	37%
Waste or Scrap Materials	2,337	199	100	2,636	15%
Nonmetallic Minerals	442	168	1,785	2,395	14%
Petroleum or Coal Products	634	1,175	141	1,951	11%
Primary Metal Products	1,589	326	1	1,915	11%
Chemicals or Allied Products	690	49	0	738	4%
Coal	373	36	1	410	2%
Metallic Ores	278	42	5	326	2%
Fabricated Metal Products	89	113	0	202	1%
Food or Kindred Products	148	50	0	198	1%
All Others	109	111	0	220	1%
Total	**6,697**	**8,676**	**2,035**	**17,409**	**100%**

Source: Cambridge Systematics, Arkansas State Freight Plan, Freight Demand and Needs technical memorandum, 2017

In Arkansas, thirteen locks and dams are located on the MKARNS. Two of these locks and dams are in proximity of the study corridor: The Murray Lock and Dam east of the I-30 Bridge and the David D Terry Lock and Dam south of the I-30 Bridge. The traffic through these two locks and dams is shown in Table 3.12. The port of Little Rock, located approximately seven miles east of downtown Little Rock, has two public docks (one directly on the MKARNS and the other on a 4,500-foot slackwater harbor). The port is operated by Logistic Services Incorporated (LSI).

The Little Rock port has a 2,600-acre industrial park. About forty port employees support 4,000-4,500 mostly skilled jobs at industries in the area. The port has good road connectivity to I-30 and I-40, maintains its own railroad, and is a Foreign Trade Zone (FTZ). Eighty percent of the port's activity is inbound bulk materials, most of it trans-loaded from ship to barge in New Orleans, with steel and industrial goods its major product.

Table 3.12 Arkansas Lock Tonnage (Millions), 2013

Lock	River Mile	Upbound	Downbound	Total
David D. Terry (East of I-30)	108.1	4.00	4.78	8.78
Murray (West of I-30)	125.4	3.00	4.20	7.22

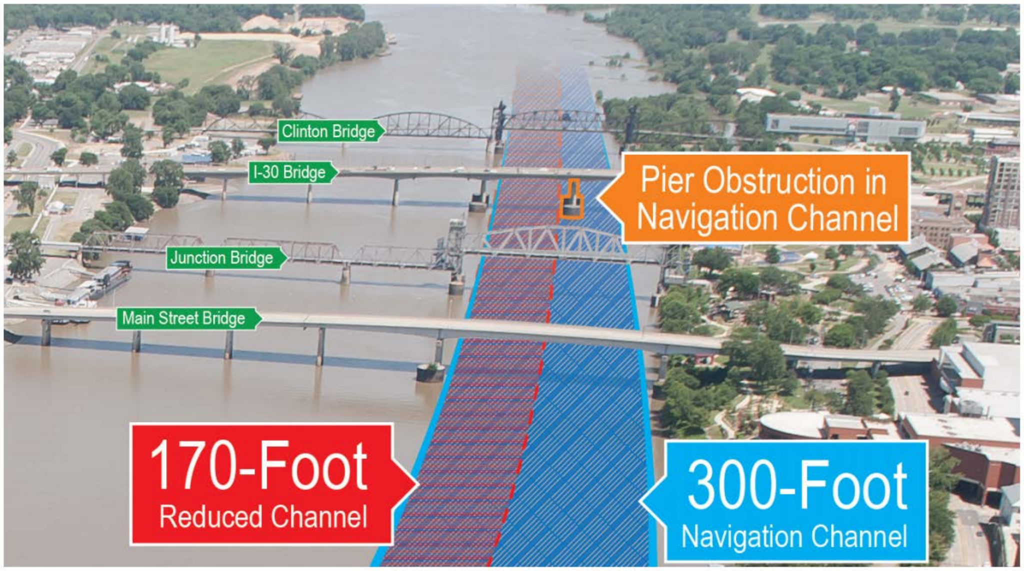
Source: Lock Performance Monitoring System, Arkansas State Profile, AWC and U.S. Army Corps of Engineers

The existing I-30 bridge conditions pose some structural and functional deficiencies. The configuration of the piers supporting the bridge obstructs river navigation due to the placement of a pier near the middle of the navigation channel. The United States Coast Guard (USCG) prescribes a minimum of 300 feet horizontal clearance between piers. Horizontal clearance between the piers of the I-30 River Bridge is only 174.5 feet in the navigation channel (Figure 3.3). At times when a pusher craft is attempting to navigate the channel with three barges side-by-side (which is normal), there is only about 32 feet of clearance on either side. The horizontal clearance and pier obstruction is cumbersome to navigate, restricts the operational speed of the barges, poses a danger to workers, and creates a risk of property loss. Barge collision data, provided by the USCG, indicates five barge strikes have occurred at this site since 2001.

According to the Arkansas Waterways Commission, accidents and lock and dam maintenance over the Arkansas River has negative impacts on maritime shipping. Closure of the navigation channel has an estimated impact of $2 million on the region's industries that rely on maritime shipping. Each time that an accident happens, (for example barge or tow boat accidents with the I-30 Bridge piers), the navigation channel and bridge traffic is closed for structural inspections. In order to estimate the impact of the maritime accidents that occur due to existing conditions and bridge deficiencies, the following process is utilized:

- Estimate average number of navigation channel closures per year
- Estimate annual impact of accidents on the industry
- Determine discounted dollar impact of Build and No-Action alternatives on maritime navigability

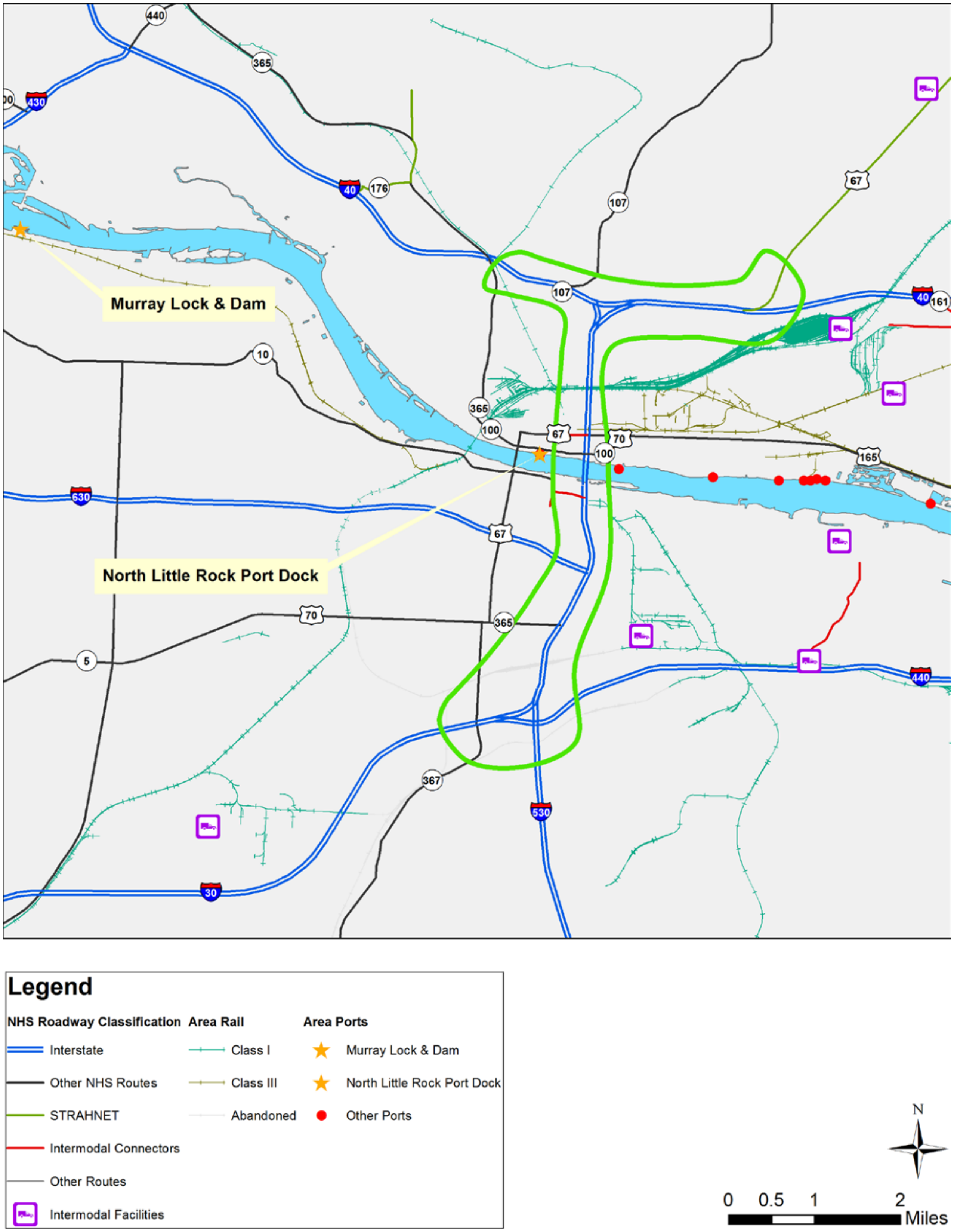
Figure 3.3 Arkansas River Navigational Channel Obstruction (I-30 Bridge)



Source: United States Coast Guard 2015

As shown in Figure 3.4, there are multiple railroads in the study area – Union Pacific, St. Louis Southwestern, and Arkansas Midland railroads. These rail yards are positioned north of the I-30 Bridge in North Little Rock. There are several intermodal facilities that serve as connections for freight movement in the project corridor. The I-30 corridor is highlighted in green in the figure and plays a critical role for freight movement. Although employment in manufacturing and other freight dependent industries has declined over the years in Arkansas, these industries still have major presence in Pulaski County.

Figure 3.4 Study Area Ports and Intermodal Facilities



Source: U.S. Bureau of Transportation Statistics, Cambridge Systematics

Table 3.13 shows that approximately 75,000 people are employed in various freight dependent industries in Pulaski County. Figure 3.5 shows employment at the census block level for these industries in 2014. As it can be seen in the figure, there are clusters of industries that rely on freight movement in McAlmont/ Sherwood; East and West Broadway St.; Little Rock Airport; and West 65th St. among other areas. This significant employment activity highlights the importance of freight movement connectivity and access to markets within and also outside Arkansas.

Table 3.13 Pulaski County Freight Dependent Employment 2014

Industry	Employment
Agriculture, Forestry, Fishing, and Hunting	38
Mining, Quarrying, and Oil and Gas Extraction	453
Utilities	2,687
Construction	9,363
Manufacturing	13,198
Wholesale Trade	13,375
Retail Trade	26,505
Transportation and Warehousing	9,246
Sum of Freight Dependent Employment	**74,865**
Total Employment	**254,226**

