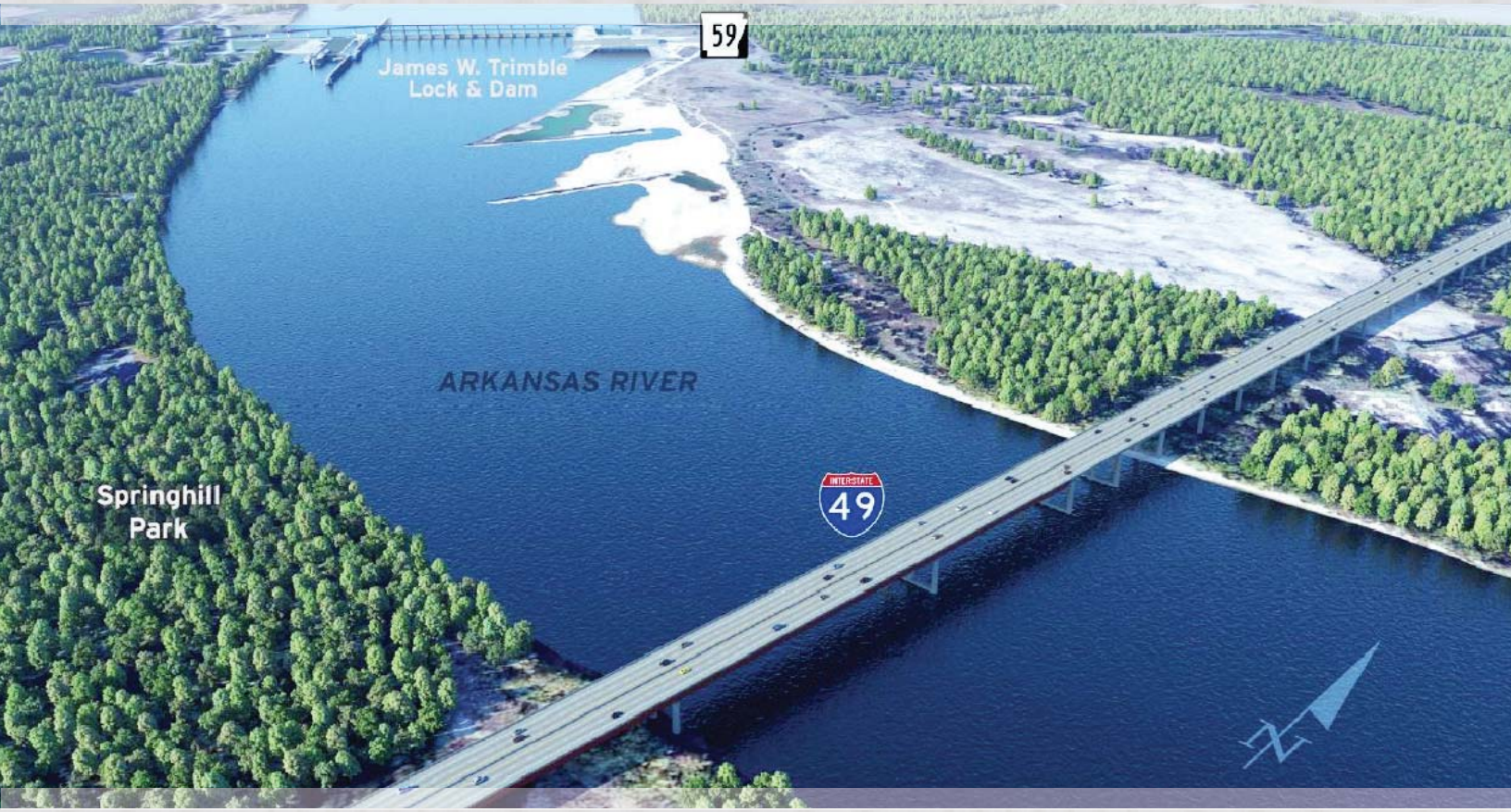
I-49 Alternative Delivery Study

Job 040748 | Highway 22 to Interstate 40 | Crawford and Sebastian Counties, Arkansas



OCTOBER 2018

HNTB

ARDOT
ARKANSAS DEPARTMENT OF TRANSPORTATION

Interstate 49 Alternative Delivery Study
Toll Feasibility Technical Report

Highway 22 to Interstate 40

Crawford and Sebastian Counties
Job No. 040748

Submitted by: HNTB

Prepared for Transportation Planning and Policy Division
Arkansas Department of Transportation
In cooperation with the Federal Highway Administration

This report was funded in part by the Federal Highway Administration, U.S. Department of Transportation. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the U.S. Department of Transportation.

HNTB makes no assertion or claim that the assumptions used in the model represent current or actual financial market terms or interest rates. The results of the HNTB model are presented solely for illustration purposes and do not represent terms for an actual transaction. HNTB is not a registered financial advisor and the results of this analysis are not intended to be used to justify a financing or P3 transaction.

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INTRODUCTION

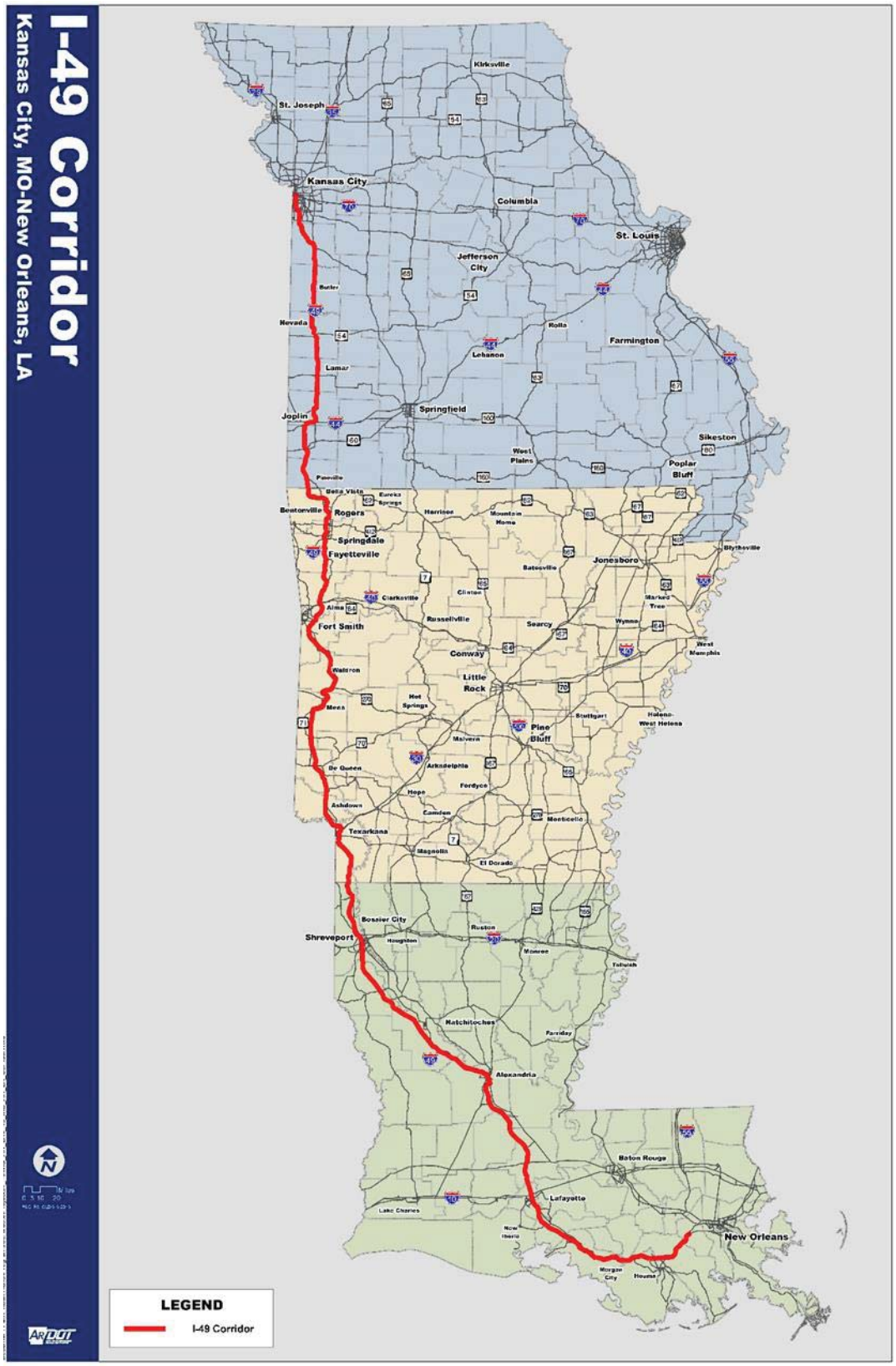
The Arkansas Department of Transportation (ARDOT), in cooperation with the Federal Highway Administration, is preparing a re-evaluation of the Final Environmental Impact Statement for a new section of Interstate 49 (I-49). The new segment (Figure 1) would connect Interstate 40 (I-40) in Crawford County with Highway 22 (Hwy. 22) in Sebastian County, a length of approximately 13.7 miles.

ARDOT, like other state departments of transportation, is facing challenges in providing needed transportation improvements with limited local, state, and federal funds. As directed by Arkansas State Highway Commission (AHC) Minute Order 2016-092 (Appendix A), tolling was evaluated as a potential funding option for this project. This feasibility analysis includes an assessment of project costs, toll revenues, and project financing strategies.

Interstate 49 is Congressionally-designated as High Priority Corridor No. 1. When completed, I 49 will connect Kansas City, Missouri, to southern Louisiana, passing through the Fayetteville-Springdale-Rogers metropolitan area, Fort Smith, and Texarkana (Figure 2). In Arkansas, I-49 has been completed between the Fayetteville-Springdale-Rogers metropolitan area and Fort Smith, and between Texarkana and the Louisiana state line. ARDOT is actively improving I-49 in northwest Arkansas, including widening of existing sections and construction of the I-49 Missouri-Arkansas Connector. In Missouri, I-49 is complete except for a connection between Pineville and the Arkansas state line. In Louisiana, I-49 is complete to Lafayette except for a connection through Shreveport.

Figure 1 – Project Location Map

Figure 2 – I-49 Corridor Map



PROJECT BACKGROUND AND OVERVIEW

This project was originally part of a larger environmental effort known as the U.S. 71 Relocation Study, extending from Hwy. 70 in DeQueen to I-40 near Alma, along the western edge of Arkansas and encompassing approximately 125 miles. The relocation of U.S. 71 in Arkansas is part of the Congressionally-designated High Priority Corridor 1, extending from Shreveport, Louisiana to Kansas City, Missouri. A Final Environmental Impact Statement (FEIS) was prepared and a Record of Decision (ROD) was issued in December 1997 approving the general alignment of a new location, four lane highway in western Arkansas.

Due to the length of the corridor and funding constraints, design and construction of sections of the corridor have been completed as funding has become available. The majority of the right-of-way (ROW) through the Fort Chaffee area had been deeded to the AHC from the Department of the Army.

The proposed project is needed to complete a vital section of the larger I-49 national interstate corridor which is congressionally-designated as High Priority Corridor 1. The proposed project is needed to provide linkage and modal connectivity to the surrounding interstate highway system, including links to both the surrounding I-49 corridor sections already completed and a vital link to I-40, resulting in increased mobility through the region and enhanced modal connectivity.

This Toll Feasibility Technical Report provides a summary of project costs and revenues along with the results of the financial feasibility analysis. Detailed sections of the report will cover cost methodology and estimates, proposed tolling plan scenarios including operations and maintenance, traffic and revenue analysis, and the overall financial feasibility results.

In addition to the primary Full Build 4-Lane project, this analysis also evaluated sensitivities to test alternate alignments, lane configurations and land use growth to evaluate the impact on costs and revenue. For the purpose of conducting the toll feasibility analysis, two phasing options in addition to the full build option were considered:

- The Interim 4-Lane scenario matches the Full Build 4-Lane except it does not include ramp access at Gun Club Road, Clear Creek Road ramp access to/from the north, and does not have ramps from I-49 northbound to I-40 westbound and I-40 eastbound to I-49 southbound.
- The Phased Initial 2-Lane scenario only includes two lanes (one roadbed) of Full Build 4-Lane (one lane in each direction, not median divided), only a two lane bridge across the Arkansas River, reduces posted speed from 70 mph to 55 mph, provides the same interchange configurations as the Interim 4-Lane scenario above and does not include a grade separation overpass at Thornhill Street.

For the purpose of testing the upside revenue potential of the project under different land use, connectivity and growth forecasts, two illustrative traffic and revenue sensitivities were evaluated. It is important to note that these revenue sensitivities are speculative and would require additional funding commitments before the results could be considered likely enough to include in a financing.

- The Increased Land Use Full Build 4-Lane scenario assumes more development in the project region and includes growth related to the West Arkansas Intermodal Authority (WAIA).
- The Complete I-49 Full Build 4-Lane scenario assumes the completion of following segments of I-49:
    - I-49 extension from Fort Smith to DeQueen based on the alignment in the 1997 EIS and from DeQueen to Texarkana based on the alignment in the 2001 EIS.

ROADWAY CONSTRUCTION AND OPERATIONS & MAINTENANCE ANALYSIS

CAPITAL COST ESTIMATE

Figure 3 and **Table 1** provide a comparison of the three alternative scenarios for the I-49 Corridor. The Full Build 4-Lane Scenario consisted of an Ultimate Build Out condition consisting of four main lanes (two lanes in each direction) with a proposed center median that varies from an open 80' median (between the inside edges of travel lanes) to a flush 18' median with center barrier to optimize the proposed bridge spanning Springhill Park, the Arkansas River/levee, and Gun Club Road. Proposed interchanges with slip/loop ramps were developed for Hwy. 22, Gun Club Road, and Clear Creek Road. System Interchange improvements at I-40 consisted of completing the remaining six of eight direct connector ramps for this to operate as a fully-directional interchange. Proposed grade separated intersections without ramps were developed for Thornhill Street, Hwy. 162, Union Pacific Railroad (UPRR), and Hwy. 64 to maintain local access.

The second alternative evaluated was the Interim 4-Lane Scenario consisting of four main lanes (two lanes in each direction) including the proposed four lane bridge spanning Springhill Park, the Arkansas River/levee, and Gun Club Road, but with reduced interchange ramp access. The following project elements were deferred for future construction phases: all ramps at Gun Club Road; both loops ramps and the southbound exit ramp at Clear Creek Road; and two direct connect ramps (north to west and east to south) at I-40.

The third alternative was the Phased Initial 2-Lane Scenario consisting of two main lanes (one lane in each direction) including a proposed two lane bridge spanning Springhill Park, the Arkansas River/levee, and Gun Club Road. The Initial 2-Lane Scenario would be constructed primarily along the Ultimate northbound main lanes. The following project elements were deferred for future construction phases: southbound main lanes; all ramps at Gun Club Road; grade separation at Thornhill Street; both loops ramps and the southbound exit ramp at Clear Creek Road; and 2 direct connect ramps (north to west and east to south) at I-40.

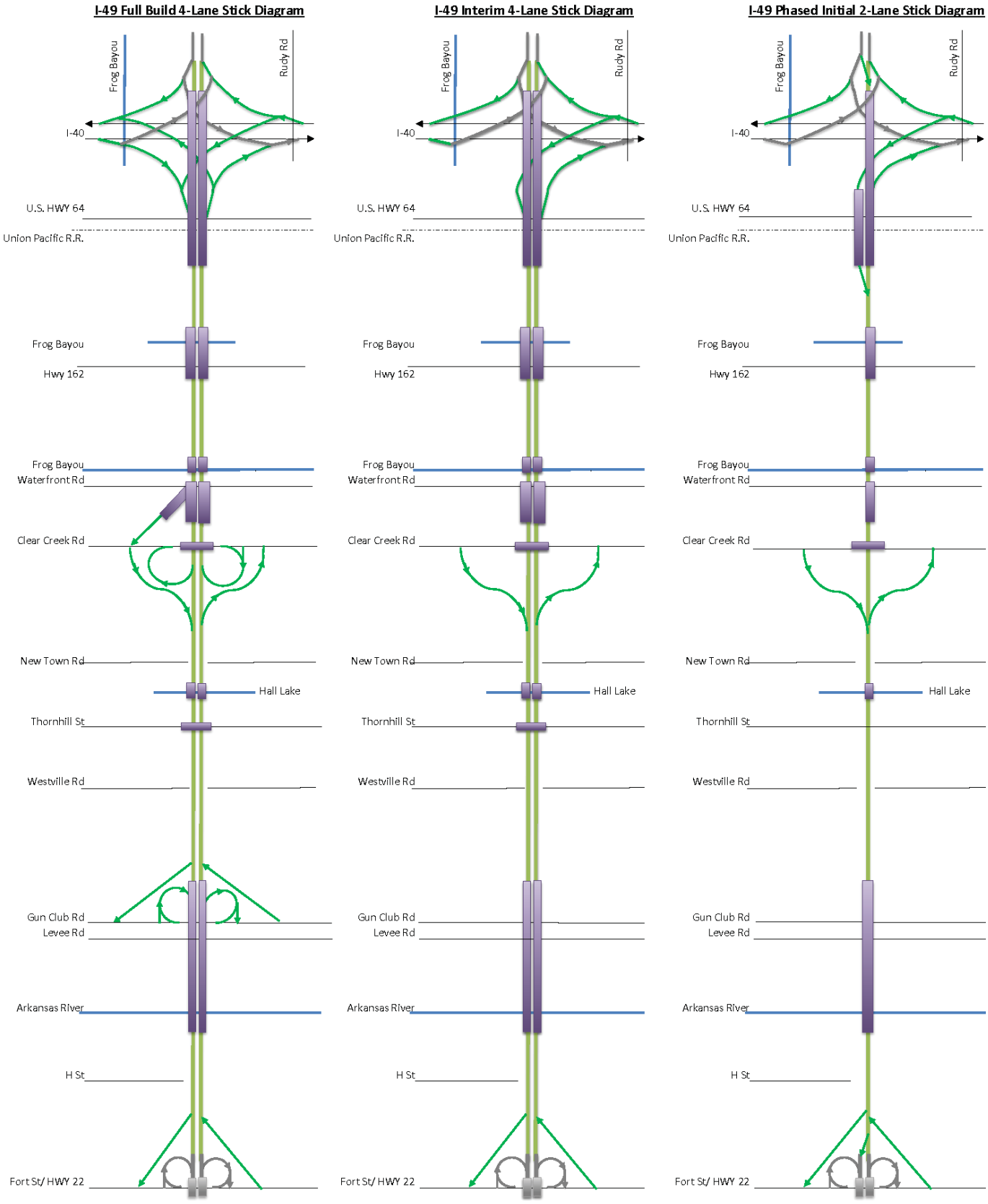


Figure 3 – Stick Diagram Scenarios

Table 1: Full Build and Phasing Options

Element	Full Build 4-Lane	Interim 4-Lane	Phased Initial 2-Lane
Main Lanes	Four – Two lanes in each direction		Two – One lane each direction
Speed Limit	70 mph		55 mph
Arkansas River Bridge	Four lanes		Two lanes
Median	Variable		None
Grade Separations	Thornhill St., Hwy. 162, UPRR & Hwy. 64		Hwy. 162, UPRR & Hwy. 64
Interchange Locations	Hwy. 22, I-40, Gun Club Rd. & Clear Creek Rd.	Complete interchange at Hwy. 22; partial interchange at I-40; and partial interchange at Clear Creek Rd. (south facing ramps only)	
I-40/I-49 Freeway-to-Freeway Ramps	Remaining direct connections for all movements	Northbound-to-westbound and eastbound-to-southbound ramps not included	

The scenarios require the construction of a new roadway along the approved 1997 FEIS centerline alignment based on current design standards for ARDOT, American Association of State Highway and Transportation Officials, and UPRR. Given the proposed design elements, existing infrastructure and development along the project corridor, construction costs must be considered preliminary at this phase of development. Detailed impacts to features such as existing utilities, environmental features, and subsurface conditions, have yet to be identified based on the level of preliminary project development. Additionally, the requirements of local agencies and regulatory agencies may expand the scope and requirements of the project beyond those contemplated in this analysis.

The cost estimate template used in the feasibility study was developed specifically for design-build pre-procurement alternative scenarios. Construction cost contingencies typically used in design-bid-build estimates were evaluated in this estimate for corridor specific elements called event driven risk items. The study team developed the following potential event driven risks (**Table 2**) throughout the corridor.

Table 2: Event Driven Risk

Item Description
James W. Trimble Lock and Dam Operations
Best Management Practice (BMP) for River Bridge
Permit Compliance Issues
Impacts to Utility Transmission Lines
Unknown Gas or Oil Well collection lines
Unknown Archaeological impacts
Clean Line Energy Easement
Unknown Hazardous Materials impacts
Endangered Mussel
Unknown Geotech issues (No. Walls, Wall Types, Borrow, Levee, Bridge Foundation Types, Variability of Shale)

Alternative capital cost scenario summaries are shown in **Tables 3-5**. Analysis of recent U.S. roadway P3 bids have shown the aggressive bidding environment has consistently delivered design-build project development costs below the engineer's estimate. This analysis did not assume any cost benefits from P3 innovation or alternative technical concepts that could deliver the project below the estimates in this preliminary analysis.

Table 3: Full Build 4-Lane Capital Cost Scenario

DB Cost	Adjusted for Risk (Contingency)		
Roadway	$	119,928,845	15.4%
Structures	$	360,648,287	46.5%
Drainage	$	17,075,419	2.2%
Traffic	$	16,178,960	2.1%
Aesthetics/Landscaping	$	-	0.0%
Maintenance of Traffic	$	1,024,525	0.1%
General Construction	$	79,652,996	10.3%
Insurance & Bonds	$	22,386,480	2.9%
Sub Total Construction	$	616,895,512	79.5%
Environmental Mitigation	$	14,295,005	1.8%
Professional Svcs. Support	$	42,534,311	5.5%
Sub Total Other DB Costs	$	56,829,316	7.3%
Event Driven Risks	$	16,470,000	2.1%
*Total DB Costs	$	690,194,827	88.9%
Estimated Owner Agency Cost			
Management /Admin	$	18,807,489	2.4%
Consultants	$	48,640,056	6.3%
ROW Parcels/Utility Relocations/Stipend	$	18,701,872	2.4%
Total Estimated Owner Agency Costs	$	86,149,417	11.1%
Total Project Costs	**$**	**776,344,245**	

Table 4: Interim 4-Lane Capital Cost Scenario

DB Cost	Adjusted for Risk (Contingency)		
Roadway	$	108,277,953	14.7%
Structures	$	345,335,111	47.0%
Drainage	$	17,106,378	2.3%
Traffic	$	14,903,932	2.0%
Aesthetics/Landscaping	$	-	0.0%
Maintenance of Traffic	$	1,026,383	0.1%
General Construction	$	75,293,994	10.2%
Insurance & Bonds	$	21,163,167	2.9%
Sub Total Construction	$	583,106,919	79.4%
Environmental Mitigation	$	13,500,124	1.8%
Professional Svcs. Support	$	40,210,018	5.5%
Sub Total Other DB Costs	$	53,710,142	7.3%
Event Driven Risks	$	16,470,000	2.2%
*Total DB Costs	$	653,287,061	88.9%
Estimated Owner Agency Cost			
Management /Admin	$	17,745,010	2.4%
Consultants	$	45,173,192	6.1%
ROW Parcels/Utility Relocations/Stipend	$	18,436,253	2.5%
Total Estimated Owner Agency Costs	$	81,354,455	11.1%
Total Project Costs	**$**	**734,641,516**	

Table 5: Phased Initial 2-Lane Capital Cost Scenario

DB Cost	Adjusted for Risk (Contingency)		
Roadway	$	76,528,474	15.6%
Structures	$	206,314,807	42.1%
Drainage	$	8,532,552	1.7%
Traffic	$	10,001,369	2.0%
Aesthetics/Landscaping	$	-	0.0%
Maintenance of Traffic	$	511,953	0.1%
General Construction	$	46,681,992	9.5%
Insurance & Bonds	$	22,944,859	4.7%
Sub Total Construction	$	371,516,007	75.9%
Environmental Mitigation	$	8,438,663	1.7%
Professional Svcs. Support	$	36,383,991	7.4%
Sub Total Other DB Costs	$	44,822,654	9.2%
Event Driven Risks	$	9,495,000	1.9%
*Total DB Costs	$	425,833,661	87.0%
Estimated Owner Agency Cost			
Management /Admin	$	11,629,404	2.4%
Consultants	$	35,293,546	7.2%
ROW Parcels/Utility Relocations/Stipend	$	16,907,351	3.5%
Total Estimated Owner Agency Costs	$	63,830,301	13.0%
Total Project Costs	**$**	**489,663,962**	

UNIT COST DEVELOPMENT

HNTB developed 2018-unit costs by utilizing the following data sources: ARDOT bid price data for projects from Federal Fiscal Year 2015 to 2018; ARDOT I-30 Project; Texas Department of Transportation (TxDOT) Amarillo Interchange Project; TxDOT Dallas Southern Gateway Design/Build Project; and North Texas Tollway Authority (NTTA) tolling infrastructure projects. For each unit costs, escalation was not factored into the price.

Quantities and Right of Way Cost Development

Quantity Cost Development

HNTB estimated the cost of new construction elements to meet necessary design and operational standards for the project. Quantities calculated from the preliminary design schematic were used to develop preliminary construction cost estimates. Costs were

developed based on per linear feet or per area quantities generated by the preliminary design. The preliminary design was based on 2017 LiDAR topographic mapping provided by ARDOT. The centerline alignment from the 1997 FEIS was imported into Microstation from a .kmz file provided by ARDOT. The alignment was best fit to the existing centerline alignments at Hwy. 22 and I-40. After the horizontal centerline alignment was normalized with best fit curves, a profile was developed to optimize earthwork while maintaining roadway and drainage design standards. After the geometry was established, proposed roadway and bridge sections templates were used to model the proposed facility that established the limits of construction for proposed ROW lines. Once the bridge span limits were evaluated, unit costs for the bridge sections were divided into the following categories to obtain a higher level of accuracy:

For Concrete:

- Standard – Typical Concrete girder bridges
- Complex – Concrete Spans that are 65’ and higher in elevation
- Direct Connectors – Concrete Connectors at the I-40/I-49 Interchange
- Arkansas River – Concrete Spans within the River
- Widenings – Concrete Spans

For Steel:

- Standard – Typical Steel Girder bridges (typical rolled w-beam bridges)
- Complex – Longer Steel Spans utilizing plate girders (spans greater than 180’)
- Direct Connectors – Steel Span Connectors at the I-40/I-49 Interchange
- Arkansas River – Steel Spans within the River
- Widenings – Steel Spans

After the model was refined and optimized, the following major units of construction were quantified:

For Roadway:

- Prep ROW
- Removals
- Excavation
- Embankment
- Block Sodding
- Mainlane Pavement
- Ramp Pavement
- Cross-Street Pavement
- Permanent Concrete Barrier

For Drainage:

- Main lanes (includes culvert crossings)

For Maintenance of Traffic:

- Roadway Traffic Control
- Navigable Water Traffic Control

For Structures:

- Concrete Bridge Structures
- Steel Bridge Structures
- Retaining Walls – Cut
- Retaining Walls-Fill
- Noise Walls – 16' Vertical Height

For Traffic:

- Signing
- Pavement Markings
- Traffic Signals
- ETC Ramp Gantry
- ETC Mainlane Gantry
- Dynamic Message Sign
- Intelligent Transportation System (ITS) - Conduit

Other costs such as Design-Build Contractor's Insurance & Bonds, Environmental Mitigation, Professional Services Support, Agency Management Costs, and Consultant Costs were derived on a percentage approach basis. As previously discussed, event-driven risks were used for determining project construction contingencies.

Right of Way Cost Development

After the preliminary design schematic was developed based on the 2017 LiDAR topographic mapping information along with best fit GIS property lines provided by ARDOT, impacts to each parcel were quantified individually. Generally, the impacts for each parcel fit into either full acquisition or partial acquisition. Each parcel was evaluated separately based on access, potential displacement, and the amount of remaining property. The costs for each parcel was derived using 2018 Arkansas appraisal information from http://agio.maps.arcgis.com/. If a potential displacement was identified, additional relocation costs were accounted for. After all the impacts were quantified per parcel, a 40% mark-up was applied to account for estimated negotiated costs totaling $4.2M.

DELIVERY AND CONSTRUCTION SCHEDULE

For the financial feasibility analysis, it is assumed that construction will last four years. The first year of operations for each scenario is assumed for 2024, accommodating additional design development, procurement, NEPA process and other pre-construction activities from 2018-2020, and construction initiation in 2020-2021.

The construction schedule identified should be viewed as a preliminary estimate. Decisions regarding maintenance of traffic, incorporation of additional scope requirements by local municipalities or regulatory agencies, and meeting potential NEPA

commitments may increase the construction duration significantly. To maintain desired traffic operations, implementation of full closures of certain roads may not be permitted which will increase construction duration.

ROADWAY MAINTENANCE COST

Maintenance of a highway facility includes routine maintenance and periodic major maintenance activities needed to ensure safe and efficient performance and preservation of the facility. Routine maintenance typically includes activities such as mowing of grass, litter and debris removal, and snow and ice removal – as described more fully in the section titled *Routine Maintenance*. Major maintenance activities will include all reasonable and necessary expenses of repair and maintenance of the facility not recurring annually, such as bridge joint repair, slab repair, and pavement rehabilitation and reconstruction – as described more fully in the section titled *Major Maintenance*.

