TRC1608

Locating Transload Facilities to Ease Highway Congestion and Safeguard the Environment

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Final Report

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"Locating Transload Facilities to Ease Highway Congestion and Safeguard the Environment"

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Executive Summary

This Final Report provides a summary of the work accomplished for TRC1608, *"Locating Transload Facilities to Ease Highway Congestion and Safeguard the Environment"*. The goal of the project was to determine potential locations for transload facilities, estimate their construction costs, and evaluate their impacts on the environment and economy. Transload potential is defined by commodity type, weight and volume of shipment (current and forecasted), existing mode share, handling and storage requirements, transportation equipment needs, and shipment distance. Throughout the various tasks of the project, each of these criteria were considered and evaluated using a variety of data sources including data from the Arkansas Statewide Travel Demand Model (AR-STDM), a transload facility operator questionnaire, and economic impact analysis software, e.g. IMPLAN.

The project consisted of six key tasks: (1) development of a commodity GIS layer, (2) establishing criteria for selection of a transload facility by type and location, (3) estimation of basic costs for transload facilities by type, (4) performing an economic benefit analysis, (5) performing an impact analysis on the trucking industry, and (6) identification of potential funding options. This report summarizes the outcomes of each tasks. Key findings from major project tasks are summarized in the following paragraphs.

Selection of Transload Facility Locations

Using commodity production and consumption data extracted from the AR-STDM, potential transload sites in Pulaski and Benton/Washington Counties were identified. These sites had the highest total production and consumption tonnage compared to all other counties in Arkansas. Three additional counties (Hot Spring, Jefferson, and Crawford/Sebastian) were selected as potential transload facility locations based on stakeholder interviews. These sites serve to enable transload of a specific commodity.

Table 1-1 ranks the proposed facilities by total tonnage and summarizes the mode access, total tonnage, and major commodity groups served by each proposed facility. The total tonnage is the combined production and attraction of the key commodity groups within a 20-mile drayage area. The first two list facilities resulted from an analysis of commodity flows and thus have substantially higher tonnage than the latter three locations. The locations identified for Jefferson (Pine Bluff), Hot Spring (Malvern), and Crawford/Sebastian (Van Buren) were proposed by stakeholders to transload a specific commodity.

TABLE 0-1. SUMMARY OF PROPOSED TRANSLOAD FACILITIES

Facility Location	Mode Access	Total Tonnage[1] *(million ton-miles)*	Major Commodity Groups *(share of ton-miles)*
Pulaski	Rail/Barge	11.7	• Nonmetallic minerals (53%) • Primary metal (22%) • Secondary and misc. mixed (17%) • Durable manufacturing (8%)
Benton/Washington	Rail	4.2	• Secondary and misc. mixed (40%) • Food (34%) • Durable manufacturing (23%) • Chemicals (2%)
Hot Spring[2]	Rail	0.50	• Lumber
Jefferson[2]	Rail/Barge	0.14	• Farm products
Crawford/Sebastian[2]	Rail/Barge	0.16	• Farm products

1. Based on forecasted (2040) total of production and attraction of key commodities within a 20-mile drayage area.
2. Result of stakeholder input

Estimation of Facility Costs
For each of the proposed facilities, the total construction costs were estimated using a unit cost estimation database called RSMeans. Unit costs for components belonging to six categories (site preparation, infrastructure, truck access, rail access, barge access, and equipment) were compiled into the total construction cost.

Table 1-2 ranks the facilities by total construction cost and summarizes the estimated construction costs of each facility. The Benton/Washington facility has the highest estimated cost while the site in Pulaski has the lowest estimated cost. This is primarily due to the high costs associated with storage. The average facility cost is approximately $21 million.

TABLE 0-2. PROPOSED TRANSLOAD FACILITIES IN ARKANSAS

Facility Location	Approximate Storage Area *(acres)*	Total Facility Construction Cost *(million dollars)*
Benton/Washington	19	$25.3
Jefferson	15	$21.6
Crawford/Sebastian	15	$21.6
Hot Spring	16	$20.9
Pulaski	6	$13.0

Estimation of Economic Benefits
Economic impacts were estimated using IMPLAN (IMpact analysis for PLANning). IMPLAN is a regional impact tool that measures the economic impact of industry and development activities. For each transportation sector (trucking, rail, and water), the direct and total impacts on employment and economic output were estimated for each facility.

Figure 1-1 summarizes the economic impact analysis for the five proposed sites. The impacts are shown in terms of the ratio of economic output (measured in dollars) to employment (measured as the number of jobs) of direct impacts by transportation sector (water, rail, and truck). In terms of the direct impacts, the impact of investment in the water sector has the greatest benefit (highest ratio) in Jefferson County while the impacts of investment in the rail or trucking sectors are approximately equal across all counties. The impact of investment in water and rail is greater than that of trucking across all counties. Based on the economic impacts alone, investment into a facility to transload from truck to water in Jefferson County would have the largest impacts on the regional economy.

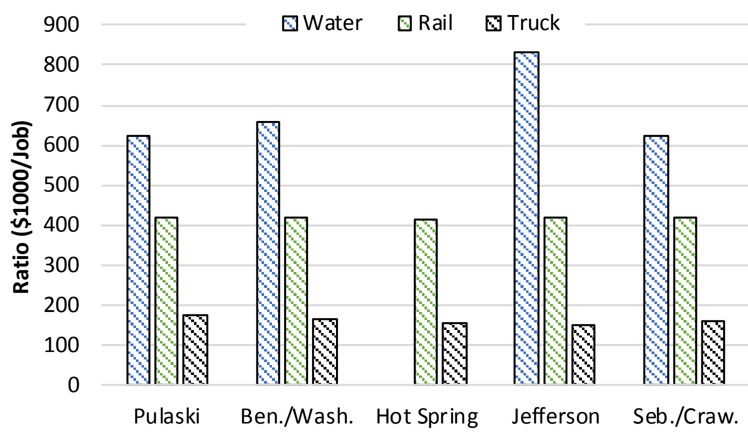


FIGURE 0-1. SUMMARY OF ECONOMIC DIRECT IMPACTS BASED ON RATIO OF OUTPUT TO EMPLOYMENT

Impacts on the Trucking Industry

To estimate the impacts on the trucking industry, different mode shift scenarios were analyzed. The scenarios are specified by the amount of tonnage expected to shift from truck to either rail or barge. For each scenario, the amount of reduced emissions and annual trucks were estimate along with the number of rail cars and barges needed to accommodate the shifted freight tonnage.

Table 1-3 ranks the proposed sites by estimated savings in CO_2 emissions and summarizes the projected annual trucks, railcar, and barge volumes assuming a 5% shift in the total tonnage to either rail or barge. Based on the ranking in **Table 1-3**, the greatest savings in CO_2 emissions could be gained by constructing a new transload facility in the Benton/Washington area.

It is important to note that a shift of only 5% of the commodities for the facilities recommended through stakeholder interviews produces an unreasonably low annual volume of barges and rail cars. Thus, for Jefferson, Hot Spring, and Crawford/Sebastian Counties, for these facilities to be feasible, a higher percentage of commodities would have to shift to rail or barge. Feasibility of tonnage is based on benchmark values found in the literature. For smaller scale facilities, a benchmark of 800 carloads per year equivalent rail volume was cited for the Gieger Spur Transload Facility in Washington State (*HDR, 2007*).

TABLE 0-3. SUMMARY OF FORECASTED IMPACTS FOR PROPOSED FACILITIES

Facility Location	CO_2 Emissions Savings[1] *(1000 pounds CO_2)*	Annual Trucks[2]	Annual Railcars[2]	Annual Barges[2]
Benton/Washington	1,200	10,488	4,196	-
Hot Spring	400	974	384	-
Crawford/Sebastian	300	498	84	5
Jefferson	200	424	71	5
Pulaski	65	25,778	8,345	391

1. Based on an assumed 5% shift in tonnage to alternate mode
2. Based on forecasted tonnage for 2040

General Conclusions

Using two different approaches, e.g. commodity flow analysis and stakeholder input, five possible transload sites were identified in this project. Single page site briefs were prepared to summarize the site characteristics and impacts for each of the recommended locations. These can be found in the Appendix. Based on tonnage captured, economic impacts, cost, and emissions savings, there is no single site dominates. Stakeholders should compare each site based on the identified measures described above and determine which measure is most suitable to their goals. For instance, the ARDOT may wish to weigh the emissions savings as the most important factor, thus leading to a final selection of a site in Benton/Washington County. The Arkansas Economic Development Commission (AEDC) on the other hand may consider economic impacts to be the most important. Thus, leading them to a final selection of a site in Jefferson County that provides access to water. The results and methods developed in this project are repeatable and scalable. Should the ARDOT or other stakeholders with to apply the analysis framework to future years or to different regions, this report provides a means to do so.

Introduction and Background

Increasing transportation costs are a concern for both suppliers and consumers. These costs have spurred major innovation in both logistics and planning in the transportation sector. In addition to the economic concerns, there is a demand for building a clean and efficient 21st century transportation network. As the price of fuel, concerns of environmental degradation, and costs to maintain highway infrastructure continue to increase, shifting freight to more efficient modes is critical.

The vast majority of freight is transported throughout the U.S. by truck *(FHWA, 2017)*. However, there are several benefits that could be obtained by shippers, business, and consumers by shifting freight to more efficient transportation modes, such as rail or water, or adopting a multimodal transportation scheme. Use of rail and barge is associated with lower transportation and infrastructure maintenance costs, release of highway capacity, increased safety, and lower emissions (*Bhamidipati and Demetsky, 2008; Bryan et al., 2008; and Natchmann et al., 2015)*. While trucks benefit from the high accessibility provided by the roadway network, barge and trains are frequently more cost effective for long haul shipments but have more limited accessibility.

Multi-modal freight transportation has grown rapidly over the last thirty years, and is often considered the fastest growing segment of transportation. Multi-modal freight movements present an efficient alternative to long-haul trucking and freight transfer facilities play a key role in multi-modal connectivity. The potential of modal shifts to reduce congestion, pavement damage, and emissions has urged transportation planners to closely examine the role of freight transfer facilities in multi-modal transportation networks. As a result, several states including Ohio, Maine, and Washington have invested in transload facilities, through financing from the state legislature, to alleviate highway congestion caused by freight movements *(Bryan et al., 2007)*.

Provision of conveniently located freight transfer facilities such as intermodal rail terminals, marine ports, or bulk-transfer facilities give freight shippers and receivers the ability to choose the most cost effective modes. Improved access to more efficient transportation modes would increase competitiveness of businesses willing to use those modes by improving their access to key markets. From a business perspective, the number and location of freight facilities in the transportation network have a direct impact on the cost of the final product, and a positive effect on the ability of a region to attract industries and trigger economic growth *(Steele and Hodge, 2011)*. Moreover, the ability for a state or region to offer a wide array of transportation options can bolster economic development programs aimed at attracting new industries to a region.

Transload Facilities

The type and size of facility that best suits a region depends on the characteristics of regional freight, which is shaped by shippers, the transportation network, and the type, quantity, and shipment distances of commodities *(Thompson, 2012).* There are different types of freight-transfer facilities, including intermodal and transload terminals that help optimize the modal distribution of freight. One solution to optimizing the modal distribution of freight flows is by establishing transload facilities. This type of facility is of particular interest to regions with significant amounts of bulk, warehouse, and dimensional commodities moving over longer distances *(BTS, 2015)*. Transload facilities are defined as “receiving and distributing [facilities] for lumber, grain, concrete, petroleum, aggregates, and other such bulk products” that provide access to multiple transportation modes *(Steele and Hodge, 2011)*. In addition to truck, highway, and barge, it should be noted, pipeline transport is can also be incorporated into a transload facility. Pipelines are highly efficient for shipping liquid products. However, pipelines were not considered in this research project. A transload facility differs from an intermodal facility which primarily handles containerized goods *(Jones et al., 2000)*. Transload facilities handle commodities that, unlike containerized freight, can be broken down into smaller volumes and shifted between storage types (e.g. railcar, semi-tractor trailer, barge storage).

Examples of bulk products are grain, aggregate, coal, and cement; dimensional goods include lumber, steel coils, beams and pipes; equipment products are military, farm and earthworks’ equipment; and warehouse goods examples are paper, canned foods, hardwoods, plywood panels, or refrigerated foods *(Thompson, 2012).* While feasible intermodal facilities require 100,000 train carloads traveling for 2,000 miles annually *(Steele and Hodge, 2011)*, feasible transload facilities operate at much lower capacities of 1,500 annual carloads *(Thompson, 2012).* Transload facilities, therefore, are more attractive to regions with relatively smaller amounts of freight and are the focus of this paper.

Transload facilities range from small, single location sites that provide transfers between only two modes and are managed by a single company, to larger facilities with multiple locations across the state, region, or country that handle a variety of commodities, provide access to multiple modes, and are managed by a larger conglomerate. Locations of transload facilities are typically driven by proximity to railroads and/or a waterway. **Figure 1-1** provides an aerial image of a transload site in Northwest Arkansas. This site is located along a Class III rail line that connects to a Class I rail line. The site contains railcar storage, covered storage, paved and unpaved outdoor storage, and warehouse storage and handles a variety of commodities.

FIGURE 0-1. EXAMPLE OF TRANSLOAD SITE IN NORTHWEST ARKANSAS (MAPS.GOOGLE.COM)

Multimodal Freight Transportation in Arkansas

In Arkansas, the Arkansas River has a robust marine port network (**Figure 1-2a**). There are five commercially navigable rivers in Arkansas totaling 1,000 miles *(26).* The Mississippi river constitutes Arkansas' Eastern boundary. Arkansas has 2,662 miles of active rail lines, 1,683 miles of which are operated Class I railroads and the remaining 979 miles operated by 23 short-line, Class III railroads (**Figure 1-2c**) *(ARDOT, 2015)*. The highway network consists of 16,444 miles of state highways (8,447 of which are the Arkansas Primary Highway Network, APHN; **Figure 1-2b**).

However, the provision of a multi-modal transportation network alone does not warrant demand for a given type of freight transfer facility. Commodity characteristics such as type (i.e. bulk, dimensional, warehouse), distance shipped, value, weight, and volume of shipments affect the location and type of transload facility.

Thus, it is necessary to study the distribution and characteristics of commodities in Arkansas to determine where and of which type a transload facility may be feasible. Data from the Commodity Flow Survey (CFS) illustrates how shipment distance, tonnage, and commodity type interact. Using data from the CFS, dominate shipment distances and mode shares by commodity type for shipments originating in Arkansas can be compared. For shipment originating in Arkansas, 24% of the tonnage of cereal grains are transported between 100 and 250 miles while 89% of the tonnage of gravel and crushed stone are transported less than 50 miles (*BTS, 2012*)[1]. The CFS data shows that for shipments of all commodities using only one mode with an origin in Arkansas, 55% percent of tonnage shipped by truck is shipped less than 50 miles (*BTS, 2012*). In comparison, 29% of tonnage shipped by rail travels less than 50 miles and 69% of tonnage shipped by water travels less than 50 miles (*BTS, 2012*). It is evident from these examples that there is variability in shipment characteristics based on commodity type and that no one criteria alone can define transload potential of a given commodity. In this research, we use a multi-criteria approach to evaluate transload potential that evaluates tonnage, distance, and proximity to the multi-modal network.

Figure 1-2 (a) Waterway Network

[1] Note that the commodity categories shown in CFS and detailed in the example are different than those in the Arkansas Statewide Travel Demand Model (AR-STDM). Also, the AR-STDM uses Transearch data, not CFS and therefore may produce different tonnage, distance, and mode share data.

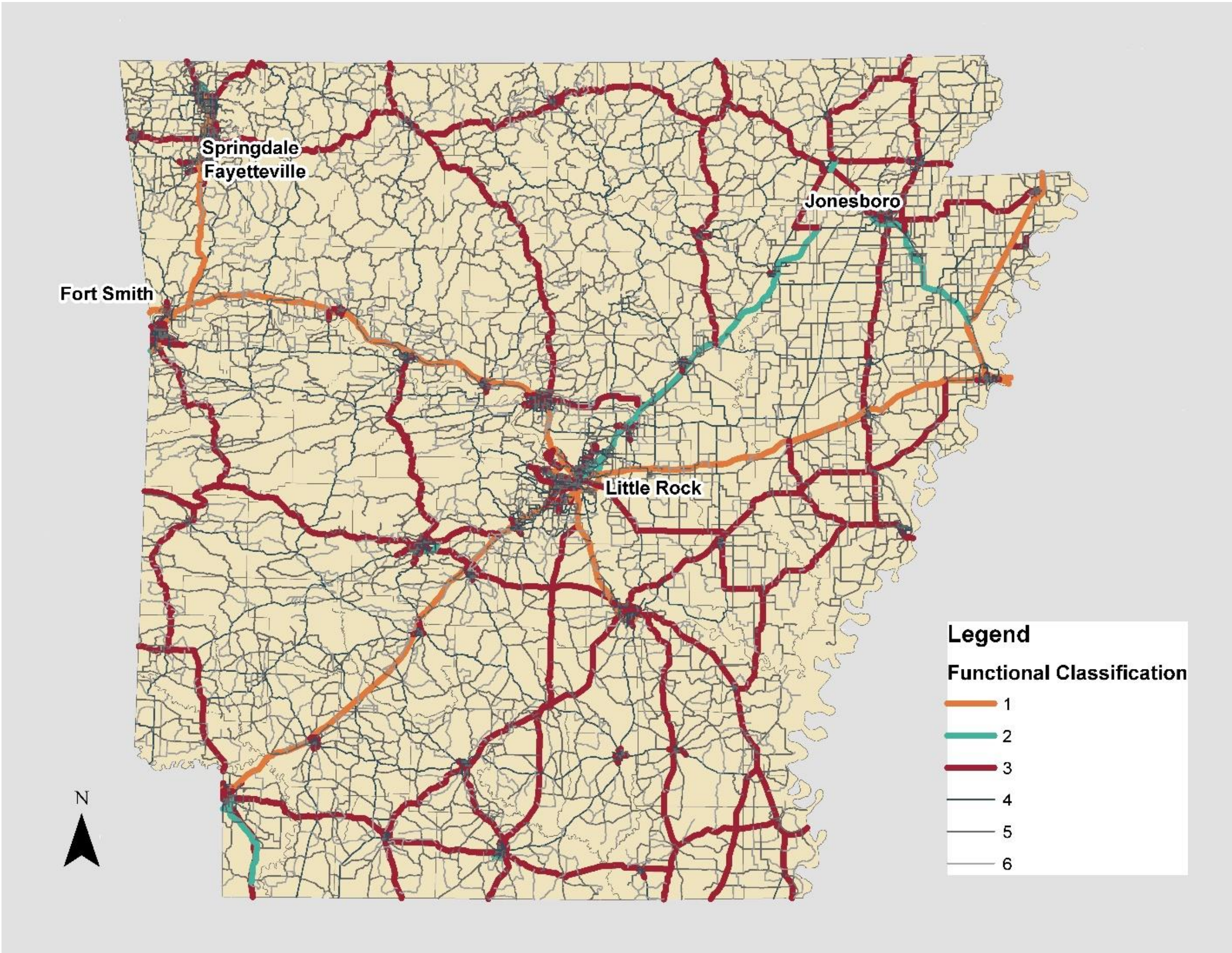


Figure 1-2 (b) Highway Network

(c) Rail Network

FIGURE 0-2. MULTIMODAL FREIGHT NETWORK IN ARKANSAS

Project Purpose and Scope

Given the potential of transload facilities to shift freight to more efficient modes to protect highway infrastructure and to attract industry to the state, the Arkansas State Highway and Transportation Department (ARDOT) and the Arkansas Economic Development Commission (AEDC) jointly sponsored a project to determine the potential market and location of new transload facilities in Arkansas. The intelligent siting of transload facilities to shift freight from truck to barge and train would better leverage the multi-modal transportation network of the State of Arkansas by tapping into the latent demand for short line rail, regional rail, and marine port terminals. However, optimal locations, types, costs, and impacts of potential transload facilities in Arkansas have not been previously established.

The decision-making process to find suitable locations for freight facilities starts with an examination of current and future needs, followed by network modeling, location screening, field validation, cost modeling, and ending with the final negotiations and site selection *(Steele and Hodge, 2011).* In particular, the first step adopts a planning framework to identify how current and future needs can be addressed by the proposed project. To develop such a framework, private companies rely on past experience, market knowledge, and proprietary business data to identify needs. For public agencies, this data is usually not available and other sources must be found. Statewide Travel Demand Models (STDMs) with freight components, like the Arkansas Statewide Travel Demand Model (AR-STDM), are one such source of facility planning data. Due to recent legislation, e.g. Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation Act (FAST) *(FHWAa, 2017; FHWAb, 2017)*, many states have developed STDMs with freight components to evaluate infrastructure needs and identify future system deficiencies. There is valuable data within these models that can be mined for multi-modal freight planning. This project uses the AR-STDMs to identify the main characteristics of regional freight, namely, commodity volume and Origin/Destination (OD) patterns.

Considerations as to the type, quantity, and shipment distances of import/export commodities are key factors in determining the type and size freight transfer facilities *(Thompson, 2012)*. The type of commodity dictates how it is handled, the mode of transport, and the storage requirements. In regards to storage, the type, amount of space required, and length of time the commodity will be stored are important considerations. An example could be aggregate, which may be stored in ground stockpiles until loaded into a truck or it could be stored in a rail car, which is typically at a facility for no longer than forty-eight hours *(Thompson, 2012)*. Storage can be covered, enclosed, uncovered paved, uncovered unpaved, or even rail cars. Modes of transportation, commodities, and storage also influence the equipment necessary to ensure efficient operation of the facility. Similarly, the availability and confluence of waterways, rail networks, and highway routes in a region play a significant role in determining the location of potential transfer facilities *(Steele and Hodge, 2011)*. Available land space near rail-lines and/or waterways is often a primary determinant for the location of a transload facility *(Barton et al., 1999)*. The modes of transportation served dictate certain features of the facility. For instance, if a facility services rail, rail spurs and some length of track are required, with the ideal rail capacity including two tracks with enough length to accommodate one train, which consists of 100 cars of length 60 feet per car *(MarTREC, 2015)*. A facility handling truck traffic, on the other hand, would require loading docks and enough pavement to allow for the required number of truck spots, which are 55 feet long by 11 feet wide *(MarTREC, 2015)*.

By combining spatial commodity production and consumption data with multi-modal transportation network data to develop criteria for siting of transload facilities, optimal locations for these facilities can be determined. The work carried out in this study will introduce a methodical approach to transload facility type and location selection that has not been applied in previous research to transload facilities. Rather, most studies discuss the costs and benefits of predetermined locations but lend little to the understanding of optimizing locations in light of particular commodity flows.

This project not only supports intelligent facility type and location selection but also provides the ARDOT and AEDC with cost estimates and benefit cost analysis for potential transload facilities. In general, the benefits of transload facilities include economic development through cost saving for commodity producers. A similar study to TRC1608 was executed in the state of Michigan in 2014, in which they compared 15 potential locations in the Upper Peninsula. In this study cost savings as high as 25% were forecasted by optimizing the location of transload facilities (*Rasul, 2014*). A second study in Virginia found that by optimizing the movement of freight by truck and rail reduced the number of truck miles in the Eastern Heartland Corridor by over 900,000 miles/year, and saved almost $300,000/year (*Bhamidipati and Demetsky, 2008*). As part of the project, a more rigorous review of other state's experiences will be explored in order to best quantify cost savings, transportation network impacts, and environmental impacts that can be achieved by optimizing the location of transload facilities, thus determining the highest benefit to the state of Arkansas.

Considering that the *Freight Analysis Framework* (FAF3), the federal freight forecasting model, predicts an increase of 47% (10,475 ton-miles) in outbound truck flows and an increase of 65% (11,092 ton-miles) in inbound truck flows for the State of Arkansas by the year 2040 (*FHWA*, *2015*), there is a significant need to develop transload transportation facilities. Because the Arkansas highway network is a critical component of the National Freight Network, any modal shift of inbound and outbound road-based freight flows to rail or barge modes will reduce demand on the highway network. Thus, the proposed work has direct benefits for the state but has far wider reaching benefits for the national freight system. In this vein, sources of federal funding and other forms of assistance can be explored as additional benefits of the project.

Methodology Overview

The project methodology is organized into the following six key tasks as shown in **Figure 2-1**. Each component is sequential with the outputs of one component serving as input to the next component as shown in **Figure 2-1**. For Task 1, we use data from the Arkansas Statewide Travel Demand Model (AR-STDM) and Transearch to develop a commodity production and consumption data layer using Geographic Information System (GIS) software. Additionally, we extract origin-destination (OD) data from the AR-STDM for use in Task 2. In Task 2, we determine potential locations for transload facilities by two methods. The first method relies primarily on commodity flow data. The second method relies primarily on stakeholder input. As a result, several potential transload sites were identified and characterized by type and quantity of commodity handled. Next, in Task 3, the total construction cost of each proposed facility was estimated using a proprietary database of construction unit costs. Then in Task 4, we assess the economic benefits of building and operating a transload facility in each of the proposed locations given the commodity types to be handled at the facility and the modes to be used. For Task 5, using commodity flow information including origin-destinations and commodity tonnages, we estimate the impacts of each proposed on vehicular emissions and in-state mileage. Additionally, through stakeholder interviews we provide a qualitative assessment of potential impacts on the trucking sector. Finally, a summary of available funding programs is provided in Task 6. After a discussion of the main data sources used in this project, the methodology and findings of each Task are described in detail in the proceeding sections.

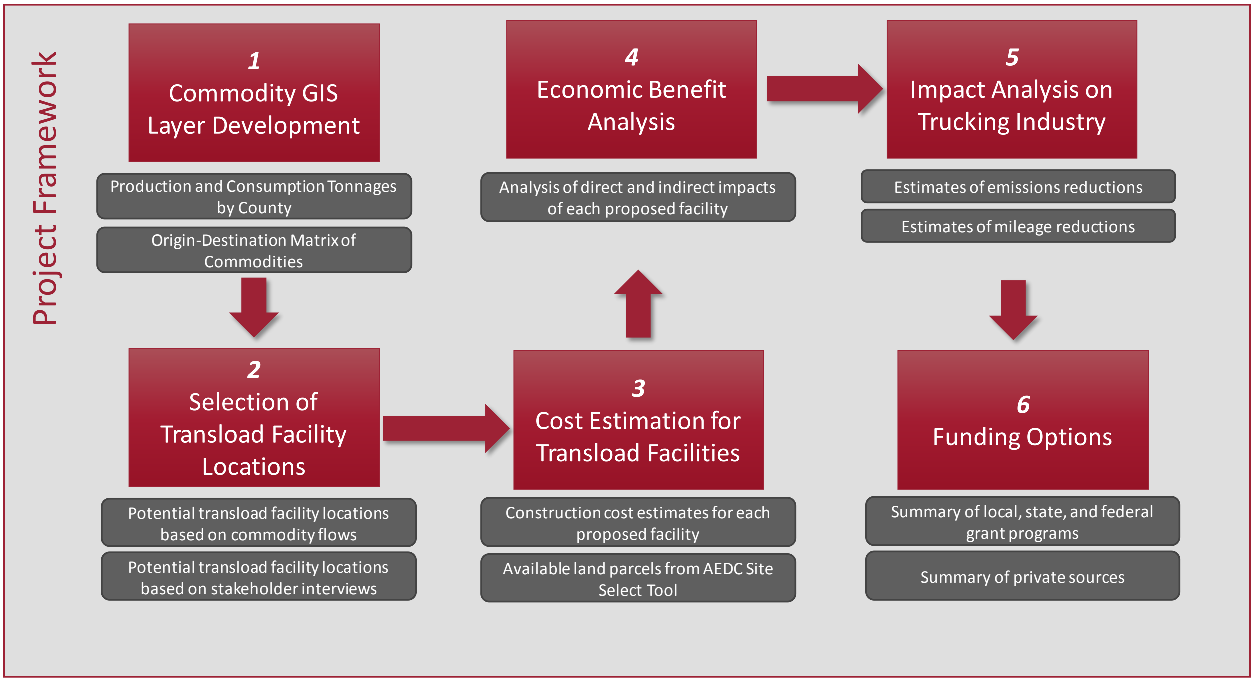


FIGURE 0-1. METHODOLOGY OVERVIEW

Data Sources

The analysis of transload facility types, locations, costs, benefits, and impacts required a variety of data sources. **Table 3-1** summarizes the data sources that were obtained from the ARDOT for this project. This included commodity tonnage and origin-destination data from the Arkansas Statewide Travel Demand Model (AR-STDM) and Transearch, facility locations from the Bureau of Transportation Statistics (BTS), unit cost estimates from RS Means, economic impact data from IMPLAN, and highway route mileage from PC Miler. To supplement available data, the research team developed two surveys and conducted interviews with stakeholders. The data created for the project is summarized in **Table 3-2**. **Figure 3-1** depicts how each data element supported the six project components. Details regarding each data source is provided in this section.

TABLE 0-1. SUMMARY OF DATA SOURCES OBTAINED

Data Source	Description	Application
Arkansas Statewide Travel Demand Model (AR-STDM)	The statewide travel forecasting model freight component is used to analyze and predict freight flows for the base (2010) and forecast (2040) years.	Commodity tonnage, origin-destination flows and distances, zoning structure, and transportation network were used to determine the location of potential transload facilities.
Transearch Database	This is a proprietary database of commodity flows consisting of base year estimates and forecasts.	Disaggregation of commodity tonnage into more distinct categories for transload facility location selection.
Intermodal Facility GIS Database	GIS layer of intermodal facility locations provided by the AR GIS Office and	Development of survey sample frame for the transload facility

	originally created by the US DOT's Bureau of Transportation Statistics (BTS) in 1998.	inventory and equipment surveys.
RS Means	Proprietary database of construction cost estimates.	Unit costs of facility infrastructure components to estimate total construction costs of each facility.
IMPLAN	IMPLAN (IMpact analysis for PLANning) is a regional impact tool that measures the economic impact of industry and development activities.	Estimation of direct and indirect economic effects of transload facilities at the county and state levels.
PC Miler	Proprietary software used by the private transportation sector to determine routes and operational costs for trucking, waterways, and rail	Estimation of the within state route distance for each of the top ranked origin-destination pairs served by the proposed transload facilities. Route distance was used to estimate emissions reductions and VMT in the state.

TABLE 0-2. SUMMARY OF DATA SOURCES DEVELOPED

Data Source	Description	Application
Transload Facility Inventory Survey	Created a database of existing transload facilities in AR characterized by facility type, modes served, location, and commodities handled. Developed via online survey of facility operators identified from the Intermodal Facility GIS Database	Comparison of existing facilities to proposed facilities; Determination of facility size and other key characteristics
Transload Facility Equipment Survey	Database of equipment needed to handle specific commodities. Developed through phone and email interviews of transload facility operators and managers	Cost estimation for equipment.
Stakeholder Interviews	Telephone and in-person interviews with key stakeholders including owners/operators of shipping companies, transload facilities, and trucking companies.	Informed the selection of transload sites not identified through commodity flow analysis. Addressed impacts on the trucking industry.

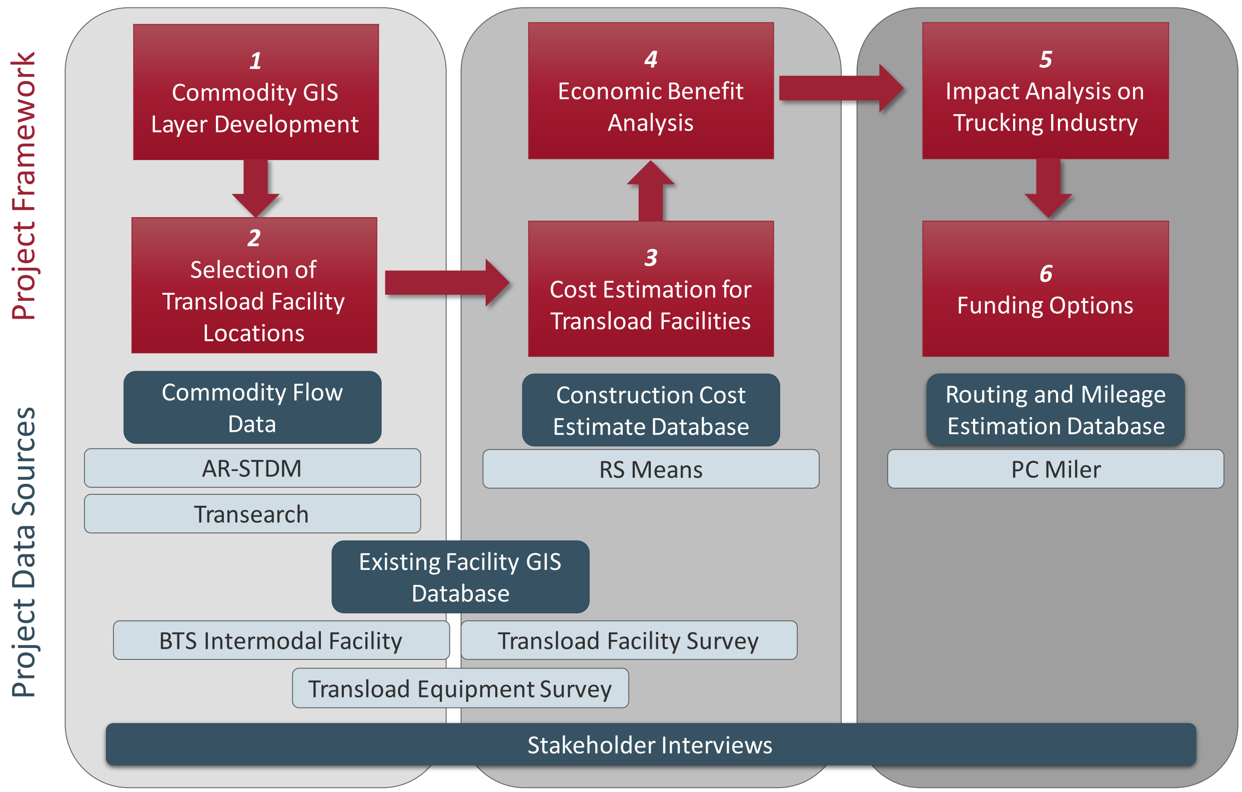


FIGURE 0-1. SUMMARY OF DATA SOURCES BY PROJECT COMPONENT

Arkansas Statewide Travel Demand Model (AR-STDM) and Transearch

Statewide Travel Demand Models (STDMs) are used for long-term travel forecasting and typically follow a sequential four-step approach: trip generation, trip distribution, mode choice, and route assignment *(Ortuzar and Willumsen, 2011).* In most cases, statewide models have two distinct components, a passenger model and a freight model, which are combined before route assignment. For the freight component, it is common to use commodity-based forecasting models *(NCFRP Report 8, 2010).* These are analogous to trip based passenger models with the replacement of person trips with commodity tons. Commodity data sources include publicly available data like the Commodity Flow Survey (CFS) or FAF, and/or proprietary sources such as Transearch *(NCFRP Report 8, 2010).* Commodity-based freight models first estimate production and attraction of freight (in annual tons) within each zone. Then, annual tons by commodity are distributed across origins-destinations (OD). Next, annual tons by OD pair are disaggregated by mode, generating OD matrices with annual tons of freight per mode, per commodity. STDMs may include truck, rail, water, air, and intermodal (a combination of modes, not containerized transport) modes.

This paper uses the AR-STDM commodity OD matrices to obtain truck tonnages by OD and commodity for the base year and to obtain all mode tonnages the forecast year. The use of STDM data to locate potential freight facilities is beneficial for state planners as it leverages an existing resource and requires no additional investment in proprietary data or surveys. The Arkansas Statewide Travel Demand Model (AR-STDM) freight component is a direct commodity model based on Transearch data *(Alliance*

Transportation, 2011). Notably, Transearch data has been used to assess the potential for modal substitution in previous studies *(Aultman-Hall et al, 2000).*

Zoning System

The zoning system for STDMs typically follows census boundaries aggregated to Traffic Analysis Zones (TAZs) and/or counties. While zones within the state can be disaggregated to TAZs, external zones tend to be much larger areas consistent with the FAF zones. The AR-STDM divides the state into Traffic Analysis Zones (TAZs). As shown in **Figure 3-2**, there are 5,849 total TAZs dividing the 75 counties in the State. Rural counties are subdivided into few TAZs while more urban counties contain many more TAZs. Washington County, for instance, is divided into 328 TAZs while rural Calhoun County is divided into only 19 TAZs. The AR-STDM segments the external zones, e.g. out-of-state zones, into larger regions. Regional boundaries are based on the Commodity Flow Survey (CFS) and Freight Analysis Framework (FAF) regions. In total there are 376 external zones across the US, Mexico, and Canada as shown in **Figure 3-3**.

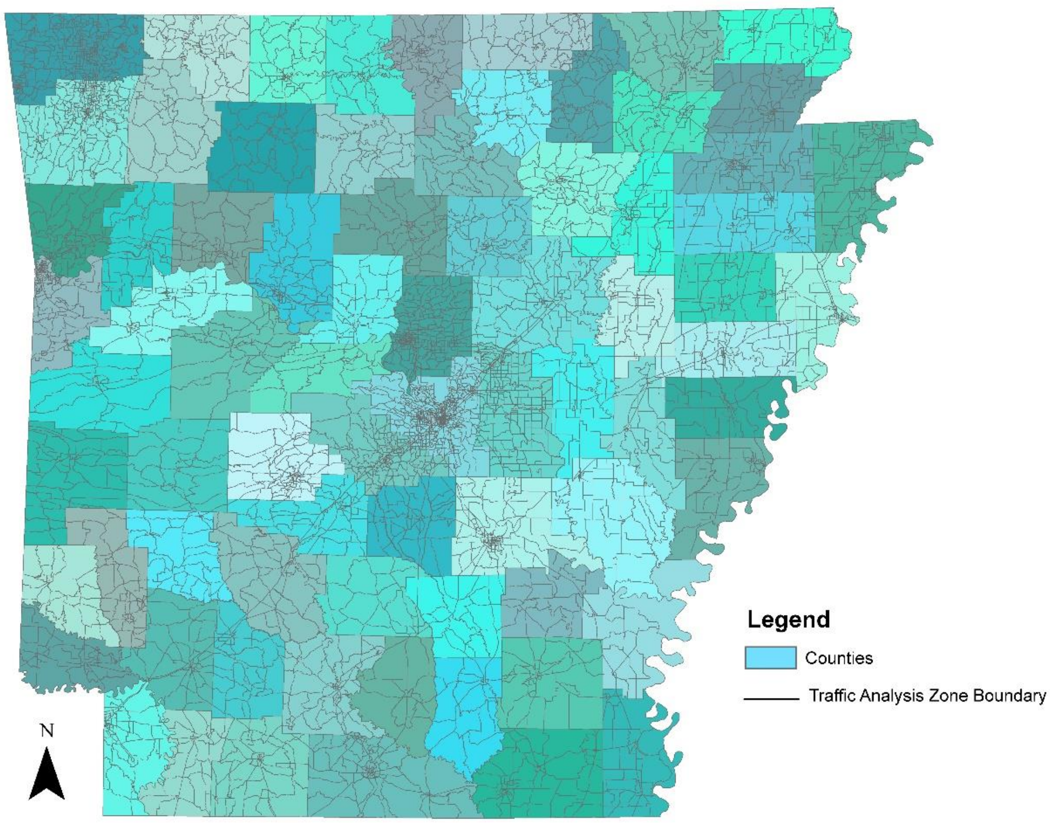


FIGURE 0-2. AR STDM TRAFFIC ANALYSIS ZONE MAP

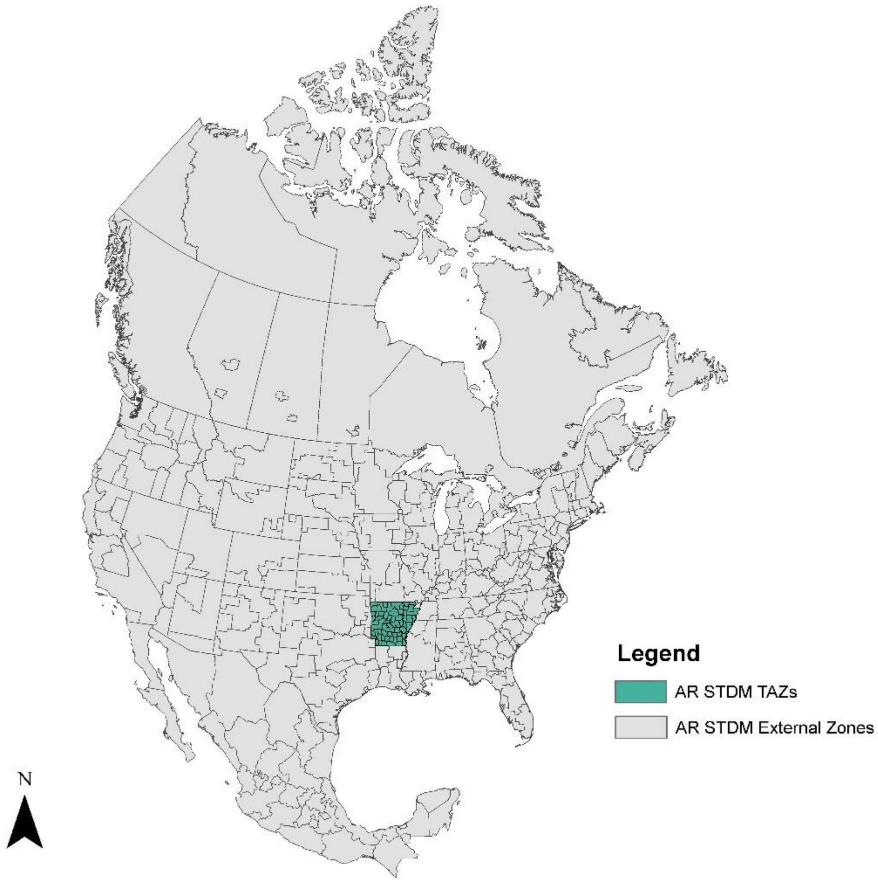


FIGURE 0-3. AR STDM REPRESENTATION OF EXTERNAL ZONES

Commodity Aggregation

The AR-STDM groups commodities into 15 categories as shown in **Table 3-3**. Because this grouping is very broad, the research team sought to use supplementary data to disaggregate each commodity group. For example, AR-STDM Commodity Group (CG) 1 pertaining to agriculture includes forest products, field crops, and livestock. With this broad category it would be difficult to infer the transload potential of the CG, i.e. it is not feasible to transload livestock while it's very feasible and economical to transload field crops such as corn.

To further refine the transload potential based on commodity tonnage, the research team obtained disaggregate commodity data from the ARDOT Planning Division's Transearch database. Disaggregate commodity data refers to the breakdown of the AR-STDM commodity groups into Standard Transportation Commodity Codes (STCC). An STCC is a seven-digit numeric code representing 38 commodity groupings. The STCC code is hierarchical in that the first two digits represent the commodity group, and succeeding digits further specify the commodity type. For example, STCC group 01 is for agriculture, 011 specifies field crops, 0113 specifies grains, and 01133 specifies oats. It should be noted that the commodity groups in the AR STDM are not the same as the STCC two-digit commodity groups. Rather, each AR STDM commodity group is a combination of STCC two-digit groups as shown in **Table**

3-3. The commodity data in the AR STDM was further disaggregated by STCC code using supplementary data provided by the ARDOT Planning Division. Additional data included: (1) disaggregate commodity tonnage data for the top ranked origin-destination (OD) pairs for all commodities, and (2) disaggregate commodity tonnage for specific commodity groups for specified sets of OD pairs.

The commodity data included in the AR-STDM are aggregated to the county level, not the TAZ level. Therefore, the majority of the analysis to determine transload facility locations are performed at the county level. Once feasible transload facility locations were determined at the county level, commodity data was disaggregated to the TAZ level in order to specify the location for the proposed transload facility.

TABLE 0-3. AR STDM COMMODITY GROUPS AND STCC TWO DIGIT LEVEL DISAGGREGATION

Commodity Group		STCC Two Digit Code	STCC Two Digit Name
1	Farm Products	1	Agriculture
		8	Forest Products
		9	Fish
2	Mining	10	Metallic Ores
		13	Crude Petroleum
3	Coal	11	Coal
4	Nonmetallic Minerals	14	Nonmetallic Minerals
5	Food	20	Food
6	Consumer Manufacturing	21	Tobacco
		22	Textiles
		23	Apparel
		31	Leather
7	Non-Durable Manufacturing	27	Printed Goods
		30	Rubber/Plastics
8	Lumber	24	Lumber
9	Durable Manufacturing	19	Ordnance
		25	Furniture
		34	Metal Products
		35	Machinery
		36	Electrical Equipment
		37	Transportation Equipment
		38	Instruments
		39	Misc. Manufactured Products
10	Paper	26	Paper
11	Chemicals	28	Chemicals
12	Petroleum	29	Petroleum
13	Clay, Concrete, Glass	32	Clay, Concrete, Glass, Stone
14	Primary Metal	33	Primary Metal
15	Miscellaneous Mixed	40	Waste
		41	Misc. Freight Shipments
		42	Shipping Containers
		43	Mail

		44	Freight Forwarder Traffic
		46	Misc. Mixed Shipments
		47	Small Packaged Freight
		48	Hazardous Materials
		501	Secondary Traffic

Intermodal Facility GIS Database

ARDOT provided a list of intermodal sites from 1998 that was derived from the US DOT Bureau of Transportation Statistics' National Transportation Atlas Database (NTAD) *(AR GIS Office, 2016)*. The ARDOT file represents the Arkansas portion of the national Intermodal Terminal Facilities data set and contains data on highway-rail and/or rail-water transfer facilities in Arkansas. The sites contained in the NTAD for Arkansas are shown in **Figure 3-4**. Overall, 43 transload facilities were identified from the BTS database. Eleven sites provided access to three modes (truck, rail, and water), ten provided access to truck and rail, and 22 provided access to truck and water. For each intermodal terminal, the database provides the location (latitude and longitude) and name of the facility. It should be noted that not all facilities included in the list are currently operational. Thus a facility inventory survey was conducted to verify the existence of each location and to determine locations developed after the 1998 list was produced.

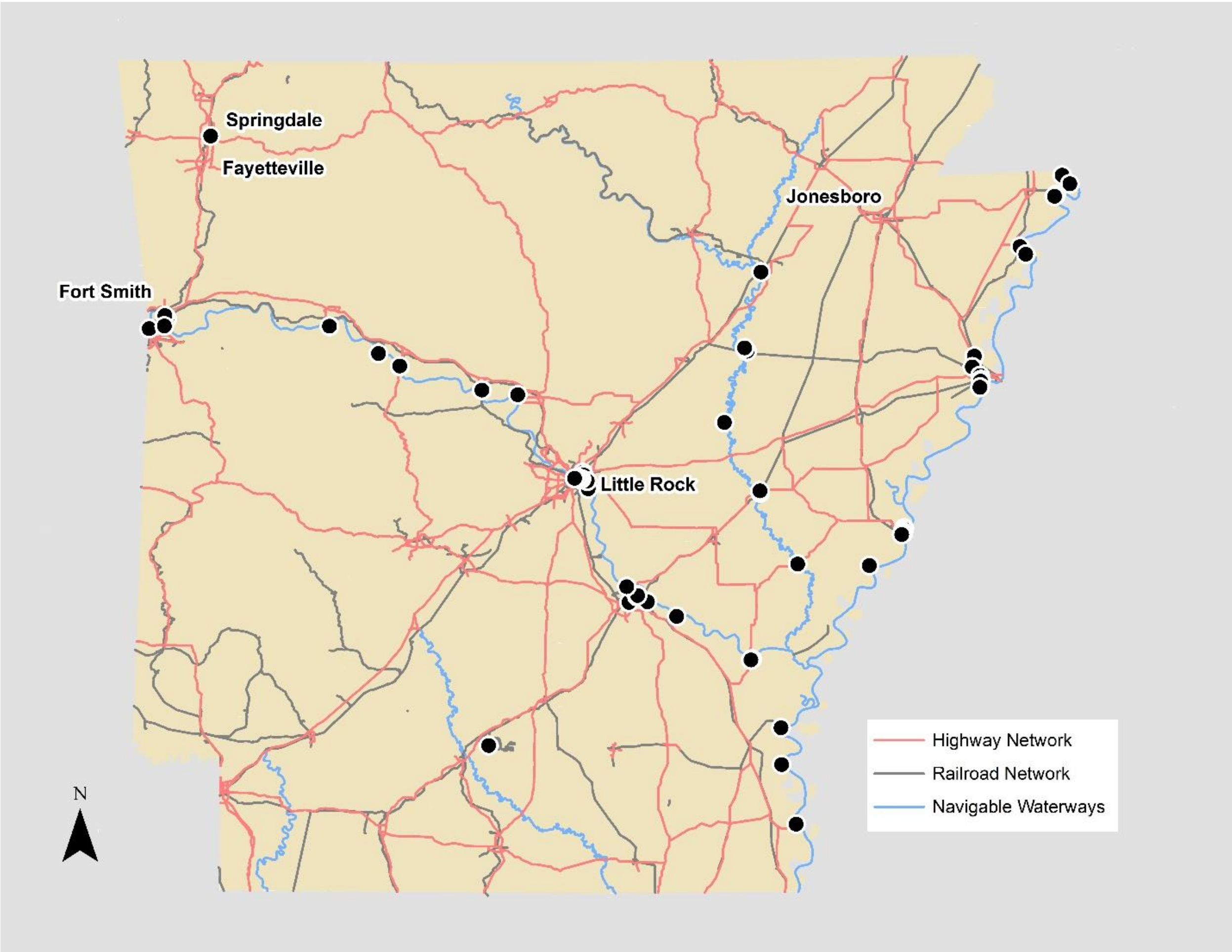


FIGURE 0-4. INTERMODAL FACILITY LOCATIONS (BTS, 1998)

Transload Facility Surveys

Two surveys were developed. The first survey designed to gather equipment information from facility managers. This survey, referred to as the '*Transload Equipment Survey*', was carried out via email and phone by the project team. It was sent to specific facility operators of transload terminals that had been contacted earlier in the project. The *Transload Equipment Survey* questionnaire is provided in **Appendix 12.3**. Information garnered from the responses was used to estimate facility costs (see Section 6). The second survey, referred to as the '*Transload Facility Survey*', was designed to inventory and characterize existing transload facilities in Arkansas. The questionnaire, survey methods, and results are discussed in this section. The *Transload Facility Survey* questionnaire is provided in **Appendix 12.2**.

Background

Comprehensive, accurate, and up-to-date databases describing the location and type of transload facilities available for use are needed to attract industry to a region and assess modal shift potentials for freight planning. However, such databases are either non-existent or extremely limited. The Transload Distribution Association of North America (TDANA) provides a list of transload facilities with the limitation that only members of the organization are included in the list *(TDANA, 2016)*. What is commonly encountered are disparate lists of locations that must be hobbled together from multiple facility operator or railroad websites in order to form a comprehensive site inventory. While sources such as the TDANA database or private company website listings may serve as a starting point, they do not provide an all-inclusive list of all sites within a state. They also do not typically provide complete information on facility size, commodities handled, storage capacity, transportation modes, and contact information.

Without a statewide inventory of transload sites it is difficult to accurately define existing conditions of the transload industry. This limits the ability to forecast future demand and opportunities for growth or development of new transload sites. Thus, a statewide inventory of existing facilities was necessary to create a comprehensive list of the specific locations and types of facilities operating around the state. A survey was developed and sent to existing transload facilities in Arkansas. While other states have performed similar surveys to gather data on multi-modal freight facilities *(Brogan et al., 2001)*, none have specifically targeted transload facilities. A survey of transload facilities has to address unique challenges related to the ownership and operation of the facility and the proprietary nature of the freight transportation industry. In addition, each of the sites shown in the 1998 Intermodal Facility List (Figure 3-4) were verified to exist and the modes served by the facility were identified using Google Earth and facility websites. Of the 66 sites listed in the BTS Intermodal Facility List, 43 were verified while 19 could not be identified based on the locations and names provided in the Facility List.

