Technical Memorandum
MULTIMODAL NEEDS

TRANSPORTATION 2040
WE MOVE ARKANSAS

Arkansas Long Range Intermodal Transportation Plan

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1. INTRODUCTION

This technical memorandum details the future multimodal needs and estimated costs for the transportation assets that are Arkansas State Highway and Transportation Department (AHTD)'s responsibility or under the jurisdiction of partner agencies or governmental entities.

1.1 State Transportation Assets – AHTD as Lead Agency

Based on available information, this technical memorandum describes the needs and estimated costs for the following transportation assets that are the responsibility of AHTD:

- State Highway System – bridge structures;
- State Highway System – highways;
- State Highway System – interchanges; and,
- Transportation System Support
  - Safety;
  - Maintenance; and
  - Intelligent Transportation System (ITS)

The needs and estimated costs for bridges and highways on the State Highway System were determined using analytical models developed by the Federal Highway Administration (the National Bridge Investment Analysis Software or NBIAS and the Highway Economics Requirements System – State Version or HERS-ST), as well as input from AHTD staff.

State Highway System interchange needs and estimated costs were developed by analyzing historical AHTD programming of such improvements.

Transportation System Support (accessory items or items associated with the transportation system) such as safety, maintenance, and Intelligent Transportation System (ITS) add to the transportation investment costs. Improvements that will be needed over the next 25 years were determined based on consultation with AHTD staff and costs were based on analysis of historical data.

1.2 Transportation Assets under Jurisdiction of Partner Entities/Agencies

Although AHTD is involved in multiple aspects of planning and developing the Arkansas transportation system, there are many occasions where AHTD works in cooperation with partner agencies to address transportation and mobility needs. Based on available information, this technical memorandum describes the needs and estimated costs for the following transportation assets that are under the jurisdiction of partner entities or governmental agencies:

- Ports and waterways
- Rail
- Public transportation
  - Urban
  - Rural
- Bicycle and pedestrian facilities
- Aviation Access

1.3 Funding Sources to Address Needs

As noted in Section 1.2, AHTD is responsible for certain parts of the transportation system and works with other partner entities and the private sector to address several transportation needs. The various transportation assets and related needs are described in this report as being "owned" or addressed by AHTD and/or partner entities with the help of various institutional mechanisms and funding arrangements. AHTD has responsibility for funding some state transportation improvements, while several partner entities fund other transportation improvements. The partner-owned assets and functions (sometimes described as modal programs) are vitally important to providing an efficient transportation system. For the purposes of the 2040 LRITP, these include: bicycle and pedestrian facilities; intermodal facilities; rail; public transportation - urban and rural; and, ports and waterways.

Partner entities include: Metropolitan and regional planning organizations; Arkansas cities and counties; Arkansas rural and urban transit providers; Arkansas Waterways Commission and the Arkansas Department of Aeronautics; Federal highway, transit and rail agencies; and the US Army Corps of Engineers. Public-private or private bodies, such as Amtrak, private rail operators, private rail corporations, and private port and terminal operators also participate in the development and delivery of transportation in the state, but only public costs and revenues are itemized in the final analysis of this report. AHTD, as well as the partner entities, provide funding for the partner-owned assets.

Without a doubt, collaboration is required to address multimodal transportation needs. AHTD is not responsible for addressing the entire range of multimodal transportation needs in Arkansas. However, AHTD and numerous federal, state, local partners work collaboratively to preserve, maintain, operate, and expand Arkansas' multimodal transportation system.

2. SUMMARY OF MULTIMODAL NEEDS

The estimated cost of meeting the 25-year needs to preserve, maintain, modernize, and expand the Arkansas state system (bridges, highways, interchanges and transportation support system) totals **$53.7 billion** (2014$). In addition to these needs, AHTD works with its local, regional, federal, and private partners to address other needs including passenger and freight rail operations, ports and waterways, bicycle and pedestrian facilities and public transportation. The 25-year cost of these (partner entity) needs is estimated at **$9.1 billion** (2014$).

In summary, the estimated total cost of meeting the 2015-2040 multimodal transportation needs in Arkansas is **$62.8 billion** (2014$). **Table 2-1** provides a summary of the estimated costs for the 2015-2040 LRITP.

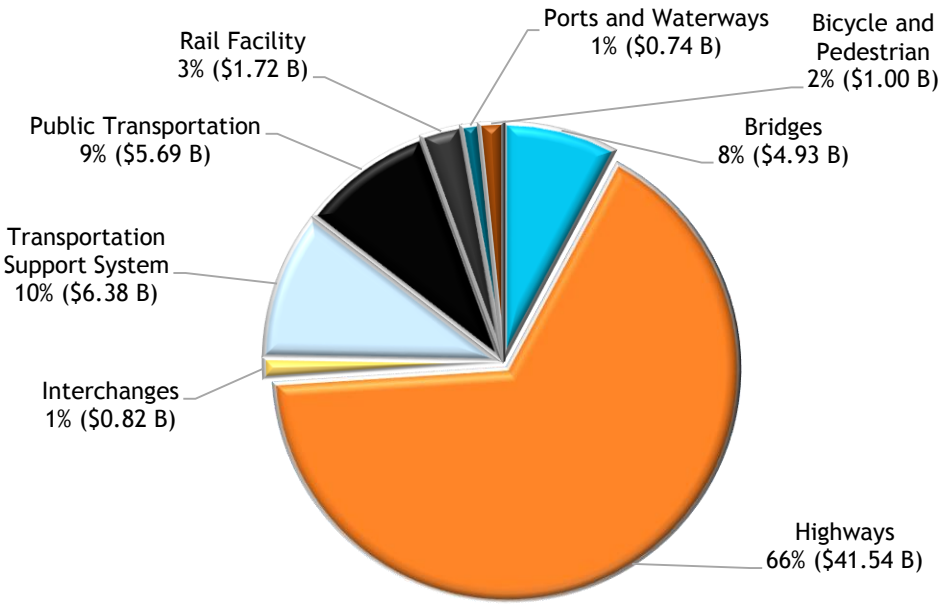
Table 2-1: Estimated Costs for 2015-2040 Arkansas Long Range Intermodal Transportation Plan

Transportation Asset	Estimated Cost (millions $)[1]
Bridges	$4,933.0
Highways	$41,540.5
Interchanges	$820.0
Transportation Support System	$6,378.5
Public Transportation	$5,687.0
Rail Facility	$1,722.5
Ports and Waterways	$743.5
Bicycle and Pedestrian	$1,001.8
2015-2040 AHTD LRITP TOTAL	**$62,826.8**

[1] *All figures shown in millions of 2014 dollars.*

As shown in **Figure 2-1**, highway, bridge, interchange, and transportation support system needs constitute the majority (85 percent) of the total cost. Public transportation costs are estimated to be approximately 9 percent of the total LRITP cost; while the cost of rail facilities, bicycle and pedestrian facilities, ports and waterways, constitute the remaining 6 percent of the total 25-year estimated needs.

Figure 2-1: Arkansas LRITP Needs and Estimated Costs (2015 – 2040)



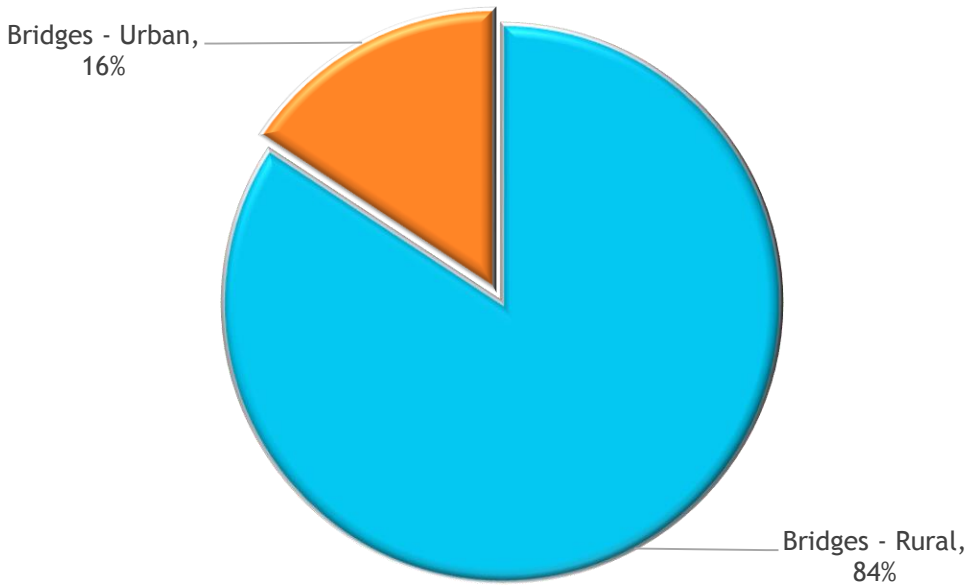
Total Needs = $62.8 B (2014$)

3. BRIDGES

The AHTD's 2013 National Bridge Inventory (NBI) was reviewed and used to summarize existing conditions of Arkansas' bridges on the State Highway system. The NBI is a database, compiled by the Federal Highway Administration (FHWA), with information on all bridges and tunnels in the United States that have roads passing above or below and over water features. The data is used by state DOTs to review bridge conditions and analyze needed improvements. In addition to the NBI data, information from AHTD was also reviewed and used to analyze the bridge needs. supplement the information provided in the NBI. This section provides details on Arkansas' 25-year bridge needs along the State Highway System.

AHTD is responsible for the inspection of all bridges on public roads which corresponds to 12,668 bridges. Of these bridges, 7,346 belong to the state system where the Department is also responsible for the replacement, maintenance and preservation (2015 AHTD Needs Study). With over 12,000 bridges, Arkansas is the 23rd largest bridge system in the nation. **Figure 3-1** illustrates the breakdown of the state maintained bridges by area type. Approximately 84 percent of the bridges are located in rural areas, while the remaining 16 percent are located in urban locations.

Figure 3-1: State Maintained Bridges by Area Type



3.1 Bridge System Description

AHTD classifies deficient bridges into three categories – Structurally Deficient (SD), Functionally Obsolete (FO) and Posted. A bridge is considered SD if significant load-bearing elements are found to be in poor condition or the waterway adequacy, which is the ability of the bridge to remain open to traffic during varying levels of flooding, is insufficient. A bridge is considered FO if it does not meet current design standards such as lane width, or shoulder width, vertical clearance or approach conditions. A bridge is posted with a weight or size restriction when it cannot safely carry one more of three different truck configurations and corresponding weight requirements.

Of the 7,346 bridges on State Highway System, 1,170 bridges are classified as deficient based on one or more of the above listed categories.

3.2 Methodology for Bridge Needs Analysis

The needs for improvement to bridges on Arkansas' State Highway System were assessed using FHWA's – National Bridge Investment Analysis System (NBIAS) software tool using input from AHTD staff.

3.2.1 National Bridge Investment Analysis System (NBIAS)

NBIAS is an investment analysis software tool that predicts bridge repair, rehabilitation, and functional improvement needs. The criteria employed to determine bridge needs are described below. The system estimates bridge needs in dollars and by the number of bridges; distribution of work done; aggregate and user benefits; benefit-cost ratios for work performed, and physical measures of bridge conditions. Outcomes can be presented by type of work, functional classification, and whether the bridges are part of the National Highway System (NHS) or the Strategic Highway Network (STRAHNET).

NBIAS is based on the same analytical framework as the Pontis bridge software program first developed by the FHWA in 1989, and subsequently taken over by the American Association of State Highway and Transportation Officials (AASHTO). AASHTO now owns and licenses Pontis to over 50 State transportation departments and other agencies. Pontis provides bridge engineers with the tools to conduct detailed bridge performance analyses. In order to perform analyses at such a detailed level, Pontis requires data on over 100 attributes pertaining to each individual bridge.

3.2.2 Methodology for Bridge Needs

Needs for bridges on the State Highway System were assessed using FHWA's National Bridge Investment Analysis System (NBIAS) Tool. NBIAS analyzes span bridge structures only and excludes culvert (bridges whose length is less than 20 feet) records from the NBI dataset. NBIAS only predicts needs for existing bridges, thus any bridges constructed after 2013 are not included in this analysis.

NBIAS uses a parameter table to determine if a bridge is under the AHTD minimum tolerable condition for a structure (as defined in section 3.2.2.1), based on roadway functional class, NHS status, or traffic level. If the bridge falls below the minimum tolerable condition, then

NBIAS identifies a rehabilitation, reconstruction, or replacement improvement and calculates the dollar amount using unit costs approved by AHTD. Based on the cost/benefit ratio of the improvement, a recommended action will be identified or the bridge is passed forward to the next annual analysis period.

The objective of NBIAS is to optimize the system condition and performance year by year. This provides guidance to AHTD on the costs to maintain an efficient and reliable bridge system. NBIAS uses the Pontis model to help determine the deterioration of the bridge over time and to decide whether the bridge falls into a structurally deficient or functionally obsolete status.

3.2.2.1 Minimum Tolerable Conditions to Determine Bridge Needs

In order to identify bridge improvement needs, the NBIAS relies on input tables specific to Arkansas. These include AHTD improvement criteria for when a bridge should be: widened, raised, or strengthened.

The criteria, also referred to as minimum tolerable conditions, are specific to Arkansas and contain the standards for each bridge type, as defined by roadway functional class, NHS status, and Annual Average Daily Traffic (AADT) class. When the bridge falls below a minimum tolerable condition, it signals the need for an improvement action. The minimum tolerable conditions are specified for shoulder width (right and left), lane width (right and left) and vertical clearance. **Appendix A** summarizes the minimum tolerable conditions specific to Arkansas.

Additionally, AHTD design standards were used as inputs for the bridge dimensions and engineering specifications that NBIAS uses to determine bridge replacement needs. Parameters used by NBIAS include design standards for lane and shoulder widths, as well as a cost coefficient used to estimate bridge improvement costs.

All values used in the 25-year bridge analysis were reviewed and approved by AHTD staff and are based on design manuals that reflect AHTD practices. The assumptions and inputs used for the bridge analysis are detailed further in **Appendix A**.

3.2.3 Types of Bridge Needs

Bridge needs are presented in terms of three improvement categories in this report:

- **Rehabilitation** – maintenance, repair and rehabilitation.
- **Reconstruction** – widening existing bridge lanes, raising bridges to increase vertical clearances, and strengthening bridges to increase load carrying capacity.
- **Replacement** – If the needed functional improvement is infeasible because of the bridge design, or impractical because of its inferior structural condition, then the bridge is designated for replacement.

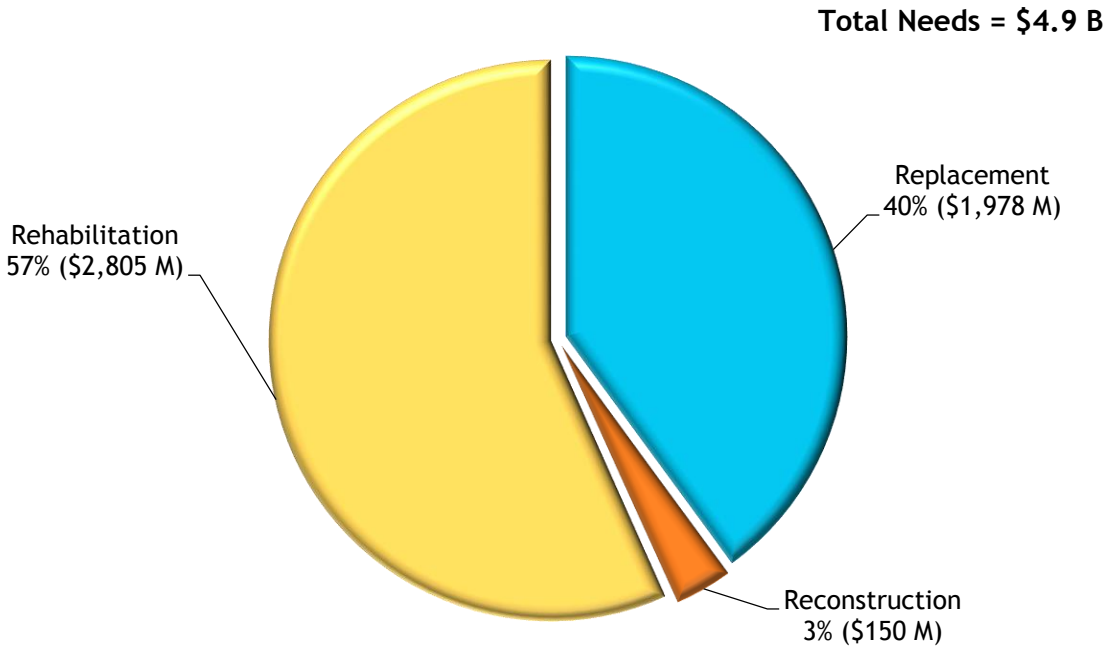
When the age and recurring maintenance of a given bridge overshadows the cost to replace it, a bridge replacement is recommended since the long-term benefit/cost ratio is favorable. When a potential action is determined, for example, raising a bridge with clearance

deficiencies, NBIAS will also consider the long-term impacts and the potential benefits that could be realized if the bridge were to be replaced. If the long-term benefit/cost ratio of replacement is just as viable (or better) than the long-term benefit/cost for the respective reconstruction of major maintenance action, NBIAS will recommend replacing the bridge.