HNTB assumed that upon completion of construction, the roadway maintenance responsibilities, including rehabilitation and reconstruction costs, would be assigned to ARDOT. The roadway maintenance costs developed by HNTB and considered for the financial feasibility analysis reflect maintenance, repair, renewal, and rehabilitation costs for the tolled lanes, ramps, cross streets, and intersections within the ARDOT ROW. The assumed limits of maintenance include the entire I-49 ROW from Hwy. 22 to I-40, including interchanges at Clear Creek Road and Gun Club Road. Maintenance costs related to the connecting roadway system currently maintained with ARDOT maintenance funds, such as I-40, Hwy. 22, and the existing ramps between these facilities and I-49 are not included in the maintenance estimates.

Routine Maintenance

Routine Maintenance Activities

Routine maintenance includes maintenance activities as well as administration and oversight activities necessary to manage the operations and maintenance of the facility, such as engineering, inspection, and construction oversight services in support of the maintenance of the tolled facility. Additionally, the administration expenses included the ARDOT salaries necessary to ensure efficient maintenance of the facility.

Routine maintenance also includes activities that will typically occur annually, including:

- Pavement surface and joint repair,
- Bridge, wall, and gantry inspection, maintenance, and repair,
- Drainage structure cleaning and repair,
- Guardrail and traffic barrier repair,
- Maintenance of pavement markings and striping,
- Sign repair or replacement as required,
- Traffic signal maintenance,
- Maintenance of illumination,
- Mowing of grassed areas,
- Tree trimming/brush removal,
- Maintenance of slopes and erosion controls,
- Maintenance of ITS components,
- Litter and graffiti removal and road sweeping, and
- Snow and ice removal

Routine Maintenance Costs

Routine maintenance costs for the three scenarios based on the estimated quantity of Project elements, current industry unit pricing, and assumed maintenance schedules. Estimated routine maintenance costs are escalated by 2.5% every five years to reflect the low maintenance costs of a newly constructed system and the anticipated increase due to the natural aging and wear of the facility subject to the traffic and climatic conditions of the region.

For each scenario, I-49 routine maintenance costs, estimated in 2018 dollars, are provided in **Table 6**.

Table 6: ARDOT I-49 Routine Maintenance Estimate (2018 dollars)

Routine Maintenance Costs (2018 dollars)			
Year	Full Build 4-Lane	Interim 4-Lane	Phased Initial 2-Lane
2024	$ 1,758,000	$ 1,627,000	$ 1,270,000
2025	$ 1,758,000	$ 1,627,000	$ 1,270,000
2026	$ 1,758,000	$ 1,627,000	$ 1,270,000
2027	$ 1,758,000	$ 1,627,000	$ 1,270,000
2028	$ 1,758,000	$ 1,627,000	$ 1,270,000
2029	$ 1,802,000	$ 1,668,000	$ 1,302,000
2030	$ 1,802,000	$ 1,668,000	$ 1,302,000
2031	$ 1,802,000	$ 1,668,000	$ 1,302,000
2032	$ 1,802,000	$ 1,668,000	$ 1,302,000
2033	$ 1,802,000	$ 1,668,000	$ 1,302,000
2034	$ 1,848,000	$ 1,710,000	$ 1,335,000
2035	$ 1,848,000	$ 1,710,000	$ 1,335,000
2036	$ 1,848,000	$ 1,710,000	$ 1,335,000
2037	$ 1,848,000	$ 1,710,000	$ 1,335,000
2038	$ 1,848,000	$ 1,710,000	$ 1,335,000
2039	$ 1,895,000	$ 1,753,000	$ 1,369,000
2040	$ 1,895,000	$ 1,753,000	$ 1,369,000
2041	$ 1,895,000	$ 1,753,000	$ 1,369,000
2042	$ 1,895,000	$ 1,753,000	$ 1,369,000
2043	$ 1,895,000	$ 1,753,000	$ 1,369,000
2044	$ 1,943,000	$ 1,797,000	$ 1,404,000
2045	$ 1,943,000	$ 1,797,000	$ 1,404,000
2046	$ 1,943,000	$ 1,797,000	$ 1,404,000
2047	$ 1,943,000	$ 1,797,000	$ 1,404,000
2048	$ 1,943,000	$ 1,797,000	$ 1,404,000
2049	$ 1,992,000	$ 1,842,000	$ 1,440,000
2050	$ 1,992,000	$ 1,842,000	$ 1,440,000
2051	$ 1,992,000	$ 1,842,000	$ 1,440,000
2052	$ 1,992,000	$ 1,842,000	$ 1,440,000
2053	$ 1,992,000	$ 1,842,000	$ 1,440,000
2054	$ 2,042,000	$ 1,889,000	$ 1,476,000
2055	$ 2,042,000	$ 1,889,000	$ 1,476,000
2056	$ 2,042,000	$ 1,889,000	$ 1,476,000
2057	$ 2,042,000	$ 1,889,000	$ 1,476,000
2058	$ 2,042,000	$ 1,889,000	$ 1,476,000
2059	$ 2,094,000	$ 1,937,000	$ 1,513,000
2060	$ 2,094,000	$ 1,937,000	$ 1,513,000
2061	$ 2,094,000	$ 1,937,000	$ 1,513,000
2062	$ 2,094,000	$ 1,937,000	$ 1,513,000
2063	$ 2,094,000	$ 1,937,000	$ 1,513,000

** assumes 2.5% increase every 5 years due to aging of the facility*

Major Maintenance

Major Maintenance Activities

In addition to being responsible for construction, operation, and routine maintenance of I-49, ARDOT would also be required to maintain the facility in good repair and make all necessary repairs, renewals, and replacements to the facility. Major maintenance activities will include all reasonable and necessary expenses of repair and maintenance of the facility not recurring annually, such as bridge joint and slab repair; pavement rehabilitation and reconstruction; guide sign replacement; ITS component replacement; and painting of bridges, retaining walls, and noise walls.

Major Maintenance Costs

Major maintenance costs were developed by estimating quantities of Project elements, current regional industry unit pricing, and assumed maintenance schedules for the items listed in **Table 7**. For each scenario, the estimated annual major maintenance expenses for the I-49 facility, estimated in 2018 dollars, are provided in **Table 8**.

Table 7: Major Maintenance Items and Maintenance Frequency

Element	Description	Major Maintenance Frequency (every X years shown)
BRIDGES		
	Joint Repair (20%)	5, 15, 25, 35, 45
	Joint Replacement (100%)	10, 20, 30, 40, 50
	Deck hydro-demolition w/ latex polymer overlay	35
	Substructure Repair	10
CONCRETE PAVEMENT		
	White Top Overlay	30
	Crack Sealing	30
	Slab Repair / Jacking (2%)	10
	Pavement Grooving for Skid Resistance	15
GUIDE SIGNS		
	Overhead Signs	15
	Ground Mounted Signs	15
PAINTING		
	Bridges, Retaining/Noise Walls, Barrier, Sign Structures, Toll Gantries	20
INTELLIGENT TRANSPORTATION SYSTEMS		
	Dynamic Message Signs	10
EMERGENCY GENERATORS		
	Emergency Generator Unit	20

Table 8: ARDOT I-49 Major Maintenance Estimate (2018 dollars)

Major Maintenance Costs (2018 dollars)			
Year	Full Build 4-Lane	Interim 4-Lane	Phased Initial 2-Lane
2024	$ -	$ -	$ -
2025	$ -	$ -	$ -
2026	$ -	$ -	$ -
2027	$ -	$ -	$ -
2028	$ -	$ -	$ -
2029	$ 372,000	$ 372,000	$ 278,000
2030	$ -	$ -	$ -
2031	$ -	$ -	$ -
2032	$ -	$ -	$ -
2033	$ -	$ -	$ -
2034	$ 5,037,000	$ 4,881,000	$ 3,689,000
2035	$ -	$ -	$ -
2036	$ -	$ -	$ -
2037	$ -	$ -	$ -
2038	$ -	$ -	$ -
2039	$ 5,376,000	$ 4,971,000	$ 3,727,000
2040	$ -	$ -	$ -
2041	$ -	$ -	$ -
2042	$ -	$ -	$ -
2043	$ -	$ -	$ -
2044	$ 5,764,000	$ 5,283,000	$ 3,978,000
2045	$ -	$ -	$ -
2046	$ -	$ -	$ -
2047	$ -	$ -	$ -
2048	$ -	$ -	$ -
2049	$ 372,000	$ 372,000	$ 278,000
2050	$ -	$ -	$ -
2051	$ -	$ -	$ -
2052	$ -	$ -	$ -
2053	$ -	$ -	$ -
2054	$ 60,247,000	$ 55,354,000	$ 40,725,000
2055	$ -	$ -	$ -
2056	$ -	$ -	$ -
2057	$ -	$ -	$ -
2058	$ -	$ -	$ -
2059	$ 35,499,000	$ 34,290,000	$ 20,516,000
2060	$ -	$ -	$ -
2061	$ -	$ -	$ -
2062	$ -	$ -	$ -
2063	$ -	$ -	$ -

TOLL PLAN AND COST ESTIMATES

GENERAL OVERVIEW OF TOLLING APPROACH

The proposed project will be tolled using a free-flowing, all-electronic tolling (AET) collection system that does not require drivers to stop at traditional toll collection booths to pay tolls. AET collection systems identify each vehicle as it passes under toll gantries at highway speeds. The Project will not provide an option for drivers to stop and pay a toll collector or use an automatic toll payment machine.

Customers will pay tolls using either a pre-paid transponder or a post-paid image-based invoicing system. Customers who choose to obtain and use a transponder will automatically be charged for their use of the roadway when their transponder is read by an antenna and reader mounted at each toll gantry. Customers who do not obtain a transponder will be invoiced for their trip using image-based technology and processes. The image-based technology includes cameras located on the toll gantries to capture an image of the driver's license plate. The license plate information is used to identify the registered owner of the vehicle and the owner is invoiced for the toll. Payment enforcement efforts, including collections, occur only after the owner fails to pay the invoice.

Based on recent federal initiatives and industry advancements, it is assumed that regional, and possibly national, interoperability will exist by the proposed project opening year of 2024. This will allow drivers with valid transponders and toll accounts from other toll facilities to seamlessly use the Project and have tolls deducted from their toll account. It is also assumed that enabling legislation, interoperability agreements, and business rules necessary for capturing information, processing transactions, and enforcing payment will be in place.

Toll analyses also assume ARDOT will establish a Customer Service Center (CSC), including a call center and walk-in center to support payment processing and communications with its customers. It is assumed the small-scale CSC will be established in Fort Smith, AR to process payments for walk-in customers and fulfill transponder orders and that all CSC operations resources will be outsourced. The outsourced CSC resources will include customer services representatives to answer customer calls,

review license plate images, coordinate with the Department of Motor Vehicles, generate and mail invoices, and process payments. ARDOT's CSC will process all ARDOT transponder toll payments and image based transactions, and will also be responsible for pursuing unpaid image based transactions. All non-ARDOT interoperable transponder transactions will be provided to each customer's respective agency for transaction processing and revenue collection.

TOLLING SCENARIOS

Five tolling scenarios were analyzed with assumed toll locations to evaluate various capital and operating costs based on industry best practices and determine the most feasible approach. Three of the five scenarios (Full Build 4-Lane, Increased Land Use Full Build 4-Lane, and Complete I-49 Full Build 4-Lane) have the same roadway configuration and tolling locations. The assumed tolling locations include a combination of mainline toll zones (spanning the mainline travel lanes) and ramp toll zones (over selected entrance and exit ramps) that allowed for no free or non-tolled movements. Each tolling location will require overhead gantry structures to support the installation and operations of tolling equipment, roadside equipment cabinets, electrical power and communications infrastructure. Special pavement may also be required through the toll zones. **Figure 4** below depicts the configuration and equipment related to a typical ramp toll zone. **Figure 5** reflects the proposed toll zones for each scenario.

Figure 4 – Typical Ramp Toll Zone Configuration and Equipment

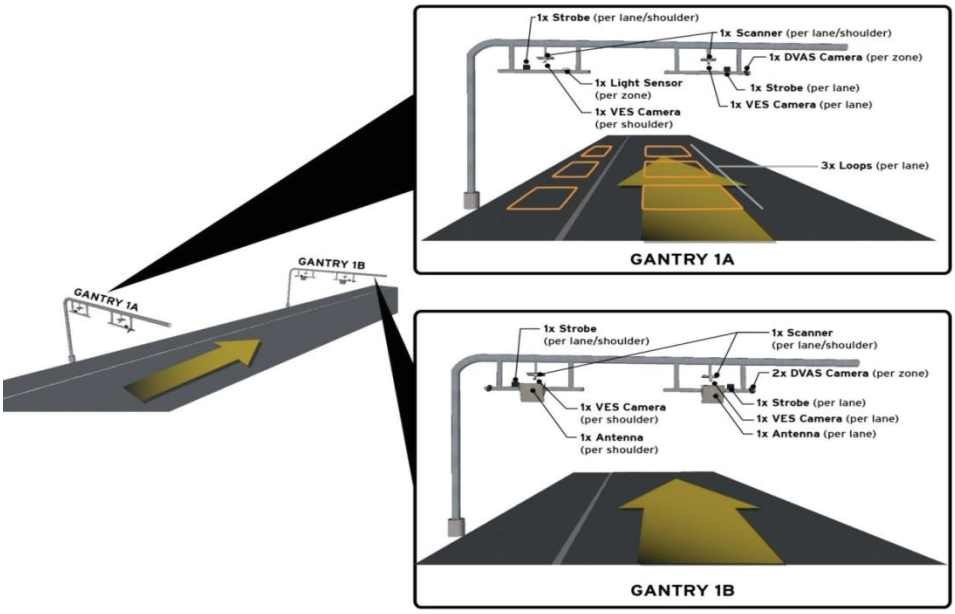
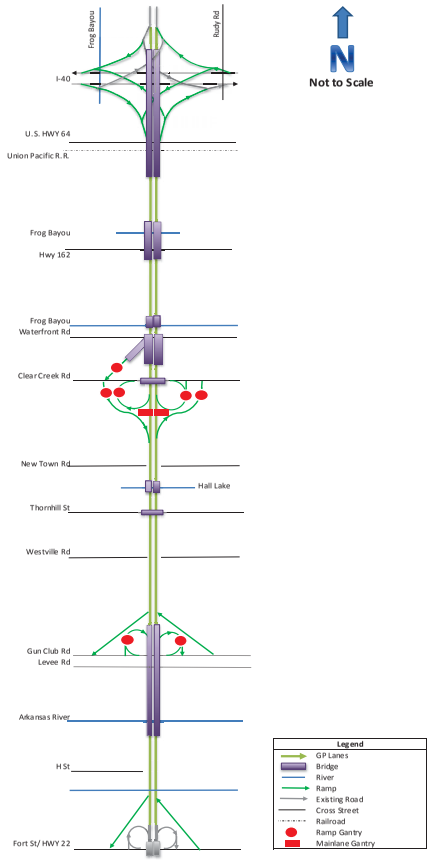
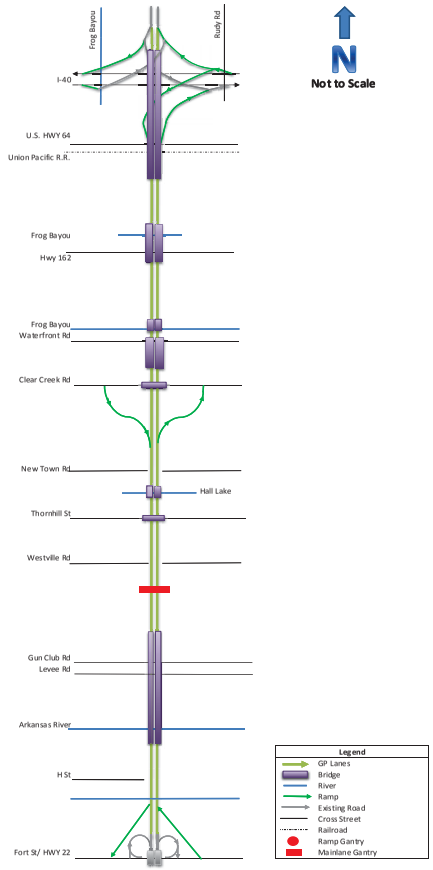
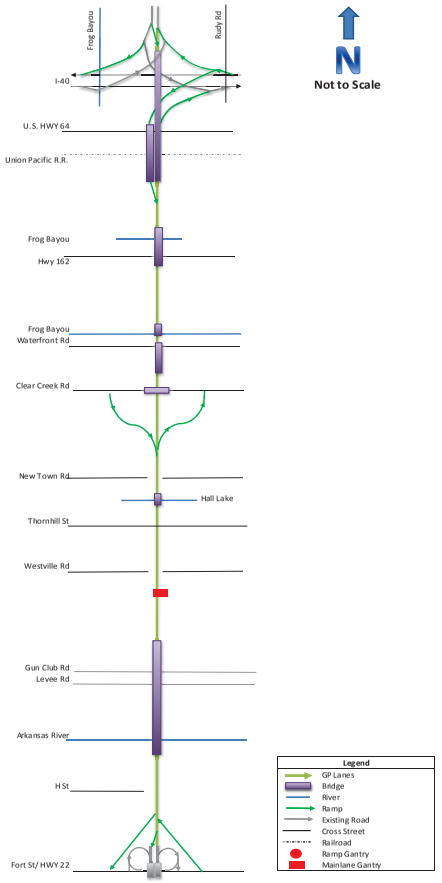


Figure 5 – Scenarios and Toll Locations

Full Build 4-Lane (also for Increase Lane Use and Complete I-49 Full Build 4-Lane)	Interim 4-Lane	Phase Initial 2-Lane
		
NOTES: • Net revenue will be small at ramp locations	**NOTES:** • Partial trips have higher toll rates per mile	**NOTES:** • Partial trips have higher toll rates per mile

TOLLING METHODOLOGY AND COST ESTIMATES

Tolling Capital Expenditures (CapEx)

Tolling system capital costs were prepared using estimated quantity of Project elements and current industry unit pricing. For each tolling scenario, the estimated annual major maintenance expenses for the I-49 facility, estimated in 2018 dollars, are provided in **Table 9**.

Table 9: Tolling System Capital Cost Estimate (2018 dollars)

Tolling System CapEx Estimate					
Scenario	**Full Build 4-Lane**	**Interim 4-Lane**	**Phase Initial 2-Lane**	**Increased Lane Use Full Build 4-Lane**	**Complete I-49 Full Build 4-Lane**
RTCS	$5,455,000	$2,235,000	$1,565,000	$5,455,000	$5,455,000
BOS/CSC	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000
Total	**$10,830,000**	**$7,610,000**	**$6,940,000**	**$10,830,000**	**$10,830,000**

The estimated tolling system capital costs include the acquisition and implementation costs for the roadside toll collection system (RTCS) and the necessary back office system (BOS) and customer service center (CSC).

At each gantry location, toll equipment will be installed over all travel lanes and shoulders to ensure that vehicles do not use shoulders to evade tolls. The major components related to the RTCS CapEx costs include:

- Overhead gantry structures (one pair at each toll location);
- Transponder antennas and radio-frequency readers;
- Equipment cabinets and backup power generators;
- Front and rear cameras;
- Automatic vehicle classification equipment;
- Digital video audit system equipment;
- Vehicle presence detectors and separators;
- Host computers; and
- Installation and testing of all components.

It is also assumed that ARDOT will contract with a toll system vendor to provide a BOS to receive and process toll transactions consistent with the business rules anticipated to be in place. In addition, ARDOT will establish a CSC, including a call center and walk-in

center, to support customer account management and invoicing. CapEx costs related to the BOS and CSC include:

- CSC facility acquisition and buildout; and
- BOS equipment and software, including all computer software, hardware and other components needed to process toll transactions and manage customer accounts.

Tolling Operations and Maintenance Expenditures (OpEx)

O&M expenditures are divided between the RTCS and BOS/CSC since they are distinct systems and services. The RTCS O&M expenditures are primarily maintenance-related services including preventative, predictive and emergency repairs to the roadside toll collection system equipment. This includes active spare-parts inventory and management. Annual O&M costs are allocated for these services based on the actual number of toll zones and toll lanes. The estimated annual O&M costs for each tolling scenario, estimated in 2018 dollars, are provided in **Tables 10A** through **10E** below.

The BOS/CSC is more labor intensive than the RTCS. It includes customer service representatives to answer calls and communicate with customers, fulfill transponder orders, review license plate images, generate invoices, and process payments. These ongoing costs are commonly estimated based on the quantity of toll transactions and amount of revenue processed through the BOS/CSC.

BOS/CSC O&M costs have been estimated for each transaction type that will occur on I-49. Transactions are categorized into three basic types: transactions using a transponder issued by ARDOT ("Home Transponder" transactions), transactions using transponders issued by other entities that are interoperable ("Away Transponder" transactions), and image-based transactions. The fees associated with collecting each type of transaction were estimated using industry standard pricing and interoperability agreements currently in place in the region.

Home Transponder transactions typically incur a standard cost per transaction plus a credit card fee based on a percentage of the transaction's toll amount. Away Transponder transactions typically incur a standard cost per transaction plus an interoperability fee. HNTB assumed a future interoperability agreement structure under which the operator of the Project pays the visiting transponder's agency a fee of $0.08

per transaction. It is assumed that 50% of the I-49 transponder transactions will be associated with Home Transponders and 50% of the I-49 transponder transactions will be associated with Away Transponders.

HNTB also assumed that 60% of transactions will be transponder transactions in the opening year, increasing to 75% in year 5, and that the remaining transactions will be image based transactions. Image based transactions typically incur additional fees for processing the images and certain pass-through costs such as postage and mailing expenses.

The estimated BOS/CSC O&M costs, which include estimates for toll collection and transaction processing, were based on the transaction and revenue projections provided in the section titled *Traffic and Revenue Forecast* and industry standard tolling policies and procedures. The estimated annual BOS/CSC O&M costs for each scenario, estimated in 2018 dollars, are presented in the tables below.

Tolling System Lifecycle Costs

Based on experiences with other electronic tolling systems, it is anticipated that both the RTCS and BOS initially installed will perform as intended for 10 years with adequate maintenance. The ongoing O&M including replacement of key parts will ensure system performance. It is recommended to replace both the entire RTCS and BOS every 10 years. The estimated periodic RTCS and BOS/CSC lifecycle/replacement costs are also presented in the tables below.

Table 10A: Tolling System O&M Costs Estimates (2018 dollars) – Full Build 4-Lane

Year	BOS/CSC Operating Costs	Maintenance and Replacement Costs				Total Tolling System O&M
		RTCS Maintenance	RTCS Lifecycle Replacement	BOS/CSC Maintenance	BOS/CSC Lifecycle Replacement	
2024	$188,000	$211,500	$0	$110,500	$0	$510,000
2025	$222,000	$423,000	$0	$221,000	$0	$866,000
2026	$258,000	$423,000	$0	$221,000	$0	$902,000
2027	$296,000	$423,000	$0	$221,000	$0	$940,000
2028	$306,000	$423,000	$0	$221,000	$0	$950,000
2029	$315,000	$423,000	$0	$221,000	$0	$959,000
2030	$325,000	$423,000	$0	$221,000	$0	$969,000
2031	$336,000	$423,000	$0	$221,000	$0	$980,000
2032	$346,000	$423,000	$0	$221,000	$0	$990,000
2033	$356,000	$423,000	$0	$221,000	$0	$1,000,000
2034	$367,000	$211,500	$3,975,000	$110,500	$5,375,000	$10,039,000
2035	$377,000	$423,000	$0	$221,000	$0	$1,021,000
2036	$387,000	$423,000	$0	$221,000	$0	$1,031,000
2037	$398,000	$423,000	$0	$221,000	$0	$1,042,000
2038	$408,000	$423,000	$0	$221,000	$0	$1,052,000
2039	$418,000	$423,000	$0	$221,000	$0	$1,062,000
2040	$429,000	$423,000	$0	$221,000	$0	$1,073,000
2041	$434,000	$423,000	$0	$221,000	$0	$1,078,000
2042	$439,000	$423,000	$0	$221,000	$0	$1,083,000
2043	$444,000	$423,000	$0	$221,000	$0	$1,088,000
2044	$449,000	$211,500	$3,975,000	$110,500	$5,375,000	$10,121,000
2045	$455,000	$423,000	$0	$221,000	$0	$1,099,000
2046	$460,000	$423,000	$0	$221,000	$0	$1,104,000
2047	$465,000	$423,000	$0	$221,000	$0	$1,109,000
2048	$470,000	$423,000	$0	$221,000	$0	$1,114,000
2049	$475,000	$423,000	$0	$221,000	$0	$1,119,000
2050	$480,000	$423,000	$0	$221,000	$0	$1,124,000
2051	$486,000	$423,000	$0	$221,000	$0	$1,130,000
2052	$491,000	$423,000	$0	$221,000	$0	$1,135,000
2053	$496,000	$423,000	$0	$221,000	$0	$1,140,000
2054	$501,000	$211,500	$3,975,000	$110,500	$5,375,000	$10,173,000
2055	$506,000	$423,000	$0	$221,000	$0	$1,150,000
2056	$511,000	$423,000	$0	$221,000	$0	$1,155,000
2057	$517,000	$423,000	$0	$221,000	$0	$1,161,000
2058	$522,000	$423,000	$0	$221,000	$0	$1,166,000
2059	$527,000	$423,000	$0	$221,000	$0	$1,171,000
2060	$532,000	$423,000	$0	$221,000	$0	$1,176,000
2061	$537,000	$423,000	$0	$221,000	$0	$1,181,000
2062	$543,000	$423,000	$0	$221,000	$0	$1,187,000
2063	$548,000	$423,000	$0	$221,000	$0	$1,192,000
Total	**$17,020,000**	**$16,074,000**	**$11,925,000**	**$8,398,000**	**$16,125,000**	**$69,542,000**

Source: *Project Team, 2018. Note: Study Area coordinated with ARDOT*

Table 10B: Tolling System O&M Costs Estimates (2018 dollars) – Interim 4-Lane

Year	BOS/CSC Operating Costs	Maintenance and Replacement Costs				Total Tolling System O&M
		RTCS Maintenance	RTCS Lifecycle Replacement	BOS/CSC Maintenance	BOS/CSC Lifecycle Replacement	
2024	$171,000	$75,000	$0	$110,500	$0	$356,500
2025	$204,000	$150,000	$0	$221,000	$0	$575,000
2026	$238,000	$150,000	$0	$221,000	$0	$609,000
2027	$275,000	$150,000	$0	$221,000	$0	$646,000
2028	$285,000	$150,000	$0	$221,000	$0	$656,000
2029	$295,000	$150,000	$0	$221,000	$0	$666,000
2030	$306,000	$150,000	$0	$221,000	$0	$677,000
2031	$318,000	$150,000	$0	$221,000	$0	$689,000
2032	$329,000	$150,000	$0	$221,000	$0	$700,000
2033	$340,000	$150,000	$0	$221,000	$0	$711,000
2034	$351,000	$75,000	$1,630,000	$110,500	$5,375,000	$7,541,500
2035	$362,000	$150,000	$0	$221,000	$0	$733,000
2036	$373,000	$150,000	$0	$221,000	$0	$744,000
2037	$384,000	$150,000	$0	$221,000	$0	$755,000
2038	$395,000	$150,000	$0	$221,000	$0	$766,000
2039	$407,000	$150,000	$0	$221,000	$0	$778,000
2040	$418,000	$150,000	$0	$221,000	$0	$789,000
2041	$423,000	$150,000	$0	$221,000	$0	$794,000
2042	$429,000	$150,000	$0	$221,000	$0	$800,000
2043	$434,000	$150,000	$0	$221,000	$0	$805,000
2044	$440,000	$75,000	$1,630,000	$110,500	$5,375,000	$7,630,500
2045	$445,000	$150,000	$0	$221,000	$0	$816,000
2046	$451,000	$150,000	$0	$221,000	$0	$822,000
2047	$457,000	$150,000	$0	$221,000	$0	$828,000
2048	$462,000	$150,000	$0	$221,000	$0	$833,000
2049	$468,000	$150,000	$0	$221,000	$0	$839,000
2050	$473,000	$150,000	$0	$221,000	$0	$844,000
2051	$479,000	$150,000	$0	$221,000	$0	$850,000
2052	$484,000	$150,000	$0	$221,000	$0	$855,000
2053	$490,000	$150,000	$0	$221,000	$0	$861,000
2054	$496,000	$75,000	$1,630,000	$110,500	$5,375,000	$7,686,500
2055	$501,000	$150,000	$0	$221,000	$0	$872,000
2056	$507,000	$150,000	$0	$221,000	$0	$878,000
2057	$512,000	$150,000	$0	$221,000	$0	$883,000
2058	$518,000	$150,000	$0	$221,000	$0	$889,000
2059	$523,000	$150,000	$0	$221,000	$0	$894,000
2060	$529,000	$150,000	$0	$221,000	$0	$900,000
2061	$534,000	$150,000	$0	$221,000	$0	$905,000
2062	$540,000	$150,000	$0	$221,000	$0	$911,000
2063	$546,000	$150,000	$0	$221,000	$0	$917,000
Total	**$16,592,000**	**$5,700,000**	**$4,890,000**	**$8,398,000**	**$16,125,000**	**$51,705,000**

Source: *Project Team, 2018. Note: Study Area coordinated with ARDOT*

Table 10C: Tolling System O&M Costs Estimates (2018 dollars) – Phased Initial 2-Lane