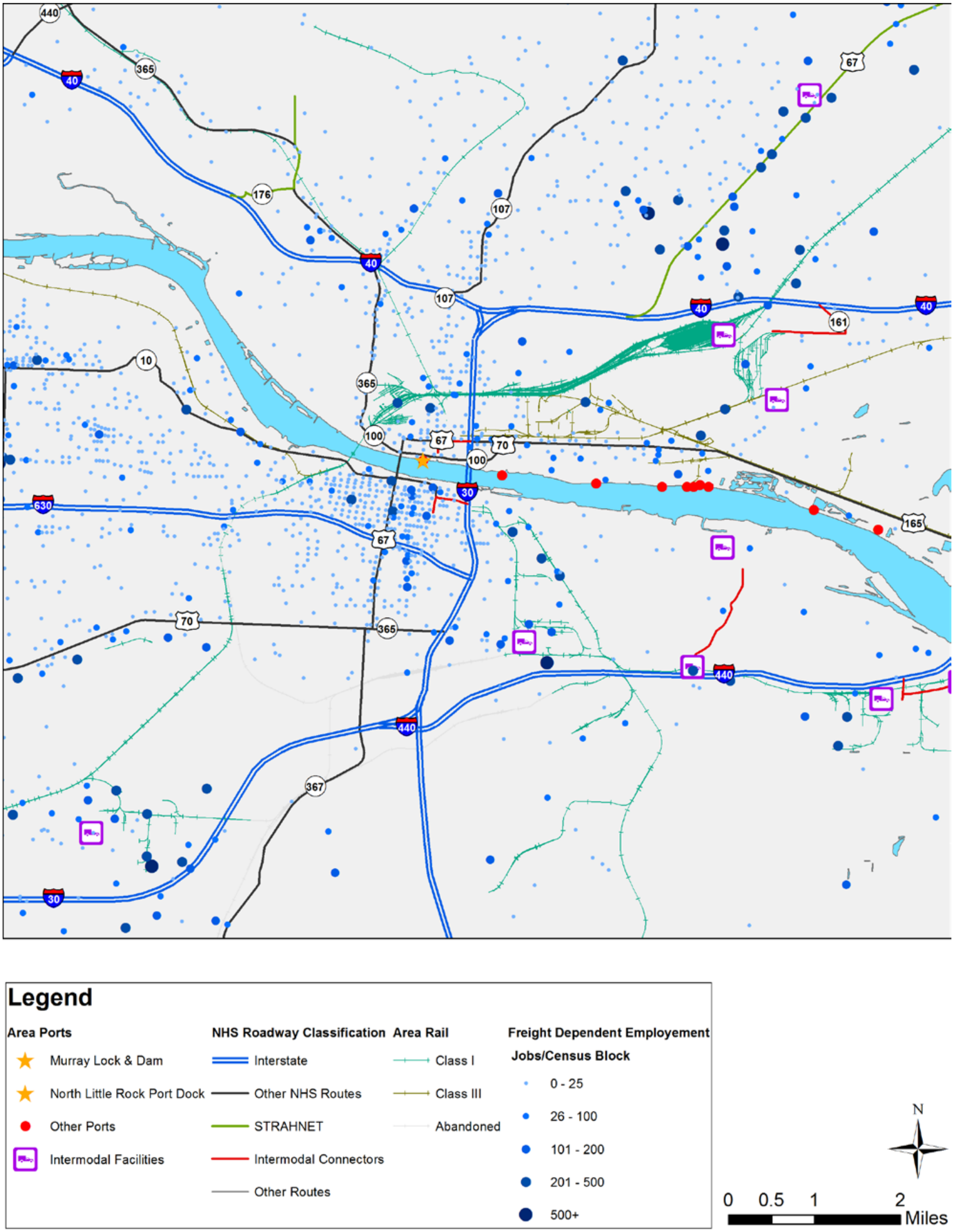
Source: US, Census Bureau 2014

A recent evaluation of truck trip ends in Arkansas counties by Cambridge Systematics found that Pulaski County attracts an average of 59,700 truck trips daily, which accounts for 18 percent of annual truck trips attracted statewide in 2015[15]. Most of these truck trips are concentrated in the metropolitan Little Rock area. Figure 3.6 shows the tract level truck trip ends in Pulaski County in 2015. As shown in the figure, truck trip generation in Pulaski County is most intense in the southeastern part of the county, which is consistent with the presence of the port and other industrial activity in this part of the county. There is heavy trucking activity due to presence of freight dependent industries to the east and northeast of I-30 as well as northwest of I-30. Access through the I-30 Bridge is critical for these industries, and changes in truck VHT and travel time savings for trucks represent wider economic benefits for these industries.

The advisory group interviews highlighted existing congestion issues, particularly for the I-30 Bridge. It was discovered during interviews that trucking and freight flow experience major challenges, and often trucks avoid the project corridor and use I-440 in the east, or I-430 in the west.

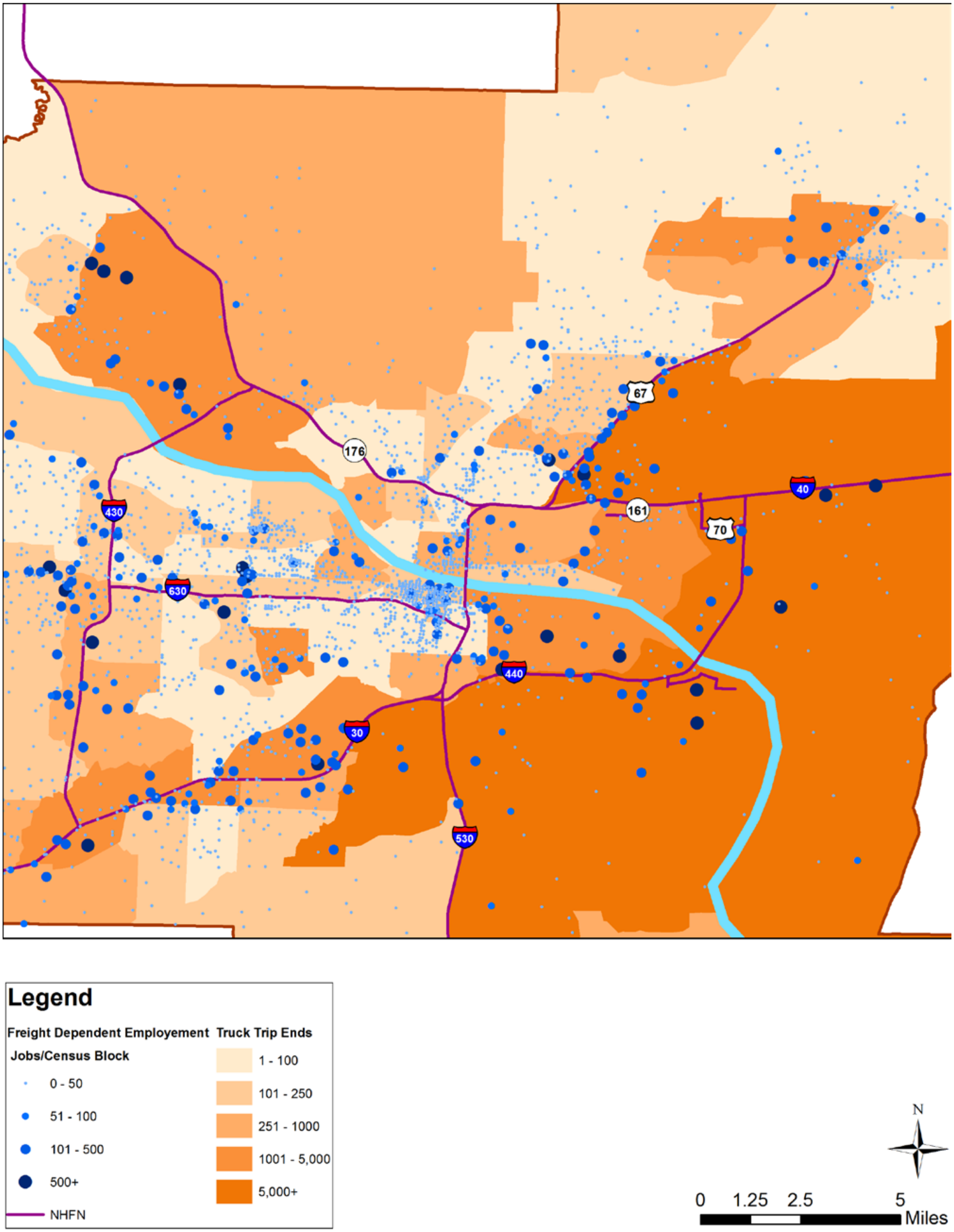
[15] Arkansas Statewide Freight Plan, Cambridge Systematics 2015. http://www.wemovearkansasfreight.com/wp-content/uploads/2016/03/FAC-Meeting-1-Power-Point.pdf

Figure 3.5 Freight Dependent Employment in the Study Area, 2014



Source: U.S. Census Bureau, Cambridge Systematics

Figure 3.6 Average Daily Truck Trip Ends in the Study Area, 2015



Source: ATRI, Cambridge Systematics

The proposed Build alternatives address the maritime navigability challenge of the Arkansas River. The anticipated modifications of the Build alternative will reduce potential crashes of barges or tow boats with the I-30 bridge piers. The benefits of having fewer accidents and fewer navigation channel closures are estimated by assuming the following parameters:

- Average annual navigation channel closures: (0.33 accidents per year or 5 accidents in 15 years)
- Growth in accidents with a 0.58% rate equal to growth of maritime freight movement (maritime freight movement growth rate is 0.58% for the 2013 to 2040 period for MKRANS waterways)[16]
- Closure costs of $2,000,000 per closure

The expected changes for the Build and No-Action are provided below in Table 3.14.

Table 3.14 Cumulative Maritime Navigation Safety Benefits/Disbenefits (2023-2043)

Maritime Navigation Benefits/Disbenefits	Build (All Alternatives)	No-Action
Maritime Crash Costs (in 2016$)	$15,294,114	$(15,294,114)
NPV of Maritime Crash Costs (3%)	$9,349,825	$(9,349,825)
NPV of Maritime Crash Costs (7%)	$5,193,267	$(5,193,267)

Source: Cambridge Systematics Economic Modeling

Note: Positive $ values represent savings and negative $ values represent losses

3.2 Direct Qualitative Impacts

3.2.1 Multimodal Impacts

Two of the goals established for the 30 Crossing project included connecting bicycle/pedestrian friendly facilities across I-30/I-40 and accommodating existing and future public transit. There is one bus route operated by the public transit system (Rock Region METRO) that uses the corridor, with five trips per day. Additionally, the River Rail Street Car runs throughout the downtown areas of Little Rock and North Little Rock, including under the existing I-30 bridge over 3rd Street. The proposed Build alternatives were developed to avoid impacts to the portion of the River Rail Street Car on 3rd Street.

Bike-Ped Analysis

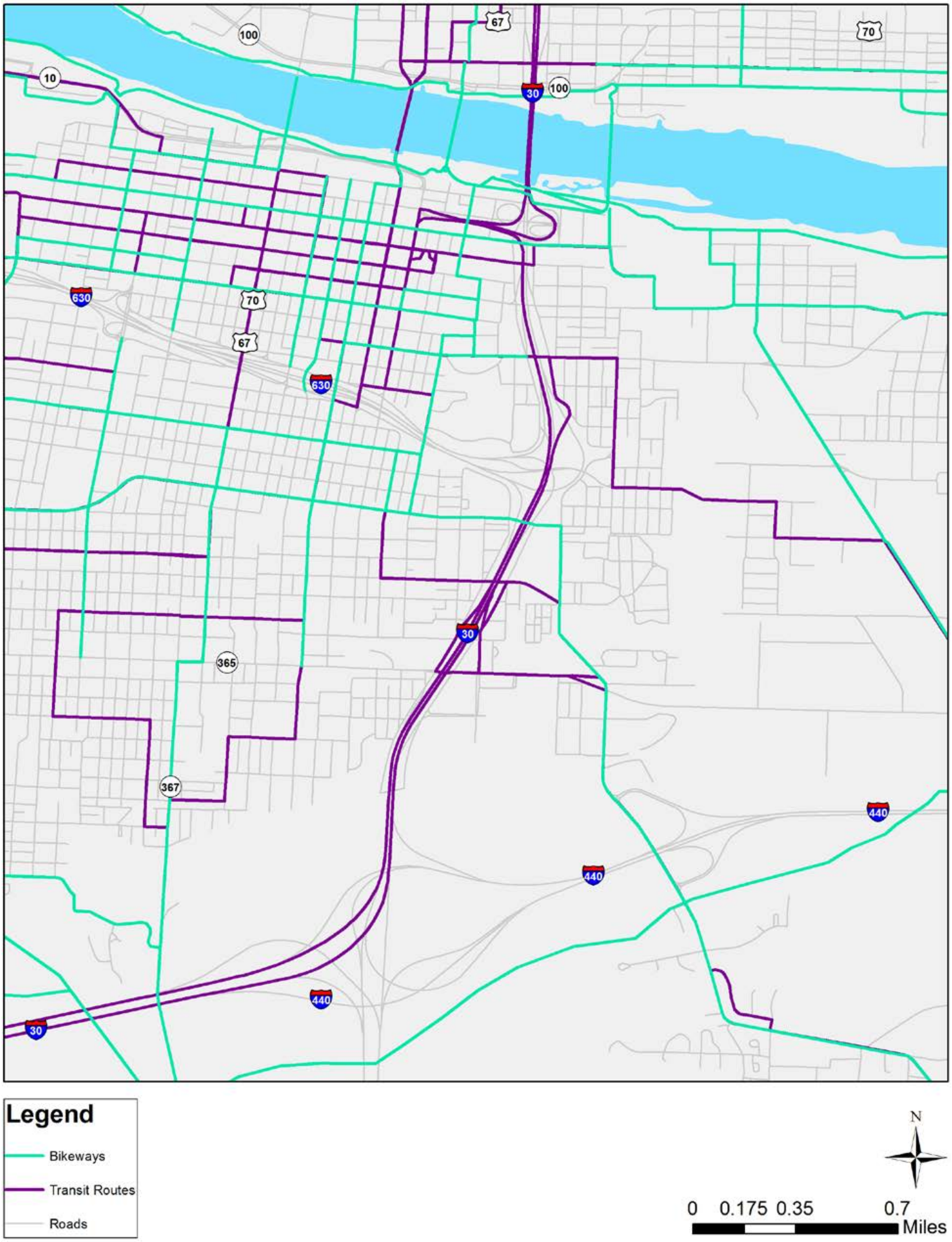
The 30 Crossing Project provides access to major attractions in Downtown Little Rock, such as the Clinton Library, Convention Center, Riverfront Park, and River Market among other attractions. In North Little Rock, I-30 serves as a major access point for the Verizon Arena, Argenta Activity Center, the Maritime Museum, the Riverside RV Park, and the Dickey-Stephens Park. As shown in Figure 3.7, Little Rock has plenty of bikeways and transit options available as a means of alternative transportation in the project area. During the interviews with advisory group members, it was noted that bike use is growing in central Arkansas and there

[16] Cambridge Systematics, Arkansas State Freight Plan, Freight Demand and Needs technical memorandum, 2017

is active cycling community that is interested in the riverfront trail and the existing bikeways in downtown Little Rock.