3.3 Projected Bridge Needs and Estimated Costs

The estimated cost of meeting 2015 – 2040 Arkansas' State Highway System bridge needs is $4.9 billion. As shown in **Figure 3-2**, rehabilitation needs total $2,805 million (57 percent); reconstruction needs total $150 million (3 percent); and replacement needs $1,978 million (40 percent).

Figure 3-2: State Highway Bridge System Needs – 25 years



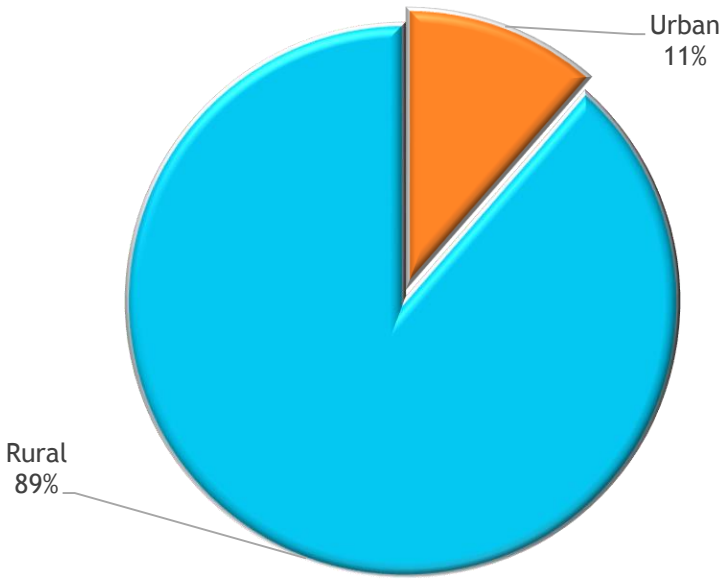
4. HIGHWAYS

4.1 Highway System Description

Information provided by AHTD to FHWA for the 2013 Highway Performance Monitoring System (HPMS) report was reviewed and used to summarize existing roadway conditions on the State Highway System. Where additional data were necessary, information from AHTD was used to supplement the HPMS roadway condition data. This section briefly describes Arkansas' State Highway System, and then proceeds to describe the improvements needed over the next 25 years.

The total public road mileage in Arkansas is 101,656 miles of which 16,418 miles (16 percent) are on the State Highway System. Arkansas' State Highway System is mostly rural in nature. Highways within local municipalities with population less than 5,000 are categorized as rural. **Figure 4-1** classifies the State Highway System based on area type. As shown, approximately 89 percent of the State Highway System is classified as rural, while only eleven percent is urban.

Figure 4-1: State Highway System Centerline Mileage by Area Type



State Highway System Mileage = 16,418*

**Based on AHTD 2015 Fact Sheet*

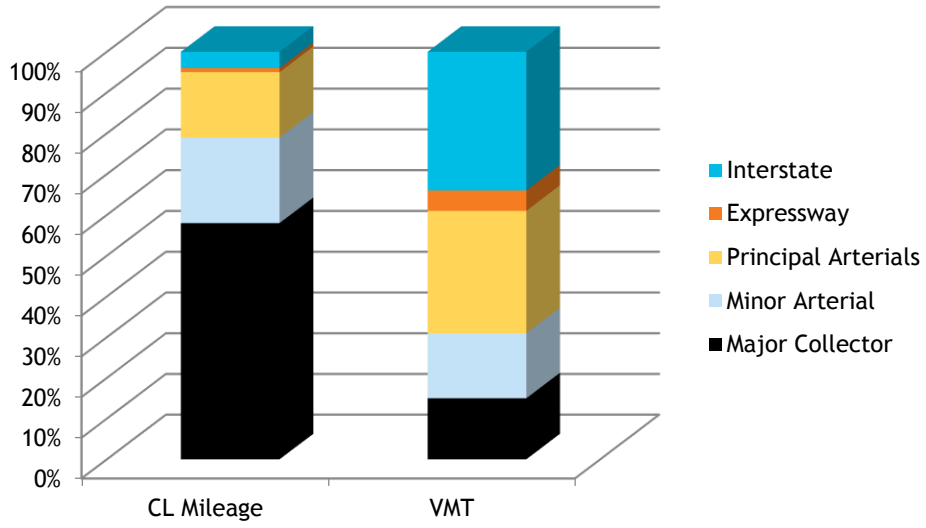
Table 4-1 summarizes the State Highway System centerline miles and lane miles based on functional classification. Interstates account for only 4 percent of the centerline miles and 7 percent of lane miles, whereas major collectors account for 59 percent of centerline miles and 51 percent of lane miles.

Table 4-1: State Highway System – Functional Classification

Category	Centerline Miles	Lane Miles
Interstate	4%	7%
Expressway	1%	2%
Principal Arterial	16%	20%
Minor Arterial	20%	20%
Major Collector	59%	51%

The interstate highway system is the highest roadway classification and is designed to be the national defense and commerce highway that moves large volumes of people and goods across the United States. **Figure 4-2** provides information on the centerline miles and daily vehicle miles traveled along Arkansas' State Highway System. While Arkansas' interstate highways account for only 4 percent of the centerline miles of the State Highway System, they carry 34 percent of the daily vehicle miles traveled in 2013. Major collectors account for 59 percent of the centerline miles, and they carry only 15 percent of the daily vehicle miles traveled in 2013.

Figure 4-2: State Highway System Mileage and VMT by Functional Class



4.2 Methodology for Highway Needs Analysis

State highway needs were analyzed using the Federal Highway Administration's (FHWA) Highway Economics Requirements System, State Version (HERS-ST). The model simulates highway conditions and performance levels, and identifies existing and future deficiencies through the use of engineering principles and Arkansas-specific design standards and unit costs. The HERS-ST model is designed to analyze the effects of funding on highway performance. In selecting improvements for implementation, the model is designed to select only enhancements whose benefits exceed costs.

In addition to FHWA's HERS-ST model, information from AHTD's latest Statewide Transportation Improvement Program (STIP) was also utilized to determine highway needs.

4.2.1 Highway Needs Analysis Process

The highway needs analysis process included several procedural steps as listed below. The specific Arkansas highway analysis assumptions and inputs are provided in ***Appendix B***.

4.2.1.1 Highway System Database

The highway database used for this analysis is the Arkansas' 2013 Highway Performance Monitoring System (HPMS) database. The highway database provides essential data on the existing State Highway System, such as geometric, structural and operational features. Additionally, the database provides future traffic projections that are used to determine future (2040) system capacity and pavement deficiencies. AHTD staff updates the state-maintained roadway system component of the HPMS annually, and it is used by FHWA to develop needs analyses, fiscal projections, and performance studies for Congress.

4.2.1.2 Minimum Tolerable Conditions to Determine Highway Needs

When a highway section falls below a minimum tolerable condition, an improvement action is triggered. Minimum tolerable conditions reflect AHTD judgment about the level of congestion and the minimum structural conditions for pavements that the travelling public can reasonably tolerate. Minimum tolerable conditions also consider acceptable lane width, shoulder conditions, and cost effectiveness principles. Criteria were defined for different types of facilities reflecting functional classification, traffic volume, and location (as defined by terrain and rural/urban characteristics). Any condition below the minimum tolerable criteria was classified as a deficiency (need), and the cost to bring the facility up to standard was quantified using AHTD improvement costs.

4.2.1.3 Improvements Needs Identified

Based on the types of deficiencies and the year in which the deficiencies are anticipated to occur, existing and future preservation, reconstruction, or expansion improvements that would correct the problem(s) were identified by HERS-ST.

Deficiencies identified by HERS-ST were analyzed to determine the level of effort needed to improve each functional classification of facility and bring it up to AHTD design standards.

4.2.1.4 Estimated Costs

The cost of each improvement was estimated using unit costs that reflect practices and cost experience in the state of Arkansas for each functional class of highways. Costs were expressed in constant 2014 dollars.

4.2.1.5 Information from AHTD's Statewide Transportation Improvement Program (STIP)

Since the HERS-ST model used HPMS data from 2013 as the input, the needs determined by HERS-ST were from 2013 to 2040. Information from the latest AHTD Statewide Transportation Improvement Program (STIP) was reviewed to determine improvements constructed or completed on highways during 2013 and 2014. Based on the results from HERS-ST, and removal of projects completed in 2013 or 2014, the 2015 to 2040 state highway needs were estimated.

4.2.2 Types of Highway Needs

The highway needs are presented in terms of three categories:

- **Preservation** refers to regular resurfacing of a road. When a road has pavement deteriorating to unacceptable levels, resurfacing is the improvement choice to maintain the integrity of the roadway. Resurfacing preserves the highway, and it is the most common type of improvement.

- **Reconstruction** is the improvement of an existing roadway by upgrading the geometrics and functionality of the segment. Improvements such as widening lanes and shoulders, and straightening curves, are examples of reconstruction. When roadways are so structurally deficient that they cannot be repaired by resurfacing alone and must be rebuilt from the base, they are slated for reconstruction.

- **Expansion** deals with the need to provide additional capacity in order to address congestion issues. When future traffic volumes exceed a minimum tolerable condition, HERS-ST identifies additional lanes to alleviate the congestion and maintain an acceptable level of service. Expansion is the costliest improvement type on average.

4.2.3 Other Highway Needs

In addition to the above mentioned highway needs analyzed using HERS-ST, the needs for Four-Lane Grid System were also considered.

In 2009, the Arkansas State Highway Commission (AHC) adopted a Four-Lane Grid System as part of the State Highway System for future highway development. The Four-Lane Grid System was established to provide for safe and efficient interstate and intrastate movement of people and goods, including connectivity to population centers and to other regional transportation facilities within Arkansas and in neighboring states, and therefore enhance state's economic competitiveness and quality of living and working environments. The Four-Lane Grid System is comprised of four sub-systems: High Priority Corridors, Remaining Four-Lane Grid, Other Regional Connectors, and Economic Development Connectors.

The Four-Lane Grid System will provide widening improvements for approximately 1,175 miles, with the specific routes to be determined through appropriate planning studies and public involvement. The total cost for the Four-Lane Grid System is estimated to $11.5 billion. **Table 4-2** provides a breakdown of the various sub-systems of the Four-Lane Grid System

Table 4-2: Four-Lane Grid System Needs and Estimated Costs

Sub-System	Miles Widened	Estimated Cost[1]
High-Priority Corridor	690	$8,500
Remaining Four-Lane Grid	308	$2,000
Other Regional Connectors	91	$500
Economic Development Connectors	53	$300
Other Widening	33	$230
TOTAL Four-Lane Grid System	**1,175**	**$11,530**

[1] All figures shown in millions of dollars.

4.2.3.1 High Priority Corridors

High Priority Corridors were designated to give priority to corridors that have national significance. With the designated High Priority Corridors in Arkansas, an additional 690 miles will be constructed or widened on these corridors. Seventy percent (or 470 miles) of these additional lane miles will be added to the interstate system. The additional interstate lane miles are expected to cost $6.25 billion and the non-interstate high Priority Corridors are expected to cost $2.25 billion. **Table 4-3** provides a summary of the mileage and cost of the six designated High Priority Corridors.

Table 4-3: Arkansas High Priority Corridors

Corridor	Length[1]	Estimated Cost[2]
I-30	100	$550
I-40	57	$300
Highway 412	174	$1,500
Future I-49	172	$2,700
Future I-69	143	$2,900
I-69 Connector	40	$500
Future I-555	4	$50
TOTAL	**690**	**$8,500**

[1] Length of corridors are in miles.
[2] All figures shown in millions of dollars.

I-49 and I-69 Corridors

Of the estimated cost of $8.5 billion for High Priority Corridors, $5.6 billion is estimated for two future corridors – I-49 and I-69.

Interstate 49 was designated High Priority Corridor 1 with the passage of ISTEA in 1991. This north-south corridor will connect New Orleans, Louisiana with Kansas City, Missouri, and will

extend 286 miles in the State of Arkansas. Arkansas has completed and designated 114 miles as I-49. The remaining 172 miles are estimated to cost approximately $2.7 billion dollars. Approximately, $100 million of the $2.7 billion will be spent on completing the final 14 miles of the Bella Vista Bypass. The remaining $2.6 billion will be spent on the 158 miles between the Red River north of Texarkana and Interstate 40 at Alma. This will also include a crossing of the Arkansas River near Alma.

Interstate 69 was designated a High Priority Corridor from a combination of High Priority Corridors 18 and 20. Interstate 69 will eventually connect Mexico with Detroit, Michigan. In Arkansas, I-69 will stretch 143 miles across the southern portion of the state. The total cost of I-69 in Arkansas is estimated to be approximately $3 billion, with $900 million as Arkansas' portion of a bridge that will span the Mississippi River near Arkansas City. The remaining $2.1 billion will be spent on the remaining 127 miles between the Louisiana State Line west of El Dorado and Highway 65 near McGehee. Additionally, 40 miles of I-69 Connector (Pine Bluff to Monticello Bypass) is anticipated to cost $500 million.

4.2.3.2 Remaining Four-Lane Grid

The remaining Four-Lane Grid routes are routes that were identified as corridors of regional significance. 308 miles are expected to be widened as a part of the remaining Four-Lane Grid which cost approximately $2.0 billion.

4.2.3.3 Other Regional Connectors

Other Regional Connectors would connect major freight routes to each other by a four-lane connector. It is expected to cost $500 million for 91 miles of additional widening.

4.2.3.4 Economic Development Connectors

Economic Development Connectors would connect cities with a population over 5,000 people to a freeway by a four-lane facility. This would provide improved transportation facilities for the movement of people and goods throughout the State. Economic Development Connectors are estimated to cost approximately $300 million for the widening of 53 miles.

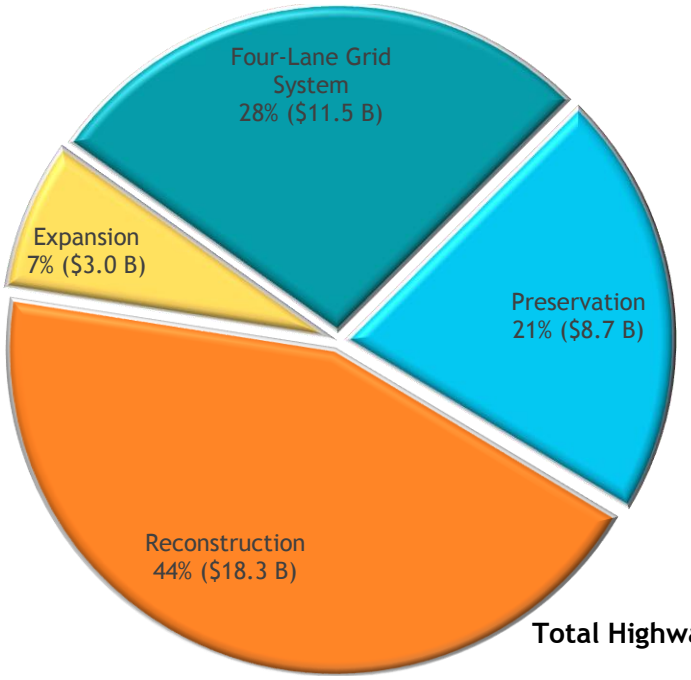
4.2.3.5 Other Widening

In addition to the categories listed above, there are 33 miles of additional widening included with a cost of $230 million. These improvements are to connect communities of a certain population or function (County Seat) to the Four-Lane Grid System.