Year	BOS/CSC Operating Costs	Maintenance and Replacement Costs				Total Tolling System O&M
		RTCS Maintenance	RTCS Lifecycle Replacement	BOS/CSC Maintenance	BOS/CSC Lifecycle Replacement	
2024	$143,000	$75,000	$0	$110,500	$0	$328,500
2025	$154,000	$150,000	$0	$221,000	$0	$525,000
2026	$167,000	$150,000	$0	$221,000	$0	$538,000
2027	$179,000	$150,000	$0	$221,000	$0	$550,000
2028	$186,000	$150,000	$0	$221,000	$0	$557,000
2029	$192,000	$150,000	$0	$221,000	$0	$563,000
2030	$199,000	$150,000	$0	$221,000	$0	$570,000
2031	$206,000	$150,000	$0	$221,000	$0	$577,000
2032	$213,000	$150,000	$0	$221,000	$0	$584,000
2033	$220,000	$150,000	$0	$221,000	$0	$591,000
2034	$227,000	$75,000	$1,100,000	$110,500	$5,375,000	$6,887,500
2035	$234,000	$150,000	$0	$221,000	$0	$605,000
2036	$241,000	$150,000	$0	$221,000	$0	$612,000
2037	$248,000	$150,000	$0	$221,000	$0	$619,000
2038	$255,000	$150,000	$0	$221,000	$0	$626,000
2039	$262,000	$150,000	$0	$221,000	$0	$633,000
2040	$269,000	$150,000	$0	$221,000	$0	$640,000
2041	$273,000	$150,000	$0	$221,000	$0	$644,000
2042	$276,000	$150,000	$0	$221,000	$0	$647,000
2043	$280,000	$150,000	$0	$221,000	$0	$651,000
2044	$283,000	$75,000	$1,100,000	$110,500	$5,375,000	$6,943,500
2045	$287,000	$150,000	$0	$221,000	$0	$658,000
2046	$290,000	$150,000	$0	$221,000	$0	$661,000
2047	$294,000	$150,000	$0	$221,000	$0	$665,000
2048	$297,000	$150,000	$0	$221,000	$0	$668,000
2049	$301,000	$150,000	$0	$221,000	$0	$672,000
2050	$304,000	$150,000	$0	$221,000	$0	$675,000
2051	$308,000	$150,000	$0	$221,000	$0	$679,000
2052	$311,000	$150,000	$0	$221,000	$0	$682,000
2053	$315,000	$150,000	$0	$221,000	$0	$686,000
2054	$318,000	$75,000	$1,100,000	$110,500	$5,375,000	$6,978,500
2055	$322,000	$150,000	$0	$221,000	$0	$693,000
2056	$325,000	$150,000	$0	$221,000	$0	$696,000
2057	$329,000	$150,000	$0	$221,000	$0	$700,000
2058	$332,000	$150,000	$0	$221,000	$0	$703,000
2059	$336,000	$150,000	$0	$221,000	$0	$707,000
2060	$339,000	$150,000	$0	$221,000	$0	$710,000
2061	$343,000	$150,000	$0	$221,000	$0	$714,000
2062	$346,000	$150,000	$0	$221,000	$0	$717,000
2063	$350,000	$150,000	$0	$221,000	$0	$721,000
Total	**$10,754,000**	**$5,700,000**	**$3,300,000**	**$8,398,000**	**$16,125,000**	**$44,277,000**

Source: *Project Team, 2018. Note: Study Area coordinated with ARDOT*

Table 10D: Tolling System O&M Costs Estimates (2018 dollars) – Increased Lane Use Full Build 4-Lane

Year	BOS/CSC Operating Costs	Maintenance and Replacement Costs				Total Tolling System O&M
		RTCS Maintenance	RTCS Lifecycle Replacement	BOS/CSC Maintenance	BOS/CSC Lifecycle Replacement	
2024	$527,000	$211,500	$0	$110,500	$0	$849,000
2025	$670,000	$423,000	$0	$221,000	$0	$1,314,000
2026	$828,000	$423,000	$0	$221,000	$0	$1,472,000
2027	$1,002,000	$423,000	$0	$221,000	$0	$1,646,000
2028	$1,083,000	$423,000	$0	$221,000	$0	$1,727,000
2029	$1,164,000	$423,000	$0	$221,000	$0	$1,808,000
2030	$1,249,000	$423,000	$0	$221,000	$0	$1,893,000
2031	$1,334,000	$423,000	$0	$221,000	$0	$1,978,000
2032	$1,419,000	$423,000	$0	$221,000	$0	$2,063,000
2033	$1,504,000	$423,000	$0	$221,000	$0	$2,148,000
2034	$1,590,000	$211,500	$3,975,000	$110,500	$5,375,000	$11,262,000
2035	$1,675,000	$423,000	$0	$221,000	$0	$2,319,000
2036	$1,760,000	$423,000	$0	$221,000	$0	$2,404,000
2037	$1,845,000	$423,000	$0	$221,000	$0	$2,489,000
2038	$1,930,000	$423,000	$0	$221,000	$0	$2,574,000
2039	$2,015,000	$423,000	$0	$221,000	$0	$2,659,000
2040	$2,101,000	$423,000	$0	$221,000	$0	$2,745,000
2041	$2,143,000	$423,000	$0	$221,000	$0	$2,787,000
2042	$2,186,000	$423,000	$0	$221,000	$0	$2,830,000
2043	$2,228,000	$423,000	$0	$221,000	$0	$2,872,000
2044	$2,271,000	$211,500	$3,975,000	$110,500	$5,375,000	$11,943,000
2045	$2,314,000	$423,000	$0	$221,000	$0	$2,958,000
2046	$2,356,000	$423,000	$0	$221,000	$0	$3,000,000
2047	$2,399,000	$423,000	$0	$221,000	$0	$3,043,000
2048	$2,441,000	$423,000	$0	$221,000	$0	$3,085,000
2049	$2,484,000	$423,000	$0	$221,000	$0	$3,128,000
2050	$2,527,000	$423,000	$0	$221,000	$0	$3,171,000
2051	$2,569,000	$423,000	$0	$221,000	$0	$3,213,000
2052	$2,612,000	$423,000	$0	$221,000	$0	$3,256,000
2053	$2,654,000	$423,000	$0	$221,000	$0	$3,298,000
2054	$2,697,000	$211,500	$3,975,000	$110,500	$5,375,000	$12,369,000
2055	$2,739,000	$423,000	$0	$221,000	$0	$3,383,000
2056	$2,782,000	$423,000	$0	$221,000	$0	$3,426,000
2057	$2,825,000	$423,000	$0	$221,000	$0	$3,469,000
2058	$2,867,000	$423,000	$0	$221,000	$0	$3,511,000
2059	$2,910,000	$423,000	$0	$221,000	$0	$3,554,000
2060	$2,952,000	$423,000	$0	$221,000	$0	$3,596,000
2061	$2,995,000	$423,000	$0	$221,000	$0	$3,639,000
2062	$3,038,000	$423,000	$0	$221,000	$0	$3,682,000
2063	$3,080,000	$423,000	$0	$221,000	$0	$3,724,000
Total	**$83,765,000**	**$16,074,000**	**$11,925,000**	**$8,398,000**	**$16,125,000**	**$136,287,000**

Source: *Project Team, 2018. Note: Study Area coordinated with ARDOT*

Table 10E: Tolling System O&M Costs Estimates (2018 dollars) – Complete I-49 Full Build 4-Lane

Year	BOS/CSC Operating Costs	Maintenance and Replacement Costs				Total Tolling System O&M
		RTCS Maintenance	RTCS Lifecycle Replacement	BOS/CSC Maintenance	BOS/CSC Lifecycle Replacement	
2024	$303,000	$211,500	$0	$110,500	$0	$625,000
2025	$357,000	$423,000	$0	$221,000	$0	$1,001,000
2026	$414,000	$423,000	$0	$221,000	$0	$1,058,000
2027	$472,000	$423,000	$0	$221,000	$0	$1,116,000
2028	$485,000	$423,000	$0	$221,000	$0	$1,129,000
2029	$498,000	$423,000	$0	$221,000	$0	$1,142,000
2030	$513,000	$423,000	$0	$221,000	$0	$1,157,000
2031	$527,000	$423,000	$0	$221,000	$0	$1,171,000
2032	$541,000	$423,000	$0	$221,000	$0	$1,185,000
2033	$556,000	$423,000	$0	$221,000	$0	$1,200,000
2034	$570,000	$211,500	$3,975,000	$110,500	$5,375,000	$10,242,000
2035	$585,000	$423,000	$0	$221,000	$0	$1,229,000
2036	$599,000	$423,000	$0	$221,000	$0	$1,243,000
2037	$613,000	$423,000	$0	$221,000	$0	$1,257,000
2038	$628,000	$423,000	$0	$221,000	$0	$1,272,000
2039	$642,000	$423,000	$0	$221,000	$0	$1,286,000
2040	$657,000	$423,000	$0	$221,000	$0	$1,301,000
2041	$664,000	$423,000	$0	$221,000	$0	$1,308,000
2042	$671,000	$423,000	$0	$221,000	$0	$1,315,000
2043	$678,000	$423,000	$0	$221,000	$0	$1,322,000
2044	$686,000	$211,500	$3,975,000	$110,500	$5,375,000	$10,358,000
2045	$693,000	$423,000	$0	$221,000	$0	$1,337,000
2046	$700,000	$423,000	$0	$221,000	$0	$1,344,000
2047	$707,000	$423,000	$0	$221,000	$0	$1,351,000
2048	$714,000	$423,000	$0	$221,000	$0	$1,358,000
2049	$722,000	$423,000	$0	$221,000	$0	$1,366,000
2050	$729,000	$423,000	$0	$221,000	$0	$1,373,000
2051	$736,000	$423,000	$0	$221,000	$0	$1,380,000
2052	$743,000	$423,000	$0	$221,000	$0	$1,387,000
2053	$751,000	$423,000	$0	$221,000	$0	$1,395,000
2054	$758,000	$211,500	$3,975,000	$110,500	$5,375,000	$10,430,000
2055	$765,000	$423,000	$0	$221,000	$0	$1,409,000
2056	$772,000	$423,000	$0	$221,000	$0	$1,416,000
2057	$779,000	$423,000	$0	$221,000	$0	$1,423,000
2058	$787,000	$423,000	$0	$221,000	$0	$1,431,000
2059	$794,000	$423,000	$0	$221,000	$0	$1,438,000
2060	$801,000	$423,000	$0	$221,000	$0	$1,445,000
2061	$808,000	$423,000	$0	$221,000	$0	$1,452,000
2062	$815,000	$423,000	$0	$221,000	$0	$1,459,000
2063	$823,000	$423,000	$0	$221,000	$0	$1,467,000
Total	**$26,056,000**	**$16,074,000**	**$11,925,000**	**$8,398,000**	**$16,125,000**	**$78,578,000**

Source: *Project Team, 2018. Note: Study Area coordinated with ARDOT.*

TRAFFIC AND REVENUE FORECAST

This chapter presents an overview of the Traffic and Revenue (T&R) methodology, results, and the transportation system impact assessment of the proposed I-49 corridor. The objective of this effort is to understand the T&R potential and corresponding transportation benefits/impacts for the project corridor. Combined with the capital and O&M cost, the T&R will help determine the overall financial feasibility of tolling this portion of I-49.

This chapter is divided into the following sections:

- Travel Demand Modeling
- Traffic and Revenue Analysis
- Annual Traffic and Revenue Stream Projections
- Transportation Impacts
- Sensitivity Scenarios

TRAVEL DEMAND MODELING

Arkansas Statewide Travel Demand Model

The Arkansas Statewide Travel Demand Model (AR TDM) was used to estimate future travel demand and traffic conditions for the I-49 and I-540/Hwy. 22 corridors and surrounding roadway network (study area). The travel estimates from the AR TDM were used to understand the future travel patterns within the study area, evaluate the transportation impacts of Build Alternatives, including I-49 tolling, compared to the No-Build Alternative, and develop future growth rates for facilities in the study area for Traffic Operations Models.

The AR TDM was developed in TransCAD, Version 6.0 and follows the traditional four-step TDM process: trip generation; trip distribution; mode choice; and trip assignment. The AR TDM consists of the entire United States with a more detailed network like interstates, US routes and state highways, only in the state of Arkansas. It reflects the most up-to-date networks and population and employment forecasts. To calculate the forecasted traffic and revenue for the project corridor, a variety of model inputs and assumptions were reviewed and the base-year validation was performed. This is discussed in the following sections as well as in Appendix B.

Analysis Years and Time Periods

The AR TDM currently has a base-year of 2010 and future years of 2020, 2030 and 2040. The models for these years reflect the assumptions of future land use, population and employment forecasts, and other transportation investments for respective years. The AR TDM model is a time-of-day model with the following time periods:

- Morning Peak Period (AM): 6:00 to 8:00
- Midday Period (MD): 8:00 to 14:00
- Afternoon Peak Period (PM): 14:00 to 18:00
- Nighttime Period (NT): 18:00 to 6:00

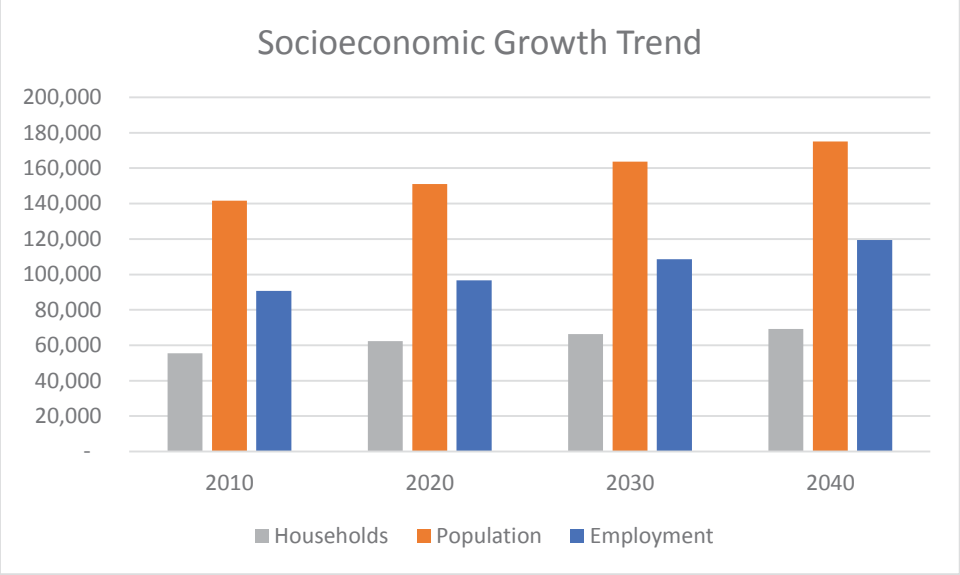
Socioeconomic Data and Trip Table

The model's socioeconomic data, that includes population, households, and employment, are shown in **Table 11** for the subarea region (described in the next section). The growth trend in these variables is shown in **Figure 6**.

Table 11: Socioeconomic Data

Year	Households	Population	Employment
2010	55,511	141,684	90,778
2020	62,304	150,993	96,700
2030	66,332	163,758	108,671
2040	69,282	175,159	119,459

Figure 6 – Socioeconomic Growth Trend



The socioeconomic data is key input for the development of TDM trip tables, which define the number of car and truck trips between various traffic analysis zone (TAZ) pairs. The trip tables were used to establish a baseline of demand for the traffic and revenue forecasts and as inputs into the toll diversion model.

Base Year Validation

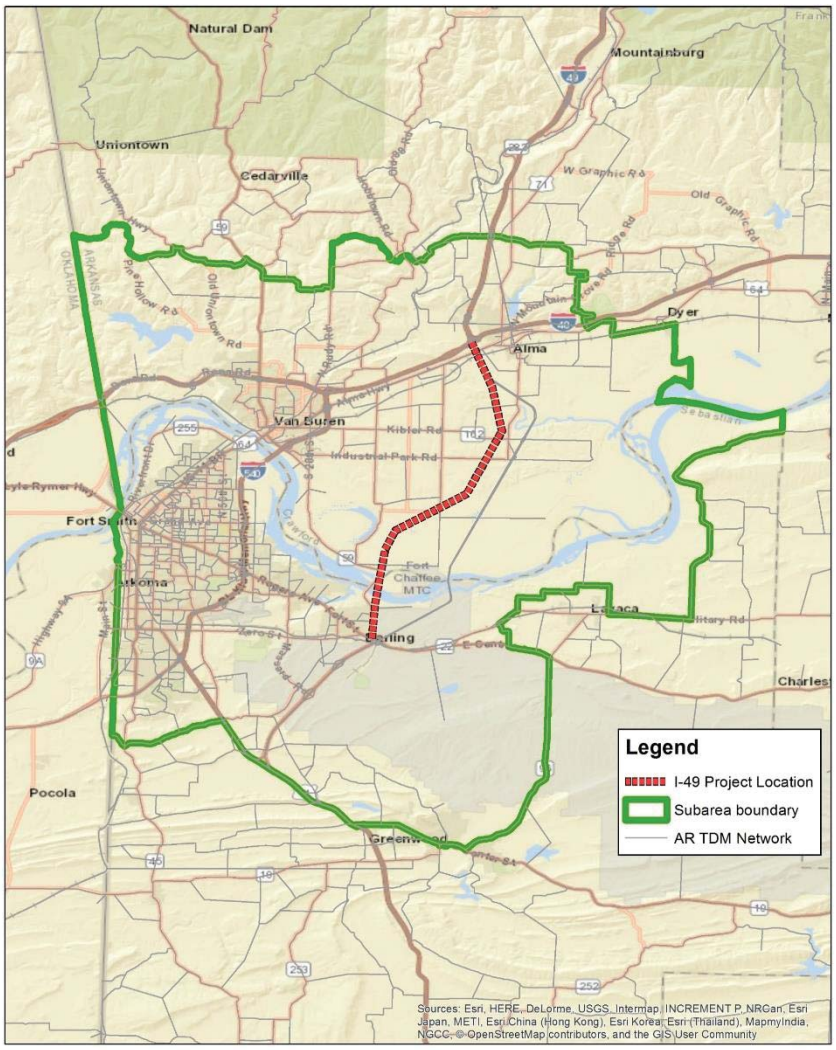
The observed data, the traffic counts and the origin-destination trip patterns, were obtained for 2017 but the AR TDM does not include year 2017. The observed data was obtained for a smaller areas adjacent to the project location. Therefore, instead of using the entire AR TDM modeling area, a subarea model was developed and validated for the year 2017.

2017 Subarea Extraction and Development

The subarea model is developed by performing a full model run for the required year and providing the subarea boundary as input to the model. The output includes a network within the defined subarea and origin-destination (OD) trip tables for zones within the subarea and external zones that are formed at the outer end of the links crossing the subarea boundary.

The subarea boundary was defined around the project location considering AR TDM TAZs and INRIX zones as shown in **Figure 7**. The 2017 subarea model was developed from the 2010 and 2020 extracted subarea models. The 2017 network was developed by revising the 2020 subarea network for number of lanes and functional classification using available data sources. This included removal of projects that would be competed between 2017 and 2020. No projects were identified for removal. The 2017 trip tables were obtained by interpolating the 2010 and 2020 trip tables.

Figure 7 – Project Location and Subarea Boundary



2017 Observed Data

The observed data for the base year consisted of the following:

- **Traffic Counts -** Traffic counts were collected at 42 locations within the subarea. Of those, 35 counts were used to validate the model. The remaining counts could not be represented properly in the model due to missing lower functional classification roads or local roads being represented by centroid connectors.
- **INRIX Origin-Destination Survey -** The origin-destination trip data was provided by INRIX for the subarea. The trip data represented a sample of trips providing a distribution pattern for internal-internal trips. In addition, the AR TDM Model and INRIX time periods were different as shown in **Table 12**. Therefore, validation was not performed but a high-level comparison was made for the trips by TAZ.

Table 12: Comparison of Time Periods for INRIX and AR TDM zones

Time Period	INRIX	AR TDM
Early AM	12am-6am	
AM	6am-10 am	6am-8am
MD	10am-3pm	8am-2pm
PM	3pm-7pm	2pm-6pm
NT	7pm-12am	6pm-6am

2017 Subarea Model Validation

The 2017 subarea validation was performed to ensure that the model was accurately reflecting the travel pattern and congestion level along the roadway facilities in 2017. As a part of network review, few network revisions were made such as:

- Removed incorrect connections between roadways
- Added missing ramps
- Provided connections from centroid connector to both directions of a facility if missing

The 2017 base year model assignment was performed with the revised network and the trip tables developed. The model results were compared with the observed data for the following:

- Daily modeled volumes vs traffic counts at traffic count locations
- Truck trip percentages at key roadway facilities
- Trip distribution pattern with the INRIX origin-destination data

The validation efforts involved revising the networks as well as the 2017 trip tables in the following areas:

- Changed speed and capacities
- Added local roads for connectivity
- Added centroid connectors
- Revised trip tables
    - Trip Generation Rates for Internal-Internal Trips
    - Internal-External and External-External Distribution
    - Auto and Truck Share

2017 Subarea Model Validation Results

The validation process includes the comparison of the model outputs to expected targets. Targets for various model parameters have been compiled using several

sources. The following documents serves as the primary sources for checking the reasonableness of model parameters and results:

- Model Validation and Reasonableness Checking Manual, Travel Model Improvement Program (TMIP), Federal Highway Administration (FHWA), 2010;
- NCHRP Report 716 Travel Demand Forecasting: Parameters and Techniques, Transportation Research Board, 2012; and,
- Calibration and Adjustment of System Planning Models, US Department of Transportation, FHWA, 1990.

The results of the validation results are described in the following sections.

Link Volume Percent Deviation

The link volume percent deviation is described in Calibration and Adjustment of System Planning Models, FHWA, 1990. This method is used to calibrate a model at system level. It is based on the expectation that the TDM should accurately predict the number of through-lanes required to provide a specific level of service (LOS) for a given facility. Trip assignment deviation should not result in a design deviation of more than one highway travel lane. Therefore, the expected accuracy of the model increases as the annual average daily traffic (AADT) on a facility increases.

Table 13 shows traffic observed traffic counts (AADT) and modeled volumes for each of the 35 count locations, as well as if the volume is validated based on the maximum deviation. The modeled volumes were within allowed deviation for 33 of 35 counts. **Figure 8** shows those counts and their locations.

Table 13: Modeled Volumes vs Traffic Counts

Corridor/Count #	AADT	Allowed Deviation	Volume	Deviation	Validated
I40_1	29,234	24%	33,535	15%	Yes
I40_2	40,294	21%	35,980	-11%	Yes
I40_3	45,743	20%	49,722	9%	Yes
I40_4	36,877	22%	32,565	-12%	Yes
I49_1	27,709	25%	27,891	1%	Yes
I49_2	29,421	24%	31,833	8%	Yes
I540_1	40,722	21%	44,588	9%	Yes
I540_2	45,550	20%	45,075	-1%	Yes
I540_3	51,891	19%	59,900	15%	Yes
I540_4	58,370	18%	62,635	7%	Yes
I540_5	55,185	18%	55,020	0%	Yes
I540_6	52,395	19%	52,683	1%	Yes
I540_7	48,457	19%	46,140	-5%	Yes
US64_1	18,520	29%	14,187	-23%	Yes
US64_2	14,923	32%	21,057	41%	No
US64_3	14,629	32%	20,219	38%	No
Hwy22_1	26,569	25%	22,401	-16%	Yes
Hwy22_2	28,236	24%	26,221	-7%	Yes
Hwy22_3	28,260	24%	26,011	-8%	Yes
Hwy22_4	35,292	22%	28,409	-20%	Yes
Hwy22_5	38,287	21%	34,739	-9%	Yes
Hwy22_6	41,155	21%	37,512	-9%	Yes
Hwy22_7	45,200	20%	44,566	-1%	Yes
Hwy22_8	43,680	20%	43,250	-1%	Yes
Hwy22_9	43,294	20%	46,654	8%	Yes
Hwy22_10	43,483	20%	36,610	-16%	Yes
Hwy22_11	41,968	20%	36,087	-14%	Yes
Hwy59_1	12,608	35%	12,307	-2%	Yes
Hwy59_2	10,204	38%	10,665	5%	Yes
Grand_1	19,288	29%	22,557	17%	Yes
Grand_2	12,086	35%	13,440	11%	Yes
Kelley_1	22,504	27%	18,195	-19%	Yes
Riggs_1	2,965	65%	3,897	31%	Yes
Riggs_2	6,531	46%	3,869	-41%	Yes
Twin_1	6,353	47%	3,917	-38%	Yes

Figure 8 – Count Locations and Validation Results

Percent Root Mean Square Error

Percent Root Mean Square Error (%RMSE) is a measure of the average deviation between the actual counts and the base year assigned volumes. It is another indicator to illustrate how closely the model volumes match the traffic counts. The AR TDM subarea model achieved an overall RMSE of 2 percent, which is lower than the target of 35 percent. Low % RMSEs were also observed for links by volume groups as shown in **Table 14**.

Table 14: Percent Root Mean Square Error

Volume Group	Number of Counts	Target range	Validated
0 – 5,000	1	<100%	31%
5,001 – 10,000	2	<75%	28%
10,001 – 15,000	5	<50%	13%
15,001 – 20,000	2	<30%	14%
20,001 – 30,000	7	<30%	4%
> 30,000	18	<30%	2%
System Total	**35**	**<35%**	**2%**

Screenlines Summary

Screenlines are defined by features such as railroads, creeks, and rivers. Because all roadways are not reflected in the TDM, these types of features serve to funnel traffic into corridors so that all trips can be analyzed where crossing of these features is possible.

The only screenline selected was the Arkansas River, consisting of four count locations. **Table 15** shows that the screenline was within the maximum allowed deviation. **Table 16** shows that three of the four count locations were within the allowed deviation.

Table 15: Screenline

Screenline	Number of Counts	AADT	Max Deviation	Volume	Deviation	Validated
Arkansas River	4	109,360	24%	132,559	21%	**Yes**

Table 16: Screenline Count locations

Count Location	AADT	Max Deviation	Volume	Deviation	Validated
East-West River Bridge along US 64	27,270	41%	30,011	10%	**Yes**
North-South River Bridge along US 64	22,220	44%	34,076	53%	**No**
North-South River Bridge along I-540	51,891	32%	59,900	15%	**Yes**
North-South River Bridge along 59	7,979	65%	8,572	7%	**Yes**

Truck Percentage

The truck share of the traffic is an important measure to understand. The project area includes both I-49 and I-540 which have high truck volumes. Additionally, trucks have a higher value of time and typically are charged a higher toll rate than passenger cars, generating revenue at a higher rate. **Table 17** shows the truck percentage validation summary.

Table 17: Truck Percentage

Count locations	Observed	Validated Model
I-49	25-30 %	25-28 %
I-40	34-47 %	35-47%
I-540	8-15%	8-15%
US 64	5-12 %	5-12 %
Hwy. 22	1-5%	1-5%
Other	4-10%	4-10%

Origin-Destination Trips by TAZ

The INRIX origin-destination trip tables were not used for comparing the absolute trip tables. Instead, a high-level comparison of trips in each TAZ as a percentage of total trips within all the subarea TAZs was conducted. The trips were broken down by origin, by destination, and for each of the peak periods (AM and PM). **Figures 9, 10, 11,** and **12** show trip percentages by TAZ for AM origins and destinations and PM origins and destination. Overall, the areas show similar percentage of trips in the model and INRIX data.