Survey Questionnaire

Due to the competitive nature of the freight industry and private ownership of most of the transload facilities in the state, it was necessary to design a questionnaire that would solicit as much information as possible without imposing on proprietary data. For instance, while it was necessary to determine the commodities moved through a particular facility, asking specific details regarding the tonnages moved through the facility would likely encroach on proprietary information. Therefore, striking the balance between obtaining necessary information and avoiding private information was an intentional effort throughout the development process.

The survey was compiled from questionnaires developed by Bhamidipati and Demetsky and BNSF Railroad *(Bhamidipati and Demetsky, 2008; BNSF, 2015)*. Bhamidipati and Demetsky *(2008)* conducted phone-based interviews of intermodal terminal managers in Virginia to better understand planning decisions and requirements of shippers and railroad companies. The BNSF *(2015)* survey was developed for internal audits of facilities that access the BNSF railroad. Questions extracted from these surveys were tailored to transload facilities. Questions related to the history of the facility, current operations, coordination with public and private stakeholders, future growth, capacity, storage, and commodities transported. **Table 3-4** summarizes the topics included in the questionnaire and provides examples of 32 questions included in the survey.

Survey Sampling Frame

The sampling frame consisted of all existing transload facilities in Arkansas. As one of the goals of the survey was to determine a complete list of transload facilities, this meant the list of sites was not known apriori so compiling the sampling frame was a significant challenge. Historical data, industry and stakeholder contacts, and facility operator websites were used to develop an initial sample frame. The BTS list of intermodal sites from 1998 described in the previous section was used to establish an initial sample frame. The ARDOT file represents the Arkansas portion of the Intermodal Terminal Facilities data set and contains data on highway-rail and/or rail-water transfer facilities in Arkansas. Contacts were made at Class I and III railroads, and although these railroads may not have owned or operated their own facilities, some were able to provide lists of facilities that serviced their rail-lines. Additionally, larger transload companies with multiple facilities, statewide or nationally, were identified and contacted for more information regarding specific locations.

After the abovementioned resources were synthesized and a list of facilities generated, specific contacts at each facility were identified. Understanding the ownership and organization of facilities became especially helpful during this step of the survey process. For local facilities, plant managers were typically the person with the authority to complete the survey and who could most accurately answer the questions. However, for companies with multiple locations around the state, individual plant managers often had to obtain approval from the corporate office before agreeing to participate. With this in mind, it was most effective to first make a contact with the corporate office, which could then distribute the survey to the correct person at each facility. In some cases, the corporate manager agreed to complete the survey for each facility in the state.

TABLE 0-4. TRANSLOAD FACILITY QUESTIONNAIRE

Topic	Questions
History of the facility	1. When was the terminal established? 2. How was the terminal originally funded? 3. What factors influenced its original location? 4. What were the private and public roles in establishing the terminal?
Current operations	5. What work units (public or private) are involved in the operation of the terminal? 6. Is the terminal exclusively used for COFC/TOFC freight? 7. Is the intermodal traffic domestic, international, or both? 8. What is the extent of the market covered in terms of maximum drayage distance? 9. What are the various services provided at the terminal? 10. What are the major commodities handled by the terminal?
Coordination stakeholders	11. What are the possible sources of funding for improvements? 12. What public support, if any, is needed to sustain the terminal?
Future of the facility	13. What are the critical factors that influence a shippers' decision to use intermodal service? 14. What are the critical factors that contribute to the success of an intermodal terminal? 15. What are the deterrents to the success of intermodal terminals?
Facility type	16. Does the facility accommodate the following transportation modes? (rail, water, truck, pipeline) 17. Is the facility located in close proximity to a port? To a highway? 18. Which railroads have access to the facility?
Capacity	19. How many railcar spots does the facility have? 20. How many rail tracks does the facility have? 21. What is the total length of track? 22. How many truck spots does the facility have? 23. Is there a truck scale on site? 24. How many berths/docks does the facility have? 25. What type of storage does the facility have? 26. What is the area of outdoor paved storage? Unpaved?
Ownership	27. Who owns the facility? (public agencies, private firms, a combination)
Rail equipment	28. What rail equipment in the following list is served by the facility? (boxcar, flatcar, pneumatic hopper, bulkhead flat, etc.)
Transload equipment	29. What transload equipment in the following list is served by the facility? (forklift, bale clamp, conveyor, excavator, etc.)
Commodities handled	30. What dimensional commodities in the following list are transloaded at this facility? (feedstocks, panel products, lumber, etc.) 31. What warehouse commodities in the following list are transloaded at this facility? (paper food and beverages, perishables, etc.) 32. What bulk commodities in the following list are transloaded at this facility? (fertilizers, chemicals, petroleum products, etc.)

Survey Instrument

This study selected to use an online platform to implement the survey. Unlike paper based surveys (e.g. mail out-mail back), an online platform is more cost effective. Also, previous studies *(22)* indicated that online surveys enhance completion rates and response errors by incorporating logic into the design of the survey. The online survey can allow respondents to skip over sections of the survey that do not pertain to their facility based on answers to preliminary questions.

The survey was designed using Qualtrics *(2016)*, a professional online survey tool. Qualtrics allows the survey preparer to incorporate flow logic, use a variety of question formats, and has a mobile friendly interface as shown in **Figure 3-5**. The survey was designed to be completed in approximately 15 minutes.

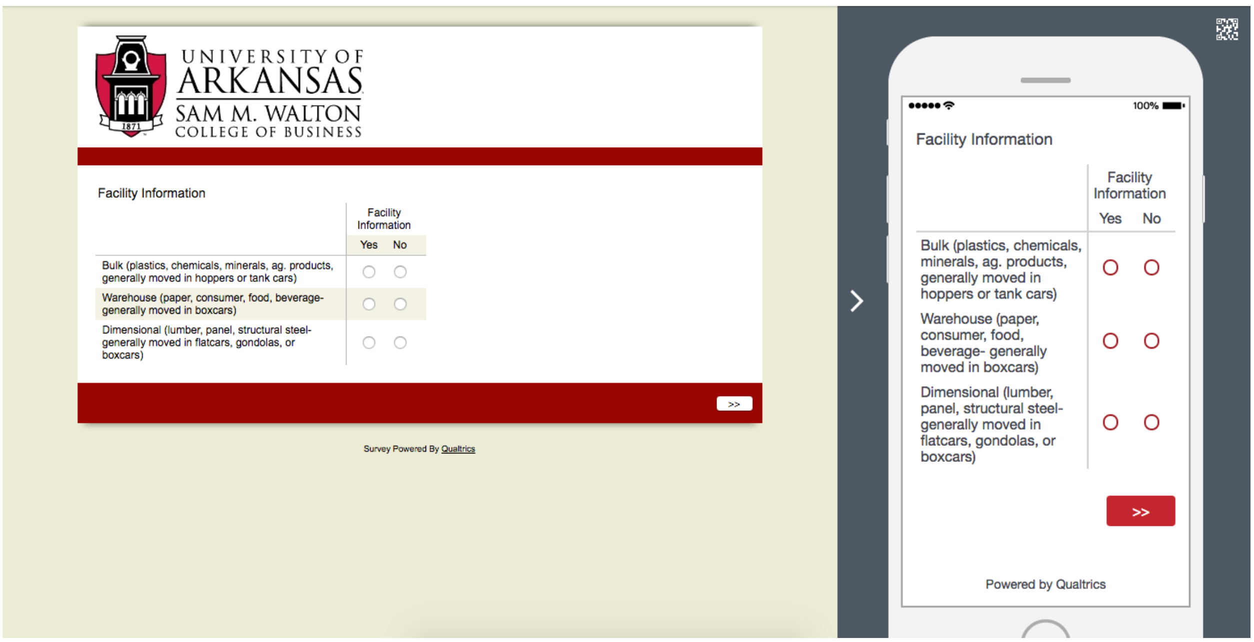


FIGURE 0-5. EXAMPLE OF THE ONLINE SURVEY DEVELOPED IN QUALTRICS

Survey Recruitment

An initial phone call was made to each of the 43 facilities identified in the compilation of the sampling frame in order to recruit facility managers to participate in the survey. During the initial phone call, the project was introduced and managers were asked if they would be willing to participate in the survey. If the contact was willing to participate, the survey was then e-mailed to the participant. After one week, each participant that had not completed the survey received a reminder e-mail. Additional reminder e-mails were sent over the two weeks following the initial reminder. The survey remained open for a period of one month from the time the first survey was distributed to the time the last response was collected.

Survey Results

Overall, 43 of the 66 facilities listed in the BTS Intermodal Facilities List were identified in Arkansas as shown in **Figure 3-6**. The 19 sites could not be identified using Google Earth, facility websites, or other information provided in the BTS Intermodal Facilities List. In some cases the Google Earth imagery did not clearly show a site near the geographical coordinates. In other cases, it was not clear if the facility was operational. The research team refers to these sites as “unverified sites”.

Of the 43 verified sites, 12 are independently owned and operated and the remaining 31 are owned by one of eight companies operating multiple facilities. This distribution of company size and structure captures the diversity of managerial and organization structures practiced by transload facilities. Further, Arkansas’ existing multi-modal transportation network, including the Arkansas River’s marine port network, multiple Class I and III railroads, as well as the vast state highway network, allow for a mixed distribution freight transportation modes at each of the listed facilities. Eleven sites provided access to three modes (truck, rail, and water), ten provided access to truck and rail, and 22 provided access to truck and water.

Several of the sites identified through the survey and the original BTS Intermodal Facilities List serve only single commodities, provide access to one shipper/receiver, or may incorporate some type of processing. In these cases, the label of transload may differ from the definition of transload adopted in this research (e.g. receiving and distribution facilities)[2]. Further, interviews with facility operators indicated that transload facilities do not take ownership of the shipped goods, but rather act only as transfer points. Under these definitions, several of the facilities shown in **Figure 3-6** may not be considered by some to be transload facilities. Therefore, the research team classified the sites shown in **Figure 3-6** as ‘transload’ or ‘other’. Transload sites only provide storage and act as receiving/distribution facilities but can be public or private. ‘Other’ refers to facilities that transform the good in some way by packaging or processing. For the sites that did not respond to the survey, classification into transload or other was based on information viewed through Google Earth, facility websites, and the BTS Intermodal Facility List. A complete list of sites can be found in Appendix 12.2 along with a map of facilities based on categorization into transload or other.

[2] The definition of a transload facility adopted in this research came from Steele and Hodge (2011): Transload facilities are defined as “receiving and distributing [facilities] for lumber, grain, concrete, petroleum, aggregates, and other such bulk products” that provide access to multiple transportation modes".

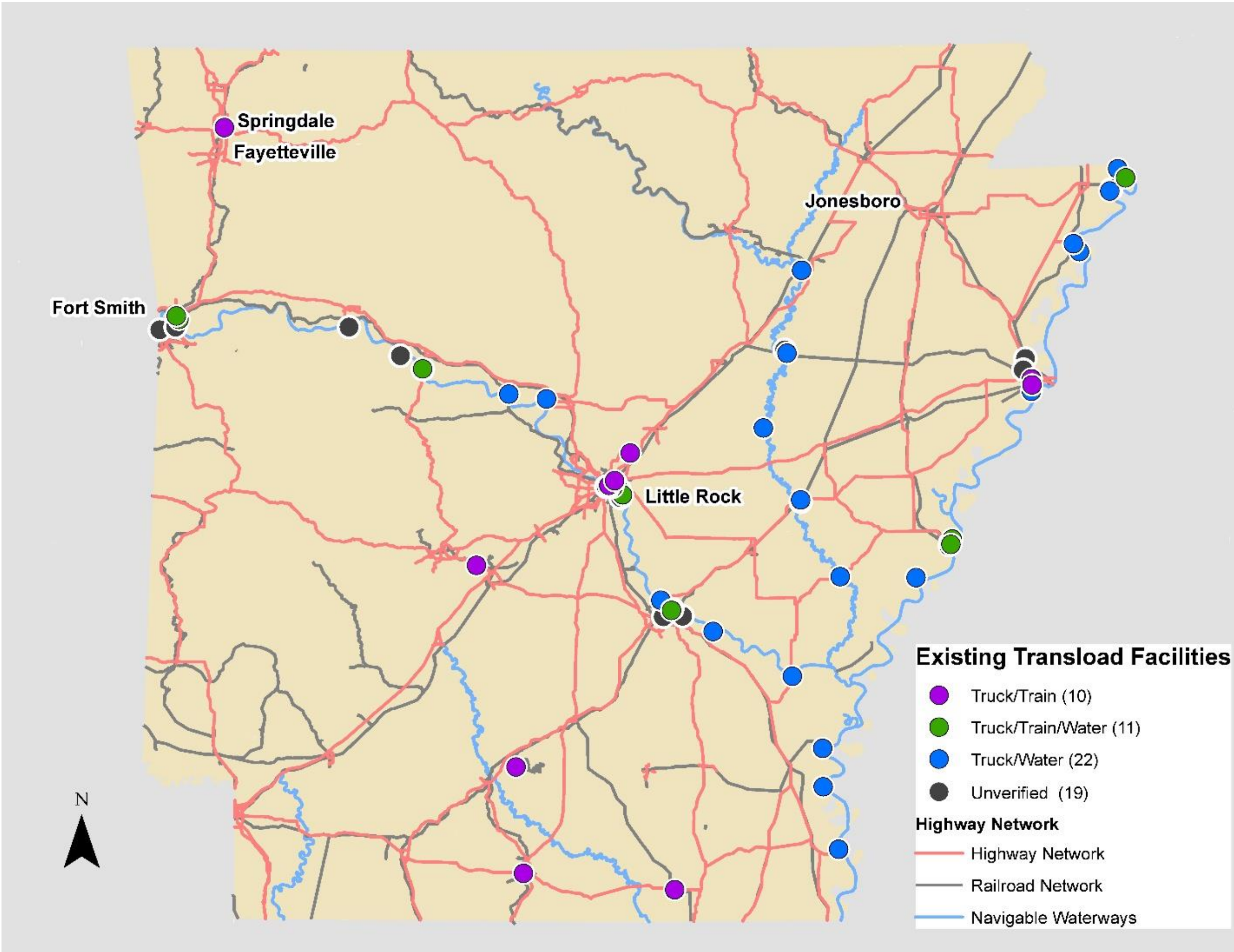


FIGURE 0-6. TRANSLOAD FACILITIES AND TRANSPORTATION INFRASTRUCTURE IN ARKANSAS

The survey was sent to 16 facilities identified in Arkansas from which six complete responses were obtained. Five responses were gathered after initial contact with the facility. An additional response was gathered following the first reminder. No responses were received as a result of the second and third reminders. While the participant could not be identified because the survey was not completed, it is interesting to note that the survey was opened but not completed at least 6 times.

Two of the 16 facilities decided not to participate after receiving the survey and five facilities did not respond. In the initial phone conversation with facility managers, several issues were raised that led the facility manager to decline participation. These included:

- Did not receive permission from corporate office
- Negative viewpoint on public participation in private industry affairs
- Did not think their services were relevant to the project

Overall, 42% of facilities were either unwilling or unable to participate in the survey. Contacts were never made at four facilities, although their existence was verified either through websites or by reaching their voicemail.

A response rate of 14% resulted for all facilities identified in the sampling frame and 37.5% response rate for those who agreed to participate. The response rate relative to the identified sampling frame (14%) is in line, and slightly better, than surveys of this nature which have reported response rates between 2 and 5% *(Jeong et al., 2016)*.

The information collected from the six complete responses provided valuable information on facility operations, equipment required, and the commodities handled. One major finding, for instance, was that the majority of facilities in Arkansas are privately owned, operated, and funded. Additionally, knowing specific equipment utilized for each mode of transportation or for particular commodities shipped allows for a more thorough understanding of costs associated with operating a transload facility. **Table 3-5** summarizes the overall findings that relate to the ownership, history, and funding of the facility.

TABLE 0-5. SAMPLE OF SURVEY RESPONSES

Question	Overall Findings
Who owns the facility?	The responses came from one publically owned facility with the rest owned by private firms. None of the responses indicated joint public-private ventures.
When was the terminal established?	Transload facilities in Arkansas were established over a wide time period. The oldest facility was established in 1960 and the most recent in 2014.
How was the terminal originally funded?	The majority of responses indicated private funding sources. Only one facility reported the use of general obligation funds and a tax levy from the city to support original development of the facility.
What were the private and public roles in establishing the terminal?	The majority of responses indicated that no public agencies played a role in establishing the terminal. The exceptions were one facility that reported involvement of the local port authority and another that reported working with the local Class III railroad.
What are the possible sources of funding for improvements?	The following were reported sources of public funds: TIGER grants, FASTLANE grants, Arkansas Highways (AHTD), sales tax initiatives, and general bond issues. Most facilities reported private funding as the main source improvement funds.
Is there a potential need to expand any of your existing operations?	All but one of the respondents reported that there is a potential need to expand existing operations. Several respondents mentioned the need to add truck bays, railcar storage, barge loading facilities, warehouse and outside storage. None indicated any need to expand to handle different commodities.

RS Means

RS Means is the leading provider of construction cost data[3]. RS Means is a collection of annual construction cost data books. For this project, two of the cost data books were used:

1. Building Construction Costs with RSMeans Data (2014)
2. Heavy Construction Costs with RSMeans Data (2017)

RS Means is a proprietary data source meaning that there is a cost associated with its use. For instance, the 2017 version of the Building Construction Costs Book can be purchased from Gordian (the publisher

[3] www.rsmeans.com

and proprietor of the database), for $248. The Books used in this project were available from the University of Arkansas Library at no cost to the project.

IMPLAN

IMPLAN (IMpact analysis for PLANning) is a regional impact tool that measures the economic impact of industry and development activities (*Mulkey and Hodges, 2015*). Specific activities under industry and development can include construction, operation of public works project, operation of public works project, retail sales, wholesale sales, manufacturing, and service sales in an economy. IMPLAN is a predictive input-output model that can estimate local, regional, and national impacts of activities. Similar models that have been developed include the Regional Input-Output Modeling System (RIMS II) and Regional Economic Modeling Inc. (REMI).

IMPLAN was originally developed by the U.S. Department of Agriculture, the Forest Service, and the Federal Emergency Management Agency. It was opened to non-Forest Service users in 1988 by the University of Minnesota. Currently IMPLAN is produced by MIG, Inc. (formerly Minnesota IMPLAN Group). Within the input-output model, IMPLAN uses 525 different sectors to measure direct impact, indirect impact, and induced impact. These can be described as follows:

- **Direct impact:** employment and purchases of goods and services in the region of analysis that result from the industry or development activities of employers
- **Indirect impact:** goods and services purchased by employers that supply inputs consumed in the direct activity
- **Induced impact:** increased household purchases of goods and services in the region of analysis by employees of both direct and indirect employers

By using economic data from the U.S. Department of Commerce, the Bureau of Economic Analysis, and the Bureau of Labor Statistics, four different quantifications can be generated: employment, labor income, total value added, and output. However, the two most utilized quantifications are the employment (number of jobs in a sector) and output (value of sector production). Finally, IMPLAN can also produce a list of the one sector's impact on other sectors, in order to determine the influence of one sector's growth on other sector's growth.

IMPLAN is utilized extensively in the business world and has been used in many different applications at the University of Arkansas (UA). One high profile example is the economic impact of the UA on the state of Arkansas (*Deck and Jebaraj, 2015*). In this study, IMPLAN determined that in 2014:

- Annual business expenditures at UA generated $573.8 million in Arkansas
- Annual business expenditures at UA directly supported 5,282 jobs and indirectly supported 6,948 jobs in Arkansas through indirect and induced effects
- Annual business expenditures at UA created labor income of $350.3 million
- Construction at UA generated $235.5 million in Arkansas
- Construction at UA directly created 1,028 jobs in Arkansas and indirectly created 1,678 jobs through indirect and induced effects
- Construction at UA created labor income of $76.5 million

This type of economic analysis is very typical for industries to showcase their impact on a local or state economy. However, while IMPLAN is frequently used in the business world, it is less frequently used in transportation applications.

One of the first documents found that utilized IMPLAN in a transportation application compared IMPLAN to RIMS II and REMI in public transit. The first type of public transit analyzed was a bus fleet, which included annual purchase, operation, and maintenance. The second type of public transit analyzed was a rail transit, which included right of way, construction, rolling stock, and operating expenses. The analysis found that for the bus fleet, RIMS II provided the lowest output, income, and jobs. IMPLAN had the highest number of jobs in the bus fleet (~58% higher than RIMS II), while REMI had the highest output and income (~48% higher than IMPLAN 32% higher than RIMS II, respectively). When developing their own economic software (RECONS), the Army Corps used the multipliers and ratios from IMPLAN for their software (Army Corps, 2013). RECONS was developed to estimate regional and national job creation, economic output, labor income, and gross regional product for spending from the American Recovery and Reinvestment Act (ARRA). This document is especially interesting as it provided mapping between IMPLAN sectors and NAICS codes.

A research project from Georgia specifically utilized IMPLAN when quantifying the economic development and workforce impacts on the state Department of Transportation (DOT) highway expenditures (*Boston and Oyelere, 2014*). Six impacts were explored at three levels: state wide, 159 counties, and seven Georgia DOT administration districts. The six impacts were total output, value added in production, new jobs created, household income, small business revenue and tax revenues. According to IMPLAN, from January 2009 – April 2013, GDOT's expenditures of $3.1 billion created 51,246 new jobs and generated $5.9 billion economic impact. A finding of interest is that this job generation and economic impact was not consistent around the state. For example, the GDOT administrative district that includes Atlanta had the smallest number of new jobs per $1.0 million spent (12.9 – versus Thomaston, which had 16.4) but led to the largest gain in small business revenue. This example is one of many, but shows that a simple state-wide analysis may mask important trends depending on the geographic areas of interest. A more research based use of IMPLAN was performed by Zhao *et al.* in 2015. This research built a model to analyze freight shipping from a supply chain management perspective, and utilized six sources of data used to calibrate and validate the model, including IMPLAN. The model developed had a median percentage difference of 2.38% for annual flows and 4.85% from simulated inventories, which the authors considered an excellent fit for the developed model.

A second report that investigated freight focused instead on the contribution of the freight industry to the state of Maryland economy (Shin *et al.*, 2015). The Maryland study is salient toward TRC1608 because multiple modes of transportation are considered, including truck, rail, water, pipeline, and air. This study found that in 2010, the freight industry directly supported approximately 70,000 jobs and indirectly supported 48,000. While the freight industry generated $4.9 billion of the entire Maryland transportation sector ($5.5 billion), the freight industry supported 70% of the jobs, demonstrating a higher impact in the freight sector versus other transportation areas. In Maryland, the trucking industry is the largest sector in terms of jobs (30%) and compensation (29%). However, the water and port sector only contributed 3% of the jobs but 15% of the compensation, showing a higher level of compensation per job.

The final transportation study found that utilized IMPLAN was from Alaska (McDowell, 2016). Since Alaska has a significant marine transportation system, this report focused only on the Alaska Marine Highway System (AMHS). IMPLAN showed that AMHS directly employed 1,017 and indirectly employed 683. These jobs lead to wages of $65.0 million and $38.7 million respectively. The research also found that the $117 million that was invested in 2014 turned into a total economic impact of $273 million.

While no reports were found that specifically examined the use of IMPLAN while investigating transload facilities, there is some literature that examined different modes of transportation, and focused on freight specifically. This stimulated the discussion to include an IMPLAN analysis in TRC1608, to explore the economic benefits of the different modes of transportation in Arkansas.

PC*Miler

PC*Miler is a proprietary truck routing, mileage, and mapping software used in the transportation industry[4]. It provides address-based routing using a variety of different routing algorithms, e.g. shortest distance, fastest time, or lowest cost. A sample of the PC*Miler interface is shown in **Figure 3-7**. For this project, PC*Miler Version 28 was used to calculate the mileage between origins and destinations. PC Miler calculates the route distance, in miles, and distinguishes this mileage by within state and out of state miles.

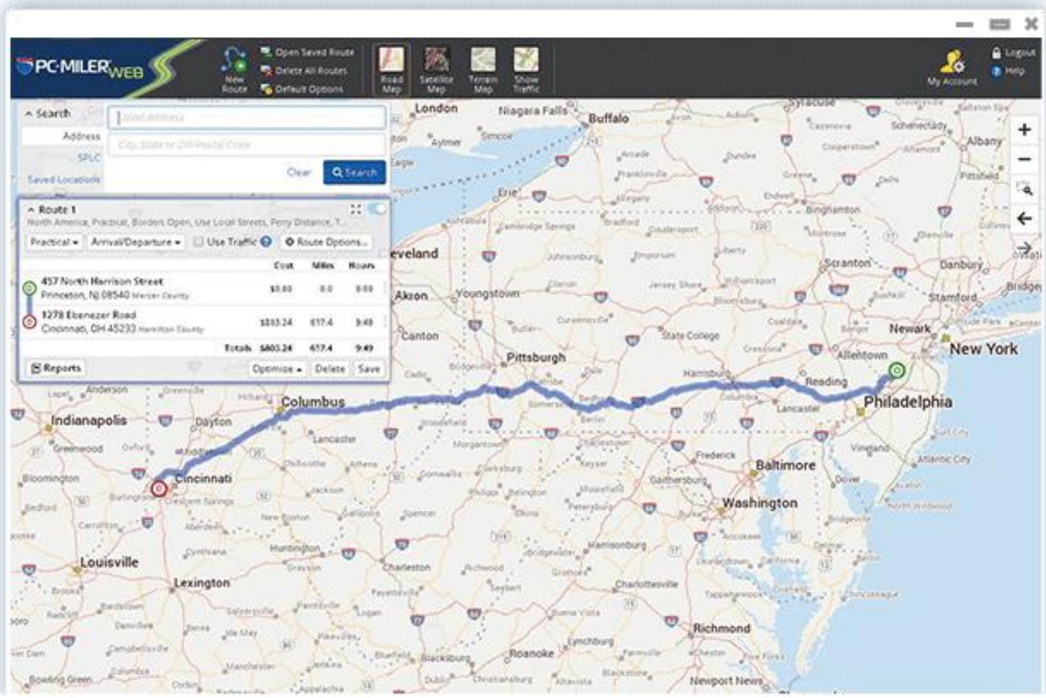


FIGURE 0-7. IMAGE OF PC*MILER INTERFACE (WWW.PCMILER.COM)

Stakeholder Interviews

A wide range of stakeholders from the railway, trucking, waterway, and pipeline industries was contacted to garner information about facility characteristics and costs. In addition, stakeholders played a large part in the initial facility inventory development to determine locations and operations of existing transload facilities, to provide references to past and on-going facility planning studies, and to give feedback on project findings. This feedback has served to validate data collected and approaches taken. These parties include the following organizations/companies:

1. Arkansas Trucking Association
2. Arkansas Oil and Gas Commission
3. US Federal Railroad Administration – National

[4] www.pcmiler.com

4. Arkansas & Missouri Railroad
5. Ozark Transmodal Inc.
6. Kansas City Southern Lines, OK
7. Arkansas Midland Railroad
8. American Short Line and Regional Railroad Association
9. UP Railroad – Marion AR Director of Public Affairs
10. Kinder Morgan
11. Northwest Arkansas Regional Planning Commission (MPO)
12. Frontier MPO
13. West Memphis MPO
14. Arkansas Waterways Commission
15. Arkansas Agriculture Department
16. Bruce Oakley Inc.
17. Bulkloads Now.com
18. USACE Little Rock Office
19. Wiese Forklifts Springdale
20. Riggs Equipment CAT Dealership for large equipment
21. Anthony Timberlands
22. Five Rivers Distribution

While this list is by no means exhaustive of all stakeholders in the transload industry, it has begun to open lines of communication, and will continue to dictate the information that is gathered. The list of existing transload facilities was developed in large part with the help of contacts on this list, or at least from their initial direction. Insight provided from the online survey (Section 3.3) responses proved to be invaluable in understanding the types of facilities operating within the state of Arkansas. Through the survey process, additional contacts were made at facilities that continue to provide more specific insight regarding the accuracy of costs and more specific equipment needs for particular commodities. In addition, these stakeholders helped with verifying that cost estimations were appropriate and in-line with actual cost estimations for specific projects.

Commodity GIS Layer Development

As each commodity has a different potential for efficient transload operations based on the commodity type, distance transported, and current mode share, a spatial assessment of commodity flows can inform the decision on where to best locate freight transload facilities. To accomplish this, the project team extracted commodity tonnages from the freight component of the Arkansas Statewide Travel Demand Model (AR STDM). Commodity production and attraction (consumption) maps for each of the 15 commodity groups were created for the 2010 base year. Each map shows the production and attraction by county to highlight locations that have higher tonnages and thus greater potential for transload operations. In addition to the commodity tonnage maps, the geo-spatial data files include waterway, highway, and rail network layers, and current transload facility locations. An example of the commodity tonnage maps are shown in **Figures 4-1 and 4-2** for chemicals. All commodity tonnage maps are provided in **Appendix 12.1** as pdfs**.** The geo-spatial data files (.shp) files used to create the commodity maps are also provided.

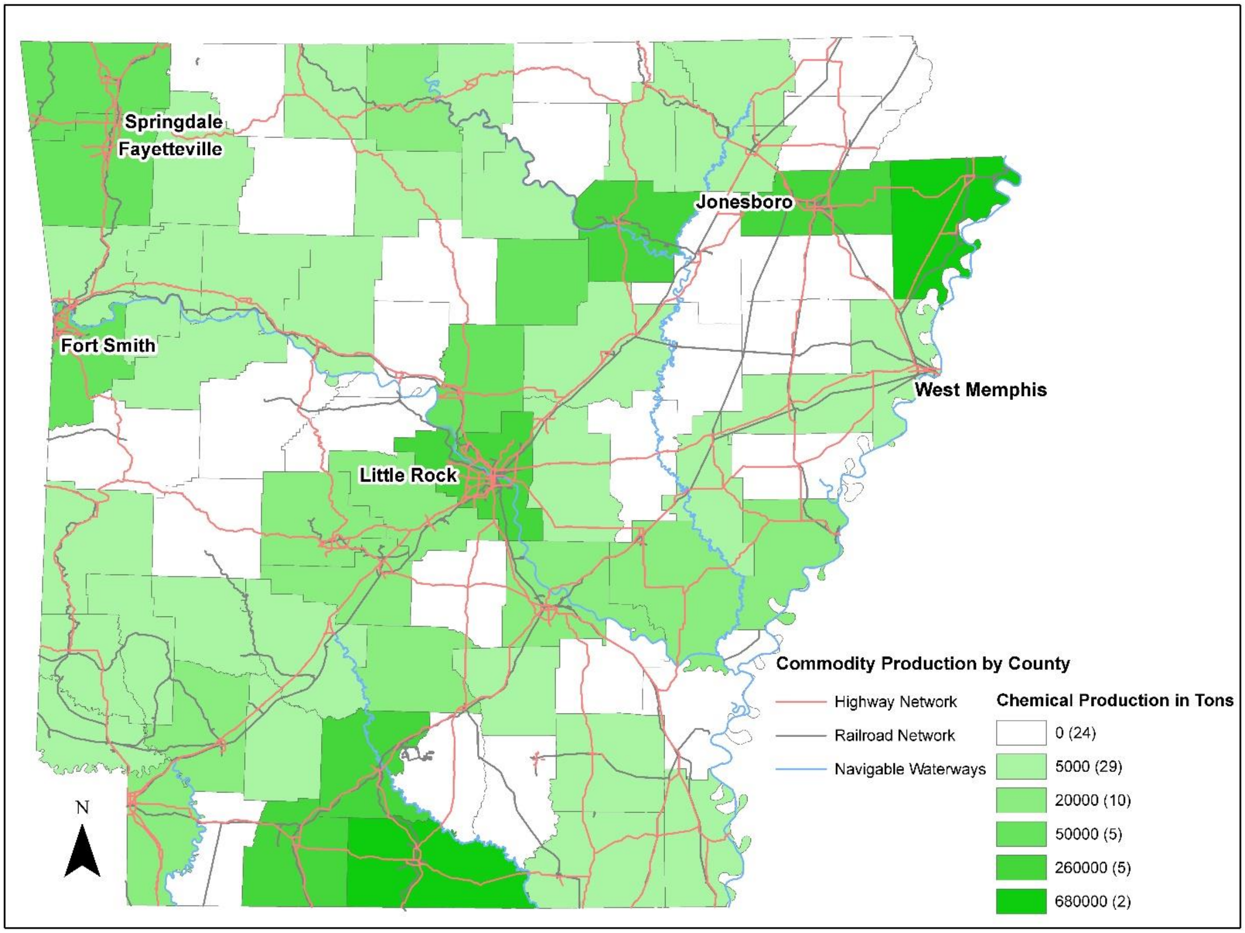


FIGURE 0-1. EXAMPLE OF COMMODITY PRODUCTION MAP

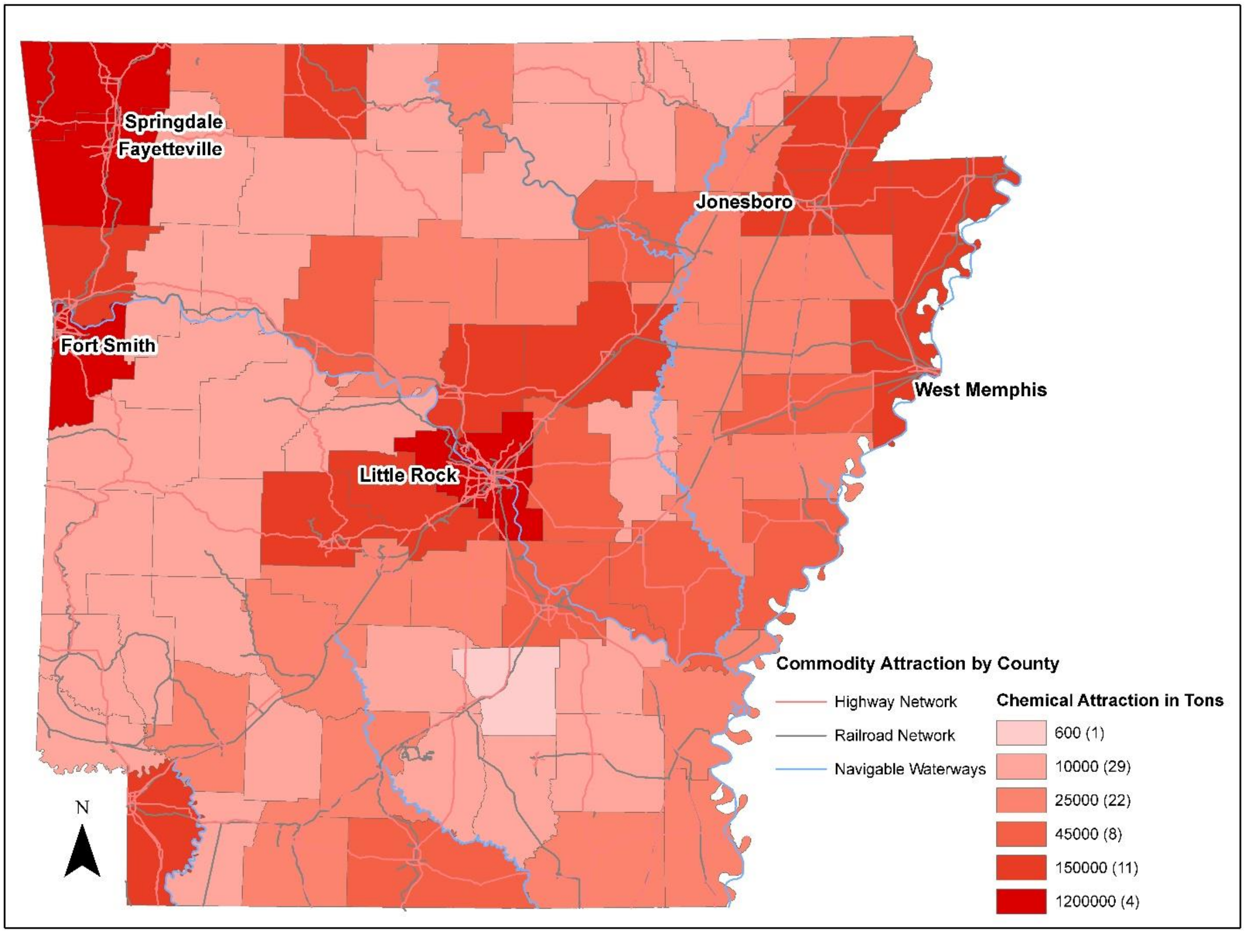


FIGURE 0-2. EXAMPLE OF COMMODITY ATTRACTION MAP

Selection of Transload Facility Locations

In Part 5 we discuss the process by which feasible locations for transload facilities were identified and summarize the five sites selected through evaluation of commodity flows and through stakeholder involvement. Section 5.1 presents the key criteria used to assess the potential for a transload facility. Section 5.2 details the process by which these criteria were used to select transload sites in Arkansas using commodity flow data. Section 5.3 presents the feasible transload sites selected through stakeholder interviews. Finally, a summary of the five transload sites is provided in Section 5.4,

Transload Facility Location Criteria

To determine potential freight facility locations, it is necessary to adopt the view of private companies, since they will be the users of these facilities. From this perspective, an ideal place to locate a freight facility would have the following characteristics *(Steele and Hodge, 2011)*:

1. ability to access key markets,
2. efficient connection with the transportation network,

3. labor and employment market in good health,
4. low total cost,
5. availability of suitable sites,
6. local regulations and permits that reflect the familiarity of local government with freight facilities,
7. tax and incentives offered,
8. natural hazards that don't impose a risk of business interruption

Most of these characteristics play a role in further decision-making stages, beyond the scope of this project. However, the single most important element when planning the location of a freight facility is the ability to access key markets *(Steele and Hodge, 2011).* This is intrinsically related to the types of commodities served by the facility and interaction of the facility with the transportation network.

Commodities with Transload Potential

Of the many factors affecting freight mode choice, the physical attributes of goods and flow and spatial distribution of shipments are central in determining if a commodity has the potential to be served by a transload facility *(CUTR, 2002)*. To identify commodities with transload potential, data from the Freight Analysis Framework (FAF) was used to compare state mode share averages to the national average. For commodities where the percentage of tons transported by truck, i.e. mode share, is higher than the national average, an opportunity for mode shift may exist. Where the percentage of tonnage transportation by barge and rail is higher than the national average, there may still be opportunity to increase barge and rail shares.

As an example of the state to national comparison, mode share distributions by commodity type for Arkansas for shipments made in 2015 are shown in **Table 5-1** *(FHWA, 2017)*. For consistency, the Standard Classification of Transported Goods (SCTG) commodity codes used by FAF have been aggregated to the commodity groups adopted by the Arkansas STDM *(Alliance Transportation, 2011; Horowitz et al., 2008).* **Table 5-1** shows that the share of chemicals moved by truck in Arkansas, for example, is higher than the national average (73.8% statewide vs 64.6% nationwide) while the share moved by water is 0.0% statewide compared to 8.7% national average. This indicates there is potential to shift chemicals to water by providing transload opportunities in the counties with high chemical tonnage production and/or attraction.

TABLE 0-1. COMPARISON OF STATE AND NATIONAL MODE SHARES BY COMMODITY TYPE

Commodity (AR-STDM Categorization)	Statewide Mode Shares			National Average Mode Shares		
	(% of Tons, 2015)					
	TRUCK	RAIL	WATER	TRUCK	RAIL	WATER
1 Farm Products	86.0	12.0	1.9	82.4	14.8	2.8
2 Mining	87.9	6.3	5.9	50.3	24.5	25.1
3 Coal	1.1	98.9	0.0	25.2	68.1	6.8
4 Nonmetallic Minerals	88.2	11.8	0.0	91.5	5.3	3.2
5 Food	92.8	5.7	1.6	91.5	7.5	1.1
6 Consumer manufacturing	89.8	1.0	9.2	97.5	1.4	1.1
7 Non Durable Manufacturing	93.7	5.5	0.8	76.1	23.3	0.6
8 Lumber	97.0	3.0	0.1	95.8	3.9	0.3
9 Durable Manufacturing	93.4	6.1	0.5	94.6	4.4	1.0
10 Paper	84.3	15.7	0.0	84.6	14.7	0.7
11 Chemicals	73.8	26.2	0.0	64.6	26.8	8.7
12 Petroleum	98.1	1.2	0.7	79.3	4.5	16.2
13 Clay, Concrete, Glass	97.8	2.0	0.2	95.3	3.7	1.0
14 Primary Metal	58.8	32.8	8.3	84.8	13.5	1.7
15 Miscellaneous Mixed	89.0	4.7	6.4	95.6	3.4	1.0

Shaded row indicates commodity group with high transload potential (National Average Truck share lower than Statewide Truck share)

Distance Threshold and Transload Potential

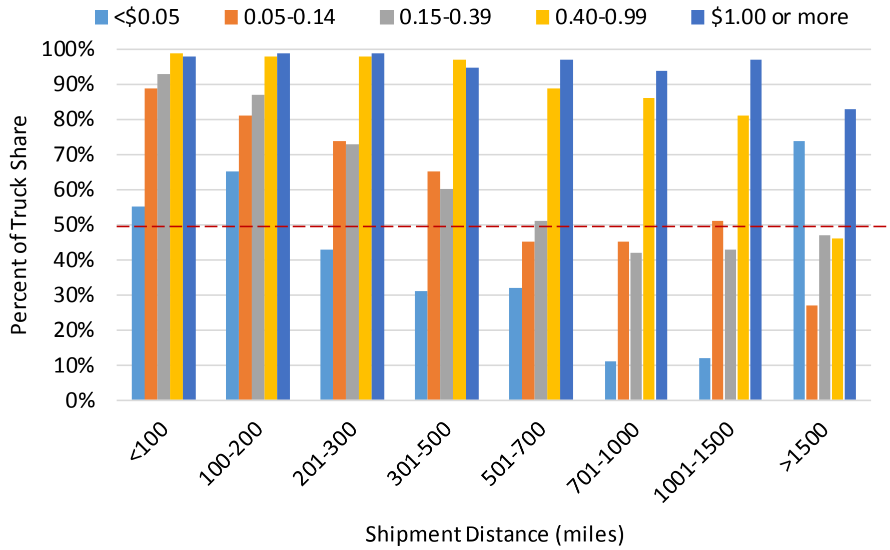
Building upon the factors that influence mode selection, total logistics costs per mode has a direct relationship with transportation distance *(CUTR, 2002).* Thus, consideration of transport distance is critical in determining the feasibility of a transload facility within a county. A review of previous studies revealed a wide range of distance thresholds at which it is more advantageous to move a commodity by truck, rail, or barge. These thresholds depend on product value and density, shipping lane density, commodity type, and the type of transport needed for the shipment (e.g. Bulk, Flatbed, Dry Van) (*USDOT, 2000*).

For example, in a study by the FHWA for shipments of product density between 36 and 60 pounds/cubic foot and value of $0.15 to 0.39 per pound, rail is competitive with truck (i.e. truck and rail shares are about equal) for distances over 500 miles *(USDOT, 2000)* while for shipments with values between $0.05 and 0.14 per pound, rail is competitive with truck for distances over 201 miles (**Figure 5-1a**). Based on shipping lane density, the same study found that for commodities transported by bulk equipment (i.e. tanks, hoppers, etc.), rail is competitive with truck for shipping distances greater than 201 miles for shipping lane densities of 2000 tons; while shipments with shipping lane densities of 25-100 miles, the competition threshold occurs at 701 or more miles (**Figure 5-1b**). More generally, considering bulk shipments of all values across all shipping lane densities, rail is competitive with truck for shipment distances more than 201 miles (**Figure 5-1c**).

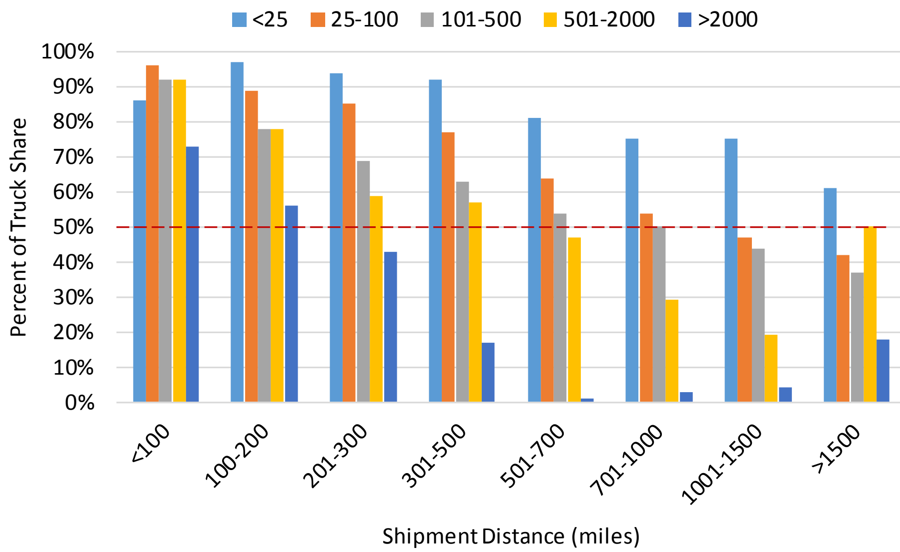
Regionally specific studies such as those conducted in Florida and for different regions of the US present different distance and tonnage thresholds. According to the Center of Urban Transportation Research, the distance at which rail competes with truck in Florida is 250 miles *(CUTR, 2002).* Gonzalez et al. (*2012*) analyzed the impact that distance traveled has on transportation costs (in $/ton) for grain and woodchips across different regions of USA (Midwest to East, to Southeast and to West) by rail car type and shipment size. The study found that for a shipment of grain consisting of a single-railcar unit from the Midwest to the West in the US, truck was the most economical transportation mode for distances up to around 250 miles (see **Figure 5-1d**). For distances traveled over approximately 250 miles, rail was more economically feasible. These thresholds differed if a unit train (110 cars) could be used.

As is evident from the review of literature, mode-shift distance thresholds differ based on the region, commodity type and value, and volume shipped. Each threshold defined in previous studies can only be applied to the specific conditions under which the study was conducted. For example, the conditions described in the Florida study (*CUTR, 2002)* mentioned above apply to the Florida region while the findings from Gonzalez et al. (*2012*) apply specifically to grain within the Midwest region. Since a definitive distance threshold does not emerge from the literature that can be directly applied to the conditions (commodity types, weights, distances, etc.) in Arkansas and considering that the scope of this paper covers a broad range of commodities, the general assumption of a 200-mile distance threshold synthesized from the FHWA study was adopted *(USDOT, 2000)*. The study conducted in Florida, also cited this threshold stating that "For short distance truck shipments (under 200 miles), truck and rail do not compete". Note that there is a gap in the literature to define the mode shift threshold between rail and barge.

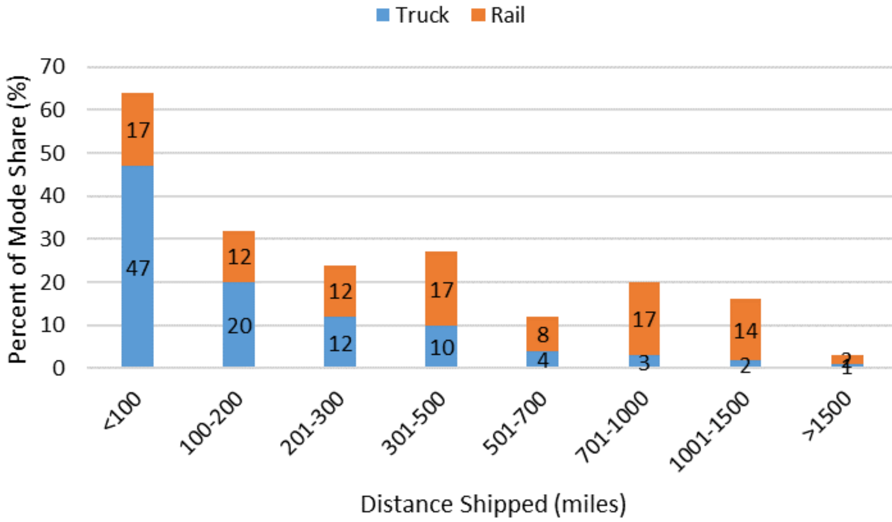
A regionally-defined, commodity-specific, and mode-specific distance threshold could be adopted in the future. The Commodity Flow Survey (CFS) microdata would be used to analyze historical mode selection for shipments with origin or destination in Arkansas, based on distance shipped. The CFS microdata contains the results of the shipper survey include commodity type, shipment distance, mode used, and origin/destination for a sample of all shipments made in the US. Based on the relationship between freight weight and distance shipped for each mode, a mode share curve could be fit to all the data that falls within these criteria in order to obtain specific distance thresholds, or mode share 'curves'. This analysis would distinguish mode share 'curves' for each commodity group.



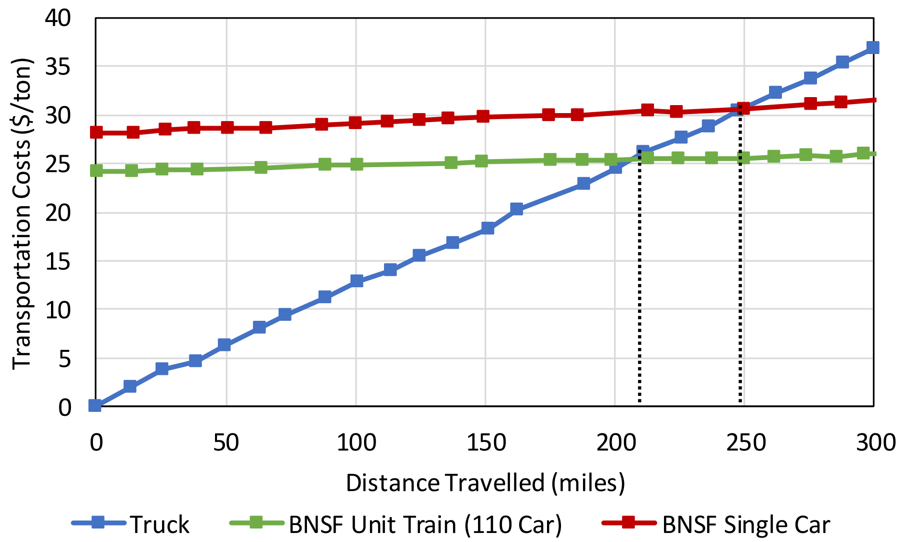
(a) Truck Mode Share as a Function of Shipment Distance and Value per Pound for Product Density of 36-60 pounds per square ft. (USDOT, 2000)



(b) Truck Mode Share as a Function of Shipment Distance and Shipping Lane Density for Commodities Shipped using Bulk Transport Equipment (USDOT, 2000)



(c) Truck and Rail Mode Share by Shipment Distance for Commodities Shipped using Bulk Transport Equipment (USDOT, 2000)



(d) Transportation cost of grain as a function of distance traveled, Midwest to West, US (Gonzalez et al, 2012)

FIGURE 0-1. MODE SHARES FOR TRUCK AND RAIL BASED ON VARIOUS SHIPMENT CHARACTERISTICS

Transload Site Selection Based on Commodity Flow Analysis

Figure 5-2 summarizes the major steps in using the commodity data from the AR STDM to determine feasible transload locations. In general, the processes entails determining the highest ton-distance shipments by commodity type to and from each Arkansas County. Since a transload facility can serve more than one commodity and more than one shipping lane, e.g. origin-destination pair, spatial analysis is used to determine potential synergies that would enhance the productivity of a potential transload facility. The result of the commodity flow analysis is the identification of four potential transload facilities. For each facility, details on the type and quantity of commodities to be served by the facility, estimates of the tonnages to be shipped by truck, rail, and barge, and other characteristics of the facility are summarized as one page briefs (included in **Appendix 12.4**). Details of the process are described in the following paragraphs.