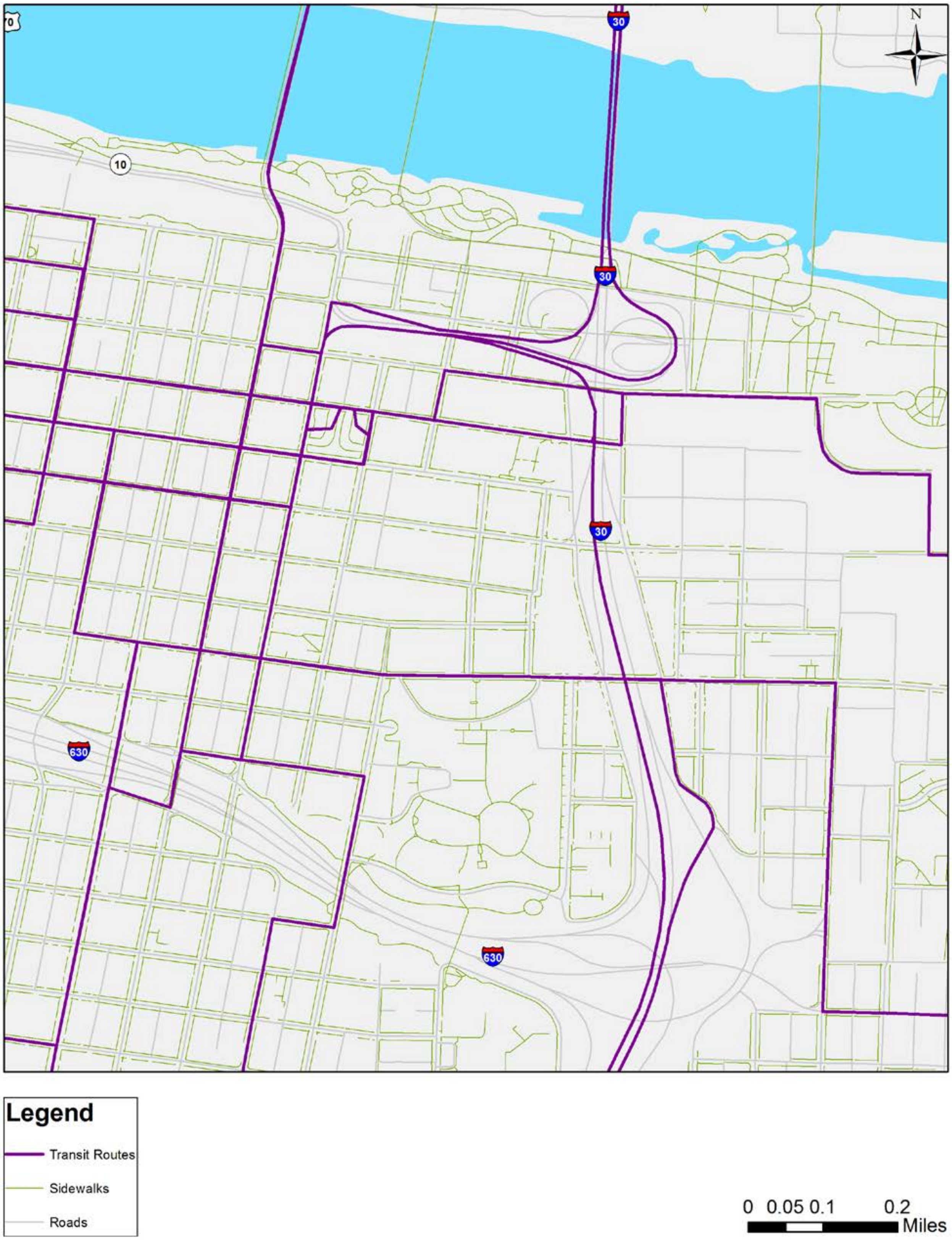
As it can be seen in Figure 3.7, there is a gap in east-west bike connectivity in proximity of I-30 in Little Rock. A closer look at downtown Little Rock as shown in Figure 3.8, shows that there are some sidewalk gaps east of I-30. There are two pedestrian bridges over the Arkansas River that connect Little Rock to North Little Rock. These two bridges enhance bike-ped access in the riverfront area and serve as alternative routes for access to the Verizon Arena, the Maritime Museum, and the Clinton Library among other attractions.

Figure 3.7 Little Rock Area Bike and Transit Network



Source: Metroplan 2017

Figure 3.8 Downtown Little Rock Bike and Transit Network



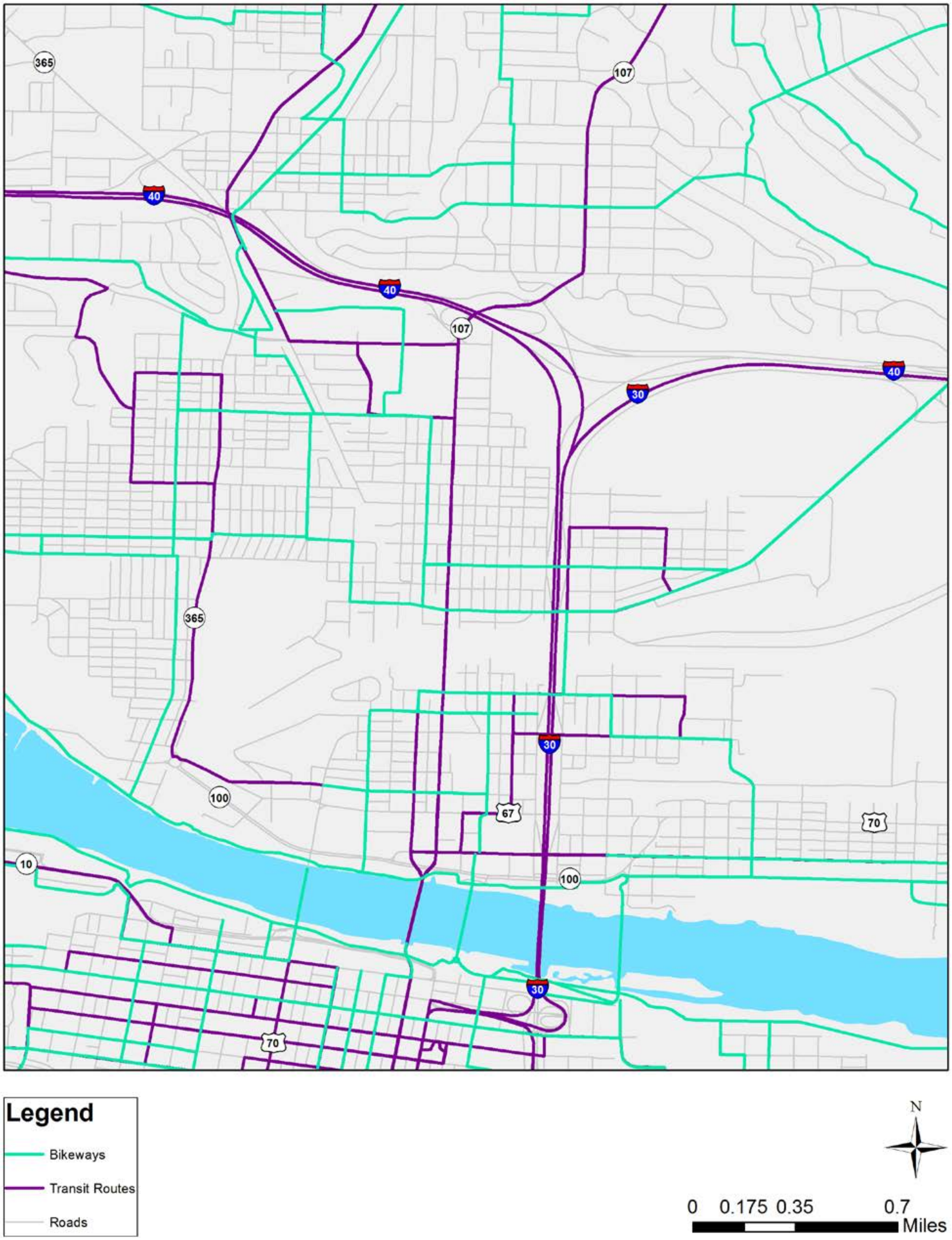
Source: Metroplan 2017

The existing bike-ped network in downtown Little Rock, particularly in the Riverfront area, has contributed to the livelihood and enhanced economic activity. Figure 3.9 shows the bike-ped and transit network in North Little Rock. The advisory group interviews also indicated that the proposed Build alternatives need to be aware of the bike-ped and access and transit coverage in the project corridor. While the area currently may not have adequate population and employment density to attract enough transit riders, it is necessary to incorporate transit and bike-ped friendly design in the Build alternatives that promote active transportation use in the I-30 corridor.

One major challenge for bike-ped access in downtown Little Rock is the existing ramp connections on 2nd St. and I-30. This issue was highlighted multiple times during interviews with the advisory group members. The existing ramp connections have multiple limitations, such as:

- Limited east-west connectivity from President Clinton Ave. to 3rd St. that hinders bike-ped access and has negative impacts on transit ridership in the area;
- Unsightly concrete ramp structures that discourage bike-ped activity due to pedestrian safety and visual aesthetics concerns;
- Lack of green space and disconnection between the Clinton Presidential Library, the Riverfront Park on both sides of I-30, and the rest of Downtown neighborhoods; and
- Lack of enhanced surface street connectivity as well as sidewalk and bike lane improvements.

Figure 3.9 North Little Rock Area Bike and Transit Network



Source: Metroplan 2017

Transit Demand Analysis

Transit demand in the Central Arkansas I-30 corridor was analyzed at a high-level as part of the PEL report. The transit analysis focuses on the impacts of proposed alternatives on transit and multimodal flow in the study area. The transit and multimodal screening of the Build alternatives is anticipated to enhance the following goals for the study area[17]:

- Improved east-west connectivity: The PEL alternative screening process shows that local street connectivity and access at the surface street level is improved in the Build alternatives compared to the No-Action. The main reason for this improvement is the increase in the number of locations allowing for local street connectivity and use of design that allow for open spaces across I-30.

- Enhanced bike-ped access: The PEL alternative screening process shows that the Build alternatives provide several grade separated bike-ped accommodations across the study area, especially on the surface streets and downtown Little Rock.

- Accommodation of existing and future transit access: The PEL alternative screening process shows that enhanced travel time along the corridor for the Build alternatives support existing and future transit ridership.

As part of the PEL report Transit Analysis, four major destinations in the study area were defined where higher-density employment is likely to attract commuters using I-30. These destinations were based on the 2040 Metroplan CARTS travel demand model prediction:

- Downtown Little Rock

- Downtown North Little Rock

- Arkansas State Hospital area

- University of Arkansas at Little Rock campus

In addition to these destinations, ten park-and-ride origin areas were defined as key locations that have the potential to generate most transit trips. These origin areas included park-and-ride catchment areas in North Little Rock, south of Little Rock, and other regions with population density of at least 3,000 people per square mile. These top 10 destinations are provided in Table 3.15. Using the Metroplan's CARTS travel demand model, the total volume of home-based work trips for the origin-destination pairs was estimated. A total daily volume of 41,872 trips were estimated for the identified origin destination pairs as shown in Table 3.16.

To estimate the number of commuters who might reasonably shift from auto to transit, it was necessary to conceptually define the transit system that would serve the origin areas previously identified. The proposed transit concept needed to divert auto trips to transit on I-30 in the 2040 No-Action condition would have multiple express routes operating on I-30 and other parts of the freeway system.

[17] Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages (PEL) Level 2 Screening Methodology and Results Memorandum, Transit Analysis CA0602, Interstate 530-Highway 67, Jan 2015.

These routes would be based on park-and-ride lots in the origin areas, which would allow commuters the option to access express transit routes by driving to the park-and-ride lots. Service frequency is one of the most important attributes commuters consider in making decisions regarding the use of transit, and increasing frequency is a proven way to increase transit usage. A headway of 10-15 minutes for service frequency was applied to ensure maximum ridership potential for the designed routes. Table 3.17 shows the peak hour transit volume with enhanced service in 2040.

Table 3.15 Transit Alternative Origin/Destination

Region	Destination
North Little Rock	Cabot/ Jacksonville/ Maumelle
South of Little Rock	West Side of Little Rock/ Bryant/ Benton
Other Regions	Pulaski Tech South Campus/ Shannon Hills/ Mabelvale/ North Little Rock (from I-40/I-30 interchange to Sherwood)

Source: Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages (PEL) Level 2 Screening Methodology and Results Memorandum, Transit Analysis CA0602, 2015

Table 3.16 Daily Volume of Home to Work Trips in 2040

		Destination				
		A	**B**	**C**	**D**	**Total**
Origin	**1**	1,715	328	152	121	2,316
	2	1,472	297	120	93	1,983
	3	1,980	401	254	180	2,814
	4	3,008	148	656	384	4,197
	5	3,414	216	437	439	4,506
	6	3,434	175	426	372	4,406
	7	1,245	69	193	202	1,710
	8	546	30	65	73	715
	9	6,327	316	757	969	8,369
	10	8,121	1,894	506	335	10,856
	Total	31,263	31,263	3,874	3,168	**41,872**

Source: Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages (PEL) Level 2 Screening Methodology and Results Memorandum, Transit Analysis CA0602, 2015

Table 3.17 Peak Hour Transit Volume in 2040 with Enhanced Service

		Destination				
		A	**B**	**C**	**D**	**Total**
Origin	**1**	109	21	10	8	147
	2	93	19	8	6	126
	3	125	25	16	11	178
	4	191	9	42	24	266
	5	216	14	28	28	285
	6	217	11	27	24	278
	7	79	4	12	13	108
	8	35	2	4	5	45
	9	401	20	48	61	530
	10	514	120	32	21	688
	Total	1,980	245	226	201	**2,652**

Source: Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages (PEL) Level 2 Screening Methodology and Results Memorandum, Transit Analysis CA0602, 2015

The most congested part of the study corridor is the I-30 Bridge over the Arkansas River. A closer look at the transit ridership over the bridge shows that a minimum of 795 vehicles passing over the I-30 Bridge would need to be diverted from auto to transit on I-30 in 2040 to improve from LOS F to LOS E with the existing 6-lane facility. However, the maximum feasible number of vehicles that can be diverted over I-30 Bridge is 650, assuming route headways of 10 minutes. Therefore, even under the best case transit-only scenario, there is a deficit of nearly 150 vehicles during the 2040 No-Action peak hour to achieve LOS E. Table 3.18 presents the comparison of feasible and required mode shift for the I-30 bridge section.