4.3 Projected Highway Needs and Estimated Costs

The estimated cost of the 2015 – 2040 Arkansas State Highway System needed improvements totals $41.5 billion. As shown in **Figure 4-3,** preservation needs total $8.7 billion (21 percent), reconstruction needs total $18.3 billion (44 percent), and the expansion needs total $3.0 billion (7 percent). Additionally, the needs for Four-Lane Grid System total $11.5 billion (28 percent), of which needs for I-49 and I-69 corridors cost $5.6 billion.

Figure 4-3: State Highway System Needs – 25-years



Total Highway Needs = $41.5 B

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5. HIGHWAY INTERCHANGES

Interchanges are another major category of highway needs which were considered for the 2015-2040 LRITP. Highway interchanges help in minimizing delays, improving traffic flow and safety. As such, they are considered as a separate category in the needs analysis.

The 25-year interchange needs were estimated by AHTD staff based on historical records of AHTD's programming of such improvements. Interchange improvements were identified and then a unit cost was applied to estimate the cost interchange needs on the State Highway System. An approximate unit cost for right-of-way and utilities for the interchanges was also taken into account. These projects would add 61 centerline miles of new construction, and add or modify six major intersections around the State. Based on this review and analysis, state-maintained interchange needs total $820 million.

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6. TRANSPORTATION SYSTEM SUPPORT

In addition to the highway, bridge, and interchange needs, transportation system support (accessory items or items associated with the transportation system) requires improvement. These support improvements include safety, maintenance, and Intelligent Transportation System (ITS) improvements. The following sections provide details on these needs over the next 25 years.

6.1 Safety

The AHTD safety needs were determined based on meeting the goals of the Strategic Highway Safety Plan (SHSP). The purpose of the SHSP is to identify key safety needs and guide investment decisions to achieve significant reduction in fatalities and serious injuries on all public roads. The primary goal of the SHSP is to reduce the annual number of roadway fatalities in Arkansas to 400 or fewer by 2017. The secondary goal is to reduce the statewide fatality rate to 1.12 or less per 100 million vehicle miles traveled by 2017. It is estimated that to meet these goals, the State would need approximately $1.750 billion.

6.2 Maintenance

The 25-year maintenance needs were developed by analyzing AHTD's maintenance budget and using trend analyses to forecast maintenance needs and related costs for 2015-2040. Maintenance needs were developed for routine maintenance as well as special maintenance. Routine maintenance encompasses all aspects of maintenance including mowing, snow removal, striping, painting, pothole repair, etc. Special maintenance includes heavier construction overlays, etc. that may often be let to contract.

Based on the input from AHTD staff and the analyses conducted, State Highway System maintenance needs total $4.540 billion.

6.3 Intelligent Transportation Systems (ITS)

AHTD's ITS needs were estimated based on the input from AHTD staff, realizing the importance of technology efficiencies through a minimal cost. ITS will allow the Department to have more real time data while also increasing the safety across the entire highway network. The ITS needs include traffic management center, dynamic message signs, closed circuit television cameras, highway advisory radios, radio weather information systems, etc. The CCTVs are currently monitored by the maintenance division. In the future, CCTVs will be monitored from the future Traffic Management Center. The estimated 25-year ITS needs total $88 million.

6.4 Summary

There are various improvements that are needed to support the highway and bridge infrastructure. In some cases, these investments may allow the deferment of costlier

investments while achieving more efficient operations along the State Highway System. These include, but are not limited to: safety measures, maintenance, and ITS technology. The total estimated costs for meeting transportation system support needs over the plan period total $6.4 billion.

7. PRIVATE FREIGHT RAIL

The State of Arkansas contains approximately 2,662 miles of active rail lines, predominantly owned by private companies. Several industrial spurs owned by port authorities or municipalities and a segment of rail line is owned by the Southeast Arkansas Economic Development District (SEAEDD) are the exceptions.[1] AHTD does not have any designated revenue for investment in rail infrastrucutre but are responsible for rail planning to ensure eligibility of Federal Railroad Administration (FRA) funds. Railroads continue to be an important component of the transportation system as rail freight volumes continue to grow. Thus, this predominantly private infrastructure element is being included as a part of the 2016-2040 LRTP.

7.1 Private Freight Rail Description

Freight rail transportation in Arkansas is provided by private corporations through three major (Class I) railroads and 23 short line (Class III) railroads. The U.S. Surface Transportation Board (STB) defines Class I railroads as those with revenues of $467.0 million or more and short line railroads are defined as those railroads with annual operating revenues $37.4 million or less. There are no regional railroads (Class II) currently operating in Arkansas, which are those carriers with revenues between $37.4 and $467.0 million in revenues. Short line railroads play an important gathering role in the freight rail system. These roles include dependable and low cost railcar pick-up and delivery, and feeder railcar services to the Class I railroads for long-haul freight delivery. Many short lines railroads also offer a full range of logistics service such as warehousing and transloading, product marketing, and trucking. **Figure 7-1** shows the current freight rail system in Arkansas.

Of the 2,662 miles of active rail lines in Arkansas, the breakdown of rail operations are as follows:

- 1,327 miles operated by UP (Class I)
- 198 miles operated by BNSF (Class I)
- 158 miles operated by KCS (Class I)
- 979 miles operated by 23 short line railroads

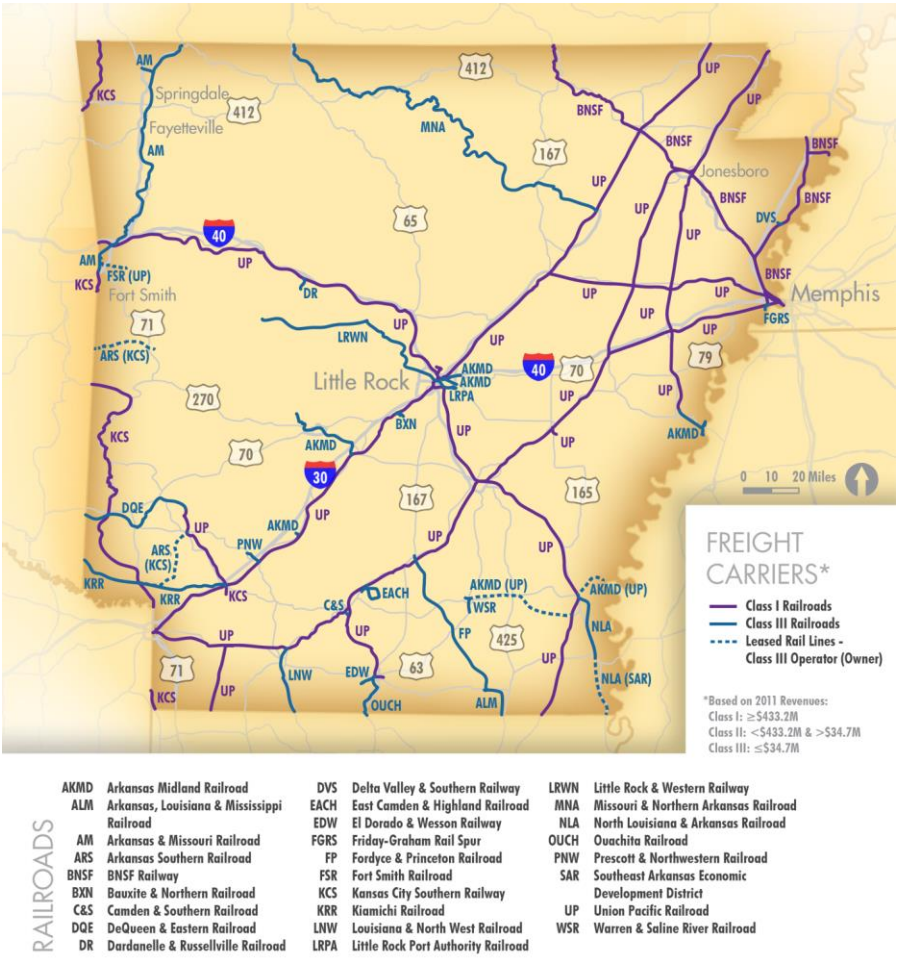
Freight rail has proven to be vital in maintaining and improving both the state and national economy. Approximately, 70 percent of the rail traffic in Arkansas is through traffic without an Arkansas origin or destination. Coal has been by far the highest tonnage commodity carried on the Arkansas rail network, and is projected to account for 57 percent of tons terminating in the state in 2015 and 36 percent of the tons passing through the state.

Arkansas' largest export destinations are Texas, Louisiana, and California. The majority of the freight shipped to California is containerized freight from the UP intermodal facility in Marion

[1] Arkansas State Highway and Transportation Department, Arkansas State Rail Plan, April 2015.

while much of the freight shipped to Texas and Louisiana consists of gravel. Arkansas' top rail imports origins arrive from Wyoming (coal), California (intermodal containers to Marion), Iowa, Nebraska and Illinois (grain and food), and Texas (chemicals or plastics).

Figure 7-1: Arkansas Freight Rail System



Source: Arkansas State Highway and Transportation Department, Arkansas State Rail Plan, April 2015

7.2 Private Rail Volumes and Demand

Based on a survey of railroads in Arkansas conducted as part of the *Arkansas State Rail Plan* study, the highest density rail lines are the Class I mainlines, in particular the UP mainlines that cross Arkansas between Texas and Chicago, Illinois, as well as the BNSF Thayer South Subdivision, which is a branch of the BNSF Transcontinental or "Transcon" route across the western United States. **Figure 7-2** displays the density of Arkansas rail lines as measured in trains per day.

Figure 7-2: Density of Freight Rail Lines in Arkansas in Trains per Day, 2012

Source: Arkansas State Highway and Transportation Department, Arkansas State Rail Plan, April 2015

Freight rail traffic is projected to experience significant growth over the next 20 years. Overall, rail tonnage originating in Arkansas is expected to grow by about 30 percent between 2015 and 2035, or about 1.3 percent per year. Rail tonnage terminating in Arkansas is expected to grow by 38 percent between 2015 and 2035, or about 1.6 percent per year. Rail tonnage moving through Arkansas between other states is expected to increase by about 24 percent or 1.1 percent per year.

By commodity, IHS Global Insight predicts that coal will post the biggest volume gains for freight terminating in Arkansas between 2015 and 2035. This forecast may overstate the volume of coal shipments, since it was developed before the dramatic recent increase in natural gas production and associated drop in price, as well as new regulations impacting coal-fired power plants.

"Other" commodity tonnage is forecasted to increase by over three million between 2015 and 2035. Non-metallic minerals are expected to post the second-highest increases, growing by 2.5 million tons over that same time period.

7.3 Private Freight Rail Needs

7.3.1 Freight Rail Issues and Needs

Issues and needs identified here for freight are primarily based on the Department's recently published Arkansas State Rail Plan.

7.3.1.1 State of Good Repair

Currently, many of the Arkansas short line railroads have excessively worn rail and ties, as well as worn switches and poor line and surface condition. Deteriorating rail conditions place railroads in jeopardy of ceasing operations if left unresolved as they could also be shut down involuntarily by the Federal Railroad Administration (FRA) due to unsafe operating conditions. Loss of rail service would have a negative impact on many shippers and communities within the state.

According to the *Arkansas State Rail Plan, 2015*, Arkansas has 286 miles of Class III rail lines that are rated FRA as "Excepted," which means that these track segments are in poor state of repair and in need of upgrade. With the inclusion of FRA Class 1 track segments, 545 miles of rail lines are limited to ten miles per hour or less for freight operations. Competitiveness of rail services offered may be hindered due to this slow speed.

7.3.1.2 Height and Weight Capacity

A total of 396 track miles in Arkansas are unable to handle 286,000-pound railcars. Of these, 310 miles are on short line railroads, and 86 miles are on rail lines owned by Class I carriers. These restrictions limit the railroads' ability to attract new business, and to remain competitive with other rail lines and modes of transportation. According to a study conducted by the FRA and the American Short Line and Regional Railroad Association (ASLRRA) in 2003, the average cost per mile of upgrading sampled rail lines to 286,000-pound standards to be approximately $102,017.

An updated average cost per mile of $141,418 was obtained using the current cost levels of the Surface Transportation Board's (STB) All Inclusive Index—Less Fuel (All-LF). Given the deficient 396 track miles of line, the total cost of upgrading all line segments would be $56 million. The actual cost may differ from this since cost will depend upon the number and type of bridges that must be upgraded, the specific condition of each rail line, as well as other factors.

7.3.1.3 Rail Corridor Preservation

In recent years, some relatively significant segments of the Arkansas rail network have either been threatened or abandoned. For example, the Caddo Valley and Delta Southern railroads went out of service in 2010 and 2011, respectively. Portions of the Delta Southern rail lines have been acquired by local and regional economic development groups, and rail service has been established under a new short line—North Louisiana and Arkansas Railroad. Characterizing freight lines as "at risk" if they carry no or small volumes of traffic and are in a poor state of repair, the segments listed below would be at risk. "Low traffic" is defined as lower than 50 carloads per mile of track operated per year.

- The Ouachita railroad is in poor condition and carries only small volumes of freight.

- The last four miles of the AKMD Hot Springs branch is inactive, carrying no traffic.
- The Fort Smith Railroad carries only small volumes of freight and is in a poor state of repair.

Given the high cost of upgrading these lines and difficulties in operating substandard rail infrastructure, there may be cause for concern over additional operations ceasing service.

7.3.1.4 Safety Crossing

Highway/rail grade crossings are a major issue in Arkansas. According to the *Arkansas State Rail Plan, 2015*, evidence suggests that the frequency of fatalities at highway/rail grade crossings in Arkansas may be higher than the national average. In addition, Arkansas has a lower population of public highway/rail grade crossings that are equipped with train-activated warning signals (gates, lights) compared to the national average. Interviews conducted as part of the study revealed that both Class I and Class III railroad companies expressed concern over highway/rail grade crossing issues. Class I railroad companies expressed interest in working AHTD to address crossing issues, particularly crossing closures. Operational inconvenience of highway/rail grade crossings to both motorists and to railroad operations was also emphasized by Class I carriers. Most of the recent long-range transportation plans prepared by metropolitan planning organizations (MPO) in the state discuss future plans for grade crossing improvements or for grade separation improvements.

7.3.1.5 Railroad Competition

As stated earlier in this chapter, UP owns half of the railroad miles in the state. While BNSF has access to a significant portion of the UP system in the eastern half of the state and handles roughly 14 percent of originating carloads/units and 11 percent of terminating carloads/units in Arkansas, BNSF's access does not necessarily translate to market share.[2]

As evidenced in a report commissioned by the Surface Transportation Board (STB) in 2009, increased railroad competition through access to multiple rail carriers can lower railroad rates[3]. In an effort to lower their railroad rates, Entergy Arkansas explored the possibility of increasing railroad competition by obtaining approval to construct an 8.6-mile track to access both the UP and BNSF from its power plant in Redfield, Arkansas. Competition by mode, such as barge, can also affect railroad rates.

7.3.1.6 Intermodal Freight

The UP terminal in Marion is Arkansas' only intermodal terminal. This terminal is one of five primary intermodal terminals in the Memphis metropolitan area. Arkansas shippers have an advantage due to the close proximity of Arkansas to the Memphis metropolitan area. The intermodal terminal in Marion, however, can be a long distance to truck containers from many parts of Arkansas. As such a number of Arkansas communities have shown an interest in having intermodal terminals located within their areas.

[2] Arkansas State Highway and Transportation Department, Arkansas State Rail Plan, April 2015.

[3] Laurits R. Christensen Associates, Inc., Analysis of Competition, Capacity, and Service Quality, November 2009.

UP previously operated a paper ramp in Fort Smith and an intermodal terminal in Little Rock but could not economically provide service to the facilities due to insufficient freight volumes.

7.3.1.7 Rail and Economic Development

Rail supports economic development initiatives in Arkansas in a number of ways. Companies sometimes decide to move, expand, or remain within a state based on rail access. Even companies that use rail only occasionally benefit from the availability of rail and may see rail as a criterion for where to locate. Effective rail service supports existing employers as well. Rail can be particularly important to rural communities where the roadway network is limited and other transportation options can be costly or not readily available.

Some stakeholders believe that there is a need to improve the amount and availability of information needed to promote rail for economic development, such as information on rail-served sites, natural resources in close proximity to rail, contact information for economic development and logistics experts, information on transload facilities, etc.