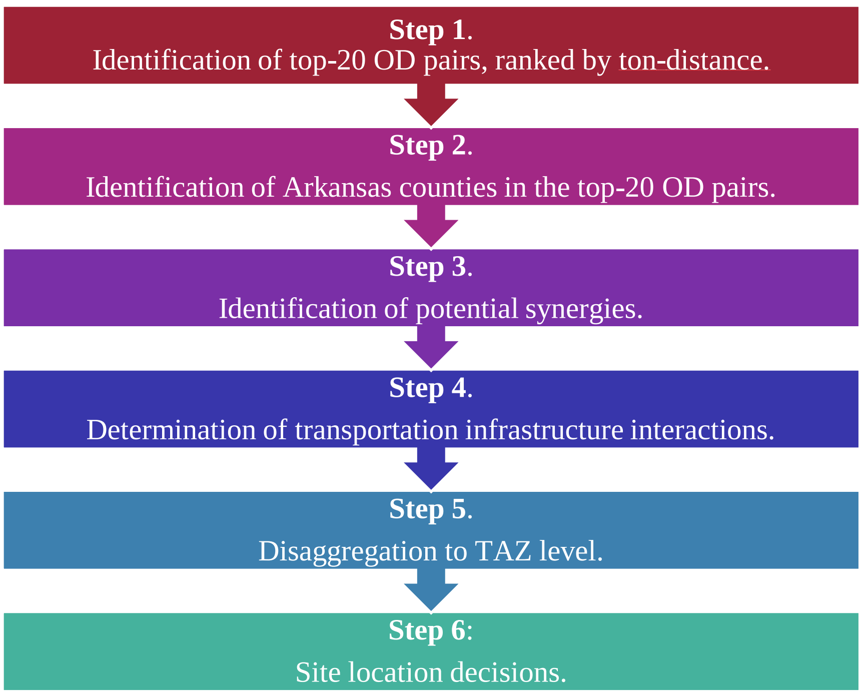


FIGURE 0-2. OVERVIEW OF PROCESS TO DETERMINE FEASIBLE TRANSLOAD LOCATIONS

Identification of Top-20 OD-Commodity Pairs (Step 1)

The goal of Step 1 is to pre-select counties within the state that have high potential for transload operations. To do this, AR STDM commodity production and consumption data at the county level and origin/destination (OD) tables were used. Each OD table represents the annual tons of freight moved by each transport mode (truck, rail or water) for each of the of the 15 commodity groups. The zones in the OD tables include within state counties and out-of-state regions. Data from the model is available for the base year (2010) and a forecast year (2040).

For our analysis, we combined the truck flows from the base year with the change in commodity flows between the base and forecast years. Data from 2010 captures existing conditions while data from 2040 allows us to consider anticipated facility capacity needs over the long-term planning horizon. For the 2010 data, we considered only the portion of the commodity moved by truck as these flows could be shifted to barge or rail. For the forecast year, 2040, we considered the total tonnage, e.g. tonnage moved by truck, rail, and barge, not already accounted for the in the base year. The equation used to calculate tonnage used for analysis is as follows:

Equation 1:

$$T = Truck_{2010} + (Truck_{2040} - Truck_{2010}) + (Rail_{2040} - Rail_{2010}) + (Barge_{2040} - Barge_{2010})$$

Where

$Truck_{2010}, Barge_{2010}, Rail_{2010}$ is the tonnage transported by truck, barge, and rail in 2010, respectively

$Truck_{2040}, Barge_{2040}, Rail_{2040}$ is the tonnage transported by truck, barge, and rail in 2040, respectively

The premise of this study is that non-truck modes are more efficient and thus a potential facility should be placed to encourage use of non-truck modes. Therefore, for the base year (2010), only the commodity tonnage that is currently shipped by truck would have potential for use of a transload facility to shift commodities from truck to rail or barge. For the future scenario (2040) true mode share is unknown so we assume that all commodity tonnage shipped by any mode would have potential for use of a transload facility. This helps to capture the possibility of expanding existing facilities that already serve as transload from truck to rail or barge. For instance, if tonnage of a particular commodity is projected to increase significantly and exceed the capacity of the transload facility that is currently used to service that commodity, then analyzing total change in tonnage between the forecast and base year, rather than just that moved by truck, would capture this possibility.

From the AR STDM OD tables we extracted distances between each OD pair, the annual tons by truck for 2010 for each commodity group transported between each OD pair, and the total annual tons by all modes for 2040 for each OD pair for each commodity group. For each OD pair, the commodity groups with the highest, second highest, and third highest tonnages were identified and the ton-distance for each of these top three commodity groups were calculated. OD pairs were then ranked by the ton-distance of the commodity group with the highest tonnage and the top-20 pairs were identified. Then the second and third highest tonnages between each of the top-20 OD pairs was entered into the ranking. As shown in **Table 5-2**, two OD pairs appear twice in the top-20 ranking. In these two cases, the commodity group with the second highest tonnage between the OD pair exceeded the tonnage of the dominate commodity group of the OD pairs included in the top-20 ranking.

Next, OD pairs located less than approximately 200 miles apart were removed. Based on the literature, trucks do not compete with other modes (rail and barge) for distances less than 200 miles on average (see Discussion in Section 5.1.2). Finally, the remaining OD pairs were sorted by maximum ton-distance and the top-20 OD pairs were identified. **Table 5-2a** shows the top-20 OD pairs ranked by ton-distance as calculated per Equation 1 (e.g. the difference between the 2010 and 2040 tonnage plus the 2010 truck tonnage).

Ton-miles carried by truck for 2010 are provided in **Table 5-2a** for comparison against the ton-miles ranking using all modes for the base and forecast year. To illustrate the difference in ranking using only truck tonnage in the base year, **Table 5-2b** shows the top-20 OD pairs ranked by ton-distance considering only tonnage carried by truck in 2010. As with **Table 5-2a**, OD pairs less than approximately 200 miles apart were removed. The first column of **Table 5-2a** lists the rank for the same OD pair and commodity group under the all modes ranking scheme. Fourteen of the 20 OD pairs appear in both ranking schemes. Under both ranking schemes (e.g. all modes for the base and forecast years vs. truck only for base year), the same counties dominate the ton-distance measure- Pulaski, Washington, and Benton. Under the all mode ranking scheme, Sebastian and Faulkner counties enter the ranking at the 14th and 18th positions for secondary and miscellaneous mixed commodities. Under the truck only ranking, Howard County enters the ranking at the 14th position for lumber.

TABLE 0-2. RANKING OF OD PAIRS BY TON-DISTANCE WITH ORIGIN OR DESTINATION IN ARKANSAS

A. TOP-20 OD PAIRS BY TON-DISTANCE WITH ORIGIN OR DESTINATION IN ARKANSAS BY ALL MODES FOR BASE AND FORECAST YEARS

	Origin Region Name (ID)	Destination Region Name (ID)	Commodity Group	Distance[1,2] (miles)	2010 Truck (1000 ton miles)	2040-2010 All Modes[3]
-	Casper, Wyoming (7312)	**Independence** (5063)*	Coal	993	0	6,518,394
-	Casper, Wyoming (7312)	**Benton** (5007)*	Coal	846	0	2,427,126
1	Los Angeles- Long Beach, California (7023)	**Pulaski** (5119)*	Sec. & Misc. Mixed	1,417	342,597	1,080,174
2	Los Angeles- Long Beach, California (7023)	**Pulaski** (5119)*	Durable Manufact.	1,417	336,005	841,796
3	Los Angeles- Long Beach, California (7023)	**Benton** (5007)*	Sec. & Misc. Mixed	1,297	168,170	751,912
4	**Pulaski** (5119)*	Huston, Texas (7261)	Nonmetallic Minerals	379	704,935	710,058
5	Los Angeles- Long Beach, California (7023)	**Benton** (5007)*	Durable Manufact.	1,297	139,975	651,851
6	**Pulaski** (5119)*	Los Angeles- Long Beach, California (7023)	Sec. & Misc. Mixed	1,417	329,873	628,772
7	**Mississippi** (5093)*	Los Angeles- Long Beach, California (7023)	Sec. & Misc. Mixed	1,535	72,406	603,751
8	**Pulaski** (5119)*	Lafayette-Acadiana, Louisiana (7110)	Nonmetallic Minerals	288	489,962	525,573
-	Casper, Wyoming (7312)	Jefferson (5069)*	Coal	1,037	0	483,179
9	Los Angeles- Long Beach, California (7023)	**Washington** (5143)*	Sec. & Misc. Mixed	1,301	155,075	456,146
10	**Benton** (5007)*	Los Angeles- Long Beach, California (7023)	Sec. & Misc. Mixed	1,297	165,982	454,724
11	**Pulaski** (5119)*	Memphis, Tennessee (7251)	Nonmetallic Minerals	199	311,388	406,188
12	**Washington** (5143)*	Los Angeles- Long Beach, California (7023)	Food	1,301	233,582	397,551
13	**Washington** (5143)*	Detroit-Warren-Flint, Michigan (7124)	Food	743	256,616	355,324
14	Los Angeles- Long Beach, California (7023)	**Sebastian** (5131)*	Sec. & Misc. Mixed	1,303	116,871	339,817
15	**Pulaski** (5119)*	Kansas City, Kansas (7094)	Primary Metal	318	188,528	326,026
16	Seattle-Tacoma-Olympia, Washington (7290)	**Pulaski** (5119)*	Durable Manufact.	1,799	208,828	317,380
17	**Washington** (5143)*	San Jose- San Fran.- Oakland, California (7028)	Food	1,544	159,836	279,636
18	Los Angeles- Long Beach, California (7023)	**Faulkner** (5045)*	Sec. & Misc. Mixed	1,412	58,446	267,945
19	Seattle-Tacoma-Olympia, Washington (7290)	**Benton** (5007)*	Durable Manufact.	1,646	72,445	258,622
20	**Pulaski** (5119)*	Birmingham-Hoover-Cullman, AL (7002)	Primary Metal	311	56,610	254,346

*1. Distances shown in **Table 5-2** are centroid-to-centroid, Euclidean distances which are approximations of the route distance between two zones.*
2. External zones represent Bureau of Economic Analysis (BEA) regions which are very large regional zones.
3. Calculated as per Equation 1.

b. Top-20 OD Pairs by Ton-Distance with Origin or Destination in Arkansas by Truck for Base Year Only

Rank by All[1]	Rank by Truck	Origin Region Name (ID)	Destination Region Name (ID)	Commodity Group	Distance (miles)	2010 Truck Only (1000 ton miles)
4	1	**Pulaski* (5119)**	Houston, Texas (7261)	Nonmetallic Minerals	379	704,935
8	2	**Pulaski* (5119)**	Lafayette-Acadiana, Louisiana (7110)	Nonmetallic Minerals	288	489,962
1	3	Los Angeles- Long Beach, California (7023)	**Pulaski* (5119)**	Sec. & Misc. Mixed	1,417	342,597
2	4	Los Angeles- Long Beach, California (7023)	**Pulaski* (5119)**	Durable Manufacturing	1,417	336,005
6	5	**Pulaski* (5119)**	Los Angeles- Long Beach, California (7023)	Sec. & Misc. Mixed	1,417	329,873
11	6	**Pulaski* (5119)**	Memphis, Tennessee (7251)	Nonmetallic Minerals	199	311,388
13	7	**Washington* (5143)**	Detroit-Warren-Flint, Michigan (7124)	Food	743	256,616
12	8	**Washington* (5143)**	Los Angeles- Long Beach, California (7023)	Food	1,301	233,582
-	9	**Pulaski* (5119)**	Jackson, Mississippi (7139)	Nonmetallic Minerals	220	209,545
16	10	Seattle-Tacoma-Olympia, Washington (7290)	**Pulaski* (5119)**	Durable Manufacturing	1,799	208,828
-	11	**Pulaski* (5119)**	Dallas-Fort Worth, Texas (7259)	Nonmetallic Minerals	308	198,661
-	12	**Washington* (5143)**	Cleveland-Akron-Elyria, Ohio (7200)	Food	769	189,367
15	13	**Pulaski* (5119)**	Kansas City, Kansas (7094)	Primary Metal	318	188,528
-	14	**Howard* (5061)**	Houston-Baytown-Huntsville, Texas (7261)	Lumber	292	173,205
3	15	Los Angeles- Long Beach, California (7023)	**Benton* (5007)**	Sec. & Misc. Mixed	1,297	168,170
-	16	**Pulaski* (5119)**	Wichita, Kansas (7098)	Primary Metal	422	167,183
10	17	**Benton* (5007)**	Los Angeles- Long Beach, California (7023)	Sec. & Misc. Mixed	1,297	165,982
17	18	**Washington* (5143)**	San Jose- San Fran.- Oakland, California (7028)	Food	1,544	159,836
9	19	Los Angeles- Long Beach, California (7023)	**Washington* (5143)**	Sec. & Misc. Mixed	1,301	155,075
-	20	**Washington* (5143)**	Los Angeles- Long Beach, California (7023)	Sec. & Misc. Mixed	1,301	151,816

1. Corresponding rank from Table 5-2a for the same OD pair and commodity.

Identification of Arkansas Counties in the Top-20 OD Pairs (Step 2)

From the top-20 OD pairs ranked by ton-distance, a list of the zones appearing as the origin or destination of the trip was created. These zones represent the Arkansas counties with highest potential to maintain, in the long term, a source of income for the transload facility operator (maximum ton-distance), for at least one commodity group. The counties ranked in the top-20 based on ton-distance that serve as an origin or destination in Arkansas in order of total tonnage are:

1. Independence
2. Pulaski
3. Benton
4. Washington
5. Mississippi
6. Jefferson
7. Sebastian

Identification of Potential Synergies (Step 3)

In order to consider potential synergies of commodities and freight directionality, next we focus on each of the counties identified in Step 2, and factor in other major commodity groups (in ton-distance) produced in or attracted to each identified county. For example, for the third ranked OD pair (California to Pulaski County) the main commodity group is 'secondary and miscellaneous mixed' with 1,080,174 ton-miles. For the same OD pair, we also observe a significant tonnage of 'durable manufactured products' with 841,796 ton-miles. Because there is a large amount of two commodities from California to Pulaski County we anticipate that a transload facility in Pulaski County would have higher potential than if only one of the commodity groups had heavy flow.

Commodity Synergies

For each county, the ton-miles of each commodity group originating in or destined to the county are aggregated as summarized in **Table 5-3**. Note that the total ton-distance shown in **Table 5-3** corresponds to the commodity group-OD pair listed in the top-20 ranking of **Table 5-2**. The last column of **Table 5-3** and **Figure 5-3** summarize the dominate commodity groups originating or destined to each county that appeared in the top-20 list. When there is more than one dominate commodity, the percent share of the total ton-distance for each prevalent commodity group is shown. For Pulaski County, for example, the ton-distance is split primarily between secondary miscellaneous mixed (34%) and non-metallic minerals (32%), with durable manufacturing as a tertiary commodity with 23% of the ton-distance share.

Based on AR-STDM model output, shipments of coal to Arkansas serve power generation plants, and are already moved exclusively by rail. Thus, Coal was excluded from the set of commodity groups, since there is not significant potential for transloading multiple commodity types or for serving multiple customers. As a result, Independence and Jefferson Counties were removed from the list of potential transload facility sites and disregarded from further analysis.

Furthermore, the ton-miles observed for commodities originating or terminating in Mississippi, Jefferson, and Sebastian counties are significantly lower than what is observed for Pulaski, Benton, and Washington counties. The highest ton-miles of the lowest ranking counties (e.g. Mississippi, Jefferson, and Sebastian) is less than an 8th of the ton-miles of Pulaski county. Thus, Mississippi, Jefferson, and Sebastian counties were removed from the list of high priority transload facility sites and disregarded from further analysis based on their commodity flow. Removal of these counties from the priority list does not indicate that transload facilities are not viable in these counties. Rather, we are placing greater emphasis Pulaski, Washington, and Benton counties. Prioritization is based on the assumption that it is not feasible to invest in facilities in all possible locations, but rather to concentrate efforts on the facilities that could handle the most commodity based on ton-distance. Coincidently, Sebastian and neighboring Crawford counties were identified by stakeholders and are thus included in the analysis of potential sites based on stakeholder interviews (Section 5.3).

TABLE 0-3. TON-DISTANCE OF DOMINATE COMMODITY GROUPS TRANSPORTED BETWEEN THE TOP-20 OD PAIRS

County	Originating in County (ton-miles)	Destined for County (ton-miles)	Total (ton-miles)	Dominate Commodity (% of Total)
Pulaski	2,850,963	2,239,350	5,090,313	Sec. and Misc. (34%), Non-Metallic Minerals (32%)
Benton	454,724	4,089,511	4,544,235	Coal (53%), Sec. and Misc. (27%)
Washington	1,032,511	456,146	1,488,657	Food (69%), Sec. and Misc. (31%)
Mississippi	603,751	-	603,751	Sec. and Misc.
Sebastian	-	339,817	339,817	Sec. and Misc.

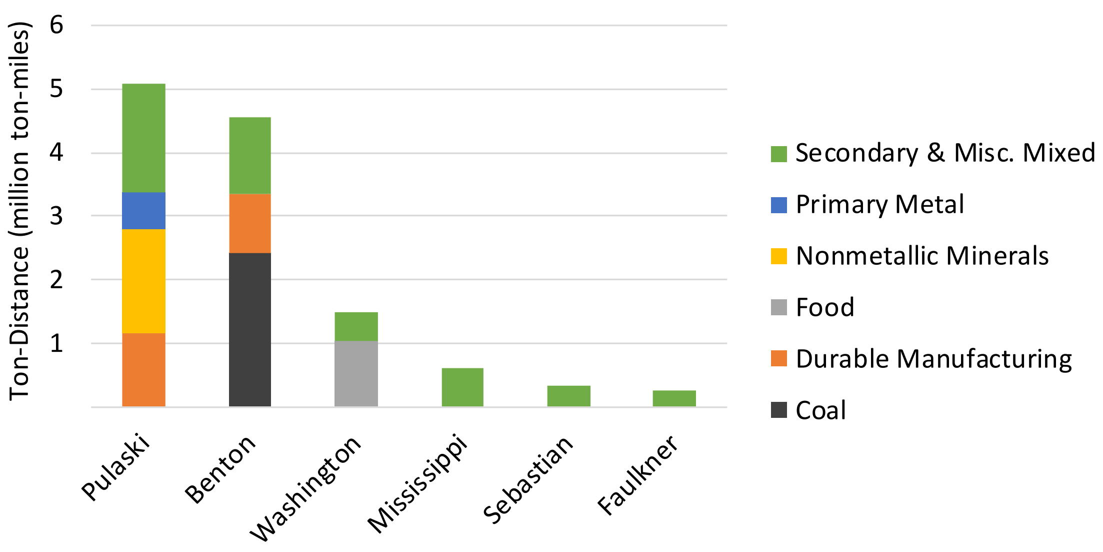


FIGURE 0-3. SUMMARY OF COMMODITY GROUPS FOR TOP-RANKED AR COUNTIES

Lastly, it is feasible to consider facilities that could serve multiple counties found in the top-20 ranking. For example, for Benton County, the commodities appearing in the top-20 OD pair ranking are Durable Manufacturing (AR-STDM CG 9) and Secondary & Miscellaneous Mixed (AR-STDM CG 15). The commodities appearing in the top-20 OD pair ranking with origin or destination in Washington County are Food (AR-STDM CG 5) and Secondary & Miscellaneous Mixed (AR-STDM CG 15). Given the proximity of Benton and Washington Counties and considering that both counties appear in the top-20 OD List, these two counties were combined for further analysis. It is reasonable to serve both counties (which are the only adjacent counties appearing in the top-20 ranked OD list from the same transload facility) with the same facility. **Table 5-4** summarizes the two proposed facilities based on commodity synergies.

TABLE 0-4. PROPOSED FACILITIES BY COMMODITY TYPE

Facility	Counties	Commodities within the Top-20 OD-pairs ranking
Facility 1	Pulaski	• Nonmetallic Minerals • Primary Metal • Durable Manufacturing • Secondary & Miscellaneous Mixed
Facility 2	Benton/Washington	• Durable Manufacturing (Benton County) • Food (Washington County) • Secondary & Miscellaneous Mixed (Both Counties)

Directionality Synergies

The general directionality of shipments to each of the remaining counties (e.g. Pulaski, Benton, and Washington) was considered as an indication of transload facility potential. Directionality represents the proximity and alignment of different markets served by the same county. This captures the ability of a facility to combine shipments orientated along the same shipment lane. For this project, shipment lane was loosely defined by the OD pair. This form of directionality (vs. specific shipping route) is necessary due to the abstract nature of the zoning system used in STDMs, where multi-region external zones are represented by centroids resulting in OD directions that are quite abstract. **Figures 5-4 and 5-5** depict the directionality of the top shipments to and from Pulaski County and Benton and Washington Counties.

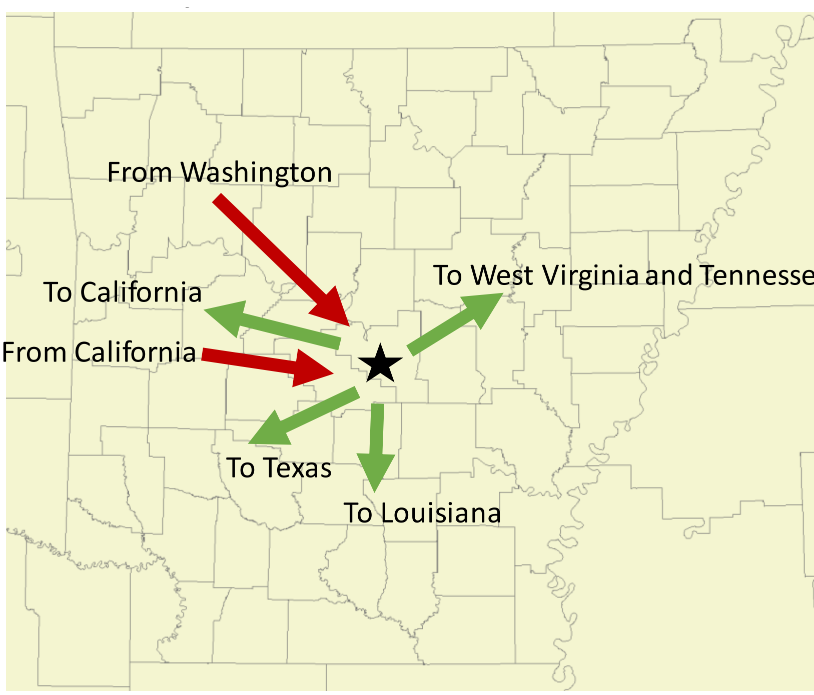


FIGURE 0-4. DIRECTIONALITY ANALYSIS FOR PULASKI COUNTY

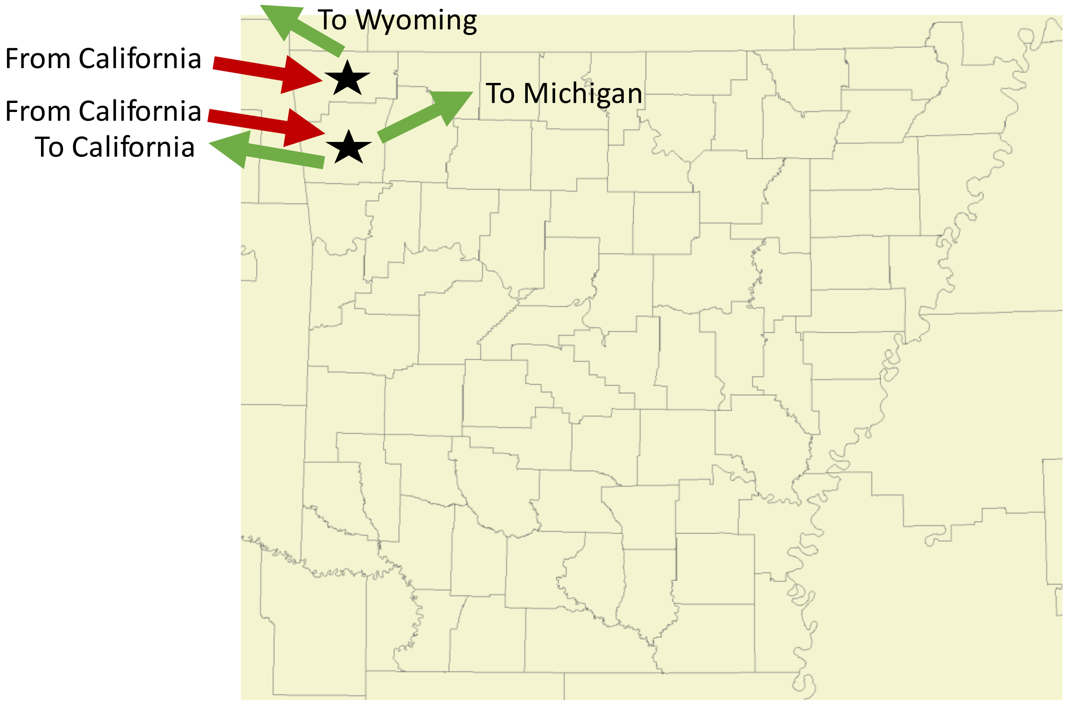


FIGURE 0-5. DIRECTIONALITY ANALYSIS FOR BENTON AND WASHINGTON COUNTIES

To assess directionality as a quantitative measure, directionality was defined, more specifically, as the angle between the line connecting an OD pair and due north, i.e. the azimuth, measured in clockwise direction from north. Directionality is aggregated to 45-degrees sections centered in the inter-cardinal directions (i.e. NNE, NEE, SEE, SSE, etc.). For each county, the percentage of tons transported within 45-degree regions are used to capture directional aggregation potential. For each county, the inter-cardinal direction with highest percentage of tons transported is identified. Then, the difference between the peak and the average percentage of tons (across the eight 45-degree sections) is calculated. Counties are ranked as per that difference, which serves as a measurement of shipping lane concentration. A higher concentration means that most of the tons are traveling to/from more similar directions, e.g. the narrowest angle from/to a particular county. Thus, the county with highest concentration is the most appropriate location to host a transload facility. For ease of comparison, the county with highest peak measurement is ranked first; while the county with lowest peak measurement receives the lowest ranking.

Shipping lane concentration values are shown in **Table 5-5**. Of the counties selected via commodity flow analysis (Pulaski, Benton, and Washington), Pulaski had the lowest concentration and thus was ranked lowest compared to Benton and Washington. This indicates that the shipments to and from Benton and Washington County are more aggregated along the same shipping lanes when compared to Pulaski County. As a point of reference, in applying the same directionality quantification to all counties ranked in the top 20 OD pairs, the shipping lane concentration ranged from 0.044 (Pulaski) to 0.569 (Independence County).

TABLE 0-5. DIRECTIONALITY AGGREGATION POTENTIAL OF TOP-RANKED AR COUNTIES

County	Concentration	Ranking
Benton	0.179	1
Washington	0.134	2
Pulaski	0.044	3

Transportation Infrastructure Interactions (Step 4)

A necessary criterion to support transload operations is the presence of multiple freight transportation infrastructure, e.g. highways, rail lines, and waterways. Thus, for Step 4, we assess the availability of the rail and water modes for each of the pre-selected counties. **Table 5-6** summarizes the rail and water accessibility of each country determined from Step 3. It should be noted that this approach only measures presence of a mode and not access to that mode, e.g., there does not have to be a port or railyard in the county to receive a positive indication for rail or barge. This is because the transload facility serves as the modal access. Access to navigable waterways and railways are the most limiting factor in regards to siting a truck to barge transload facility. Of the three counties listed in **Table 5-6**, only Pulaski County has access to all three modes.

For each of the pre-selected counties, we seek to locate a new facility or to potentially expand an existing transload facility. Existing transload locations in each of the pre-selected counties were identified from the facility survey and are summarized in **Table 5-7** below.

Figure 5-6 maps the state rail network, navigable waterways, and locations of existing transload facilities, highlighting the selected counties.

TABLE 0-6. ACCESSIBILITY TO EXISTING INFRASTRUCTURE

Pre-Selected Counties	Rail Accessibility	Water Accessibility	Existing Transload Facility
Pulaski	Yes	Yes	Yes
Benton	Yes	No	No
Washington	Yes	No	Yes

TABLE 0-7. EXISTING TRANSLOAD FACILITY LOCATIONS IN THE PRE-SELECTED COUNTIES

Counties	Existing Transload Facilities (Available Modes)
Pulaski	1. AKMD Smart Warehousing (Truck/Train) 2. AKMD transload (Truck/Train) 3. UP North Little Rock (Truck/Train) 4. Oakley (Truck/Train/Water) 5. Port of Little Rock (Truck/Train/Water) 6. Jeffrey Sand Co. (Truck/Water) 7. Petroleum Fuel and Terminal (Truck/Water)
Benton	No Facilities
Washington	Ozark Transmodal (truck/Train)

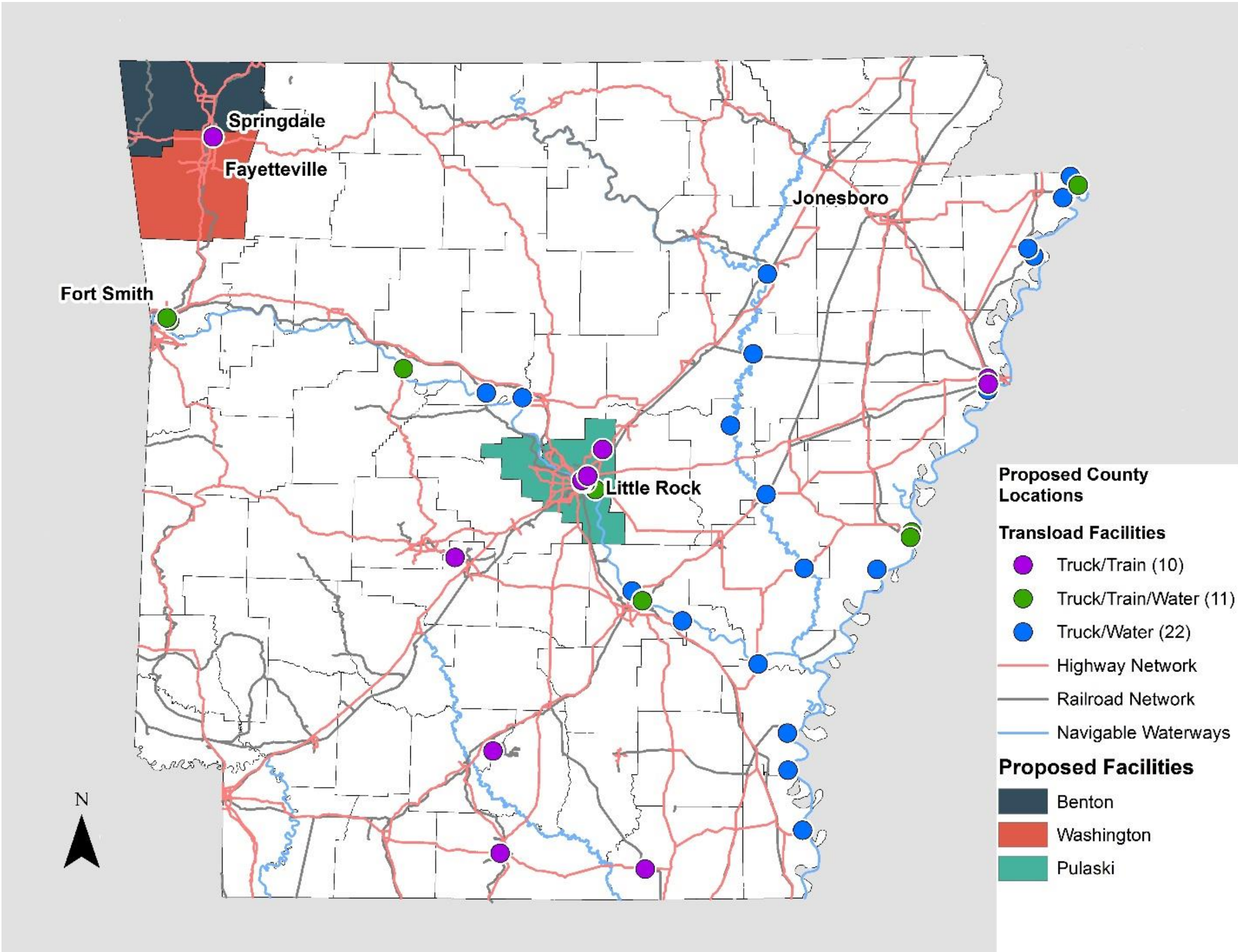


FIGURE 0-6. POTENTIAL COUNTY LOCATIONS FOR TRANSLOAD FACILITIES AND EXISTING FREIGHT INFRASTRUCTURE

Disaggregation to TAZ Level (Step 5)

The objective of this step is to identify the most suitable TAZs to locate a freight transload facility within the top-ranked Arkansas counties of Pulaski and Benton/Washington. To do this, the commodity flow data at the county level was disaggregated to the TAZ level using weekday truck trip estimates from the AR-STDM. Then, for each county, the TAZ that 'captures' the most freight in a 20-mile drayage zone was selected as the freight centroid of the county. In this analysis, only commodity types proposed to be handled at each facility listed in **Table 5-8** are included in the disaggregation process and the determination of the centroid TAZ**,** e.g. only non-metallic minerals, primary metals, durable manufacturing, chemicals, food products, and secondary and miscellaneous mixed commodities. The centroid TAZ is the location in which the transload facility is proposed.

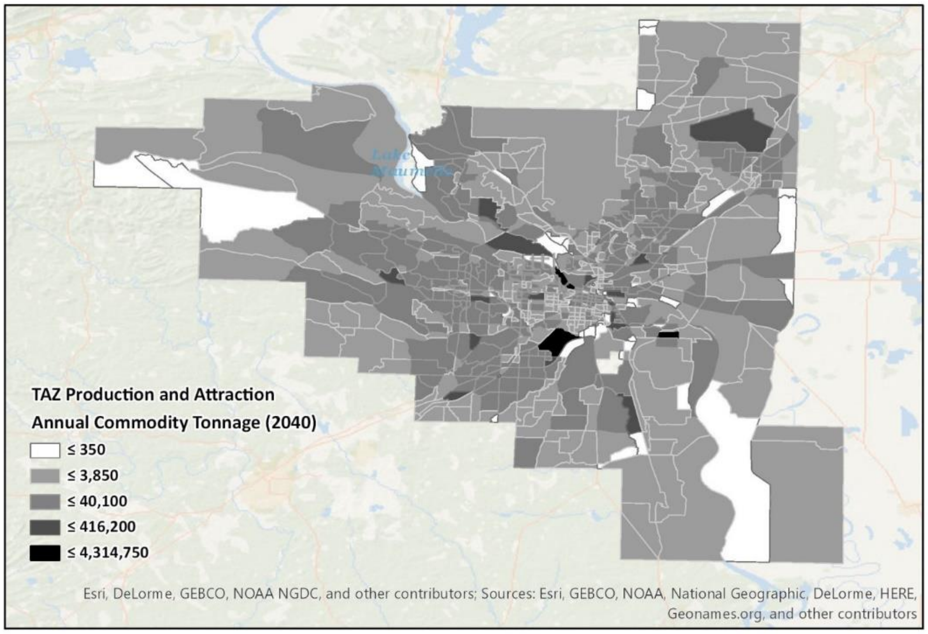
Disaggregation to TAZ based on Truck Trips

The OD truck trip data provided by the AR-STDM TransCAD model for the 2040 forecast scenario was used as the primary data source to perform disaggregation from county to TAZ. The truck trip data is the weekday truck trips to and from each TAZ within and external to Arkansas. While the commodity tonnage data is available as modal output at the county level of aggregation, commodity data at the disaggregated TAZ level is not a direct model output. This is due to the inherent use of the TransCAD model in that the goal of the model is to estimate truck traffic on the highway system. Thus, after the mode choice step, only truck trip matrices are available. These matrices (one per commodity) have information of week-day truck trips, in tons. The daily truck trip matrix at the TAZ level was converted to annual tons by applying payload factors specific to each commodity and a conversion factor from week-day to annual days. The resulting matrices have the annual tons of commodity transported by truck between each OD pair modeled in the AR-STDM, at TAZ level, in 2040.

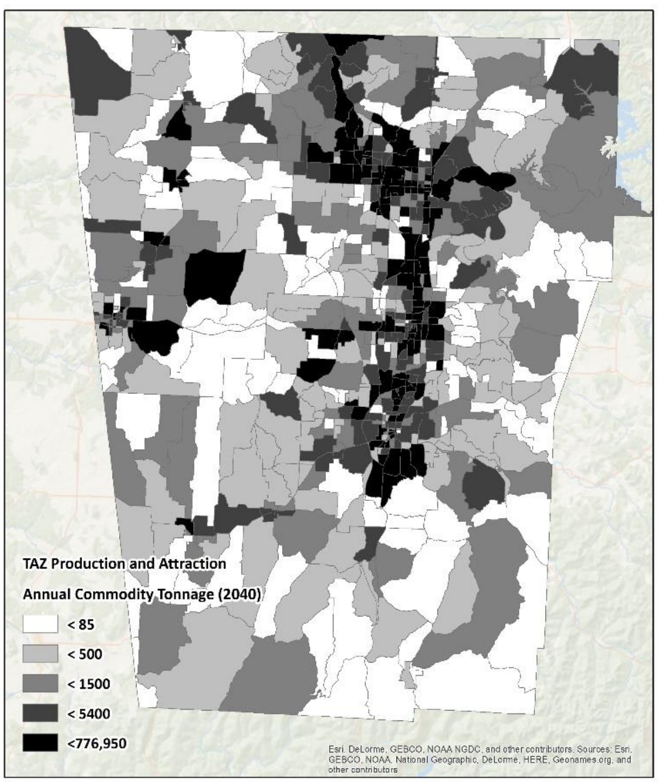
Figures 5-7a and 5-7b show TAZ heat maps of the annual commodity tonnage carried by truck for Pulaski and Benton/Washington counties for the forecast year, 2040. On these maps, the total commodity tonnage is the sum total of production and attraction for the commodity groups corresponding to those listed in **Table 5-4** and for the shipping lanes identified in the top-20**.** For example, for Pulaski County, the tonnage shown in **Figure 5-7a** is the sum of flows across the following regions, for the commodity groups identified in the top-20 ranking for Pulaski County (secondary and misc. mixed, durable manufacturing, nonmetallic minerals, and primary metals):

- All internal-internal (I-I) flows between TAZs within Pulaski County
- The External zones identified in the top-20 ranking with Pulaski County as an origin or destination (e.g. the E-I and I-E flows).

The same analysis is repeated for each of the counties where a transload facility is proposed to be located.



(A) PULASKI COUNTY



(B) BENTON AND WASHINGTON COUNTIES

FIGURE 0-7. COMMODITY TONNAGE BY TAZ FOR THE FORECAST YEAR WITH ORIGIN OR DESTINATION IN THE SELECTED COUNTIES

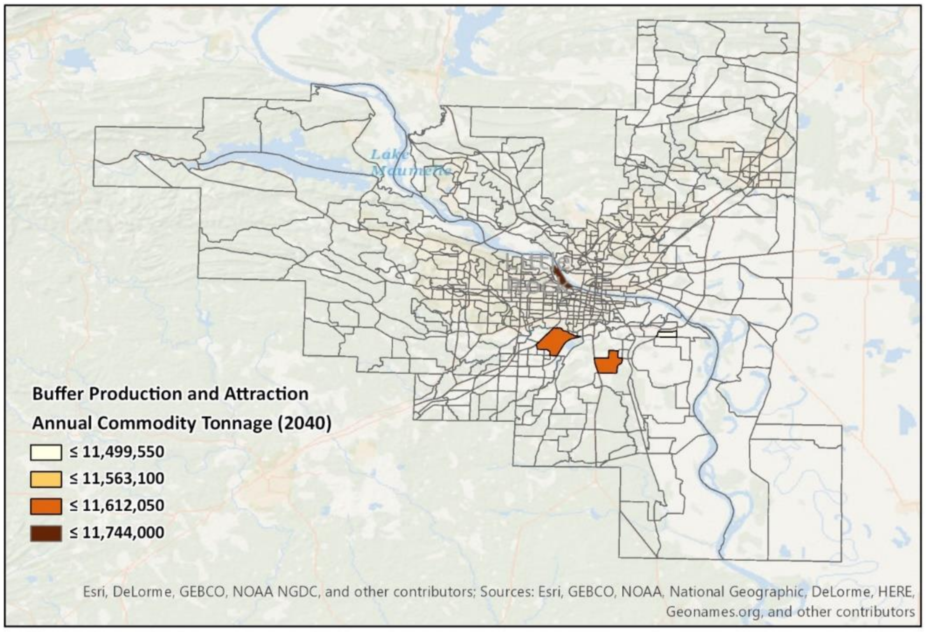
Determination of County ‘Centroid TAZ’

Once freight commodities are disaggregated from county to TAZ level, it is necessary to determine which TAZ handles the most freight as this will be the most suitable location for a transload facility. In this project, the TAZ with the most freight activity (defined by tonnage) is referred to as the ‘centroid TAZ’. The centroid TAZ not only has a high amount of originating or terminating freight, but also is located such that it can capture freight drayed in or out from nearby TAZs.

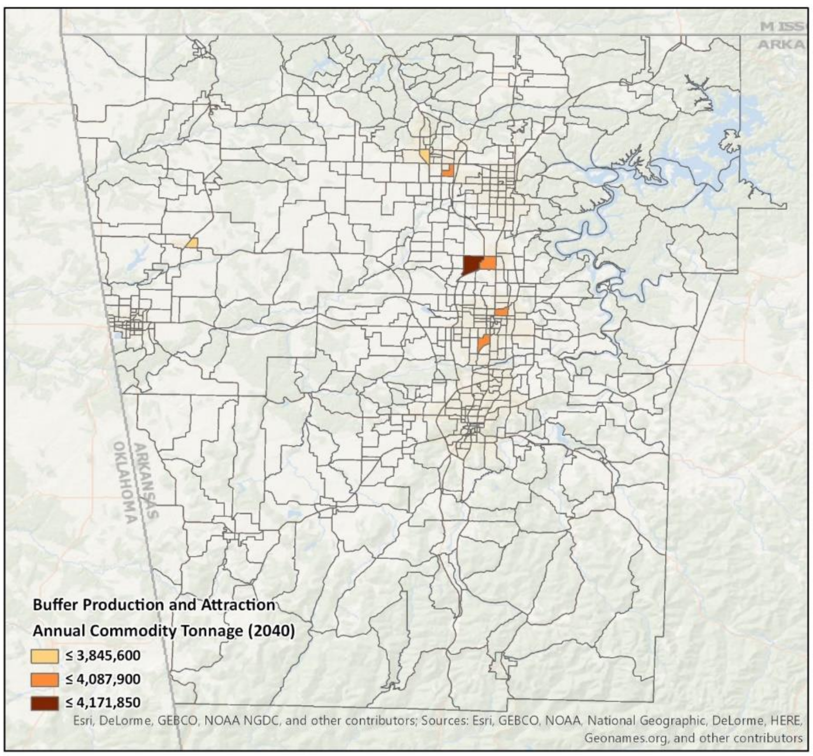
Based on a Spatial Aggregation Analysis using ArcMap (GIS Software), the TAZ with the highest combined production and attraction of selected commodities within a reasonable drayage area was determined. Based on the literature, a drayage distance of 20-miles was used. The drayage buffer defines how far a truck would be willing to carry a shipment to or from its final pick-up or delivery point.

Figures 5-8a and 5-8b show the results of the spatial aggregation analysis used to determine the centroid TAZ in each county. The heat map depicts the combined total of (i) a TAZ’s production and consumption tonnage and (ii) the tonnage of TAZ’s production and consumption tonnage within the 20-mile drayage buffer. The TAZs with darker shading have higher total tonnages than those with lighter shading. Note that the drayage buffer combines tonnages from any TAZ within the buffer but does not account for partial coverage of the buffer across the TAZ.

The TAZ with the highest total production and consumption across all commodity groups of interest is the selected as the centroid TAZ for the county. The centroid TAZ is likely the best site for the transload facility in terms of its ability to capture commodity flow. The centroid TAZs of Pulaski and Benton/Washington counties are shown in **Table 5-8**.



(a) Pulaski County



(b) Benton and Washington Counties

FIGURE 0-8. COMMODITY TONNAGE BY TAZ DRAYAGE BUFFER FOR THE FORECAST YEAR WITH ORIGIN OR DESTINATION IN PULASKI, BENTON AND WASHINGTON COUNTIES

TABLE 0-8. CENTROID TAZS OF PULASKI, BENTON/WASHINGTON

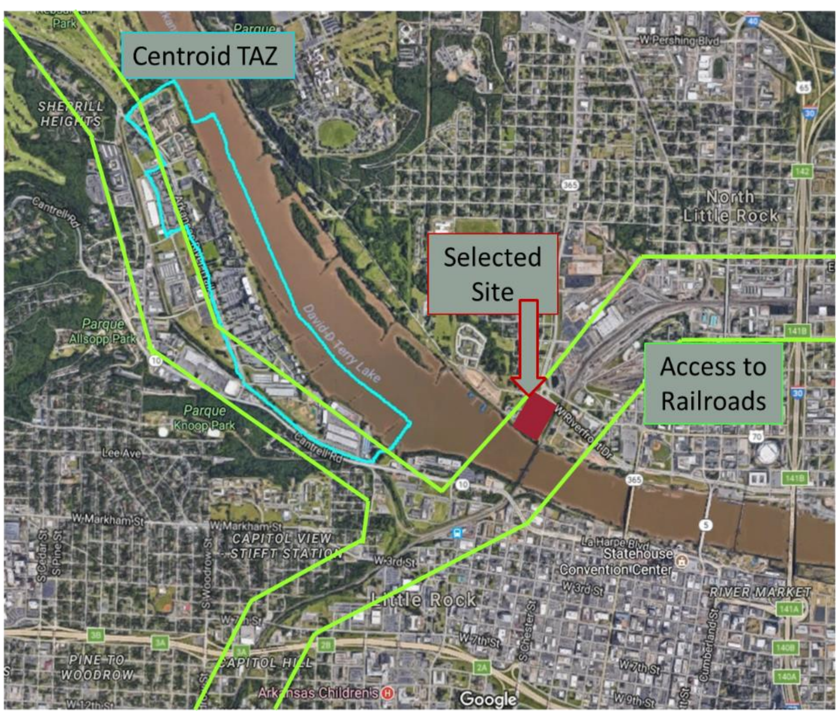
Facility	Counties	Commodities to be handled in the facility	Centroid TAZ
Facility 1	Pulaski	• Nonmetallic Minerals • Primary Metal • Secondary & Miscellaneous Mixed • Durable Manufacturing	105618
Facility 2	Benton and Washington Counties	• Secondary & Miscellaneous Mixed • Food • Durable Manufacturing	220221

Site Location Decision (Step 6)

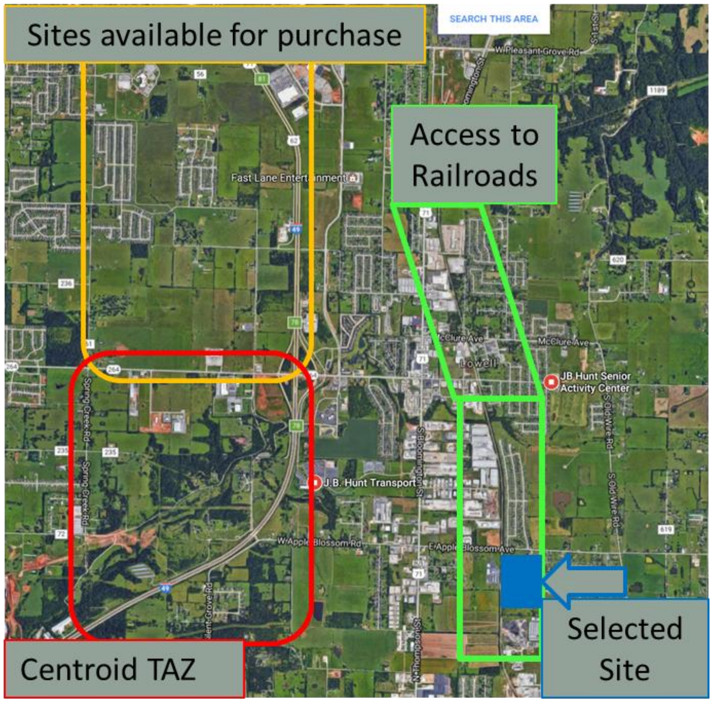
Up to this point in the analysis, the selection of feasible transload facilities has been restricted to the level of selecting a TAZ. The next step is to select an appropriate site and identify commercially available land. Details to identify feasible sites are described in the next sections.

Identify Vacant Land Parcels

The final selection of a site in which to locate the transload facility is completed using Google Earth and Google Maps. For each centroid TAZ selected from previous stages, Google earth is mainly used to identify vacant sites in the proximity of the TAZ and to identify if the nearest site that has access to rail and/or water. In addition, Google Earth is used to contextualize the centroid TAZ, by analyzing buildings and activities currently occurring within it. **Figures 5-9a and 5-9b** depict the neighboring areas for the Pulaski and Benton/Washington Centroid TAZs. In cases like this, were the centroid TAZ does not have access to the rail or water network, the latter is given priority to locate a potential vacant site as close as possible of the centroid TAZ.



(A) PULASKI COUNTY



(B) BENTON/WASHINGTON COUNTIES

FIGURE 0-9. USE OF GOOGLE MAPS FOR SITE CONTEXTUALIZATION AND IDENTIFICATION

Identification of existing freight transportation infrastructure

For each of the proposed transload facility locations, reasonably close existing facilities were identified. The results of the Transload Facility Inventory Survey were used for this analysis. **Table 5-9** summarizes the existing facilities found in each county, their mode access, and the distance to the centroid TAZ. From our survey (Section 3.3), we were unable to obtain enough detail about the facility types, equipment, and, most importantly, capacity to determine if an existing facility could handle additional commodities in terms of tonnage or type. For future studies, **Table 5-9** can be referenced to contact existing facilities to discuss potential expansion.

TABLE 0-9. EXISTING TRANSLOAD FACILITY LOCATIONS NEAR CENTROID TAZS

Counties	Existing Transload Facilities	Modes Other than Truck	Distance to Centroid TAZ (miles)[1]
Pulaski	AKMD Smart Warehousing	Rail	12.0
	AKMD transload	Rail	3.4
	UP North Little Rock	Rail	5.0
	Oakley	Rail/Water	4.5
	Port of Little Rock	Rail/Water	7.7
	Jeffrey Sand Co.	Water	3.6
	Petroleum Fuel and Terminal	Water	4.1
Benton/Washington	Ozark Transmodal	Rail	4.6

1. Based on Euclidean distance

Leveraging Arkansas Site Selection Tool

Once a potential TAZ is identified as a transload facility site, the Arkansas Economic Development Commission's Site Selection tool was used to identify commercially available parcels in the TAZ or neighboring TAZs. In particular, the Map Search tool was used to gather information contained in the one-page Site Profiles.

The information obtained from for each parcel includes availability, size, cost, coordinates, proximity to nearby transportation routes, available utilities, and terrain. When available parcels cannot be found within the proximity of preselected TAZ (which is the case for Benton of Washington, at the time of developing this project), only the vacant land parcels approximate location is show in the one-page site profiles provided in **Appendix 12.4**.

Because this exercise is based in a future planning horizon, the identification of current sites is made with the objective to potentially "reserve" available parcels for future development and adapt land zoning type in the future, if required. This pre-selection is of an early-stage nature. Thus, further site-specific studies need to be made before proceeding to final site selection, such as traffic impact studies, environmental impact studies, etc.

Evaluation of site sizes

One of the difficulties encountered during the development of this project was the lack of public information about existing transload facilities' capacity and land area. Transload capacity, storage capacity, and commodities specifically handled in each of the existing facilities are difficult data to obtain from stakeholders, since they consider it to be proprietary information. However, this information is needed to determine how large a proposed facility needs to be to handle a given commodity type and tonnage.