Figure 9 – Percentage of Total AM Origin Trips

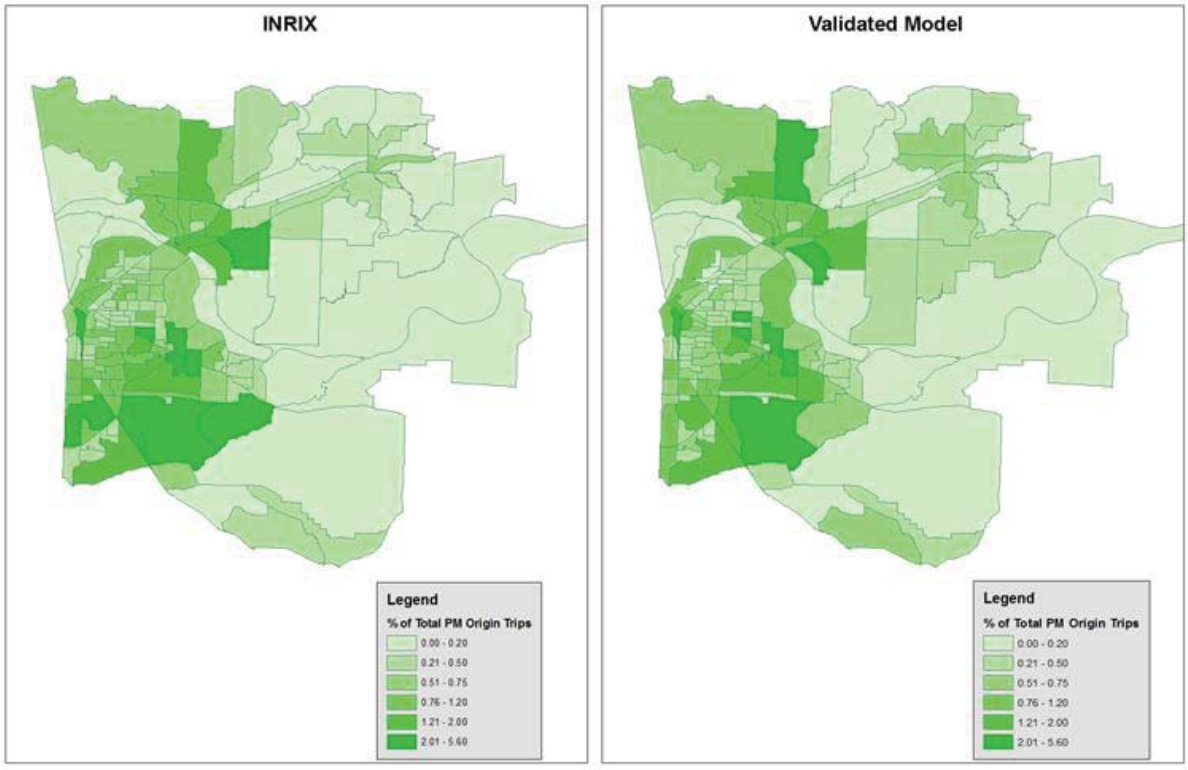


Figure 10 – Percentage of Total AM Destination Trips

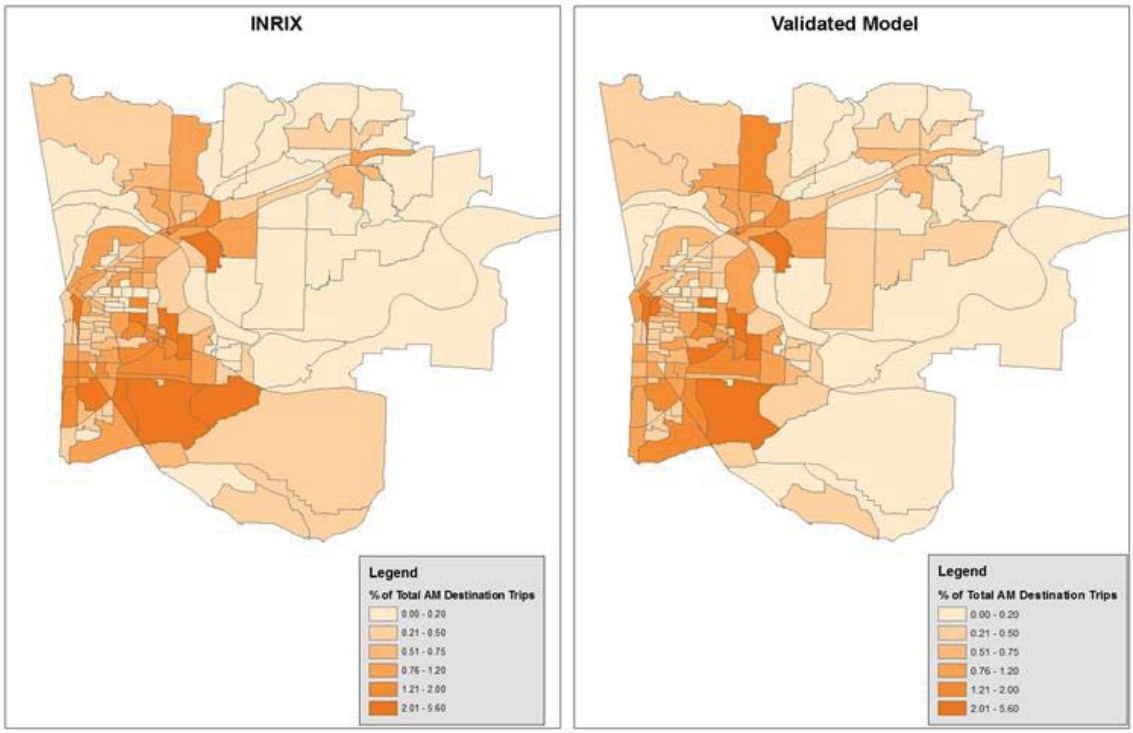


Figure 11 – Percentage of Total PM Origin Trips

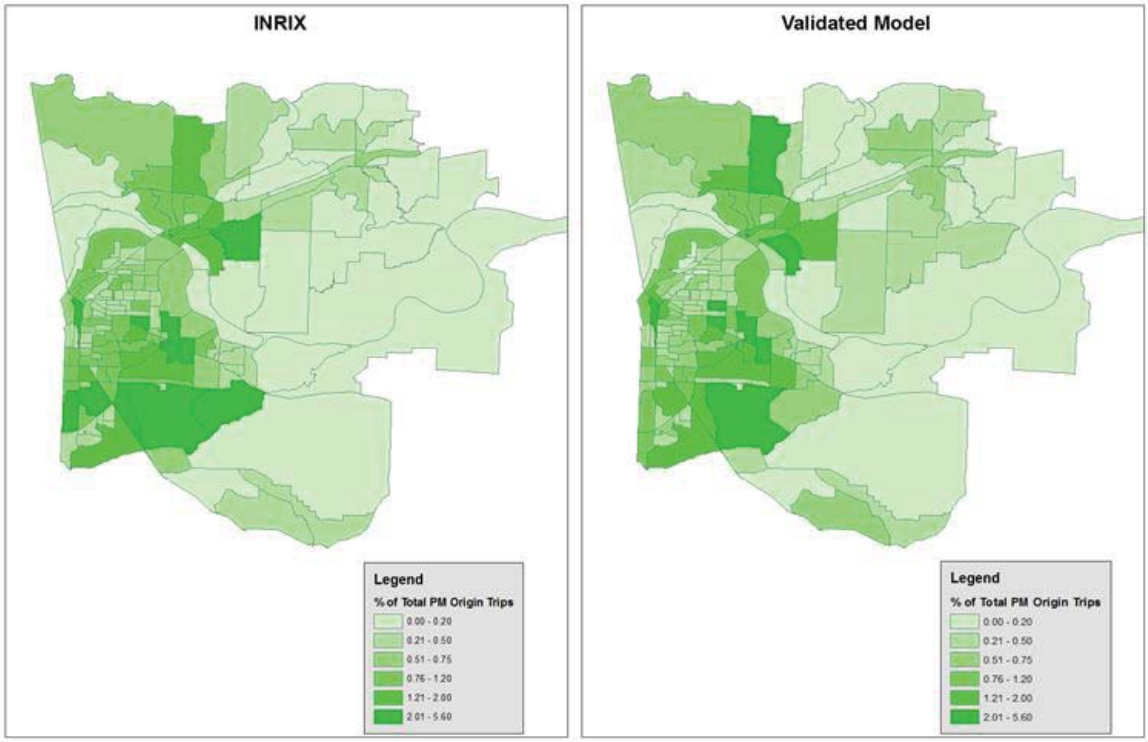
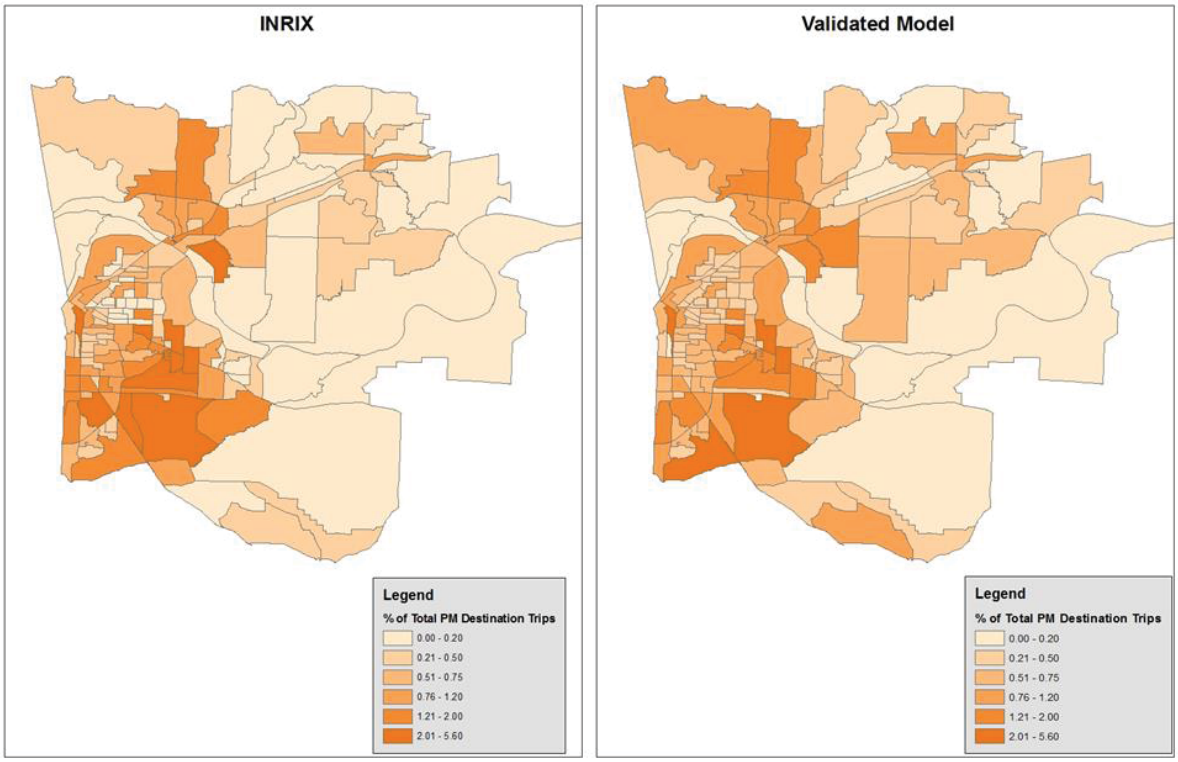


Figure 12 – Percentage of Total PM Destination Trips



TRAFFIC AND REVENUE ANALYSIS

Toll Diversion Model

In developing a toll rate structure, it is important to understand an individual's willingness to pay (WTP) a toll and their value of time (VOT). There are individuals who are not willing to pay a toll and will go out of their way to avoid toll facilities. Other individuals may be willing to pay a toll, up to a threshold amount, based on their value of time and potential travel time savings. Typically value of time for auto drivers is estimated using stated preference data that vary by time of day, trip purpose, and trip distance. Truck values of time can vary by trip distance and vehicle size (number of axles). Mean value of time for autos (at average incomes and trip distances) typically vary from $7 to $15 per hour, while a 5-axle truck making an average trip distance may have a value of time of $60 or more per hour.

No stated preference survey for the study area or the region has been conducted. After reviewing various data sources, the value of time was taken from the North Belt Freeway Toll Feasibility Study, May 2014, which provided 2012 passenger car VOT as $12/hour and $41/hour. Per the North Belt Freeway Toll Feasibility Study Report, VOT was estimated using the mean hourly wage for the Little Rock-North Little Rock-Conway area. The inflation in the area was assumed to be 2.5% resulting in 2017 VOTs for cars and trucks of $13/hour and $45/hour, respectively. This study assumes the same VOT information and it is assumed that the VOT will remain the same for future years.

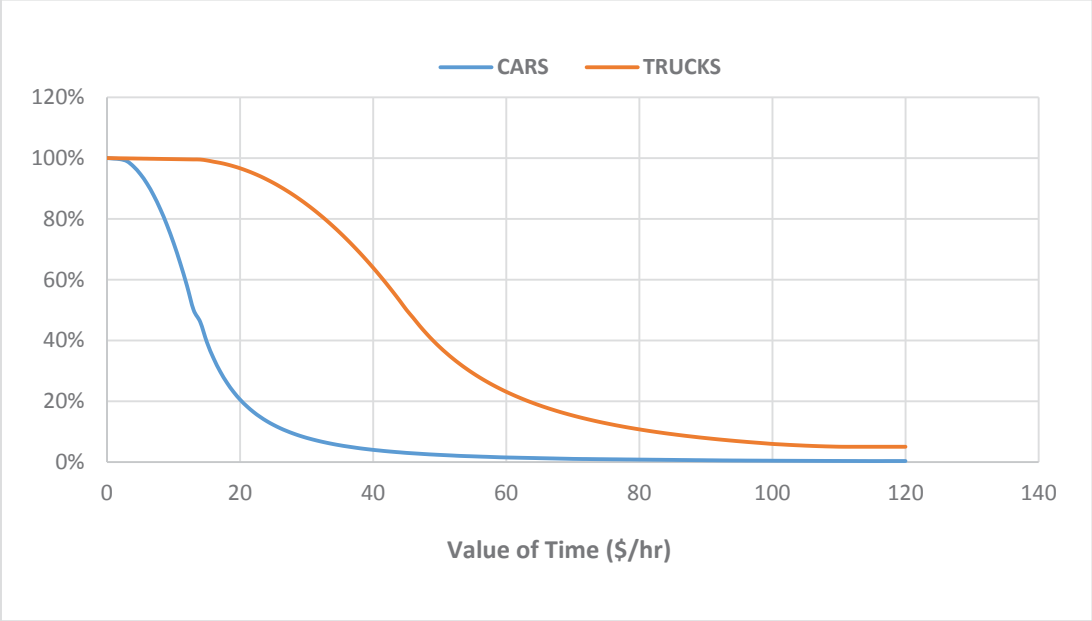
Table 17: Mean Value of Time (2017)

Vehicle Class	Mean Value of Time
Passenger Cars	13 $/Hour
Trucks	45 $/Hour

To accurately forecast priced I-49 corridor use within the regional transportation network and for consistency, a toll diversion model was developed and incorporated in the subarea model for the I-49 corridor toll and revenue analysis. The toll diversion model incorporates WTP into the highway assignment process to help determine a driver's probability of using the priced lanes.

Figure 13 illustrates WTP curves for the passenger cars and trucks, with the ratio of the toll rate to amount of travel time savings on the x-axis and the percentage of WTP on the y-axis.

Figure 13 – Willingness to Pay Curves



The WTP curves were incorporated into the equilibrium highway assignment process to estimate the percentage of travelers who could choose tolled travel based on the various trade-offs related to travel time savings, toll cost, and other trip characteristics. After the determination of WTP, the individual trip table for each vehicle type is split in two: one table for those willing to pay tolls (under certain travel circumstances) and another table for those who are not willing to pay tolls (under any circumstances). Then the standard travel demand model equilibrium assignment methodologies were applied.

Those not willing to pay a toll are all assigned to paths without tolls. Those who are willing to pay a toll become eligible for tolled facilities and are assigned to both tolled and non-tolled roads based on congestion levels. It is important to note the various vehicle types were handled separately in the assignment process to recognize different values of time and toll charges.

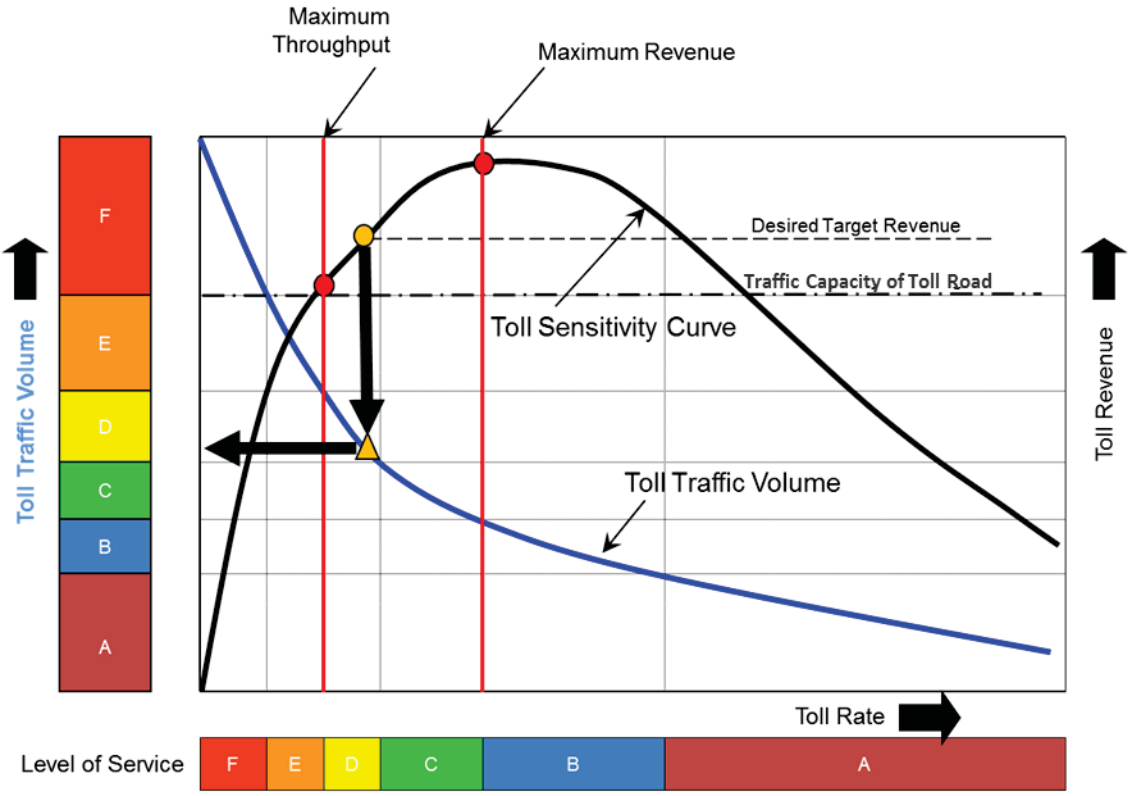
Toll Sensitivity Analysis

The toll sensitivity analysis is designed to quantify the impact on the use of the tolled portion of I-49 under a range of toll rates. The goal of performing a toll sensitivity

analysis is to provide an understanding of the relationship between toll rates, traffic impacts, and revenue levels.

The Toll Sensitivity Output (**Figure 14**) shows an example of a toll sensitivity curve (in black) and an associated toll traffic volume curve (in blue), with the toll rate along the x-axis and the revenue/toll traffic volume along the y-axis. As seen from the toll traffic volume curve, lower toll rates result in higher use (higher traffic volumes), while higher toll rates result in lower use (lower traffic volumes). The toll sensitivity curve shows different trends. As the x-axis values (toll rates) increase from left to right, revenue increases to a high point and then begins to decline. With a higher percent of traffic using the tolled facility, demand and operating speeds along parallel facilities improve. Consequently, improving the conditions in the parallel facilities can erode the value of the tolled facility to paying travelers. Constantly changing conditions results in a delicate balance between the operating conditions in the tolled facility and the parallel facilities and the price associated with the tolled facility. The resulting toll sensitivity curves illustrate the relative levels of potential toll revenue and the traffic associated with each hypothetical toll charge.

Figure 14 – Toll Sensitivity Output



Toll sensitivity analysis was conducted for the new I-49 corridor. The project corridor assumptions include four access locations at I-40, Clear Creek Road, Gun Club Road and Hwy. 22. Based on these access locations, following segments were defined:

- Segment A: I-40 to Clear Creek Road
- Segment B: Clear Creek Road to Gun Club Road
- Segment C: Gun Club Road to Hwy. 22

Distance-based toll rates, from 10 cents/mi to 50 cents/mi in increments of 5 cents/mile, were tested and sensitivity curves were created for each segment, travel direction, and time period for the two horizon years (2020 and 2040) to illustrate the relationships between the toll rates and revenue potential. Based on the toll sensitivity curves, optimized toll rates were determined by selecting the toll rates that maximized the revenue.

Toll Sensitivity Results

Toll sensitivity curves for each segment, direction and time period for 2020 and 2040 were developed as a part of this analysis. A summary of toll optimum rates (rates that maximize revenue) is presented in **Table 18** for 2020 and 2040.

Table 18: 2020 and 2040 Optimum Toll Rates (cents/mile)

Year	Segment	Direction	AM	MD	PM	NT	Daily
2020	A	Northbound	15	15	15	10	15
2020	A	Southbound	15	15	15	10	15
2020	B	Northbound	15	15	15	10	15
2020	B	Southbound	15	15	15	10	15
2020	C	Northbound	15	15	15	10	15
2020	C	Southbound	15	15	15	10	15
2040	A	Northbound	20	15	20	10	15
2040	A	Southbound	20	15	20	10	15
2040	B	Northbound	20	15	20	10	15
2040	B	Southbound	20	15	20	10	20
2040	C	Northbound	20	15	20	10	20
2040	C	Southbound	20	15	20	10	20

Below are the findings from the toll sensitivity results:

- In 2020, maximum revenue is produced by toll rate of 15 cents/mile during AM, MD and PM periods, and 10 cents/mile during the NT period
- In 2040, maximum revenue is produced by toll rate of 20 cents/mile during AM and PM, 15 cents/mile during MD, and 10 cents/mile during the NT period
- Assuming the same toll rate for the entire day, the 2020 maximum revenue occurs at a toll rate of 15 cents/mile for any segment and direction
- Assuming the same toll rate for the entire day, the 2040 maximum revenue occurs at a toll rate of 15 cents/mile or 20 cents/mile, depending on the segment and direction

From the analysis, it was found optimum toll rates did not vary significantly by segment and direction for any of the four periods for both 2020 and 2040. Therefore, it was proposed to keep a constant toll rate for all segments in both the directions, and if possible for the entire day as well.

Further analyses were performed, where total daily revenue with uniform toll rates across the entire day for all segment and directions were compared. The average volume on the three segments on I-49 were also reviewed. These values were reviewed only for the potential toll choices of 10 cents/mi, 15 cents/mi and 20 cents/mi and shown in **Table 19**.

Table 19: Daily Revenue and Volumes

	2020		2040	
Toll Rate (c/mi)	Total Revenue	Average Volume	Total Revenue	Average Volume
10	$9,072	4,523	$16,496	8,628
15	$9,711	3,108	$18,225	6,264
20	$9,123	2,122	$18,229	4,572

Table 19 shows that in 2020, uniform toll rate of 15 cents/mile produces maximum revenue, while in 2040, uniform toll rate of 15 cents/mile and 20 cents/mile, both produce similar revenue. Is should be noted, 15 cents/mile provides more throughput to the I-49 corridor (6,300 vs 4,600), thereby relieving adjacent parallel facilities.

The total toll for the 13.7 mile I-49 connection would be $2.05 based on 15 cents/mile. A full toll of $2 (14.6 cents/mile) was recommended due to user understanding and communication. This rate was also used for both the 2020 and 2040 revenue projections.

ANNUAL TRAFFIC AND REVENUE STREAM PROJECTIONS

Based on the identified toll rates recommended, the average weekday gross revenue was estimated for each forecast year (2020 and 2040). Several parameters and assumptions were used to estimate annual gross revenue and generate the 40-year gross revenue stream. This section provides an overview for the parameters including the annualization factor, ramp-up schedule, and revenue development methodology. **Table 20** shows the daily traffic volumes for the Full Build scenario by segment, interchange, ramps, and direction. These volumes identified several interchanges with very low volumes leading to the consideration of fewer access points for two scenarios.

Table 20: Daily Traffic Volumes for Full Build

Segment	Direction	2020	2040
I-49 Segment A	SB	1,211	2,750
I-49 Segment A	NB	1,247	2,669
Clear Creek Interchange	SB off	43	80
Clear Creek Interchange	SB on	806	1,154
Clear Creek Interchange	NB off	598	834
Clear Creek Interchange	NB on	14	21
I-49 Segment B	SB	1,974	3,823
I-49 Segment B	NB	1,831	3,483
Gun Club interchange	SB off	0	0
Gun Club interchange	SB on	90	251
Gun Club interchange	NB off	44	190
Gun Club interchange	NB on	0	0
I-49 Segment C	SB	2,068	4,078
I-49 Segment C	NB	1,876	3,678

Annualization Factor

Traffic and revenue estimates were produced first for a typical weekday. An annualization factor was then used to expand this estimate to an annual value. The weekend revenue was estimated to be 75% of the weekday revenue. This percentage was estimated using the weekday and weekend traffic counts at key locations on I-49 and I-540. Assuming 250 weekdays and 115 weekends and holidays, the annualization factor calculated was of 336.25 (250+115*0.75). The estimated annual gross revenues were calculated by multiplying this factor by the typical weekday revenue.

Revenue Streams

The study assumes 2024 as the opening year for the proposed connector. A 40-year revenue stream was developed from 2024 to 2063. Based on the estimated revenues for 2020 and 2040, revenue streams were developed by linearly interpolating for the intermediate years from 2020 to 2040 and then extrapolating the data linearly through the year 2063. Annual growth was assumed to reduce by 50% after 2040 to take into

account the uncertainty in socioeconomic growth and the capacity limitation of the facility. The revenue numbers of the first three years, 2024 through 2026, were then factored down per the assumed ramp-up schedule, discussed below.

Ramp-up Schedule

Traffic and toll revenue in the first few years after opening were adjusted using a "ramp-up" methodology. It considers the time that it takes the driving public to recognize any potential benefits of using a new toll facility. It is also the time before traffic reaches its full potential without considering nominal growth. Typical ramp-up periods vary by facility depending on traffic growth, development, traffic characteristics and other local considerations. Generally, a ramp-up period is two to five years and upgraded facilities which are part of an existing roadway network generally reach equilibrium faster. This study used a three-year ramp-up period based on coordination with the project management team. It was assumed that 70% of the traffic would be realized in Year 1 (2024), 80% in Year 2 (2025), and 90% in Year 3 (2026).

Transactions Streams

The transactions were calculated based on the proposed gantry locations for the Full Build 4-Lane. The proposed locations are shown in **Figure 15** and were selected with the intention that each toll road user will be charged only once.

Full Build 4-Lane Traffic and Revenue Summary

The 40-year (from open year 2024 to year 2063) revenue stream and transactions are presented in **Table 21**. **Figure 16** shows the trend of the annual gross revenue. The annual gross revenue increases from approximately $2.7M in 2024 to approximately $7.8M in 2063, resulting in a 40-year cumulative gross revenue of approximately $243M. The annual transactions increase from approximately 1.1M in 2024 to approximately 3.4M in 2063.