7.3.1.8 Highway Relief

Freight and passengers that are moving by rail are not moving by truck or vehicle on busy highways. As discussed earlier in this Plan, rail transportation is safer, less polluting on a per ton-mile basis, does not consume valuable Arkansas highway capacity, and does not generate wear and tear on publicly maintained roadways and bridges. However, the State Freight Plan which is currently under development will address the issues of connectivity between the State Highway System and the various rail access points as well as ports, airports, and pipeline terminals.

7.4 Private Freight Railroad Needs and Estimated Costs

As per the Arkansas State Rail Plan, 2015, five funded freight rail projects are currently being completed in Arkansas. **Table 7-1** outlines currently funded projects with associated costs and funding mechanisms. These projects are classified as short-term investment program because they will be completed within the next four years.

Safety improvements include highway rail crossing upgrades yard rehabilitation, grade separation, and power switches.

As shown in **Table 7-1**, a total of $45.27 million has been earmarked for the five funded projects. In addition, there are a total of 91 projects worth $1.72 billion planned to be undertaken within the life of this plan but funds have not yet been apportioned to them. Projects include transload facilities, turnouts, storage and marshalling yards, bridge upgrades, rail line extensions, signals etc.

Table 7-1: Funded Rail Projects in Arkansas (Short-Term Investment Program)

Project Description	Cost	Funding Mechanism	Project Benefits
Rail extension and rehabilitation at the Port of West Memphis	Total cost is $27.0 million	$10.9 million from 2012 TIGER grant, other local and private funds	Economic development and modal connectivity
Rail Rehabilitation of the North Louisiana and Arkansas Railroad (information is provided for the entire project in Arkansas and Louisiana)	$13 million	U.S. Economic Development Administration, State of Arkansas SEAEDD, Lake Providence Port Commission, State of Louisiana, Delta Regional Authority, Arkansas Short Line Railroads, Inc.	Economic development, rail system preservation/ state of good repair, freight system efficiency
City of Jonesboro Railroad Corridor Highway 18/BNSF Crossing Planning for environmental and designs	$1.5 million	$1.2 million from 2014 TIGER grant, $0.3 million in local match	Safety, reduce community impacts
Arkansas Midland (AKMD) Warren Branch Rail Line Rehabilitation	$3.4 million	$2.7 million from FRA Rail Line Relocation and Improvement program, $0.7 million from AKMD	Rail system preservation/ state of good repair, freight system efficiency
Ouachita Railroad (OUCH) Bridge Rehabilitation	$370,000	$330,000 from FRA Rail Line Relocation and Improvement program, $40,000 from OUCH	Rail system preservation/ state of good repair, freight system efficiency

Source: Arkansas State Rail Plan, Table 12-1 Funded Rail Projects in Arkansas, April 2015

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8. PASSENGER RAIL

8.1 Passenger Rail Description

Passenger rail service in Arkansas is provided by the Amtrak, Texas Eagle service, a long-distance train that runs between Chicago and Los Angeles with a transfer at San Antonio, Texas. (**Figure 8-1**) A single train in each direction passes through Arkansas each day, making six nightly stops. The northbound train makes its first stop in Arkansas at Texarkana at 8:43 PM and makes its last stop in Arkansas at Walnut Ridge at 1:41 AM. The Southbound makes its first stop in Arkansas at Walnut Ridge at 12:37 AM and its last stop in Texarkana at 5:58 AM. Little Rock, which accounts for 56 percent of passengers who got on or off Amtrak trains in Arkansas in 2013 is the most heavily used Arkansas station on the Texas Eagle route.

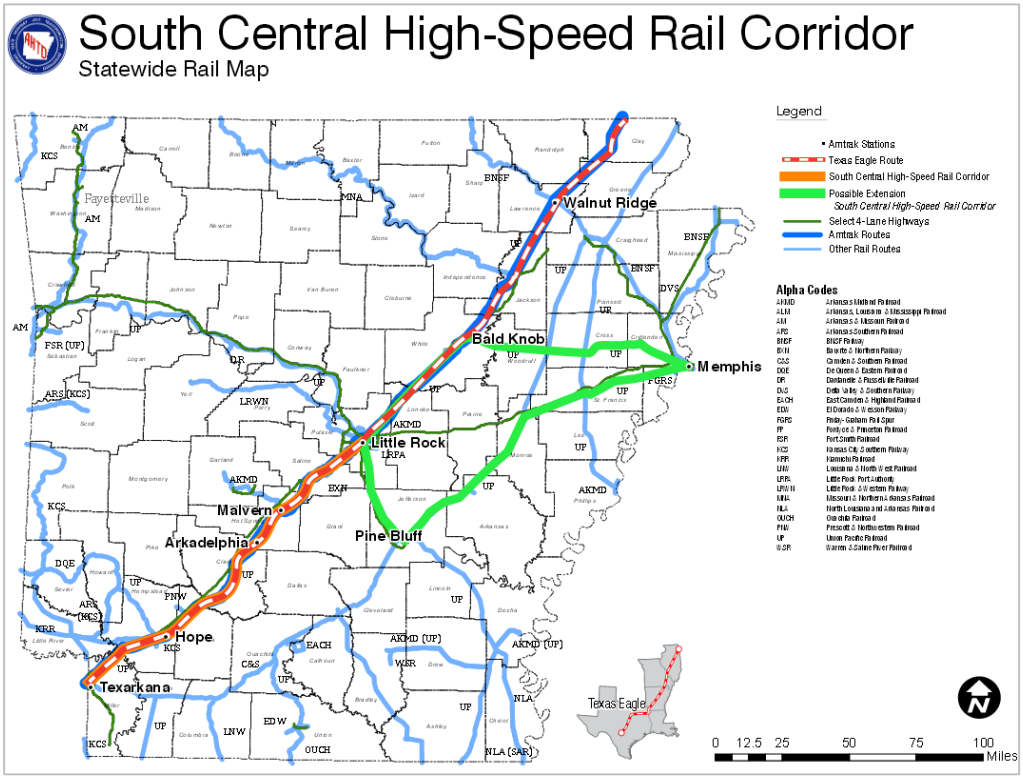
In addition to incovenient arrival and departure times, the Texas Eagle is slower and less reliable than automobile travel. On the other hand, Amtrak by some measures is a less expensive mode of travel than automobile travel, at least when compared with single occupancy automobiles from Arkansas to and from locations such as St. Louis, Chicago, Dallas, and Austin. The number of pasengers boarding and unboarding Amtrak trains in Arkansas increased from 20,789 in 2003 to 41,358 in 2013 despite its limitations.

Figure 8-1: Amtrak's Texas Eagle in Arkansas

Source: Arkansas State Rail Plan, Figure 3-2 Amtrak's Texas Eagle, April 2015

The U.S. Congress has designated a series of High-Speed Rail Corridors, which would be the focus of investment for improving intercity passenger rail train speeds. A portion of one of these corridors, the South Central High Speed Rail Corridor (SCHSRC), lies between Dallas and Little Rock through Texarkana. The U.S. Congress requested an investigation of whether the SCHSRC could be extended to Memphis from Little Rock. Arkansas is currently studying the possibility of improving service between Texarkana and Little Rock, and also the feasibility of passenger rail service between Little Rock and Memphis. This effort is collectively referred to as the Arkansas Passenger Rail Study. The study is funded by about $0.4 million from the FRA, matched by about $0.4 million from AHTD, and $0.1 million from the Arkansas General Improvement Fund. Figure 8-2 shows the SCHSRC with possible extensions from Little Rock to Memphis.

Figure 8-2: SCHSRC with Possible Extensions from Little Rock to Memphis



Source: Arkansas State Rail Plan, Figure 10-1 Existing Texas Eagle, and SCHSRC with Possible Extensions from Little Rock to Memphis, March 2015

8.2 Passenger Rail Issue and Needs

Issues that were identified with the existing Amtrak Texas Eagle service in the *Arkansas State Rail Plan, 2015* are as follows:

- **Highway/Railroad Grade Crossings**: The numerous grade crossings along the Texas Eagle route in Arkansas can affect travel time and safety. Many of these crossings lack adequate protection for higher speed passenger rail service such as four quadrant gates, median barriers or flashing lights with gates. These additional safety measures would be necessary if additional, faster passenger rail service were initiated.

Passenger trains must reduce speed for crossings where vehicle/train crashes are possible.

- **Train Scheduling**: Amtrak's service in Arkansas suffers from inconvenient arrival and departure times. Southbound stops in the state are between midnight and 6:00 a.m.; northbound stops are between 9:00 p.m. and 1:30 a.m. This schedule has a negative impact on train ridership in the state.
- **Freight Train Conflicts**: The Texas Eagle uses shared track with the UP. Increases in freight train traffic have caused scheduling conflicts with the passenger trains, resulting in passenger rail delays and service reliability problems.
- **Inadequate Modal Connections**: Few options are available along the Texas Eagle route for passengers to connect with other modes of transportation like regional airports and bus terminals.
- **Stations**: Stakeholders mentioned that some stations are in a poor state of repair and in need of upgrade/rehabilitation. The station at Malvern was singled out as a station particularly in need of improvement.

8.3 Passenger Rail Needs and Estimated Costs

The need for improved Arkansas intercity passenger rail service is demonstrated by:

- Increasing intercity and regional travel demands
- No direct passenger rail connectivity between Little Rock and Memphis
- Limited rail system capacity that causes conflicts between freight and passenger rail services
- The identified need to reduce roadway congestion between Little Rock and Memphis

Based on the *Arkansas State Rail Plan, 2015*, stakeholders also recommended new passenger rail services with the most prominent being:

- Rail service in between central Arkansas and Northwest Arkansas;
- Rail access within the northwest Arkansas region;
- Rail service between Hot Springs and Little Rock; and
- New services at existing stations, such as enclosed passenger waiting areas in those stations which currently have only platforms/shelters.

Over the next five years Amtrak plans to make upgrades at stations around the nation to ensure a path of travel from the public right of way through stations to trains that is compliant with the Americans with Disabilities Act (ADA). This work will include Arkansas stations that are not publicly owned.

9. PUBLIC TRANSPORTATION

9.1 Description

In 1870, Arkansas' first transit program got its start as a privately owned operation in Pine Bluff, and was then followed by a system in Little Rock in the 1880s. The City of Eureka Springs started its first publicly owned transit system in 1891 but discontinued it in the 1920s. Modern public transit systems began to emerge in the 1970s, largely with the signing of the Urban Mass Transportation Act of 1964 by authorizing transit programs and providing Federal funding assistance for transit equipment, facilities and operations. Arkansas, more specifically Metroplan, received its first Federal Transit Administration (FTA) funds in September 1965 - $383,000 for 42 buses.[4]

The Arkansas State Highway and Transportation Department became actively involved in transit programs with the passage of Arkansas Act 192 of 1977 which gave the Department responsibilities for administering public transportation programs in Arkansas. The Department established seven rural transit systems and funded vehicles for non-profit human service agencies providing transportation service to seniors and persons with disabilities. Today, there are eight urbanized and nine rural transit systems providing service in Arkansas. The FTA provides federal funding for public transportation, and it is supplemented with state and local funding. The Department also provides funds to 200 human service agencies to support transportation services to seniors, persons with disabilities, and persons seeking employment opportunities.

Since 1965, approximately $603 million of FTA/FHWA and $198 million of State and local funds have supported transit planning, training, capital, administrative, and operating activities.

The total cost of operating the eight urban transit systems for calendar year 2013 was approximately $29 million with Central Arkansas Transit Authority (CATA) having the largest share ($16.7 million). With 88 vehicles in service and 188 operating personnel, CATA also has the largest vehicle fleet and personnel. CATA recently changed its name to Rock Region Metro.

The total cost of operating the nine rural transit systems for the calendar year 2013 was approximately $17 million with Central Arkansas Development Council/South Central Arkansas Transit (CADC/SCAT) having the largest share (approximately $6.8 million). **Table 9-1** and **Table 9-2** show the operating characteristics of both urban and rural transit systems in Arkansas.

Intercity bus service in Arkansas is provided by three national and regional carriers, Greyhound, Jefferson Lines, and Kerrville. Two rural transit agencies, South Central Arkansas

[4] Arkansas Transit Association, Arkansas Public Transportation Directory, 2014.

Transit and Southeast Arkansas Transit supplement the services by providing three intercity bus lines.

Table 9-1: Urban Transit Characteristics

Transit Agency	Operating Characteristics					
	Ridership	Vehicles in Service	Personnel (Operating)	Annual System Miles	Annual Vehicle Hours	Total Operating Cost
Central Arkansas Transit Authority (CAT)[1]	2,946,784	88	188	3,263,314	260,850	$16,700,000
Fort Smith Transit	287,015	15	34	461,977	N/A	$2,176,180
Hot Springs Intracity Transit	174,451	12	15	214,764	27,440	$1,443,215
Jonesboro Economical Transportation System (JET)	80,086	9	25	261,652	16,280	$825,474
Ozark Regional Transit (ORT)[2]	231,108	26	65	612,531	40,554	$2,536,399
Pine Bluff City Transit	91,280	10	24	219,611	16,324	$1,056,109
Razorback Transit	1,930,956	31	38	476,470	50,053	$2,592,100
Texarkana Urban Transit District (TUTD)[3]	321,504	31	19	376,585	23,639	$1,656,376
Total	**6,063,184**	**222**	**408**	**5,886,904**	**435,140**	**$28,985,853**

Source: Arkansas Public Transportation Directory, 2014
[1]Central Arkansas Transit Authority recently changed its name to Rock Region Metro.
[2]Ozark provides both urban and rural service. Operating Statistics reflect urban services only.
[3]TUTD operates in two states; data is for Arkansas service only.

Table 9-2: Rural Transit Characteristics

Transit Agency	Operating Characteristics					
	Ridership	Vehicles in Service	Personnel (Operating)	Annual System Miles	Annual Vehicle Hours	Total Operating Cost
Black River Area Development (BRAD)	21,677	14	7	54,549	4,852	$265,212
Central Arkansas Development Council/ South Central Arkansas Transit (CADC/SCAT)	453,725	166	210	4,723,696	311,745	$6,785,174
Eureka Springs Transit	118,576	14	25	158,796	11,098	$743,298
Mid-Delta Transit	82,608	39	121	1,217,520	56,072	$1,346,300
North Arkansas Transportation Service (NATS)	146,166	64	48	724,305		$1,344,534
North East Arkansas Transportation (NEAT)	17,966	8	8	180,858		$247,576
Ozark Regional Transit (ORT)[1]	3,592	18	49	30,524	2,616	$232,783
Southeast Arkansas Transportation (SEAT)	246,481	103	140	3,713,762	221,944	$5,876,562
Western Transit System (WTS)	2,638	10	13	84,016	4,898	$204,350

Total	**1,093,429**	**436**	**621**	**10,888,026**	**613,225**	**$17,045,789**

Source: Arkansas Public Transportation Directory, 2014
[1]Ozark provides both urban and rural service. Operating Statistics reflect rural services only.

9.2 Public Transportation Needs

The following section discusses the 25-year public transportation needs in Arkansas. The 2015-2040 public transportation needs include capital improvements, operations, and administration/planning services for rural and urban transit system in Arkansas.

According to the *Arkansas Statewide Public Transportation Needs Assessment Report, 2012,* only 36 percent of the estimated overall need of over 13 million annual trips is being met currently. The smaller cities and rural areas have a smaller portion of their needs being met as compared to the eight urban areas. The afore-mentioned study estimated that there is currently an unmet need for 8.4 million annual trips, with a little over 7 million of those in the rural areas. The same report indicates that there will be 9.6 million trips and 560,000 people to serve by 2020.

In addition, the report indicates a potential annual need for over 11.2 million human service agency program trips, with only 40 percent of that need (4.4 million) served. The need for these additional trips (6.8 million) is dependent on expanded funding for the agencies' non-transportation programs, since it is the existence of those programs that creates the need for the supporting transportation services. Therefore, expanded funding for transportation-related expenses will only be effective if agencies are able to expand their overall programs with additional non-transportation funding.