In the absence of facility size and capacity information, to evaluate whether the area of a potential site would be suitable to place a transload facility, an analysis of existing facilities using ArcMap and its Google imagery was made. Three measurements were taken on existing facilities: the site area (in acres), the rail-frontage length (in miles), and the waterfront length (in miles). Then, their average, maximum and minimum were calculated. Lastly, these measurements were compared with the same measurements taken from sites selected in previous steps. Results are summarized in **Table 5-10.**

TABLE 0-10. COMPARISON OF DIMENSIONS OF EXISTING FACILITIES AND PROPOSED SITED

Facility	Area (acres)	Rail-front length (miles)	Waterfront length (miles)
Average Existing Facilities	**39.7**	**0.7**	**0.3**
Max Existing Facilities	**293.7**	**3.0**	**0.9**
Min Existing Facilities	**3.0**	**0.1**	**0.1**
Benton / Washington	61	0.76	N/A
Pulaski[1]	6.5	0.11	0.05
1. The available land parcel identified for the Pulaski County site is smaller than what is used by sites of similar type			

Transload Site Selection Based on Stakeholder Interviews

In addition to the commodity flow analysis, stakeholder interviews were conducted to help identify potential transload facility sites. Stakeholder interviews help to fill a gap in the available data on commodity tonnage predictions. The commodity data extracted from the AR-STDM only predicts growth or decline of markets that exist in 2010. There is no mechanism in the commodity forecasts to account for new industries or commodities. For example, according to the AR State Rail Plan, Arkansas may begin producing and shipping wood pulp to Europe as a result of new European sanctions allowing wood as a sustainable fuel. Since this represents a new industry that would operate in Arkansas, it is not predicted in the commodity forecast data contained in the AR-STDM.

In this section, the process by which stakeholders were interviewed and the results of the interviews are described. Then, for each of the sites identified by stakeholders, the same commodity flow analysis described in Section 5.2 was applied to each of the sites. The results of the commodity flow analysis are presented in this Section.

Sites Identified by Stakeholders

Three of the industry interviews helped identify Malvern (Hot Spring County), Van Buren (Sebastian and Crawford County), and Pine Bluff (Jefferson County) as potential new or expansion sites for transload facilities. Each of the interviews were structured to focus on truck-to-rail/rail-to-truck or truck-to-barge/barge-to-truck transload opportunities.

Representing the truck transportation segment of the grain industry the Managing Partner for BulkloadsNow.com was interviewed in September of 2016. The interviewed identified a grain truck-to-barge study conducted in 2015 which identified a “market” need for an additional grain transload facility in the Pine Bluff area. Operationally, capacity appears to be sufficient; however, the overall grain industry believes an additional buyer would improve market conditions for grain products.

Representing the river terminal segment of the water transportation industry the President Five Rivers Distribution in Van Buren was interviewed in November 2016. The interview didn’t identify any traditional transload opportunities; however, container on barge (CoB) truck-to-barge and barge-to-truck intermodal opportunities are being evaluated.

Representing the pine timber industry, a VP of Mill Operations at Anthony Timberlands was interviewed in December of 2016. Due to the close proximity of timber forests to the mill locations truck-to-barge or truck-to-rail transloading of logs was not seen as feasible. One potential truck-to-rail or even mill directly to rail expansion opportunity was identified in Malvern for outbound finished timber products. The existing rail transload terminal is in close proximity to the mill and during peak seasons the rail facility doesn’t have sufficient capacity.

Commodity Flow Analysis to Stakeholder Sites

For Malvern (Hot Spring County), Van Buren (Sebastian and Crawford County), and Pine Bluff (Jefferson County), Steps 1, 2 and 3 shown in Section 5.2 were skipped. This is because the objectives of these steps (to identify counties and commodities that would be handled in the proposed facilities) are replaced by information obtained directly from stakeholder’s interviews.

Steps 4, 5 and 6 described in Section 5.2 were applied to Malvern (Hot Spring County), Van Buren (Sebastian and Crawford County), and Pine Bluff (Jefferson County). The sequential process followed was similar to the one used in Section 5.2. However, to identify the center of freight activity TAZ, the interaction with transportation network was analyzed first, and then only those TAZs witch had access to rail and/or water were subject to the buffer analysis. The TAZs with highest production and attraction of the selected commodity within the buffer is selected as the centroid TAZ. The Site Location Decision (Step 6) was done exactly the same for these sites than for Pulaski and Benton/Washington.

Transportation Infrastructure (Step 4)

Step 4 compared the transportation mode access and existing transload facilities in each county. As shown in **Table 5-11**, a potential transload site in Sebastian/Crawford and Jefferson Counties would likely provide access to all three modes while the facility in Hot Spring County would only provide rail access. **Table 5-12** lists the existing transload facilities in each county identified by stakeholders and found using the AEDC Site Select tool[5]. **Figure 5-10** highlights the location of the counties identified from stakeholder interviews and references their location against existing transportation infrastructure.

TABLE 0-11. ACCESSIBILITY TO EXISTING INFRASTRUCTURE FOR COUNTIES IDENTIFIED BY STAKEHOLDERS

County	Rail	Water	Existing Transload Facility
Sebastian/Crawford	Yes	Yes	Yes
Jefferson	Yes	Yes	Yes
Hot Spring	Yes	No	No

TABLE 0-12. EXISTING TRANSLOAD FACILITY LOCATIONS FOR COUNTIES IDENTIFIED BY STAKEHOLDERS

Counties	Existing Transload Facilities (Available Modes)
Sebastian/Crawford	1. Akhola Sand and Gravel (Truck/Train/Water) 2. West Ark Terminal (Truck/Train/Water)
Jefferson	1. Bunge Corp Pine Bluff Elevator (Truck/Water) 2. SP Pine Bluff TOFC/COFC (Truck/Rail) 3. Bunge Corp Linwood Elevator (Truck/Water) 4. Victoria Bend Terminal: Pine Bluff (Truck/Water) 5. Port of Pine Bluff Public Terminal (Truck/Rail/Water) 6. Petroleum Fuel & Terminal: Pine Bluff (Truck/Rail/Water) 7. Century Tube Inc: Pine Bluff (Truck/Water)
Hot Spring	None

[5] Obtained from http://www.arsiteselection.com/medc/portaldata/transp_inf/intermodal_facility.zip

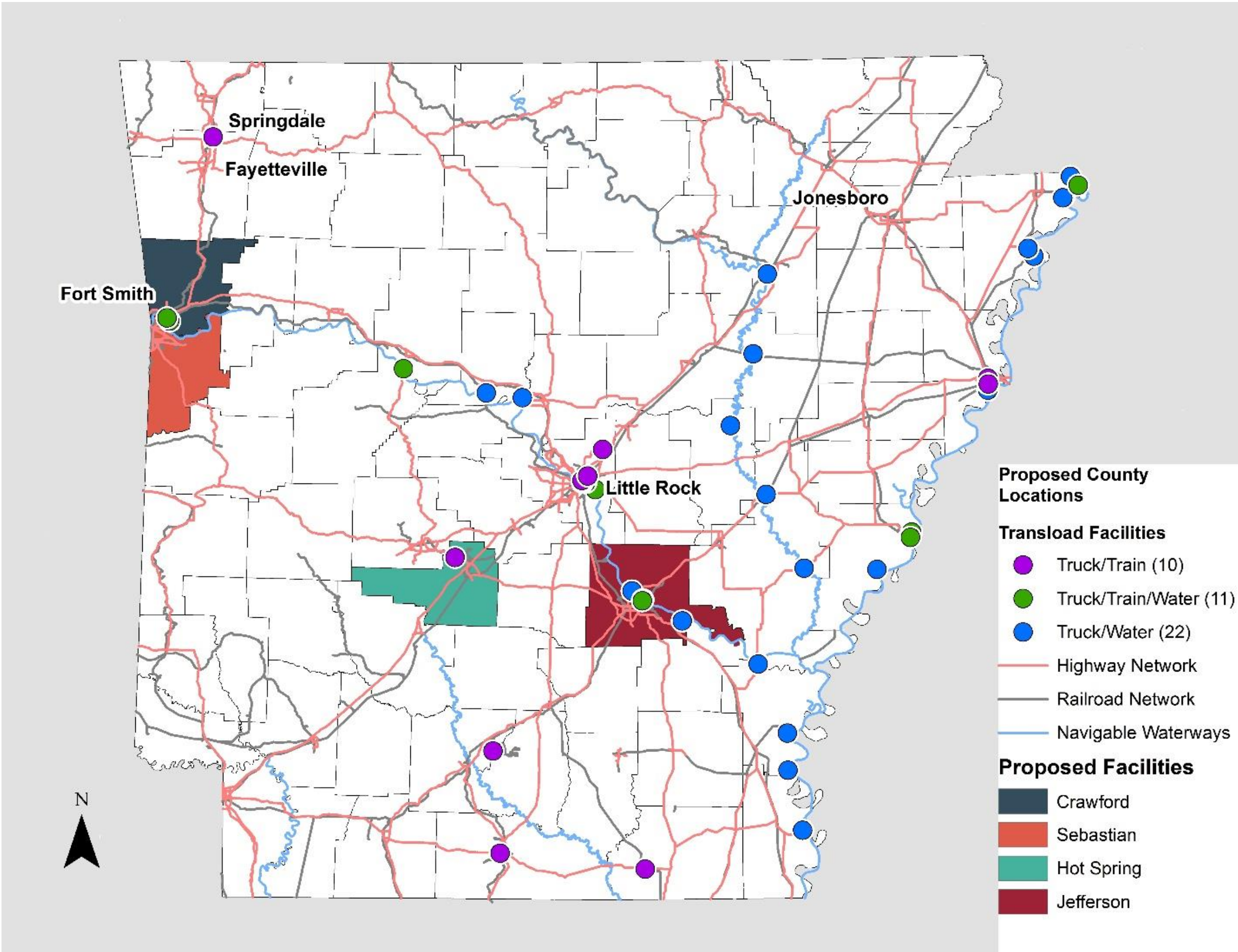
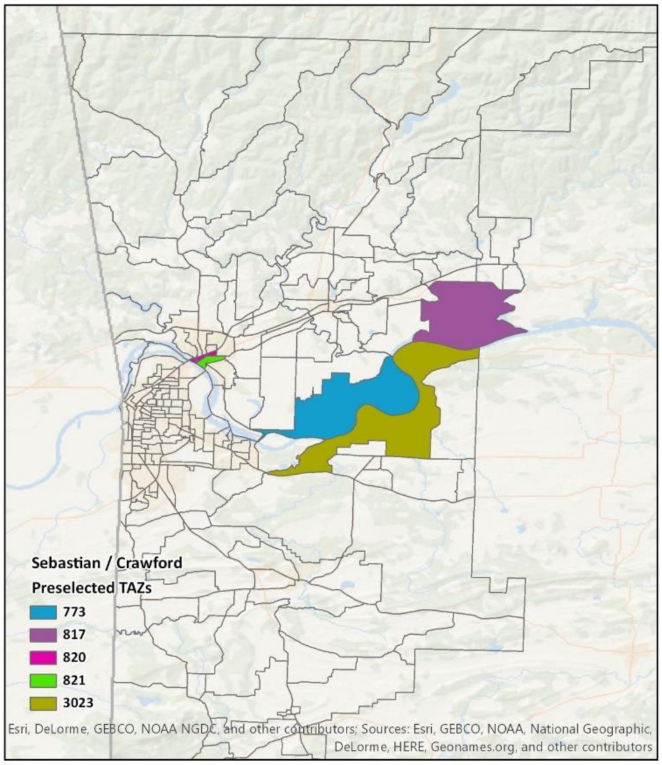


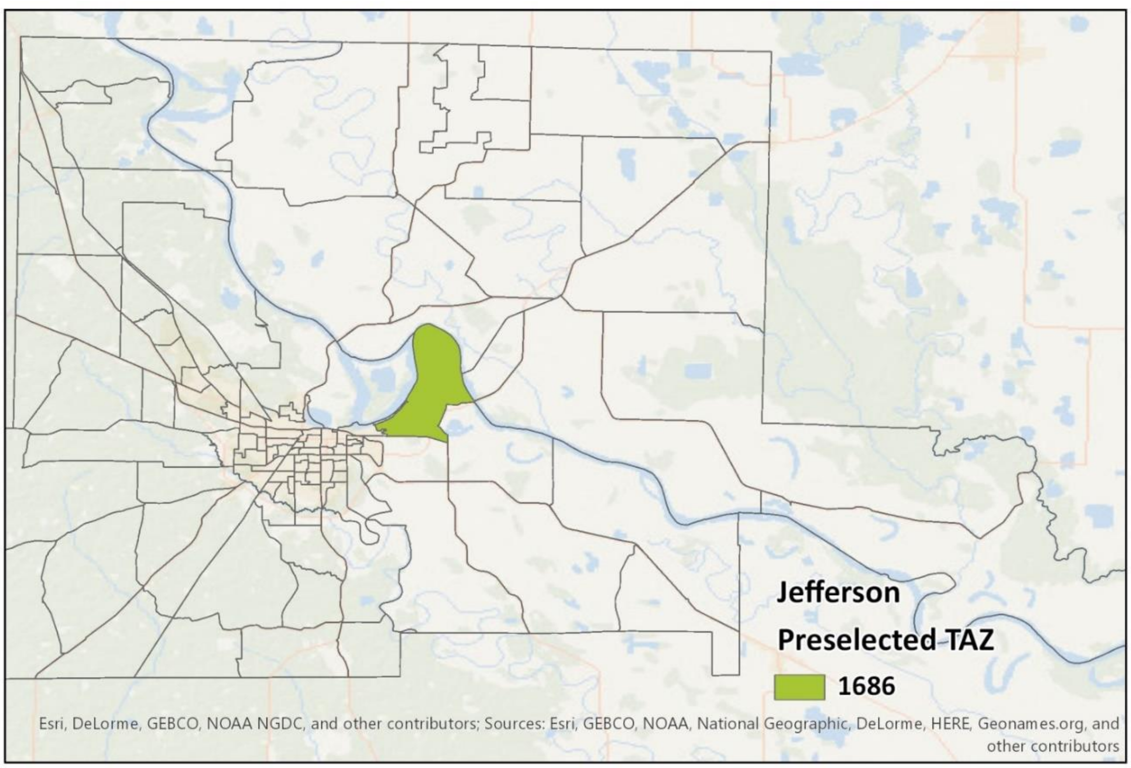
FIGURE 0-10. POTENTIAL COUNTY LOCATIONS FOR TRANSLOAD FACILITIES IDENTIFIED BY STAKEHOLDER INTERVIEWS AND EXISTING FREIGHT INFRASTRUCTURE

Disaggregation to TAZ Level (Step 5)

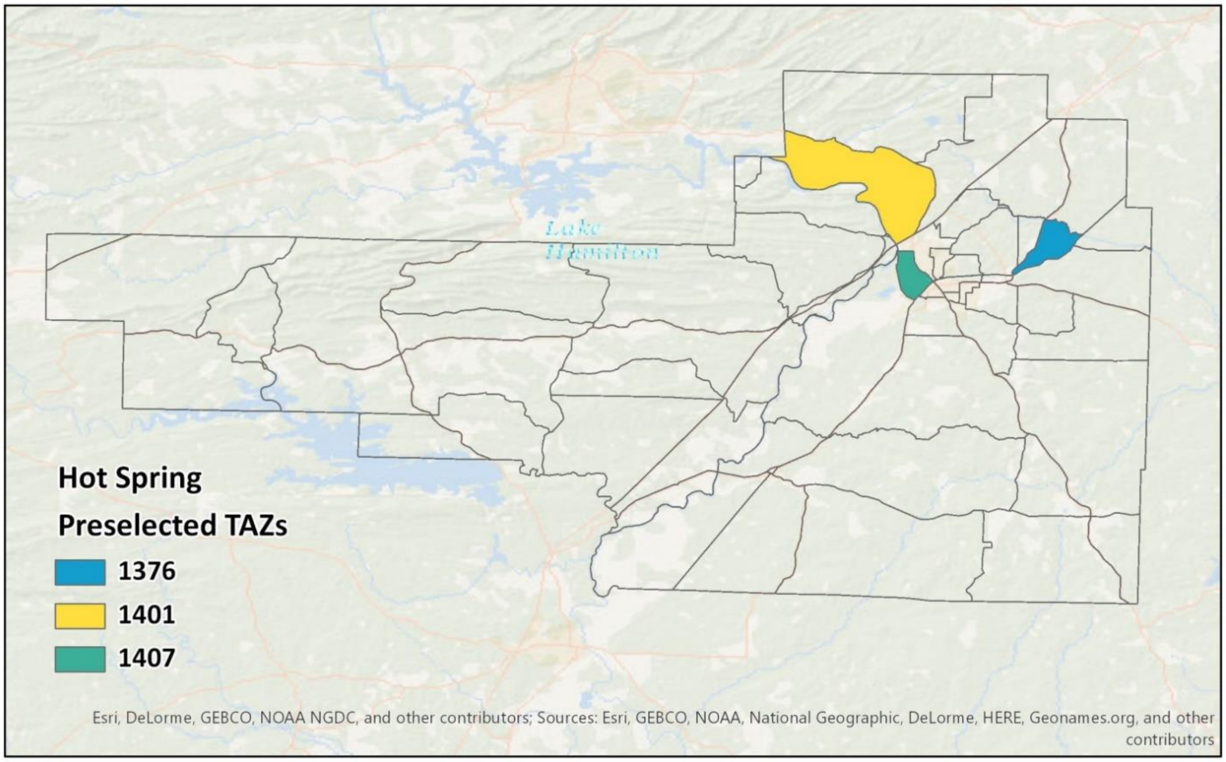
Step 5 disaggregated county level commodity flow data to the TAZ, identified centroid TAZs, and estimated to total commodity tonnage within a drayage buffer of each centroid TAZ. Unlike the analysis in Section 5.2, only the TAZs with access to rail and/or water were analyzed. **Table 5-13** results from the analysis of commodities within a drayage buffer of the pre-identified TAZs shown in **Figure 5-11**. In **Table 5-13**, it is evident that the tonnage forecasted by the AR-STDM is considerable lower than what was forecasted for the Pulaski and Benton/Washington sites. Hence, this is why these sites were not identified based on commodity flow.



(a) Crawford/Sebastian County



(b) Jefferson County



(c) Hot Spring County

FIGURE 0-11. TAZS SELECTED FROM THE STAKEHOLDER COUNTIES

TABLE 0-13. TONS OF COMMODITY GROUPS FOR COUNTIES IDENTIFIED BY STAKEHOLDERS

County	TAZ ID	Total Tonnage	Main Commodities
Sebastian/Crawford	773	190,147	Farm Products (Grain)
	817	151,450	
	820	161,572	
	821[1]	161,572	
	3023	192,678	
Jefferson	1686[1]	138,443	Farm Products (Grain)
Hot Spring	1376	488,664	Lumber
	1401[1]	493,245	
	1407	492,763	
1. Selected TAZ.			

Site Location Decision (Step 6)

After selecting the centroid TAZs, land parcels near the centroid TAZ were identified for the potential transload site. **Table 5-14** summarizes the available land parcels for each facility. **Figures 5-12, 5-13, and 5-14** show the available land parcels identified for Crawford/Sebastian, Hot Spring, and Jefferson, respectively.

TABLE 0-14. COMPARISON OF DIMENSIONS OF EXISTING FACILITIES AND PROPOSED SITES

Facility	County	Area (acres)	Rail-front length (miles)	Waterfront length (miles)
Facility #4	Crawford/Sebastian (Van Buren)	22.5	0.19	0.19
Facility #5	Hot Spring (Malvern)	141.0	Within industrial park	N/A
Facility #6	Jefferson (Pine Bluff)	129.2	0.49	0.49

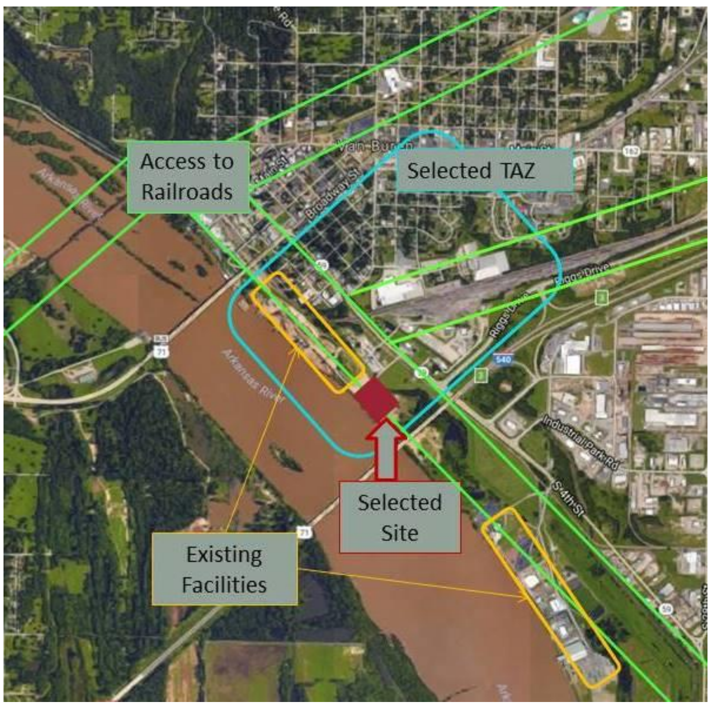


FIGURE 0-12. USE OF GOOGLE MAPS FOR SITE CONTEXTUALIZATION AND IDENTIFICATION IN CRAWFORD/SEBASTIAN COUNTY

FIGURE 0-13. USE OF GOOGLE MAPS FOR SITE CONTEXTUALIZATION AND IDENTIFICATION IN HOT SPRING COUNTY

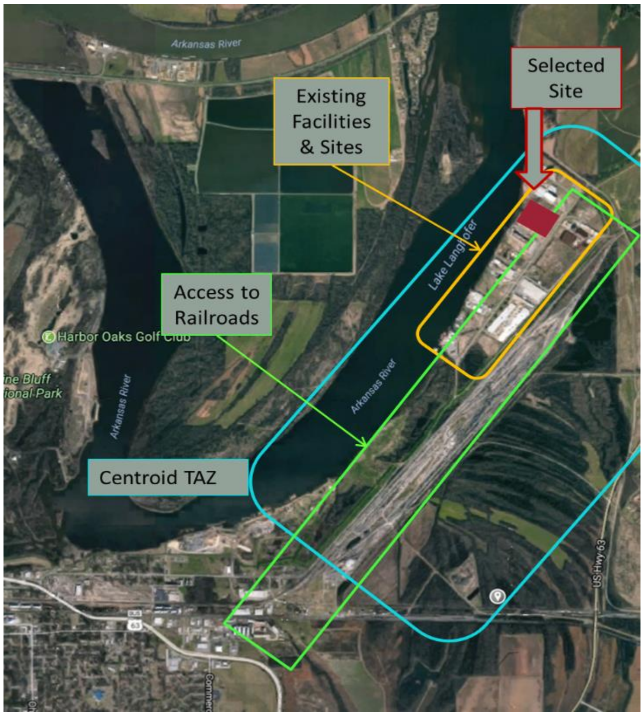


FIGURE 0-14. USE OF GOOGLE MAPS FOR SITE CONTEXTUALIZATION AND IDENTIFICATION IN JEFFERSON COUNTY

Proposed Transload Facility Sites Summary

Through both an analysis of commodity flows and stakeholder input, five sites were selected for potential transload facilities (**Figure 5-15**). **Table 5-15** summarizes the locations of each proposed facility, commodities to be handled by the facility, forecasted tonnage, truck volume, and the percent of total tonnage to be shifted to rail or water. The latter three columns (Total Tonnage, Truck Volume, Tonnage Shift) represent the tonnage shifts corresponding to the necessary amount of tons needed to support a reasonable volume of railcars and/or barges. For example, in Pulaski County, almost 600k ton are projected for 2040. To support a volume of at least 1250 railcars per year for larger facilities (*Thompson, 2012*), 5% of the tonnage would need to shift from truck to rail. Alternately, for counties with lower commodity tonnage, such as Sebastian/Crawford, a higher percentage of the commodity will need to be transloaded to rail or barge to produce significant enough railcar and barge volumes to support such a facility. Based on the literature a benchmark of 800 carloads per year was cited for feasibility (*HDR, 2007*). The percent shift is also a product of the payload of the commodities handled by the facility.

Table 5-16 summarizes the characteristics of each site in terms of the modes served, whether an existing transload site was found, the land area of new sites, and whether there was an available land parcel near the proposed site. All but the Crawford/Sebastian sites are proposed new sites. The site in Crawford/Sebastian is proposed to expand an existing transload facility.

For each site, a one-page brief was prepared (**Figure 5-16**). The two-sided brief lists the site characteristics (side 1) and the estimated impacts of the site (side 2). Estimated impacts are discussed in Section 8.

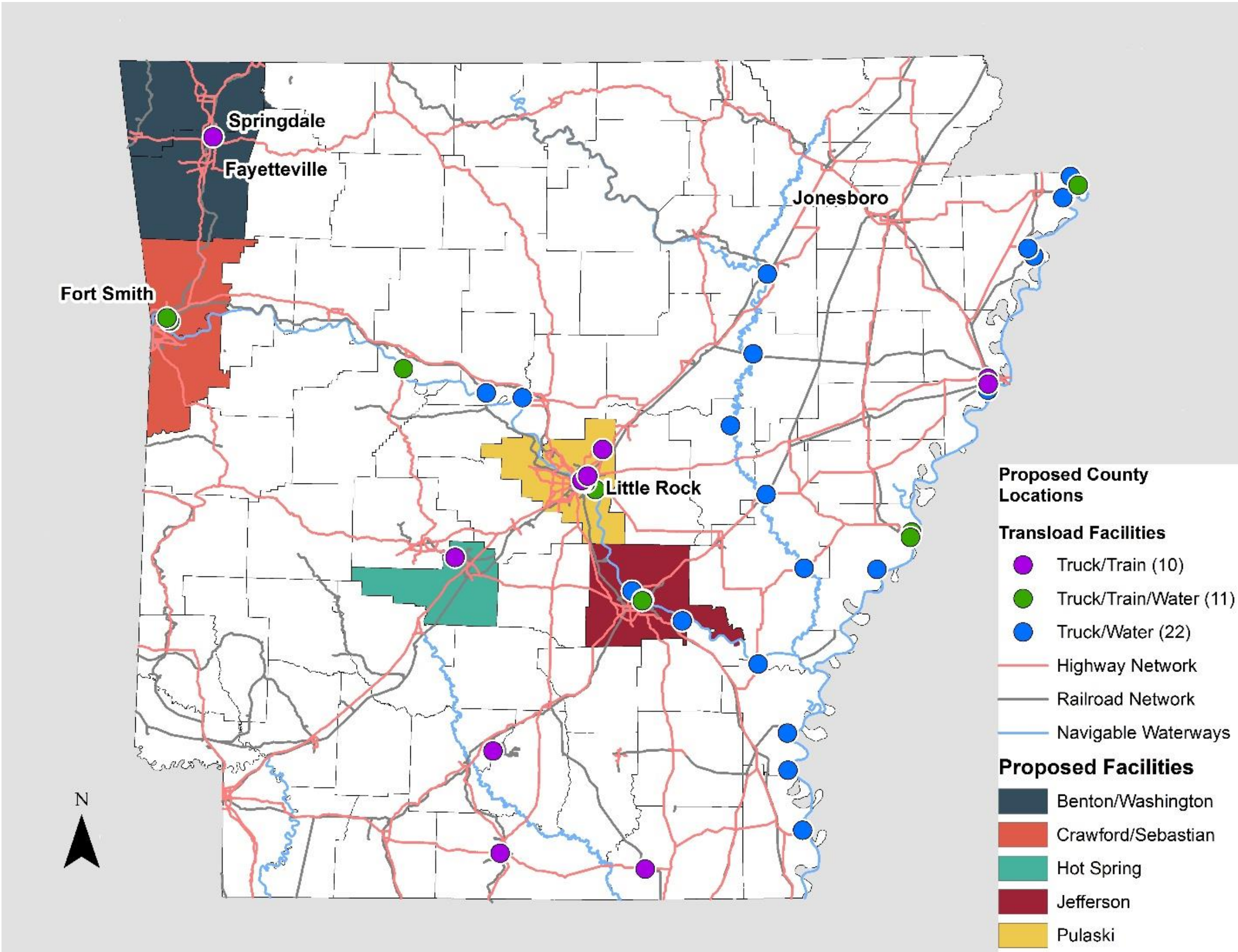


FIGURE 0-15. MAP OF SELECTED COUNTIES FOR TRANSLOAD FACILITIES

TABLE 0-15. SUMMARY COMMODITIES HANDLED BY PROPOSED TRANSLOAD FACILITIES

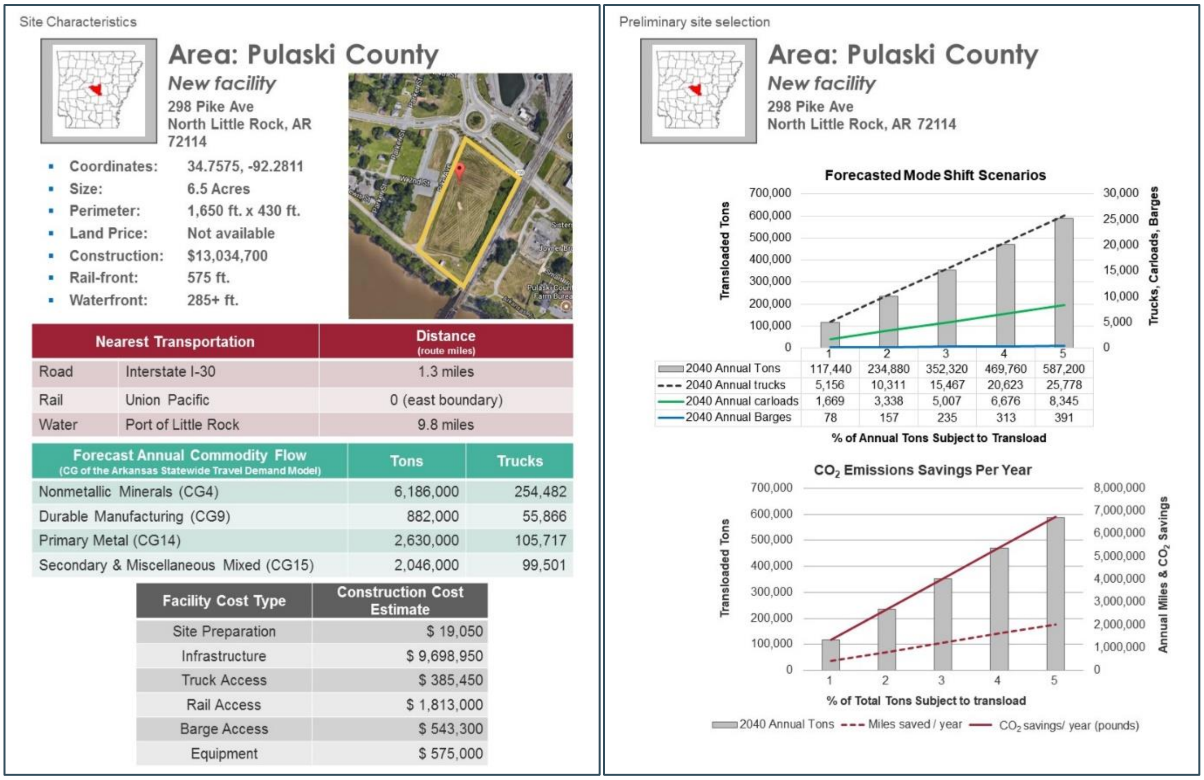
	County (TAZ ID)	Commodities	Total Volumes[1]		Feasible Shift[2]		
			Tons	Trucks	Tons	Trucks	Tonnage Shift[3]
1	Pulaski (105618)	• Nonmetallic minerals • Primary Metal • Sec. & Misc. Mixed • Durable Manufacturing	11,744,000	515,566	587,200	25,779	5%
2	Benton/ Washington (220221)	• Sec. & Misc. Mixed • Food • Durable Manufacturing	4,171,000	209,804	208,550	10,488	5%
3	Sebastian/ Crawford (821)	• Grain	162,000	9,937	76,800	4,720	48%
4	Hot Spring (1401)	• Lumber	493,000	19,477	49,300	1,949	10%
5	Jefferson (1686)	• Grain	138,000	8,514	76,800	4,720	56%

1. Projected volumes of tons and trucks for 2040 forecast year.
2. These columns report the amount of commodity that would shift to rail or barge to produce feasible railcar or barge volumes.
3. The percent of total commodity tonnage for the site that would need to shift to an alternate mode to provide feasible railcar or barge volumes.

TABLE 0-16. SUMMARY FACILITY CHARACTERISTICS OF PROPOSED TRANSLOAD FACILITIES

Facility	County	Non-Truck Modes Served	Existing Facility	Land Area (Acres)	Available Parcel[2]
Facility 1	Pulaski	Rail/Water		6.5	No
Facility 2	Benton/Washington	Rail		61	No
Facility 3	Sebastian/Crawford	Rail/Water	Yes[1]	22.5	No
Facility 4	Hot Spring	Rail		141	Yes
Facility 5	Jefferson	Rail/Water		20	Yes[3]

1. Exiting facility is called 'Consolidated Terminals'
2. Available parcels listed on at AREDC Site Select website as of May 2017.
3. The parcel available on the AREDC Site Select website does not have access to water, therefore this parcel was not recommended as a possible site. Instead, a different site (not listed in the AREDC Site Select database) was chosen.



(a) Front Material **(b) Back Material**

FIGURE 0-16. EXAMPLE OF ONE-PAGE SITE BRIEF FOR PULASKI COUNTY

Basic Cost Estimation for Selected Transload Facilities

A preliminary understanding of the basic types of transload facilities and their characteristics is essential before beginning to create a cost estimate framework. Unfortunately, a generalized framework capable of being applied to facilities of various types and size, handling a number of different commodities, and in different areas of the country was not found in literature. Thompson provides a detailed look at facility design considerations, and then illustrates these considerations through a specific case study for the City of Davenport *(Thompson, 2012)*. While the total facility area was stated to be approximately 12.5 acres, specific cost information was not provided. Similarly, Bhamidipati and Demetsky (2008) present a case study in Virginia with the freight handling capacity and total acreage of about 40 acres, but there is no discussion of facility cost. The Upper Great Plains Transportation Institute conducted a study evaluating the feasibility of a "logistics center," or intermodal facility, including the development of an economic engineering model to simulate costs for an intermodal facility *(North Dakota State, 2007)*. This cost information was neither disaggregated nor robust enough to be generalized to various configurations of transload facilities, which have different storage and equipment needs than an intermodal facility. Williams Associates-Engineers presented disaggregated cost information for barge transload facilities. However, these costs are based on estimates from local contractors and are limited to barge components, not including truck, rail, or storage requirements *(Willams Associates, 2004)*.

While the above mentioned research is helpful in providing general guidance regarding transload facility design considerations including the size of a facility and relative magnitudes of their total construction cost, it would be difficult to apply this information to facilities of a different size, configuration, mode combination, or commodity type to obtain an accurate construction cost. Additionally, in each of these cases, some preliminary facility design existed. In this project, a cost estimation framework was created to determine the basic cost of transload facilities by type using unit costs from a construction cost database, equipment costs from local dealers, the projected commodity tonnage, design recommendations from literature, and survey responses from local facilities. While there is currently no construction design for these facilities, this framework yielded costs consistent with those expected. Thus, this cost framework is believed to balance general scalability with accuracy well to provide reasonable cost estimations for constructing new or expanded facilities.

In this project, we followed a three-stage approach to estimate the cost of a potential transload facility expansion or new construction:

(1) Identify transload facility components (infrastructure and equipment) based on size, modes, and types of commodities handled

(2) Estimate component costs using construction cost estimates

(3) Determine total facility construction cost.

The method outlined in this Section serves to provide basic construction cost estimates for a transload facility. Such estimates could be used by public sector decision makers at economic development agencies, state DOTs, or MPOs to make high-level comparisons of alternative transload facility investment projects. Data to support each of the above mentioned steps was garnered from the facility inventory surveys, stakeholder outreach, and a proprietary construction cost estimate database.

Cost Estimation Framework

Since this works seeks to provide information at a high level it was necessary to seek a balance between providing robust and accurate construction cost estimates without having a construction design for a facility. The major groups of transload facility costs were identified as (Thompson, 2012):

a) **Site Costs:** site acquisition and land preparation
b) **Building Costs:** basic facility infrastructure, e.g. parking lots, offices, storage, etc.
c) **Mode Access Costs:** mode infrastructure e.g. truck bays, rail spurs, barge docks, etc.
d) **Equipment Costs:** transload equipment, e.g. forklifts, conveyors, etc.

Each of these major groups was further divided into more specific items for which unit costs were determined. Components included in this cost estimate were selected based upon facility design information found in literature, interviews with local facility operators, and responses to the online survey sent to existing facilities in Arkansas (Thompson, 2012; Chimka, 2015; Smith *et al.*, 2017).

Estimation of Component Costs

The databases used along with the unit cost items selected to determine unit costs were validated through interviews with industry representatives familiar with this type of cost estimate. The breakdown of components and units of measurement is shown in **Table 6-1**. These facility components were all selected from a material, construction, and equipment cost database (RS Means, 2014; RS Means, 2017). This database is comprised of national averages updated annually and is often used by contractors to provide accurate estimates for project costs. For this research, the unit costs selected included labor and materials as well as general overhead and profit. These costs were selected as they were believed to provide the most complete picture of potential costs associated with each item. When selecting the items to include in this cost estimate, a balance between accuracy and generality was sought. The objective was to create an estimate framework that can easily be scaled and applied to any transload facility. When possible, aggregated square foot costs were selected. For instance, the office and enclosed storage costs were total building costs, including things like electricity and plumbing. This database did not have the purchase prices for equipment, however, only rental prices. Thus, local equipment dealers shared prices of purchasing new equipment, which was used in this cost estimate.

TABLE 0-1. TRANSLOAD FACILITY COMPONENT UNIT PRICES

(a) Site Costs

Group	Component	Unit
Site Preparation	Site Clearing	Acre
		Square Yard
	Site Earthwork	Cubic Yard

(b) Building Costs

Group	Component	Unit
Infrastructure	Enclosed Storage	Square Foot
	Silo	Each
	Covered Storage	Each
	Storage Tank	Each
	Paved Storage	Square Foot
	Unpaved Storage	Square Yard
	Employee Parking	Square Foot
	Office	Square Foot

(c) Mode Access Costs

Group	Component	Unit
Truck	Loading Dock	Each
	Pavement Under Loaded Trucks	Square Foot
	Truck Scales	Each
Rail	Railroad Sidings	Linear Foot
	Railroad Turnouts	Each
Barge	Dredging	B.C.Y.
	Elevated Slab	Cubic Yard
	Concrete Caisson	Vertical Linear Foot
	Concrete Revetment	Each
	Gravel Base Course	Square Yard

(d) Equipment Costs

Group	Component	Approximate Unit Price
Equipment	Air Compressor	$45,000

	Auger	$3,500
	Back Hoe	$90,000
	C Hook[1]	-
	Car Puller[1]	-
	Containment Pans[1]	-
	Conveyor	$15,000
	Crane[1]	
	Excavator	$210,000
	Fork Lift	$77,500
	Lift[1]	-
	Pallet Jacks	$700
	Ramp-Portable	$2600
	Roll Clamp	$2000
	Wheel Loader	$152,500
1. Cost estimates for the indicated items were unavailable. Note – cost estimates for equipment are highly dependent on type of freight and should be verified for local needs		

As previously mentioned, all components were included based upon design considerations found in literature, seen in site visits, and reported in survey responses (*Thompson, 2012; Upper Great Plains Transportation Institute, 2007*). For the majority of these cost items, an appropriately aggregated item was listed in the database. An example of this is the aggregated square footage costs used for the office and storage warehouse, which is assumed to include things like the foundation, utilities, construction materials, etc.

Unfortunately, there was no aggregated cost item similar to a barge berth. Therefore, the items included for barge berth cost were selected based upon design recommendations found in Ernst and Runge-Schmidt's "Planning and Design of Ports and Marine Terminals" (Agerschou *et al.*, 2004). Considering that transload terminals are common on the inland waterway network, these berths are designed as open-piled structures as this is the most widely used design (Agerschou *et al.*, 2004). These structures typically include a concrete deck supported by steel or concrete piles with some slope stabilizer for the bank beneath the deck (Agerschou *et al.*, 2004). Comparable cost items were then selected from the cost database for use in the cost estimate. In order to verify the items selected for the barge berth, the cost of constructing a berth with a 60-foot by 60-foot deck was calculated and compared to the cost of a similar pile supported concrete dock using the unit price listed in the U.S. Army Corps of Engineers final report on barge landing system design alternatives for various locations in Alaska (URS, 2010). The locations in Alaska ranged from facilities on lakes, rivers, and even some coastal sites. Using the cost database, the price of this berth with a 60-foot by 60-foot deck was found to be $543,267, compared to $990,000 determined using the U.S. Army Corp of Engineers' prices. While this difference may initially seem significant, when considering the total cost of a transload facility with waterfront access, which could be about $20 million, a difference of $446,733 is only 2% of the total facility cost. Additionally, it is worth mentioning that prices in Alaska are often higher due to the need to import many materials. Finally, all of the salient costs found in Table 1 are of the same order as those found by Williams Associates-Engineers for a Maryland port (Williams Associates-Engineers, 2004). Therefore, it was decided that the items selected from the cost database were appropriate for inclusion in this cost estimate.

Determination of Facility Construction Cost

Once the facility components and unit costs were selected, a procedure was developed for a complete cost estimation for a proposed transload facility. It is important to again note that at this stage in the decision making process of choosing a facility location, no construction design exists for the facilities. Rather, only very general facility characteristics have been outlined for the facilities. For example, the proposed facility may be characterized to handle a certain type and quantity of a commodity and provide access to barge and/or rail. Therefore, a number of assumptions were made in order to produce a final construction cost estimate without specific quantity requirements.

Facility Infrastructure

The annual tonnage of commodities projected for a forecast year, e.g. 2040, within the area of the proposed facility was the basis of much of the quantity estimation. This tonnage was converted to an equivalent number of annual trucks projected for the forecast year using truck payload factors. Using the freight equivalency from Iowa DOT, an equivalent number of annual rail cars and barges were determined to be 70 truckloads can be transported by 16 carloads and 1 barge load *(Iowa DOT, 2017*). This is a simple conversion approach that could be enhanced using commodity-specific mode conversion factors available from the Commodity Flow Survey (CFS) or a region specific commodity flow database (*BTS, 2015*). For the purposes of this paper, a general conversion approach was deemed appropriate given the high-level cost estimates desired.

To size a facility given commodity tonnage in a region, it was assumed that 3% of the commodity tonnage in the region would use the transload facility. This factor represents the amount of tonnage that would shift from truck to rail or barge and could be altered based on stakeholder feedback to provide a scalable cost estimate for the facility. For the purpose of this paper, 3% was chosen based on the literature (*Thompson, 2012*). Therefore, only 3% of the total forecasted annual tonnage for the defined region would be handled by each of the proposed facilities.

The expected number of trucks, rail cars, and barges each day was then used to determine the number of loading docks, truck parking spots, length of rail track, number of berths, and the storage requirements. The procedure and assumptions used to determine these quantities are as follows:

- Truck loading docks were determined using the assumption that trucks would be at the facility no longer than 2 hours due to the potential of incurring detention charges and a 12-hour work day (Farrell *et al.*, 2016).
- The amount of parking space required for trucks was based upon the number of daily trucks expected and by assuming truck spots are 55-feet by 11-feet (Chimka, 2015).
- The length of rail track was based upon the daily number of rail cars expected and the ideal rail capacity recommendations made by MarTREC of 100 rail cars, which is one train, over two tracks (Chimka, 2015).
- To account for rail car storage, the number of daily rail cars was multiplied by the typical ratio of 3:2 for storage to working track, also recommended by MarTREC (Chimka, 2015).
- The number of berths required was based upon the number of barges expected per day.
- Storage requirements were found by multiplying the daily number of trucks by the volume of a 53-foot truck trailer and 30 days based upon the assumption that long-term storage of commodities would typically be one month (UPDS, 2017; ASSC, 2017).
- Three different storage scenarios were determined for each facility: 10% of the commodity tonnage requiring storage, 50% of the commodity tonnage requiring storage, and 90% of the commodity tonnage requiring storage.

Measurements taken in Google Earth were used to determine average quantities for office space, employee parking, and a truck driveway. The facilities measured were the seven survey respondents (Smith *et al.*, 2017). These facilities were selected because other information regarding the facility capacity was known through survey responses and these facilities represented a range of facility size, from small, single commodity facilities, to large, multiple commodity facilities.

RSMeans has been selected as the primary source for this task due to the comprehensive list of costs provided and the industry acceptance for providing reliable estimates of material, construction, and equipment costs. The goal of this cost estimation is to identify the components necessary to comprise a transload facility, select accurate costs associated with each of these components, and then start combining these pieces to create cost estimations for each type of facility. The major groups of facility components that have been identified are basic infrastructure (parking lots, offices, storage, etc.), truck, rail, barge, and equipment. Each of these groups will then be broken down into more specific items for which costs are determined. The goal of this task is to provide a basic cost estimation for transload facilities, therefore, it is necessary to seek a balance between providing a robust and accurate estimate but not becoming too specific that estimates may not be applicable to transload facilities in general.

Tables 6-3 through 6-6 display each of the major groups of costs for a transload facility. The structure of these tables includes a description of the particular component, the item selected within RSMeans, the unit for which the RSMeans cost is given, and an "adjusted" unit price to allow for a more obvious comparison of prices between components. For instance, to be able to more easily compare the cost of covered storage, for which the price is listed per 12'x40' metal canopy, with the cost of enclosed storage, which is presented as a cost per square foot, the unit price of enclosed storage was calculated for a 12'x40' area. The units used for the adjusted price of each table are presented in **Table 6-2**. These adjusted units were selected to make prices from each mode more comparable. All facilities will have components from the basic infrastructure, and then dependent on the modes of transit serviced by that particular facility, necessary components for each mode can be added in to estimate the overall facility cost.

TABLE 0-2. ADJUSTED UNITS

Table	Adjusted Unit
Infrastructure	12'x40' sq. ft.
Truck	12'x60' sq. ft.
Rail	60 linear ft.
Barge	10'x60' sq. ft.

TABLE 0-3. BASIC FACILITY INFRASTRUCTURE COSTS

Component	RSMeans Item	Unit	Unit Price	Adjusted Unit Price
Enclosed Storage	Warehouses & Storage Buildings	Square Foot	$60.50	$29,040
Silo	Silo	Each	$28,700.00	$28,700
Covered Storage	Metal canopies, 12'x40'	Each	$14,400.00	$14,400
Storage Tank	Steel Tank, single wall, above ground; 5,000-10,000 gallon	Each	$1,450.00	$1,450
Paved Storage	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 1" Topping	Square Foot	$2.46	$1,181
Unpaved Storage	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$10.70	$571
Employee Parking	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 2" Topping	Square Foot	$2.91	$1,397
Office	Offices Low Rise (1 to 4 Story)	Square Foot	$125.00	$60,000

TABLE 0-4. TRUCK COMPONENT COSTS OF TRANSLOAD FACILITY

Component	RSMeans Item	Unit	Unit Price	Adjusted Unit Price
Loading Dock	Dock Boards, 60"x60", aluminum, 15,000 lb. capacity	Each	$1,750	$1,750
	Dock leveler, hinged for trucks, 10 ton capacity, 6'x8'	Each	$6,925	$6,925
	Shelters, Fabric, for truck or train	Each	$2,375	$2,375
Pavement Under Loaded Trucks	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 3" Binder Course, 2" Topping	Square Foot	$3.32	$2,391
Truck Scales	Truck Scales, Digital, Electric, 60'x10' Platform	Each	$48,000	$48,000
	Concrete Foundation Pit, 70'x10' Platform, 40 C.Y. Required	Each	$18,400	$18,400

TABLE 0-5. RAIL COMPONENT COSTS OF TRANSLOAD FACILITY

Component	RSMeans Item	Unit	Unit Price	Adjusted Unit Price
Rail Track/ Railroad Sidings	Wood ties and ballast, 100 lb. new rail	Linear Feet	$179.00	$10,740.00
Ballast	Crushed Stone Ballast	Linear Feet	$23.00	$1,380.00
Total Rail		Linear Feet	$202.00	$12,120.00

TABLE 0-6. BARGE COMPONENT COSTS OF TRANSLOAD FACILITY

Component	RSMeans Item	Unit	Unit Price	Adjusted Unit Price
Dock	Pope Supported dock, 1" aluminum pipe; wood deck and galv. Steel framing; 10' wide	Square Foot	$66.50	$39,900
Bumpers	Shock absorbing tubing, vertical bumpers 3" diam., vinyl, white	Linear feet	$15.80	$948

Facility Equipment

A final consideration in completing the facility construction cost estimate is selecting the equipment required to move particular commodities. Using general facility characteristic data available at this stage in the facility location planning process, it is possible to identify the types of commodities that a facility might handle. For example, in Arkansas, typical transloaded commodities included crushed stone, sand, gravel, food products, metals, feed products, manufactured products, chemicals, waste, and lumber. For this set of commodities, the specific equipment needs for these commodities were determined via a previously conducted online survey (Smith *et al.*, 2017). Survey responses linked commodity type to equipment needed to handle that equipment as shown in **Table 6-7**. While this table provides an example for specific commodities listed in the top row, it could be expanded to a complete set of bulk commodities using similar survey approaches or site visits.

TABLE 0-7. EQUIPMENT REQUIRED TO HANDLE COMMODITIES

Equipment	Commodity					
	Crushed Stone, Sand, Gravel	Food Products	Metals	Feed Products	Chemicals	Waste
Fork Lift		■	■		■	■
Conveyor	■			■	■	■
Excavator	■		■	■		■
Ramp-Portable		■	■			
Roll Clamp			■			
Air Compressor	■		■	■	■	
Auger				■		
C Hook			■			
Containment Pans					■	
Front End Loads	■		■	■		■
Pallet Jacks		■	■			
Back Hoe						■
Car Puller	■	■	■	■	■	
Crane	■		■	■		■
Lift			■			

Total Construction Cost Estimate

Combining the unit costs in **Table 6-1** with quantity estimations based upon projected commodity tonnage and the equipment requirements for the commodities of interest, a cost estimate can be prepared for a proposed facility. The first step will be using the projected commodity tonnages to determine mode access items and storage quantities. Annual barge and railcar equivalents are found using the ratios established by Iowa DOT (Iowa DOT, 2017). The projected number of trucks is multiplied by the assumed 3% that will be transloaded and divided by the number of working days, which is assumed to be 254. This yields the number of trucks expected at the facility daily. From this number of daily trucks, the number of loading docks is found by multiplying by the ratio of 2 hours it is assumed the truck would remain at the facility to the 12-hour work day. Similarly, the number of railcar spots and barge berths is found by taking the daily number of railcars and barges, respectively, and dividing by this 2 hour to 12-hour ratio. Storage quantities are also found using the number of daily trucks. The volume of a 53' semi-truck trailer is multiplied by the assumed 30 days for which the commodity is stored, the number of daily trucks, and the percentage of commodity requiring storage. Remaining items, such as site preparation, which are more site specific, the equipment required for the commodities of interest, and an office are combined with the mode access and storage items to create the total facility cost estimate.

Five facilities are proposed to be built across the state of Arkansas: two of these facilities would provide access to only truck and rail, and three of the facilities would provide access to truck, barge, and rail. The projected number of annual trucks, approximate facility storage area, and total facility costs are shown for the five proposed locations in **Table 6-8**. These costs are discussed in the following section. Full cost breakdowns are provided in **Appendix 12.5**.