Figure 15 – Gantry Locations for Transactions

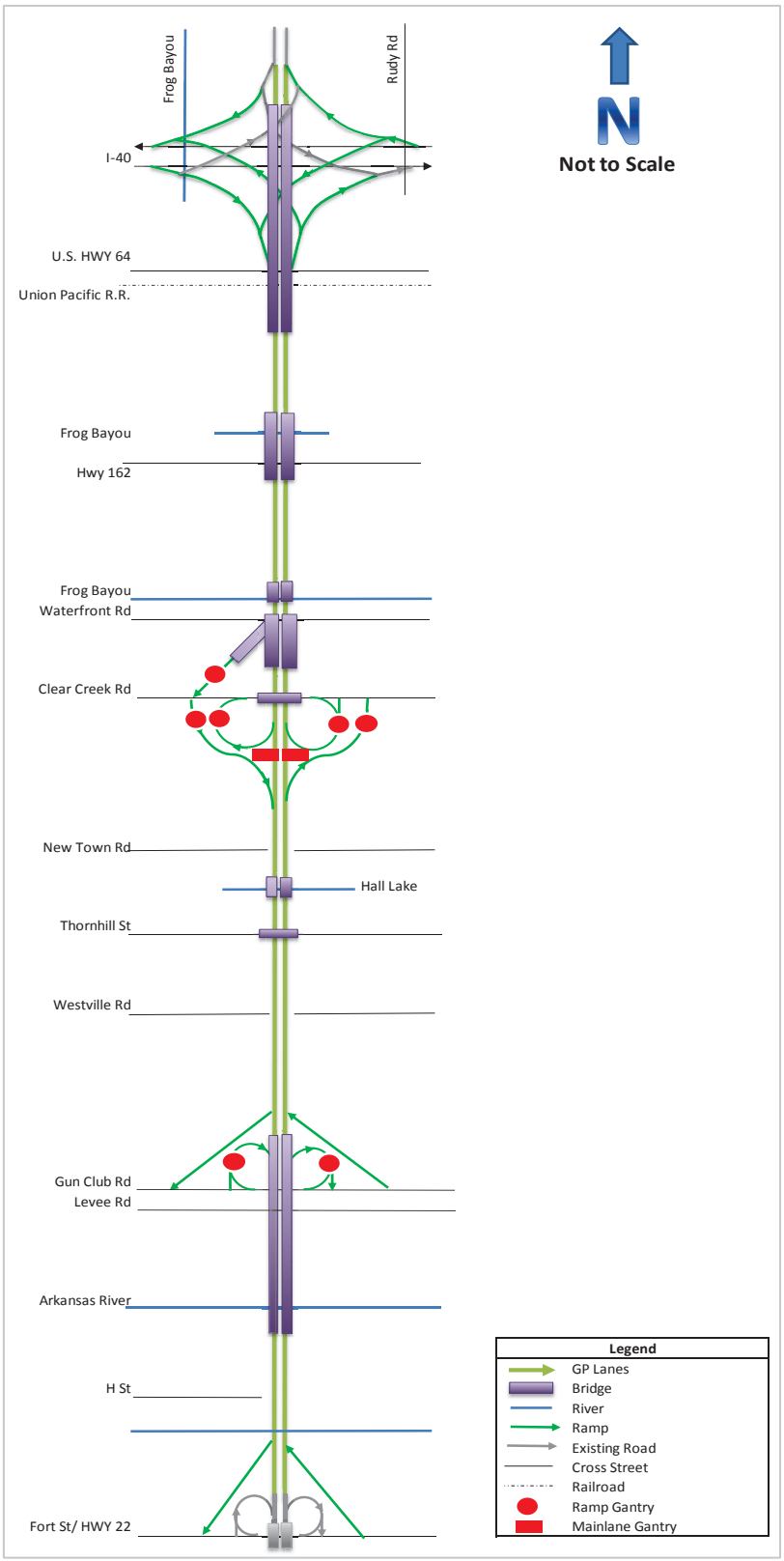
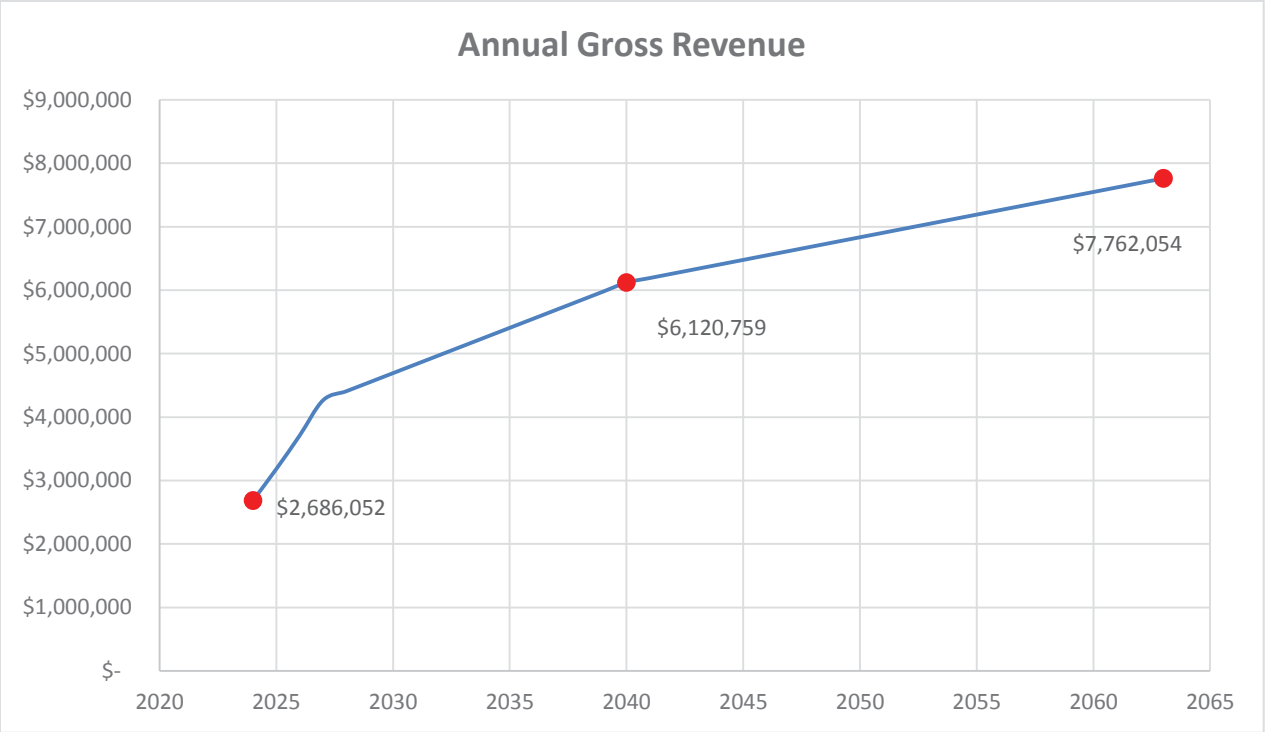


Table 21: 40 Year Gross Revenue Stream and Transactions (in Current Year Dollar)

Order	Year	Daily Gross Revenue	Annual Gross Rev w/o ramp up	Ramp-Up Factor	Annual Gross Revenue	Cumulative Gross Revenue	Daily Transactions	Annual Transactions
1	2024	$ 11,412	$ 3,837,218	70%	$ 2,686,052	$ 2,686,052	4,747	1,117,419
2	2025	$ 11,836	$ 3,979,939	80%	$ 3,183,951	$ 5,870,004	4,941	1,328,995
3	2026	$ 12,261	$ 4,122,660	90%	$ 3,710,394	$ 9,580,398	5,134	1,553,556
4	2027	$ 12,685	$ 4,265,382		$ 4,265,382	$ 13,845,780	5,327	1,791,103
5	2028	$ 13,110	$ 4,408,103		$ 4,408,103	$ 18,253,883	5,520	1,856,033
6	2029	$ 13,534	$ 4,550,824		$ 4,550,824	$ 22,804,707	5,713	1,920,963
7	2030	$ 13,959	$ 4,693,546		$ 4,693,546	$ 27,498,253	5,906	1,985,893
8	2031	$ 14,383	$ 4,836,267		$ 4,836,267	$ 32,334,520	6,099	2,050,822
9	2032	$ 14,807	$ 4,978,988		$ 4,978,988	$ 37,313,508	6,292	2,115,752
10	2033	$ 15,232	$ 5,121,710		$ 5,121,710	$ 42,435,217	6,485	2,180,682
11	2034	$ 15,656	$ 5,264,431		$ 5,264,431	$ 47,699,648	6,678	2,245,612
12	2035	$ 16,081	$ 5,407,152		$ 5,407,152	$ 53,106,800	6,872	2,310,542
13	2036	$ 16,505	$ 5,549,874		$ 5,549,874	$ 58,656,674	7,065	2,375,472
14	2037	$ 16,930	$ 5,692,595		$ 5,692,595	$ 64,349,269	7,258	2,440,402
15	2038	$ 17,354	$ 5,835,316		$ 5,835,316	$ 70,184,585	7,451	2,505,332
16	2039	$ 17,779	$ 5,978,037		$ 5,978,037	$ 76,162,622	7,644	2,570,261
17	2040	$ 18,203	$ 6,120,759		$ 6,120,759	$ 82,283,381	7,837	2,635,191
18	2041	$ 18,415	$ 6,192,119		$ 6,192,119	$ 88,475,500	7,934	2,667,656
19	2042	$ 18,627	$ 6,263,480		$ 6,263,480	$ 94,738,981	8,030	2,700,121
20	2043	$ 18,840	$ 6,334,841		$ 6,334,841	$ 101,073,821	8,127	2,732,586
21	2044	$ 19,052	$ 6,406,201		$ 6,406,201	$ 107,480,023	8,223	2,765,051
22	2045	$ 19,264	$ 6,477,562		$ 6,477,562	$ 113,957,585	8,320	2,797,516
23	2046	$ 19,476	$ 6,548,923		$ 6,548,923	$ 120,506,507	8,416	2,829,981
24	2047	$ 19,689	$ 6,620,283		$ 6,620,283	$ 127,126,791	8,513	2,862,446
25	2048	$ 19,901	$ 6,691,644		$ 6,691,644	$ 133,818,435	8,609	2,894,911
26	2049	$ 20,113	$ 6,763,005		$ 6,763,005	$ 140,581,439	8,706	2,927,376
27	2050	$ 20,325	$ 6,834,365		$ 6,834,365	$ 147,415,805	8,803	2,959,841
28	2051	$ 20,537	$ 6,905,726		$ 6,905,726	$ 154,321,531	8,899	2,992,306
29	2052	$ 20,750	$ 6,977,087		$ 6,977,087	$ 161,298,617	8,996	3,024,771
30	2053	$ 20,962	$ 7,048,447		$ 7,048,447	$ 168,347,065	9,092	3,057,235
31	2054	$ 21,174	$ 7,119,808		$ 7,119,808	$ 175,466,872	9,189	3,089,700
32	2055	$ 21,386	$ 7,191,169		$ 7,191,169	$ 182,658,041	9,285	3,122,165
33	2056	$ 21,599	$ 7,262,529		$ 7,262,529	$ 189,920,570	9,382	3,154,630
34	2057	$ 21,811	$ 7,333,890		$ 7,333,890	$ 197,254,460	9,478	3,187,095
35	2058	$ 22,023	$ 7,405,251		$ 7,405,251	$ 204,659,711	9,575	3,219,560
36	2059	$ 22,235	$ 7,476,611		$ 7,476,611	$ 212,136,322	9,671	3,252,025
37	2060	$ 22,448	$ 7,547,972		$ 7,547,972	$ 219,684,294	9,768	3,284,490
38	2061	$ 22,660	$ 7,619,333		$ 7,619,333	$ 227,303,626	9,865	3,316,955
39	2062	$ 22,872	$ 7,690,693		$ 7,690,693	$ 234,994,320	9,961	3,349,420
40	2063	$ 23,084	$ 7,762,054		$ 7,762,054	$ 242,756,373	10,058	3,381,885

Figure 16 – Annual Gross Revenue



TRANSPORTATION IMPACTS

The transportation impact analysis was conducted to understand the traffic impacts on key facilities within the subarea network. For this purpose, key statistics include average volumes, vehicles-miles travelled (VMT), vehicle hours travelled (VHT), and travel speeds. These statistics were compared between the No-Build and the Full Build 4-Lane Tolled scenario) for the design year 2040.

Traffic Volume

Figure 17 and **Figure 18** show the daily traffic volumes in the subarea region for 2040 No-Build and 2040 Build, respectively. Facilities with higher volumes include I-540, I-40, I-49, Highways 22, 71, and 59. Based on the future I-49 corridor project location, higher impacts are expected on the facilities that connect to, or are parallel to, I-49. Therefore, statistics related to transportation impacts are presented for these facilities.

Figure 17 – 2040 No-Build Daily Volumes

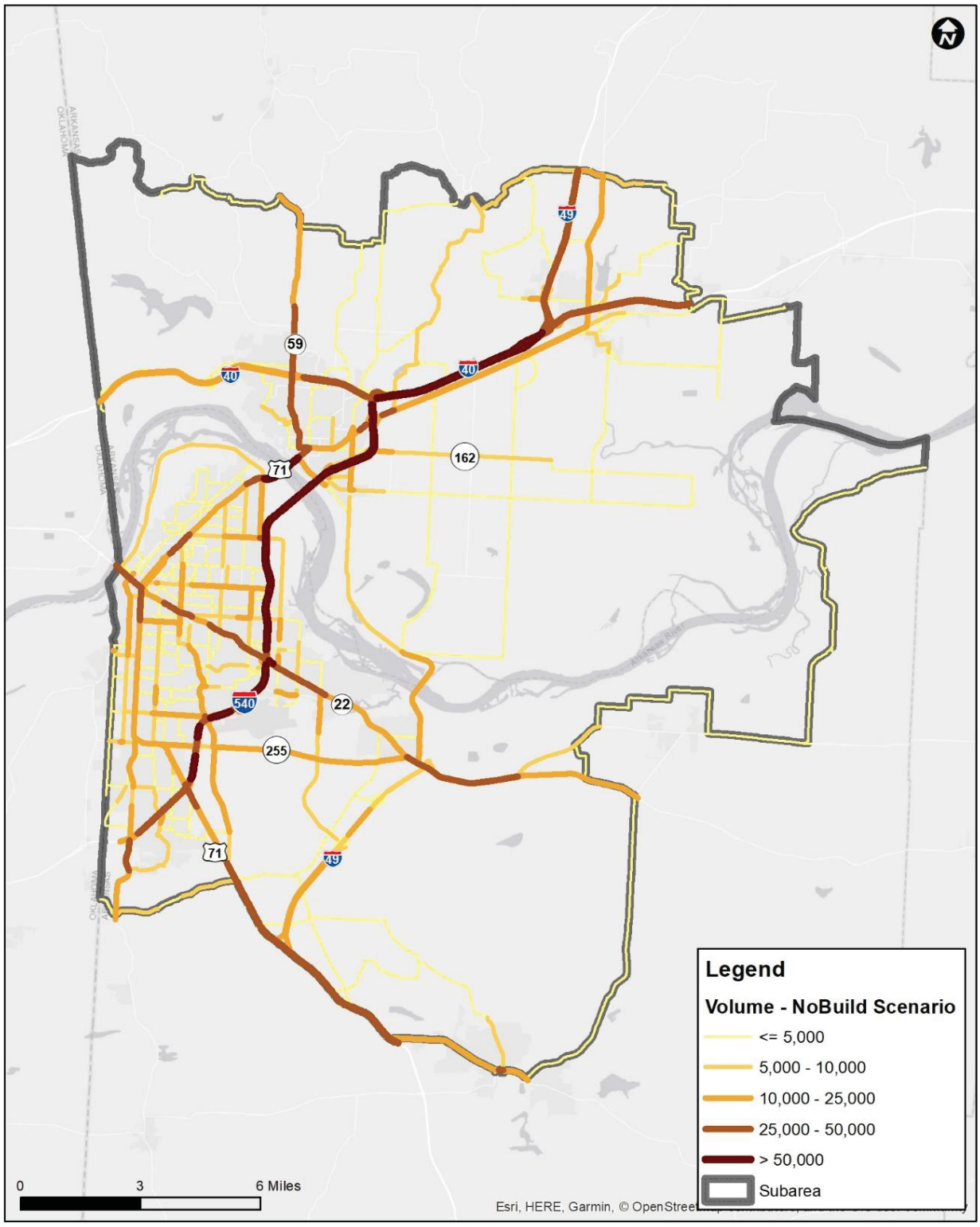
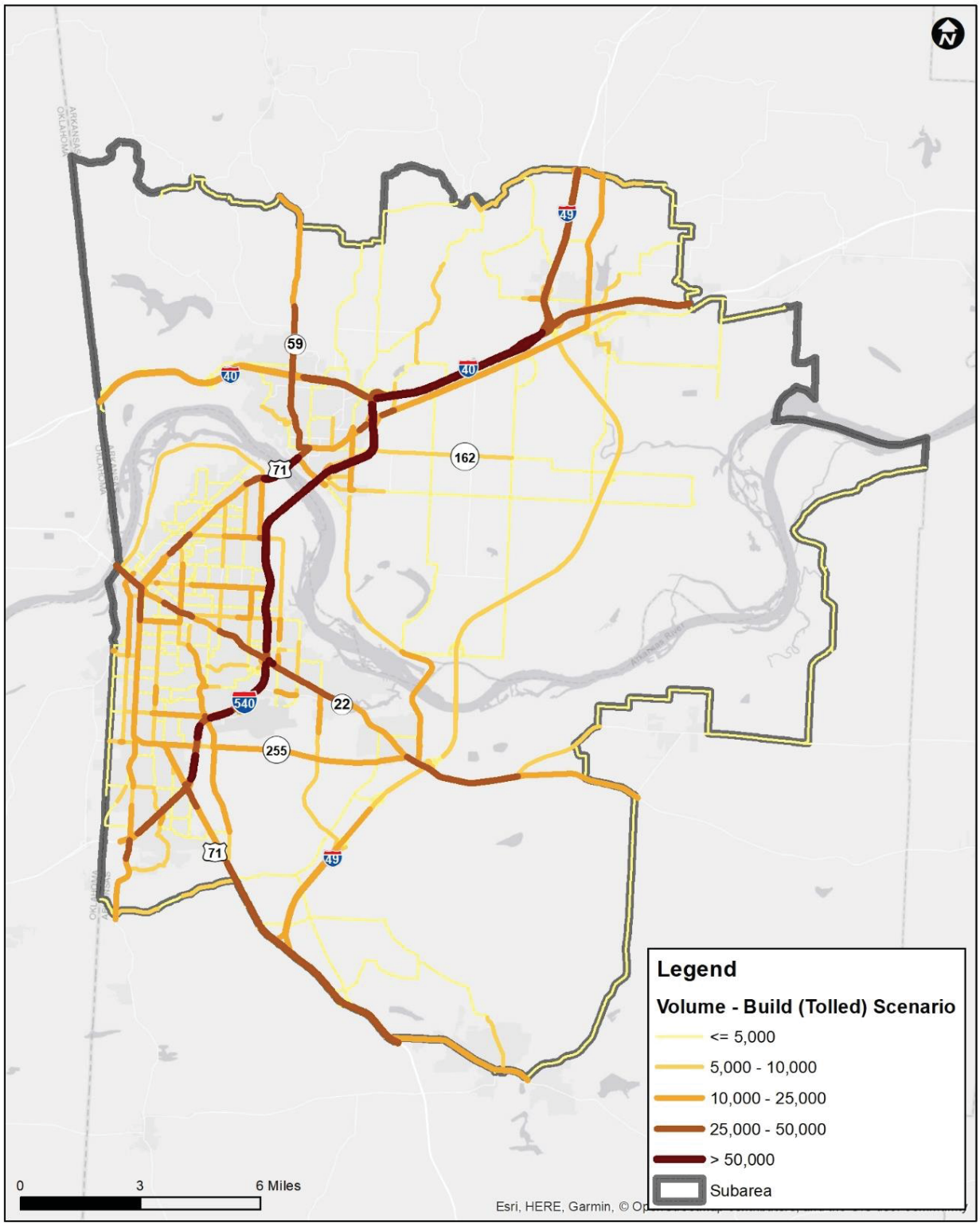


Figure 18 – 2040 Build Daily Volumes

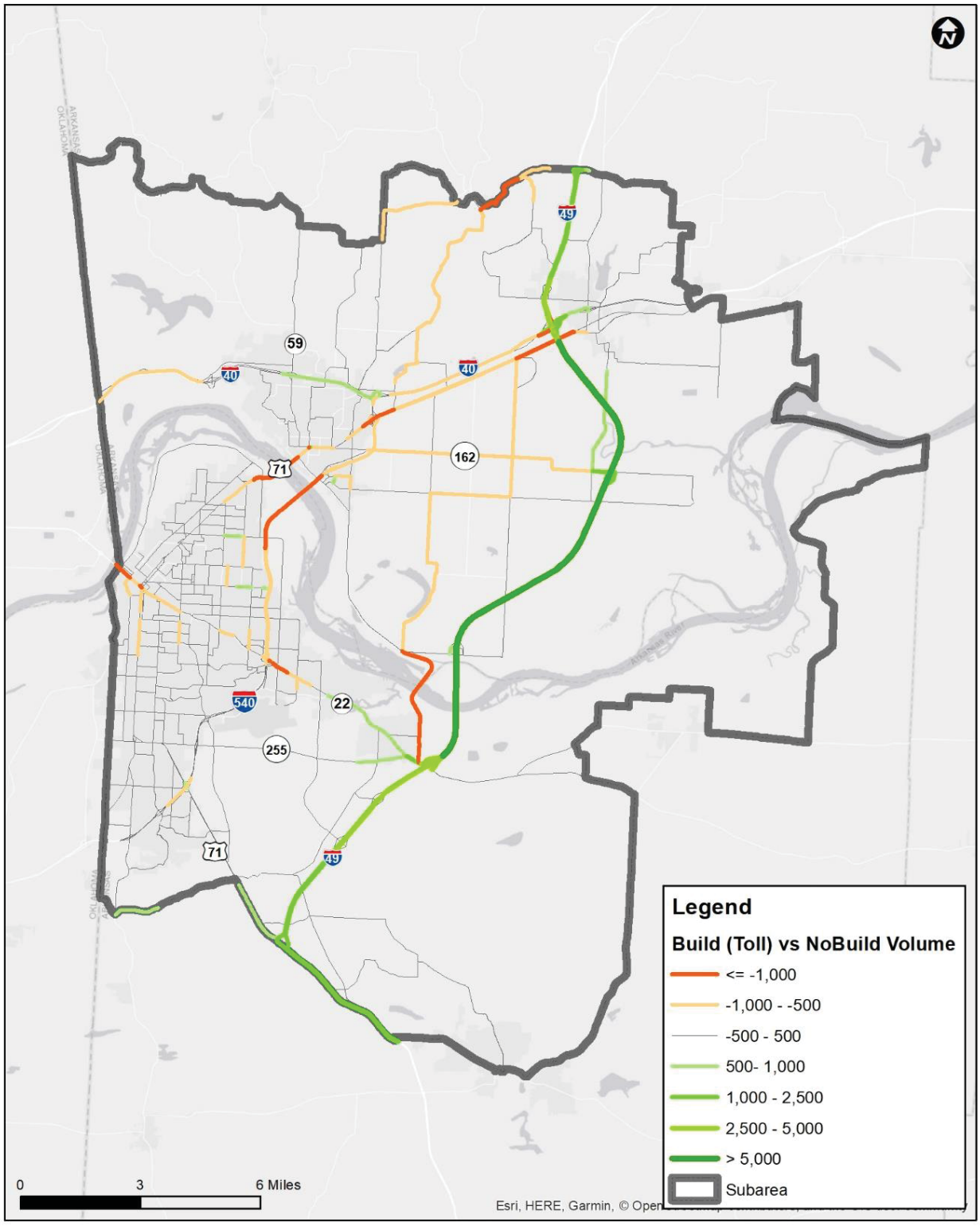


A Comparison of daily volumes on key facilities between 2040 No-Build and 2040 Full Build 4-Lane Scenario are provided in **Table 22**. **Figure 19** shows the difference in traffic volumes between the Build and the No-Build. The positive values show a gain in volume while negative volumes show loss in volumes in the Build.

Table 22: Daily Traffic Volumes

Corridor	Segment	No-Build	Full Build 4-Lane	Diff
I-49	Between Hwy. 282 and I-40	41,360	43,450	2,090
	Between Hwy. 22 and US-71	10,440	12,820	2,380
I-40	Between I-49 and I-540	54,740	54,460	(280)
I-540	Between I-40 and Hwy. 22	56,560	55,960	(600)
	Between Hwy. 22 and US-71	44,970	44,820	(150)
Hwy 22	Between Hwy. 96 and I-49	21,340	21,170	(170)
	Between I-49 and I-540	27,410	27,740	330
US 71	Between SR 105 and I-49	44,280	45,600	1,320
	Between I-49 and I-540	30,670	31,110	440
I-49	Segment A - Between I-40 and Clear Creek	-	5,210	5,210
	Segment B - Between Clear Creek and Gun Club Rd	-	7,250	7,250
	Segment C - Between Gun Club Rd and Hwy. 22	-	7,110	7,110

Figure 19 – Difference in Volumes between 2040 Build and No-Build



Vehicle Miles Traveled

Vehicle Miles Traveled (VMT) were calculated for 2040 No-Build and the Full Build 4-Lane for key facilities as well as a system-wide total. The VMTs and the percentage difference in the Build (vs No-Build) are shown in **Table 23**. **Table 23** indicates the total VMT also increases in the subarea as the future I-49 corridor provides connectivity between the existing segments of I-49. VMT statistics shows which facilities gain volume as they provide access to the future I-49 corridor and which facilities lose traffic.

Table 23: Vehicle Miles Traveled (VMT)

Corridor	Segment	No-Build	Full Build 4-Lane	% Diff
I-49	Between Hwy. 282 and I-40	156,800	164,700	5%
	Between Hwy. 22 and US-71	61,200	75,200	23%
I-40	Between I-49 and I-540	293,200	291,600	-1%
I-540	Between I-40 and Hwy. 22	492,100	486,800	-1%
	Between Hwy. 22 and US-71	274,300	273,400	0%
Hwy. 22	Between Hwy. 96 and I-49	114,500	113,600	-1%
	Between I-49 and I-540	142,300	144,000	1%
US 71	Between SR 105 and I-49	160,100	164,900	3%
	Between I-49 and I-540	152,800	155,000	1%
I-49	Segment A - Between I-40 and Clear Creek	-	24,100	
	Segment B - Between Clear Creek and Gun Club Rd	-	43,100	
	Segment C - Between Gun Club Rd and Hwy. 22	-	23,700	
System-wide (Subarea)		4,869,000	4,939,600	1%

Vehicle Hours Traveled

The Vehicle Hours Traveled (VHT) were calculated for 2040 No-Build and Full Build 4-Lane and are shown in **Table 24**. The table shows that some of the connecting facilities have higher VHT as the traffic on them increases to access the I-49 project corridor and most of the parallel facilities have reduced VHT, which means travel time savings. The system level VHT decreases, even though the VMTs are more, indicating improved travel times on roadway facilities.

Table 24: Vehicle Hours Traveled (VHT)

Corridor	Segment	No-Build	Build	% Diff
I-49	Between Hwy. 282 and I-40	2,700	2,930	8.5%
	Between Hwy. 22 and US-71	890	1,090	22.5%
I-40	Between I-49 and I-540	5,310	5,230	-1.5%
I-540	Between I-40 and Hwy. 22	13,330	12,830	-3.8%
	Between Hwy. 22 and US-71	5,530	5,480	-0.9%
Hwy. 22	Between Hwy. 96 and I-49	3,240	3,110	-4.0%
	Between I-49 and I-540	4,430	4,500	1.6%
US 71	Between SR 105 and I-49	3,590	3,750	4.5%
	Between I-49 and I-540	3,710	3,770	1.6%
I-49	Segment A - Between I-40 and Clear Creek	-	350	
	Segment B - Between Clear Creek and Gun Club Rd	-	620	
	Segment C - Between Gun Club Rd and Hwy. 22	-	340	
System-wide (Subarea)		127,990	127,590	-0.3%

Travel Speeds

Travel speeds in the No-Build and the Full Build 4-Lane are presented in **Table 25**. The travel speeds are lower for most connecting facilities in the Build (due to higher traffic volumes) and higher for parallel facilities. At the system-wide level for the subarea, the average travel speed is better as can be seen from **Table 25**.

Table 25: Travel Speeds

Corridor	Segment	No-Build	Build	% Diff
I-49	Between Hwy. 282 and I-40	58	56	-3%
	Between Hwy. 22 and US-71	69	69	-1%
I-40	Between I-49 and I-540	55	56	1%
I-540	Between I-40 and Hwy. 22	37	38	3%
	Between Hwy. 22 and US-71	50	50	1%
Hwy. 22	Between Hwy. 96 and I-49	35	37	3%
	Between I-49 and I-540	32	32	-1%
US 71	Between SR 105 and I-49	45	44	-1%
	Between I-49 and I-540	41	41	0%
I-49	Segment A - Between I-40 and Clear Creek	-	70	
	Segment B - Between Clear Creek and Gun Club Rd	-	70	
	Segment C - Between Gun Club Rd and Hwy. 22	-	69	
System-wide (Subarea)		38	39	2%

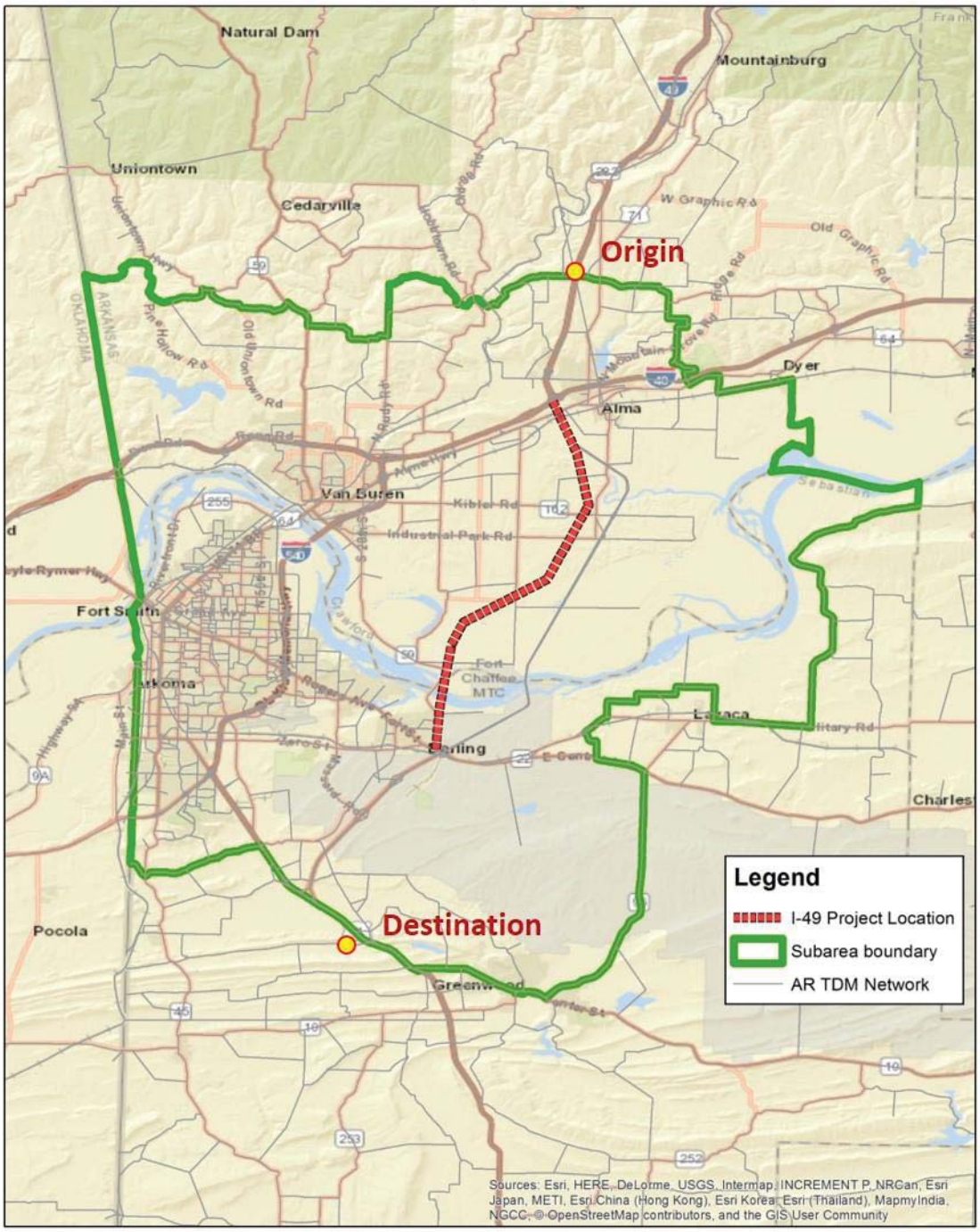
Travel Time Analysis

A comparison of travel time savings was done by selecting on origin and destination pair and calculating travel time in the No-Build and Build scenarios. In the Build scenario, travel time savings was calculated for two types of trips (1) trips using the I-49 corridor, and (2) trips that choose not to use the I-49 corridor. The selected origin and destination locations are shown in **Figure 19** and the travel time comparison for a one-way trip from origin to destination is shown in **Table 26**. The table shows that the travel time is saved for both, toll users and non-users. More savings occur in AM and PM peak periods. Users who choose non-toll path save around one minute and toll users save around 15 minutes in AM and PM peak periods.