While there are currently approximately 99,000 intercity bus trips taken annually in the state, there is a need to serve an additional 250,000. Serving the unmet need will likely require expansion of feeder services from rural areas connecting to the national and regional bus carriers serving the interstate corridors in the state.[5]

This study uses the data provided in the *Arkansas Statewide Public Transportation Needs Assessment Report, 2012* as basis for its projections. Extrapolating from the 10-year estimates provided in the needs assessment report, this study estimated that the total general transit needs for this plan will be approximately $5.7 billion with the majority (4.3 billion) needed for operating costs. This extrapolation using historical trend analysis shows a 1.7% annual growth in the estimated cost of needs. Approximately, three-quarters of this estimate will be for the rural areas. For 25-year life span of this plan, general public transit needs are estimated to be approximately $240,000 every year. Capital needs would primarily consist of vehicles, but would also include new facilities and technology for improving the efficiency of operations. Capital ($642 million) and administrative ($6 million) needs for the entire life of this plan have been estimated at $648 million, with an urban-rural split of $63 million and $578 million respectively. Human and intercity services were estimated to need $515 million and $201 million respectively. **Table 9-3** summarizes these needs.

[5] Arkansas State Highway and Transportation Department, Arkansas Statewide Public Transportation Needs Assessment, July 2012.

Table 9-3: 2016-2040 Transit Needs Summary

Transit Needs	Total (2016 - 2040)	Urban	Rural
Total AHTD Staff Cost	$6,000,000	NA	NA
Total Operating Costs	$4,321,500,000	$663,400,000	$3,658,000,000
Total Capital Costs	$642,000,000	$63,600,000	$578,500,000
Intercity Transportation			
Total Operating Cost	$201,900,000	NA	NA
Human Service Agency Program-Related Transportation			
Total Vehicle Cost (State share)	$515,500,000	NA	NA
Total	**$5,687,000,000**	**$726,900,000**	**$4,236,600,000**

Source: Projections using 10-year estimates from the Arkansas Statewide Public Transportation Needs Assessment Report, 2012.

9.3 Common Public Transit Needs

As part of the *Arkansas Statewide Public Transit Needs Assessment, 2012* study, a survey of human service agencies, interviews of telephone stakeholders, and member input from the Regional Advisory Committee were conducted.

While some specific local needs were identified through these discussions, most of the needs identified were general in nature and apply statewide. The major needs for public transportation can be grouped into a few categories by trip purpose:

- Transportation to Medical Services
- Transportation to Employment or Training
- Transportation for Independent Living

9.3.1 Transportation to Medical Services

Whether trying to reach life sustaining dialysis treatments or ensuring a healthy future for a child with routine screenings, people must have a way to get to their medical appointments. If a medically vulnerable person is unable to get the medical attention he or she needs because of a lack of transportation, that lack of mobility may put that person's life at additional risk. These types of trips tend to be infrequent but are critical needs. They may be short trips to a nearby doctor, but many may require long trips to medical facilities in Little Rock.

In Arkansas, as in many other states, the principal medical transportation provided is through the Medicaid non-emergency transportation program and through the veterans' medical transportation programs. While both of these programs provide valuable services, they each provide services only to very specific populations— the poor and veterans, respectively. In addition, some senior centers provide transportation to medical appointments, but only within a limited area. Individuals that do not belong in these groups must seek other means of

reaching medical services. Providing better service to those already served as well as to those that are not currently served, requires increased coordination between these transportation providers and other transportation services.

9.3.2 Transportation to Employment or Training

Retaining employment can be difficult for anyone who does not have a reliable private automobile, or who cannot operate an automobile, unless there are other transportation options. Many individuals with low incomes, disabilities, or age-related issues lack access to a private automobile and thus need public transportation for employment or even training. Furthermore, many entry-level positions are shift work that requires late night or early morning hours, and therefore cover a wide span of service hours. People who are employed also need transportation more frequently than people who have other types of transportation needs (20 round trips per month if they regularly use public transportation to access work as compared to 5 or fewer trips per month for other purposes), which means that employment transportation may be best provided by carpools and vanpools, as well as subscription-based demand responsive services.

9.3.3 Transportation for Independent Living

In order to live independently, seniors and others without access to an automobile need to travel to banks, government offices, shopping, and recreational/social /cultural facilities. In 2002 the American Association of Retired Persons (AARP) Public Policy Institute published a report that estimates one in five (21 percent) Americans age 65 and older does not drive, and more than 50 percent of non-drivers age 65 and older stay home on any given day due to a lack adequate transportation options. Further compounding the problem, people generally outlive their ability to drive by an average of 6 to 11 years.

These statistics indicate that our aging population will rely more and more on transportation services in the near-term. Seniors, individuals with disabilities, and others lacking regular access to a private automobile depend on transportation services to maintain their independence and promote healthy and vital living, and their overall quality of life. This includes access to basic necessities, like food and clothing, the ability to handle personal business, like visiting the bank and government offices, and the ability to have a quality life, including social outings and access to community services for recreation. These types of trips may be regular trips or infrequent but may involve traveling to many different locations in any given week or month. These trips require demand responsive services that are convenient to use and are available when needed.

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10. PORTS AND WATERWAYS

10.1 Description of Ports and Waterways

Water transportation is one of five modes that comprise Arkansas' freight transportation network.[6] The nation's inland navigable waterways provide a viable system for transporting bulk commodities within the United States and for accessing deepwater ports for overseas shipments. Arkansas is linked to this transportation system via its navigable waterways. Water access to the ports of the Gulf of Mexico is very important to the growth of commerce, as Arkansas' business sectors become more involved with the global marketplace, especially with Latin American countries. Arkansas' waterway system consists of four commercially active waterways and one river (the Red River) designated as a future navigable waterway.

There are ten public riverports and slackwater harbors located along the waterways as shown in **Figure 10-1**.

10.1.1 Ports and Harbors

In Arkansas, city and/or county port authorities govern public ports and harbors. Private stevedore companies lease the cargo handling facilities and operate the public use terminal. All public ports in Arkansas are classified as General Purpose Terminals, which, in most cases, handle a wide variety of bulk commodities in large bags, coils, bundles and loose, voluminous forms. The primary function of public ports is to act as a center for intermodal transportation and product distribution. A secondary activity is industrial production and processing.

10.1.2 Waterways

Arkansas' waterway system consists of four commercially active waterways and one river (the Red River) designated as a future navigable waterway. The active waterways are the McClellan-Kerr Arkansas River Navigation System and the Mississippi, Ouachita and White Rivers.

10.1.2.1 McClellan-Kerr Arkansas River Navigation System (MKARNS)

The Arkansas part of the system starts at the Oklahoma State Line near Fort Smith and extends a distance of 308 miles. The waterway system has a width of 250-300 feet, a minimum maintained depth of nine feet and is designed for eight barge tows but can accommodate up to 15 barge tows using double lockage. A feasibility study is underway by the Little Rock District of the Corps of Engineers to determine the possible impacts of maintaining the Arkansas River as a 12-foot channel instead of the current nine-foot channel. Funding for the study has been authorized by Congress. On the Arkansas segment of the river, public river terminals are located at the Port of Van Buren, the Little Rock Riverport/Slackwater Harbor Complex and the Port of Pine Bluff.

[6] Arkansas State Highway and Transportation Department, Arkansas State Public Riverport Study and Needs Assessment, March 2005.

Figure 10-1: Commercially Navigable Waterways, Public Ports and Harbors

Source: Arkansas State Public Riverport Study and Needs Assessment, 2005

10.1.2.2 Mississippi River

The Arkansas segment of the Mississippi River starts at the Missouri State Line in the vicinity of Blytheville and extends south to the Louisiana State Line near Eudora, a length of 321 miles. This segment of the Mississippi River is maintained to a width of 300 feet for barge traffic. The absence of locks and dams and unrestrained water flow during the winter months are significant advantages for barge transportation on the lower Mississippi River, allowing tows of 40 or more barges. On the Arkansas side of the Mississippi River, public use terminals are located at the Port of Osceola, the Port of West Memphis, the Helena Harbor, and the Yellow Bend Harbor.

10.1.2.3 Ouachita River

Arkansas' commercially navigable portion of the Ouachita River begins at Camden and flows southeasterly to the Arkansas/Louisiana State Line. The river joins the Black and Red Rivers in Louisiana and eventually flows into the Mississippi River, a distance of 371 miles. The navigable segment in Arkansas is 116 miles long and is maintained to a depth of nine feet, with a channel width of 100 feet. Two public riverports are located on the Ouachita River in Arkansas: the Port of Camden and the Port of Crossett.

10.1.2.4 White River

The White River is navigable from Newport south to the Mississippi River, a length of 254 miles. The river has a nine-foot approved depth but this draft is not maintained throughout the year.

10.1.2.5 Red River (J. Bennett Johnson Waterway)

The Red River is classified as a future navigable waterway from Index, Arkansas (Miller County/Texas State Line) to the Louisiana State Line, a length of 97 miles. There is no official designation of its depth or width and, as a result, there are no public ports or private terminals on this segment of the river. The Red River is now commercially navigable from Shreveport, Louisiana to the Mississippi River, a length of 225 miles.

10.2 Ports and Waterway Needs

10.2.1 Ports and Harbors

Using needs estimated by the *Arkansas State Public Riverport Study and Needs Assessment, 2005*, and updated 2015 estimates from the ports and harbors, approximately $194 million is needed to satisfy all identified infrastructure, equipment and support facility needs. **Table 10-1** summarizes estimated costs for the needs.

Table 10-1: Public Ports and Harbors Needs

Ports	Long Term Needs
Port of Osceola	$3,960,000.00*
Port of West Memphis	$1,779,300.00
Port of Helena Harbor	$8,320,500.00
Port of Yellow Bend Harbor	$53,782,500.00*
Port of Fort Smith	$11,392,800.00
Port of Little Rock	$78,354,000.00
Port of Pine Bluff	$7,443,000.00*
Port of Crossett	$28,929,900.00
Port of Camden	-
Port of Van Buren	-
Total	**$193,962,000.00**

Source: Arkansas State Public Riverport Study and Needs Assessment, 2005.
**Updated needs from Ports in 2015*
- At the time of publication, the Port of Camden and Van Buren did not have needs identified

10.2.2 Waterways

10.2.2.1 Mississippi River

In August 2012, the Arkansas Waterways Commission worked with the Arkansas Congressional delegation to secure funding for the Corps of Engineers to dredge the Yellow Bend Harbor.

Through this supplemental funding, the Corps was able to dredge in 2012, and did a commendable job working with the U.S. Coast Guard to keep a channel open between the Yellow Bend Port and the Mississippi River. The FY 2016 Corps of Engineers budget contains less funding for dredging the Mississippi than in 2015 and this poses a serious fiscal constraint to the Yellow Bend Port.

10.2.2.2 McClellan-Kerr Arkansas River Navigation System (MKARNS)

The deepening of the MKARNS channel to 12 feet (current navigable draft is 9 feet draft) is another need of the inland waterway system. Congressional authorization to deepen the channel was received in the Energy and Water Development Act of 2004, H.R. 2754, but funds have not been appropriated by Congress.[7] The cost to deepen the entire 445-mile long channel totals $177 million. Out of the total cost, approximately $103 million will be required to deepen the Arkansas portion of the channel.[8]

The MKARNS, while having a maintenance backlog of $78 million also has a $3 million annual cost for dredging the 9-foot channel. If the MKARNS channel is deepened to 12-foot, the annual dredging cost will increase to $4 million. The cost estimate for the MKARNS channel will total $145 million for the life of this plan.

Deepening the MKARNS channel to a 12-foot draft would allow barges to carry increased weights thereby saving shipper costs and making the system more competitive with similar waterway systems and other modes of transportation. Increased tonnage on the system would decrease the burden placed on railroads and highways, thereby potentially reducing pavement deterioration and improving air quality.

10.2.2.3 Ouachita River

The Ouachita/Black River Navigation System faces challenges from recent changes to lock operations. The Ouachita River has two locks that operate in Arkansas: Felsenthal, near Crossett; and H.K. Thatcher, near El Dorado. Lock operating hours are set according to the "Levels of Service" as defined in the Inland Marine Transportation System (IMTS) guidelines; the IMTS guidelines are based on the amount of commercial traffic that passes through the locks. Approximately 80% of the traffic along this river is recreational. Industries such as Tetra Technologies and Cross Oil of Smackover depend on the Ouachita/Black River Navigation System. The reduction in operation hours will jeopardize investments and the opportunity for economic development along the Ouachita river.

[7] U.S. Army Corps of Engineers, McClellan-Kerr Arkansas River Navigation System Fact Sheet, April 2012.

[8] Arkansas Waterways Commission, Legislative Summary, September 2012.

Needs estimated for the Ouachita/Black River Navigation System were obtained from the Arkansas Waterways Commission. It is estimated that $15 million will be needed for maintenance and $87.5 million for dredging of this system for 25 years.

10.2.2.4 White River

Navigation is presently available along the White River on a seasonal basis with a 9-foot deep channel to Newport, a distance of 255 miles from the Mississippi River. The Memphis District of the U.S. Army Corps of Engineers (USACE) is currently studying expanding navigation from about 57 percent of the year to 95 percent of the year.[9]

Needs estimated for the White River was obtained from the Arkansas Waterways Commission. It is estimated that $5 million will be needed for maintenance and $40 million for dredging of this system for 25 years.

10.2.2.5 Red River (J. Bennett Johnson Waterway)

Currently, the Red River is navigable to Shreveport, Louisiana. A USACE study has been done to allow navigation to the Index Bridge (between Texarkana and Ashdown, Arkansas). There are also variations calling for navigation to Garland and Fulton, Arkansas. Each study includes a cost/benefit ratio. Unfortunately, the cost/benefit ratio does not meet the minimum requirement set by USACE for these investments.

Groups such as the Texarkana Chamber of Commerce and the Arkansas Red River Commission continue to work to establish a cost/benefit ratio that falls in the acceptable range to support navigation to the Index Bridge. Most recently, individuals from economic development groups in Dallas, Texas and the Red River Valley Association in Shreveport are discussing the possibility of extending the Red River to Denison, Texas, to serve as a river port for Dallas-Fort Worth area.

10.2.2.6 Three Rivers

As the Arkansas River flows east, it comes to a confluence with the White, and Mississippi Rivers in southeast Arkansas. The merging of these rivers, complicated by land use and geology changes over many years, has become problematic in that the rivers depart from their banks and the area experiences periodic flooding. The continuation or expansion of this flooding and related damage could cause a serious breach to the navigation system.[10] Additionally there is concern for the surrounding area that is also home to a wildlife refuge and over 100,000 acres of hardwoods.[11]

Obtaining a permanent fix for the flood-prone area of the navigation channel at the confluence of the Arkansas, White, and Mississippi Rivers, is a priority for maintaining and improving the MKARNS system. Finally, adding tow haulage to the locks has been identified as another improvement that is needed in the next 25 years. No cost estimates are available for these two items.

[9] http://waterways.arkansas.gov/rivers/Pages/whiteRiver.aspx Accessed November 13, 2012.

[10] http://newsok.com/study-of-arkansas-river-should-be-of-keen-interest-to-oklahoma-policymakers/article/5414203

[11] http://www.swd.usace.army.mil/Portals/42/docs/FY13%20Three%20Rivers%20Study,%20AR.pdf

Funding of $100,000 is needed to complete a reconnaisance study of the water resource probem. The study will determine potential solutions, scope, further federal participation, and identify non-federal sponsors to provide a comprehensive watershed analysis of basin conditions and alternatives.[12]

10.3 Development Issues and Improvement Strategies

Arkansas' public ports and harbors encounter intense competition from other freight modes and from river ports in surrounding states. They must contend with deteriorating infrastructure and equipment and insufficient funds to make needed improvements.

10.3.1 Development Issues

Discussion with port directors and their board members, stevedore operators, water transportation users, Corps of Engineers personnel and from the responses to the Port/Harbor Questionnaire in the *Arkansas State Public Riverport Study and Needs Assessment report* cites the following common issues:

- Poor landside access;
- Inadequate intermodal transportation capabilities;
- Lack of funding resources;
- Deteriorated condition of infrastructure, facilities and equipment;
- Dredging and dock operation problems;
- Absence of a marketing plan; and
- Unknown port security costs.

10.3.2 Improvement Strategies

Major capital investment is needed at the public ports to replace obsolete facilities and equipment and for additional capacity to accommodate future shipping requirements. A comprehensive marketing program is needed to detail the many advantages that ports have to offer to businesses. Strategies to assist the ports with facility construction and other infrastructure support, service improvement, and intermodal transportation project development include a capital improvement grant program, a revolving loan program, public/private partnerships, and a marketing program.

[12] U.S. Army Corps of Engineers, FACT SHEET as of 06 February 2012.