TABLE 0-8. PROPOSED TRANSLOAD FACILITIES IN ARKANSAS

Facility Location	Annual Projections for Identified Commodity Groups		Approximate Storage Area (acres)	Total Facility Cost
	Total Trucks	Transloaded[1]		
Pulaski County	515,566	15,467	6	$13,034,666
Benton/Washington County	209,804	6,293	19	$25,255,825
Crawford/Sebastian County	9,937	298	15	$21,598,235
Hot Spring County	19,477	584	16	$9,672,405
Jefferson County	8,514	255	15	$21,598,235

1. Represents an assumed lower bound of 3% of trucks to use transload facility.

Comparing the projected number of annual trucks, it is evident that there is a significant range from the 8,514 projected for the Jefferson County area to the 515,566 in Pulaski County. Although a direct comparison to existing transload sites is difficult due to a lack of information in the literature regarding the projected tonnage of commodities expected, the storage area and the facility costs are of the same magnitude as those seen in literature (Bhamidipati and Demetsky, 2008; Thompson, 2012; Farrell *et al.*, 2016).

Pulaski County Costs

This facility was proposed based upon recommendations of the commodity flows through central Arkansas. The commodity flow analysis in the previous section was conducted in the area to determine the projected annual tons of nonmetallic minerals, durable manufacturing, primary metal, and secondary and miscellaneous mixed commodities for the forecast year 2040. Upon identifying the area of interest for building this facility, a vacant plot of land was identified, however no pricing information on the property could be found in the AEDC Building and Sites Database. The costs analysis can be seen in **Table 6-9**.

TABLE 0-9. PULASKI COUNTY FACILITY COST ESTIMATE BY CATEGORY

Category	Subtotal for Category
Site Preparation	$ 19,049
Infrastructure	$ 9,698,948
Truck Access	$ 385,441
Rail Access	$ 1,812,960
Barge Access	$ 543,267
Equipment	$ 575,000
TOTAL	**$ 13,034,666**

Benton/Washington County Costs

This facility was proposed based upon recommendations of the commodity flows through Northwest Arkansas. The commodity flow analysis in the previous section was conducted in the area to determine the projected annual tons of food products, durable manufacturing, chemicals, and secondary and miscellaneous mixed commodities for the forecast year 2040. Upon identifying the area of interest for building this facility, a vacant plot of land was identified, however no pricing information on the property could be found in the AEDC Building and Sites Database. The costs analysis can be seen in **Table 6-10**.

TABLE 0-10. BENTON/WASHINGTON COUNTY FACILITY COST ESTIMATE BY CATEGORY

Category	Subtotal for Category
Site Preparation	$ 15,504
Infrastructure	$ 22,905,694
Truck Access	$ 231,786
Rail Access	$ 1,527,840
Barge Access	None provided
Equipment	$ 575,000
TOTAL	**$ 25,255,825**

Jefferson County Costs

This facility was proposed based upon recommendations from stakeholders in the area of Pine Bluff, Arkansas, requesting an additional facility for farm products. The commodity flow analysis in the previous section was conducted in the area to determine the projected annual tons of farm products for the forecast year 2040. Upon identifying the area of interest for building this facility, an available plot of land was selected with the statewide Building and Sites Database. The costs analysis can be seen in **Table 6-11**.

TABLE 0-11. JEFFERSON COUNTY FACILITY COST ESTIMATE BY CATEGORY

Category	Subtotal for Category
Site Preparation	$ 25,524
Infrastructure	$ 19,137,292
Truck Access	$ 131,509
Rail Access	$ 1,349,640
Barge Access	$ 543,267
Equipment	$ 411,000
TOTAL	**$ 21,598,235**

Hot Spring County Costs

This facility was proposed based upon recommendations of stakeholders in the area of west-central Arkansas, requesting an additional facility for bulk products. The commodity flow analysis in the previous section was conducted in the area to determine the projected annual tons of lumber products for the forecast year 2040. Upon identifying the area of interest for building this facility, an available plot of land was selected with the statewide Building and Sites Database. The costs analysis can be seen in **Table 6-12**.

TABLE 0-12. HOT SPRING COUNTY FACILITY COST ESTIMATE BY CATEGORY

Category	Subtotal for Category
Site Preparation	$ 140,165
Infrastructure	$ 8,048,929
Truck Access	$ 133,670
Rail Access	$ 1,349,640
Barge Access	None provided
Equipment	$11,231,505
TOTAL	**$ 20,903,909**

Sebastian/Crawford County Costs

This facility was proposed based upon recommendations of stakeholders in the area of west Arkansas, requesting an additional facility for bulk products. The commodity flow analysis in the previous section was conducted in the area to determine the projected annual tons of farm products for the forecast year 2040. Upon identifying the area of interest for building this facility, a nearby transload site was identified for possible expansion. However, without feedback from the facility owner on the possibility of expansion, the cost analysis was prepared for building of a new facility. The costs analysis can be seen in **Table 6-13**.

TABLE 0-13. CRAWFORD/SEBASTIAN COUNTY FACILITY COST ESTIMATE BY CATEGORY

Category	Subtotal for Category
Site Preparation	$ 25,524
Infrastructure	$ 19,137,292
Truck Access	$131,510
Rail Access	$ 1,349,640
Barge Access	$ 543,267
Equipment	$ 411,000
TOTAL	**$21,598,233**

Economic Benefit Analysis

In this project, the economic benefits of a transload facility are measured using IMPLAN (see detailed description in Section 3.5). IMPLAN is a tool that measures the economic impact of industry and development activities using a predictive input-out model. IMPLAN has been used by other public agencies to analyze public transit impacts, highway expenditures, and contribution of freight industry. However, no reports were found that examined the economic impact of freight mode shifts, i.e. the focus of this project. In fact, due to the structure of the assumptions made in the IMPLAN model (see Section 7.1), it is not possible to use IMPLAN to understand the effects of mode shifts. Therefore, the methodology employed in this project takes a different approach. To assess the economic impact of a potential transload facility within a county, direct, indirect, and induced impacts related to each major freight transportation sector were analyzed. The sectors of interest were trucking (IMPLAN sector 411), rail (409), and water (410). Additionally, total employment in each freight transportation sector and related sectors was analyzed for each county proposed to site a transload facility.

Following a description of the impact types and assumptions used in IMPLAN, results of a statewide analysis are summarized. After completing a statewide analysis, selected counties that may house transload facilities were examined to gauge the impact of each mode of transportation. This allowed for an examination of the influence of each sector in specific regions, and to see if, like Georgia, the impact of each sector was different across the state. This Section concludes with a comparative analysis of impacts, and a summary of key findings.

Details Regarding IMPLAN

This section describes definitions of key concepts and terms used in the IMPLAN analysis and provides a summary of the IMPLAN model assumptions.

Definitions

Four impact types are calculated in IMPLAN as illustrated in **Figure 7-1**. These are the (1) direct effects, (2) indirect effects, (3) induced effects, and (4) total effects. The direct effects are employment and purchases of goods and services in the region of analysis that result from the industry or development activities of employers of the sector of interest. Indirect effects are the goods and services purchased by employers that supply inputs consumed in the direct activity. This is the effect of local industries buying goods and services from other local industries. The induced effect is the increased household purchases of goods and services in the region of analysis by employees of both direct and indirect employers. Lastly, total effects are the sum of direct, indirect, and induced effects. Based on the literature review, the most utilized outputs from IMPLAN are direct and total effects for employment (number of jobs in a sector) and output (value of sector production in dollars).

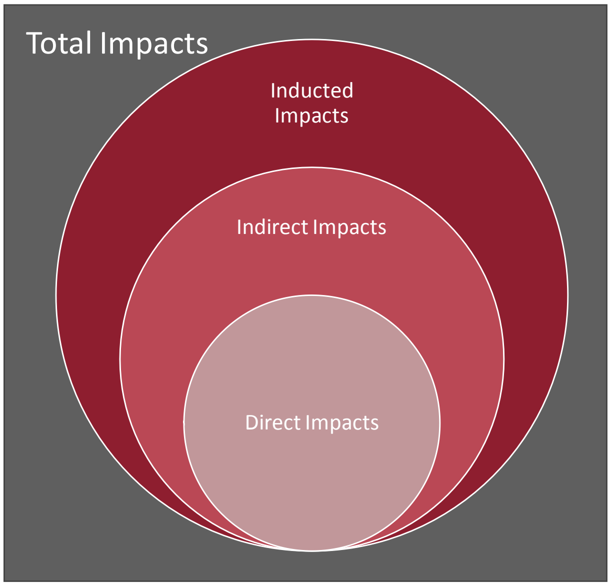


FIGURE 0-1. ILLUSTRATION OF IMPLAN IMPACT TYPE

Assumptions

There are six assumptions made in IMPLAN to successfully execute the input-output analysis. These are as follows:

1. **Constant returns to scale:** This means that the same quantity of input is needed per unit of output, regardless of production level. For example, if output increases by 15%, the input requirements will also increase by 15%.
2. **No supply constraints:** This means that there are no raw material restrictions, or that there is unlimited amount of product that can be produced.
3. **Fixed input structure:** This assumption recognizes that changes in the economy will affect output, but not the mix of commodities and services required to produce that output.
4. **Industry technology assumption:** This structure assumes that an industry will always produce the same commodity mix regardless of the level of production. An industry will not increase the output of one product with a proportionate increase the output of all other products associated with that industry.
5. **Commodity technology assumption**: This assumption which states that an industry uses the same technology to produce each of its products. In other words, a production function of an industry takes the primary product's weighted average of inputs toward production and weighs them with the output of each product.
6. **The model is static**: This simply assumes that no prices changes occur. While the user can physically change the year of analysis, the data and relationships within IMPLAN are not affected by impact runs.

Each assumption has an effect on the ability of IMPLAN to accurately depict economic impacts due to investment in a particular sector. In relation to this project, Assumption #3 (Fixed Input Structure), has immediate consequences on the ability to explain mode shift impacts using IMPLAN. IMPLAN does not contain a mode choice model. Thus, given constant production or consumption of commodity, additional employment and/or expenditures in one transportation sector would not decrease the employment or output of a competing transportation sector. For example, investment in a rail transload facility in Benton/Washington Counties would result in employment and output increases (direct and total effects) for the rail sector and not in decreased employment and output in the trucking sector as we would expect with a mode shift.

Statewide Analysis

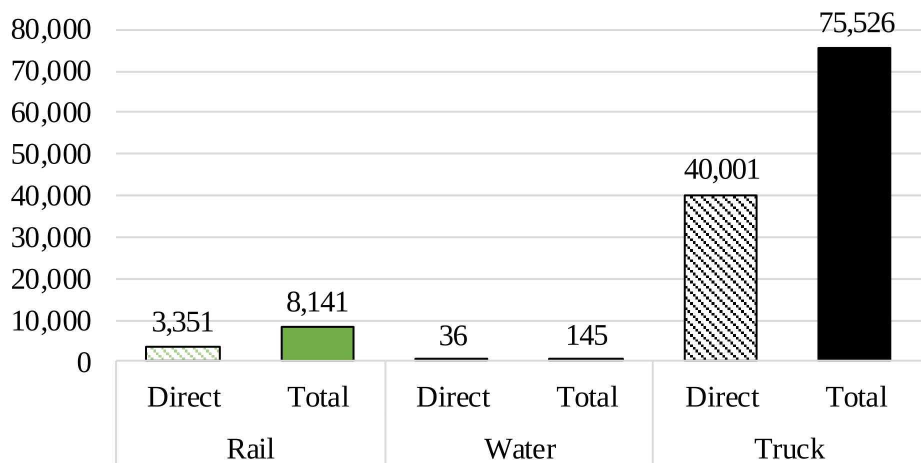
In order to show the full outputs of IMPLAN, the rail sector (Sector 409) is examined. For the year 2014, **Table 7-1** summarizes the full impact of rail on the state of Arkansas. The impact of direct, indirect, and induced effects can be seen, with the total effect simply the sum of the previous three. The employment and labor income are provided as outputs, in addition to the total value added and the output (essentially, the Gross Domestic Product). As mentioned above, however, the two most utilized quantifications are the employment and output. Only these will be analyzed for each county. **Table 7-2** shows the state-wide influence of rail (Sector 409), water (Sector 410), and truck (Sector 411). **Table 7-2** is shown graphically in **Figure 7-2a and 7-2b**. The trucking sector has the highest direct and total effects for both employment and output. Another way to look at the data, however, is to divide the output by employment. This analysis gives a sense of the impact in dollars per job for each mode. This is shown in **Figure 7-2c.**

TABLE 0-1. EXAMPLE OF IMPLAN OUTPUT FOR THE RAIL SECTOR

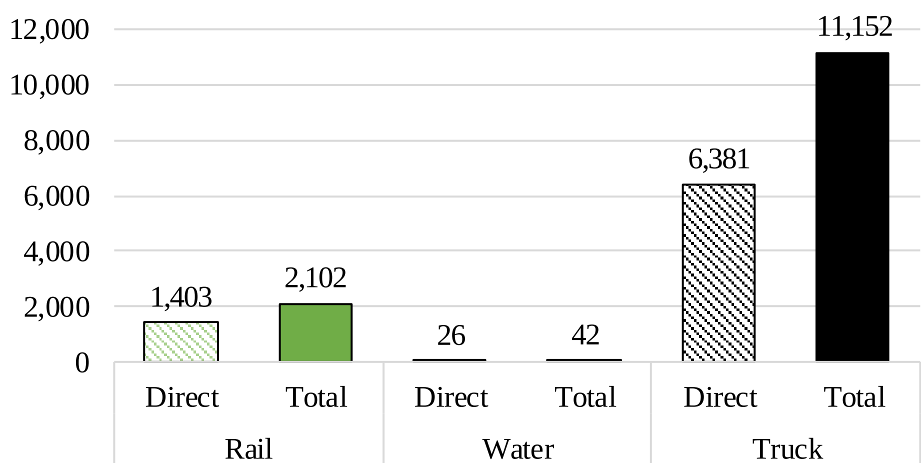
Impact Type	Employment (persons)	Labor Income (Million $)	Total Value Added (Million $)	Output (Million $)
Direct Effect	3,351	374.1	831.4	1,403.4
Indirect Effect	2,101	102.3	179.4	366.7
Induced Effect	2,688	97.8	188.0	331.6
Total Effect	*8,140*	*574.2*	*1,198.5*	*2,101.8*

TABLE 0-2. EMPLOYMENT AND OUTPUT FOR RAIL, WATER, AND TRUCK IN ARKANSAS

Mode	Impact Type	Employment (persons)	Output (Million $)
Rail (409)	Direct	3,351	1,403.4
	Total	8,141	2,101.8
Water (410)	Direct	36	25.5
	Total	145	42.2
Truck (411)	Direct	40,001	6,381.2
	Total	75,526	11,152.3



(A) EMPLOYMENT



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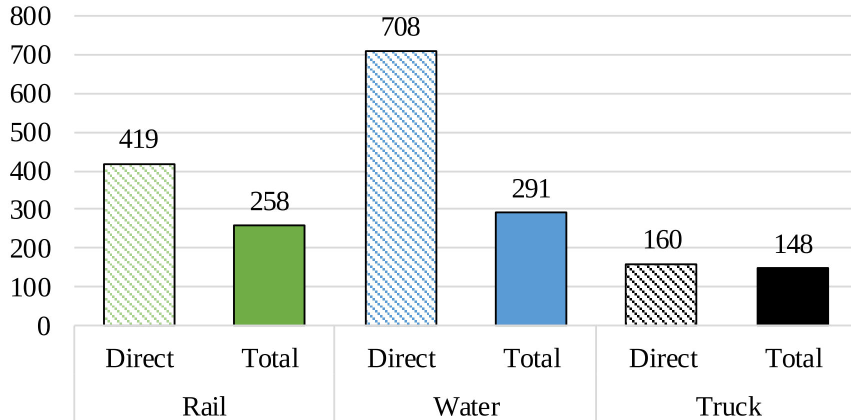


(C) RATIO OF OUTPUT TO EMPLOYMENT

FIGURE 0-2. EMPLOYMENT AND OUTPUT IMPACTS FOR THE STATE OF ARKANSAS

While the water mode had the lowest employment and output contribution (**Figure 7-2a and 7-2b**), it has the largest direct effect per single employment, indicating that any addition to the water sector would have the largest impact on the economy. This is somewhat muted in the total effect, which indicates that jobs indirectly related to and induced by each mode dilutes the actual value of the mode job itself.

In addition to the employment and output for each mode, the impact in other areas of employment can also be examined. These are the indirect and induced employment sectors and outputs associated with each freight transportation mode (rail, water, and trucking). **Tables 7-3 through 7-5** show the influence for rail, water, and truck respectfully. In **Tables 7-3 through 7-5**, it is interesting how the overlapping sectors between all three modes are limited-service restaurants, real estate, and wholesale trade.

TABLE 0-3. IMPACT OF RAIL ON OTHER SECTORS IN THE STATE OF ARKANSAS

Sector	Description	Total Employment (persons)	Total Output (Million $)
409	Rail transportation	3,357.5	1,406.1
395	Wholesale trade	285.8	70.5
502	Limited-service restaurants	182.3	12.6
436	Other financial investment activities	165.5	20.2
482	Hospitals	164.2	21.3
501	Full-service restaurants	161.7	6.3
468	Services to buildings	158.7	4.9
62	Maintenance and repair construction of nonresidential structures	157.0	23.7
440	Real estate	154.3	26.4
434	Nondepository credit intermediation and related activities	136.3	16.3

TABLE 0-4. IMPACT OF WATER ON OTHER SECTORS IN THE STATE OF ARKANSAS

Sector	Description	Total Employment (persons)	Total Output (Million $)
410	Water transportation	36	25.5
414	Scenic and sightseeing transportation and support activities for transportation	11	1.6
471	Waste management and remediation services	6	1.2
395	Wholesale trade	6	1.4
440	Real estate	5	0.88
464	Employment services	4	0.21
415	Couriers and messengers	4	0.37
435	Securities and commodity contracts intermediation and brokerage	3	0.44
518	Postal service	3	0.27
502	Limited-service restaurants	2	0.16

TABLE 0-5. IMPACT OF TRUCK ON OTHER SECTORS IN THE STATE OF ARKANSAS

Sector	Description	Total Employment (Persons)	Total Output (Million $)
411	Truck transportation	40,819	6,511.8
415	Couriers and messengers	2,037	205.1
414	Scenic and sightseeing transportation and support activities for transportation	1,789	266.0
518	Postal service	1,737	150.5
464	Employment services	1,596	86.1
440	Real estate	1,366	233.7
502	Limited-service restaurants	1,238	85.3
395	Wholesale trade	1,176	290.0
416	Warehousing and storage	1,152	109.0
501	Full-service restaurants	1,072	42.0

County Analysis

The state-wide summary above provides the most aggregate level of detail in regards to employment and output by freight transportation sectors (direct effects) and related sectors (indirect and induced effects). The following section applies the same analysis framework to each of the five counties selected for a potential transload facility.

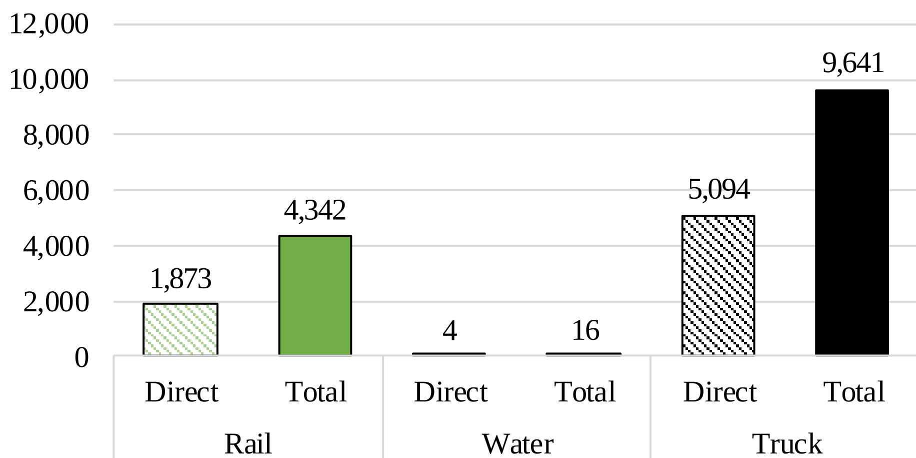
Pulaski County

Table 7-6 and Figure 7-3 show the direct and indirect effect for both employment and output in Pulaski County for rail, water, and truck transportation. There is a slight difference between Pulaski County and the state wide analysis. While employment and output for the trucking sector are larger than for rail, the difference between the direct and indirect impacts of rail are truck are much smaller for Pulaski County compared to the statewide estimates. As seen with the statewide analysis, the impact of the water sector is essentially negligible. **Figure 7-3c** divides the output by the employment for Pulaski County to give a ratio of output value in dollars per job. This gives an indication of the impact in terms of dollars per job for each mode.

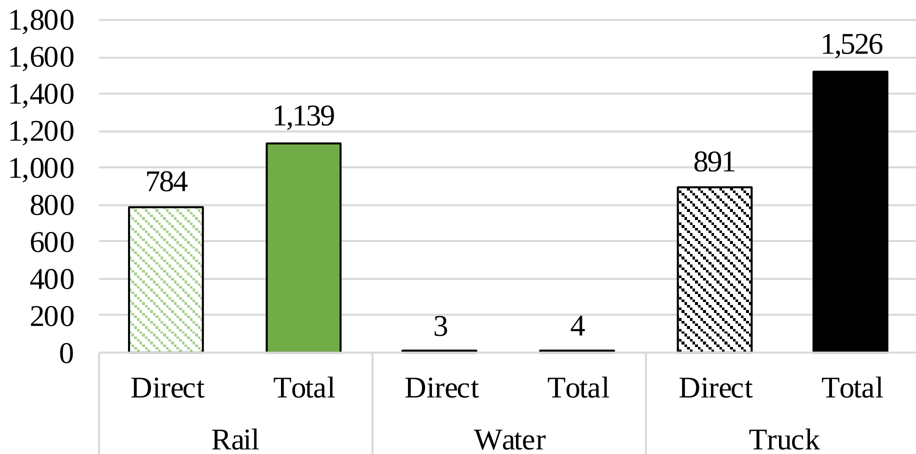
Similar to the statewide analysis, the water sector had by far the lowest employment and output contribution to the county. However, the ratio of output to employment shows that the water sector has the largest direct and total effect per job. This indicates that potential investments to the water sector, as in the development of a transload site with access to the waterway, would have the largest impact on the local economy compared to an equivalent investment in trucking or rail sectors.

TABLE 0-6. EMPLOYMENT AND OUTPUT FOR RAIL, WATER, AND TRUCK SECTORS IN PULASKI COUNTY

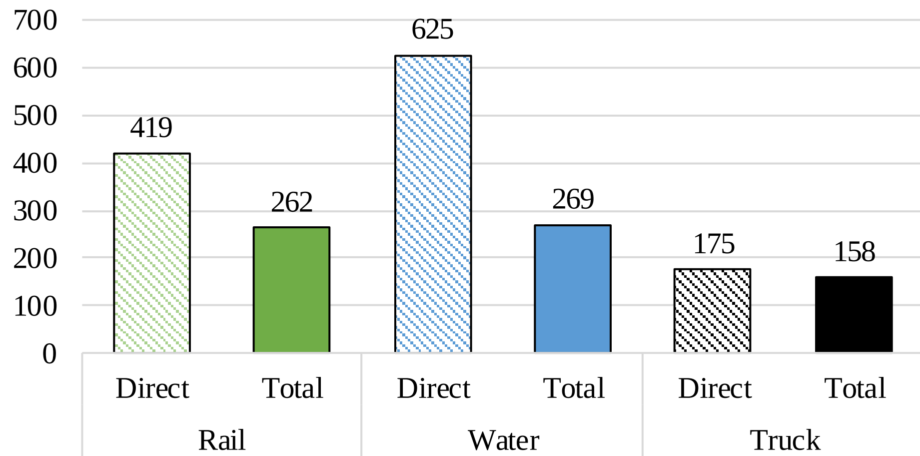
Sector	Impact Type	Employment (persons)	Output (Millions of $)
Rail (409)	Direct	1,873	783.9
	Total	4,342	1,138.7
Water (410)	Direct	4	2.5
	Total	16	4.3
Truck (411)	Direct	5,094	890.7
	Total	9,641	1,525.6



(A) EMPLOYMENT



(B) OUTPUT



(C) RATIO OF OUTPUT TO EMPLOYMENT

FIGURE 0-3. ECONOMIC IMPACTS IN PULASKI COUNTY

Benton and Washington Counties

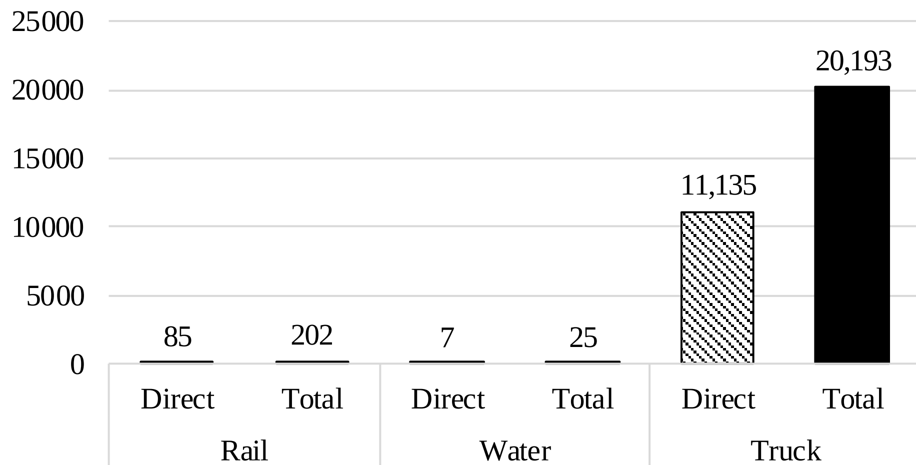
Since the proposed transload facility in Northwest Arkansas is designed to service both Benton and Washington Counties, a combined analysis was pursued for these two counties. **Table 7-7** and **Figure 7-4** show the direct and total effects for both employment and output in Benton and Washington Counties for the rail, water, and truck sectors. **Figure 7-4c** shows the ratio of output to employment for Benton and Washington Counties for each of the three transportation sectors.

Compared to the state analysis, there is considerably higher output and employment in the trucking sector in Benton and Washington counties. This is most likely due to the "headquarters effect" caused by the presence of J.B. Hunt Transport Services which is located in the Northwest Arkansas region. The headquarters effect occurs when business and employment data for a large company are reported from its headquarters location rather than dispersed throughout its operating area. For the case of J.B. Hunt, which operates its truck fleet across the US but concentrates corporate and technical staff in Northwest Arkansas, this is likely the case. Further, while J.B. Hunt employs a large number of corporate and technical staff at its office in Northwest Arkansas that would be represented as part of the trucking sector employment, it is unlikely that a transload facility placed in Northwest Arkansas would significantly affect employment or economic output of J.B. Hunt.

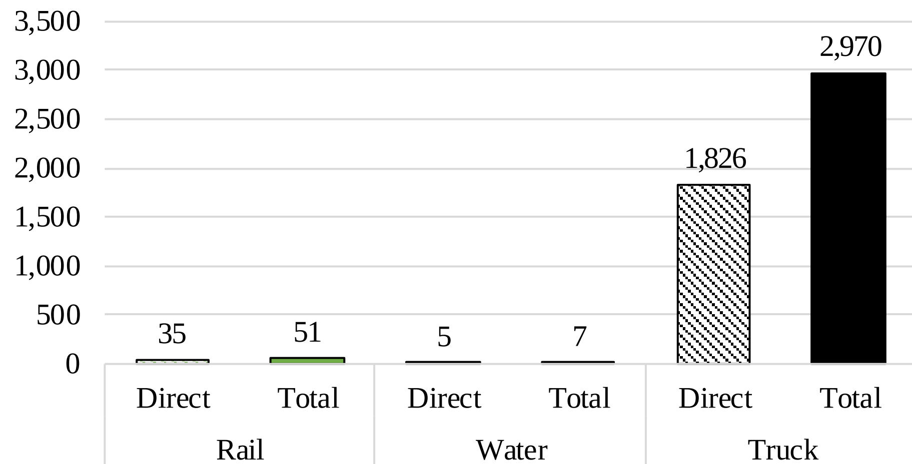
Similar to the state and Pulaski County analysis, the water sector had the lowest employment and output contribution compared to the truck and rail sectors, but the highest output to job ratio. However, the transload facility proposed for Benton and Washington county would not provide access to water. Rather, it would serve to move freight from truck to rail. Therefore, only the direct and total effects of rail and truck sectors are relevant for the Benton/Washington facility.

TABLE 0-7. EMPLOYMENT AND OUTPUT FOR RAIL, WATER, AND TRUCK IN BENTON AND WASHINGTON COUNTIES

Mode	Impact Type	Employment (persons)	Output (Million $)
Rail (409)	Direct	85	35.4
	Total	202	50.9
Water (410)	Direct	7	4.6
	Total	25	7.3
Truck (411)	Direct	11,135	1,826
	Total	20,193	2,970



(A) EMPLOYMENT



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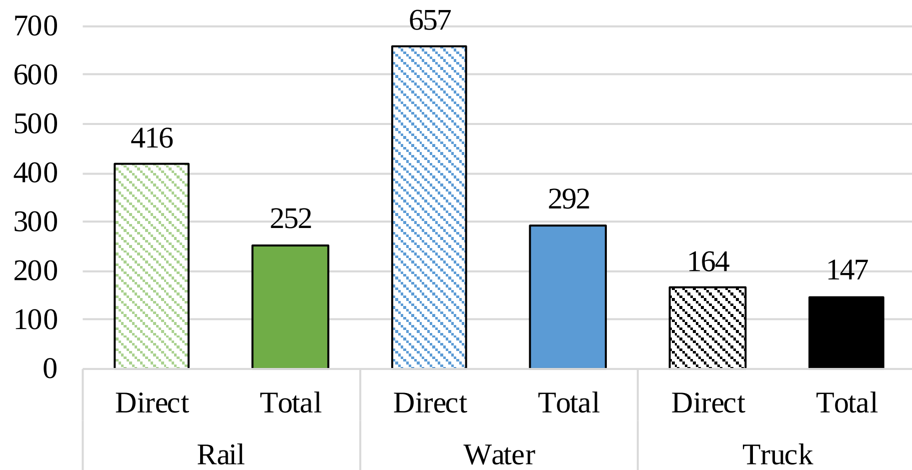


(C) RATIO OF OUTPUT TO EMPLOYMENT

FIGURE 0-4. ECONOMIC IMPACTS IN BENTON AND WASHINGTON COUNTIES

Hot Spring County

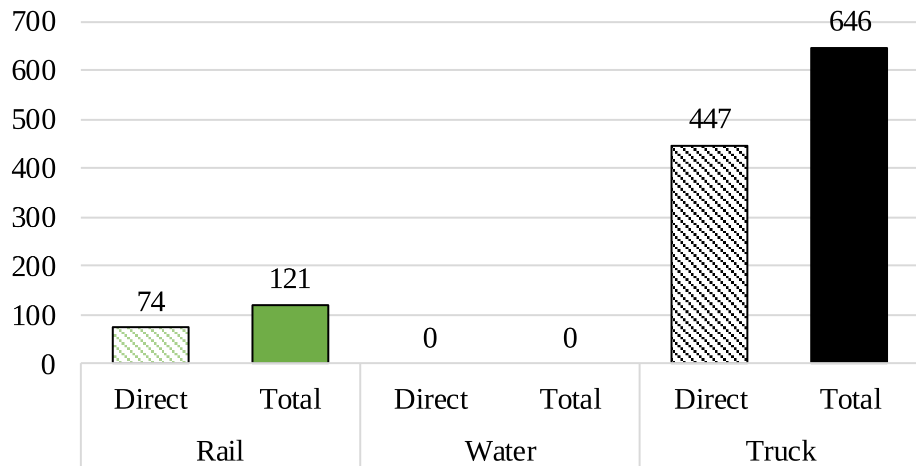
While the transload facilities in Pulaski and Benton/Washington Counties were identified by commodity flows, the location of a transload facility in Hot Spring County was based on stakeholder input. Unlike Pulaski County, but similar to Benton/Washington Counties, no water access would be provided by the transload facility in Hot Spring County. However, unlike Benton/Washington Counties, there is no water employment in Hot Spring County, so there are no measured direct or total effects in the water sector of Hot Spring County as shown in **Table 7-8 and Figure 7-5**.

The same trends seen in the state of Arkansas and Pulaski County are evident in Hot Spring County, i.e. the trucking sector has a higher direct and total impact than rail. A significant difference, however, is the relative magnitude of employment and output compared to the state and other counties. Pulaski County had truck and rail employment between 1,873 and 9,641 persons and economic output between 783 and 1526 million dollars. Benton/Washington Counties had truck and rail employment between 84 and 20,193 persons and economic output between 35 and 2,970 million dollars. Comparatively, Hot Spring County has employment between 74 and 646 persons and economic output between 31 and 93 million dollars. This smaller magnitude is reflective of the relatively smaller quantity of commodities that flow through the region as compared to the other counties included in the analysis (See Section 5.3).

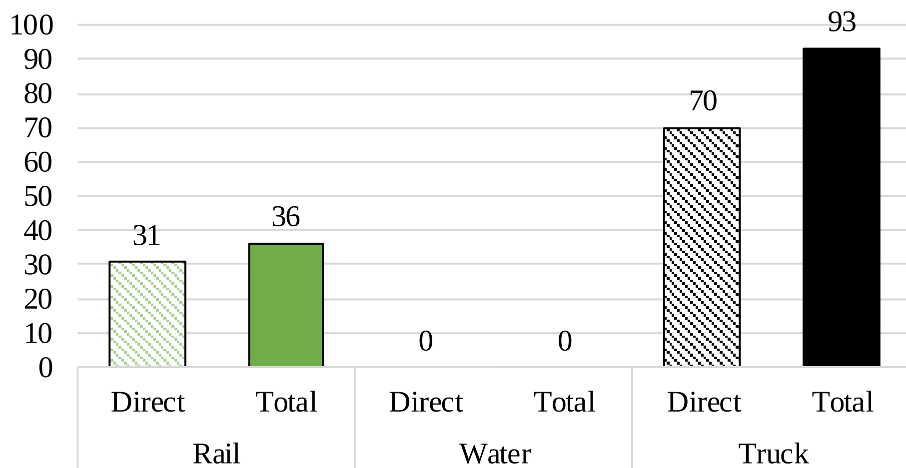
As seen in **Figure 7-5c**, even with the smaller employment and economic impact, the rail sector had a higher output per job ratio. Again, this indicates that employment in the rail sector of Hot Spring County has a larger economic impact per job compared to employment in the trucking sector.

TABLE 0-8. EMPLOYMENT AND OUTPUT FOR RAIL, WATER, AND TRUCK IN HOT SPRINGS COUNTY

Mode	Impact Type	Employment (persons)	Output (Million $)
Rail (409)	Direct	74	30.8
	Total	121	36.3
Water (410)	Direct	0	0.0
	Total	0	0.0
Truck (411)	Direct	447	70.1
	Total	646	93.2



(A) EMPLOYMENT



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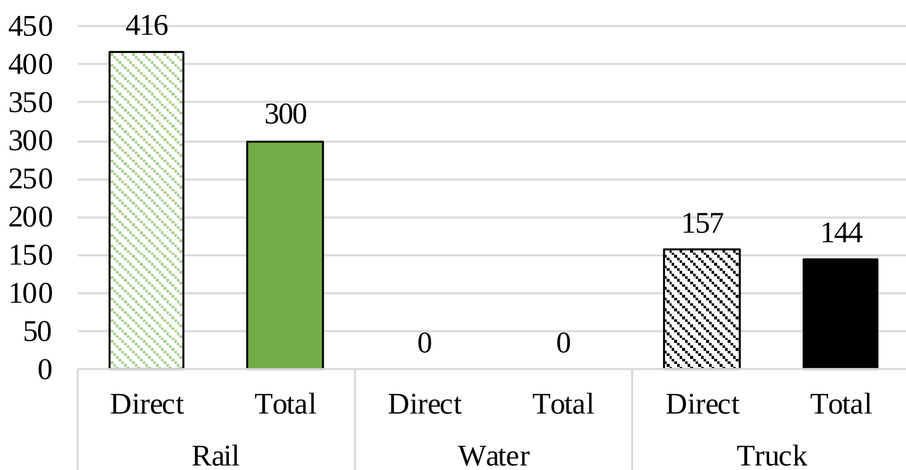


(C) RATIO OF OUTPUT TO EMPLOYMENT

FIGURE 0-5. ECONOMIC IMPACTS IN HOT SPRING COUNTY

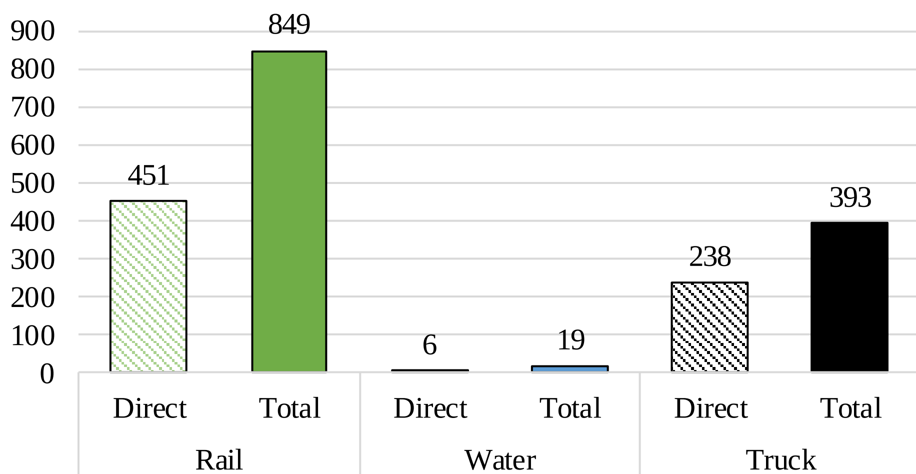
Jefferson County

Jefferson County, like Hot Spring County, was included in the list of potential transload facility sites due to stakeholder input. Interestingly, the stakeholders did not feel that there was a lack of transload facility, but a lack of competition for a transload facility. **Table 7-9 and Figure 7-6** summarize the IMPLAN output. **Figure 7-6c** depicts the ratio of output to employment for Jefferson County.

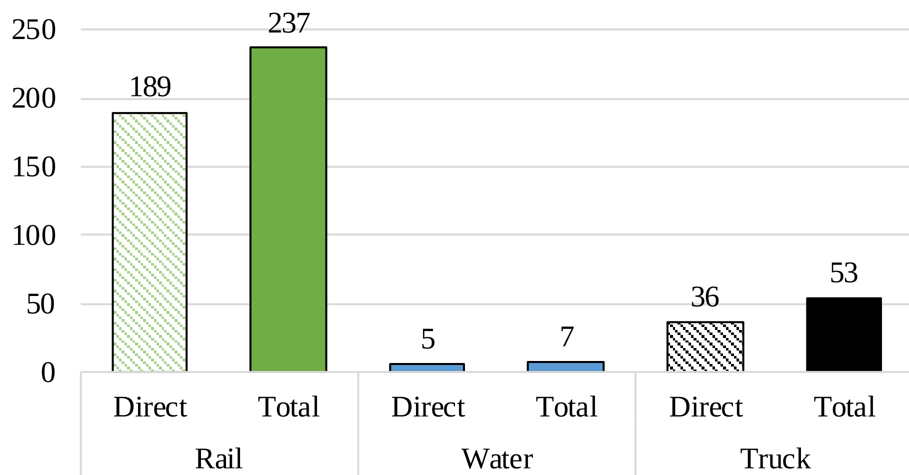
Jefferson County has a different distribution of employment and economic impact by transportation sector than the statewide or county analysis for Pulaski, Benton/Washington, and Hot Spring counties. While Pulaski, Benton/Washington, and Hot Spring counties each showed the greatest employment, direct, and total effects for the trucking sector, in Jefferson County the rail sector maintains the highest share of employment, total, and direct effects. **Figure 7-6c** shows that even with the higher impact of the rail sector on employment and the economy, the general trend of ratio of output per job is consistent with the other counties. The water sector has the highest output to job ratio, followed by the rail sector, and the trucking sector.

TABLE 0-9. EMPLOYMENT AND OUTPUT FOR RAIL, WATER, AND TRUCK IN JEFFERSON COUNTY

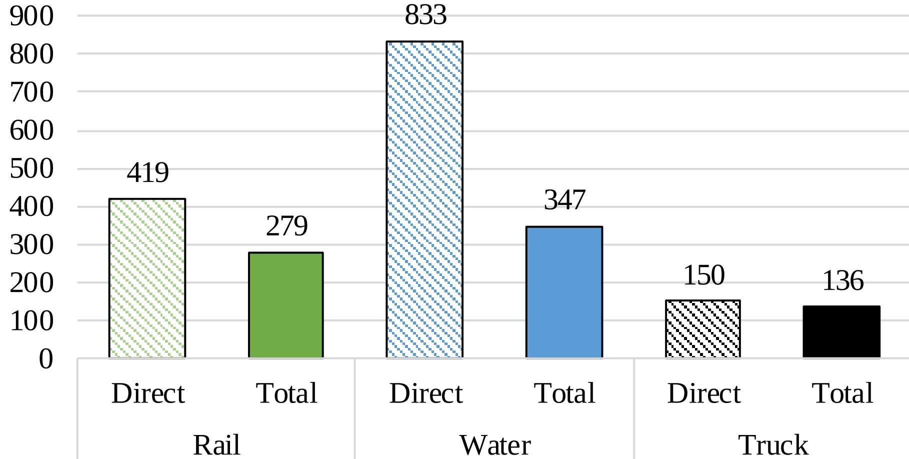
Mode	Impact Type	Employment (persons)	Output (Million $)
Rail (409)	Direct	451	188.9
	Total	849	236.7
Water (410)	Direct	6	5.0
	Total	19	6.6
Truck (411)	Direct	238	35.7
	Total	393	53.3



(A) EMPLOYMENT



(B) OUTPUT



(C) RATIO OF OUTPUT TO EMPLOYMENT

FIGURE 0-6. ECONOMIC IMPACTS IN JEFFERSON COUNTY

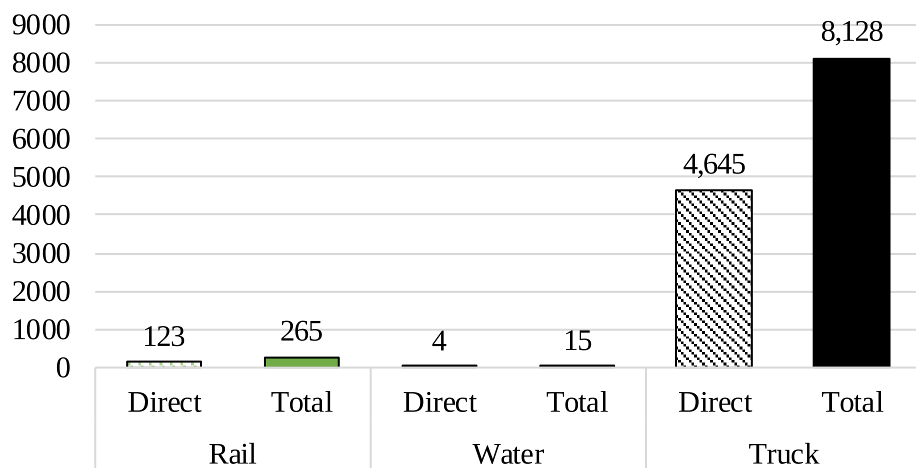
Sebastian and Crawford Counties

The proposed transload facility site in Fort Smith, AR straddles the border of Sebastian and Crawford Counties in order to serve commodities originating or terminating in either county. Therefore, a combined analysis of the economic impacts for Sebastian and Crawford Counties was completed in IMPLAN. **Table 7-10** and **Figure 7-7** summarize the IMPLAN output.

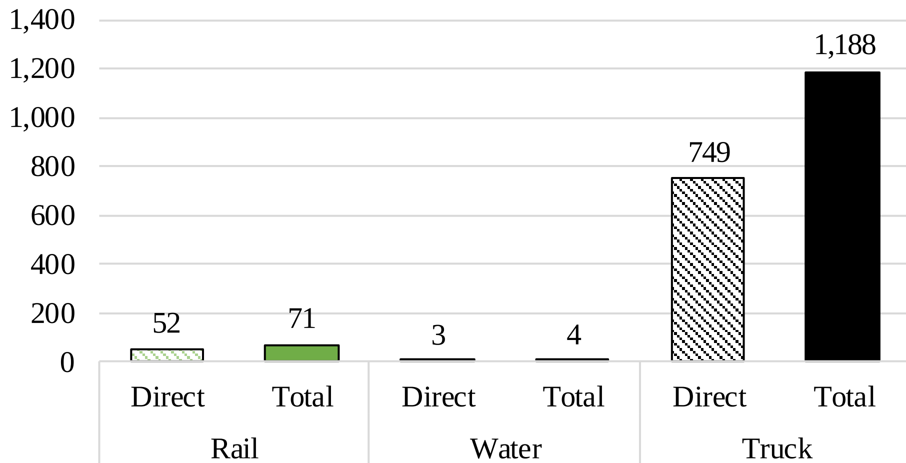
The results that were seen in the state of Arkansas, Pulaski County, Benton/Washington Counties, and Hot Spring County are seen in the combined Sebastian and Crawford Counties analysis, with employment and economic output in the trucking sector dominating the analysis. The analysis of the ratio of output to employment shows that the water sector has the highest ratio, with the rail sector second and the trucking sector third.

TABLE 0-10. EMPLOYMENT AND OUTPUT FOR RAIL, WATER, AND TRUCK IN SEBASTIAN AND CRAWFORD COUNTIES

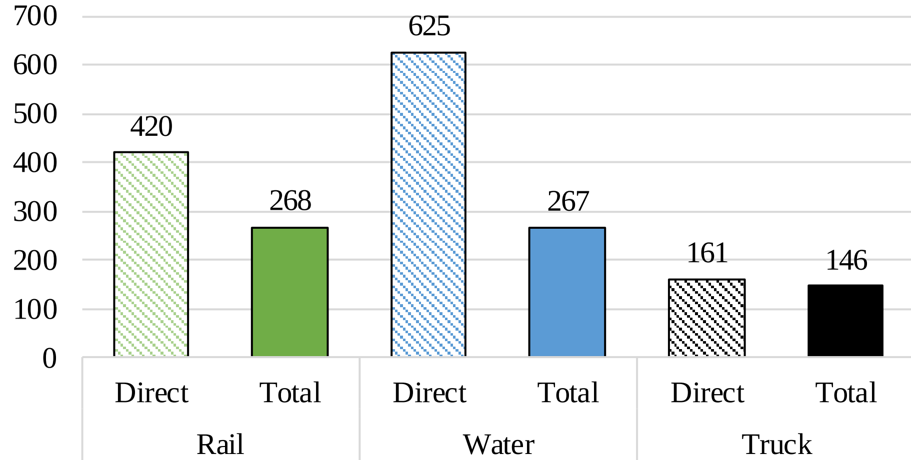
Mode	Impact Type	Employment (persons)	Output (Million $)
Rail (409)	Direct	123	51.6
	Total	265	71.0
Water (410)	Direct	4	2.5
	Total	15	4.0
Truck (411)	Direct	4,645	748.6
	Total	8,128	1,188.4



(A) EMPLOYMENT



(B) OUTPUT



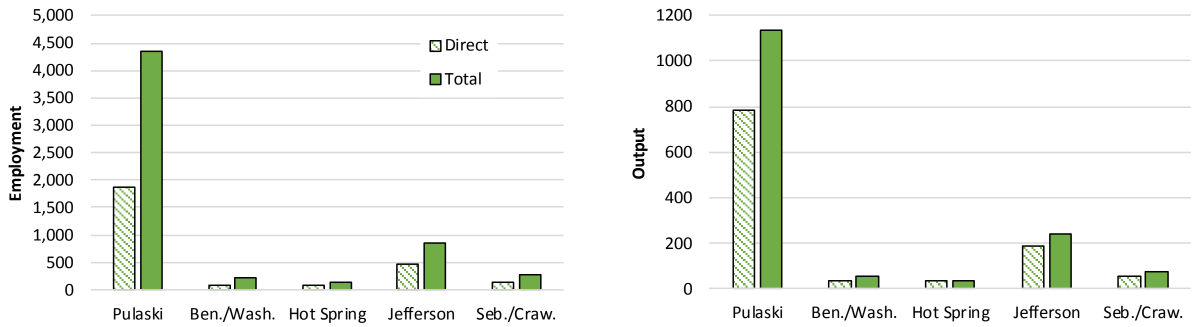
(C) RATIO OF OUTPUT TO EMPLOYMENT

FIGURE 0-7. ECONOMIC IMPACTS IN SEBASTIAN AND CRAWFORD COUNTIES

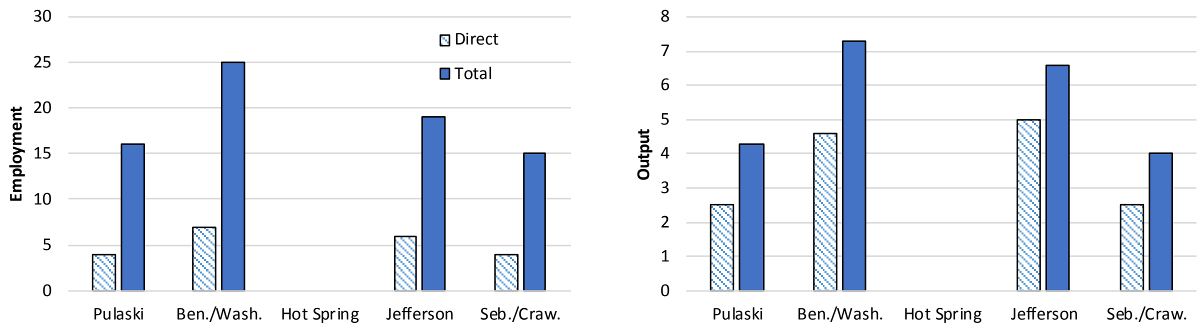
Comparative Analysis

Figure 7-8 summarizes the ratio of output to employment for all of the county analyses for the rail, truck and water sectors. In the IMPLAN analysis, employment (number of jobs) and economic output (dollars), both direct and total effects, are correlated to the productivity of a region. Benton and Washington Counties has the highest employment and economic output, while Hot Spring County has the lowest employment and economic output. However, the ratio of output to employment is much more stable across the state regardless of the region.

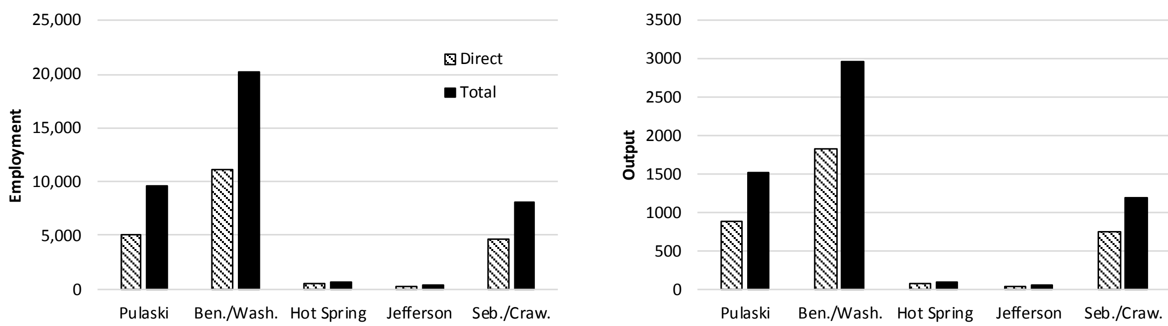
In **Figure 7-9**, the water mode has by far the highest direct output divided by employment, while the truck mode has the lowest. The results for the six analysis groups are very stable, with the coefficient of variation (COV) of only 15% for the direct water impact, and as low as 0.04% for the direct rail impact. This indicates that regardless of which area in the state a job is created in these three modes, the impact of that job is relatively stable across the entire state. In addition, it appears that from an economic impact perspective, the direct impact of one employee is about four times greater for water versus truck, and about one and a half times greater for water versus rail. The indirect impact of one employee is about two times greater for water versus truck, and just slightly higher for water versus rail.