While neither of the proposed express transit systems alone can eliminate the need for I-30 infrastructure improvements, transit enhancements can reduce the magnitude of improvements needed. Other transit enhancements such as Bus on Shoulder or Transportation Demand Management (TDM) strategies can also be used to complement the transit system and the overall I-30 solution. It should also be noted that the Build alternatives have the potential to enhance travel times as shown in the previous sections. Although both the baseline and enhanced transit scenarios fall short of addressing the congestion in the study corridor and particularly on the I-30 Bridge, it is important to note the impact of transit service and other TDM strategies in dealing with congestion throughout the study area.

Table 3.18 Comparison of Feasible and Required Mode Shift for I-30 (2040)

Feasible Auto Trips (I-30 Bridge)	Transit Ridership	Required Mode Shift for LOS E	LOS E Deficit	Required Mode Shift for LOS D	LOS D Deficit
Baseline Transit Scenario (30 min. headways)	510	795	(285)	1,604	(1,094)
Enhanced Transit Scenario (10-15 min. headways)	650		(145)		(954)

Source: Arkansas State Highway and Transportation Department (AHTD), The Planning and Environmental Linkages (PEL) Level 2 Screening Methodology and Results Memorandum, Transit Analysis CA0602

Based on the transit analysis conducted as part pf the PEL alternative screening, the following enhancements are recommended to enhance multimodal access in the study area:

- **Transit Bus-on-Shoulder Operation:**

Further enhancements such as transit priority measures would make the service even more attractive, and possibly attract a higher number of commuters. Bus-on-shoulder operation, which allows buses to use the freeway shoulder to bypass congested traffic, is a proven approach to making express transit service more effective and attractive. Bus-on-shoulder operation offers many of the same benefits of rail transit, but is less costly to implement. This priority measure would allow buses to use the shoulder when general purpose lane speeds drop below approximately 35 miles per hour, and requires highway shoulders that are 10 to 11 feet wide.

- **Transit Headway Enhancement:**

Service frequency is one of the most important attributes commuters consider in making decisions regarding the use of transit, and increasing frequency is a proven way to increase transit usage. Research by the Transit Cooperative Research Program (TCRP) on traveler response noted a service elasticity of -0.4 for changes in headway[18]. That is, a 40 percent increase in ridership can be expected given a 100 percent reduction in headway. With a change in headway from 30 minutes to 10 minutes (67 percent) an increase in ridership of 27 percent can be expected.

- **Evaluation of East-West and Airport Transit Connectivity**

The existing transit network in the Little Rock/North Little Rock region (Rock Region Metro) provides bus service through 25 transit routes. The street car network consists of two lines, with one serving Downtown Little Rock and the other one crossing the Arkansas River over the Main St. Bridge and linking Little Rock to North Little Rock. As mentioned in the Advisory Group interviews, the street car network lacks connectivity to the Little Rock Airport. Evaluation of better east-west connectivity for the existing transit network through a comprehensive transit analysis can highlight the gaps and needs for the study region. Since the Build alternatives provide enhanced surface street connectivity, a comprehensive evaluation of transit origin/destinations analysis and system gaps may highlight detailed recommendations to increase transit system effectiveness.

3.3 Construction, Operations and Maintenance Costs

The total design and construction costs of the project are estimated to be $631.7 million in 2016 dollars. Assuming a 15% design cost of this total, the construction costs are estimated to be $549.7 million in 2016 dollars.

The O&M costs for the Build alternatives are evaluated using the total lane-mile estimates for each alternative. The unit cost for O&M are multiplied by total lane-miles in each alternative and yield total O&M costs. The unit costs are inflated using consumer price index (CPI) values for each year of the analysis. The total life cycle costs for each alternative are then discounted at 3% and 7% discount rates to determine the net present value of project costs. The construction and O&M expenditures are also used as basis of estimating total number of jobs that will be added during construction and O&M in the project corridor.

Considering the maintenance schedule of 7 to 10 years and rehabilitation schedule of 15 to 20 years, the lifecycle costs of the Build alternatives are estimated as shown in Table 3.19. The maintenance costs are incurred at 2029, 2036, and 2043. The reconstruction costs are not considered since they are incurred once in 20+ years, which are avoided through routine maintenance. The total O&M costs of the Build alternatives are estimated to be $25.1 in 2016 dollars.

Although the No-Action alternative does not involve major construction, the study corridor will need O&M expenditures to preserve existing conditions. The schedule of O&M activities for the No-Action involve bridge replacement in 2022-2023, 2026, and 2036-2037 with an estimated cost of $91.9 million, $23.1 million, and $24.0 million respectively. Further, the corridor will require roadway resurfacing in 2030-2031 with an estimated cost of $53.3 million. By avoiding the Build alternatives and delaying O&M, the project requires major reconstruction in some areas that need to happen by 2043. Considering this O&M schedule, the maintenance costs of the No-Action alternative are estimated to be $192.3 in 2016 dollars. The increase in O&M expenditures in the No-Action alternative is $167.2 million. The total construction and O&M expenditures are among the important inputs for IMPLAN economic modeling. However, for the purpose of economic modeling it is estimated that only 85 percent of total costs will be spent on construction activities.

[18] Traveler Response to Transportation System Changes Handbook, Third Edition: Chapter 9, Transit Scheduling and Frequency. TCRP Report 95, Chapter 9. http://www.trb.org/Publications/Blurbs/154748.aspx

Table 3.19 Project Life Cycle Costs Analysis (2023-2043)

Year	Calendar Year	Build Capital Costs (in 2016$)	Build O&M Costs (in 2016$)	Build Total Costs (in 2016$)	NPV of Build Total Costs		No-Action O&M Costs (in 2016$)*
					3%	7%	
0	2016	$0	$0	$0	$0	$0	$0
1	2017	$0	$0	$0	$0	$0	$0
2	2018	$0	$0	$0	$0	$0	$0
3	2019	$157,925,000	$0	$157,925,000	$144,523,747	$128,913,842	$0
4	2020	$157,925,000	$0	$157,925,000	$140,314,317	$120,480,226	$0
5	2021	$157,925,000	$0	$157,925,000	$136,227,492	$112,598,342	$0
6	2022	$157,925,000	$0	$157,925,000	$132,259,701	$105,232,096	$45,963,429
7	2023	$0	$0	$0	$0	$0	$45,963,429
8	2024	$0	$0	$0	$0	$0	$0
9	2025	$0	$0	$0	$0	$0	$0
10	2026	$0	$0	$0	$0	$0	$23,120,253
11	2027	$0	$0	$0	$0	$0	$0
12	2028	$0	$0	$0	$0	$0	$0
13	2029	$0	$8,365,203	$8,365,203	$5,696,296	$3,471,262	$0
14	2030	$0	$0	$0	$0	$0	$26,636,000
15	2031	$0	$0	$0	$0	$0	$26,636,000
16	2032	$0	$0	$0	$0	$0	$0
17	2033	$0	$0	$0	$0	$0	$0
18	2034	$0	$0	$0	$0	$0	$0
19	2035	$0	$0	$0	$0	$0	$0
20	2036	$0	$8,365,203	$8,365,203	$4,631,610	$2,161,727	$12,001,665
21	2037	$0	$0	$0	$0	$0	$12,001,665
22	2038	$0	$0	$0	$0	$0	$0
23	2039	$0	$0	$0	$0	$0	$0
24	2040	$0	$0	$0	$0	$0	$0
25	2041	$0	$0	$0	$0	$0	$0
26	2042	$0	$0	$0	$0	$0	$0
27	2043	$0	$8,365,203	$8,365,203	$3,765,923	$1,346,215	$0
Totals		**$631,700,000**	**$25,095,609**	**$656,795,609**	**$567,419,086**	**$474,203,711**	**$192,322,440**

Source: Cambridge Systematics Cost Analysis and ARDOT Cost Estimates

Note: *No-Action costs were calculated as a replacement of what is existing in the corridor today without any improvement to functional or safety deficiencies of the corridor. In reality, the functional and safety deficiencies of the corridor would have to be addressed when replacing any portion of the project. This would result in replacement costs much higher than what is shown here. The costs shown in this table are considered to be the most conservative possible for an economic analysis.

3.4 Asset Residual Value

The asset residual value accounts for the 30 years of service life beyond the analysis period. To calculate the residual value, O&M costs for the 20 years beyond the analysis period are subtracted from the anticipated value of the structure in 2023. O&M costs for other portions of the project over the remaining 30 year lifespan are anticipated to negate the residual value, so the calculations in this analysis only account for the bridge portion of the project.

To find the I-30 Bridge residual value at the end of the 20-year analysis period (2023-2043), first the value of the bridge capital costs in 2043 have to be estimated. The O&M costs for the rehabilitation of the bridge components over the 20 year No-Action alternative are used as a basis to estimate annual bridge rehabilitation costs for the whole 50-year service life of the bridge. The estimated O&M costs for the remainder of the service life of the bridge (30 years after 2043) are then subtracted from the estimated bridge value in 2043, to find the residual value of the bridge in 2016 dollars as well as discounted with a 3 percent and 7 percent discount rate. The formula used to estimate the residual values is provided below:

$$Residual\ Value = \left(\frac{Bridge\ Service\ Life - Analysis\ Period}{Bridge\ Service\ Life}\right) \times (Estiamted\ Bridge\ Cost\ in\ \$2016) - (Total\ Estiamted\ O\&M\ Costs\ for\ the\ Remaing\ Service\ Life)$$

$$Residual\ Value = \left(\frac{50-20}{50}\right) \times (\$139{,}050{,}440) - (\$623{,}654 \times 30) = \$64{,}720{,}647\ in\ 2016\ Dollars$$

Table 3.20 Estimated Cumulative Impacts of the No-Action Alternative (2023-2043)

Residual Value Description	Cost/Value
Total Estimated Project Capital Cost	$631,700,000
Total Estimated Bridge Capital Cost	$139,050,440
Total Estimated Bridge Value in 2043	$83,430,264.27
Total Estimated O&M Costs (2043-2073)	$18,709,616.97
Residual Value in 2043 ($2016)	**$64,720,647**
Residual Value in 2043 (Discounted at 3%)	**$12,363,979**
Residual Value in 2043 (Discounted at 7%)	**$1,464,034**

Source: Cambridge Systematics Economic Modeling and ARDOT Cost Estimates

Note: Total capital costs, bridge capital costs, O&M costs, and the residual values are estimates based on preliminary analysis for the purpose of economic impact assessment.

3.5 Impacts of the No-Action Alternative

The No-Action alternative is anticipated to give rise to increased transportation and safety costs, potentially leading to slower economic growth. The quantitative impacts of the No-Action alternative are estimated using the same process applied to the Build alternatives. The No-Action alternative was used as the baseline for analysis of the Build alternatives. To estimate the No-Action impacts, the 2043 impacts are estimated using 2023 as the baseline, by comparing 2043 impacts relative to 2023 impacts. The impacts of delaying the project are described in Table 3.21 in the same categories as the Build alternatives. As it can be seen from the table the No-Action alternative impacts are estimated to be $724.9 million. The average annual marginal cost of the No-Action alternative over the 20-year analysis period is $36.2 million. It should be noted that marginal costs are different from total cost to maintain the project corridor. The marginal cost is the cost due to increased traffic if no improvements are implemented (i.e., do nothing). The marginal cost means that it will cost $36.2 million more per year (or $724.9 million in 20 years) to maintain existing conditions if traffic projections in the study corridor occur as planned.