Table 26: Travel Time Between Origin-Destination

Period	No-Build	Build			
		No-Toll path	Difference	Toll path	Difference
AM	40.30	39.33	(1.0)	25.16	(15.1)
MD	36.37	35.87	(0.5)	24.20	(12.2)
PM	39.79	38.97	(0.8)	25.50	(14.3)
NT	28.36	28.47	0.1	23.11	(5.3)

Figure 19 – Origin-Destination Pair



SENSITIVITY SCENARIOS

The I-49 project used several assumptions in estimating the annual gross revenue and 40-year Traffic and Revenue (T&R) streams. Sensitivity tests can be used to test a variety of conditions and how they affect the revenue stream and overall return on investment (ROI). ROI involves cost factors in addition to the benefits (benefits-to-cost ratio is a typical measure). The tests are sometimes used specifically to test downward potential trends to the baseline revenue stream. The initial T&R for this study revealed relatively low vehicle throughput when pricing was added as well as a resulting low revenue forecast. For this reason, sensitivities were developed to best understand potential upward trends that could positively affect either the revenue stream or the capital and O&M aspects of the project. This section discusses the sensitivity scenarios developed and the T&R forecasts summaries. All the values in the T&R tables are in current year dollars.

Interim 4-Lane

The Interim 4-Lane scenario matches the Full Build 4-Lane except with reduced access as mentioned below:

- No Gun Club Road ramps
- No system interchange ramps from I-49 northbound to I-40 westbound and I-40 eastbound to I-49 southbound

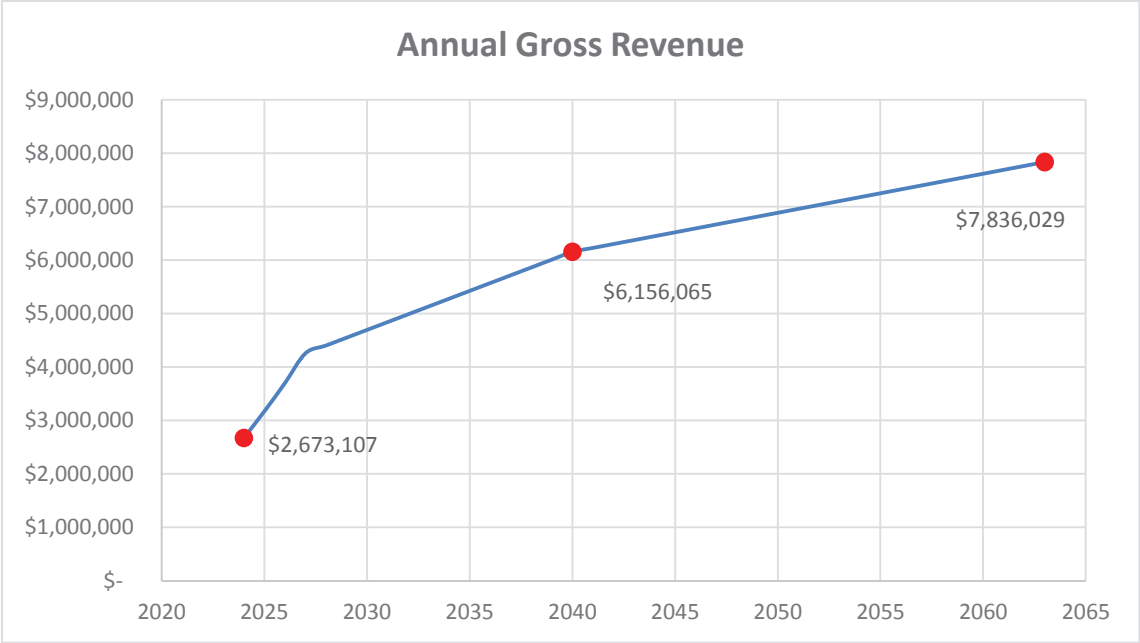
This sensitivity used the same toll rate of 14.4 cents/mile from the Full Build 4-Lane. The 40-year (from open year 2024 to year 2063) revenue stream is presented in **Table 27** and the trend of the Annual Gross Revenue is shown in **Figure 20**.

The annual gross revenue increases from approximately $2.7M in 2024 to approximately $7.8M in 2063, resulting in a 40-year cumulative gross revenue of approximately $244M (1% increase from Full Build 4-Lane). The annual transactions increase from approximately 965K in 2024 to approximately 3.3M in 2063.

Table 27: Interim 4-Lane 40 Year Gross Revenue Stream and Transactions (in Current Year Dollar)

Order	Year	Daily Gross Revenue	Annual Gross Rev w/o ramp up	Ramp-Up Factor	Annual Gross Revenue	Cumulative Gross Revenue	Daily Transactions	Annual Transactions
1	2024	$ 11,357	$ 3,818,724	70%	$ 2,673,107	$ 2,673,107	4,100	965,085
2	2025	$ 11,791	$ 3,964,808	80%	$ 3,171,846	$ 5,844,953	4,313	1,160,130
3	2026	$ 12,226	$ 4,110,892	90%	$ 3,699,802	$ 9,544,756	4,525	1,369,469
4	2027	$ 12,660	$ 4,256,975		$ 4,256,975	$ 13,801,731	4,738	1,593,102
5	2028	$ 13,095	$ 4,403,059		$ 4,403,059	$ 18,204,790	4,950	1,664,572
6	2029	$ 13,529	$ 4,549,143		$ 4,549,143	$ 22,753,933	5,163	1,736,042
7	2030	$ 13,964	$ 4,695,227		$ 4,695,227	$ 27,449,160	5,376	1,807,512
8	2031	$ 14,398	$ 4,841,311		$ 4,841,311	$ 32,290,471	5,588	1,878,982
9	2032	$ 14,832	$ 4,987,395		$ 4,987,395	$ 37,277,865	5,801	1,950,452
10	2033	$ 15,267	$ 5,133,478		$ 5,133,478	$ 42,411,344	6,013	2,021,922
11	2034	$ 15,701	$ 5,279,562		$ 5,279,562	$ 47,690,906	6,226	2,093,392
12	2035	$ 16,136	$ 5,425,646		$ 5,425,646	$ 53,116,552	6,438	2,164,862
13	2036	$ 16,570	$ 5,571,730		$ 5,571,730	$ 58,688,281	6,651	2,236,332
14	2037	$ 17,005	$ 5,717,814		$ 5,717,814	$ 64,406,095	6,863	2,307,801
15	2038	$ 17,439	$ 5,863,897		$ 5,863,897	$ 70,269,992	7,076	2,379,271
16	2039	$ 17,874	$ 6,009,981		$ 6,009,981	$ 76,279,974	7,288	2,450,741
17	2040	$ 18,308	$ 6,156,065		$ 6,156,065	$ 82,436,039	7,501	2,522,211
18	2041	$ 18,525	$ 6,229,107		$ 6,229,107	$ 88,665,145	7,607	2,557,946
19	2042	$ 18,742	$ 6,302,149		$ 6,302,149	$ 94,967,294	7,714	2,593,681
20	2043	$ 18,960	$ 6,375,191		$ 6,375,191	$ 101,342,485	7,820	2,629,416
21	2044	$ 19,177	$ 6,448,233		$ 6,448,233	$ 107,790,718	7,926	2,665,151
22	2045	$ 19,394	$ 6,521,275		$ 6,521,275	$ 114,311,992	8,032	2,700,886
23	2046	$ 19,611	$ 6,594,316		$ 6,594,316	$ 120,906,309	8,139	2,736,621
24	2047	$ 19,829	$ 6,667,358		$ 6,667,358	$ 127,573,667	8,245	2,772,356
25	2048	$ 20,046	$ 6,740,400		$ 6,740,400	$ 134,314,067	8,351	2,808,091
26	2049	$ 20,263	$ 6,813,442		$ 6,813,442	$ 141,127,509	8,457	2,843,826
27	2050	$ 20,480	$ 6,886,484		$ 6,886,484	$ 148,013,993	8,564	2,879,561
28	2051	$ 20,697	$ 6,959,526		$ 6,959,526	$ 154,973,519	8,670	2,915,296
29	2052	$ 20,915	$ 7,032,568		$ 7,032,568	$ 162,006,087	8,776	2,951,031
30	2053	$ 21,132	$ 7,105,610		$ 7,105,610	$ 169,111,697	8,883	2,986,766
31	2054	$ 21,349	$ 7,178,652		$ 7,178,652	$ 176,290,349	8,989	3,022,501
32	2055	$ 21,566	$ 7,251,694		$ 7,251,694	$ 183,542,042	9,095	3,058,236
33	2056	$ 21,784	$ 7,324,736		$ 7,324,736	$ 190,866,778	9,201	3,093,971
34	2057	$ 22,001	$ 7,397,777		$ 7,397,777	$ 198,264,555	9,308	3,129,706
35	2058	$ 22,218	$ 7,470,819		$ 7,470,819	$ 205,735,375	9,414	3,165,441
36	2059	$ 22,435	$ 7,543,861		$ 7,543,861	$ 213,279,236	9,520	3,201,176
37	2060	$ 22,653	$ 7,616,903		$ 7,616,903	$ 220,896,139	9,627	3,236,911
38	2061	$ 22,870	$ 7,689,945		$ 7,689,945	$ 228,586,084	9,733	3,272,646
39	2062	$ 23,087	$ 7,762,987		$ 7,762,987	$ 236,349,071	9,839	3,308,381
40	2063	$ 23,304	$ 7,836,029		$ 7,836,029	$ 244,185,100	9,945	3,344,116

Figure 20 – Interim 4-Lane Annual Gross Revenue



Phased Initial 2-Lane

The Phased Initial 2-Lane scenario was developed with the following assumptions along I-49:

- Reduced typical section to 2 lanes (1-lane in each direction, median divided)
- Posted speed limit was reduced from 70 mph to 55 mph
- Removed ramp access
    - No Gun Club Road ramps
    - No system interchange ramps from I-49 northbound to I-40 westbound and I-40 eastbound to I-49 southbound

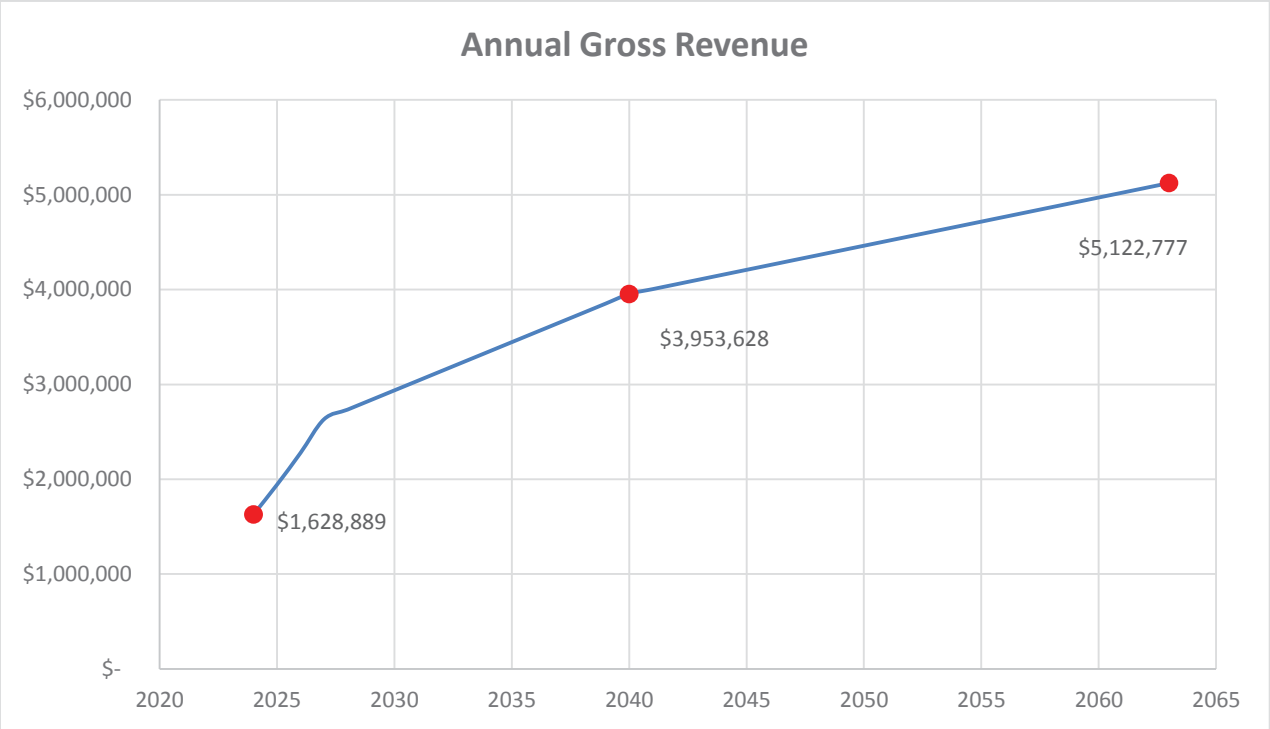
This sensitivity used the same toll rate of 14.4 cents/mile from the Full Build 4-Lane. The 40-year (from open year 2024 to year 2063) revenue stream is presented in **Table 28** and the trend of the annual gross revenue is shown in **Figure 21**.

The annual gross revenue increases from approximately $1.6M in 2024 to approximately $5.1M in 2063, resulting in a 40-year cumulative gross revenue of approximately $157M (35% percent less than base). The annual transactions increase from approximately 942K in 2024 to approximately 2.1M in 2063.

Table 28: Phased Initial 2-Lane 40 Year Gross Revenue Stream and Transactions (in Current Year Dollar)

Order	Year	Daily Gross Revenue	Annual Gross Rev w/o ramp up	Ramp-Up Factor	Annual Gross Revenue	Cumulative Gross Revenue	Daily Transactions	Annual Transactions
1	2024	$ 6,920	$ 2,326,985	70%	$ 1,628,889	$ 1,628,889	2,804	942,778
2	2025	$ 7,223	$ 2,428,650	80%	$ 1,942,920	$ 3,571,809	2,931	985,465
3	2026	$ 7,525	$ 2,530,315	90%	$ 2,277,283	$ 5,849,092	3,058	1,028,152
4	2027	$ 7,827	$ 2,631,980		$ 2,631,980	$ 8,481,072	3,185	1,070,839
5	2028	$ 8,130	$ 2,733,645		$ 2,733,645	$ 11,214,718	3,312	1,113,526
6	2029	$ 8,432	$ 2,835,310		$ 2,835,310	$ 14,050,028	3,439	1,156,212
7	2030	$ 8,735	$ 2,936,976		$ 2,936,976	$ 16,987,004	3,566	1,198,899
8	2031	$ 9,037	$ 3,038,641		$ 3,038,641	$ 20,025,644	3,692	1,241,586
9	2032	$ 9,339	$ 3,140,306		$ 3,140,306	$ 23,165,950	3,819	1,284,273
10	2033	$ 9,642	$ 3,241,971		$ 3,241,971	$ 26,407,922	3,946	1,326,960
11	2034	$ 9,944	$ 3,343,636		$ 3,343,636	$ 29,751,558	4,073	1,369,647
12	2035	$ 10,246	$ 3,445,302		$ 3,445,302	$ 33,196,860	4,200	1,412,334
13	2036	$ 10,549	$ 3,546,967		$ 3,546,967	$ 36,743,826	4,327	1,455,021
14	2037	$ 10,851	$ 3,648,632		$ 3,648,632	$ 40,392,458	4,454	1,497,708
15	2038	$ 11,153	$ 3,750,297		$ 3,750,297	$ 44,142,755	4,581	1,540,395
16	2039	$ 11,456	$ 3,851,962		$ 3,851,962	$ 47,994,718	4,708	1,583,082
17	2040	$ 11,758	$ 3,953,628		$ 3,953,628	$ 51,948,345	4,835	1,625,769
18	2041	$ 11,909	$ 4,004,460		$ 4,004,460	$ 55,952,805	4,898	1,647,112
19	2042	$ 12,060	$ 4,055,293		$ 4,055,293	$ 60,008,098	4,962	1,668,456
20	2043	$ 12,212	$ 4,106,125		$ 4,106,125	$ 64,114,223	5,025	1,689,799
21	2044	$ 12,363	$ 4,156,958		$ 4,156,958	$ 68,271,181	5,089	1,711,143
22	2045	$ 12,514	$ 4,207,790		$ 4,207,790	$ 72,478,972	5,152	1,732,486
23	2046	$ 12,665	$ 4,258,623		$ 4,258,623	$ 76,737,595	5,216	1,753,830
24	2047	$ 12,816	$ 4,309,456		$ 4,309,456	$ 81,047,050	5,279	1,775,173
25	2048	$ 12,967	$ 4,360,288		$ 4,360,288	$ 85,407,339	5,343	1,796,517
26	2049	$ 13,119	$ 4,411,121		$ 4,411,121	$ 89,818,459	5,406	1,817,860
27	2050	$ 13,270	$ 4,461,953		$ 4,461,953	$ 94,280,413	5,470	1,839,203
28	2051	$ 13,421	$ 4,512,786		$ 4,512,786	$ 98,793,199	5,533	1,860,547
29	2052	$ 13,572	$ 4,563,619		$ 4,563,619	$ 103,356,818	5,597	1,881,890
30	2053	$ 13,723	$ 4,614,451		$ 4,614,451	$ 107,971,269	5,660	1,903,234
31	2054	$ 13,874	$ 4,665,284		$ 4,665,284	$ 112,636,553	5,724	1,924,577
32	2055	$ 14,026	$ 4,716,116		$ 4,716,116	$ 117,352,669	5,787	1,945,921
33	2056	$ 14,177	$ 4,766,949		$ 4,766,949	$ 122,119,618	5,851	1,967,264
34	2057	$ 14,328	$ 4,817,782		$ 4,817,782	$ 126,937,400	5,914	1,988,608
35	2058	$ 14,479	$ 4,868,614		$ 4,868,614	$ 131,806,014	5,978	2,009,951
36	2059	$ 14,630	$ 4,919,447		$ 4,919,447	$ 136,725,461	6,041	2,031,295
37	2060	$ 14,782	$ 4,970,279		$ 4,970,279	$ 141,695,740	6,105	2,052,638
38	2061	$ 14,933	$ 5,021,112		$ 5,021,112	$ 146,716,852	6,168	2,073,982
39	2062	$ 15,084	$ 5,071,945		$ 5,071,945	$ 151,788,796	6,231	2,095,325
40	2063	$ 15,235	$ 5,122,777		$ 5,122,777	$ 156,911,574	6,295	2,116,669

Figure 21 – Phased Initial 2-Lane Annual Gross Revenue



Increased Land Use Full Build 4-Lane

The Increased Land Use Full Build 4-Lane scenario assumed more development in the project region. The growth assumptions were focused on:

- Hypothetical growth related West Arkansas Intermodal Authority (WAIA), shown in **Table 29.**
- Secondary growth rate assumed to be higher than the existing 2040 forecast current 2040 Plan as reflected in the model. **Table 30** shows the factors used to increase the current growth rate.

Table 29: Hypothetical WAIA Development

Phase	Size	Type	Year	Zone
Phase 1	100 acres	Warehousing	Year 5	772
	315 acres	Light Manufacturing	Year 5	772
	315 acres	Light Manufacturing	Year 10	772
Phase 2	200 acres	Light Manufacturing	Year 12	822
	150 acres	Light Manufacturing	Year 20	822
Phase 3	1000 acres	Logistics	Year 25	822

Table 30: Factors for Secondary Growth Rate

Zone	Population Rate	Employment Rate
771	Increase by 2.0	Increase by 2.0
774	No Change	No Change
775	No Change	No Change
776	Increase by 2.0	Increase by 1.25
811	Increase by 2.0	Increase by 1.5
812	No Change	No Change
813	Increase by 1.5	Increase by 1.5
829	No Change	No Change
830	Increase by 1.25	Increase by 1.25
3533	No change	No change
3053	No change	No change

The growth related to WAIA were incorporated in the year 2020 and 2040 model subarea trip tables. The growth rate calculated from the 2020 and 2040 population and employments were multiplied by the factors for the secondary growth to calculate the new growth rate and the 2020 and 2040 subarea trip tales were revised accordingly.

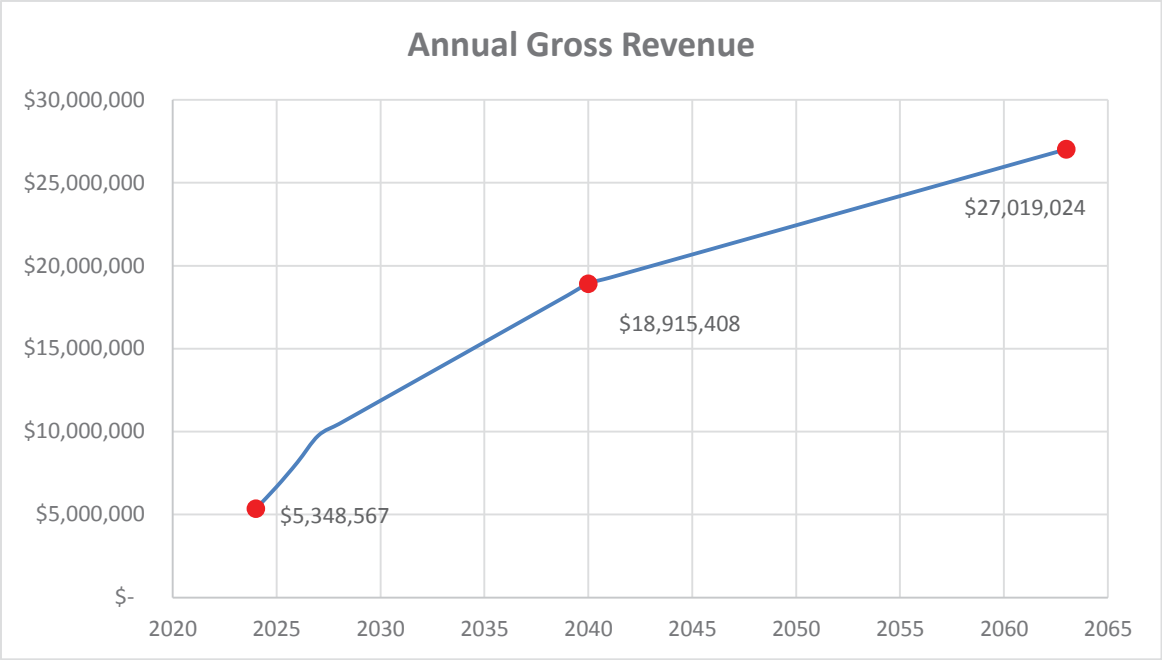
This scenario also used the Full Build 4-Lane toll rates of 14.4 cents/mile. The 40-year (from open year 2024 to year 2063) revenue stream is presented in **Table 31** and the trend of the annual gross revenue is shown in **Figure 22**.

The annual gross revenue increases from approximately $5.3M in 2024 to approximately $27M in 2063, resulting in a 40-year cumulative gross revenue of approximately $753M (210% increase from Full Build 4-Lane). The annual transactions increase from approximately 3.6M in 2024 to approximately 23M in 2063.

Table 31: Increased Land Use Full Build 4-Lane 40 Year Gross Revenue Stream and Transactions (in Current Year Dollar)

Order	Year	Daily Gross Revenue	Annual Gross Rev w/o ramp up	Ramp-Up Factor	Annual Gross Revenue	Cumulative Gross Revenue	Daily Transactions	Annual Transactions
1	2024	$ 22,724	$ 7,640,811	70%	$ 5,348,567	$ 5,348,567	15,523	3,653,726
2	2025	$ 24,819	$ 8,345,473	80%	$ 6,676,378	$ 12,024,946	17,442	4,691,831
3	2026	$ 26,915	$ 9,050,135	90%	$ 8,145,122	$ 20,170,067	19,361	5,858,971
4	2027	$ 29,011	$ 9,754,797		$ 9,754,797	$ 29,924,865	21,279	7,155,148
5	2028	$ 31,106	$ 10,459,460		$ 10,459,460	$ 40,384,324	23,198	7,800,328
6	2029	$ 33,202	$ 11,164,122		$ 11,164,122	$ 51,548,446	25,117	8,445,507
7	2030	$ 35,298	$ 11,868,784		$ 11,868,784	$ 63,417,231	27,036	9,090,687
8	2031	$ 37,393	$ 12,573,447		$ 12,573,447	$ 75,990,678	28,954	9,735,867
9	2032	$ 39,489	$ 13,278,109		$ 13,278,109	$ 89,268,787	30,873	10,381,046
10	2033	$ 41,584	$ 13,982,771		$ 13,982,771	$ 103,251,558	32,792	11,026,226
11	2034	$ 43,680	$ 14,687,434		$ 14,687,434	$ 117,938,991	34,711	11,671,406
12	2035	$ 45,776	$ 15,392,096		$ 15,392,096	$ 133,331,087	36,629	12,316,585
13	2036	$ 47,871	$ 16,096,758		$ 16,096,758	$ 149,427,846	38,548	12,961,765
14	2037	$ 49,967	$ 16,801,421		$ 16,801,421	$ 166,229,266	40,467	13,606,945
15	2038	$ 52,063	$ 17,506,083		$ 17,506,083	$ 183,735,349	42,386	14,252,124
16	2039	$ 54,158	$ 18,210,745		$ 18,210,745	$ 201,946,094	44,304	14,897,304
17	2040	$ 56,254	$ 18,915,408		$ 18,915,408	$ 220,861,502	46,223	15,542,484
18	2041	$ 57,302	$ 19,267,739		$ 19,267,739	$ 240,129,240	47,182	15,865,074
19	2042	$ 58,350	$ 19,620,070		$ 19,620,070	$ 259,749,310	48,142	16,187,663
20	2043	$ 59,397	$ 19,972,401		$ 19,972,401	$ 279,721,711	49,101	16,510,253
21	2044	$ 60,445	$ 20,324,732		$ 20,324,732	$ 300,046,443	50,061	16,832,843
22	2045	$ 61,493	$ 20,677,063		$ 20,677,063	$ 320,723,507	51,020	17,155,433
23	2046	$ 62,541	$ 21,029,394		$ 21,029,394	$ 341,752,901	51,979	17,478,023
24	2047	$ 63,589	$ 21,381,726		$ 21,381,726	$ 363,134,627	52,939	17,800,613
25	2048	$ 64,637	$ 21,734,057		$ 21,734,057	$ 384,868,683	53,898	18,123,203
26	2049	$ 65,684	$ 22,086,388		$ 22,086,388	$ 406,955,071	54,857	18,445,792
27	2050	$ 66,732	$ 22,438,719		$ 22,438,719	$ 429,393,790	55,817	18,768,382
28	2051	$ 67,780	$ 22,791,050		$ 22,791,050	$ 452,184,841	56,776	19,090,972
29	2052	$ 68,828	$ 23,143,381		$ 23,143,381	$ 475,328,222	57,736	19,413,562
30	2053	$ 69,876	$ 23,495,713		$ 23,495,713	$ 498,823,934	58,695	19,736,152
31	2054	$ 70,924	$ 23,848,044		$ 23,848,044	$ 522,671,978	59,654	20,058,742
32	2055	$ 71,971	$ 24,200,375		$ 24,200,375	$ 546,872,353	60,614	20,381,331
33	2056	$ 73,019	$ 24,552,706		$ 24,552,706	$ 571,425,059	61,573	20,703,921
34	2057	$ 74,067	$ 24,905,037		$ 24,905,037	$ 596,330,096	62,532	21,026,511
35	2058	$ 75,115	$ 25,257,368		$ 25,257,368	$ 621,587,464	63,492	21,349,101
36	2059	$ 76,163	$ 25,609,699		$ 25,609,699	$ 647,197,164	64,451	21,671,691
37	2060	$ 77,211	$ 25,962,031		$ 25,962,031	$ 673,159,195	65,411	21,994,281
38	2061	$ 78,258	$ 26,314,362		$ 26,314,362	$ 699,473,556	66,370	22,316,870
39	2062	$ 79,306	$ 26,666,693		$ 26,666,693	$ 726,140,249	67,329	22,639,460
40	2063	$ 80,354	$ 27,019,024		$ 27,019,024	$ 753,159,273	68,289	22,962,050

Figure 22 – Increased Land Use Full Build 4-Lane Annual Gross Revenue



Complete I-49 Full Build 4-Lane

The Complete I-49 Full Build 4-Lane scenario assumes the completion of following segments of I-49:

- I-49 extension from Fort Smith to DeQueen based on the alignment in the 1997 EIS and from DeQueen to Texarkana based on the alignment in the 2001 EIS.
- The I-49 Missouri-Arkansas Connector from Bella Vista, AR to Pineville, Missouri.

Both extensions assumed a 4-lane typical section with posted speeds of 70 mph.

This scenario included performing full toll sensitivity. As in the Full Build 4-Lane, the sensitivity was performed for each segment, direction and time period. Summary of optimum toll rates is presented in **Table 32** for both 2020 and 2040.