(a) Rail Sector

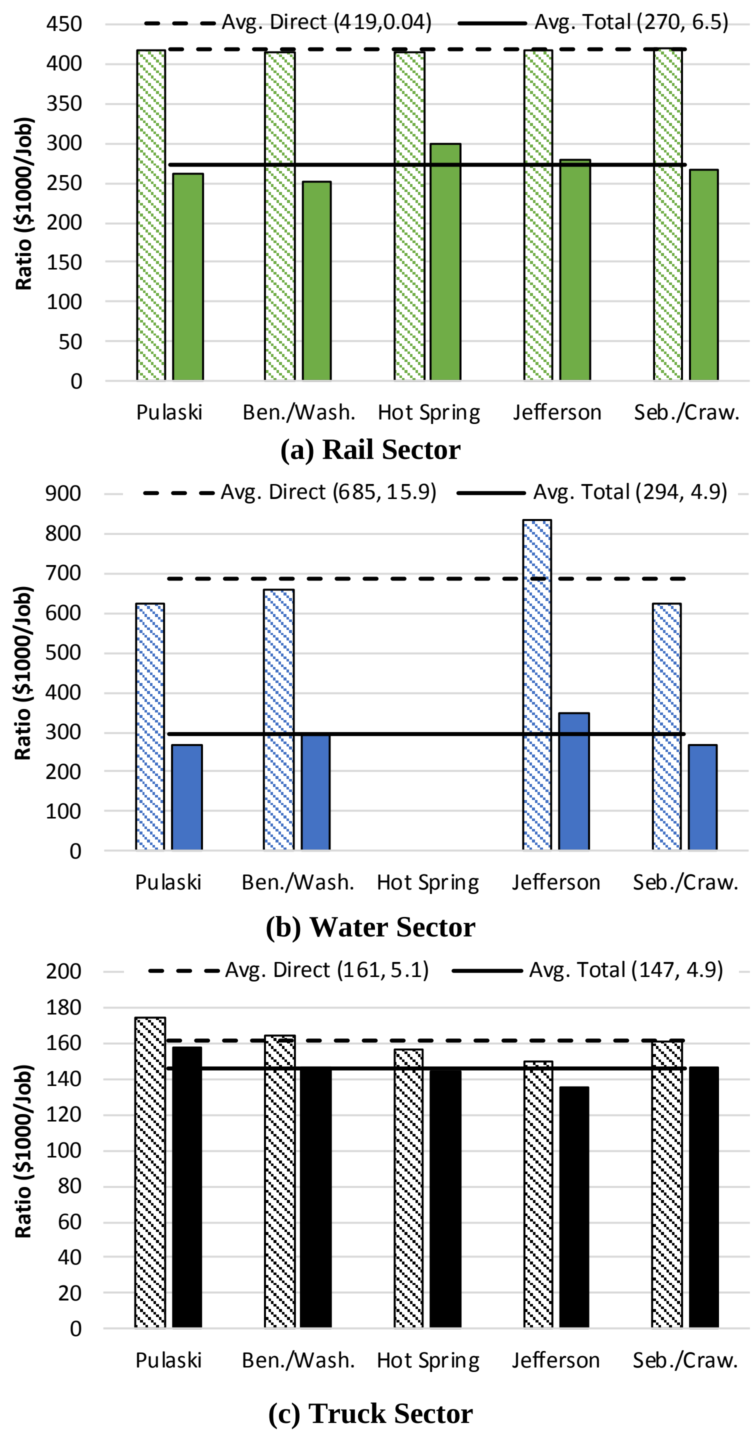


(b) Water Sector



(c) Truck Sector

FIGURE 0-8. OUTPUT AND EMPLOYMENT FOR THE RAIL, TRUCKING, AND WATER SECTORS FOR EACH COUNTY



Note: Legend shows the (average, coefficient of variation) for the direct and total impacts

FIGURE 0-9. RATIO OF OUTPUT TO EMPLOYMENT FOR SELECTED COUNTIES

Key Findings

In order to explore the impact of different modes of transportation, six analyses were run for Arkansas. The first was statewide, and the other five were either at a county level or joint counties, in the location where recommended transload facilities were identified by either commodity flow analysis or stakeholder feedback. At a statewide level, the total economic effect of truck transportation was over $11 billion, rail over $2 billion, and water over $42 million. These three modes also, in total, employed over 75,000 in trucking, over 8,000 in rail, and about 144 in water. This trend of truck transportation dominated four of the five county level assessments, with Pulaski, Benton/Washington, Hot Springs, and Sebastian/Crawford all showing truck as by far the strongest influence in employment and economic effect. Jefferson County was the only analysis where rail had a higher employment and economic impact versus truck. The impact of water was essentially negligible when comparing to truck and rail in all six analyses.

Hot Springs County and Jefferson County were analyzed because of input from stakeholders, but besides rail having a larger impact than truck in Jefferson County, these two counties fell in line with the other four analyses when comparing to general economic activity of an area. The Benton/Washington Counties had employment impacts in the ten-thousands and economic output in the billions of millions of dollars, and can be considered one of the largest economic areas in the state. Pulaski County saw the second largest impact, while Hot Springs, the smallest area of economic activity in the analysis, had the lowest impact per mode for employment and economic impact.

One trend of interest was exploring the output divided by employment in the analysis. In theory, this number is the economic impact of a single job in each mode of transportation. With very clear and consistent results, water employment had the highest direct and indirect impact (on average $680,000 and $295,000 per job respectfully), while truck employment had the lowest direct and indirect impact (on average $161,000 and $147,000 per job), with rail in between.

In conclusion, it appears that IMPLAN can examine the impact of each mode of transportation. This analysis is sensitive to the geographic area of analysis for employment and economic impact, but interestingly, the economic impact per job is relatively stable regardless of the analysis area.

Impact Analysis on the Trucking Industry

The purpose of Task 5 was to determine the impact on the trucking industry as a result of new and/or expanded transload facilities at the locations selected through stakeholder feedback and commodity flow analysis. The premise was the use of new and existing transload facilities will promote the use of rail and/or barge and reduce the number of long haul trucks on the state's highways and CO_2 emissions.

The research for the impact analysis included both primary and secondary methods. Primary data for miles and OD pair analysis was collected using PC*Miler's highway routing software. Primary data for types of cargo, tonnage and the origin/destination of shipments was collected from the AR STDM. Primary data was also gathered through interviews with freight stakeholders including Anthony Timberlands, Bulkloadsnow.com, Bruce Oakley, 5 Rivers Distribution and OTI. Secondary data sources were utilized to determine types of cargo, tonnage and the origin/destination of shipments.

The process using AR-STDM commodity flow data to evaluate the impacts on the trucking industry is outlined in **Figure 8-1**. The input data to the impact analysis is the selection of major OD pairs based on ton-distance as described in **Section 5.2**.

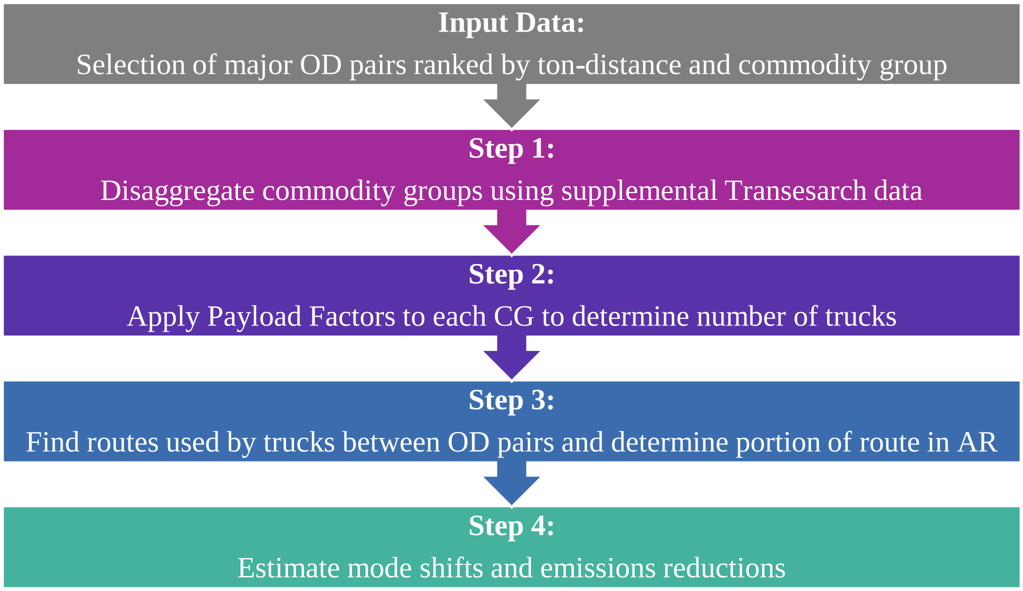


FIGURE 0-1. PROCESS FOR ESTIMATING IMPACTS ON THE TRUCKING INDUSTRY

Disaggregation of Commodity Groups (Step 1)

The commodity groups transported over each OD pair was further disaggregated into STCC two or three digit levels. For example, between Pulaski County and the Harris, Texas region, ranked fifth in the top-20 list), 1,859,987 tons of non-metallic minerals are shipped by truck annually. Non-metallic minerals, CG 4, can be disaggregated into dimensional stone (STCC 1411) and crushed stone/riprap (STCC 1421). This disaggregation was performed using the supplementary data provided by the ATHD for the main commodity for each of the top-20 OD pairs. An example of the disaggregation mentioned above is shown in **Table 8-1**.

The process to disaggregate commodity groups was applied to the top-20 ranked OD pairs that have Pulaski, Benton or Washington as origin or destination. First, the AR STDM the annual tons by truck travelling between each of those OD pairs (at county level) in the base year (2010) was obtained. Next, supplemental data from Transearch was used to disaggregate OD flows into their respective commodity sub-groups at the four digit STCC level. Then, the share of each commodity subgroup (STCC 4-digit level) within its commodity group was determined from the Transearch data and applied to the 2010 AR-STDM data. Specifically, the commodity sub-group shares were used to disaggregate the 2010 annual tons by truck. The results of applying this procedure are exemplified in **Table 8-1**.

TABLE 0-1. DISAGGREGATION OF NONMETALLIC MINERALS (CG 4)

Origin	Destination	Total Routed Miles	Annual Tons by Truck 2010	STCC CG Code	STCC CG Description
Total for OD Pair					
Pulaski County, AR	Harris County, TX	287.9	1,859,987	14	Nonmetallic Minerals
Disaggregated for OD Pair					
Pulaski County, AR	Harris County, TX	287.9	20,646	14 11	Dimension stone, quarry
Pulaski County, AR	Harris County, TX	287.9	1,839,341	14 21	Broken or crushed stone or rip rap

Payload Factor Conversion (Step 2)

Payload factors, e.g. ton-to-truck conversion factors, pulled from the AR-STDM were applied to the tons for each OD pair to determine the number of trucks serving the route. **Table 8-2** provides a sample of payload factors for the six commodity groups appearing in the top-20 list of OD pairs. A full list of payloads by commodity group and disaggregated to commodity subgroup can be found in the ARDOT AR-STDM model documentation.

TABLE 0-2. PAYLOAD FACTORS FOR SELECT COMMODITY GROUPS

Commodity Group	Payload Factor (tons per truck)
Non-metallic minerals	24.31
Food	23.00
Durable Manufacturing	15.78
Chemicals	20.67
Primary Metal	24.88
Secondary and Misc. Mixed	20.56

Estimation of Within-State Mileage (Step 3)

Primary data for routes and mileages was sourced from PC*Miler and was used to determine the most practical truck route between the OD pairs. The result of the analysis was used to determine miles in Arkansas for each OD pair. These miles were then divided by 6.75 miles per gallon to determine gallons of fuel which could be saved to calculate the CO_2 savings. Approximately 22.4 pounds of CO_2 are produced from burning a gallon of diesel fuel per gallon and used to estimate the CO_2 reduction[6]. A summary table of the total routed miles and the Within-Arkansas miles obtained from PC*Miler for the Pulaski-Harris OD pairs exemplified in Step 1 is provided in **Table 8-3**. Summaries of total VMT within Arkansas, based on 2040 expected number of trucks are provided in **Table 8-4**.

[6] US Energy Information Administration, Frequently Asked Questions, "How much carbon dioxide is produced from burning gasoline and diesel fuel?" available online at: https://www.eia.gov/tools/faqs/faq.php?id=307&t=11

TABLE 0-3. EXAMPLE OF PC*MILER RESULTS FOR WITHIN-STATE MILEAGE CALCULATION

Origin	Destination	Total Routed Miles	AR Origin	AR Destination	AR Routed Miles	Total Trucks	AR VMT
Pulaski County	Harris, TX	287.9	Little Rock	Texarkana	141.5	76,511	10,826,333

TABLE 0-4. SUMMARY OF TOTAL WITHIN-STATE MILEAGE BY FACILITY

Facility	County	Within Arkansas VMT (Annual, 2040)
1	Pulaski	40,622,159
2	Benton/Washington	7,154,568
3	Sebastian/Crawford (Van Buren)	1,868,114
4	Hot Spring (Malvern)	1,967,157
5	Jefferson (Pine Bluff)	911,033

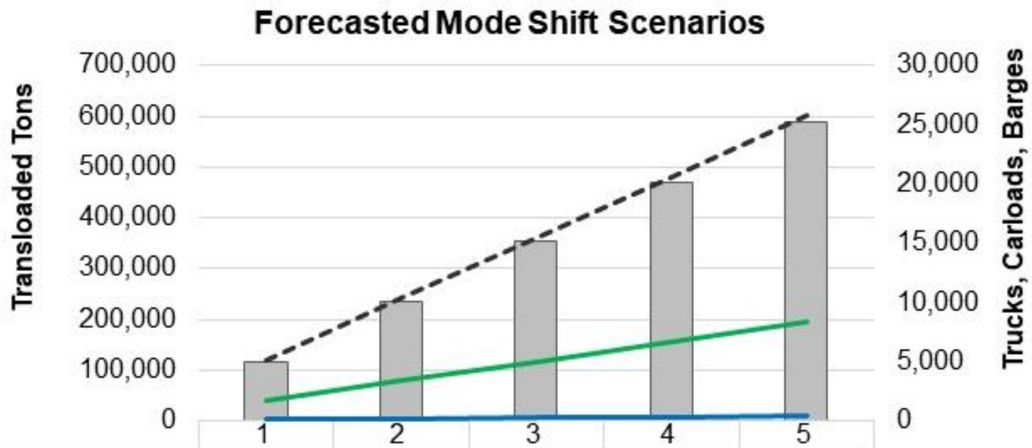
Estimation of Mode Shift and Emissions (Step 4)

Table 8-5 summarizes the truckload equivalent units, CO_2 reduction, AR miles and AR ton-miles reduced by trucks traveling on roadways for each of the locations assuming a 1% mode shift. Because of the uncertainty of how much freight could actually shift modes, different scenarios of potential tons subject to modal shift and CO_2 emissions savings were proposed. These scenarios range from 1% to 5% for sites where several commodities are expected to be handled (Pulaski and Benton/Washington); while scenarios of 1% to 20% were simulated for sites where smaller amounts of single commodities would be handled (Hot Spring, Jefferson, and Sebastian/Crawford). Results for Pulaski, Benton/Washington, Sebastian/Crawford, Hot Spring, and Jefferson are shown in **Figures 8-2** through **8-6**.

With a 1% increase in annual transloading to rail and barge from truck the overall impact for Arkansas is calculated to be a reduction of 7,633 truck load equivalent units, reducing 525,231 miles driven by trucks and removes approximately 50.84 billion ton-miles from the state's highways if all facilities proposed were in operation. Resulting in an estimated reduction of 1,742,987 pounds of CO_2 emissions. Note: a slight increase of CO_2 emissions would be experience by the offset increase to rail and barge.

TABLE 0-5. MODE SHIFT IMPACTS UNDER 1% SHIFT OF TONS TO RAIL OR BARGE FOR 2040

County	Truckload Equivalent	CO_2 Reduction	AR Miles	Ton-miles
Pulaski	5,156	1,348,054	406,222	47.7M
Benton/Washington	2,098	237,426	71,546	2.9B
Crawford/Sebastian	99	61,994	18,681	30.2M
Hot Spring	195	65,280	19,672	96.9M
Jefferson	85	30,233	9,110	12.6M



	1	2	3	4	5
2040 Annual Tons	117,440	234,880	352,320	469,760	587,200
2040 Annual trucks	5,156	10,311	15,467	20,623	25,778
2040 Annual carloads	1,669	3,338	5,007	6,676	8,345
2040 Annual Barges	78	157	235	313	391

% of Annual Tons Subject to Transload

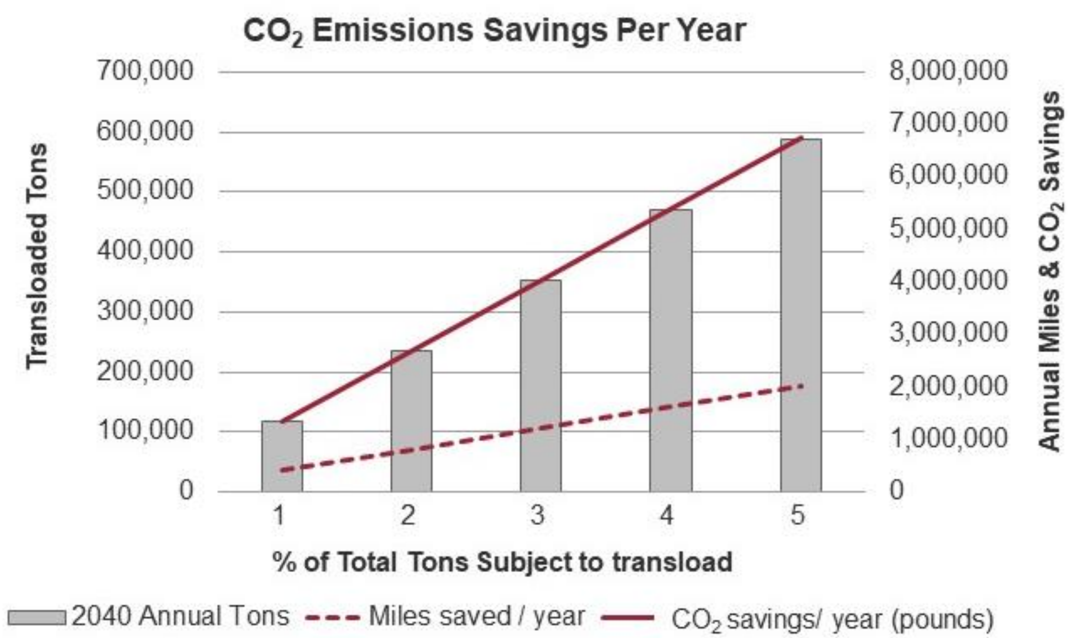
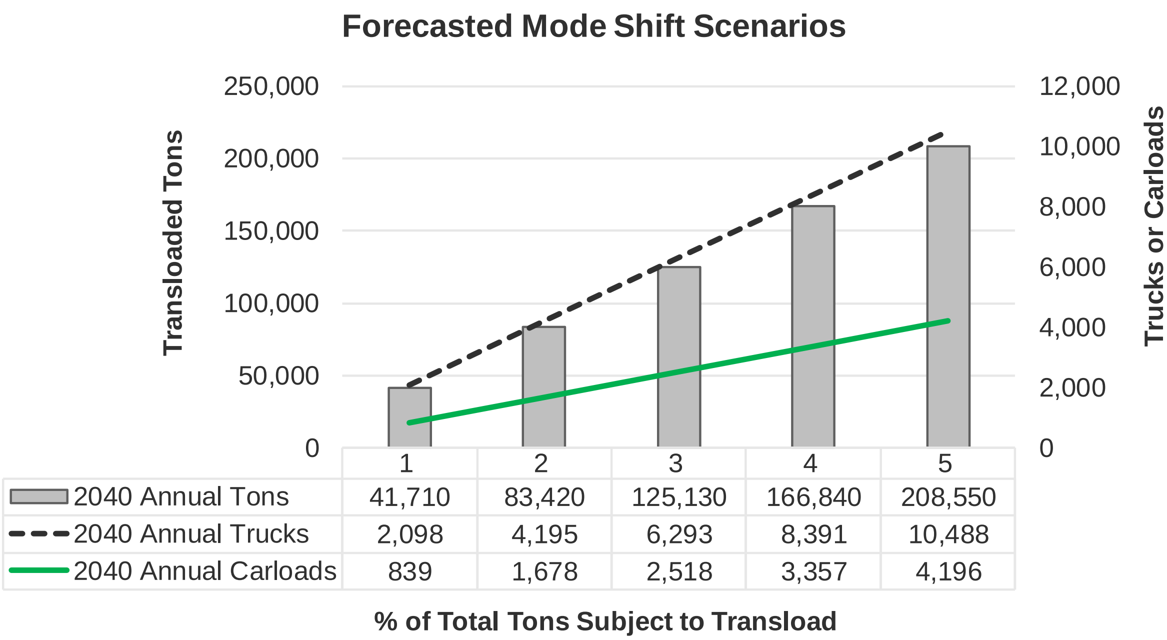


FIGURE 0-2. ANNUAL TONS, CO_2 EMISSIONS, AND WITHIN-STATE MILES FOR PULASKI COUNTY SITE



	1	2	3	4	5
2040 Annual Tons	41,710	83,420	125,130	166,840	208,550
2040 Annual Trucks	2,098	4,195	6,293	8,391	10,488
2040 Annual Carloads	839	1,678	2,518	3,357	4,196

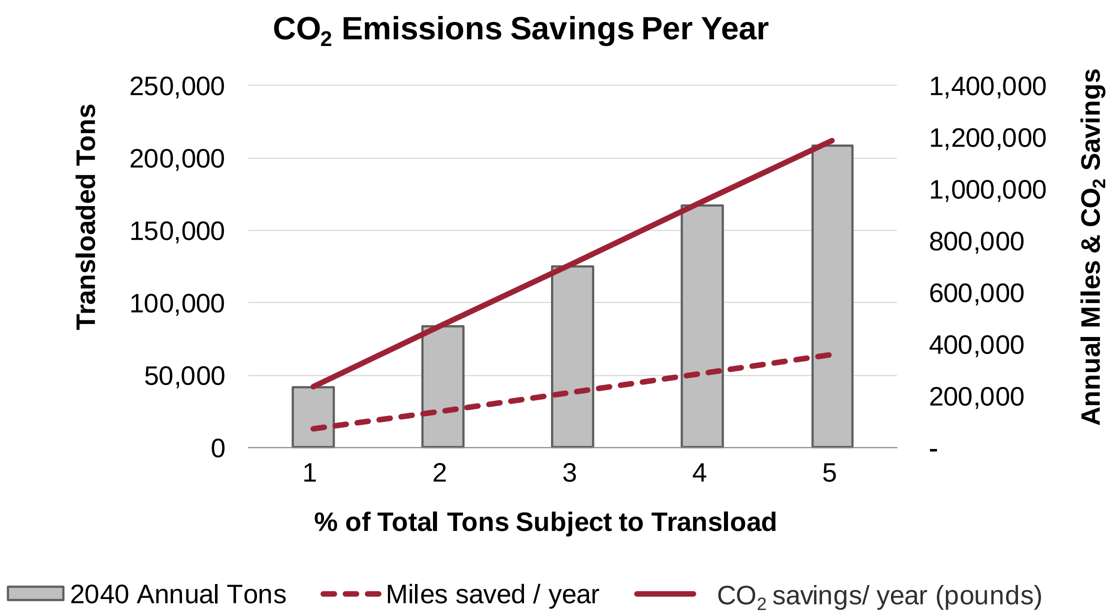
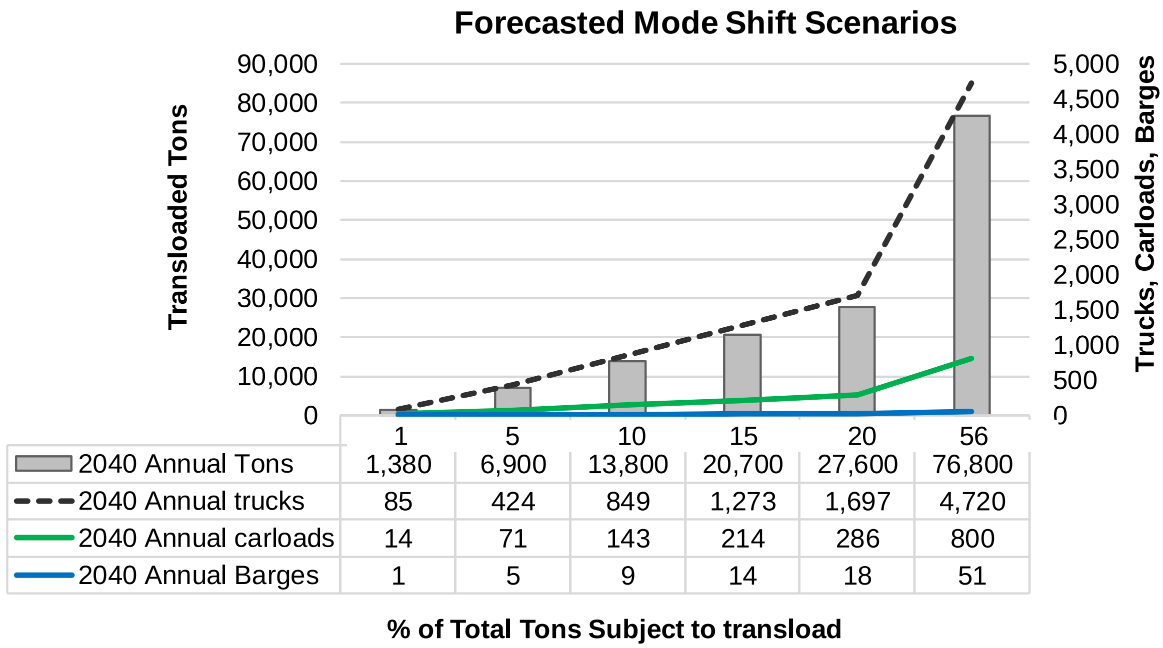


FIGURE 0-3. ANNUAL TONS, CO_2 EMISSIONS, AND WITHIN-STATE MILES FOR BENTON/WASHINGTON COUNTY SITE



	1	5	10	15	20	56
2040 Annual Tons	1,380	6,900	13,800	20,700	27,600	76,800
2040 Annual trucks	85	424	849	1,273	1,697	4,720
2040 Annual carloads	14	71	143	214	286	800
2040 Annual Barges	1	5	9	14	18	51

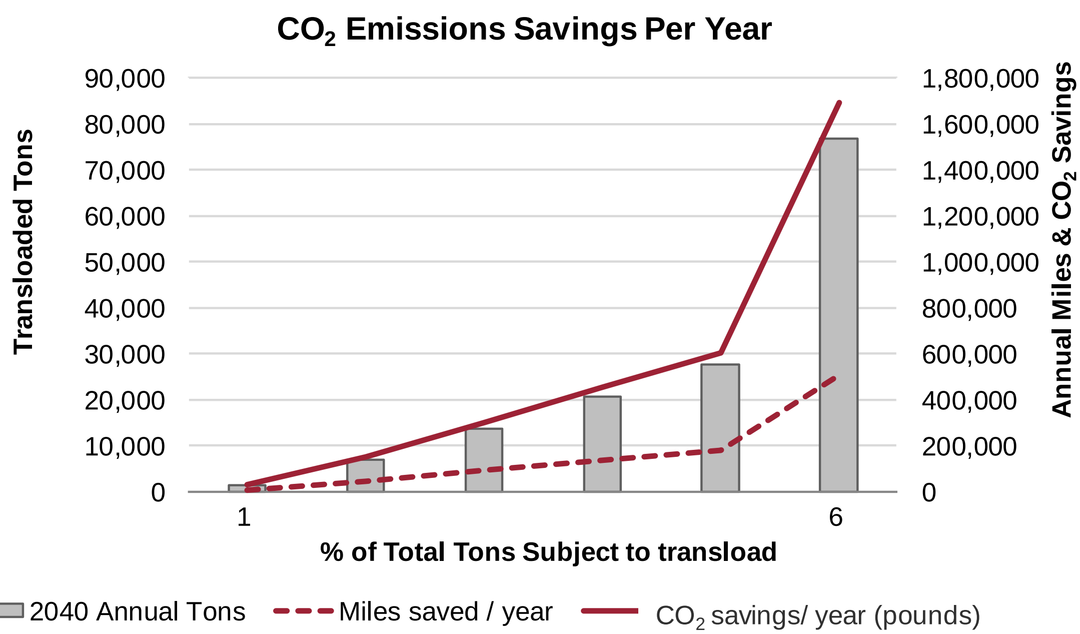
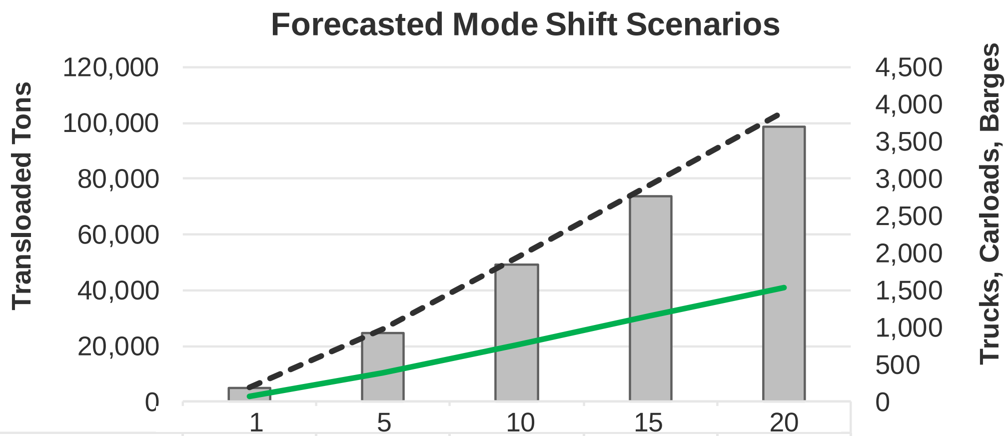


FIGURE 0-4. ANNUAL TONS, CO_2 EMISSIONS, AND WITHIN-STATE MILES FOR JEFFERSON COUNTY SITE



	1	5	10	15	20
2040 Annual Tons	4,930	24,650	49,300	73,950	98,600
2040 Annual trucks	195	974	1,949	2,923	3,897
2040 Annual carloads	77	384	769	1,153	1,538

% of Annual Tons Subject to Transload

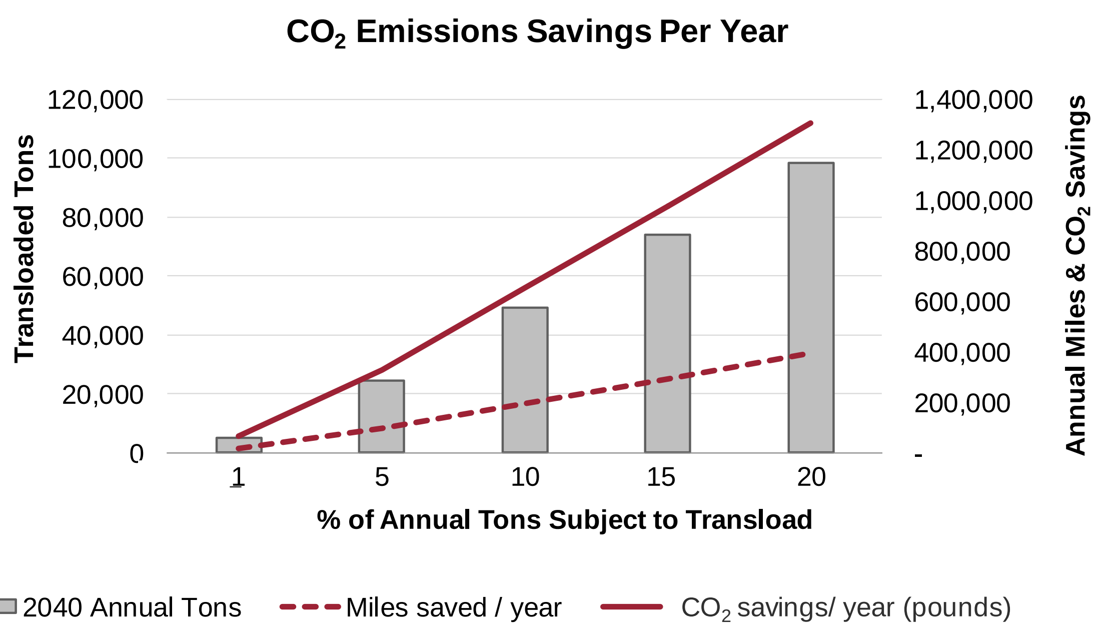
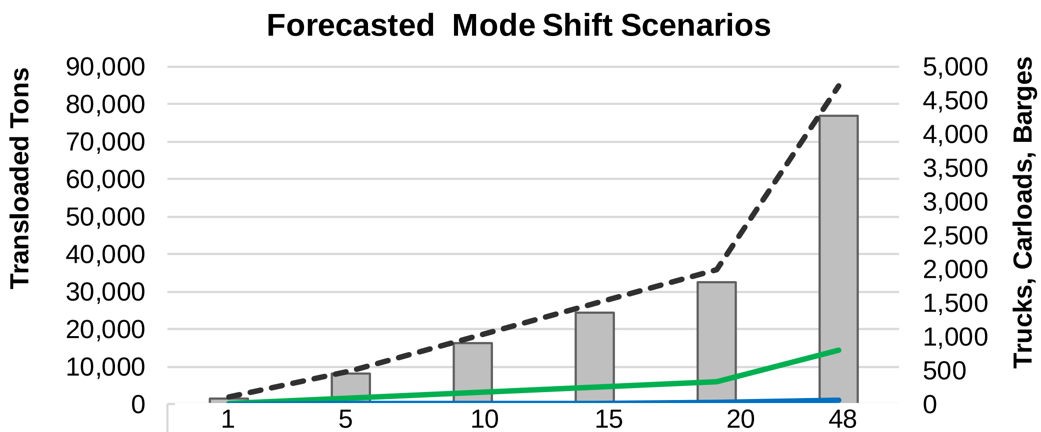


FIGURE 0-5. ANNUAL TONS, CO_2 EMISSIONS, AND WITHIN-STATE MILES FOR HOT SPRING COUNTY SITE



	1	5	10	15	20	48
2040 Annual Tons	1,620	8,100	16,200	24,300	32,400	76,800
2040 Annual trucks	100	498	996	1,494	1,993	4,720
2040 Annual carloads	17	84	168	251	335	800
2040 Annual Barges	1	5	11	16	22	51

% of Annual Tons Subject to Transload

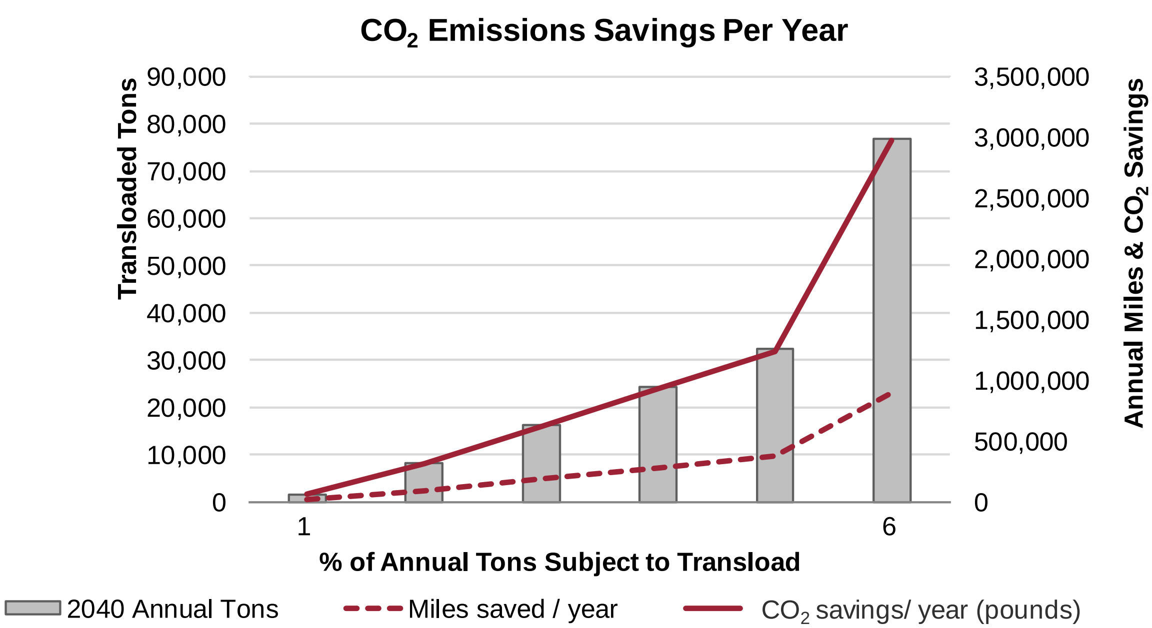


FIGURE 0-6. ANNUAL TONS, CO_2 EMISSIONS, AND WITHIN-STATE MILES FOR CRAWFORD/SEBASTIAN COUNTY SITE

Funding Options

Literature has shown potential funding options can come from local, state and federal grants (public sources); companies who buy, sell, transport, warehouse and/or transload products and commodities (private sources); or public/private partnerships. All are three are viable transloading infrastructure funding options.

Based on the current federal funding indicators for infrastructure, public funding options should be mostly targeted toward local and state entities. A recent New York Times article titled Trump Plans to Shift Infrastructure Funding to Cities, States and Business states "President Trump will lay out a vision this coming week for sharply curtailing the federal government's funding of the nation's infrastructure and calling upon states, cities and corporations to shoulder most of the cost of rebuilding roads, bridges, railways and waterways." Therefore, public funding options should target the State of Arkansas along with the city and county governments in the five proposed transloading sites contained in this report.

Potentially, the most viable funding option will be engaging companies who rely on or could benefit from a transloading supply chain. Working directly with these companies as sole source private funding or encouraging collaboration between these companies and their local governments including the State of Arkansas wherever appropriate. The State of Arkansas, specifically ARDOT, could provide right-of-way improvements and/or access to transloading facilities. As an example, Five Rivers Distribution mentioned improving highway access to their facility in Van Buren. In either the private or the public/private options engaging companies currently in or potentially benefitting from a transloading supply chain could be a logical first step in securing funding for transloading infrastructure projects.

A non-traditional more innovative funding option could be engaging an independent investment management firm like Steel River Partners[7] that invests in core infrastructure assets.

Recommendations for Future Research

The majority of progress on larger concepts for this project occurred during the research team group meetings that were held approximately every two weeks. However, there were often ideas identified that were put side, or concepts that were deemed beyond the scope of the proposed work for TRC1608. Many of these discussion fall under the umbrella of either future work or limitations of the delivered work and will be described in more detail in the following text.

Future Research

While there are dozens of potential paths forward from this research, there are five that stand out. For future work, it is recommended to:

- Develop a more refined distance threshold based on geography, commodity, and mode
- Coordinate commodity flows with neighboring states
- Include pipeline as a transportation mode
- Fully leverage the capabilities of IMPLAN
- Incorporate intermodal containers into mode-shift analysis

The first potential path forward would be the development of a regionally-defined, commodity-specific, and mode-specific distance threshold. The Commodity Flow Survey (CFS) microdata would be used to analyze historical mode selection for shipments with origin or destination in Arkansas, based on distance shipped. The CFS microdata contains the results of the shipper survey include commodity type, shipment distance, mode used, and origin/destination for a sample of all shipments made in the US. Based on the relationship between freight weight and distance shipped for each mode, a mode share curve could be fit

[7] http://www.steelriverpartners.com/description/.

to all the data that falls within these criteria in order to obtain specific distance thresholds, or mode share 'curves'. This analysis would distinguish mode share 'curves' for each commodity group.

The second area of future work would be coordinating with neighboring states for transload analysis. It was very obvious looking at commodity flow maps that a significant amount of freight was traveling either to or from Houston and Dallas in Texas, from Kansas City and St. Louis in Missouri, New Orleans in Louisiana, and to a lesser extent, other major metropolitan areas in surrounding states. This research was focused on just intra-Arkansas freight movement, but leveraging the trade relationships with neighboring states or by simply targeting major cities that have significant levels of trade with Arkansas could potential open new options for transload facilities in the state.

The third path forward would be the inclusion of pipelines as a potential mode of freight transportation. According to the Bureau of Transportation Statistics, approximately 5.9 trillion ton-miles of freight was moved in 2012. When broken down into truck, railroad, pipeline, water, and air, trucks moved about 44% ton-miles of freight and rail moved about 30%. Interestingly, pipelines came in third at 17%, which water was at about 9%. By ton-miles, air transport was negligible. Therefore, there is the potential for a significant amount of liquid freight that could be transloaded from truck to pipeline with the proper commodities and location.

The fourth area of future work would be to more fully explore IMPLAN for quantifying the influence of transload facilities. This research project mainly focused on the impact of a single job in each mode of transportation to determine what employment influence was seen for each mode. However, there was an effort made to see if the influence of shifting modes of transportation could be explored. For example, what would be the impact to the state industry if 5% of the trucking industry was transferred to the rail industry? Due to built in assumptions to IMPLAN, that essentially mask these types of transfer when attempted, this line of research was not followed up.

The fifth and final area of recommended future work would be to either include, or perform a stand-alone study, on the impact of intermodal container traffic on Arkansas highways by evaluating highway freight flows when integrated with both container on flat rail car (COFC) and container on barge (COB). At the very beginning stages of this project, a significant amount of effort went into defining what exactly a transload facility was, and it was determined that intermodal containers do not fall into the transload family. However, many of our discussions with stakeholders, and much of the literature we reviewed, included intermodal container concepts. Therefore, there is a real possibility that facilities that include the ability to switch intermodal containers from one mode of transportation to another could be beneficial of the state of Arkansas.

Limitations

While there were five primary areas of future work, there were also several limitations identified during this study. In particular, three limitations stood out that could have influenced different areas of the analysis. These limitations were:

- Improve current transload facility inventory
- Enhance cost estimation framework
- Further refine IMPLAN analysis under each mode

The first limitation was the extent of the current transload facility inventory in Arkansas. Some of the greatest difficulties with developing a comprehensive transload facility inventory survey were identifying an initial list of facilities, confirming contacts at each of the facilities, and recruiting willing participants. The initial list of transload facility sites in Arkansas provided by the National Transportation Atlas Database (NTAD) contained only nine locations, a fraction of the final 43 sites included in the final sampling frame. Contact information for the facility managers at 16 of the 43 sites was obtained and six complete surveys were acquired. While the information contained in the completed surveys provides valuable information on facility operations, equipment used, warehousing capacities, and funding and ownership, a larger set of data would have enhanced the analysis significantly. With a response rate of 14%, alternative means of data collection such as visual inspections using Google Earth were necessary to produce a comprehensive transload facility inventory. While this provided a general estimation of the current inventory, a more robust dialogue with local transload facilities would have probably produced more accurate and precise results.

The second limitation of this research was the cost estimation framework. The goal of this portion of the research was to develop a generalized cost estimation framework for transload facilities that could be used as a tool for transportation planners and economic developers to draw this type of industry to a region. In addition to determining the benefits, such as the emissions savings or pavement damage reductions garnered by shifting commodity tonnage from trucks onto alternative modes of transport, understanding the costs associated with building transload facilities is also necessary in comparing alternative solutions. Unfortunately, literature did not provide an adequately disaggregated and scalable cost estimation approach for various types of transload facilities. Therefore, a general cost estimation framework was developed to determine the cost of transload facilities by type using unit costs from a construction cost database, equipment costs from local dealers, the projected commodity tonnage, design recommendations from literature, and survey responses from local facilities. While we have confidence that the costs are reasonable, there are several potential areas of concern. First, this framework is believed to be scalable based upon general transload facility characteristics yet accurate enough to give decision makers reasonable cost estimates for constructing new or expanded facilities. But the scale is probably not as simple as a linear relationship, as we assumed. Second, in order to illustrate the usefulness of this methodology, a case study of proposed facilities in Arkansas was presented. There is currently no construction design for these facilities; however, this framework yielded costs consistent with those expected and therefore, seems to be useful in determining a general estimate. These two areas could be improved by commodity specific payload factors and more accurate methods of estimating the number of berths, loading docks, length of rail track, and storage area. The number of loading docks, berths, railcar spots, and quantity of storage area were all determined based upon the assumed number of daily trucks for a facility. Thus, this number significantly affected the overall cost estimate.

The third and final limitation to this research is the assumptions of employment by mode under IMPLAN. When looking at the IMPLAN database, we simply looked at three general categories: rail (sector 409), water (sector 410), and truck (sector 411). However, it was apparent that the employment numbers under each sector were not necessarily directly related to the physical movement of freight. Northwest Arkansas had a disproportionally high number of employment under sector 411, the truck factor, and this was assumed to be because of the international headquarters of JB Hunt in the region. Therefore, it was assumed that all of the employees of JB Hunt (from custodians to truck drivers to upper management) were counted under sector 411. While we observed some general trends along these lines, it would be worthwhile to better understand the subtleties of each sector to further refine the analysis.