Table 3.21 Estimated Cumulative Impacts of the No-Action Alternative (2023-2043)

Impact Category	Monetary Value of Impact ($2016)
State of Good Repair of the Highway Infrastructure	$(1,791,578)
Travel Time Costs	$(304,602,238)
Vehicle Operating Costs	$(149,031,909)
Non-Carbon Emission Costs	$12,200,667
Traffic Safety Costs	$(15,068,251)
Lost Tourism and Travel Spending	$(1,287,877)
Maritime Navigability Costs	$(15,294,114)
Total Benefits/Disbenefits	**$(474,875,299)**
Increased O&M Spending	**$(167,226,831)**
Total Impacts	**$(642,102,131)**
Average Annual Impacts	**$(32,105,106.53)**

Source: Cambridge Systematics Economic Modeling

3.6 Summary of Overall Impacts

The direct and indirect quantitative impacts (benefits/cost) of the 30 Crossing Project will feed into various categories of economic modeling and analysis in section 4.5. Table 3.22 summarizes the Quantitative impacts of the Build alternatives. Further, the estimated construction and O&M costs and their discounted values are also presented in this table. Since the estimated project capital costs are capped at $631.7 million for the Build alternatives, their respective O&M costs and discounted lifecycle costs are also presented in Table 3.22. As it can be seen from the summary table, the 6-Lane C/D SPUI results in higher benefits followed by the 6-Lane C/D SDI alternative.

Table 3.22 Summary of Quantitative Impacts of Build Alternatives Relative to No-Action (2023-2043)

Impact Category	6-Lane C/D SPUI	6-Lane C/D SDI
State of Good Repair Costs Savings	$(22,870,784)	$(23,808,286)
Travel Time Costs Savings	$1,990,195,707	$1,457,899,826
Truck Travel Time Reliability Cost Savings	$36,545,629	$30,305,497
Vehicle Operating Costs Savings	$(210,858,204)	$(149,638,983)
Non-Carbon Emissions Costs Savings	$5,650,344	$3,485,609
Traffic Safety Costs Savings	$332,450,280	$308,516,104
Tourism Expenditures Increased/ Decreased	$87,362,368	$76,865,115
Maritime Crash Costs Savings	$15,294,114	$15,294,114
O&M Cost Savings	$167,226,831	$167,226,831
Residual Value of the I-30 Bridge	$64,720,647	$64,720,647
Total Benefits/Disbenefits ($2016)	**$2,465,716,933**	**$1,950,866,475**
NPV of Total Benefits/Disbenefits (3%)	**$1,382,435,962**	**$1,078,201,664**
NPV of Total Benefits/Disbenefits (7%)	**$676,843,795**	**$515,026,581**
Total Capital Costs ($2016)	**$631,700,000**	**$631,700,000**
Total Capital Costs (3%)	**$553,325,257**	**$553,325,257**
Total Capital Costs (7%)	**$467,224,507**	**$467,224,507**
Benefit to Cost Ratio ($2016)	**3.90**	**3.09**
Benefit to Cost Ratio (3%)	**2.50**	**1.95**
Benefit to Cost Ratio (7%)	**1.45**	**1.10**

Source: Cambridge Systematics Economic Modeling

Notes: (1) Positive $ values represent savings and negative $ values represent losses

3.7 Sensitivity Analysis

Economic impact assessment studies are based on assumptions for certain parameters, such as value of time, vehicle operating costs, tourism spending, and traffic crash costs. A guiding principle of this study was to use a data-driven, stakeholder-informed process to Build support for findings by ensuring the study process is transparent, objective and defensible. A second guiding principle was to use vetted and accepted data and tools to the extent possible while maintaining the objectivity and defensibility. A third guiding principle was to allow for uncertainty about the future by examining alternative outcomes, based on different assumptions. Therefore, a sensitivity analysis was conducted using the alternative assumptions to analyze three additional scenarios that are described in this section. Table 3.23 presents the summary of the proposed sensitivity analysis assumptions.

Table 3.23 Sensitivity Analysis Assumptions

Scenarios	Assumption	Impacted Parameters	Base Value	Alternative Value	Source
Scenario 1: USDOT Recommended Value of Time	Per USDOT TIGER/INFRA Benefit-Cost Analysis Guidance the hourly value of travel time savings and average vehicle occupancy are updated to national averages	Commute Trip Value of Time (VOT) and AVO	VOT = $10.35 AVO = 1.15	VOT = $14.10 AVO = 1.39	U.S. DOT Benefit-Cost Analysis (BCA) Resource Guide for TIGER and INFRA Grant Applications, July 2017. (https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance)
		Leisure Trip Value of Time (VOT) and AVO	VOT = $10.35 AVO = 1.39	VOT = $13.60 AVO = 1.39	
		Business Trip Value of Time (VOT) and AVO	VOT = $20.70 AVO = 1.15	VOT = $25.40 AVO = 1.00	
		Truck Trip Value of Time (VOT) and AVO	VOT = $17.51 AVO = 1.07	VOT = $27.20 AVO = 1.00	
Scenario 2: Inflation-Adjusted Tourism Spending	Adjusting day-trip tourism spending to inflation to reflect the time value of money	Average Day-trip Tourism Spending	$65 in 2016	Adjusted to average 2.1% CPI growth in the 2006 to 2016 period	CPI data provided by the US Bureau of Labor Statistics (http://www.bls.gov/data/)
Scenario 3: Growth in Maritime Freight Safety Costs	Increase maritime crash rates by increasing the maritime freight flow	Average maritime freight growth	0.52 % for the 2013-2040 period	Assume a 2% maritime freight growth	Cambridge Systematics, Arkansas State Freight Plan, Freight Demand and Needs technical memorandum, 2017
	Adjusting maritime freight crash costs to inflation	Average annual I-30 Bridge and navigation channel closure costs	$2,000,000	Adjusted to average 2.1% CPI growth in the 2006 to 2016 period	CPI data provided by the US Bureau of Labor Statistics (http://www.bls.gov/data/)

Source: Source text here.

3.7.1 Scenario 1: USDOT Recommended Value of Time

The first scenario for the sensitivity analysis of the 30 Crossing alternatives involves adjusting regional value of travel time savings and average vehicle occupancy parameters for passenger cars and trucks with national values as recommended by the U.S. DOT 2017 Benefit-Cost Analysis (BCA) Resource Guide. The change in value of time parameters provided by the USDOT ultimately result in higher value of time, but lower occupancy. Particularly, for truck trips the national average value of time is higher than regional values derived from the Bureau of Labor Statistics. Table 3.24 presents the BCA summary for the proposed Build alternatives under scenario 1.

Table 3.24 Summary of Quantitative Impacts of Build Alternatives Relative to No-Action for Scenario 1 (2023-2043)

Impact Category	6-Lane C/D SPUI	6-Lane C/D SDI
State of Good Repair Costs Savings	$(22,870,784)	$(23,808,286)
Travel Time Costs Savings	***$2,653,416,389***	***$1,946,351,494***
Truck Travel Time Reliability Cost Savings	***$53,055,990***	***$43,996,729***
Vehicle Operating Costs Savings	$(210,858,204)	$(149,638,983)
Non-Carbon Emissions Costs Savings	$5,650,344	$3,485,609
Traffic Safety Costs Savings	$332,450,280	$308,516,104
Tourism Expenditures Increased/ Decreased	$87,362,368	$76,865,115
Maritime Crash Costs Savings	$15,294,114	$15,294,114
O&M Cost Savings	$167,226,831	$167,226,831
Residual Value of the I-30 Bridge	$64,720,647	$64,720,647
Total Benefits/Disbenefits ($2016)	***$3,145,447,976***	***$2,453,009,375***
NPV of Total Benefits/Disbenefits (3%)	***$1,761,612,193***	***$1,352,244,840***
NPV of Total Benefits/Disbenefits (7%)	***$862,932,315***	***$645,053,929***
Total Capital Costs ($2016)	**$631,700,000**	**$631,700,000**
Total Capital Costs (3%)	**$553,325,257**	**$553,325,257**
Total Capital Costs (7%)	**$467,224,507**	**$467,224,507**
Benefit to Cost Ratio ($2016)	***4.98***	***3.88***
Benefit to Cost Ratio (3%)	***3.18***	***2.44***
Benefit to Cost Ratio (7%)	***1.85***	***1.38***

Source: Cambridge Systematics Economic Modeling

Notes: (1) Positive $ values represent savings and negative $ values represent losses; (2) Values in italic denote changes due to the scenario analysis.

3.7.2 Scenario 2: Inflation-Adjusted Tourism Spending

The second scenario for the sensitivity analysis of the 30 Crossing alternatives involves adjusting average day-trip tourism spending to reflect the impacts of inflation on tourism benefits/disbenefits. In order to adjust average tourism spending to inflation, this study uses the average 2.1% CPI growth rate for the 2006-2016 10-year period. The base 2016 value of average day-trip tourist spending is $65. Therefore, average spending for the 20-year period of the economic analysis is estimated by inflating 2016 values using the 2.1% CPI growth rate. Table 3.25 presents the BCA summary for the proposed Build alternatives under scenario 2.

Table 3.25 Summary of Quantitative Impacts of Build Alternatives Relative to No-Action for Scenario 2 (2023-2043)

Impact Category	6-Lane C/D SPUI	6-Lane C/D SDI
State of Good Repair Costs Savings	$(22,870,784)	$(23,808,286)
Travel Time Costs Savings	$1,990,195,707	$1,457,899,826
Truck Travel Time Reliability Cost Savings	$36,545,629	$30,305,497
Vehicle Operating Costs Savings	$(210,858,204)	$(149,638,983)
Non-Carbon Emissions Costs Savings	$5,650,344	$3,485,609
Traffic Safety Costs Savings	$332,450,280	$308,516,104
Tourism Expenditures Increased/ Decreased	***$131,618,773***	***$116,378,184***
Maritime Crash Costs Savings	$15,294,114	$15,294,114
O&M Cost Savings	$167,226,831	$167,226,831
Residual Value of the I-30 Bridge	$64,720,647	$64,720,647
Total Benefits/Disbenefits ($2016)	***$2,509,973,339***	***$1,990,379,544***
NPV of Total Benefits/Disbenefits (3%)	***$1,406,208,313***	***$1,099,317,244***
NPV of Total Benefits/Disbenefits (7%)	***$687,881,384***	***$524,752,471***
Total Capital Costs ($2016)	**$631,700,000**	**$631,700,000**
Total Capital Costs (3%)	**$553,325,257**	**$553,325,257**
Total Capital Costs (7%)	**$467,224,507**	**$467,224,507**
Benefit to Cost Ratio ($2016)	*3.97*	*3.15*
Benefit to Cost Ratio (3%)	*2.54*	*1.99*
Benefit to Cost Ratio (7%)	*1.47*	*1.12*

Source: Cambridge Systematics Economic Modeling

Notes: (1) Positive $ values represent savings and negative $ values represent losses; (2) Values in italic denote changes due to the scenario analysis.

3.7.3 Scenario 3: Growth in Maritime Freight Safety Costs

The third and last scenario for the sensitivity analysis of the 30 Crossing alternatives involves adjusting maritime shipping accident rates to reflect the regional growth in maritime freight movement. This scenario also adjust the I-30 Bridge closure and navigational channel closure costs to the industry due to freight accidents with inflation. The rationale behind this scenario is that freight flows through the Arkansas River are expected to grow at a steady rate. The freight tonnage moved by water in Arkansas is expected to grow by 14 percent from 17.4 million tons in 2013 to 19.8 million tons in 2040. Of this total, 12.2 million tons are moved through the MKARNS waterways[19]. In order to adjust closure costs to inflation rates, the same methodology applied to scenario 2 is utilizes in scenario 3. Therefore it is assumed that the $2,000,000 closure costs per incident will grow consistent with inflation for the 2006-2016 period. Table 3.26 presents the BCA summary for the proposed Build alternatives under scenario 3.

Table 3.26 Summary of Quantitative Impacts of Build Alternatives Relative to No-Action for Scenario 3 (2023-2043)

Impact Category	6-Lane C/D SPUI	6-Lane C/D SDI
State of Good Repair Costs Savings	$(22,870,784)	$(23,808,286)
Travel Time Costs Savings	$1,990,195,707	$1,457,899,826
Truck Travel Time Reliability Cost Savings	$36,545,629	$30,305,497
Vehicle Operating Costs Savings	$(210,858,204)	$(149,638,983)
Non-Carbon Emissions Costs Savings	$5,650,344	$3,485,609
Traffic Safety Costs Savings	$332,450,280	$308,516,104
Tourism Expenditures Increased/ Decreased	$87,362,368	$76,865,115
Maritime Crash Costs Savings	***$19,744,618***	***$19,744,618***
O&M Cost Savings	$167,226,831	$167,226,831
Residual Value of the I-30 Bridge	$64,720,647	$64,720,647
Total Benefits/Disbenefits ($2016)	***$2,470,167,437***	***$1,955,316,979***
NPV of Total Benefits/Disbenefits (3%)	***$1,384,967,212***	***$1,080,732,913***
NPV of Total Benefits/Disbenefits (7%)	***$678,120,316***	***$516,303,102***
Total Capital Costs ($2016)	**$631,700,000**	**$631,700,000**
Total Capital Costs (3%)	**$553,325,257**	**$553,325,257**
Total Capital Costs (7%)	**$467,224,507**	**$467,224,507**
Benefit to Cost Ratio ($2016)	***3.91***	***3.10***
Benefit to Cost Ratio (3%)	***2.50***	***1.95***
Benefit to Cost Ratio (7%)	***1.45***	***1.11***

Source: Cambridge Systematics Economic Modeling

[19] Cambridge Systematics, Arkansas State Freight Plan, Freight Demand and Needs technical memorandum, 2017

Notes: (1) Positive $ values represent savings and negative $ values represent losses; (2) Values in italic denote changes due to the scenario analysis.