11. INTERMODAL NEEDS

11.1 Description of Intermodal Facilities

Multimodal transportation involves the use of two or more modes of transportation for a single freight movement from origin to destination. Multimodal transportation allows shippers to benefit from the unique advantages of each mode. For example, the transportation cost of rail is lower than the cost of trucking over longer distances, but many shippers and their receiving customers do not have direct access to rail at their facilities. Rail/truck transfers allow shippers to benefit from the favorable long-haul economics of rail as well as the local flexibility of trucking. Similarly, shippers may have access to railroad transportation but are not located near a navigable waterway. Multimodal transloading allows these shippers to use inexpensive long-haul maritime transportation with rail providing the link to the port facility. Multimodal transportation within Arkansas will be categorized into three categories.

11.1.1 Rail/Truck Intermodal

These are movements of either containers or trailers using flat cars commonly referred to as Container-On-Flatcar (COFC) or Trailer-On-Flatcar (TOFC). The sole intermodal terminal located within Arkansas is the UP terminal in Marion, Arkansas; the major UP train operations in Little Rock do not include a container/trailer intermodal facility. The Marion terminal has the capacity to handle 375,000 containers per year.

11.1.2 Non-Containerized Rail/Truck

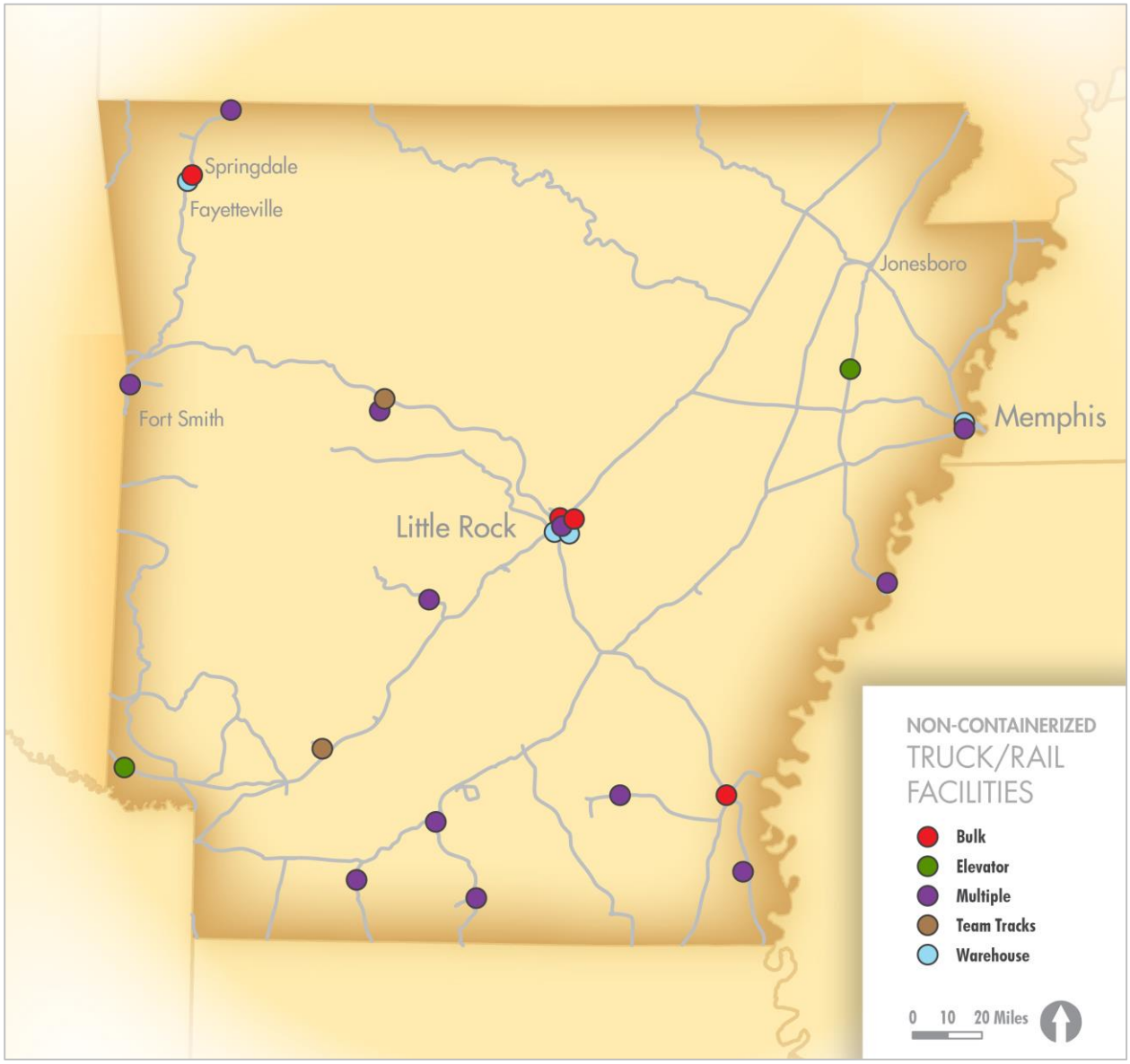
These are shipments of bulk or loose freight moved by truck and rail. A broad range of facilities are used to transfer non-containerized cargo between truck and rail, often generically referred to as “transload” facilities. A broad range of facilities are used to transfer non-containerized freight between truck and rail:

- **Bulk**—These facilities are used for transferring fertilizers, plastics, chemicals, petroleum, ethanol, clays, aggregates, cement, minerals, agricultural, and other bulk products. Most items move in hopper or tank cars.
- **Warehouse**—Paper, consumer products, food, and beverages are stored and/or transferred within a warehouse. For food and other perishable commodities, warehouses can be refrigerated to include freezer temperature spaces.
- **Dimensional**—Lumber, panel, structural steel, and machinery are transferred either within a covered area or in the open. These items move in flatcars, gondolas, or boxcars.
- **Elevators**—Storage of agricultural products in elevated structures.

- **Team Tracks**—These are general purpose tracks with adjacent space for truck loading/unloading. These are often self-service, whereby the shipper arranges for product to be loaded/unloaded onto or off of railcars.

Figure 11-1 provides the locations of selected non-containerized rail/truck transfer facilities in Arkansas. The data sources for this figure are a database maintained by the U.S. Department of Transportation (USDOT), carrier websites, and a survey of short line railroads.

Figure 11-1: Non-Containerized Rail/Truck Facilities in Arkansas



11.1.3 Rail/Barge

Cargo is transferred between rail and barge transportation. Rail-served river port facilities also enable transfer between three modes: rail, truck, and barge. Arkansas is one of 24 states in the U.S. that has access to inland waterways. With 1,000 miles of navigable waterways along four rivers, Arkansas enjoys one of the largest inventories of navigable waterways in the nation. According to U.S. Army Corps of Engineers statistics, Arkansas ports handled 14.5 million tons of freight in 2011—fairly evenly split between inbound and outbound shipments.

Rail can be used in conjunction with water transportation, with rail providing access to the waterway system. Ports can serve as logistics/transportation hubs, where truck, rail, and barge transportation, along with storage and other logistics services, are available at a single location. As businesses locate near transportation hubs, ports can serve as economic development engines.

Waterborne transportation in Arkansas is provided on the Arkansas,[13] Mississippi, Ouachita, and White Rivers. Currently, the Red River is navigable only to Shreveport, Louisiana, but plans are underway to extend navigation into Arkansas. Table 11-1 and Figure 11-1 list public ports and harbors in Arkansas, their railway access, and the commodities handled. Some ports, such as Osceola or Fort Smith, are fairly specialized, while others, such as the Port of Little Rock, handle a broader range of cargo.

Rail access has been proposed for the Yellow Bend Harbor and the Ports of Crossett and West Memphis. The Yellow Bend Harbor has selected a preferred alternative for gaining rail access but is seeking funding for environmental, construction, and engineering work. Rail access to the Port of Crossett is in the early planning stages. In West Memphis, funding from a TIGER grant will fund rail access to the base of the levee adjacent to the port facilities. A conveyor system over the levee will allow bulk freight to be transported between the port and a rail transloading area.

[13] In Arkansas, the McClellan-Kerr Arkansas River Navigation System primarily follows the Arkansas River, except for several miles where the System uses the White River Entrance Channel to access the Mississippi River.

Table 11-1: Public Ports and Harbors in Arkansas

Port/Harbor Name*	Rail Access	Commodities Handled
McClellan-Kerr Arkansas River Navigation System		
Port of Van Buren	Union Pacific Railroad, Arkansas & Missouri Railroad	Non-Metallic Minerals, Other
Port of Fort Smith (located on the Poteau River)	Arkansas Missouri Railroad, Fort Smith Railroad	Iron Ore and Iron & Steel Waste & Scrap, Primary Iron and Steel Products (Ingots, Bars, Rods, etc.), Other
Little Rock Port/Harbor	Union Pacific Railroad, Burlington Northern Santa Fe Railway, Little Rock Port Authority Railroad	Distillate, Residual & Other Fuel Oils; Lube Oil & Greases, Building Cement & Concrete; Lime; Glass, Fertilizers, Iron Ore and Iron & Steel Waste & Scrap, Paper & Allied Products, Primary Iron and Steel Products (Ingots, Bars, Rods, etc.), Food and Farm Products, Other
Port of Pine Bluff	Union Pacific Railroad, Burlington Northern Santa Fe Railway	Fertilizers, Forest Products, Lumber, Logs, Woodchips, Paper & Allied Products, Primary Iron and Steel Products (Ingots, Bars, Rods, etc.), Food and Farm Products, Other
Mississippi River		
Helena Harbor	Arkansas Midland Railroad	Coal, Lignite & Coal Coke, Primary Iron and Steel Products (Ingots, Bars, Rods, etc.), Food and Farm Products, Other
Port of Osceola	None (Burlington Northern Santa Fe Railwaynearby)	Food and Farm Products
Port of West Memphis	Friday-Graham Rail Spur (Expected 2016)	Food and Farm Products, Oilseeds (Soybean, Flaxseed and Others), Primary Iron and Steel Products (Ingots, Bars, Rods, etc.), Other
Yellow Bend Harbor	None	Various
Ouachita River		
Port of Camden	Union Pacific Railroad	Various
Port of Crossett	None	Various

Source: U.S. Army Corps of Engineers
** Harbors refer to facilities located at inlets located away from the primary river flow.*

11.2 Intermodal Facility Needs

During the development of the Arkansas State Rail Plan, stakeholders have expressed interest in extending the following rail networks to areas where it can provide intermodal connectivity.

- Southeast Arkansas Industrial Rail-Port Connection – An 8.1-mile rail line from Yellow Bend harbor to Trippe Junction
- Rail Access to an industrial area in Fayetteville
- Rail Access to the Northwest Arkansas Regional Airport

Following are other projects identified in the Arkansas State Rail Plan that are specifically focused on multimodal improvements:

- The Port of Little Rock benefit from an expanded marshalling yard in the harbor area which would enable the Port to more easily handle unit trains.
- Rail and warehousing infrastructure at the Port of Fort Smith needs to be upgraded, including upgraded rail, repairs to spur lines, and an extension of the rail line into the port.
- Several short line railroads have proposed transload projects.
- In the future, UP may need to expand its intermodal terminal in Marion. Recommended related improvements are included in this Plan.
- Some shippers have expressed a desire for containerized intermodal service within Arkansas outside of the UPRR Marion facility. Shippers would need to coordinate better by consolidating movements which can help railroads to justify the volume required for establishing this intermodal service

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12. BICYCLE AND PEDESTRIAN

12.1 Description of Bicycle and Pedestrian Facilities

Bicycle and pedestrian facilities throughout Arkansas consist of multi-use trails, shared use paths, bicycle routes, and sidewalks. The planning and implementation of bicycle and pedestrian improvements predominantly take place at the local level. Thus, municipal and county governments and Metropolitan Planning Organizations (MPOs) are the key agencies for the planning and implementation process. AHTD, however provides leadership and funding for development of bicycle and pedestrian facilities, and statewide plans. Funding for these bicycle and pedestrian improvements is almost always from a combination of federal, local, and private and/or non-profit sources.

Statewide initiatives for bicycle and pedestrian facilities have been implemented through the federal transportation funding programs such as the Safe Routes to School (SRTS), Transportation Enhancement Program – TE Funding (TEA-21 and SAFETEA-LU), and subsequently through the MAP-21 Transportation Alternatives Program (TAP).[14]

12.2 Statewide Needs

The statewide bicycle and pedestrian plan currently under development, *Arkansas Bicycle and Pedestrian Plan, 2015*, identifies statewide needs for pedestrian and bicycle transportation. About 73 percent respondents to the study's survey indicated that a lack of sidewalks and trails is a factor that keeps them from walking more; only 50 percent cited destinations being too far as a reason they do not walk more; and 46 percent said that heavy traffic and dangerous intersections are a deterrent. This suggests that improving the physical network of pedestrian accommodations, especially as they relate to travel along and across arterial roadways, is critical to making Arkansas communities more pedestrian friendly.

To no surprise, improving on-street bicycling conditions was a priority for cyclists in Arkansas. Many respondents to the survey stressed the need for bicycle infrastructure. Their comments varied when asked what type of non-infrastructure programs or what other measures would encourage them to bicycle more often. The highest priorities included the following:

- Motorist education about cycling laws and how to respectfully share the road with cyclists (68% rated this a HIGH priority)
- Increased enforcement of traffic laws (56% rated as a HIGH priority)
- Increased roadway maintenance (53% rated as a HIGH priority)
- Improved wayfinding (50% rated as a HIGH priority)

[14] Arkansas State Highway and Transportation Department, Arkansas Bicycle and Pedestrian Plan, August 2015.

A key recommendation of the *Arkansas Bicycle and Pedestrian Plan, 2015*, is the creation of a Statewide Bikeway Network. Using the National Corridor Plan (NCP) map (**Figure 12-1**) of the United States Bicycle Route System published by the American Association of State Highway Transportation Officials in 2009, the Plan identified an additional route that the state is interested in studying further—a diagonal link between the Southern Tier Route (BR 90) which pass through Louisiana and the TransAmerica Trail (BR76) which pass through Spring Field, MS.

Figure 12-1: US Bicycle Route Plan—In Arkansas

Source: Arkansas Bicycle and Pedestrian Plan, 2015

12.3 Bicycle and Pedestrian Needs and Estimated Cost

The bicycle and pedestrian needs were examined for each metropolitan area by reviewing the regional bicycle plans and/or bicycle-pedestrian elements of the latest Long Range Transportation Plans of the eight MPOs. **Table 12-1** provides a summary of the bicycle/pedestrian plans currently envisioned by each MPO in Arkansas. The MPO long range plans are updated every five years, so the information provided below is evolving and changing.

Table 12-1: Bicycle and Pedestrian Needs

MPO	Cost
Central Arkansas MPO	$354,100,000
Frontier MPO	$15,177,353
Tri Lakes MPO	$71,449,632
Jonesboro MPO	$19,402,693
North West Arkansas MPO	$534,057,111
Pine Bluff MPO	$6,980,000
Texarkana MPO	$637,632
West Memphis MPO	$8,200,000
Total	**$1,010,004,421**

Source: Arkansas MPOs Long Range Plans

13. AIRPORT ACCESS

13.1 Description of Airports

Arkansas is home to 91 public use airports. This includes four primary airports, four non-primary airports, and 83 general aviation and public-use airports. The focus will be on the four primary airports which are the busiest airports in Arkansas. The Arkansas economy benefits greatly from aviation, with the 91 airports performing the vital role as a gateway to their communities. When all economic impacts of Arkansas' airports and the Little Rock Air Force Base are summed, over 39,700 jobs can be traced to aviation. These employees annually receive $1.3 billion in payroll and benefits. In total, nearly $3.1 billion in economic activity can be attributed to aviation activity in the state. In addition to economic benefits, the airport system provides numerous critical services to enhance the quality of life, health, safety, and welfare of Arkansas citizens.

Bill and Hillary Clinton National Airport in Little Rock is also known by its previous name Little Rock National-Adams Field (LIT). Clinton National Airport has a full-service fixed-base operator and is Arkansas's largest commercial service airport, with nearly 2.2 million passengers annually. Clinton National Airport hosts six airlines with dozens of daily departures and nonstop service to 18 cities using one of two parallel runways measuring 8,273 and 7,200 feet in length or the 5,124 feet crosswind runway. The parallel runways are equipped with precision instrument landing system (ILS) approaches. Non-precision approaches are available for all runways. Clinton National Airport recently completed a $20 million terminal renovation.