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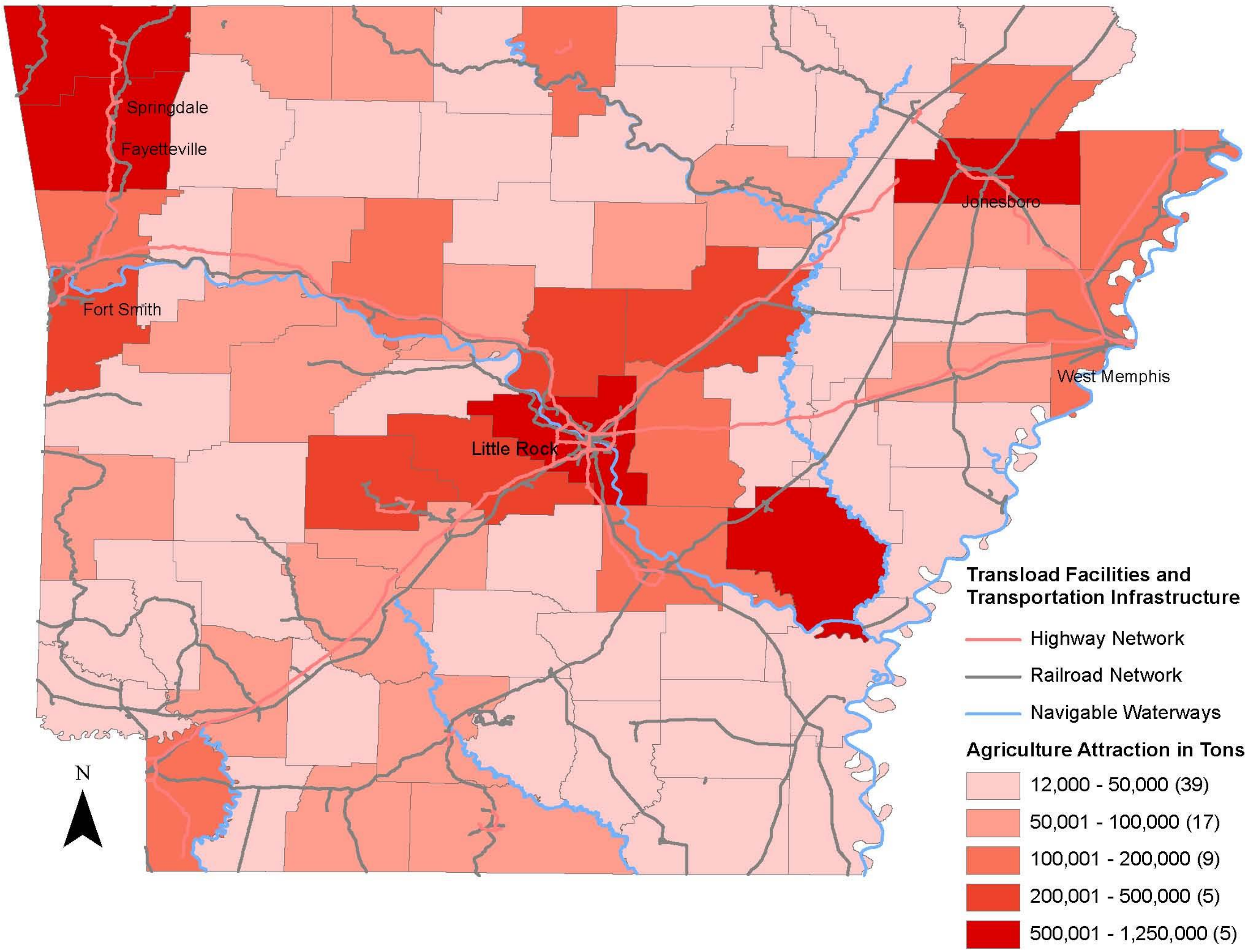
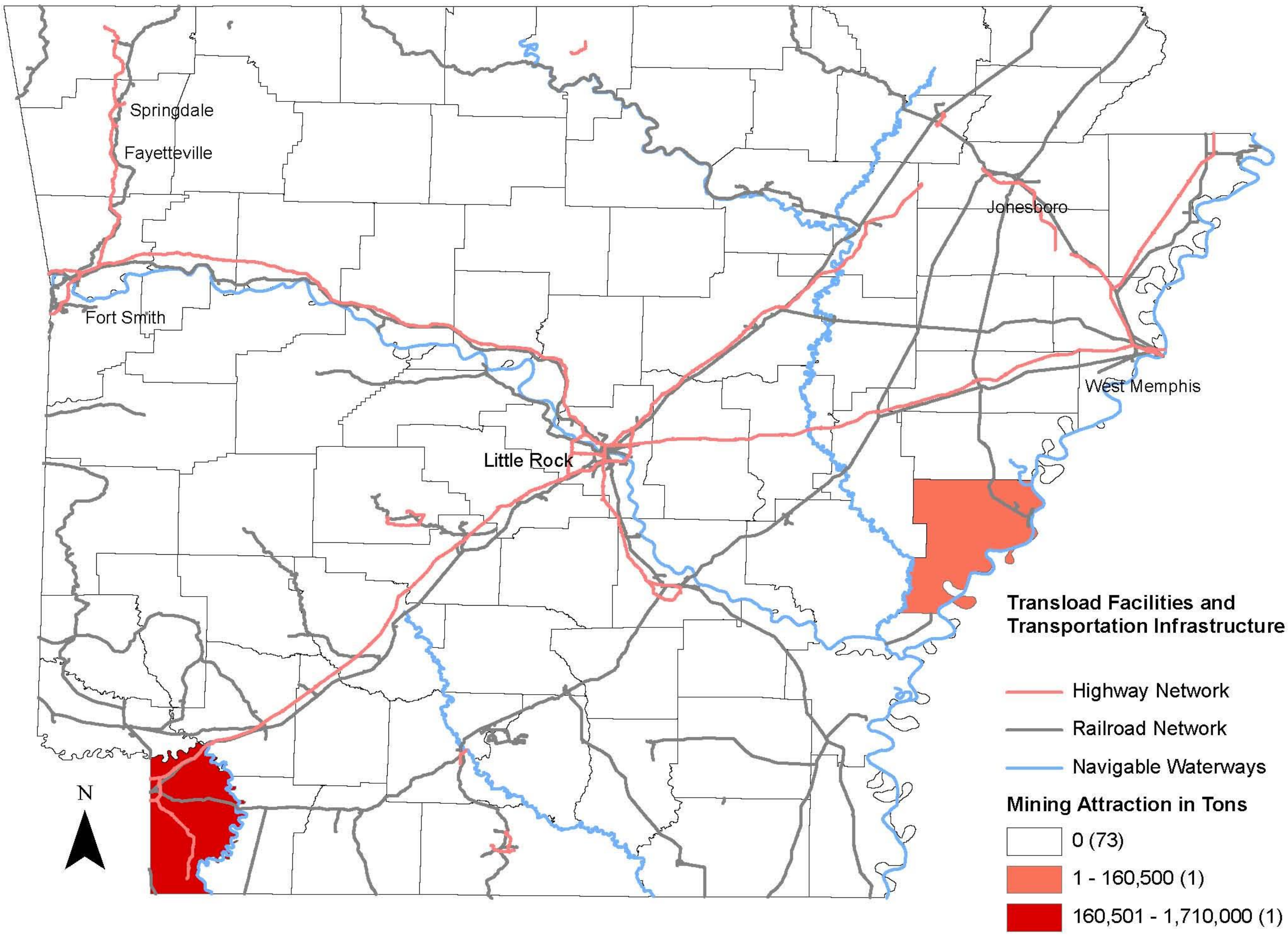
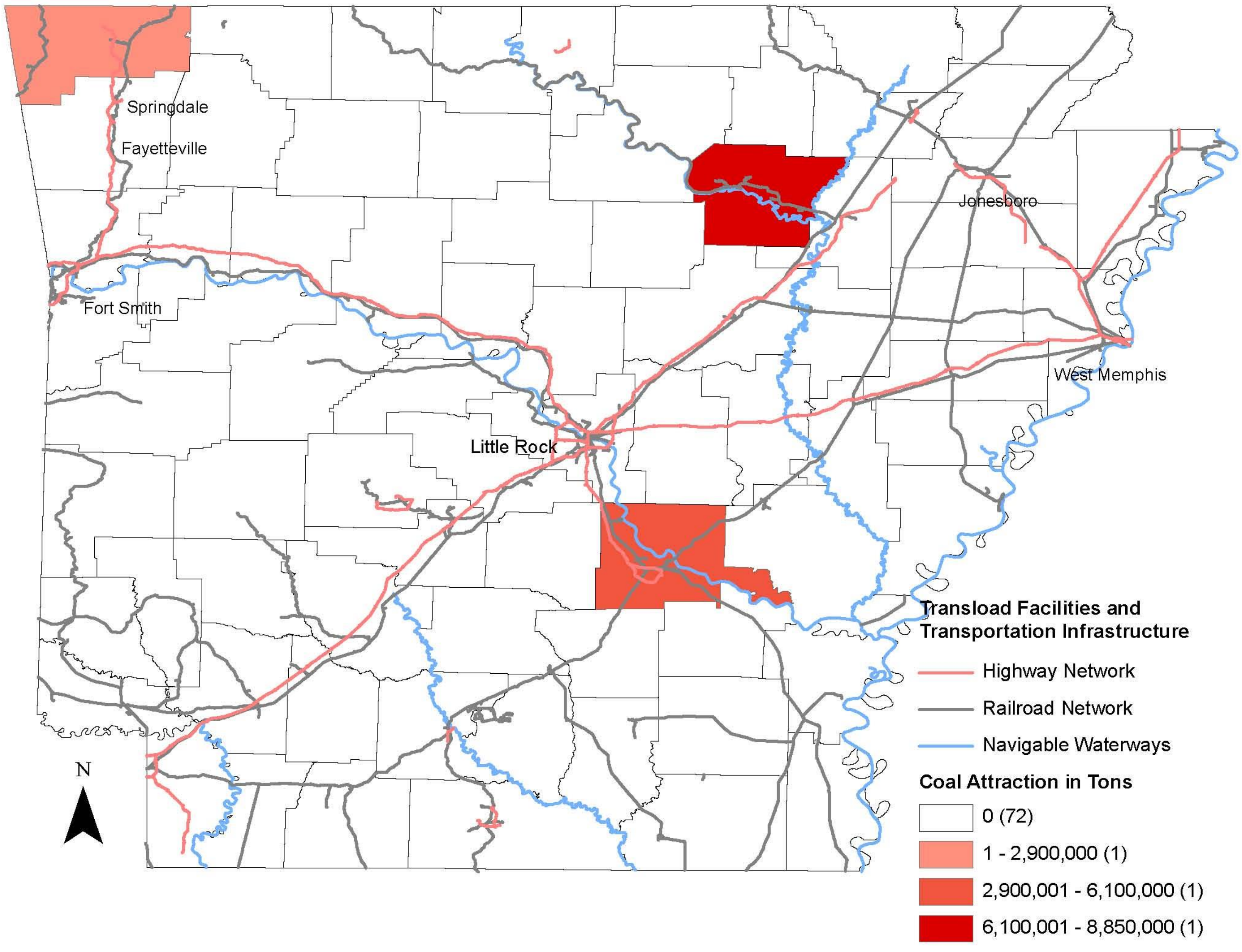
Appendices

Commodity Maps


Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Agriculture Attraction in Tons
12,000 - 50,000 (39)
50,001 - 100,000 (17)
100,001 - 200,000 (9)
200,001 - 500,000 (5)
500,001 - 1,250,000 (5)



Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Mining Attraction in Tons
0 (73)
1 - 160,500 (1)
160,501 - 1,710,000 (1)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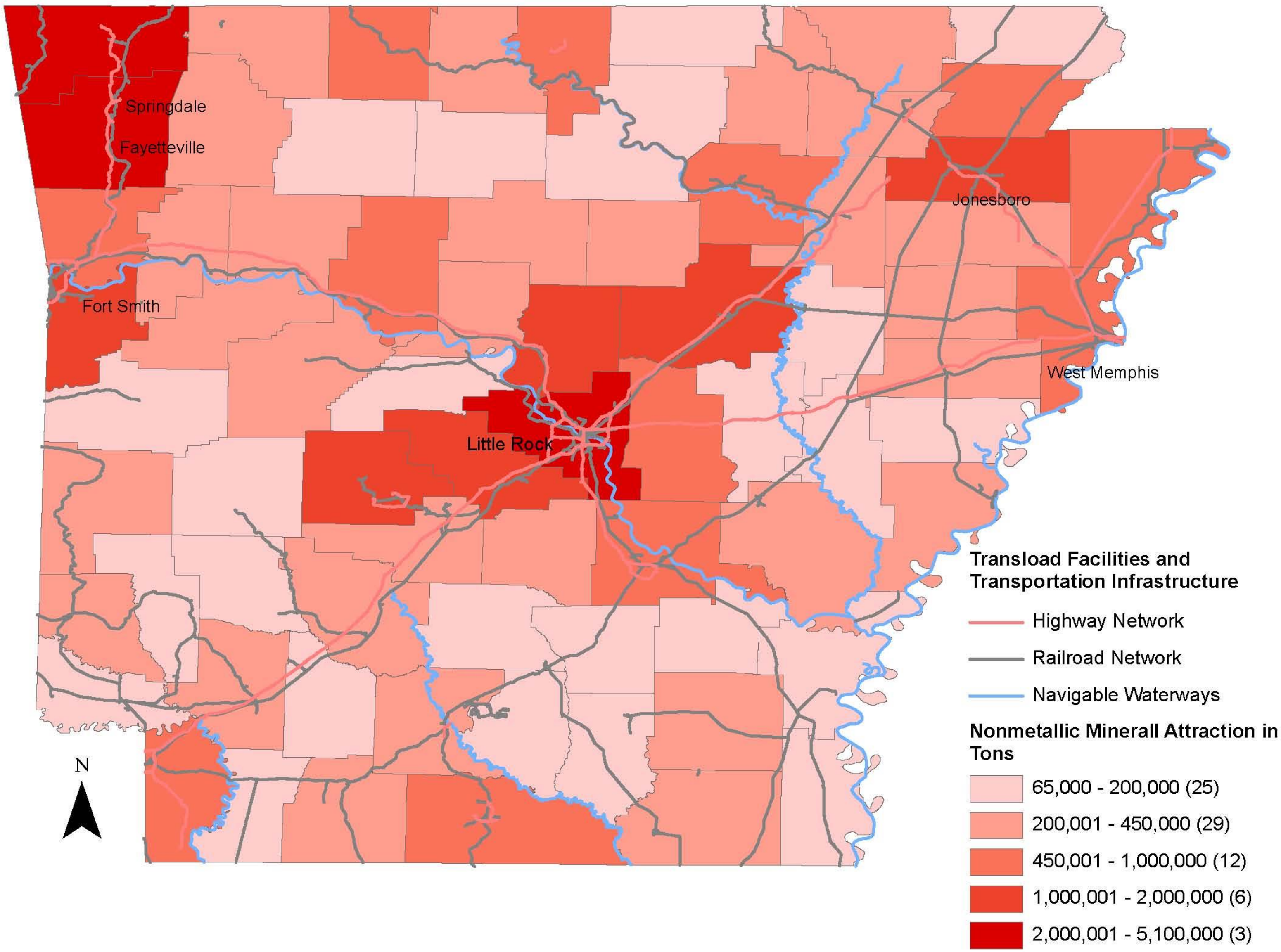
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Coal Attraction in Tons
0 (72)
1 - 2,900,000 (1)
2,900,001 - 6,100,000 (1)
6,100,001 - 8,850,000 (1)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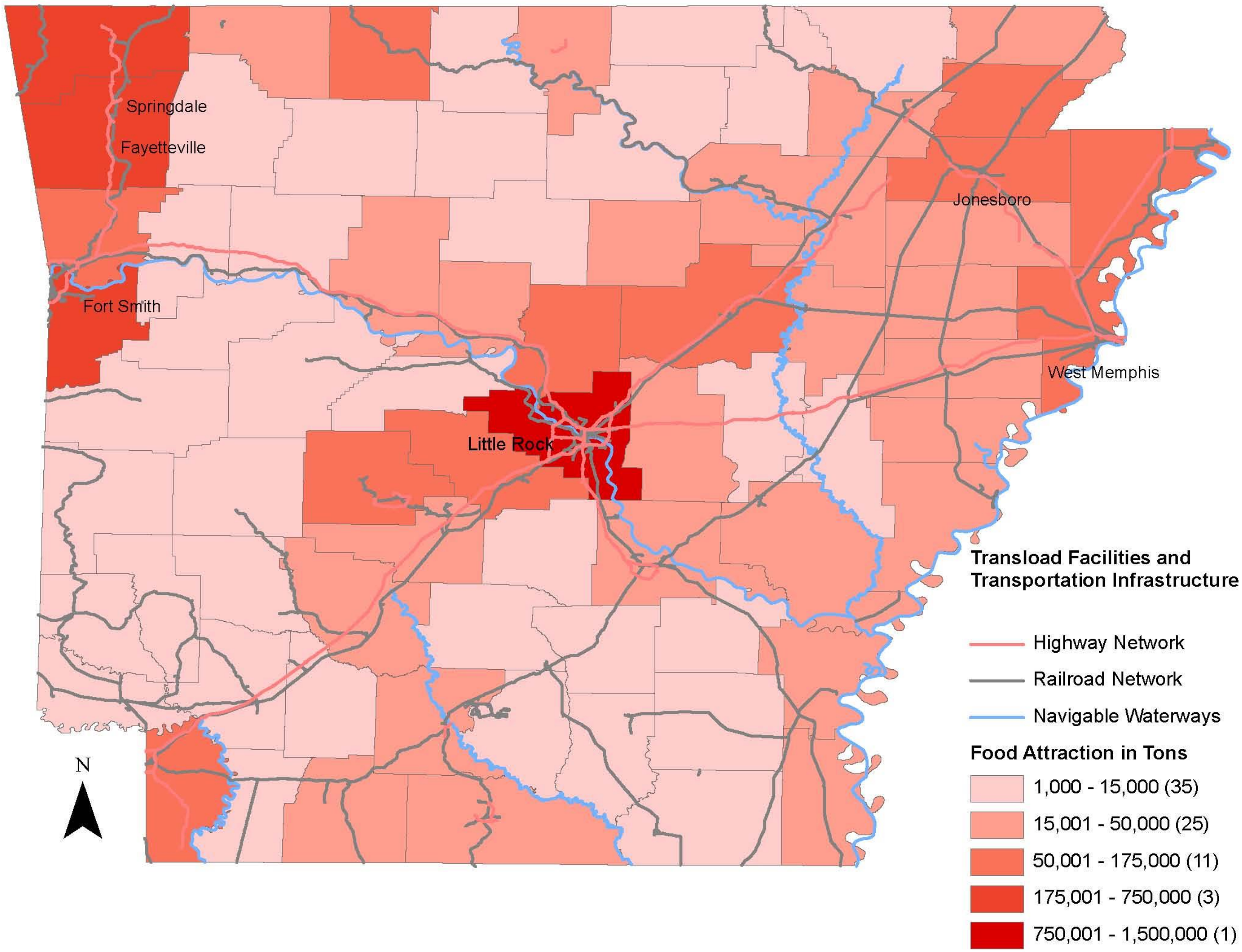
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Nonmetallic Minerall Attraction in Tons
65,000 - 200,000 (25)
200,001 - 450,000 (29)
450,001 - 1,000,000 (12)
1,000,001 - 2,000,000 (6)
2,000,001 - 5,100,000 (3)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Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Food Attraction in Tons
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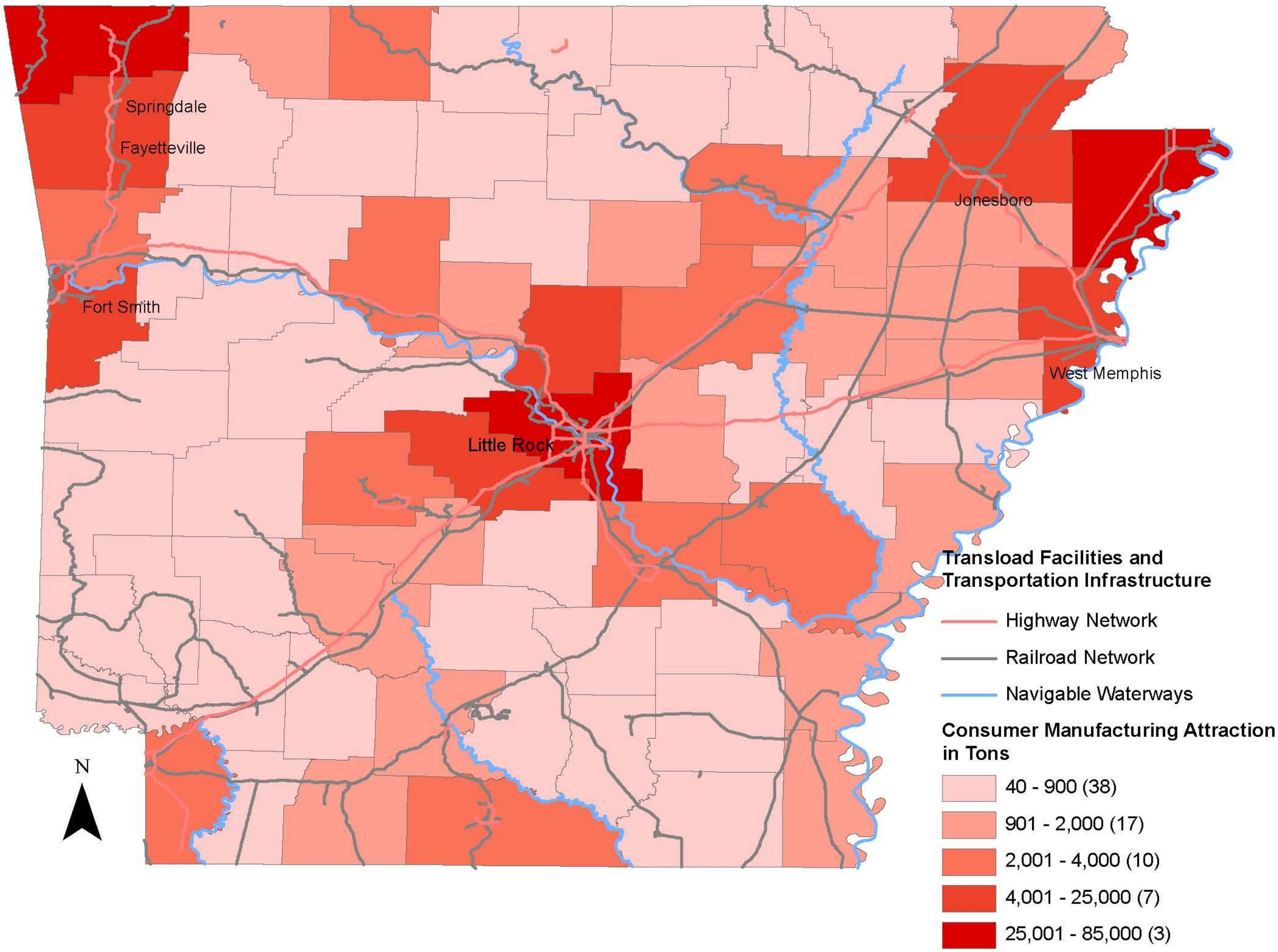
15,001 - 50,000 (25)
50,001 - 175,000 (11)
175,001 - 750,000 (3)
750,001 - 1,500,000 (1)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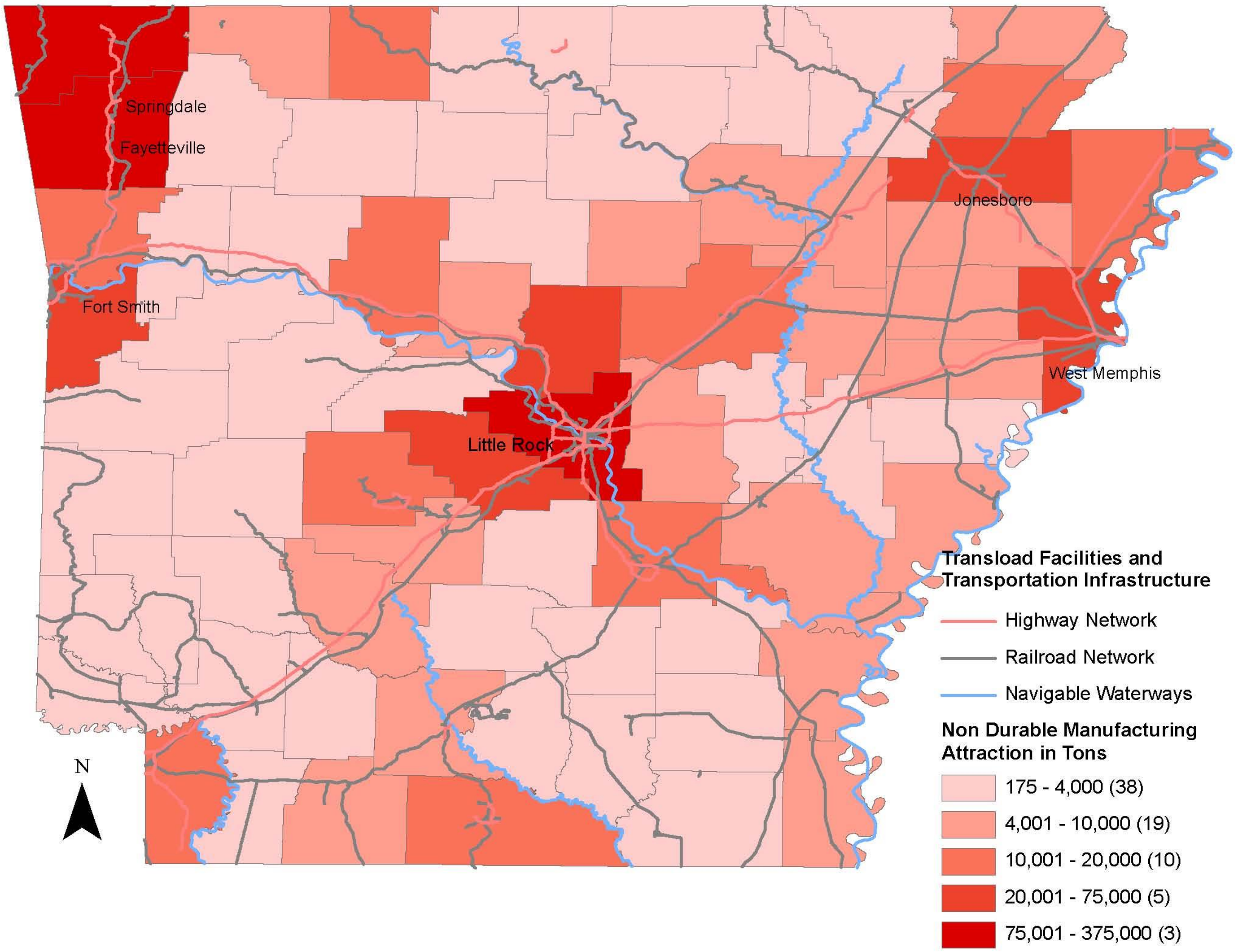
Fort Smith
Little Rock
Jonesboro
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Consumer Manufacturing Attraction in Tons
40 - 900 (38)
901 - 2,000 (17)
2,001 - 4,000 (10)
4,001 - 25,000 (7)
25,001 - 85,000 (3)


Springdale
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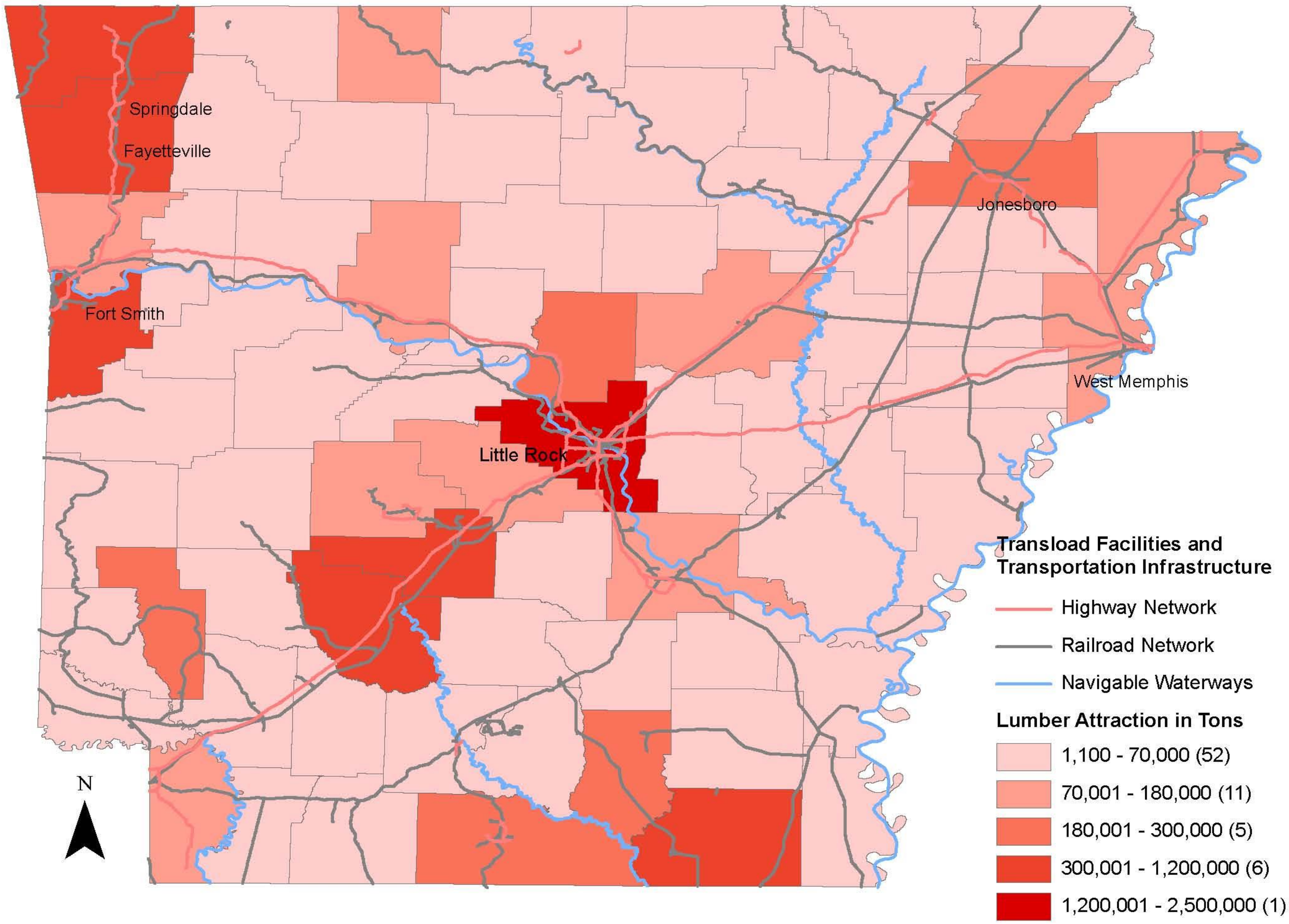
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Non Durable Manufacturing Attraction in Tons
175 - 4,000 (38)
4,001 - 10,000 (19)
10,001 - 20,000 (10)
20,001 - 75,000 (5)
75,001 - 375,000 (3)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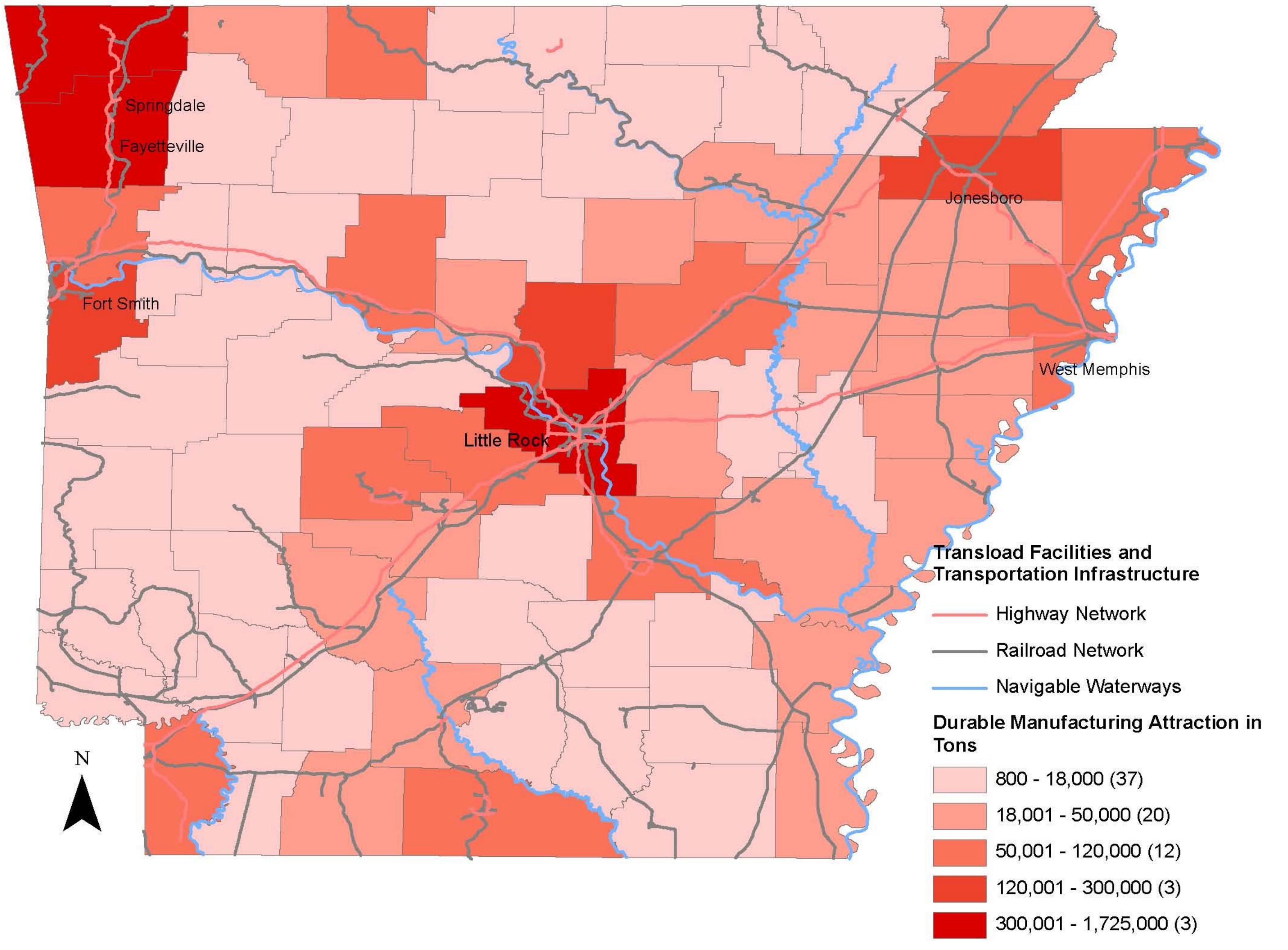
Jonesboro
Fort Smith
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Lumber Attraction in Tons
1,100 - 70,000 (52)
70,001 - 180,000 (11)
180,001 - 300,000 (5)
300,001 - 1,200,000 (6)
1,200,001 - 2,500,000 (1)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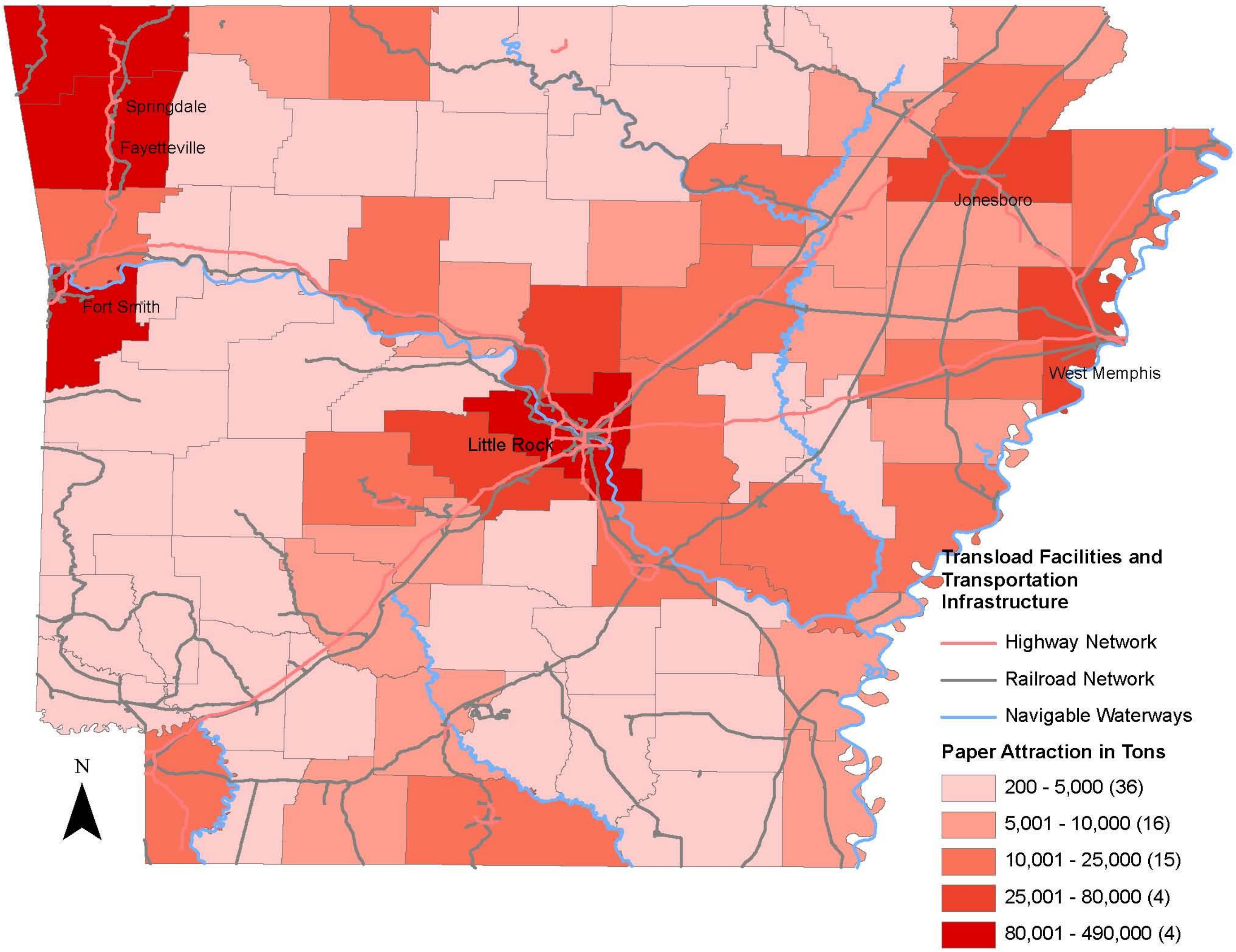
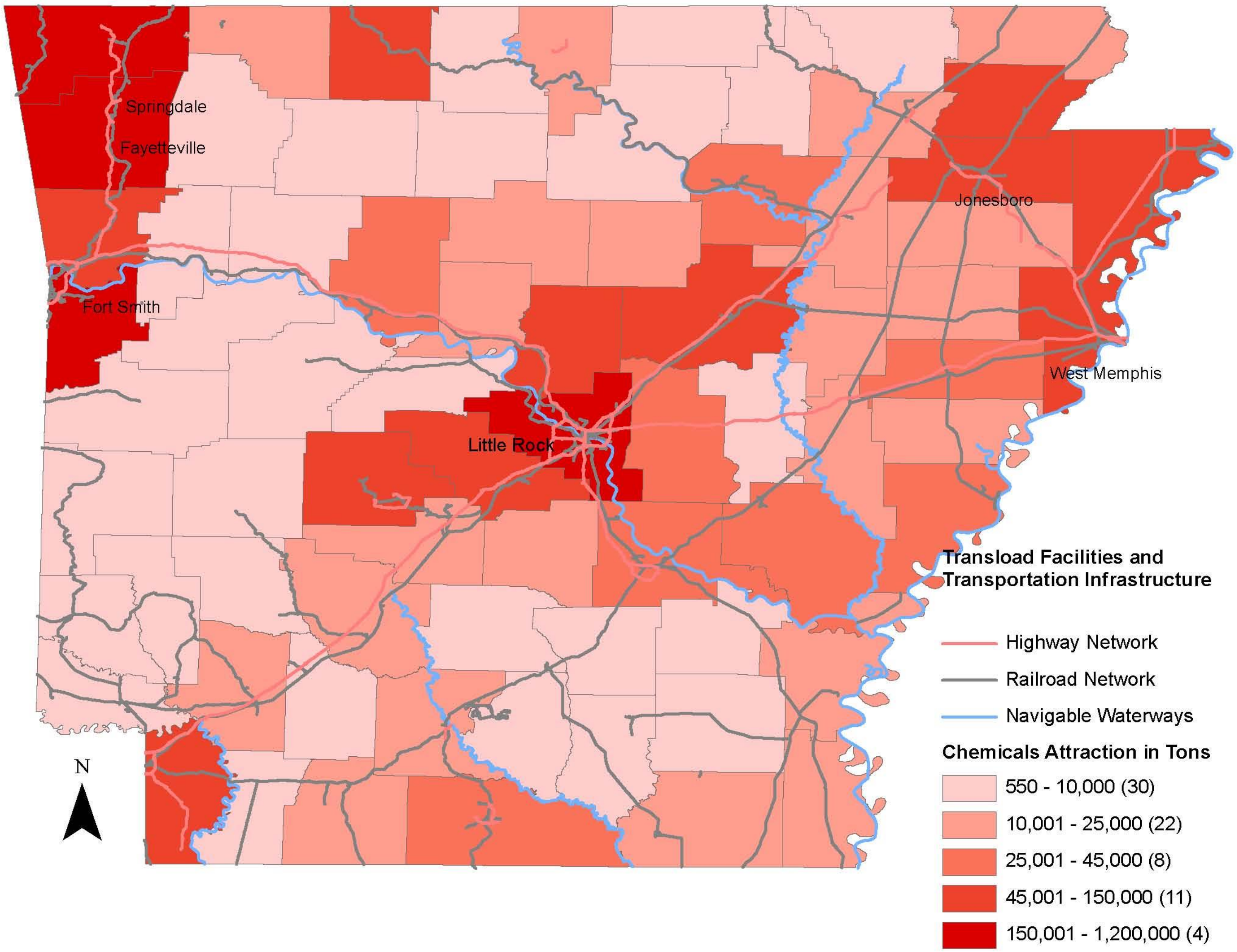
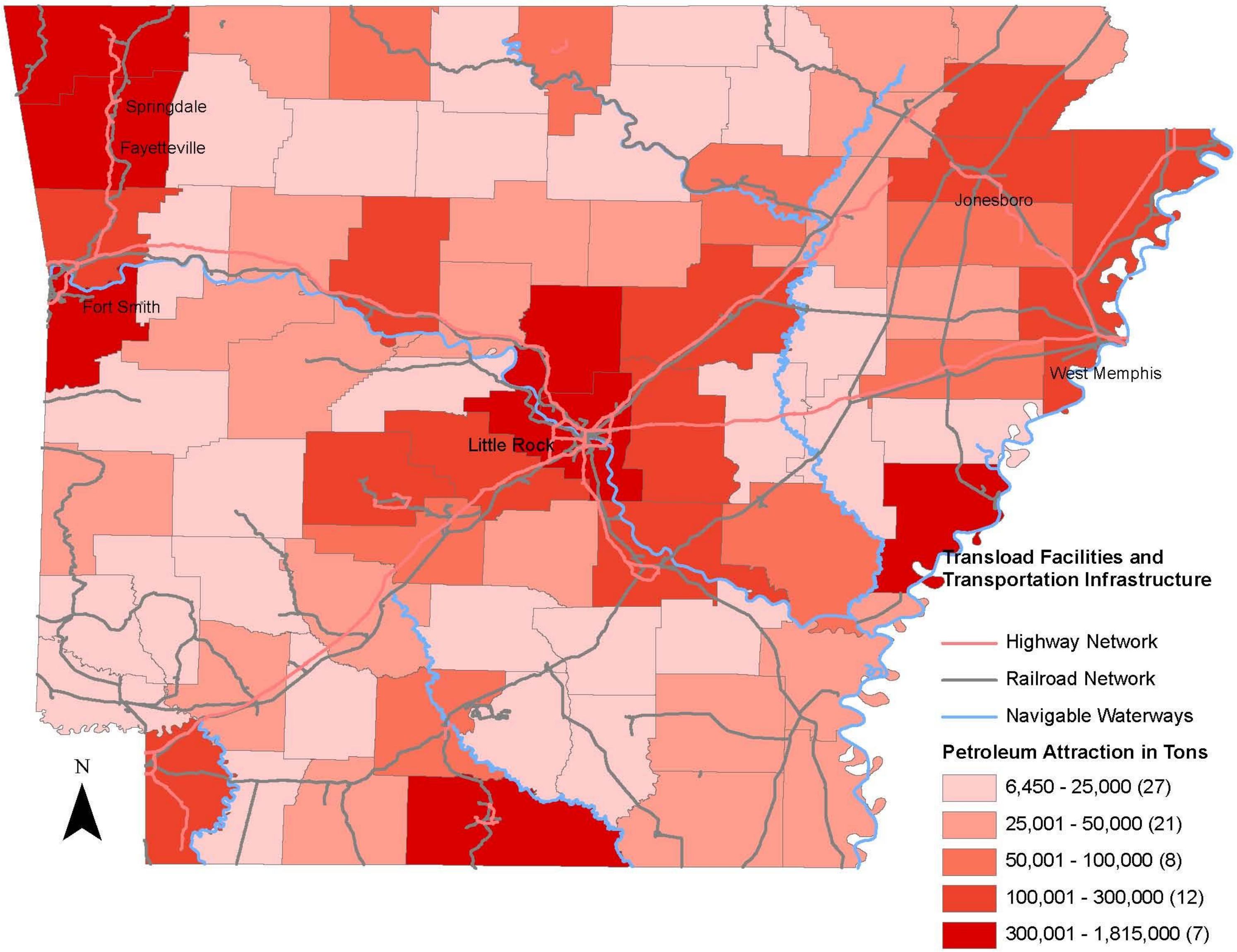
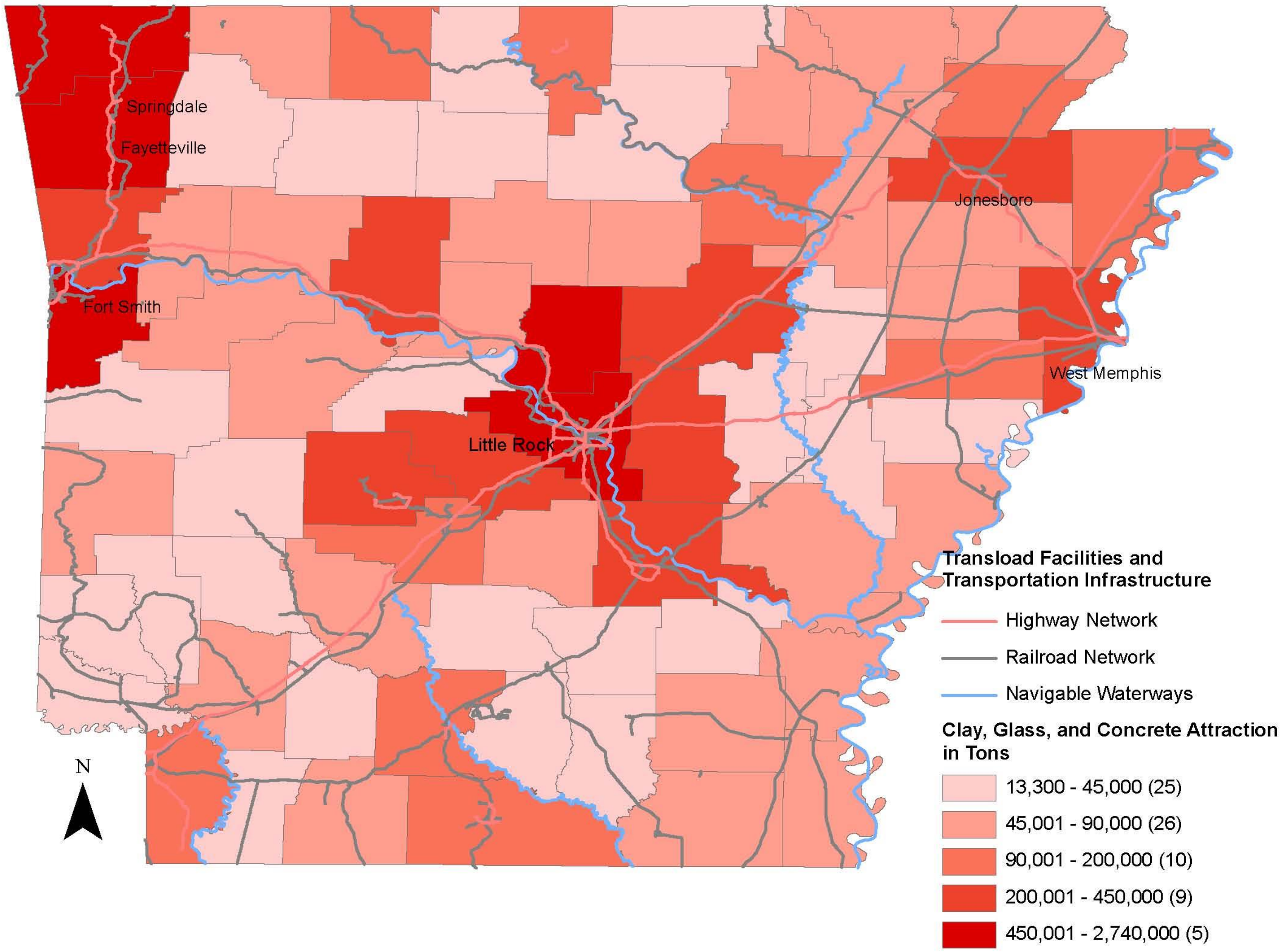
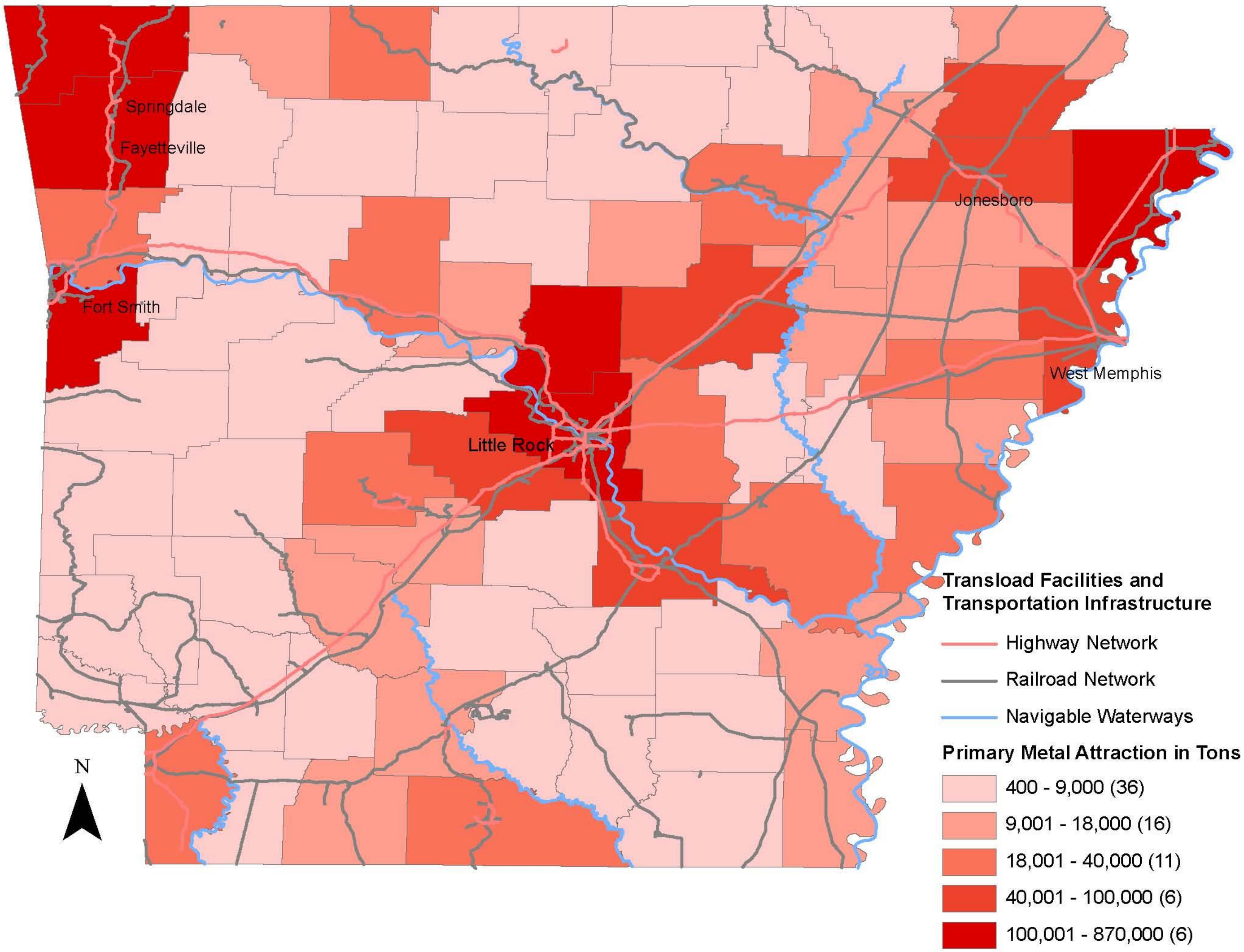
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Durable Manufacturing Attraction in Tons
800 - 18,000 (37)
18,001 - 50,000 (20)
50,001 - 120,000 (12)
120,001 - 300,000 (3)
300,001 - 1,725,000 (3)

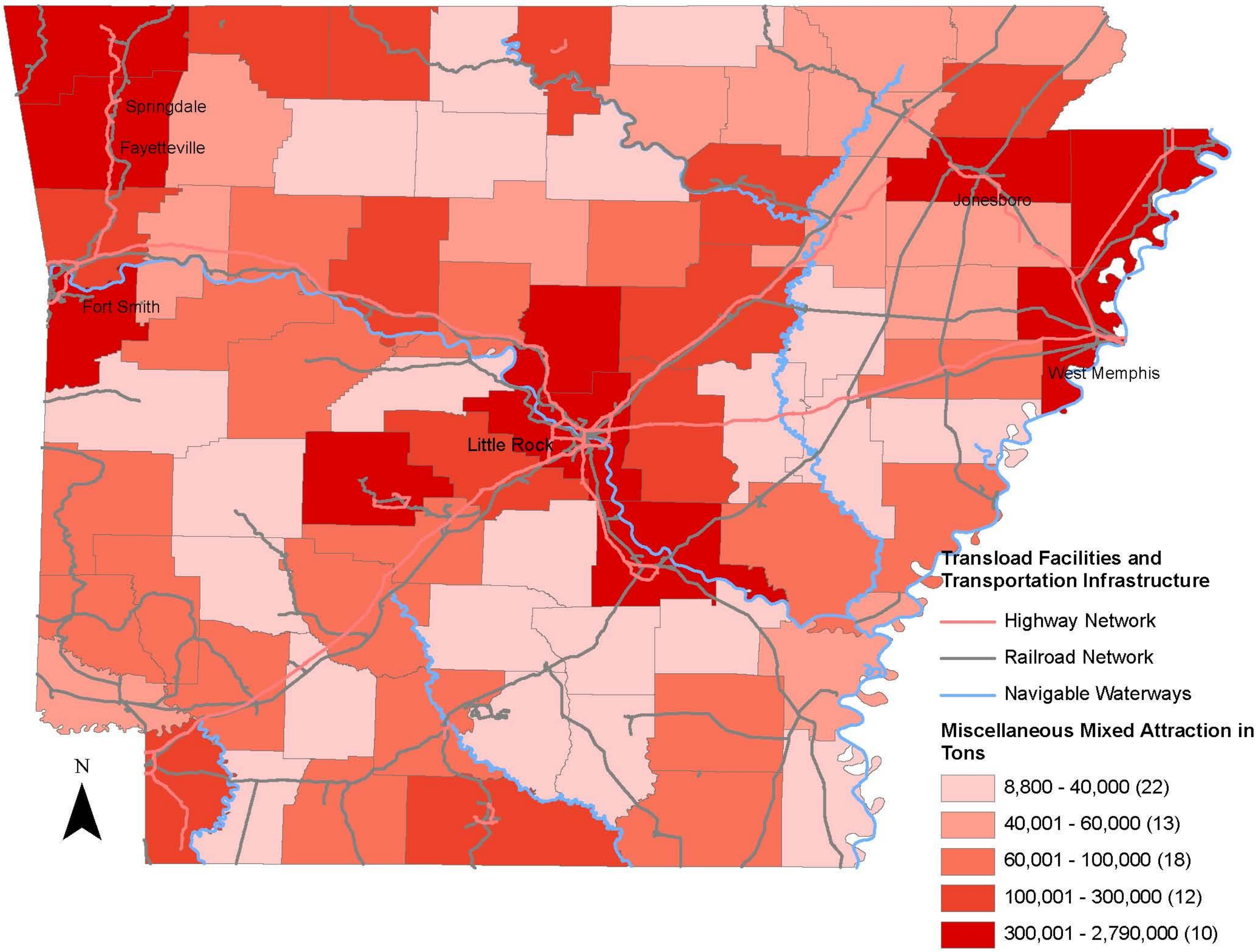

Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Paper Attraction in Tons
200 - 5,000 (36)
5,001 - 10,000 (16)
10,001 - 25,000 (15)
25,001 - 80,000 (4)
80,001 - 490,000 (4)