3.8 IMPLAN Economic Modeling

The direct impacts discussed above are incorporated into an economic modeling software package known as IMPLAN (IMpact analysis for PLANning). IMPLAN is an economic modeling software package that uses county level data and input/output methodology to simulate how changes in direct user costs, spending and output impacts give rise to indirect and induced impacts and affect the overall growth of an economy. In use since 1974, IMPLAN is one of the most widely used economic impact models in the U.S. More information on the model and the company can be found at www.implan.com. Appendix A provides more detail on the IMPAN model as well as the steps taken to convert the direct economic impacts into economic changes used as input for IMPLAN.

Table 3.27 presents the aggregate summary of IMPLAN inputs. Once the changes are entered, IMPLAN models how these changes will impact the economy of Arkansas. The results of the economic modeling are presented in the next section.

Table 3.27 Summary of IMPLAN Inputs

IMPLAN Input	6-Lane C/D SPUI	6-Lane C/D SDI	No-Action
Total Trucking Cost Savings	$316,160,098	$276,475,630	$(47,199,033)
Total Business Travel Cost Savings	$502,301,898	$371,251,425	$(112,650,815)
Total Maritime Transportation Cost Savings	$15,294,114	$15,294,114	$(15,294,114)
Total Changes due to Tourism Spending	$87,362,368	$76,865,115	$1,287,877
Total Changes due to O&M Spending	$(167,226,831)	$(167,226,831)	$-
Total Changes due to Construction Spending	$536,945,000	$536,945,000	$-
Total Changes in Household Income	$188,445,629	$128,547,320	$(150,229,021)

Source: Cambridge Systematics Calculations

3.9 Economic Impact Analysis Findings

This section presents the total (direct, indirect and induced) economic impacts that are expected to be generated by the 30 Crossing Project over the 20-year analysis period from 2023 to 2043. This analysis captures the total economic impacts generated due to congestion relief, traffic safety, tourism, and maritime navigability as well as the total economic impacts generated by construction and operations and maintenance activities. The 30 Crossing Project provides benefits to trucking, business trips, leisure and commute trips, maritime trips, the tourism sector, and other multimodal benefits that were not quantified due to the lack of data. Hence, the values presented herein are considered conservative estimates.

The net benefits associated with the SOGR of the highway infrastructure as well as the environmental emission benefits have no a multiplier effect in the regional economy, and, therefore, they are not input into the economic model.

Using the 2015 IMPLAN model for Pulaski County, the economic impacts are measured in terms of employment (number of jobs supported by an industry), labor income (compensation of employees), value-added or GRP (economic output less intermediate inputs, accounting for the additional output create at that stage of production), and local and state tax revenues. Since IMPLAN is a static model, the economic impact analysis presented in this section does not take into account the economic, industrial, and demographic changes, or changes in business costs, that may occur in Pulaski County over the 20-year analysis period. Given the limitations of the IMPLAN model for forecasting future economic impacts, the outcomes of this analysis can be refined by using a dynamic model that can estimate the variability of economic impacts over time.

Economic impacts from the 30 Crossing Project to Pulaski County initially occur as a result of the actual construction of the project. Construction expenditures are of economic value because large-scale infrastructure development expenditure increases the gross domestic product and supports the creation and retention of construction related jobs. Once the construction phase is completed, subsequent expenditures on operating and maintaining the facility are required, which also results in additional economic impacts for the region. The impacts of construction activities for the Build alternatives are analyzed separately, since some of these expenditures occur outside the duration of the analysis and unlike direct and indirect benefits, typically happen in the short-term. The impact of construction spending is thus temporary and due to the magnitude of expenditures can have ripple effects on the findings for the proposed alternatives as well as the No-Action alternative.

3.9.1 Economic Impact of the No-Action Alternative

The impacts of the No-Action alternative on travel time, vehicle operating costs, safety, tourism, and maritime navigability, are analyzed in IMPLAN to reflect the direct, indirect, induced, and total impacts to employment, labor income, GRP, and local and state tax revenues.

Table 3.28 presents the results of the IMPLAN analysis for the No-Action alternative. These results indicate that not doing the project could cost the study area 1,870 jobs and will result in reduction of labor income by $87.8 million. The reduction of GRP and tax revenues are estimated to be $158.8 and $12.7 million respectively.

Table 3.28 Estimated Cumulative Economic Impacts of the No-Action Alternative (2023 to 2043)

Impact Type	Employment	Labor Income	GRP	Tax Revenues
Direct Effect	(460)	$(23,175,569)	$(39,829,222)	$(2,926,303)
Indirect Effect	(170)	$(8,806,639)	$(15,570,313)	$(958,998)
Induced Effect	(1,240)	$(55,810,945)	$(103,446,290)	$(8,834,776)
Total Effect	**(1,870)**	**$(87,793,153)**	**$(158,845,825)**	**$(12,720,077)**

Source: Values have been rounded; Cambridge Systematics using IMPLAN economic model

3.9.2 Economic Impacts of the Build Alternatives

The proposed Build alternatives result in different direct, indirect, and induced economic impacts. These impacts are modeled based on the change in costs of truck trips, business trips, maritime trips, as well as tourism and O&M spending. The results of IMPLAN analysis for the four proposed Build alternatives are presented in this section. These results do not include the construction spending impacts since they are reported for the 20-year analysis period. Hence, the construction impacts are reported separately.

As shown in Table 3.29, the 6-Lane C/D SPUI alternative will give rise to 4,820 additional jobs and $201.2 million in labor income. The project benefits under this alternative will also result in an increase of $379.2 million in GRP and $37.6 million in tax revenues. The 6-Lane C/D SDI alternative will give rise to 3,440 jobs and $136.4 million in labor income as shown in Table 3.30. The project benefits under this alternative will also result in an increase of $263.7 million in GRP and $28.3 million in tax revenues.

Table 3.29 Estimated Cumulative Economic Impacts of the 6-Lane C/D SPUI Alternative (2023 to 2043)

Impact Type	Employment	Labor Income	GRP	Tax Revenues
Direct Effect	2,320	$85,733,911	$164,813,198	$21,239,612
Indirect Effect	620	$30,956,358	$57,629,648	$2,942,709
Induced Effect	1,880	$84,521,090	$156,759,131	$13,444,197
Total Effect	**4,820**	**$201,211,359**	**$379,201,977**	**$37,626,518**

Source: Values have been rounded; Cambridge Systematics using IMPLAN economic model

Table 3.30 Estimated Cumulative Economic Impacts of the 6-Lane C/D SDI Alternative (2023 to 2043)

Impact Type	Employment	Labor Income	GRP	Tax Revenues
Direct Effect	1,730	$58,178,395	$117,680,569	$17,314,761
Indirect Effect	430	$20,934,948	$39,722,396	$1,856,939
Induced Effect	1,280	$57,332,498	$106,327,277	$9,115,638
Total Effect	**3,440**	**$136,445,841**	**$263,730,242**	**$28,287,338**

Source: Values have been rounded; Cambridge Systematics using IMPLAN economic model

3.9.3 Economic Impact of Construction Activities

In addition to the benefits/costs associated with various categories of impacts in the 20-year analysis period, the Build alternatives have construction impacts during the construction years. The impacts of construction activities are reported separately since they give rise to employment, income, GRP, and tax revenues in the short-term and may fade away once construction activities are completed. The construction spending for the Build alternatives will result in short-term increase of 4,880 jobs, $281.2 million in labor income, $432.5 in GRP, and $24.2 million in tax revenues (Table 3.31).

Table 3.31 Estimated Cumulative Construction Impacts of the Build Alternatives (2019-2022)

Impact Type	Employment	Labor Income	GRP	Tax Revenues
Direct Effect	2,800	$173,147,884	$228,226,786	$6,134,874
Indirect Effect	1,010	$59,923,140	$114,646,042	$10,173,666
Induced Effect	1,070	$48,129,900	$89,604,434	$7,878,851
Total Effect	**4,880**	**$281,200,924**	**$432,477,262**	**$24,187,391**

Source: Values have been rounded; Cambridge Systematics using IMPLAN economic model

3.9.4 Summary and Key Findings

The economic impact assessment of the 30 Crossing Project included an analysis of the Build alternatives' impacts, construction spending impacts, and the cost of delaying the project. The economic impact assessment included a detailed analysis of benefits and costs due to various direct and indirect impacts, such as travel time costs, vehicle operating costs, traffic safety costs, tourism spending, maritime navigability, and construction and O&M spending.

A summary of cumulative economic impacts for the Build and No-Action alternatives is presented in Table 3.32. The annual average economic impacts are presented in Table 3.33. Comparison of the economic impacts of the project alternatives in the 20-year analysis period without considering construction spending, shows that the No-Action alternative will result in loss of jobs, labor income, GRP, and tax revenues. Both the Build alternatives, 6-Lane C/D SPUI and 6-Lane C/D SDI, result in positive economic impacts due to various direct and indirect benefits.

The construction spending impacts in the short-term are significant. Table 3.34 presents the summary of economic impacts including construction spending. As anticipated, construction spending will result in job growth as well as labor income growth, and increase in GRP and tax revenues. However, the added impact of construction spending is rather short-term compared with long-term economic benefits of congestion relief, tourism spending, and safety benefits.

To put these economic impacts in perspective, Table 3.35 presents the change in economic indicators for Pulaski County for each of the project alternatives. The existing values for employment, labor income, GRP, and tax revenues are provided by IMPLAN. The change in the economic indicators for each alternative includes the cumulative economic benefits as well as construction and O&M spending for the project.

As it can be seen from the Table 3.35, among the top three Build alternatives with positive impacts, the 6-Lane C/D SPUI alternative results in higher increases in employment, labor income, GRP, and tax revenues relative to the 6-Lane C/D SDI. Finally, the No-Action alternative will result in economic disbenefits for Pulaski County.

Table 3.32 Summary of Cumulative Estimated Economic Impacts w/o Construction (2023-2043)

Cumulative Impacts	6-Lane C/D SPUI	6-Lane C/D SDI	No-Action*
Employment	4,820	3,440	(1,870)
Labor Income	$201,211,359	$136,445,841	$(87,793,153)
GRP	$379,201,977	$263,730,242	$(158,845,825)
Tax Revenues	$37,626,518	$28,287,338	$(12,720,077)

Source: Cambridge Systematics using IMPLAN economic model

*Note: Values have been rounded; The No-Action alternative does not include construction spending

Table 3.33 Summary of Average Annual Estimated Economic Impacts w/o Construction (2023-2043)

Average Annual Impacts	6-Lane C/D SPUI	6-Lane C/D SDI	No-Action*
Employment	241	172	(94)
Labor Income	$10,060,568	$6,822,292	$(4,389,658)
GRP	$18,960,099	$13,186,512	$(7,942,291)
Tax Revenues	$1,881,326	$1,414,367	$(636,004)

Source: Cambridge Systematics using IMPLAN economic model

Note: Values have been rounded; *The No-Action alternative does not include construction spending

Table 3.34 Summary of Cumulative Estimated Economic Impacts with Construction (2019-2043)

Cumulative Impacts	6-Lane C/D SPUI	6-Lane C/D SDI	No-Action*
Employment	9,700	8,320	(1,870)
Labor Income	482,412,283	417,646,765	(87,793,153)
GRP	811,679,239	696,207,504	(158,845,825)
Tax Revenues	61,813,909	52,474,729	(12,720,077)

Source: Cambridge Systematics using IMPLAN economic model

*Note: Values have been rounded; The No-Action alternative does not include construction spending

Table 3.35 Summary of Percent Change in Regional Economic Impacts with Construction (2019-2043)

Cumulative Impacts	6-Lane C/D SPUI	6-Lane C/D SDI	No-Action
Employment	3.1%	2.7%	-0.6%
Labor Income	2.5%	2.2%	-0.5%
GRP	2.5%	2.1%	-0.5%
Tax Revenues	2.8%	2.4%	-0.6%

Source: Cambridge Systematics using IMPLAN economic model

*Note: Values have been rounded; The No-Action alternative does not include construction spending

Appendix A. IMPLAN Economic Modeling

IMPLAN generates estimates of the total economic impact, which includes the direct, indirect and induced impacts. The product of this analysis is an economic impact assessment based on a methodology that captures the impacts arising to the actual users of the roadway and the businesses that depend upon the roadway. It should be noted the direct user impacts must be decomposed by trip type for input into IMPLAN, since the value of time associated with different trip purposes have differing impacts on the economy. Business travel, including truck trips, represents "on-the-clock" travel and thus the time spent traveling results in real monetary value. Travel time associated with leisure is not "on-the-clock" and thus represents only opportunity costs, or as the trade-off of other ways that time could have been spent.