Northwest Arkansas Airport (XNA) in Benton County is only one of two Airport Authorities in the state of Arkansas. The Northwest Arkansas Regional Airport Authority operates the airport and is comprised of five cities (Bentonville, Fayetteville, Rogers, Siloam Springs and Springdale) and Benton and Washington counties. XNA is one of the newest airports in the country and has one 8,800 feet runway with both ILS precision and non-precision instrument approach guidance available. XNA is centrally located within close proximity to all the communities of northwest Arkansas while also being far enough away from populated areas so as to minimize any adverse impact from aircraft operations.

Fort Smith Regional Airport (FSM) is a commercial service airport in west central Arkansas and governed by the Fort Smith Airport Commission with a fixed based operator. FSM provides regional passenger air service to over 100,000 passengers a year. Fort Smith Regional has flights to Dallas-Fort Worth and Memphis with connections from these locations to anywhere in the world. In addition to airline service, Fort Smith Regional Airport is home to the Arkansas Air National Guard with over 300 full time employees and nearly 1,000 reservists which emphasizes the significant role the military plays in the region. FSM has an 8,000 feet runway with a complimentary 5,002 feet crosswind runway. ILS precision approach is available for the primary runway with a combination of precision and non-precision on the crosswind runway.

Texarkana Regional Airport (TXK) is a commercial airport in southwest Arkansas and managed by the Texarkana Airport Authority with a fixed base operator providing the daily airport operations. Texarkana Airport Authority is comprised of two cities (Texarkana, AR and Texarkana, TX). TXK offers two runways with the primary measuring 6,601 feet and a crosswind runway at 5,200 feet in length. The primary runway is equipped with ILS precision instrument approach and all runway ends have non-precision instrument approaches.

13.2 Airport Access Needs

Air transportation plays an important role in economic competitiveness and access to the airports and surrounding infrastructure is important for quality of life, tourism, and commerce. The various cities, town, and counties in Arkansas that have public airports within their political boundaries work with the Arkansas Aeronautics Commission and the Federal Aviation Administration to ensure the aviation needs of commerce and communities across Arkansas are met.

As the manufacturing base shifts to high value and high tech products, the importance of efficiency and reliability in transportation has increased to support just-in-time supply chains. Airport services are integral to this component of the freight supply chain. Convenient airport access is also important to local residents and businesses. It is understood and preferred by the airport users that good surrounding infrastructure and network connectivity is vital for personal and business travel.

13.2.1 Support for Airports

Although no major deficiencies exist, continued investment in the State's airports is necessary to keep the aviation in excellent condition and well-positioned to meet future aviation demand. [15] Some of the key elements include access, signage, terminal upgrades, and operational and functional projects.

15 http://www.fly.arkansas.gov/Airports. Accessed December 2, 2015.

14. SUMMARY

Arkansas' 25-year multimodal transportation needs total $62.8 billion (2014$) and it includes needs that are AHTD's responsibility as well as needs and costs addressed by partnering federal, state, and local agencies:

- State Highway System – bridge structures;
- State Highway System – highways;
- State Highway System – interchanges; and,
- Transportation System Support
  - Safety;
  - Maintenance; and
  - Intelligent Transportation System (ITS)
- Ports and waterways;
- Passenger rail;
- Public transportation
  - Urban
  - Rural
- Bicycle and pedestrian facilities.

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APPENDIX A:

Assumptions and Inputs for AHTD Bridge Needs Analysis Using the National Bridge Inventory Analysis Software (NBIAS)

Introduction to Bridge Needs Analysis

Bridge needs for Arkansas were determined using National Bridge Investment Analysis System (NBIAS) software. NBIAS is an analysis tool used to predict bridge rehabilitation, reconstruction, and replacement needs. The NBIAS model forecasts bridge performance and offers recommendations for improvements based on economic concepts. The system supports analysis of different funding levels and policy assumptions for over 200 measures of effectiveness. The software uses the state's National Bridge Inventory (NBI) File, deficiency levels, design standards, and unit cost estimates as inputs to assess structurally deficient and/or functionally obsolete structures in order to achieve scenario specific objectives.

Types of Analysis

NBIAS analyzes bridge structures only and excludes culvert records from the NBI dataset. NBIAS can only predict and maintain needs for existing bridges. New location analysis had to be performed outside of NBIAS and added to the totals. New Bridges can be queried out of the State Transportation Improvement Program (STIP) database and reviewed by AHTD personnel for inclusion.

Results

Reporting of needs from the NBIAS analysis will show number of bridges needing improvement and the cost of the improvements by three categories: *rehabilitation*, *reconstruction*, and *replacement*. For the purposes of the 2015-2040 LRTP, bridges needing to be raised, widened and/or strengthened were grouped into the category or bridge *reconstruction*.

NBIAS also reports a maintenance figure which estimates the preservation and *rehabilitation* costs across the study period for all the structures in order to minimize user and agency costs. Functional improvements such as widening existing bridge lanes, raising bridges to increase vertical clearances, and strengthening bridges to increase load-carrying capacity are identified by comparing with AHTD standards.

The *replacement* category identifies structures that are beyond a simple rehabilitation or improvement because they may be structurally deficient or functionally obsolete. All categories are evaluated and compared in the model scenario for optimal benefit and cost.

Unit Costs

Bridge unit costs are used to determine the improvement cost total for each action taken (or potentially taken) by NBIAS. Values are stored in the "Matrix_cost" table. The table contains user cost information required for the improvement models. These values include activities such as widening, raising, strengthening, and replacing a bridge. Unit costs can vary by functional class, national highway system status, and/or traffic volume range. An improvement cost within NBIAS is determined by multiplying the unit cost for the improvement type by deck area that will be improved, considering the change in dimensions that may result from the improvement for widening or replacing a bridge. These costs do not necessarily include sub-structure improvements, utility relocation, or right-of-way acquisition.

Table A-1 shows the unit cost information used in NBIAS, as provided by AHTD.

Table A-1: Unit Cost Per Square Foot of Deck (2014$)

Replace	Widen	Raise	Strengthen
$129	$96	$48	$48

Improvement Criteria

The "Matrix_policy" table deals with the improvement policy criteria for when a bridge should be: Widened, Raised, Strengthened. The criteria, also referred to as Minimum Tolerable Conditions (MTC), are specific to each state and contain the standards for each bridge type, as separated by functional class, NHS status, and AADT class. The deficiency (MTC) values trigger NBIAS to take an improvement action when a bridge falls below the respective structural standard, while design values are the new bridge dimensions NBIAS will use for a replacement bridge. Design standards are the engineering specifications for a new bridge.

Values addressed in the table include design standards for lane and shoulder widths, as well as the swell factor which is a cost-increase coefficient. NBIAS applies a swell factor to maintenance, repair, and rehabilitation (MR&R) needs to account for the way in which such projects are implemented in practice. When State and local governments repair or rehabilitate deficient components of bridges, they typically try to raise the standards of other components that might not yet be deficient. In other words, MR&R actions cannot be viewed in isolation, and a swell factor is applied for these related improvements. **Table A-2** presents the values used for the bridge needs analysis for Arkansas.

Table A-2: Policy Values

		Deficiency					Design				Ratings (Metric Tons)	
		right		left								
		Lane Width	Shlder Width	Lane Width	Shlder Width	Vert Clear	Lane Width	Shlder Width	Vert Clear	Swell	Legal Operating	Legal Inventory
Rural	Interstates	11.2	3.0	11.2	3.0	14.1	12.1	16.1	16.1	3.9	41	41
	Principal Arterials	11.2	3.0	11.2	3.0	14.1	12.1	16.1	16.1	3.9	36	36
	Minor Arterials	11.2	3.0	9.8	2.0	14.1	12.1	7.9	14.4	3.9	36	36
	Major Collectors	11.2	0.0	9.8	0.0	14.1	12.1	7.9	14.4	3.9	33	33
	Minor Collectors	11.2	3.0	9.8	1.0	14.1	12.1	7.9	14.4	3.9	30	30
	Local Roads	11.2	3.0	9.8	1.0	14.1	12.1	7.9	14.4	3.9	27	27
Urban	Interstates	11.2	3.0	9.8	0.0	14.1	12.1	7.9	14.4	3.9	41	41
	Expressways	11.2	3.0	11.2	3.0	14.1	12.1	16.1	16.1	3.9	36	36
	Principal Arterials	11.2	3.0	11.2	3.0	14.1	12.1	7.9	16.1	3.9	36	36
	Minor Arterials	11.2	3.0	9.8	2.0	14.1	12.1	7.9	14.4	3.9	36	36
	Collectors	11.2	0.0	9.8	0.0	14.1	12.1	7.9	14.4	3.9	33	36
	Local Roads	11.2	3.0	9.8	1.0	14.1	12.1	7.9	14.4	3.9	27	36

APPENDIX B:

Assumptions and Inputs for AHTD Highway Needs Analysis Using Highway Economic Requirements System – State Version (HERS-ST)

Introduction to Highway Needs Analysis

To determine the future needs and performance of roads for Arkansas, the Highway Economic Requirements System - State Version (HERS-ST) software is used. HERS-ST is a highway investment analysis tool provided and supported by the Federal Highway Administration (FHWA). HERS-ST considers engineering principles when determining deficiencies and economic criteria when determining improvements for implementation on a statewide level. The model will estimate future needs utilizing a state's HPMS data, design standards, minimum tolerable conditions, improvement costs, and other parameters that were customized to the state.

Types of Analysis

In any given computer program execution, HERS-ST is designed to perform one of four types of analysis as specified in the user input field "Objective." The user-specified objective may be in any of four possible forms:

- Maximize the net present value of all benefits of highway improvements subject to specified constraints on funds available during the period;
- Minimize the cost of improvements necessary to achieve a specified goal for the performance of the highway system at the end of the funding period;
- Implement all improvements with a benefit-cost ratio (BCR) greater than some specified threshold value; and
- Perform a full engineering analysis to highlight deficiencies within each funding period and implement improvements within the same funding period without a limiting variable.

Input Files

There are four main categories of files required for analyzing the highway needs to Arkansas requirements. They are:

- The roadway section file found within the HPMS dataset with adequate sample records present. HERS-ST utilizes the sample records only and not the full data set for determining the highway needs.
- **Parameter** file (PARAMS.DAT) contains parameters covering the breadth of the HERS-ST modeling process: the pavement model, operating cost components, the speed model, and the safety model, to name a few.
- **Improvement cost** file (IMPRCOST.DAT) contains data items which define the costs of improving highway sections.
- **Deficiency level tables** file (DLTBLS.DAT) defines the various condition levels which will prompt HERS-ST to analyze a section for possible improvement.

Results

Results from HERS-ST model analysis will be grouped and discussed by improvement categories for reporting purposes. Those categories are preservation, reconstruction and expansion.

- **Preservation** is simply the regular maintenance and resurfacing of a road. When a road has pavement deteriorating to unacceptable levels, resurfacing is the improvement choice to maintain the integrity of the roadway. Preservation is the most common improvement type.

- **Reconstruction** is the improvement of an existing roadway by upgrading the geometrics and functionality of the segment. Improvements such as widening lanes and shoulders are examples of reconstruction. Reconstruction identifies roadways that are so structurally deficient that it cannot be repaired by resurfacing alone and must be rebuilt.

- **Expansion** deals with the need to provide additional capacity in order to address congestion issues. When future volumes exceed a minimum threshold levels, the HERS-ST model looks to add new lanes and to alleviate the congestion and maintain an acceptable level of service. It is the costliest improvement type on average. Thus it will most likely be a more beneficial solution for roadways with heavy traffic volumes, like interstates and freeways.

The following outlines some of the more important variable that should be addressed at the beginning of the analysis process. These are by no means the extent of the variable inputs and there will be other inputs of varying degree to determine within the HERS-ST model.

Parameters

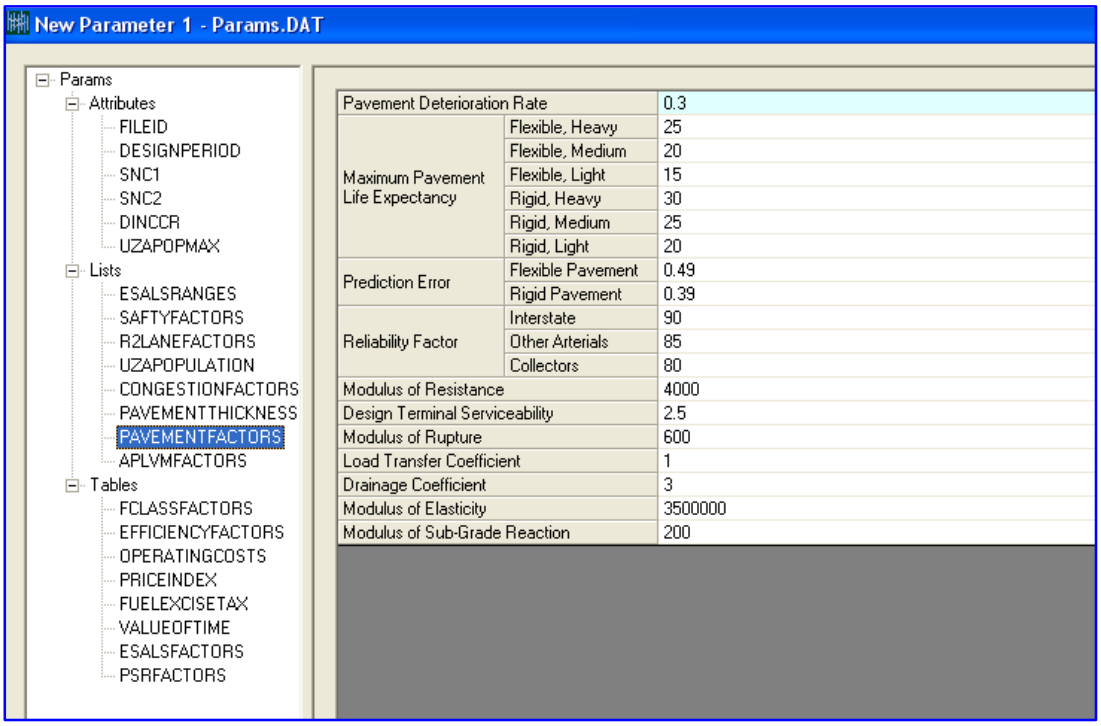
The pavement factors are very important for determining the highway preservation needs over time. Pavement Factor table from HERS-ST used for Arkansas highway needs analysis is shown in **Figure B-1**.

Two important pavement factors that will impact the highway needs are:

- **Pavement Deterioration Rate (PDR)** is the maximum deterioration rate that HERS-ST will assume for any pavement.

- **Maximum Pavement Life Expectancy** is also critically important for determining preservation needs over time.

Figure B-1: Pavement Factors - Key Determinant of Resurfacing Needs

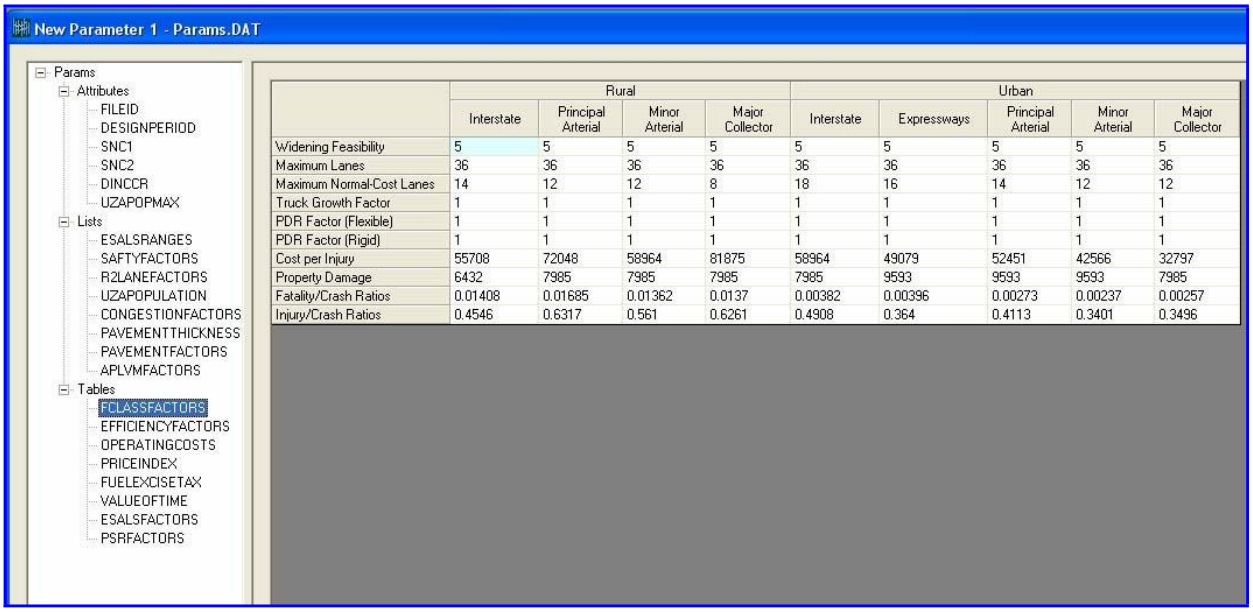


Many important determinants of highway needs vary by functional classification. Few key parameters that impact the highway needs are discussed below.