Table 32: 2020 Optimum Toll Rates (cents/mile

Year	Segment	Direction	AM	MD	PM	NT	Daily
2020	A	Northbound	20	15	20	10	15
	A	Southbound	20	15	20	10	15
	B	Northbound	20	15	20	10	15
	B	Southbound	20	15	20	10	15
	C	Northbound	20	20	20	10	15
	C	Southbound	20	15	20	10	15
2040	A	Northbound	25	25	25	10	15
	A	Southbound	20	20	20	10	15
	B	Northbound	25	20	25	10	20
	B	Southbound	20	20	20	15	15
	C	Northbound	25	25	30	10	20
	C	Southbound	25	20	25	15	20

In 2020, AM, MD and PM periods have optimum toll rates as either 15 cents/mile or 20 cents/mile, while NT period has slightly lower. In 2040, AM, MD and PM periods have optimum toll rates as either 20 cents/mile or 25 cents/mile, while NT period has slightly lower. The optimum toll rates also vary by segment and direction in 2040. To establish more uniform toll rates by segment direction and time period, daily revenue and average volumes were estimated for potential toll rate choices assuming they were kept constant for all the time periods, segments and directions. The results are summarized in **Table 33**.

Table 33: Complete I-49 Full Build 4-Lane Daily Revenue and Volumes

	2020		2040	
Toll Rate (c/mi)	Total Revenue	Average Volume	Total Revenue	Average Volume
10	$16,373	6,959	$27,083	12,372
15	$18,119	5,015	$31,360	9,405
20	$17,518	3,565	$31,388	6,975
25	$15,416	2,499	$30,192	5,294

Table 34 shows that in 2020, a uniform toll rate of 15 cents/mile produces maximum revenue, while in 2040, uniform toll rates of 15 cents/mile and 20 cents/mile, both produce similar revenue. However, 15 cents/mile provides higher vehicle throughput to the I-49 facility (9,400 vs 7,000), thereby relieving adjacent parallel facilities and hence would be recommended toll for 2040. As in the Full Build 4-Lane, the optimum toll was changed to 14.4 cents/mile to keep the total toll for I-49 project corridor as $2.00 even.

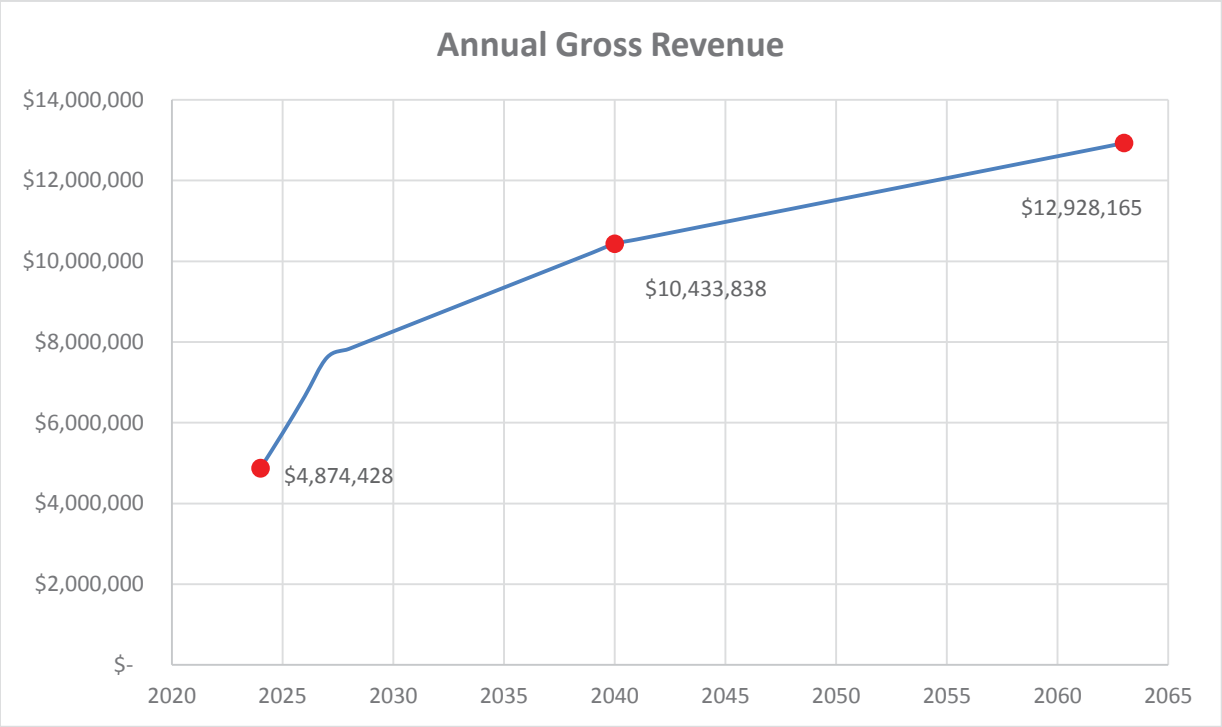
The 40-year (from open year 2024 to year 2063) revenue stream is presented in **Table 34** and the trend of the annual gross revenue is shown in **Figure 23**.

The annual gross revenue increases from approximately $4.9M in 2024 to approximately $13M in 2063, resulting in a 40-year cumulative gross revenue of approximately $413.5M. The annual transactions increase from approximately 1.7M in 2024 to approximately 4.8M in 2063.

Table 34: Complete I-49 Full Build 4-Lane 40 Year Gross Revenue Stream and Transactions (in Current Year Dollar)

Order	Year	Daily Gross Revenue	Annual Gross Rev w/o ramp up	Ramp-Up Factor	Annual Gross Revenue	Cumulative Gross Revenue	Daily Transactions	Annual Transactions
1	2024	$ 20,709	$ 6,963,469	70%	$ 4,874,428	$ 4,874,428	7,168	1,687,262
2	2025	$ 21,354	$ 7,180,367	80%	$ 5,744,293	$ 10,618,721	7,425	1,997,325
3	2026	$ 21,999	$ 7,397,265	90%	$ 6,657,538	$ 17,276,259	7,682	2,324,644
4	2027	$ 22,644	$ 7,614,163		$ 7,614,163	$ 24,890,422	7,938	2,669,220
5	2028	$ 23,289	$ 7,831,061		$ 7,831,061	$ 32,721,483	8,195	2,755,502
6	2029	$ 23,934	$ 8,047,959		$ 8,047,959	$ 40,769,442	8,451	2,841,783
7	2030	$ 24,580	$ 8,264,857		$ 8,264,857	$ 49,034,298	8,708	2,928,065
8	2031	$ 25,225	$ 8,481,755		$ 8,481,755	$ 57,516,053	8,965	3,014,347
9	2032	$ 25,870	$ 8,698,653		$ 8,698,653	$ 66,214,706	9,221	3,100,629
10	2033	$ 26,515	$ 8,915,551		$ 8,915,551	$ 75,130,257	9,478	3,186,910
11	2034	$ 27,160	$ 9,132,449		$ 9,132,449	$ 84,262,707	9,734	3,273,192
12	2035	$ 27,805	$ 9,349,347		$ 9,349,347	$ 93,612,054	9,991	3,359,474
13	2036	$ 28,450	$ 9,566,245		$ 9,566,245	$ 103,178,299	10,248	3,445,756
14	2037	$ 29,095	$ 9,783,143		$ 9,783,143	$ 112,961,442	10,504	3,532,037
15	2038	$ 29,740	$ 10,000,041		$ 10,000,041	$ 122,961,484	10,761	3,618,319
16	2039	$ 30,385	$ 10,216,939		$ 10,216,939	$ 133,178,423	11,017	3,704,601
17	2040	$ 31,030	$ 10,433,838		$ 10,433,838	$ 143,612,261	11,274	3,790,883
18	2041	$ 31,353	$ 10,542,287		$ 10,542,287	$ 154,154,547	11,402	3,834,023
19	2042	$ 31,675	$ 10,650,736		$ 10,650,736	$ 164,805,283	11,531	3,877,164
20	2043	$ 31,998	$ 10,759,185		$ 10,759,185	$ 175,564,467	11,659	3,920,305
21	2044	$ 32,320	$ 10,867,634		$ 10,867,634	$ 186,432,101	11,787	3,963,446
22	2045	$ 32,643	$ 10,976,083		$ 10,976,083	$ 197,408,184	11,916	4,006,587
23	2046	$ 32,965	$ 11,084,532		$ 11,084,532	$ 208,492,715	12,044	4,049,728
24	2047	$ 33,288	$ 11,192,981		$ 11,192,981	$ 219,685,696	12,172	4,092,869
25	2048	$ 33,610	$ 11,301,430		$ 11,301,430	$ 230,987,126	12,300	4,136,010
26	2049	$ 33,933	$ 11,409,879		$ 11,409,879	$ 242,397,005	12,429	4,179,150
27	2050	$ 34,255	$ 11,518,328		$ 11,518,328	$ 253,915,332	12,557	4,222,291
28	2051	$ 34,578	$ 11,626,777		$ 11,626,777	$ 265,542,109	12,685	4,265,432
29	2052	$ 34,900	$ 11,735,226		$ 11,735,226	$ 277,277,335	12,814	4,308,573
30	2053	$ 35,223	$ 11,843,675		$ 11,843,675	$ 289,121,010	12,942	4,351,714
31	2054	$ 35,545	$ 11,952,124		$ 11,952,124	$ 301,073,134	13,070	4,394,855
32	2055	$ 35,868	$ 12,060,573		$ 12,060,573	$ 313,133,707	13,199	4,437,996
33	2056	$ 36,190	$ 12,169,022		$ 12,169,022	$ 325,302,729	13,327	4,481,137
34	2057	$ 36,513	$ 12,277,471		$ 12,277,471	$ 337,580,200	13,455	4,524,277
35	2058	$ 36,835	$ 12,385,920		$ 12,385,920	$ 349,966,120	13,583	4,567,418
36	2059	$ 37,158	$ 12,494,369		$ 12,494,369	$ 362,460,489	13,712	4,610,559
37	2060	$ 37,481	$ 12,602,818		$ 12,602,818	$ 375,063,307	13,840	4,653,700
38	2061	$ 37,803	$ 12,711,267		$ 12,711,267	$ 387,774,574	13,968	4,696,841
39	2062	$ 38,126	$ 12,819,716		$ 12,819,716	$ 400,594,291	14,097	4,739,982
40	2063	$ 38,448	$ 12,928,165		$ 12,928,165	$ 413,522,456	14,225	4,783,123

Figure 23 – Complete I-49 Full Build 4-Lane Annual Gross Revenue



Comparison of Sensitivity Scenarios with the Full Build 4-Lane

Table 35 shows comparison of daily transactions, daily revenue and 40-year cumulative gross revenue. The percentage increase in the sensitivity scenarios compared to the Full Build 4-Lane, is shown in **Figure 24, Figure 25** and **Figure 26**.

Table 35: Revenue and Transactions Comparison

Scenario	2020		2040		40-year Gross Revenue (Million)
	Daily Transactions (Thousand)	Daily Revenue (Thousand)	Daily Transactions (Thousand)	Daily Revenue (Thousand)	
Full Build 4-Lane	4.0	$ 9.7	7.8	$ 18.2	$ 243
Interim 4-Lane	3.3	$ 9.6	7.5	$18.3	$ 244
Phase Initial 2-Lane	2.3	$ 5.7	4.8	$11.8	$ 157
Increased Land Use Full Build 4-Lane	7.8	$14.3	46.2	$56.3	$ 753
Complete I-49 Full Build 4-Lane	6.1	$18.1	11.3	$31.0	$ 414

Figure 24 – Comparison of Daily Transactions (vs Full Build 4-Lane)

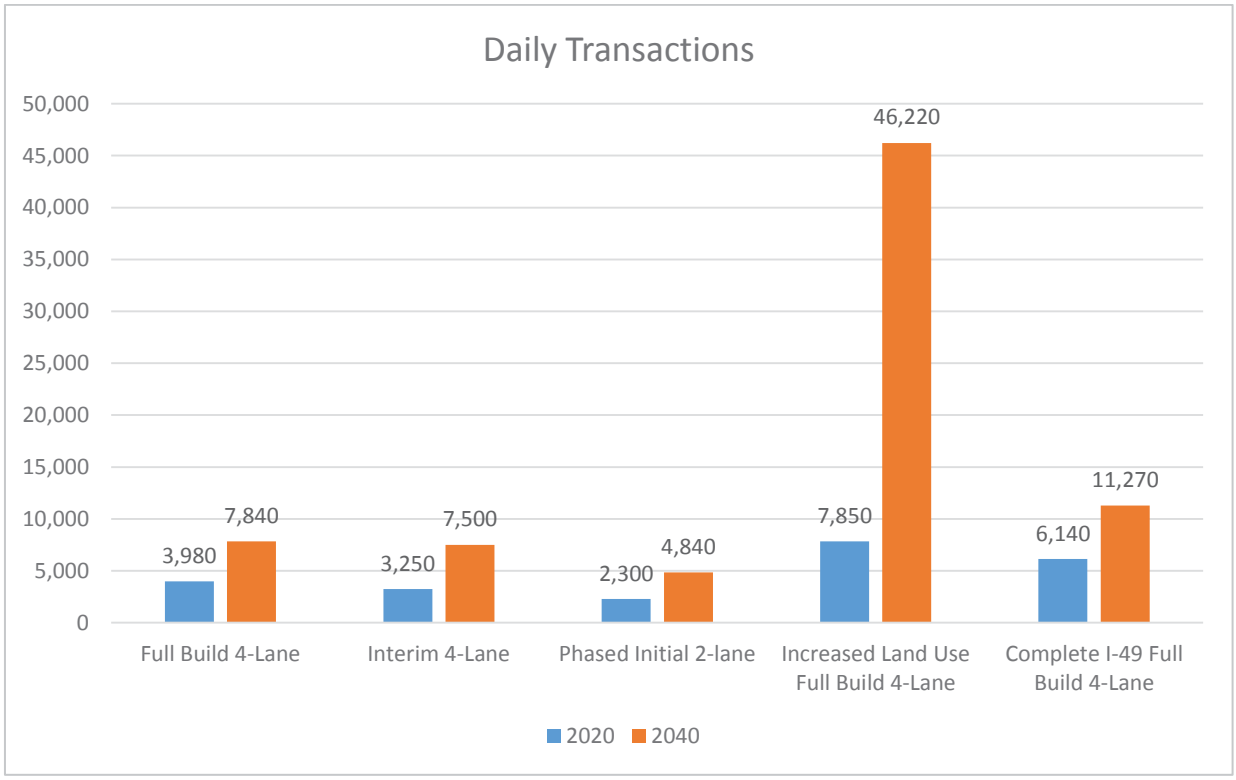


Figure 25 – Comparison of Daily Revenue (vs Full Build 4-Lane)

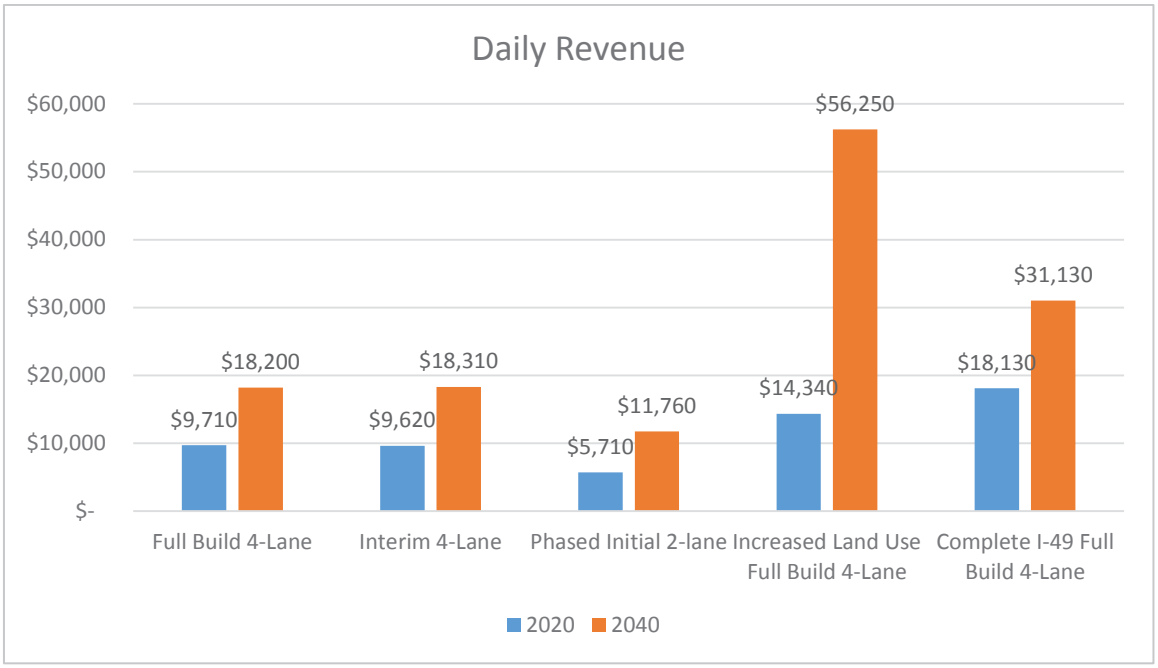
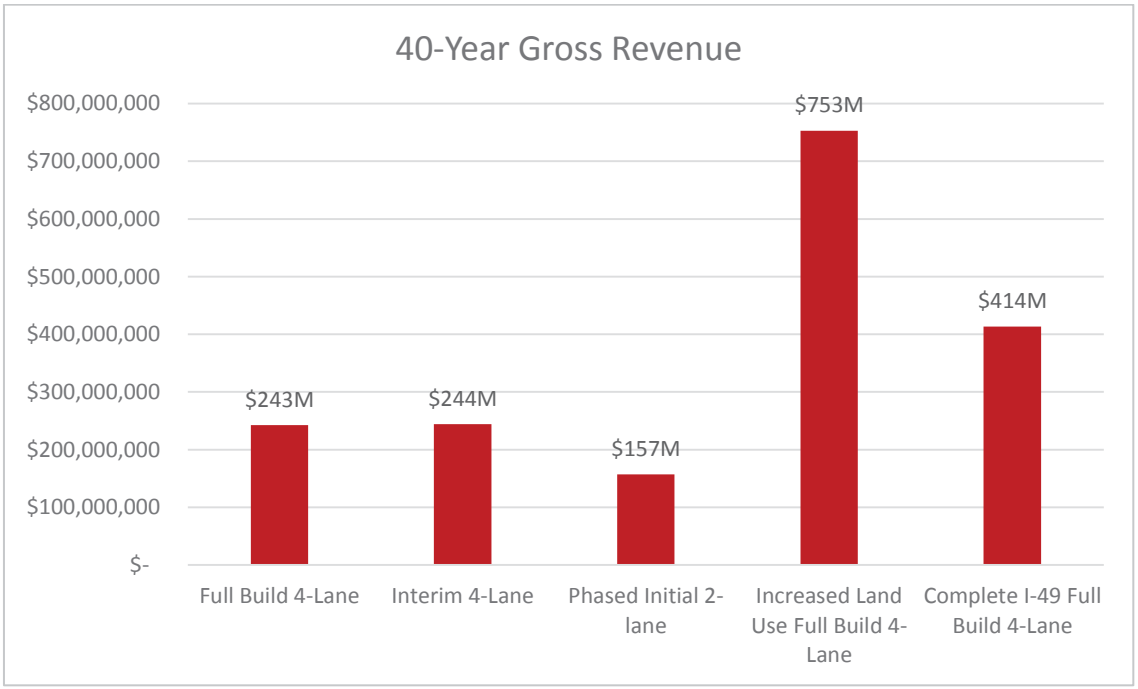


Figure 26 – Comparison of 40-Year Gross Annual Revenue (vs Full Build 4-Lane)



NET REVENUE AND FEASIBILITY

This section evaluates the net revenue potential of the project and presents preliminary toll financing scenarios to assess the ability of I-49 to contribute upfront financing proceeds toward construction costs of the facility. Most new toll facilities require multiple funding sources to fully fund the project and this financial feasibility assessment identifies the portion of upfront and ongoing lifecycle costs that tolls can help fund. This report has presented the methodology and the results of the revenue and cost forecasts that enable the calculation of annual cash flows of net revenue.

The financial analysis has identified three public, tax-exempt gross toll revenue financing structures along with a P3 Design-Build-Finance-Operate-Maintain (DBFOM) Availability Payment structure. The toll financing feasibility analysis evaluated the upfront financing capacity of the toll projects. The availability payment P3 structure identified the annual payments required to deliver the entire project. Given the preliminary nature of this tolling analysis, future refinements are required before advancing the project towards implementation and an actual financing. Feasibility of the project will be affected by any future refinements which affect costs or revenue and changes in the financial markets.

HNTB developed an Excel-based financial model to evaluate various financing and structuring options for the scenarios. The model structured debt against forecasted net toll revenues to evaluate the financing potential of the projects. This analysis presented gross toll revenue finance structures where ARDOT is obligated to provide funding for O&M and Major Maintenance activities if future toll revenues are insufficient, and a scenario in which ARDOT also is obligated to fund lifecycle and debt service payments if future toll revenues are insufficient. The assumptions and financial structures used in the model are based on observable market indicators.

FINANCIAL MODEL INPUTS AND NET REVENUE

This section will aggregate and summarize the cost and revenue forecasts for the Full Build 4-Lane scenario along with four sensitivity scenarios. The sensitivity scenarios were developed to illustrate and quantify the impacts of changing certain assumptions. It is important to note that the sensitivity scenarios of Increased Land Use and Complete I-49 are designed to show upside revenue potential and outcomes cannot be viewed as likely or probable, and could not support financing.

The cost and revenue analysis detailed earlier in this report forms the basis for the financial evaluation of the scenarios. All project revenues and costs are inflated from 2018 dollars to year of expenditure dollars at 2.5% annual inflation in the financial model. The following summaries present results for the Full Build 4-Lane scenario and all of the sensitivity scenarios:

- Capital Cost Summary
- 40-Year Net Revenue Summary
- Full Build 4-Lane Annual Net Revenue Graph

Table 36 summarizes the total capital costs of each scenario in 2018 and future year dollars.

Table 36: Summary of Scenario Capital Costs

Scenario (millions)	Roadway (2018$)	Tolling (2018$)	Total (2018$)	Inflated Total (2.5%)
1. Full Build 4-Lane	$776	$11	$787	$859
Sensitivity Analysis Scenarios (for illustration only)				
2. Interim 4-Lane	$735	$8	$742	$810
3. Phased Initial 2-Lane (55 MPH)	$490	$7	$497	$542
4. Increased Land Use Full Build 4-Lane	$776	$11	$787	$859
5. Complete I-49 Full Build 4-Lane	$776	$11	$787	$859

Table 37 presents the 2018 revenue and cost forecasts over the 40-year period.

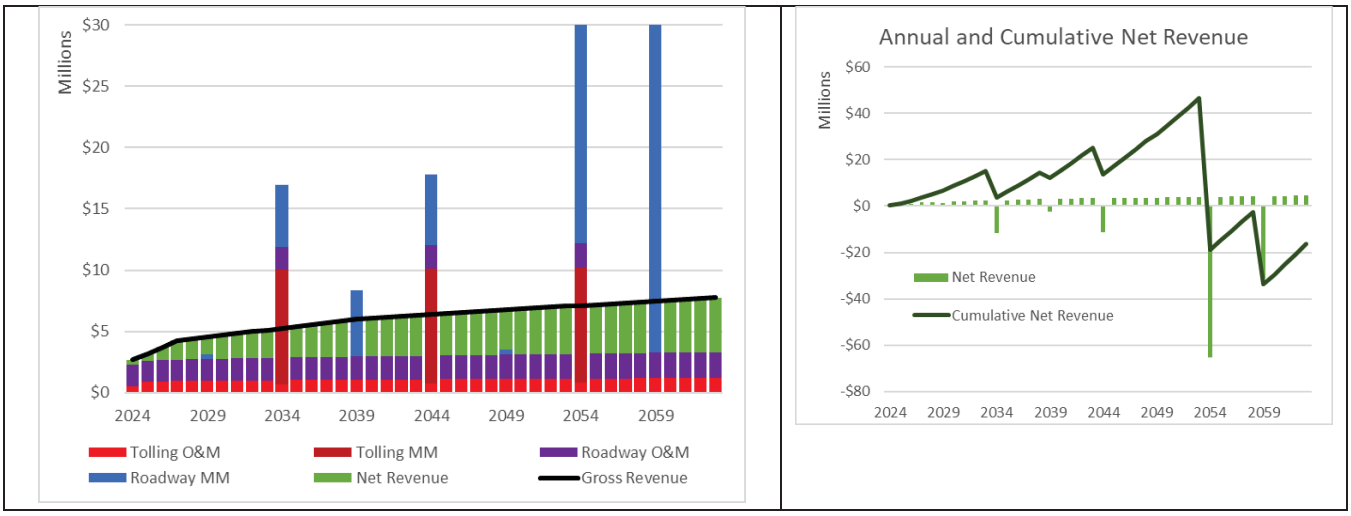
Table 37: 40-Year Net Revenue Summary (2018)

Scenario (millions)	Gross Revenue	O&M	Major Maintenance	Net Revenue
1. Full Build 4-Lane	$243	$118	$141	-$16
2. Interim 4-Lane	$244	$102	$127	$16
3. Phased Initial 2-Lane (55MPH)	$157	$80	$93	-$16
4. Increased Land Use Full Build 4-Lane	$753	$185	$141	$427
5. Complete I-49 Full Build 4-Lane	$414	$127	$141	$145

Note: Scenario 4 and 5 are upside revenue illustrations and are highly speculative

Figure 27 presents a graph of net revenue components and a graph of the cumulative net revenue for the Full Build 4-Lane scenario in 2018. As the graphics illustrate, the project can support all routine roadway and tolling costs but cannot support the periodic major maintenance needs. The project remains cash flow positive (if it accrues all net revenue) up until the significant capital needs in 2054. The project could support a significant toll revenue bond just before 2054 to finance the major reconstruction needs in the future.

Figure 27 – 40-Year Net Revenue Summary (2018) for Full Build 4-Lane



Regardless of phasing, anticipated toll revenues fall well short of estimated costs, with a total gap of between $513 million and $803 million. Thus, tolling cannot contribute substantially to the upfront costs of constructing the project.

PUBLIC FINANCING STRUCTURE AND ASSUMPTIONS

Publicly operated and financed toll facilities can either use a net or gross revenue pledge to establish the flow of funds and revenue use priority. Under a net revenue pledge, the project is a stand-alone facility and does not require any revenue or credit support. Gross toll revenues first fund all operations and maintenance requirements before repaying debt holders. The Full Build 4-Lane scenario cannot fund all of its major maintenance requirements. Therefore, a net revenue pledge is not optimal for I-49.

A gross revenue pledge where all revenues are pledged first to repay debt holders can be used on I-49 and generate financing proceeds to fund a portion of capital costs. With a gross revenue pledge, the public owner "guarantees" or pledges to fund any O&M and major maintenance costs that are unable to be funded from toll revenue. This analysis identified three types of gross revenue pledges to illustrate how the financing proceeds increase as ARDOT takes on additional financing risk. A summary of the primary financing assumptions are summarized below in **Table 38.**

Table 38: Financing Scenario Assumptions

Item	Gross Revenue Pledge Less Toll O&M Costs	Pure Gross Revenue Pledge	Fully Guaranteed Gross Revenue Pledge
DOT Risk	Toll MM Roadway O&M and MM	Toll O&M and MM Roadway O&M and MM	Toll O&M and MM Roadway O&M and MM Debt Service
Debt Description	40 years; CIBs & CABs, Capitalized Interest, Reserve Funds, Costs of Issuance	40 years; CIBs & CABs, Capitalized Interest, Reserve Funds, Costs of Issuance	40 years; CIBs & CABs, Capitalized Interest, Reserve Funds, Costs of Issuance
TIFIA Description	Initial BAN, interest accretion during construction and 35 years	Initial BAN, interest accretion during construction and 35 years	Initial BAN, interest accretion during construction and 35 years
Toll Bond Rate	4.00 – 5.00%	4.00 – 5.00%	3.50 – 4.50%
TIFIA Debt Rate	3.25 - 4.25%	3.25 - 4.25%	3.25 - 4.25%
Coverage	1.75x – 2.00x	1.75x – 2.00x	1.25x – 1.50x
Illustrative Rating	BBB category	BBB category	A or AA category

PRELIMINARY FINANCIAL FEASIBILITY RESULTS

HNTB's proprietary financial model was used to assess the upfront financing capacity for each of the financing cases. This model is designed to evaluate preliminary feasibility by structuring debt against a net revenue stream and evaluating the total upfront financing proceeds. As the results in **Table 39** demonstrate, the upfront toll financing proceeds can contribute some upfront proceeds and can cover all routine tolling and roadway expenses.

Table 39: Preliminary Financial Feasibility Results for Full Build 4-Lane

Item	Gross Revenue Pledge Less Toll O&M Costs	Pure Gross Revenue Pledge	Fully Guaranteed Gross Revenue Pledge
Capital Cost (inflated)	$859	$859	$859
Upfront Financing Proceeds			
Toll Revenue Bond Financing (no TIFIA)	$44 - $64	$53 - $77	$79 - $119
TIFIA & Toll Bond Financing	$57 - $85	$68 - $102	$94 - $146
Comments	- Can also fund all tolling and roadway O&M - Future financing in year 30 could finance the forecasted large Major Maintenance requirements - TIFIA loan produces additional upfront proceeds but requires a lengthy application process	- Can also fund all tolling and roadway O&M - Future financing in year 30 could finance the forecasted large Major Maintenance requirements - TIFIA loan produces additional upfront proceeds but requires a lengthy application process	- Lower coverage ratio generates additional proceeds but leaves less money available to fully fund all O&M - Future financing in year 30 could finance the forecasted large Major Maintenance requirements - TIFIA loan produces additional upfront proceeds but requires a lengthy application process

As the results illustrate, a Full Build gross revenue financing can contribute $44 to $146 million dependent upon the financial structure and debt assumptions. All scenarios require additional funding from public sources to complete the funding plan and construct the project using the assumptions developed in this report.