The IMPLAN economic simulation model customized for the study area was utilized to estimate the impact of the alternatives on the study area's economy in terms of jobs, personal income and gross regional product (GRP). The IMPLAN economic model utilizes inputs such as the estimates of changes in transportation-related costs, shipper-costs and tourism spending to estimate the impact on the study area's economy in terms of jobs, personal income and GRP. The results from previous chapters in this report form the basis of the input for the IMPLAN economic modeling as follows:

- Direct Quantitative Impacts for Autos and Trucks (Chapter 3.1.1 to 3.1.7)
- Tourism Impacts (Chapter 3.1.6)
- Construction and O&M Impacts (Chapter 3.3)

Since IMPLAN utilizes a static economic modeling methodology, the impacts are reported in a cumulative manner rather than annual. The cumulative impacts for the 2023-2043 period are distributed in their required categories and then incorporated in IMPLAN. The anticipated final results of the economic analysis will be similar when using annual impacts and analyzing it for each year of the analysis. Hence, in this report cumulative and average annual values are reported as the final results. The data preparation for the Build and No-Action alternatives follows the same process. The remainder of this section explains in detail the process of converting the direct user impacts into the required model inputs for IMPLAN.

A.1 Translating Changes in Truck Trips into IMPLAN Inputs

Changes in travel efficiency were translated into changes in the cost of freight trucking. In order for IMPLAN to estimate the economic impacts of these changes in trucking costs they were converted into changes in output for each industry in the study area. To do this, two main tasks were performed:

- **Task 1:** The changes in trucking costs were distributed across all of the industries in the study area.
  - **Step 1:** Identify the Direct Trucking Required per Dollar of Output for Each Industry
  - **Step 2:** Calculate the Share of Trucking Costs Incurred by Each Industry
  - **Step 3:** Distribution of Travel Efficiency Costs (or Savings)
- **Task 2:** The changes in trucking costs were converted into the resulting changes in output.

- **Step 1:** Calculate the Percentage Change in Total Costs
- **Step 2:** Estimate Elasticities
- **Step 3:** Apply Output Elasticities

The following sections describe the steps involved in each task, and provide illustrative examples.

Task 1: Distribution of Changes in Trucking Costs

In order to properly distribute the changes in trucking costs across industries, two issues should be considered:

- Some industries require more trucking expenditure than others in terms of freight expenditure per dollar of output.
- Those industries that have higher trucking costs, in terms of total dollars, will take on a greater share of the changes in costs.

Each of these points is addressed in the following steps, which walk through the process of apportioning changes in trucking costs to the correct industries in the study area. As an example of this process, the industry of Tire Manufacturing (IMPLAN industry 196) is used.

Task 1, Step 1: Identify the Direct Trucking Required per Dollar of Output for Each Industry

Different industries require varying amounts of spending on inputs in order to produce a dollar of output. One of these inputs is trucking, either through the expense of maintaining a fleet of trucks in-house, or hiring another company to provide transportation services.

The U.S. Department of Transportation (USDOT) publishes this data in the Transportation Satellite Accounts (TSA), specifically the Commodity-by-Industry Direct Requirements by Sector. These data report the direct requirement per dollar of industry output at producers' prices. The TSA has 72 industry classifications. IMPLAN has 536 industries. In order to apply the correct expenditure per dollar of output, the TSA industries were mapped to the appropriate IMPLAN industries.

Example:

The IMPLAN example industry, Tire Manufacturing, falls into the TSA industry of Plastics and Rubber Products (TSA industry 326). For this industry, USDOT reports that on average in this industry, one dollar of output requires direct trucking inputs of $0.0285.

Task 1, Step 2: Calculate the Share of Trucking Costs Incurred by Each Industry

Once the required direct trucking input requirement per dollar of output has been identified for each IMPLAN industry, the total annual expenditure on trucking within the study area can be calculated for any given industry (x) with the following equation:

$$Trucking\ Expenditure_x = (Output_x) \times (Trucking\ Input\ per\ Dollar\ of\ Output_x)$$

The regional share of total trucking expenditure spent by the given industry (x) is calculated as:

$$Share\ of\ Trucking\ Expenditure_x = \frac{(Trucking\ Expenditure_x)}{(Sum\ of\ Trucking\ Expenditure\ for\ All\ Industries)}$$

Even though the data used is from 2014, it is assumed that the approximate share per industry will remain unchanged.

Example:

Taking the example of the Tire Manufacturing industry, IMPLAN reports that annual output in Pulaski County for the industry was $20,843,512 in 2015. Using the trucking expenditure per dollar of output from step 1 and the first equation in step 2, the 2015 trucking expenditure in this industry in Pulaski County was:

$$Trucking\ Expenditure = (\$20{,}843{,}512\ ) \times (0.0285) =\ \$594{,}041$$

The total of the annual trucking expenditure across all industries comes to $886,428,317. Therefore, the share of total trucking costs attributable to the Tire Manufacturing industry is calculated as:

$$Share\ of\ Trucking\ Expenditure = \frac{(\$594{,}041\ )}{(\$886{,}428{,}317)} = 0.07\%$$

Task 1, Step 3: Distribution of Travel Efficiency Costs (or Savings)

The changes in travel efficiency were converted into dollar costs or savings for trucking trips. These were then apportioned to the IMPLAN industries in proportion to their share of annual trucking expenditures (calculated in step 2):

$$\begin{aligned} &Raw\ Change\ in\ Trucking\ Costs_x \\ &\qquad = (Travel\ Efficiency\ Change\ in\ Trucking\ Costs)\ \times (Share\ of\ Trucking\ Expenditure_x) \end{aligned}$$

By using this equation, all of the changes in trucking costs caused by changes in travel efficiency are distributed across the industries in the study area. In the next task (Task 2) in the process, changes in trucking costs were translated to a change in output for each industry.

Example:

In step 2, the Tire Manufacturing industry share of trucking expenditures in the study area was calculated to be 0.07 percent. Using the change in travel efficiency in the 6-Lane C/D SPUI alternative for example, the change in trucking costs is expected to be a decrease of $316,160,098. Therefore the change in trucking costs in the Tire Manufacturing industry is:

$$Change\ in\ Trucking\ Costs = (-\$316{,}160{,}098) \times (0.07\%) = -\$221{,}312$$

So in this specific scenario, the Tire Manufacturing industry is expected to experience a decrease of $221,312 in trucking costs.

Task 2: Convert Cost Changes to Output Changes

A change in cost does not necessarily have a one-to-one impact on output. A firm will choose to shift from more expensive inputs to cheaper comparable inputs as relative prices change, or decrease levels of production, or both.

The elasticity of demand for freight services is an estimate of the expected change in freight services demanded, as a result from a one percent change in total costs, holding all other prices constant. The output elasticity with respect to the price of an input is a measure of the percentage change in output that is expected to result from a one percent change in total cost.

The elasticities above were applied in order to convert the changes in trucking costs from Task 1 into changes in output, using the following steps:

Task 2, Step 1: Calculate the Percentage Change in Total Costs

Prior to applying elasticities, the percentage change in total cost was calculated. In order to calculate the percentage change in total cost caused by the change in trucking costs for the industry, the following equation was used:

$$Percentage\ Change\ in\ Cost_x = \frac{(Change\ in\ Trucking\ Cost_x)}{(Total\ Industry\ Output_x)}$$

Example:

In Pulaski County, the Tire Manufacturing industry has an annual output of $20,843,512. The change in trucking costs (calculated in Task 1, step 3) is a decrease of $221,312. Hence, the percentage change in total cost is:

$$Percentage\ Change\ in\ Cost = \frac{(-\$221{,}312)}{(\$20{,}843{,}512)} = -1.1\%$$

The change in trucking costs for this industry amounts to a 1 percent decrease in total costs.

Task 2, Step 2: Estimation of Elasticities

Output elasticities with respect to trucking cost were estimated for the goods sector and the service sector, based on the Victoria Transport Policy Institute, “Understanding Transport Demand and Elasticities” 2013 research[20]:

Goods Sector Freight Elasticity: -0.35

Service Sector Freight Elasticity: -0.25

These can be interpreted to mean that, within the goods sector a 1 percent increase in total costs caused by a change in trucking costs will result in a 0.35 percent decrease in output. Similarly, for the service sector a 1 percent increase in total costs caused by a change in trucking costs will result in a 0.25 percent decrease in output. These elasticities were used for the industries within each of these sectors.

Example:

[20] Litman, T. (2013). Understanding Transport Demand and Elasticities: How Prices and other Factors Affect Travel Behavior. Victoria Transport Policy Institute. Accessed from http://www.vtpi.org/elasticities.pdf

The Tire Manufacturing industry falls into the goods sector. Therefore the appropriate output elasticity to apply to changes in trucking cost is -0.35.

Task 2, Step 3: Application of Output Elasticities

Once the percentage change in trucking costs were calculated, the output elasticities were applied in order to calculate the percentage change in output for each industry.

$$Percentage\ Change\ in\ Output_x = (Output\ Elasticity_x) \times (Percentage\ Change\ in\ Cost_x)$$

The percentage change in output was then applied to the total output for the industry in order to convert the percentage change into a dollar change.

$$Change\ in\ Output_x = (Output_x) \times\ (Percentage\ Change\ in\ Output_x)$$

This change in output for each industry in the study area was entered into IMPLAN in order to estimate the economic impact of the change in trucking costs due to changes in travel efficiency.

Example:

In Step 1, the percentage change in total trucking costs for the Tire Manufacturing industry was calculated to be a decrease of 0.9 percent. In step 2, the output elasticity with respect to trucking cost was determined to be -0.35. Using these two pieces of information, along with industry output, the change in output in this industry was calculated:

$$Percentage\ Change\ in\ Output = (-0.35) \times (-1.1\%) =\ 0.39\%$$

$$Change\ in\ Output = (\$20{,}843{,}512) \times (0.39\%) =\ \$81{,}290$$

For the example industry, the cost decrease in trucking caused by changes in traffic efficiency lead to a $81,290 increase in output. This change was entered into IMPLAN, along with the other changes in output by industry and income in order to estimate the economic impacts of the project.

A.2 Translating Changes in Business Travel into IMPLAN Inputs

Business travel cost changes are handled very similarly to changes in trucking costs. The same steps (as outlined in Section 4.5.1) are applied with two important changes:

- Rather than using trucking input per dollar of output (in Task 1, step 1), ground travel input per dollar of output is used.
- The output elasticity with respect to ground travel costs is estimated instead of the output elasticity with respect to trucking costs (Task 2, Step 1).

As with the trucking impacts, the TSA data is used to assign the cost of ground travel needed to produce a dollar of output for each IMPLAN industry. Again, the IMPLAN industries were mapped to the appropriate TSA industry. The output elasticities with respect to ground travel cost for the goods and service sectors are applied from the Victoria Transport Policy Institute, “Understanding Transport Demand and Elasticities” 2013 research[21]:

Goods Sector: -0.50

Service Sector: -0.50

While the sectors are more elastic with respect to ground travel cost than trucking cost, ground travel generally comprises a smaller part of total costs, and therefore the impact of price changes in ground travel on output levels is generally smaller.

The process for calculating the change in output caused by changes in business travel costs is the same as the process for calculating trucking cost changes. An example using the same industry as before (Tire Manufacturing) is used to illustrate the process.

Task 1, Step 1: Identify the Direct Share of Ground Travel Required per Dollar of Output for Each Industry

For the Tire Manufacturing industry, on average, one dollar of output requires direct ground travel inputs of $0.0008 (compared to the required trucking input of $0.0285).

Task 1, Step 2: Calculate the Share of Ground Travel Costs Incurred by Each Industry

As reported previously, the 2015 industry output in Pulaski County was $20,843,512 in 2015. Applying the direct ground travel input per dollar of output produces the expenditure on ground travel for the industry:

$$Ground\ Travel\ Expenditure = (\$20{,}843{,}512\ ) \times (\$0.0008) = \$16{,}675$$

The sum of ground travel expenditure across all industries is $41,489,257. Therefore:

$$Share\ of\ Ground\ Travel\ Expenditure = \frac{(\$16{,}675)}{(\$41{,}489{,}257)} = 0.04\%$$

Task 1, Step 3: Distribution of Travel Efficiency Costs (or Savings)

In the 6-Lane C/D SPUI alternative, for example, business travel costs are expected to decrease by $502,301,898. Apportioning this to the Tire Manufacturing industry based on share of ground travel costs results in the following:

$$Change\ in\ Ground\ Travel\ Costs = (-\$502{,}301{,}898) \times (0.04\%) = -\$200{,}921$$

Task 2, Step 1: Calculate Percent Change in Total Costs

As calculated in Section 4.5.1 above, prior to applying elasticities, the percentage change in total cost was calculated. The change in ground travel costs (calculated in Task 1, Step 3) is a decrease of $200,921 for the 6-Lane C/D SPUI alternative. Therefore, the percentage change in total cost is:

[21] Litman, T. (2013). Understanding Transport Demand and Elasticities: How Prices and other Factors Affect Travel Behavior. Victoria Transport Policy Institute. Accessed from http://www.vtpi.org/elasticities.pdf

$$Percentage\ Change\ in\ Cost = \frac{(-\$200{,}921)}{(\$20{,}843{,}512)} = -1\%$$

Task 2, Step 2: Estimation of Elasticities

As noted above, the Tire Manufacturing industry is within the goods sector. As such, the output elasticity with regard to changes in ground travel cost is -0.5.