- **Maximum Lanes** – If the "Maximum Lanes" parameter is set too high; HERS-ST will assume Arkansas needs to continue widening a facility as traffic grows regardless of its number of existing lanes. An unrealistically high "Maximum Lanes" parameter is often a reason for analyses showing exceptionally high highway expansion requirements. The higher the "Maximum Number of Lanes", the greater the expansion needs found in the analysis.

- **Maximum Number of Normal Cost Lanes** – If a highway requires a capacity improvement for a number of lanes beyond the "Maximum Number of Normal Cost Lanes", HERS-ST will assume that these improvements will be made at a higher cost. In **Figure B-2**, maximum number of "Normal Cost Lanes" assumes that any lanes more than fourteen on rural interstates will require a higher cost than adding lanes up to 14 lanes (7 in each direction). The higher the maximum number of normal cost lanes, the lower the overall cost of expansion needs in the analysis.

Figure B-2: Functional Class Factors - Key Determinants of Major Widening and High Cost



	Rural				Urban				
	Interstate	Principal Arterial	Minor Arterial	Major Collector	Interstate	Expressways	Principal Arterial	Minor Arterial	Major Collector
Widening Feasibility	5	5	5	5	5	5	5	5	5
Maximum Lanes	36	36	36	36	36	36	36	36	36
Maximum Normal-Cost Lanes	14	12	12	8	18	16	14	12	12
Truck Growth Factor	1	1	1	1	1	1	1	1	1
PDR Factor (Flexible)	1	1	1	1	1	1	1	1	1
PDR Factor (Rigid)	1	1	1	1	1	1	1	1	1
Cost per Injury	55708	72048	58964	81875	58964	49079	52451	42566	32797
Property Damage	6432	7985	7985	7985	7985	9593	9593	9593	7985
Fatality/Crash Ratios	0.01408	0.01685	0.01362	0.0137	0.00382	0.00396	0.00273	0.00237	0.00257
Injury/Crash Ratios	0.4546	0.6317	0.561	0.6261	0.4908	0.364	0.4113	0.3401	0.3496

- **Normal and High Cost** – The HERS-ST model differentiates between lanes added at "Normal" and "High" cost. New lanes are added at normal cost when they do not violate the state-supplied Widening Feasibility code (WDFEAS) for the section, as found in the HPMS data. The user has the option of allowing lanes beyond those permitted by the state code if the benefit outweighs the increased cost of Right of Way (ROW) acquisition, which is usually obtained from the agency's relevant information. This is identified by the maximum lane limit (MAXLNS). These lanes are added at high cost. It is possible for a section to be improved by the addition of lanes at both cost levels: HERS-ST reports these improvements as high cost lanes in the output statistics.

Lanes Needed

- **Widening Feasibility** is another value that influences the ability to expand the system. These values specify a system widening feasibility that overrides the widening feasibility of individual sections coded within the HPMS data. When the override code allows for more widening than a section's HPMS code, HERS-ST may consider additional widening options. Lanes that are added up to the level of the sections HPMS code are treated as normal-cost lanes (up to the aforementioned limit) while lanes added beyond the sections code are treated as high-cost lanes.

  Widening codes are as follows:

1	None
2	Partial Lane
3	One Lane
4	Two Lanes
5	Three + Lanes

- **Present Serviceability Rating (PSR) Factors** are important for HERS-ST to determine Full Engineering Needs. The Reconstruction level gives the maximum PSR that can be expected after a lane-mile of highway with a given pavement type is reconstructed. Present Serviceability Rating Factors are directly related to international Roughness Index (IRI) and Pavement Condition Index (PCI) regarding pavement condition. The IRI is a scale for roughness based on the simulated response of a generic motor vehicle to the roughness in a single wheel path of the road surface. PCI is a value that represents roadway pavement condition. PCI is based on several factors such as smoothness, rutting, and cracking. It is assumed for example, that when a High- Flexible Rural pavement is reconstructed, it is restored to a PSR level of 5.0. This affects the number of years (or funding periods) before the segment will require resurfacing. The higher the reconstruction PSR level, the less preservation need will be found on the system.

Improvement Costs

Improvement Costs are the average costs assumed to make different types of improvements to a lane-mile of highway. They may vary by functional classification, area type and terrain. Improvement costs are typically input to HERS-ST in thousands of dollars.

The HERS-ST unit costs include both improvement and right-of-way (ROW) costs, but do not include costs such as unusual cut and fill operations, excessive number of structures, or non-construction costs. For example, the HERS-ST unit costs include costs for right-of-way, grading, drainage, shoulder, utility, curb and gutter. The unit costs do not include costs for engineering, maintenance and other non-construction related work.

A description of the improvement types used in HERS-ST is as follows:

- **Reconstruction with Wider Lanes** – Complete reconstruction with wider lanes than the existing section. No additional lanes are added. Shoulder and drainage deficiencies are corrected.
- **Pavement Reconstruction** – Complete reconstruction without adding or widening lanes. Any other shoulder or drainage deficiencies are corrected.
- **Resurface with Wider Lanes** – This improvement includes resurfacing the existing lanes and other minor work such as shoulder and drainage work. The added width yields wider lanes or shoulders, but no additional lanes.
- **Resurfacing** – The overlay of existing pavement.
- **Resurfacing with Shoulder Improvements** – The overlay of existing pavement plus the widening of shoulders to design standards. A minor amount of additional right-of-way may be acquired.
- **Add Lanes** – The addition of lanes to an existing facility. Lanes added in excess of the state- coded widening feasibility code are added at high cost – otherwise, lanes are added at normal cost. This improvement includes resurfacing the existing lanes and other minor work such as shoulder and drainage work.

- **Alignment** – Complete reconstruction with the addition of lanes to the existing section. Lanes added in excess of the state-coded widening feasibility code are added at high cost – otherwise, lanes are added at normal cost. Shoulder and drainage deficiencies are corrected.

Figure B-3 summarizes the unit costs for the various improvement types used for Arkansas. It is important to note that the unit costs are in 2013 dollars.

Figure B-3: Improvement Cost Table - Cost in Thousands per Lane Mile

$$ in Thousands Per Lane Mile			Reconstruction		Resurface		Shoulder Improve-ments	Add Lanes		Alignment	
	2013$		Lane Widening	Pavement	Lane Widening	Pavement		Normal Cost	High Cost	Normal Cost	High Cost
Rural	Interstate	Flat	2,450	1,600	366	150	120	3,875	3,875	6,750	6,750
		Rolling	2,450	1,600	366	150	120	3,875	3,875	6,750	6,750
		Mountainous	2,695	1,760	403	165	120	4,263	4,263	10,400	10,400
	Principal Arterials	Flat	1,850	1,500	1,850	93	100	1,850	1,850	4,725	4,725
		Rolling	1,850	1,500	1,850	93	100	1,850	1,850	4,725	4,725
		Mountainous	2,035	1,650	2,035	102	100	2,035	2,035	5,675	5,675
	Minor Arterials	Flat	1,850	1,500	1,850	93	100	1,850	1,850	2,750	2,750
		Rolling	1,850	1,500	1,850	93	100	1,850	1,850	2,750	2,750
		Mountainous	2,035	1,650	2,035	102	100	2,035	2,035	2,975	2,975
	Major Collectors	Flat	1,850	1,500	1,850	93	100	1,850	1,850	1,700	1,700
		Rolling	1,850	1,500	1,850	93	100	1,850	1,850	1,700	1,700
		Mountainous	2,035	1,650	2,035	102	100	2,035	2,035	1,900	1,900
Urban	Interstates/ Expressways	Small Urban	2,695	1,760	587	150	120	4,560	4,560	8,800	8,800
		Small Urbanized	2,695	1,760	587	150	120	4,560	4,560	8,800	8,800
		Large Urbanized	2,964	1,936	646	165	120	5,016	5,016	10,850	10,850
		Major Urbanized	2,964	1,936	646	165	120	5,016	5,016	10,850	10,850
	Principal Arterials	Small Urban	3,450	1,650	3,450	93	120	3,150	3,150	3,175	3,175
		Small Urbanized	3,450	1,650	3,450	93	120	3,150	3,150	3,175	3,175
		Large Urbanized	3,795	1,815	3,795	102	120	3,465	3,465	3,493	3,493
		Major Urbanized	3,795	1,815	3,795	102	120	3,465	3,465	3,493	3,493
	Arterials/ Collectors	Small Urban	3,450	1,650	3,450	93	120	3,150	3,150	2,100	2,100
		Small Urbanized	3,450	1,650	3,450	93	120	3,150	3,150	2,100	2,100
		Large Urbanized	3,795	1,815	3,795	102	120	3,465	3,465	2,310	2,310
		Major Urbanized	3,795	1,815	3,795	102	120	3,465	3,465	2,310	2,310

Deficiency Levels

Deficiencies in HERS-ST refers to roadway characteristics based on the traffic level and terrain and whether it meets the Minimum Tolerable Conditions standards. If the record is identified as deficient, then HERS-ST triggers an improvement action.

Deficiency Level for Volume to Capacity Ratio

The "DLTbls" parameter in HERS-ST also defines a "Deficiency Level" for Volume to Capacity Ratio. This is the volume to capacity (V/C) ratio at which it is assumed that a roadway must be widened to accommodate its anticipated traffic level. When a segment is forecast to reach a deficient V/C ratio (as defined by the Highway Capacity Manual), it is assumed there is a need to add lanes to the segment, driving up the expansion "Need" found by the HERS-ST analysis.

The higher the deficiency level for V/C ratio, the lower the overall expansion need. For Arkansas, all interstate highways are assumed to be deficient with a V/C ratio of 0.7. Any

segment with a V/C ratio of 0.7 or more is considered to represent an expansion need. However, if the deficiency level were raised to 0.9, then fewer segments would be deficient and overall expansion needs would be less. Arterials and collectors are assumed to be deficient with a V/C ratio of 0.9.

The "deficient" V/C can be best understood as the highest V/C ratio the state is willing to accommodate before recognizing a need to add lanes.

Deficiency Level for Lane Width

HERS-ST also defines a "Deficiency Level" for Lane Width. This is the lane width that Arkansas seeks to maintain for all roadways with given traffic levels for each functional classification. As volumes increase, the required lane width is also expected to increase.

Therefore, the greater the deficiency level for lane width, the more reconstruction improvement need will be found by the HERS-ST model. For example, a Major Collector on flat terrain with a volume of 350 vehicles per day is considered deficient if its lane width is less than 8 feet. However, if in a future funding period, the traffic on this segment rises to 500 it would then be considered deficient with a lane width any less than 10 feet. The increase in traffic is assumed to result in a deficiency, which HERS-ST then recognizes as a reconstruction need.

The higher the deficiency level (or the lane-width requirement), and the more sensitive lane-width requirements are to increases in traffic volumes, the more reconstruction needs will be found on the system in the HERS-ST analysis.

Deficiency Level for Shoulder Width and Type

HERS-ST also defines a "Deficiency Level" for Shoulder Width and Shoulder Type. As with lane width, this is the shoulder width that Arkansas seeks to maintain for all roadways with given traffic levels for each functional classification. As volumes increase, the required shoulder width is also expected to increase. Therefore, the greater the deficiency level for shoulder width, the more shoulder improvement need will be found by the HERS-ST model.

However, unlike lane width, deficient shoulders alone do not constitute an improvement need in HERS-ST. Instead, when reconstruction needs are found in HERS-ST, shoulder widths are checked against the specified deficiency levels, with shoulder improvements and their costs added to the project cost in a separate "shoulder" category.

As with shoulder width, there is a shoulder type that Arkansas seeks to maintain for all roadways with given traffic levels for each functional classification. As volumes increase, the required shoulder type is also expected to change. Therefore, the higher the volumes, the higher the standard for shoulder type.

As with shoulder width, deficient shoulder types alone do not constitute an improvement need in HERS-ST. Instead, when reconstruction needs are found in HERS-ST, shoulder widths are checked against the specified deficiency levels. Then, necessary shoulder improvements and their costs added to the project cost in a separate "shoulder" category.

Design Standards (DS)

Design standards specify the engineering level to which a segment will be rebuilt within the model analysis. These standards address items such as: surface type, lane, shoulder, & median width; curve, and grade. A segment will **not** be targeted for improvement simply because it does not meet the design standards laid out in the table, but will be modified during a reconstruction improvement when a segment is highlighted with a deficiency. Once a segment improvement is implemented with these predetermined designs, the segment will retain the characteristics within the software only. **Figure B-4** shows the default design standards.

Factors Specific to Cost/Benefit Analysis

The following are other important factors to address when preparing for a cost/benefit analysis.

User Criteria

Serious Deficiency Levels (SDL)

The SDLs are criteria for deficiencies that must be corrected if any improvement is made to the section, but they will not be corrected if no improvement is found to be worthwhile.

Unacceptable Levels (UL)

If requested by the user, ULs must be corrected, whether the best improvement is cost-effective or not. If the section is also deficient in pavement or capacity, this UL is voided.

Discount Rates

Discount Rate (DRATE)represents the diminishing buying power of the dollar over time from the base year. A rate of 3 percent is used for Arkansas highway needs analysis. Although HERS-ST discounts future benefits and costs using DRATE, HERS-ST does not support fluctuations in the value of the dollar and conducts all evaluations using constant dollars.

Figure B-4: Design Standards

			Surface Type	Lane Width (ft)	Rt Shoulder Width (ft)	Curve Categories	Grade Categories	Median Width
RURAL	Interstate	Flat	2	12	12	1	3	64
		Rolling	2	12	10	1	3	64
		Mountainous	2	12	8	3	5	46
	Principal Arterials AADT > 6000	Flat	2	12	10	1	3	46
		Rolling	2	12	10	1	3	46
		Mountainous	2	12	8	3	5	46
	Principal Arterials AADT < 6000	Flat	2	12	10	1	3	46
		Rolling	2	12	10	1	3	46
		Mountainous	2	12	8	3	5	46
	Minor Arterials AADT > 2000	Flat	2	12	8	1	3	46
		Rolling	2	12	8	2	3	46
		Mountainous	2	12	8	3	5	46
	Minor Arterials AADT < 2000	Flat	3	12	8	1	3	0
		Rolling	3	12	8	2	3	0
		Mountainous	3	12	6	3	5	0
	Major Collectors AADT > 1000	Flat	3	12	8	2	4	46
		Rolling	3	12	8	3	5	46
		Mountainous	3	12	6	4	6	46
	Major Collectors AADT > 400	Flat	4	12	4	2	4	0
		Rolling	4	12	4	3	5	0
		Mountainous	4	12	4	4	6	0
	Major Collectors AADT < 400	Flat	4	12	4	2	4	0
		Rolling	4	12	4	3	5	0
		Mountainous	4	12	4	4	6	0

		Surface Type	Lane Width (ft)	Rt Shoulder Width (ft)	Shoulder Type	Curve Categories	Median Width
Urban	F/E by design	2	12	10	3	3	20
	Other divided	2	12	10	3	3	-
	Undivided arterials	2	12	9	3	3	-
	Undivided collectors	3	12	8	3	3	-

Curve Category	Grade Category	Surface Type	Shlder Type
1-All Crv Appropriate	1-All Grd Appropriate	2-High	1-Surfaced
2-All Curves Accept	2-All Grades Accept	3-Intermediate	2-Stabilized
3-Some Reduce Speed	3-Some Reduce Speed	4-Low	3-Earth
4-Significant Curves	4-Significant Grades	5-Unpaved	4-Curbed