A Pure Gross Revenue Pledge financing was also run for the four sensitivity scenarios to evaluate the upfront financing potential of each scenario, as shown in **Table 40**.

Table 40: Preliminary Financial Feasibility Results for All Scenarios

Item	1. Full Build 4-Lane	2. Interim 4-Lane	3.Phased Initial 2-Lane (55MPH)	4. Increased Land Use 4-Lane	5. Complete I-49 4-Lane
Capital Cost (inflated)	**$859**	$810	$542	$859	$859
Upfront Financing Proceeds: Pure Gross Revenue Pledge					
TIFIA & Toll Bond Financing	**$68 - $102**	$68 - $103	$43 - $65	$194 - $293	$118 - $173
Comments	-Scenarios 4 and 5 are highly speculative and could not achieve investment grade ratings -All scenarios can also fund all tolling and roadway O&M -Future financing in year 30 could finance the forecasted large Major Maintenance requirements -TIFIA loan produces additional upfront proceeds but requires a lengthy application process				

As the results illustrate, toll financing can contribute some upfront proceeds and can cover all routine tolling and roadway operations, as well as some maintenance expenses. However, none of these scenarios will produce adequate revenue to cover all expenses. More specifically, with the initial capital cost of nearly $800 million, none of these financing scenarios could contribute significantly to the upfront capital costs of the project.

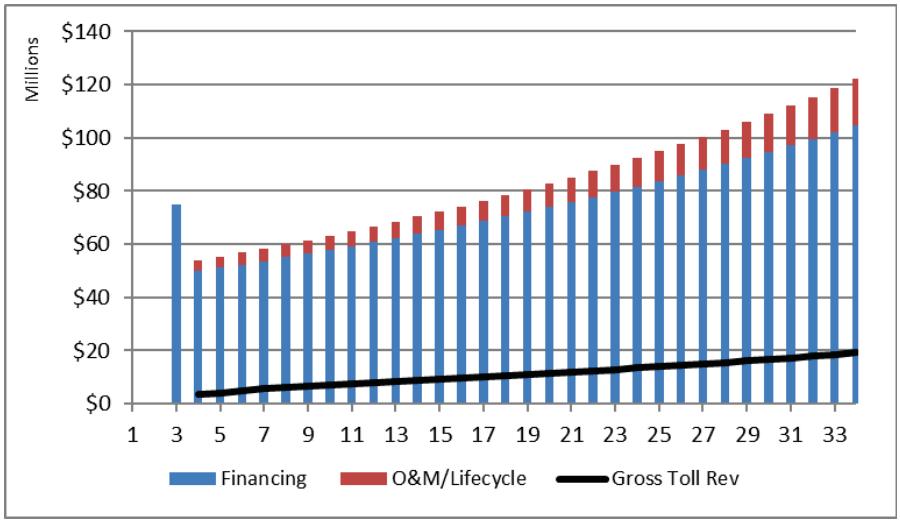
Additionally, the Full Build 4-Lane scenarios was analyzed as a DBFOM Availability Payment Transaction. For this transaction, the private sector finances the full construction costs of the project and ARDOT, performs all routine and major maintenance functions and is compensated in annual payments from ARDOT. The structure and major assumptions for this analysis is presented in **Table 41**.

Table 41: Availability Payment Transaction Results

Illustrative Availability Payment Scenario	
	Full Build 4-Lane
Availability Payment Structure	
Total Term (from financial close)	34 yrs
Payment Term (number of payments)	30 yrs
Construction Cost	*$ 787m*
Construction Completion Milestone Payment (Year 4)	*$75m*
Inflation Factor for Annual Payments	2.50%
O&M Forecast with Handback	Included
Financial Structure	
Debt Component	90%
Senior Debt Rate	5.00%
TIFIA Rate	4.25%
Private Equity Component	10%
Private Equity IRR	11%
Blended Borrowing Rate (debt and equity)	
Borrowing Cost (debt and equity)	5.50%
Illustrative Results - Base Year Availability Payment	
1st Year Payment (Financing)	**$48-52m**
Additional O&M/Lifecycle Component	**$4m**
Illustrative Results -Total 30 Years of Payments (Financing & Lifecycle)	
Total Payments (Year of Expenditure with Milestone Payment)	**$2,650m**

The graph below presents the annual payment stream required to deliver the project along with toll revenues that can be used to pay a portion of the payments.

Figure 28 – Annual Availability Payment Requirements and Revenue



HNTB makes no assertion or claim that the assumptions used in the model represent current or actual financial market terms or interest rates. The results of the HNTB model are presented solely for illustration purposes and do not represent terms for an actual transaction. HNTB is not a registered financial advisor and the results of this analysis are not intended to be used to justify a financing or P3 transaction.

APPENDICES

A – Minute Order 2016-092

B – Travel Demand Model Assumptions

APPENDIX A
MINUTE ORDER 2016-092

ARKANSAS STATE HIGHWAY COMMISSION

MINUTE ORDER

District: Four

County: Sebastian and Crawford

Category: Improvement Project-Arkansas Primary Highway Network (APHN)

WHEREAS, IN SEBASTIAN AND CRAWFORD COUNTIES, the alignment for the Future Interstate 49 segment between Highway 22 and Interstate 40 was approved by the Federal Highway Administration in August 1997; and

WHEREAS, completion of this segment will provide a continuous interstate facility from U.S. Highway 71 south of Fort Smith to U.S. Highway 71 in Bentonville; and

WHEREAS, the Statewide Transportation Improvement Program for Federal Fiscal Years 2016-2020 includes $10 million to begin project development activities for this improvement; and

WHEREAS, due to the high cost of constructing over 13 miles of interstate on new location, which will include a bridge over the Arkansas River, it is reasonable for the Department to explore the possibility of a public/private partnership to increase limited available funds; and

WHEREAS, consultant services are needed to supplement Department staff availability and expertise to provide a reassessment of the 1997 Environmental Impact Statement, to do a conceptual and preliminary design for more accurate cost estimating, to conduct a toll feasibility analysis, and to determine whether this proposed freeway segment is a viable candidate for the Design/Build/Maintain project delivery method.

NOW THEREFORE, the Director is authorized to solicit proposals from qualified firms and enter into a contract to provide the necessary project development services as listed above.

Approved:

Chairman

Vice-Chairman

Member

Member

Member

DD-COO

Form 19-456
Rev. 1/13/2016

Submitted By:
Deputy Director and Chief Operating Officer

Approved:
Director

Minute Order No. 2016 092

Date Passed SEP 14 2016

APPENDIX B – TRAVEL DEMAND MODEL ASSUMPTIONS

ARDOT
ARKANSAS DEPARTMENT OF TRANSPORTATION

Job No. 040748

I-49

Hwy. 22 – I-40 (Arkansas River) (S)

I-540/Highway 22

Interstate 40 to Hwy. 22

Travel Demand Model Assumptions

November 22, 2017

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Figures

Tables

CHAPTER 1
INTRODUCTION AND OVERVIEW

Interstate 49 is a congressionally designated High Priority Corridor running from Shreveport, Louisiana to Kansas City, Missouri. As part of the several corridors identified as nationally important by the U.S. Congress in the 1991 Intermodal Surface Transportation Efficiency Act, Interstate 49 is intended to complement the existing Interstate system, integrate regions of the country, improve safety and efficiency of travel and commerce, and promote economic development.

The Arkansas Department of Transportation (ArDOT or Department) in cooperation with the Federal Highway Administration (FHWA) is partnered with HNTB Corporation (Consultant) for professional services for the Future Interstate 49 segment between Highway 22 (Hwy. 22) and Interstate 40 in western Arkansas. The required professional services are divided into multiple phases.

The initial phase (Phase 1) will be to perform the environmental re-evaluation for this segment, perform a conceptual and preliminary design for more accurate cost estimating, explore tolling as a feasible funding option, determine viable project delivery methods and recommend steps for moving forward. Future phases may include an investment grade tolling study, and/or complete final design.

In coordination with the I-49 re-evaluation, the I-540/Hwy. 22 Corridor Improvement Study along I-540 from I-40 to Hwy. 22 and along Hwy. 22 from 46th St. to 74th St. will be performed simultaneously.

This report provides the Travel Demand Model Assumptions. The report will be submitted when Chapters 1, 2, and 3 are complete. The Travel Demand Model Results will be submitted later when Chapter 4 is complete with accompanying narrative.

Chapter 1 – Introduction and Overview
Chapter 2 – Project Description
Chapter 3 – Travel Demand Model Assumptions
Chapter 4 – Travel Demand Model Results

CHAPTER 2

PROJECT DESCRIPTION

Both I-49 and I-540 are in Sebastian County and Crawford County, Arkansas in the Fort Smith metropolitan area, in northwest Arkansas. The limits of the Future I-49 Study are between Highway 22 and Interstate 40, approximately 13.7 miles. The new location facility will connect Highway 22 in Sebastian County to the Interstate 40 and Interstate 49 interchange in Crawford County. In conjunction with the Future I-49 study, the I-540/Hwy. 22 Corridor Improvement Study will be performed simultaneously. Figure 1 shows the general location of both study areas within the state. Figure 2 provides a more detailed illustration of the study limits and the surrounding roadway network.

Figure 1
I-49 Project Location - Statewide

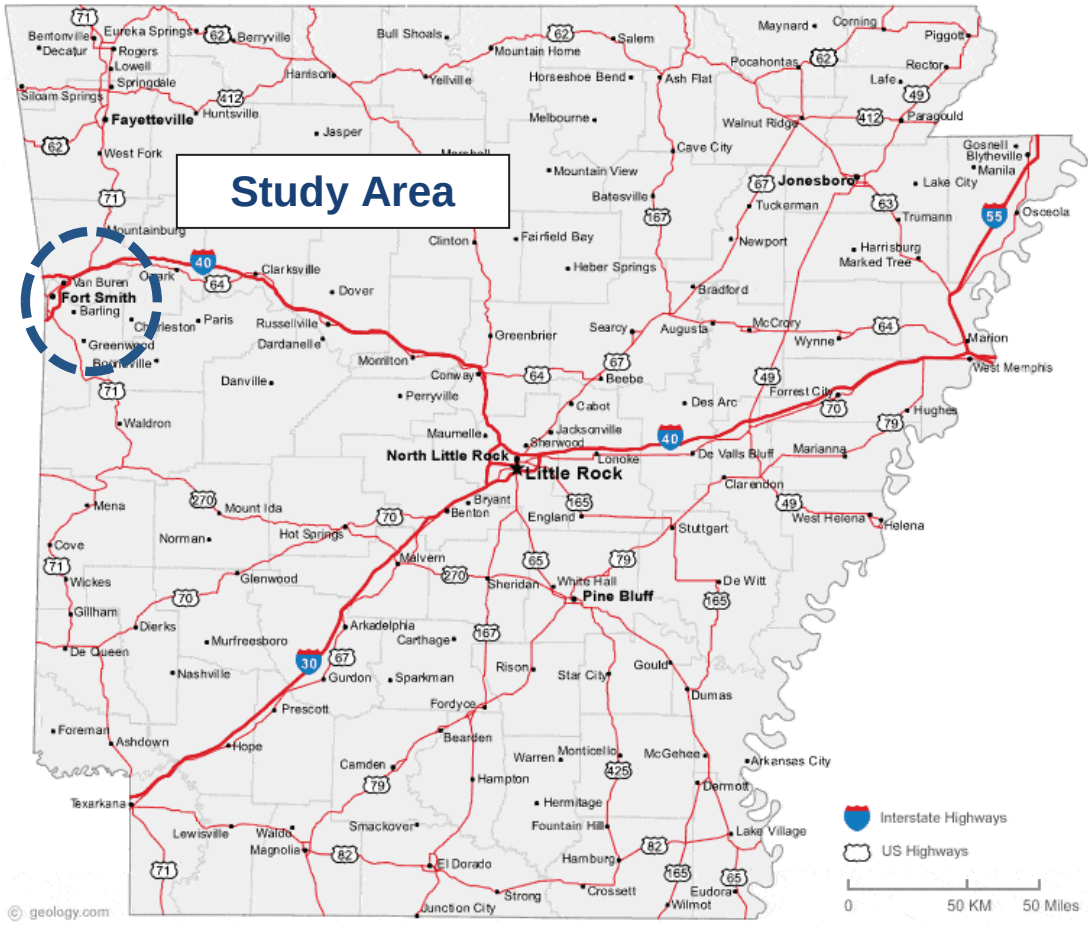
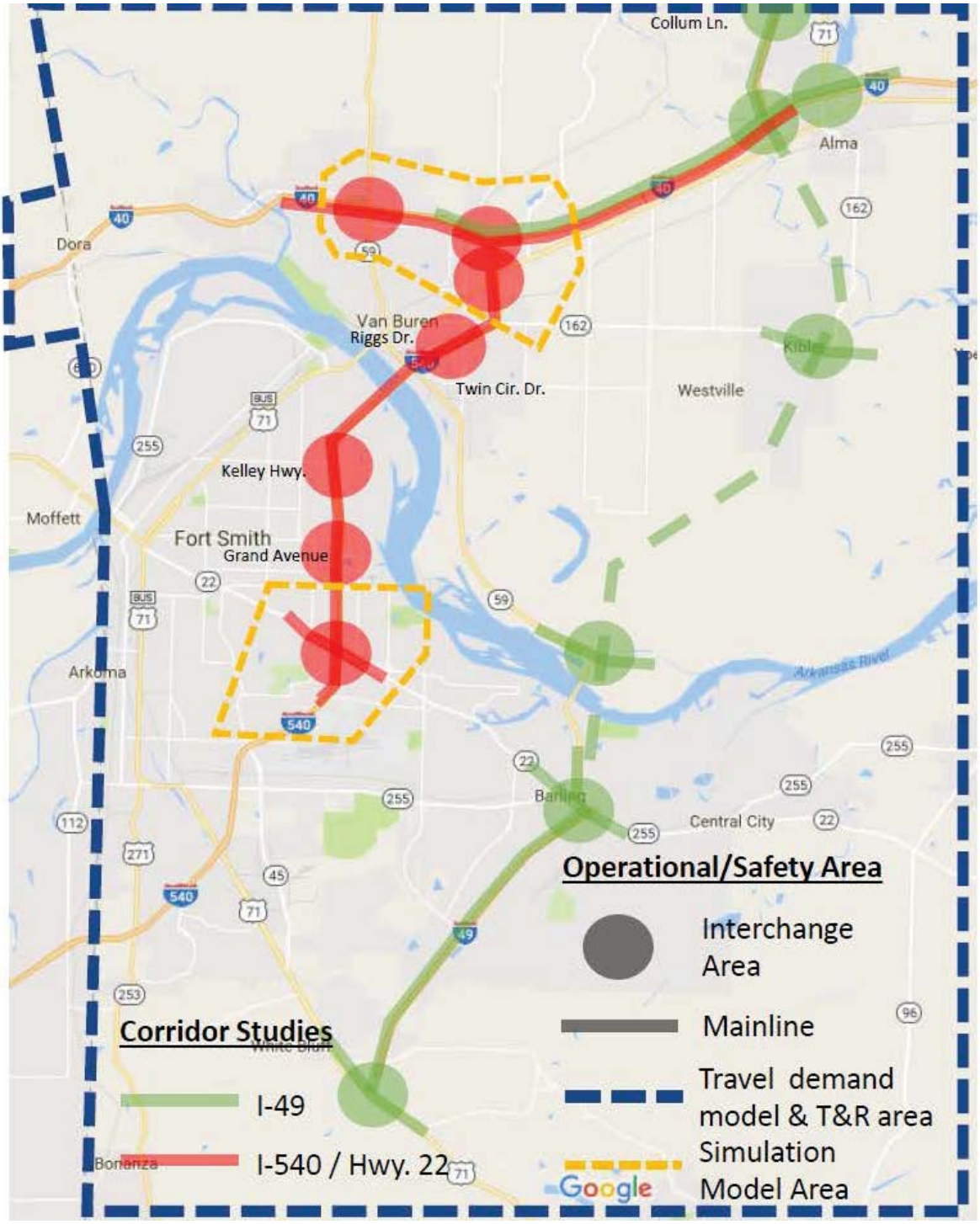


Figure 2
I-49/I-540 Project Location - Regional



CHAPTER 3
TRAVEL DEMAND MODEL ASSUMPTIONS

Background

The Arkansas Statewide Travel Demand Model (AR TDM) will be the fundamental tool to estimate future travel demand and traffic conditions for the I-49 and I-540/Hwy. 22 corridors and surrounding roadway network (Study Area). The travel estimates from the AR TDM will be used to understand the future travel patterns within the study area, evaluate the transportation impacts of Build Alternatives, including I-49 tolling, compared to the No-Build Alternative, and develop future growth rates for facilities in the Study Area for Traffic Operations Models. Future growth rates will be developed using existing trendline data, travel demand model forecasts, county growth rates, and other available data.

The AR TDM was developed in TransCAD, Version 6.0 and follows the traditional four-step TDM process: trip generation; trip distribution; mode choice; and trip assignment. It reflects the most up-to-date networks and population and employment forecasts.

Model Scenarios

The Table below shows the scenarios that will be developed as part of the corridor study and traffic and revenue (T&R) study.

Table 1
Scenarios

I-49 Scenario	2017	2020 (Opening Year)[1]		2040 (Design Year) [1]		2060 T&R Forecast[1]	Study
	Operational & Safety Analysis (AM & PM)	Operational & Safety Analysis (AM & PM)	T&R Forecast	Operational & Safety Analysis (AM & PM)	Limited Operational Analysis[2] (AM & PM)		
No-Build	X	--	--	X	--	--	Corridor Study
Tolled 2-Lanes	--	--	--	--	--	--	Toll Study
Toll Free 4-Lanes	--	--	--	--	--	--	Corridor Study
Tolled 4-Lanes	--	--	X	X	X	X	Corridor Study Toll Study
Sensitivity Analyses Four (4) Tolled Scenarios	--	--	X	--	--	X	Corridor Study Toll Study
Interim Analysis	--	--	X	--	--	X	Corridor Study Toll Study

[1] Actual opening, design and T&R year will be discussed with ARDOT first.
[2] Limited Operational Analysis includes a high level HCS mainline basic analysis only for the I-40 and I-49 Interchange only.
T&R will be performed for the I-540 and I-49 study area.
"—" Not Applicable. No analysis will be performed.

A. Travel Demand Model Methodology

The study will use the following methodology.

Development and validation of 2017 subarea model

- Subarea extraction and development

A subarea travel demand model for 2017 will be developed using the AR TDM. An extracted subarea model includes a network within the defined subarea and origin-destination trip tables for zones within the subarea and external zones that are formed at the outer end of the links crossing the subarea boundary. The AR TDM has a base year of 2010 and forecast years of 2020, 2030 and 2040. A subarea model will be developed from 2020 AR TDM and then revised to develop 2017 subarea model.

The 2017 subarea network will be developed by revising the 2020 subarea network for number of lanes and functional classification using the available data sources. The existing model roadway network includes only State Highways. It will be further refined to include additional facilities within the subarea to better represent travel patterns and conditions.

2017 subarea trip tables will be developed by four time-periods (AM, MD, PM and NT) for passenger cars and freight from 2020 subarea trip tables and refining them during validation. A new set of Traffic Analysis Zones (TAZ) will be developed for the subarea to be consistent with the origin-destination trips being collected from INRIX. The 2017 subarea trip tables will be further disaggregated and validated by INRIX data to feed the corridor network. An equivalency table will be established between the original AR TDM traffic analysis zones and the expanded subarea traffic analysis zones.

- Subarea model validation

The 2017 subarea model validation will be performed with the 2017 collected traffic data and travel speeds from NPMRDS, mainline counts collected for this study by ArDOT and field study. Considering the demand side (trip table) will be validated with INRIX observed data, the validation for the subarea model will focus on network representation including the following:

- Centroid connections;
- Capacity-related link attributes;
- Speed-related link attributes; and
- Adjustment of volume-delay functions.

Using the refined subarea network and validated 2017 trip table, the highway assignment module will be run to replicate the 2017 traffic conditions. The validation will follow an iterative process of refining network variables and running assignments until the validation statistics are within the desirable deviation. The validation outputs will include but not be limited to Vehicle Miles Traveled (VMT) by functional classification, screenlines, cutlines and percent root mean square errors (% RMSE) to represent deviation between modeled volumes and actual counts, by volume group and at system level.

The following documents will serve as the primary sources for validation targets:

- Model Validation and Reasonableness Checking Manual, Travel Model Improvement Program (TMIP), FHWA, 2010;
- NCHRP Report 716 Travel Demand Forecasting: Parameters and Techniques, Transportation Research Board, 2012; and,
- Calibration and Adjustment of System Planning Models, USDOT, FHWA, 1990.

The targets for validation statistics are presented in the following table.

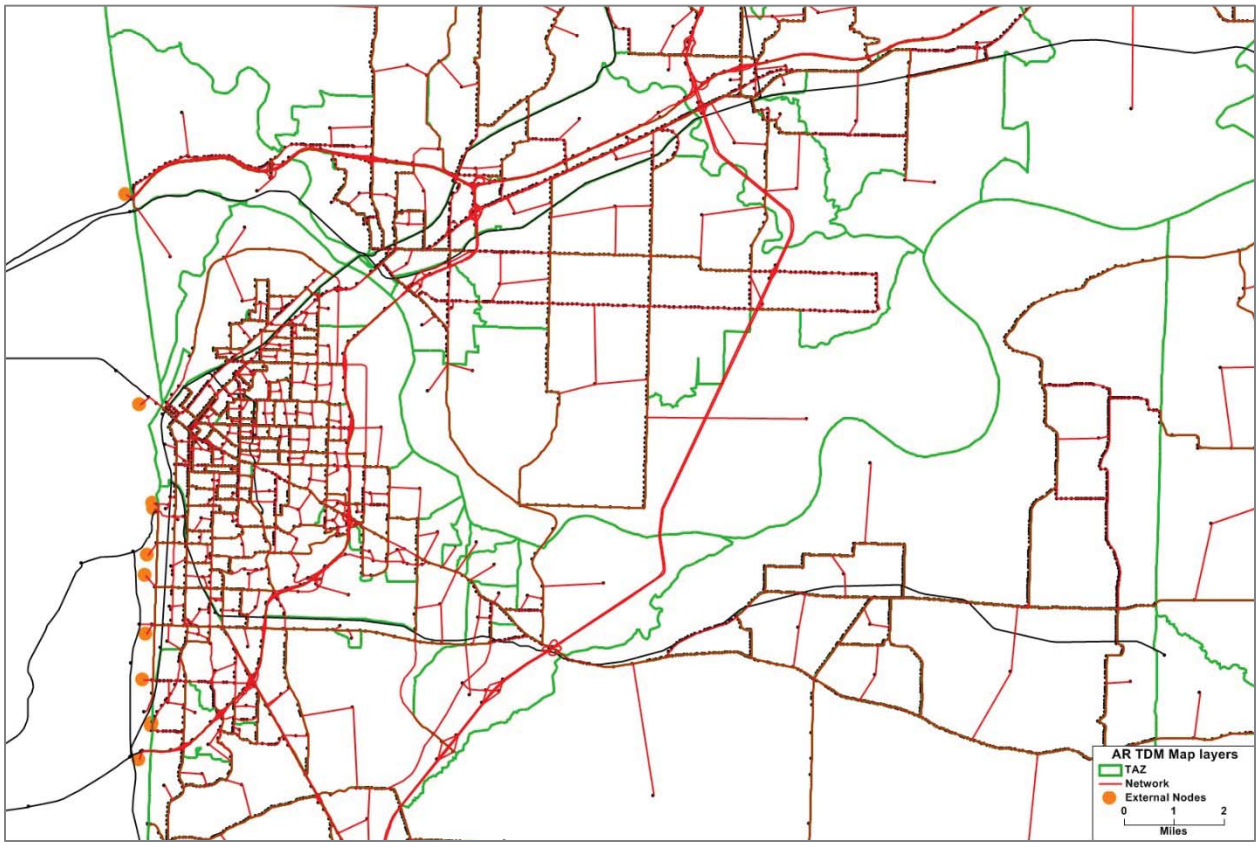
Table 2

Travel Demand Model Calibration Targets

Validation Measure	**Target Range**
VMT	*Source: FHWA, 2010*
Freeway	± 7%
Major Arterial	± 10%
Minor Arterial	± 15%
Collector	± 25%
Link Volume % RMSE	*Source: FHWA, 1990*
AADT Volume Group	
0 - 5,000	< 100%
5,000 - 10,000	< 75%
10,000 - 15,000	< 50%
15,000 - 20,000	< 30%
20,000 - 30,000	< 30%
>30,000	< 30%
Total	< 35%
Volumes for Individual Links	*Source: NCRHP 255*
Volumes to Count Deviation	Less than Maximum Desirable Deviation
Screenlines and Cutlines	*Source: NCRHP 255*
Volumes to Count Deviation for each line group	Less than Maximum Desirable Deviation

The subarea model extent is shown in Figure 3.

Figure 3
AR TDM I-49/I-540/Hwy. 22 Subarea Model Area



Development of subarea models for opening year 2020 and design year 2040

The No-Build and the Build subarea models will be developed for the opening year 2020 and design year 2040.

The 2020 and 2040 No-Build subarea models will be developed from the AR TDM 2020 and 2040 scenarios respectively. The networks will be modified with the revisions in the 2017 network, including revisions in lanes and functional classification. The networks will also be reviewed and updated to include the projects in the constraint list of Frontier Metropolitan Planning Organization's (MPO) Long Range Transportation Plan (LRTP). The No-Build network will exclude any identified projects in the LRTP for the I-49 or I-540 corridors. The subarea trip tables for 2020 and 2040 will be based on expanded subarea traffic analysis zone system and will be developed using growth from the AR TDM trip tables and equivalency between original AR TDM TAZ and expanded subarea TAZ.

The 2020 and 2040 build subarea networks will be developed by including the build projects, which are I-49 corridor extension and I-540/Hwy 22 corridor improvements, in the corresponding no-build networks. The build subarea trip tables will be same as corresponding no-build subarea trip tables.

B. Traffic and Revenue Methodology and Assumptions

Development of Toll-diversion Model

To accurately forecast I-49 corridor utilization with tolling component, a toll diversion module will be developed and integrated into the I-49 subarea model to estimate the impact of various toll rates and forecast revenue. The toll diversion model will incorporate willingness to pay (WTP) methodology into the highway assignment process. Typically, willingness to pay reflects the value of time for auto drivers and truck shippers and carriers based on stated or revealed national preference surveys. HNTB look at surveys from other states for similar toll facilities, The WTP methodology will help determine an auto or truck driver's probability of using the toll facility based on the various tradeoffs related to travel time savings, toll cost, reliability and other trip characteristics.

Toll Sensitivity Analysis

A toll sensitivity analysis will be performed using the subarea model with the toll diversion component to estimate the traffic and revenue for I-49 corridor by time-of-day and by direction for both year 2020 and year 2040. No change to the travel demand model planning horizon year will be performed. The 2060 traffic and revenue forecasts will be developed by extrapolating the 2020 and 2040 travel demand results output. The goal of performing a toll sensitivity analysis is to provide an understanding of the relationship between toll rates, revenue potentials and transportation impacts on the I-49 corridor and surrounding facilities. The toll sensitivity analysis will help quantify the impacts on usage of I-49 toll facility under a series of toll rates and estimate the optimum toll rates based on the established corridor goals.

Revenue Projections

- Daily Revenue Forecast

Based on the results from toll sensitivity analysis, the average weekday gross revenue and transactions will be estimated for 2020 and 2040 and extrapolated to 2060.

- Annual Revenue Forecasts

To convert the daily revenue to an annual value, an annualization factor will be used. The 2060 estimated annual gross revenues will be calculated by multiplying this factor with the typical weekday revenue for 2020 and 2040 respectively. No weekend analysis will be performed.

- Revenue Streams

An accumulated 40-year to 50-year toll transaction and gross revenue stream will be forecasted based on the 2020 and 2040 estimated annual revenue and transactions. Revenue and transaction streams will be developed by linearly interpolating for the intermediate years from 2020 to 2040 and then extrapolating the data beyond 2040 to an estimated 2060.

- Ramp-up Schedule

Traffic and toll revenue in the first few years after opening are typically adjusted by using a "ramp-up" methodology. It considers the time that it takes the driving public to recognize potential benefits of using a new toll facility. It also considers the time required before traffic reaches its full potential. Ramp-up periods vary by facility type and by location and will depend on traffic growth, surrounding development, traffic characteristics and other local considerations. Generally, a ramp-up period can be two to five years. A greenfield toll facility might take slightly longer time. A peer review on similar toll facilities will be conducted to help determine the ramp period and ramp factors for I-49 toll facility.

C. Results and observations

Future year No-Build and Build subarea model runs will be performed and key measures of effectives (MOEs) will be analyzed and summarized. The MOEs will include system level Vehicle Miles Traveled (VMT), Vehicle Hours Travelled (VHT) and Vehicle Hours Delay (VHD). In addition, the future traffic conditions will be analyzed by looking at the link level volumes, volume to capacity (V/C) ratio and the impact of the project in mitigating the congestion on key parallel corridors to I-49 in the Build scenario. In addition, maps showing the difference in volumes between the build and no-build scenarios will be developed to understand from which facilities the I-49 project is diverting the traffic.

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Submitted by: HNTB

Interstate 49 Alternative Delivery Study

Highway 22 To Interstate 40

Crawford and Sebastian Counties