Task 2, Step 3: Application of Output Elasticities

For the example industry, we know that:

The appropriate output elasticity is -0.5, the percentage change in total cost is -1 percent, and the industry output is $20,843,512. Thus, the change in industry output is:

$$Percentage\ Change\ in\ Output = (-0.5) \times (-1\%) = 0.5\%$$

$$Change\ in\ Output = (\$20{,}843{,}512) \times (0.5\%) = \$104{,}218$$

For the Tire Manufacturing industry, the cost decrease in business travel caused by changes in traffic efficiency lead to a $104,218 increase in output.

A.3 Translating Changes in Maritime Transportation into IMPLAN Inputs

Maritime travel cost changes are handled very similarly to changes in trucking costs. The same steps (as outlined in Section 4.5.1) are applied with two important changes:

- Rather than using trucking input per dollar of output (in Task 1, step 1), water travel input per dollar of output is used.
- The output elasticity with respect to water travel costs is replaced with the output elasticity with respect to trucking costs (Task 2, Step 1).

As with the trucking impacts, the TSA data is used to assign the cost of water travel needed to produce a dollar of output for each IMPLAN industry. Again, the IMPLAN industries were mapped to the appropriate TSA industry. The output elasticities with respect to water travel cost for the goods and service sectors are replaced with trucking elasticities from the Victoria Transport Policy Institute, “Understanding Transport Demand and Elasticities” 2013 research[22]:

Goods Sector: -0.35

Service Sector: -0.25

[22] Litman, T. (2013). Understanding Transport Demand and Elasticities: How Prices and other Factors Affect Travel Behavior. Victoria Transport Policy Institute. Accessed from http://www.vtpi.org/elasticities.pdf

The process for calculating the change in output caused by changes in water travel costs is the same as the process for calculating trucking cost changes. An example using the same industry as before (Tire Manufacturing) is used to illustrate the process.

Task 1, Step 1: Identify the Direct Share of Water Travel Required per Dollar of Output for Each Industry

For the Tire Manufacturing industry, on average, one dollar of output requires direct water travel inputs of $0.0003 (compared to the required trucking input of $0.0285).

Task 1, Step 2: Calculate the Share of Water Travel Costs Incurred by Each Industry

As reported previously, the 2015 industry output in Pulaski County was $20,843,512 in 2015. Applying the direct water travel input per dollar of output produces the expenditure on water travel for the industry:

$$Ground\ Travel\ Expenditure = (\$20{,}843{,}512\ ) \times (\$0.0003) = \$6{,}253$$

The sum of water travel expenditure across all industries is $45,281,677. Therefore:

$$Share\ of\ Water\ Travel\ Expenditure = \frac{(\$6{,}253)}{(\$45{,}281{,}677)} = 0.01\%$$

Task 1, Step 3: Distribution of Travel Efficiency Costs (or Savings)

In the 6-Lane C/D SPUI alternative for example, water travel costs are expected to decrease by $15,294,114. Apportioning this to the Tire Manufacturing industry based on share of water travel costs results in the following:

$$Change\ in\ Ground\ Travel\ Costs = (-\$15{,}294{,}114) \times (0.01\%) = -\$1{,}529$$

Task 2, Step 1: Calculate Percent Change in Total Costs

As calculated in Section 4.5.1 above, prior to applying elasticities, the percentage change in total cost was calculated. The change in water travel costs (calculated in Task 1, Step 3) is a decrease of $1,529 for the 6-Lane C/D SPUI alternative. Therefore, the percentage change in total cost is:

$$Percentage\ Change\ in\ Cost = \frac{(-\$1{,}529)}{(\$20{,}843{,}512)} = -0.01\%$$

Task 2, Step 2: Estimation of Elasticities

As noted above, the Tire Manufacturing industry is within the goods sector. As such, the output elasticity with regard to changes in water travel cost is -0.35.

Task 2, Step 3: Application of Output Elasticities

For the example industry, we know that:

The appropriate output elasticity is -0.35, the percentage change in total cost is -0.01 percent, and the industry output is $20,843,512. Thus, the change in industry output is:

$$Percentage\ Change\ in\ Output = (-0.35) \times (-0.01\%) = 0.0035\%$$

$$Change\ in\ Output = (\$20{,}843{,}512) \times (0.0035\%) = \$730$$

For the Tire Manufacturing industry, the cost decrease in water travel caused by changes in water travel efficiency lead to a $730 increase in output.

A.4 Translating Changes in Leisure and Commute Travel into IMPLAN Inputs

This section describes the process used to generate IMPLAN inputs from the travel efficiency changes for both leisure and commuting trips. As in previous sections, an example will be used to illustrate the steps in this process.

Costs resulting from decreases in travel efficiencies (or increase in travel costs) for leisure and commuting trips are treated as reductions in household incomes in the study area. This is because these costs effectively reduce the amount of disposable income available to the households in the study area. Similarly, improvements in travel efficiencies result in a reduction in costs, and therefore are treated as an increase in household income for the area.

In order to input changes in household income into IMPLAN, the changes must be assigned to households within specific income ranges. The steps involved in the assignment process are described in the following sections.

Step 1: Determine the Distribution of Households by Income Range

The IMPLAN model breaks households up into nine groups, based on annual household income as shown in Table A.1.

Table A.1 IMPLAN Household Income Groups

IMPLAN ID	Income Range
10001	Less than $15,000
10002	$15,000 to $30,000
10003	$30,000 to $40,000
10004	$40,000 to $50,000
10005	$50,000 to $70,000
10006	$70,000 to $100,000
10007	$100,000 to $150,000
10008	$150,000 to $200,000
10009	$200,000 and Above

Source: IMPLAN

The assumption was made that the change in income is borne by all households in the study area equally. In order to apply this assumption, the percentage of households falling into each income range was calculated.

$$Percent\ Household\ in\ Income\ Range\ x = \frac{(Housholds\ in\ Income\ Range\ x)}{(Total\ Housholds)}$$

The household counts needed for this calculation are available from IMPLAN. The most current IMPLAN data is for 2015. It was assumed that the relative proportions will stay roughly the same over time.

Example:

This example focuses on the households in Pulaski County, Arkansas, with income of $40,000 to $50,000 per year. In 2015, 15,504 households fell into this range. The total count of households at the time was 161,641. The percentage of households in the county that are within this range was calculated as:

$$Percent\ Housholds, \$40{,}000\ to\ \$50{,}000 = \frac{(15{,}504)}{(161{,}641)} = 9.6\%$$

Step 2: Apportion Changes in Costs across Households

Changes in traffic efficiency were converted into dollar costs or savings for leisure and commuter trips. These savings/costs were treated as changes in household income. These changes were apportioned to the IMPLAN income groups in proportion to their share of households (calculated in step 1). The following equation was used to apportion the changes in income to the households within a given income range (x):

$$Change\ in\ Houshold\ Income_x = (Change\ in\ Commuter\ and\ Leisure\ Costs)\ \times (Share\ of\ Households_x)$$

This change in household income was calculated for all households in the study area and used as an input into IMPLAN, which produces the resulting economic impacts for the area.

Example:

In Step 1, the share of households with an annual income of $40,000 to $50,000 in Pulaski County was calculated to be 9.6 percent. The projected decreases in travel costs (in 2016 dollars) for leisure and commuter trips for the 6-Lane CD SPUI alternative are as follows:

- Increase in Leisure Travel Costs: $113,933,148
- Decrease in Commuter Travel Costs: $302,378,778

Therefore the change in household income for the households within the $40,000 to $50,000 income range is:

$$Change\ in\ Income = (-\$113{,}933{,}148\ + \$302{,}378{,}778) \times (9.6\%) = \$18{,}090{,}780$$

In this scenario, the changes in travel efficiency for leisure and commuter trips in the 6-Lane CD SPUI alternative is an effective increase of $18,090,780 in income (in 2016 dollars) for the 9.6 percent of households with annual income of $40,000 to $50,000.

A.5 Translating Changes in Tourism Expenditures into IMPLAN Inputs

When dealing with the projected changes in tourism expenditures, the estimates are already in the form of increase/decrease in output. Therefore, they could be entered directly into IMPLAN after they are apportioned to the proper industries. In the case of this specific project, it is assumed projected tourism impacts are of four different types:

- Changes in restaurant sales
- Changes in gas station sales
- Changes in grocery store sales
- Changes in transportation at destination revenues

Changes in revenue for these sectors each fall into a directly comparable IMPLAN industry. The matching industries are shown in Table A.2. Within the IMPLAN model, sixteen industries would be impacted by changes in tourism sales. The relative share of each industry to the overall output of all these industries is reported in this table as well.

Table A.2 Tourism Impacts and the Associated IMPLAN Industries

IMPLAN Industry Code	IMPLAN Industry	Share of Tourism Revenues
396	Retail - Motor vehicle and parts dealers	11.51%
397	Retail - Furniture and home furnishings stores	3.35%
398	Retail - Electronics and appliance stores	1.54%
399	Retail - Building material and garden equipment and supplies stores	4.87%
400	Retail - Food and beverage stores	6.93%
401	Retail - Health and personal care stores	4.94%
402	Retail - Gasoline stores	3.02%
403	Retail - Clothing and clothing accessories stores	6.85%
404	Retail - Sporting goods, hobby, musical instrument and book stores	2.56%
405	Retail - General merchandise stores	12.33%
406	Retail - Miscellaneous store retailers	3.73%
407	Retail - Nonstore retailers	4.94%
412	Transit and ground passenger transportation	1.07%
501	Full-service restaurants	10.79%
502	Limited-service restaurants	18.02%
503	All other food and drinking places	3.56%

Source: IMPLAN

The change in tourism expenditures was assumed to impact these industries in proportion to their relative share of annual output for the respective industries. To calculate this share for one of the three industries (industry x), the following equation was used:

$$Relative\ Share\ of\ Output_x = \frac{(Output_x)}{(Sum\ of\ Output\ for\ All\ Tourism\ Industries)}$$

The data used is from 2014, and it was assumed that the approximate share per industry would remain unchanged. The change in restaurant sales/revenues was then apportioned to the industries using the relative share of output.

$$Change\ in\ Revenues/Sales_x = (Change\ in\ Revenues/Sales\ for\ All\ Industries) \times (Realtive\ Share\ of\ Output_x)$$

The changes in revenues/sales for each of the industries were then entered into IMPLAN as changes in output.

Example:

Using the gas station sales (IMPLAN industry 402) as an example, in the 6-Lane CD SDI alternative, it was projected that tourism expenditures will be increased by $87,362,368. Using the industry output data from IMPLAN, along with the equation to calculate relative share of output, produces the following results:

$$Relative\ Share\ of\ Output_x = \frac{(\$110{,}117{,}607)}{(\$3{,}649{,}535{,}938)} = 3.02\%$$

$$Change\ in\ Revenues/Sales_x = (\$87{,}362{,}368) \times (3.02\%) = \$2{,}638{,}344$$

The increase/decreases in sales were entered for each IMPLAN industry as increase/decreases in output.

A.6 Translating Changes in Construction and O&M Expenditures into IMPLAN Inputs

The proposed Build alternatives' construction and O&M activity have induced impacts in the project area and Pulaski County in general. Similarly, O&M activity of the No-Action alternative will have induced impacts on the labor market and industry output.

When dealing with the projected changes in construction and O&M expenditures the estimates are already in the form of increase/decrease in output. Therefore, they could be entered directly into IMPLAN after they are apportioned to the proper industries. In the case of this specific project, it is assumed projected construction and O&M impacts belong to the following industries:

- Industry Sector 56: Construction of new highways and streets
- Industry Sector 64: Maintenance and repair construction of highways, streets, bridges, and tunnels

Changes in construction expenditures fall into sector 56, and changes in O&M spending fall into sector 64. The project construction and O&M spending impacts are modeled separately in IMPLAN through a Build and No-Action alternative. Due to the magnitude of construction and O&M spending, there will be short-term employment and income benefits that can affect the direct benefits/disbenefits of project alternatives. Hence, construction and O&M impacts are analyzed and reported independent of other project impacts.

The No-Action alternative has significant O&M costs due to the anticipated project delays that can increase the cost of maintain existing conditions. As estimated in section 3.3, the No-Action O&M expenditures are $192,322,440 in 2016 dollars. The construction expenditures of the Build alternatives are estimated to be $536,945,000. Due to replacement of the I-30 Bridge and overall corridor improvements, the O&M expenditures for the Build alternatives are estimated to be $ $25,095,609. The net O&M impact of the Build alternatives are derived by subtracting the No-Action O&M spending from the Build O&M spending, since there will be reduced impacts in the Build alternatives.

The Build O&M changes are estimated as follows:

$$\$25{,}095{,}609\ -\$192{,}322{,}440 = \$(167{,}226{,}831)$$

The increase/decreases in spending were entered for each IMPLAN industry as increase/decreases in output (Table A.3).

Table A.3 Construction and O&M Impacts and the Associated IMPLAN Industries

IMPLAN Industry Code	IMPLAN Industry	Change in Industry Output (Build)
56	Construction of new highways and streets	$536,945,000
64	Maintenance and repair construction of highways, streets, bridges, and tunnels	$(167,226,831)

Source: IMPLAN, Cambridge Systematics Cost Analysis