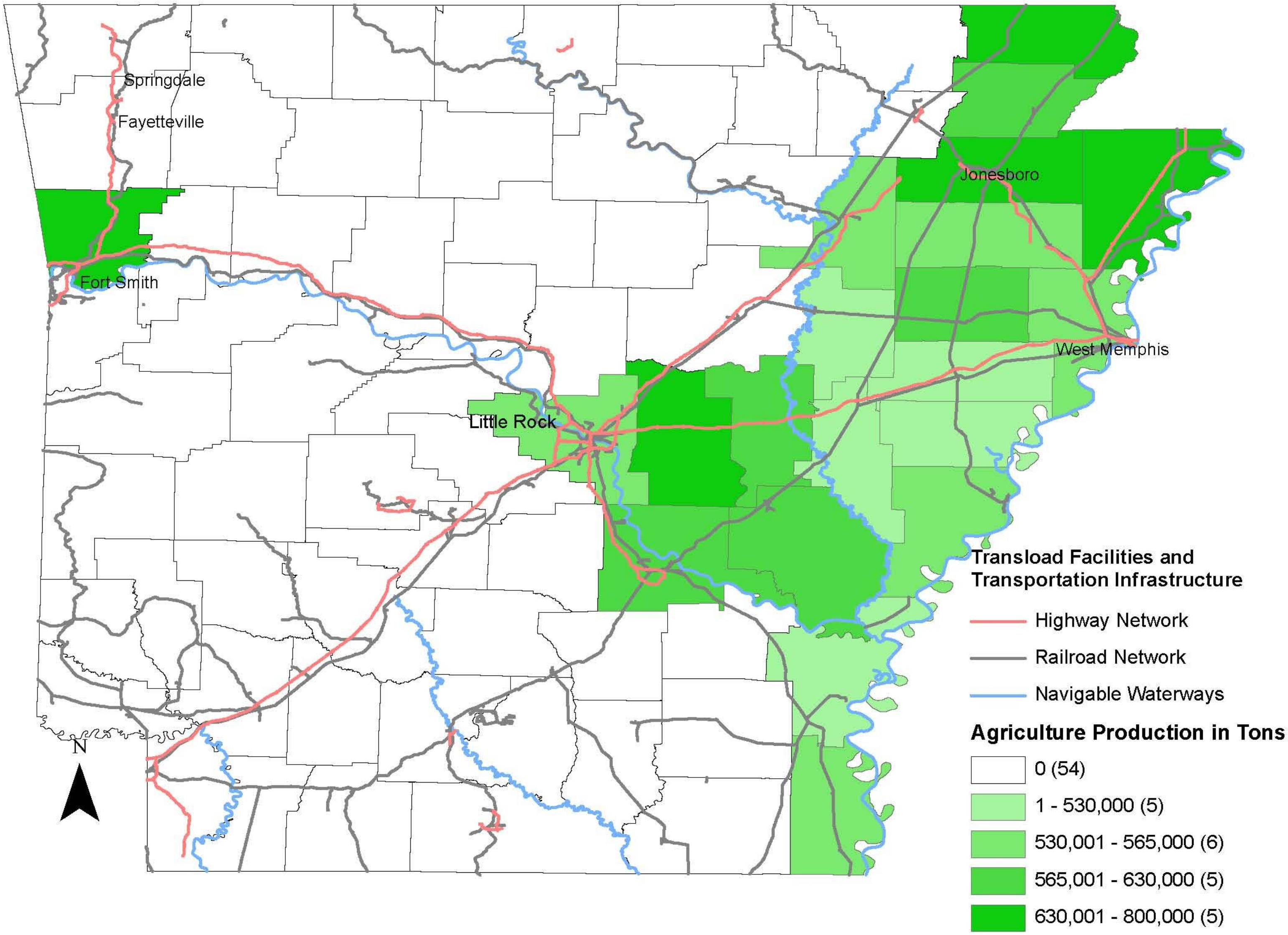

Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and
Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Chemicals Attraction in Tons
550 - 10,000 (30)
10,001 - 25,000 (22)
25,001 - 45,000 (8)
45,001 - 150,000 (11)
150,001 - 1,200,000 (4)

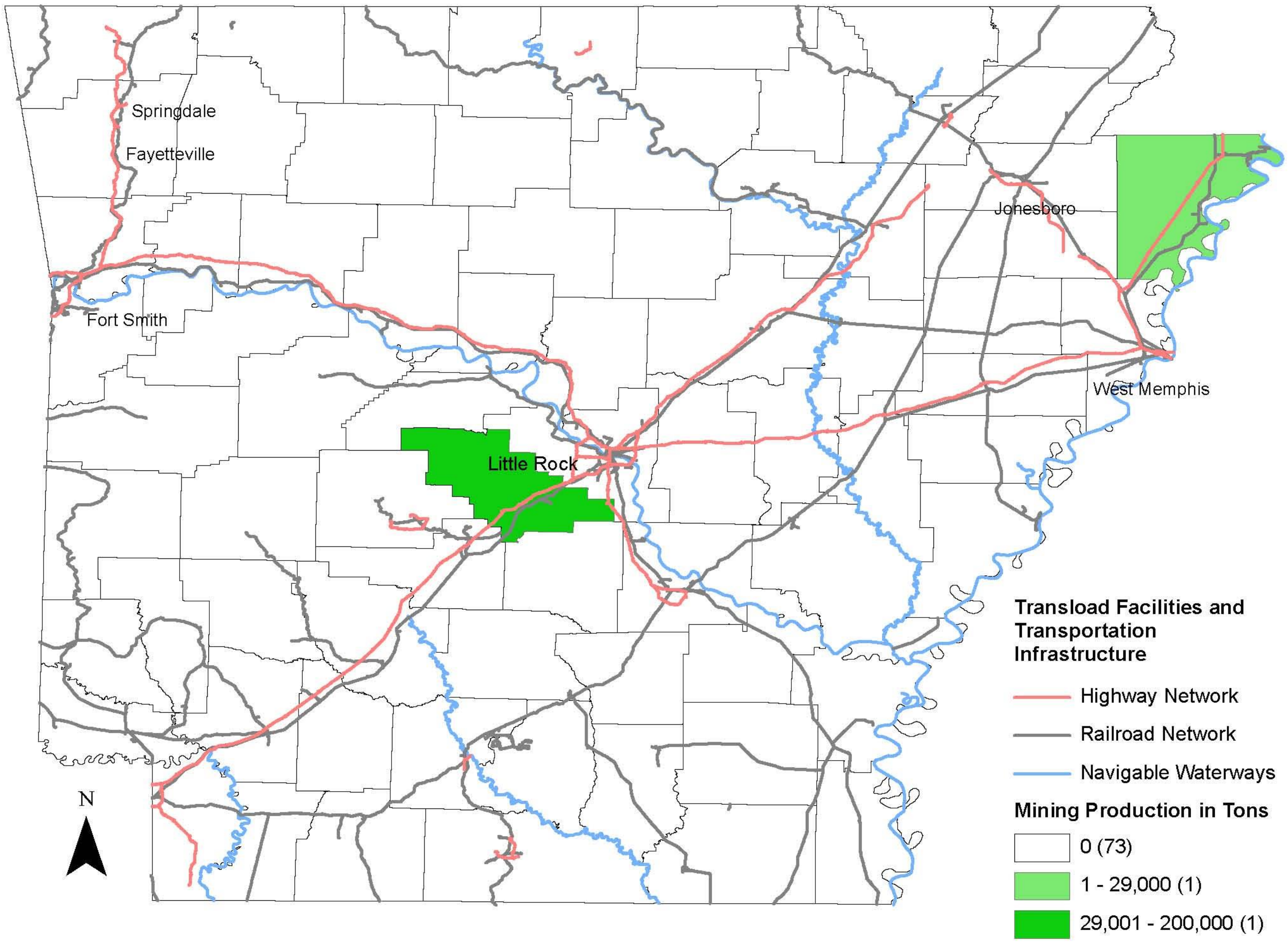

Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Petroleum Attraction in Tons
6,450 - 25,000 (27)
25,001 - 50,000 (21)
50,001 - 100,000 (8)
100,001 - 300,000 (12)
300,001 - 1,815,000 (7)

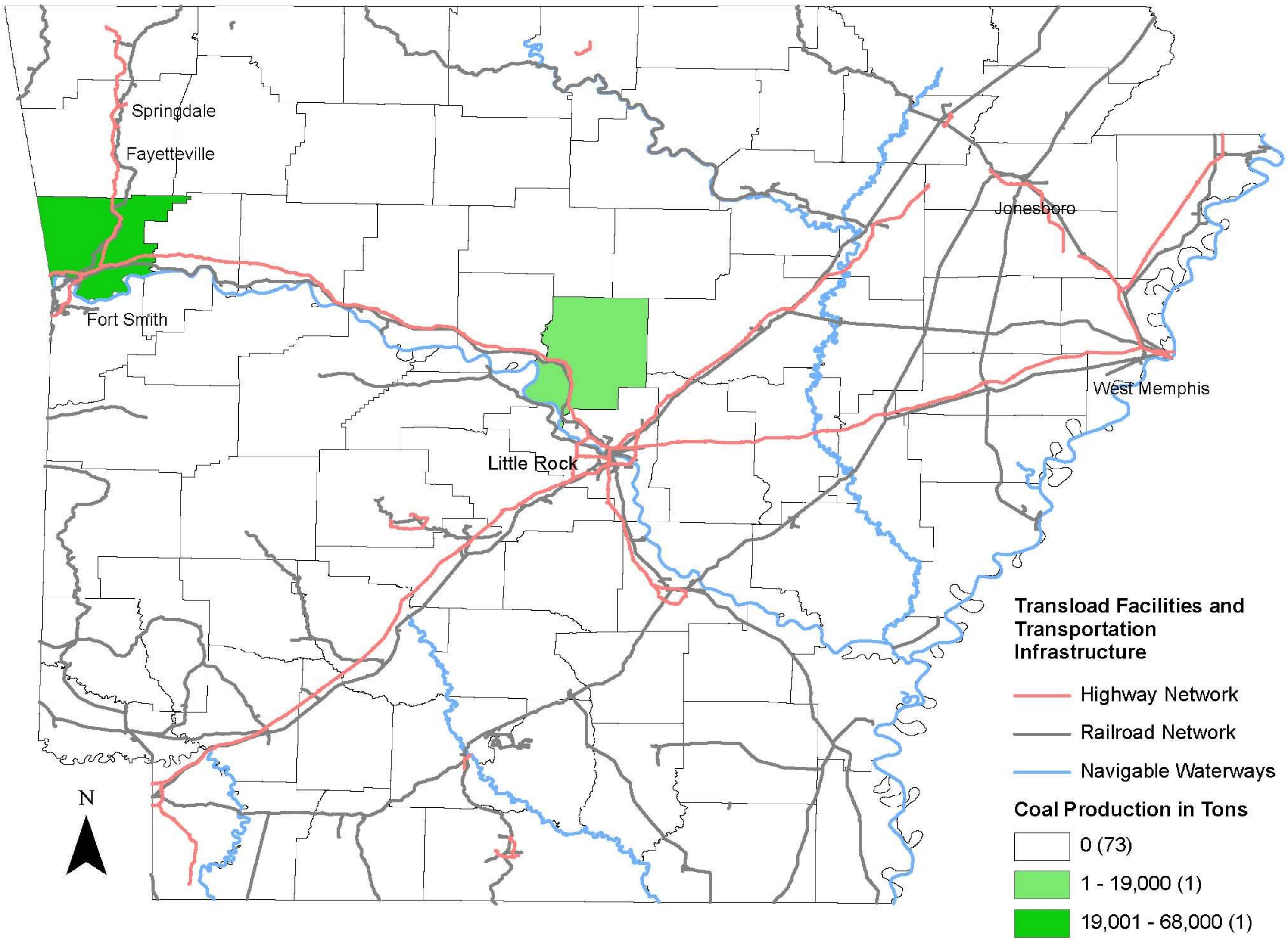

Springdale
Fayetteville
Fort Smith
Jonesboro
Little Rock
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Clay, Glass, and Concrete Attraction in Tons
13,300 - 45,000 (25)
45,001 - 90,000 (26)
90,001 - 200,000 (10)
200,001 - 450,000 (9)
450,001 - 2,740,000 (5)

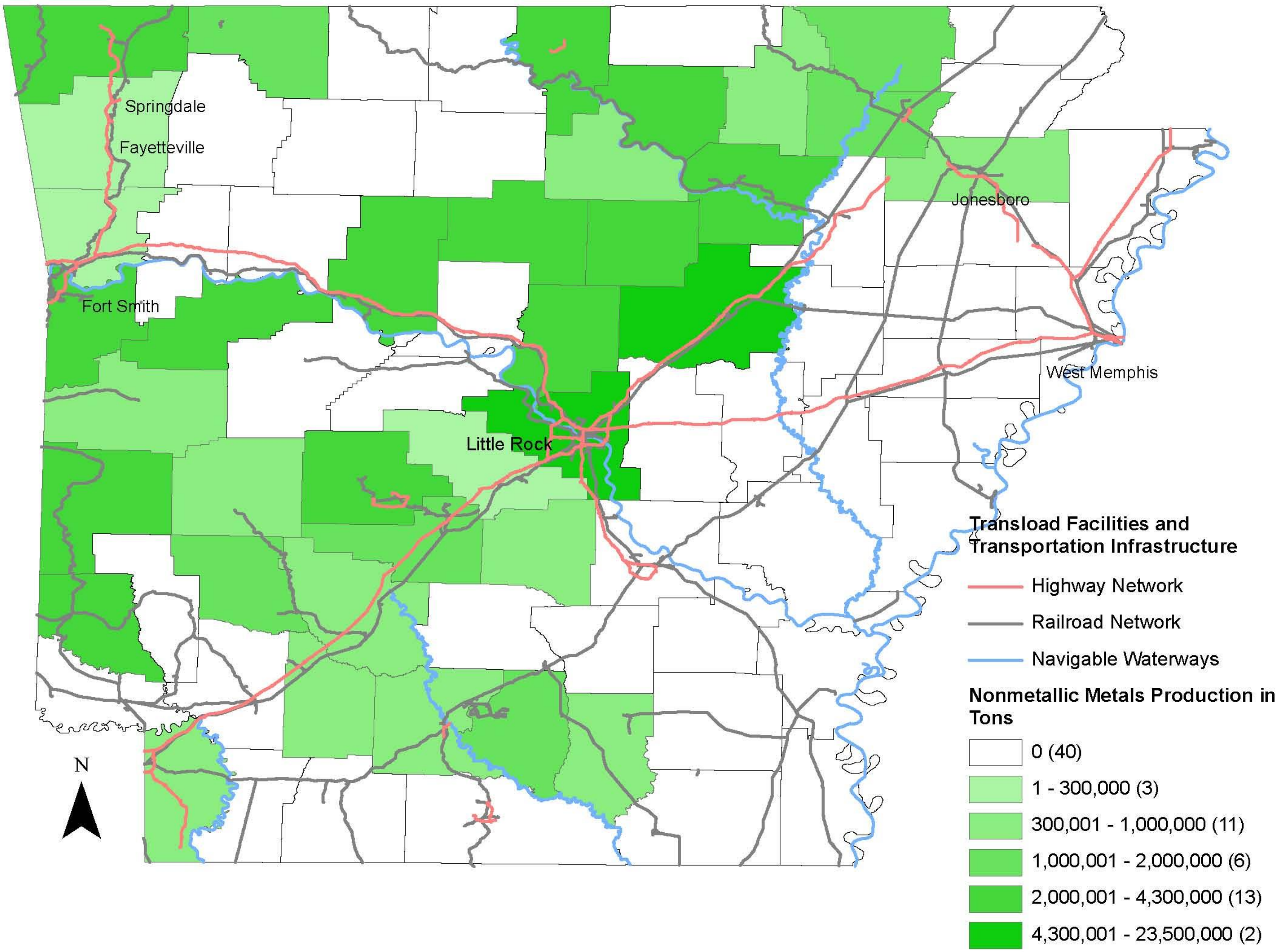

Springdale
Fayetteville
Fort Smith
Little Rock
Jonesboro
West Memphis
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Primary Metal Attraction in Tons
400 - 9,000 (36)
9,001 - 18,000 (16)
18,001 - 40,000 (11)
40,001 - 100,000 (6)
100,001 - 870,000 (6)
N


Springdale
Fayetteville
Fort Smith
Little Rock
Jonesboro
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Miscellaneous Mixed Attraction in Tons
8,800 - 40,000 (22)
40,001 - 60,000 (13)
60,001 - 100,000 (18)
100,001 - 300,000 (12)
300,001 - 2,790,000 (10)

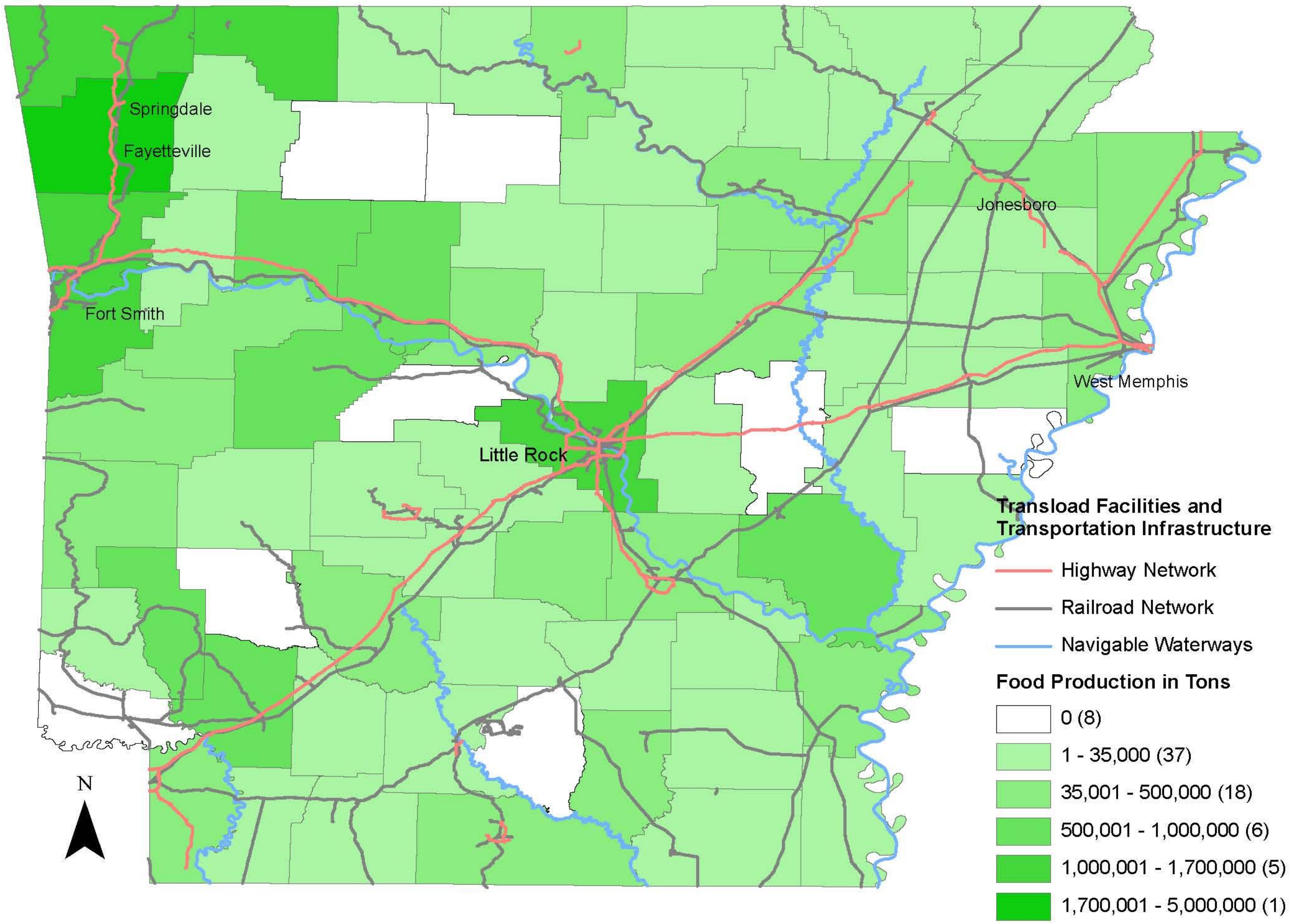

Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and
Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Agriculture Production in Tons
0 (54)
1 - 530,000 (5)
530,001 - 565,000 (6)
565,001 - 630,000 (5)
630,001 - 800,000 (5)

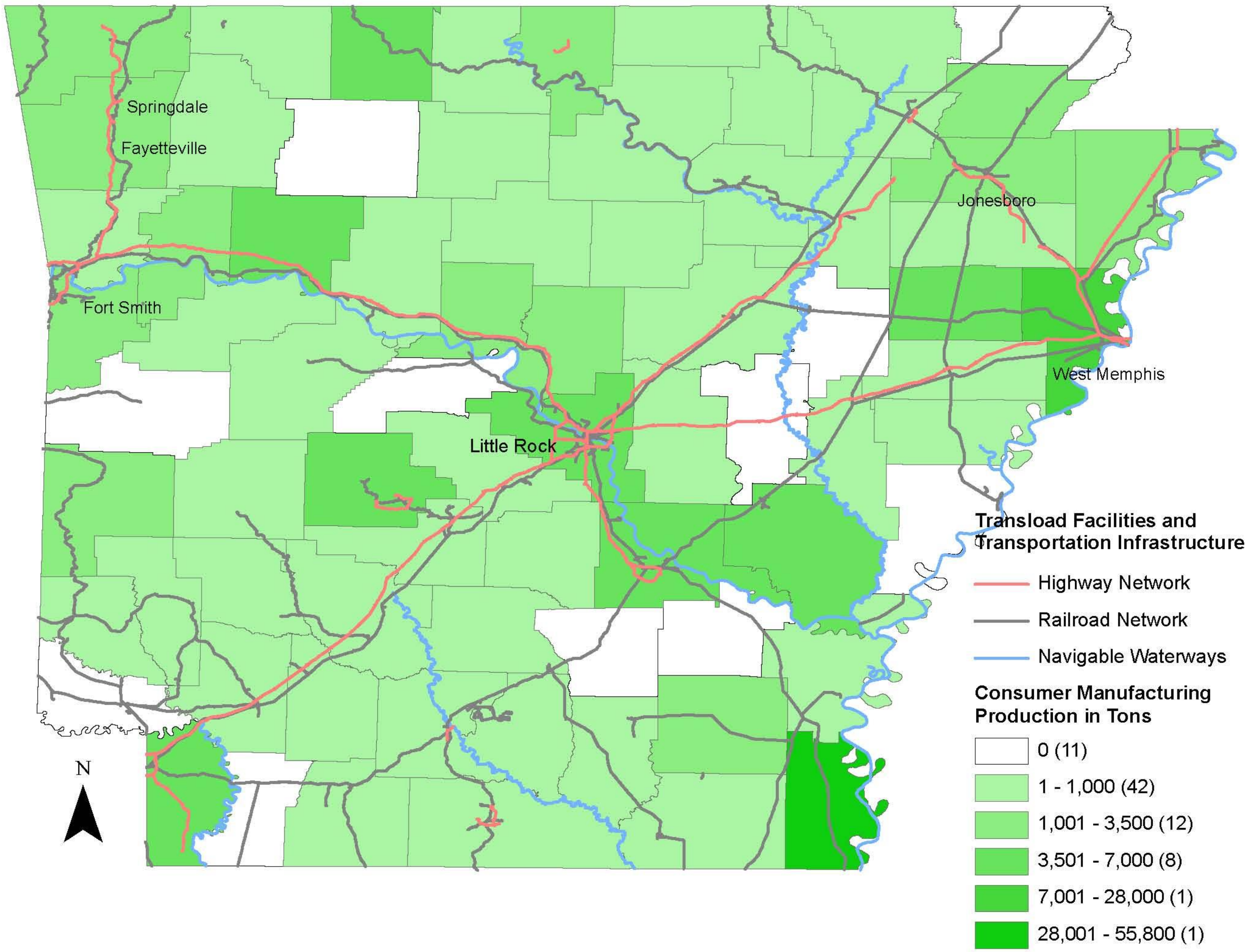

Springdale
Fayetteville
Jonesboro
Fort Smith
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Mining Production in Tons
0 (73)
1 - 29,000 (1)
29,001 - 200,000 (1)

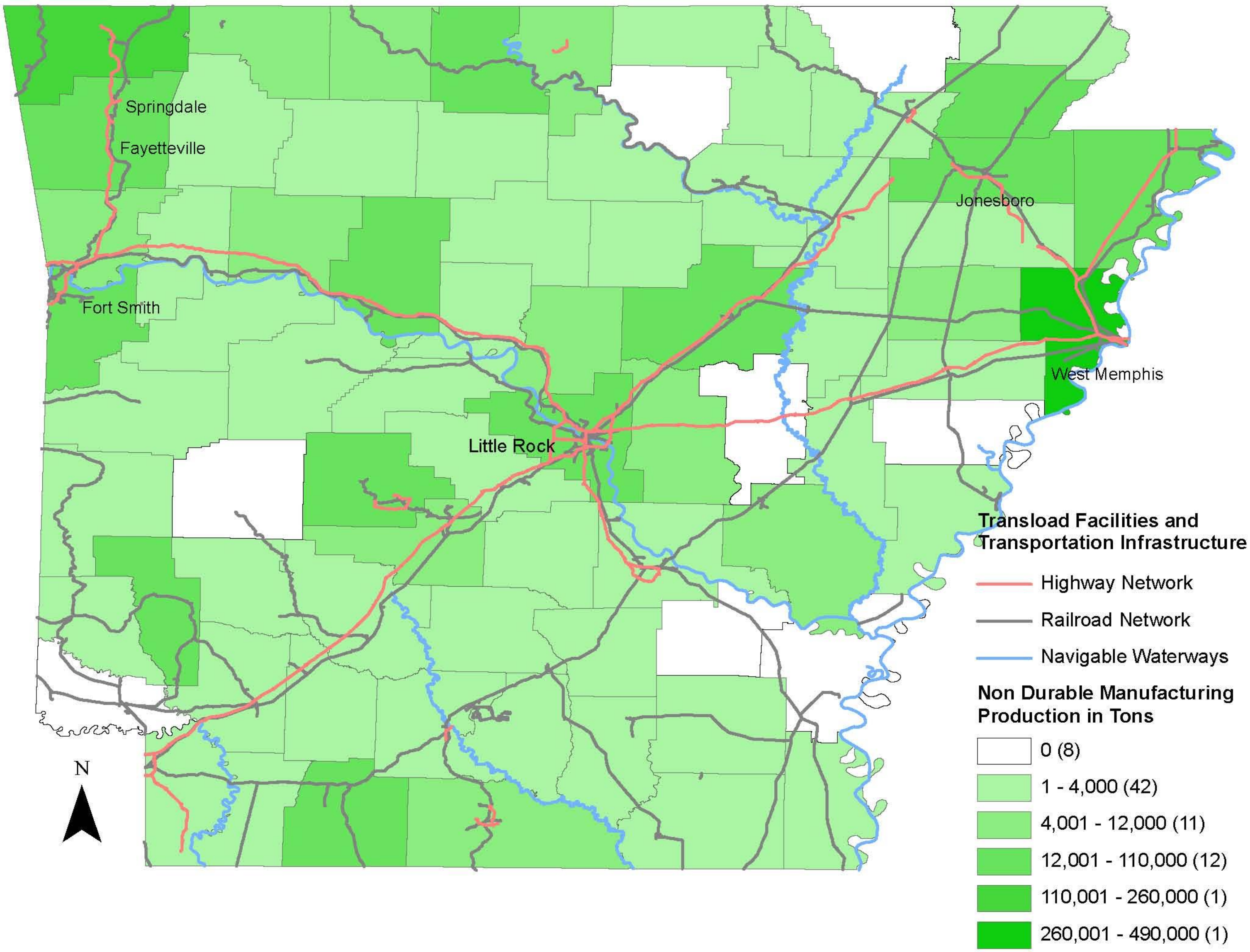

Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Coal Production in Tons
0 (73)
1 - 19,000 (1)
19,001 - 68,000 (1)

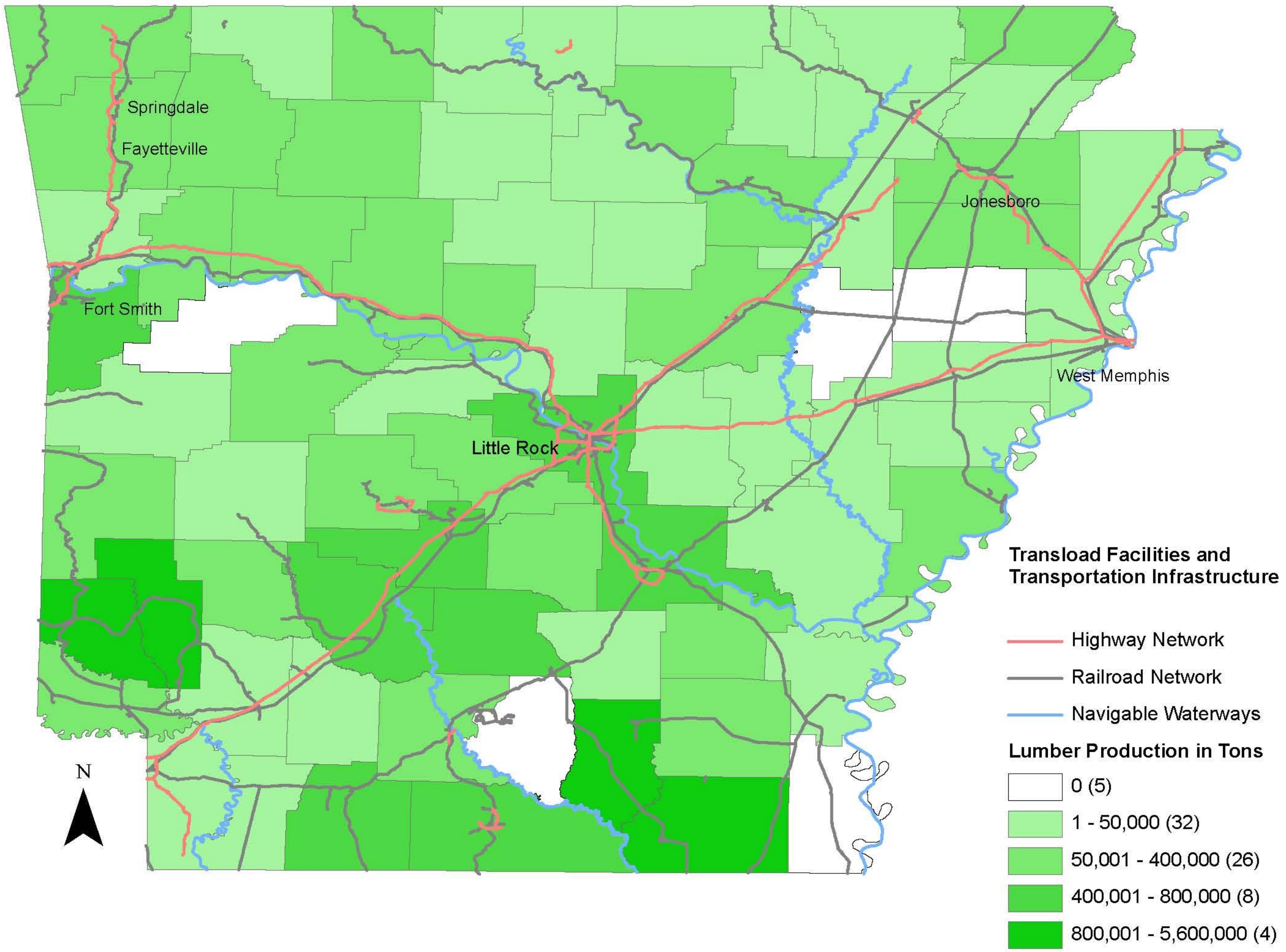


Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Nonmetallic Metals Production in Tons
0 (40)
1 - 300,000 (3)
300,001 - 1,000,000 (11)
1,000,001 - 2,000,000 (6)
2,000,001 - 4,300,000 (13)
4,300,001 - 23,500,000 (2)

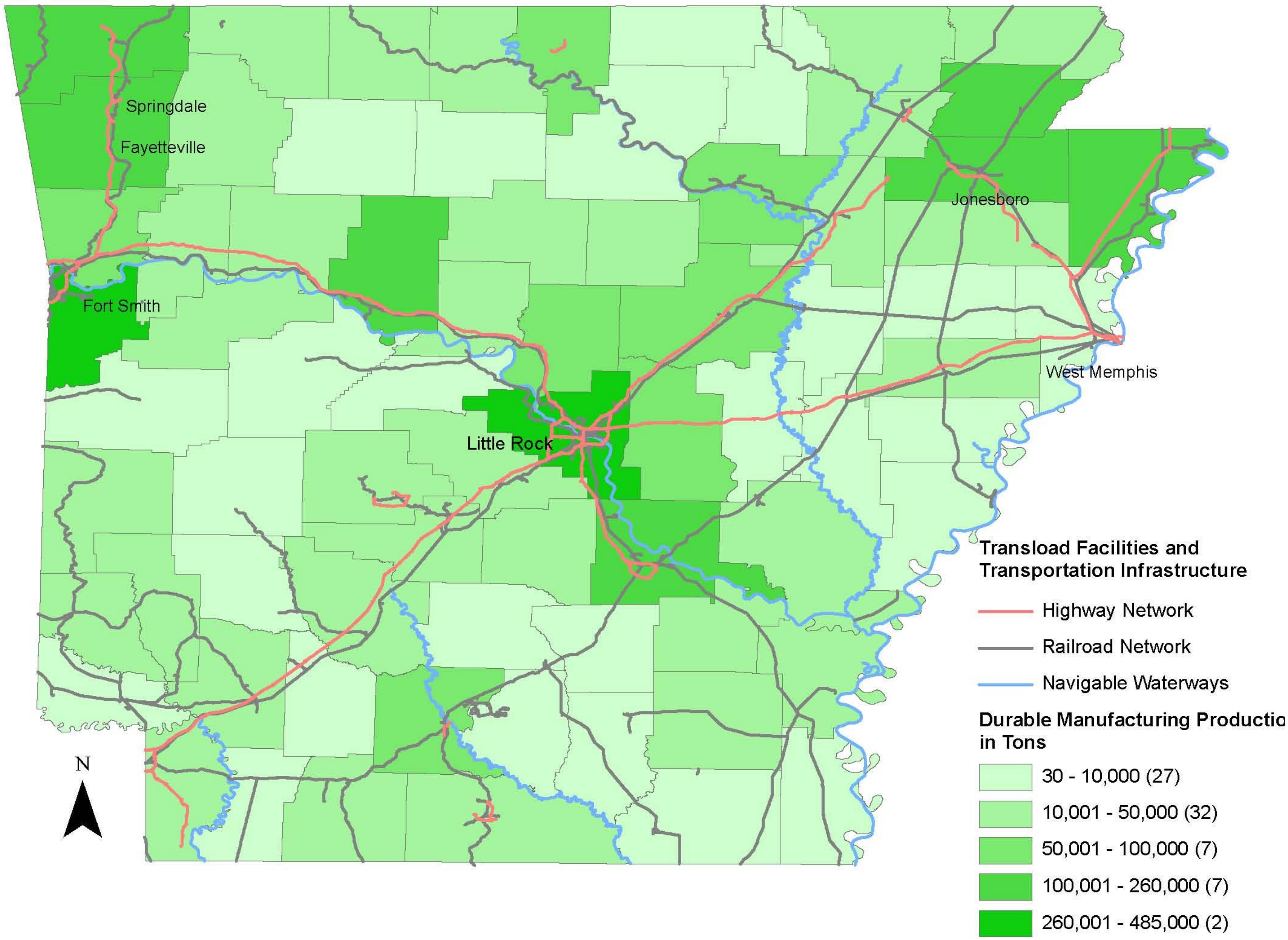

Springdale
Fayetteville
Fort Smith
Little Rock
Jonesboro
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Food Production in Tons
0 (8)
1 - 35,000 (37)
35,001 - 500,000 (18)
500,001 - 1,000,000 (6)
1,000,001 - 1,700,000 (5)
1,700,001 - 5,000,000 (1)

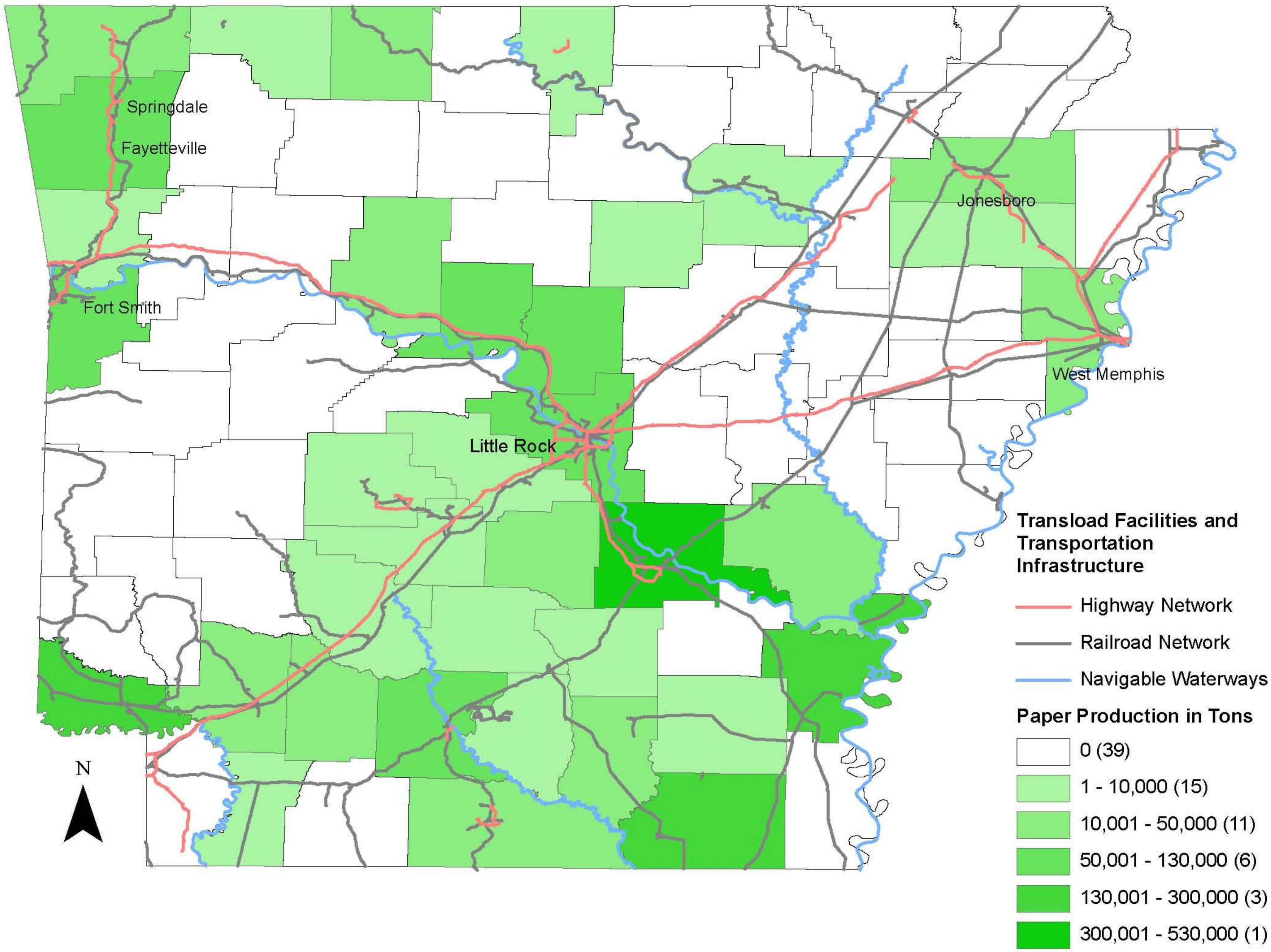

Springdale
Fayetteville
Fort Smith
Little Rock
Jonesboro
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Consumer Manufacturing Production in Tons
0 (11)
1 - 1,000 (42)
1,001 - 3,500 (12)
3,501 - 7,000 (8)
7,001 - 28,000 (1)
28,001 - 55,800 (1)

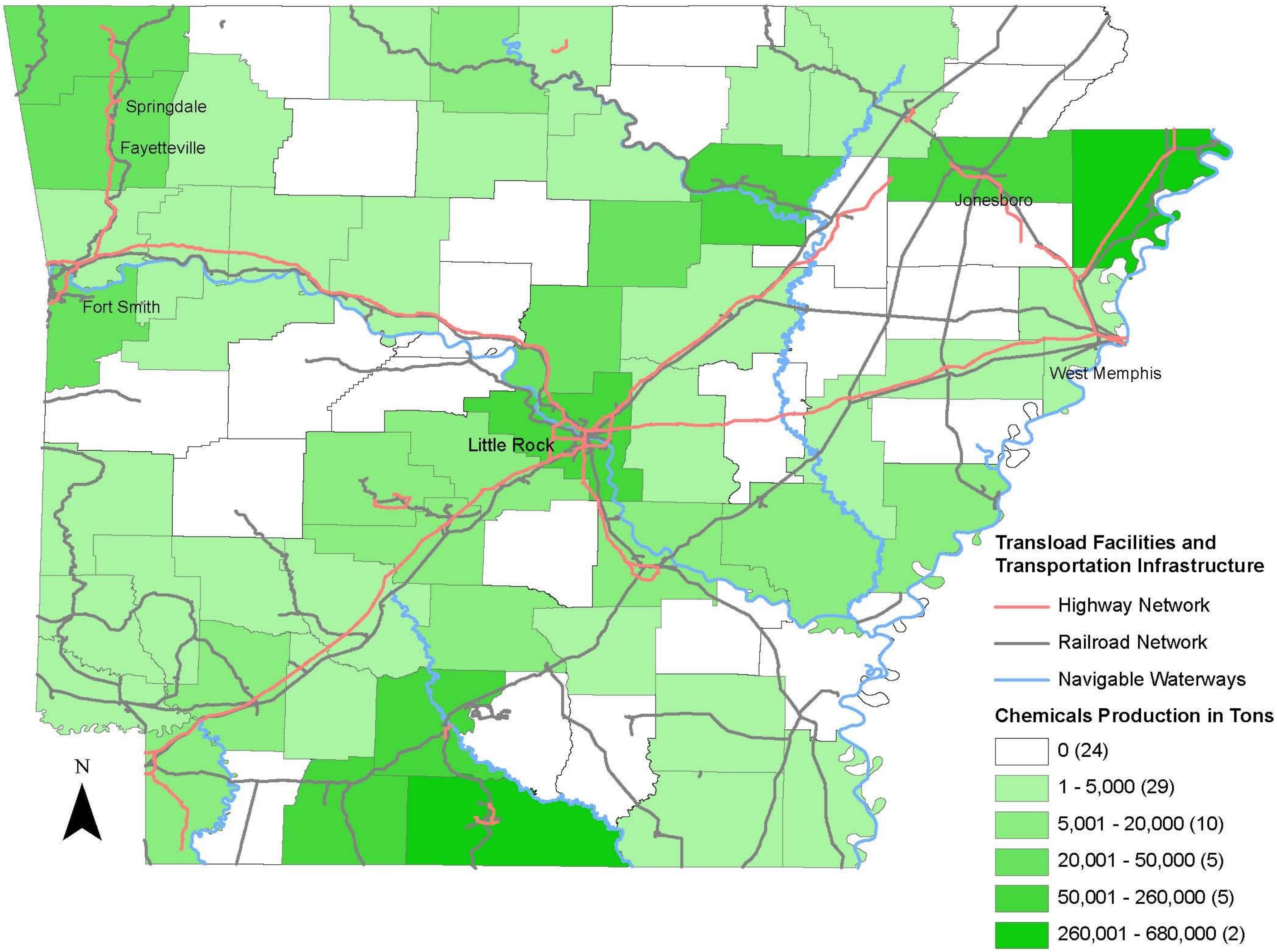

Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Non Durable Manufacturing Production in Tons
0 (8)
1 - 4,000 (42)
4,001 - 12,000 (11)
12,001 - 110,000 (12)
110,001 - 260,000 (1)
260,001 - 490,000 (1)

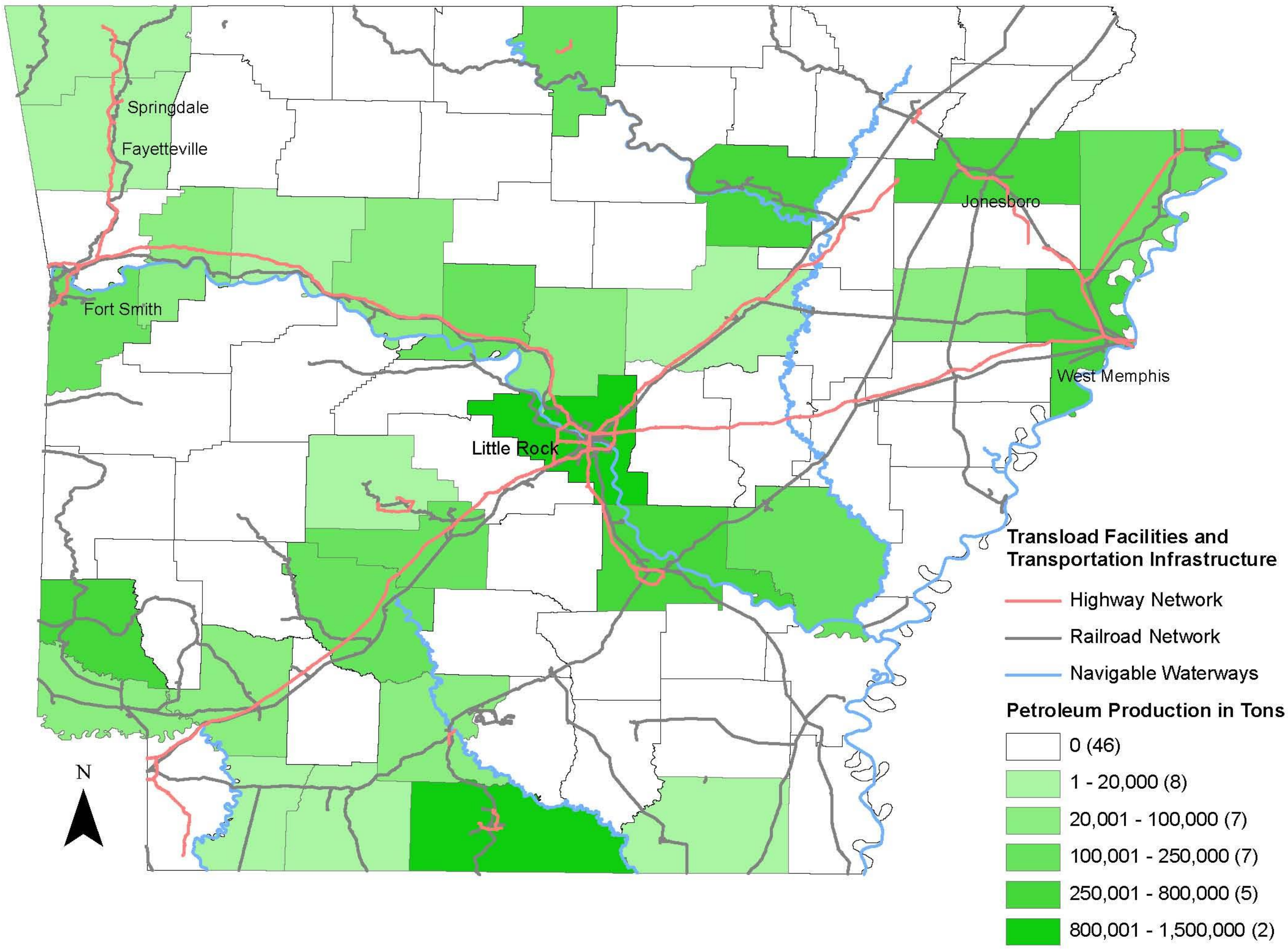


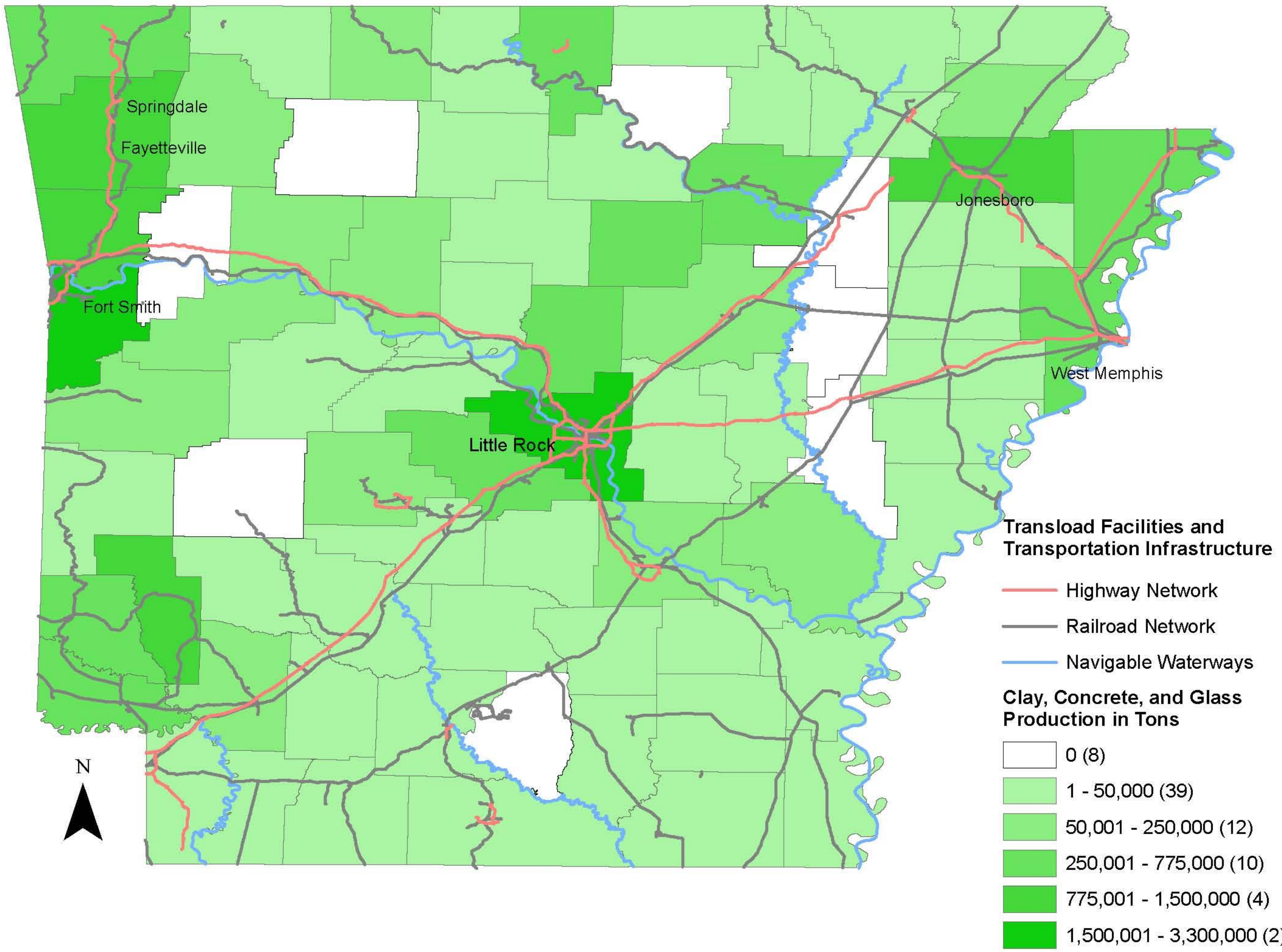
Springdale
Fayetteville
Jonesboro
Fort Smith
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Lumber Production in Tons
0 (5)
1 - 50,000 (32)
50,001 - 400,000 (26)
400,001 - 800,000 (8)
800,001 - 5,600,000 (4)

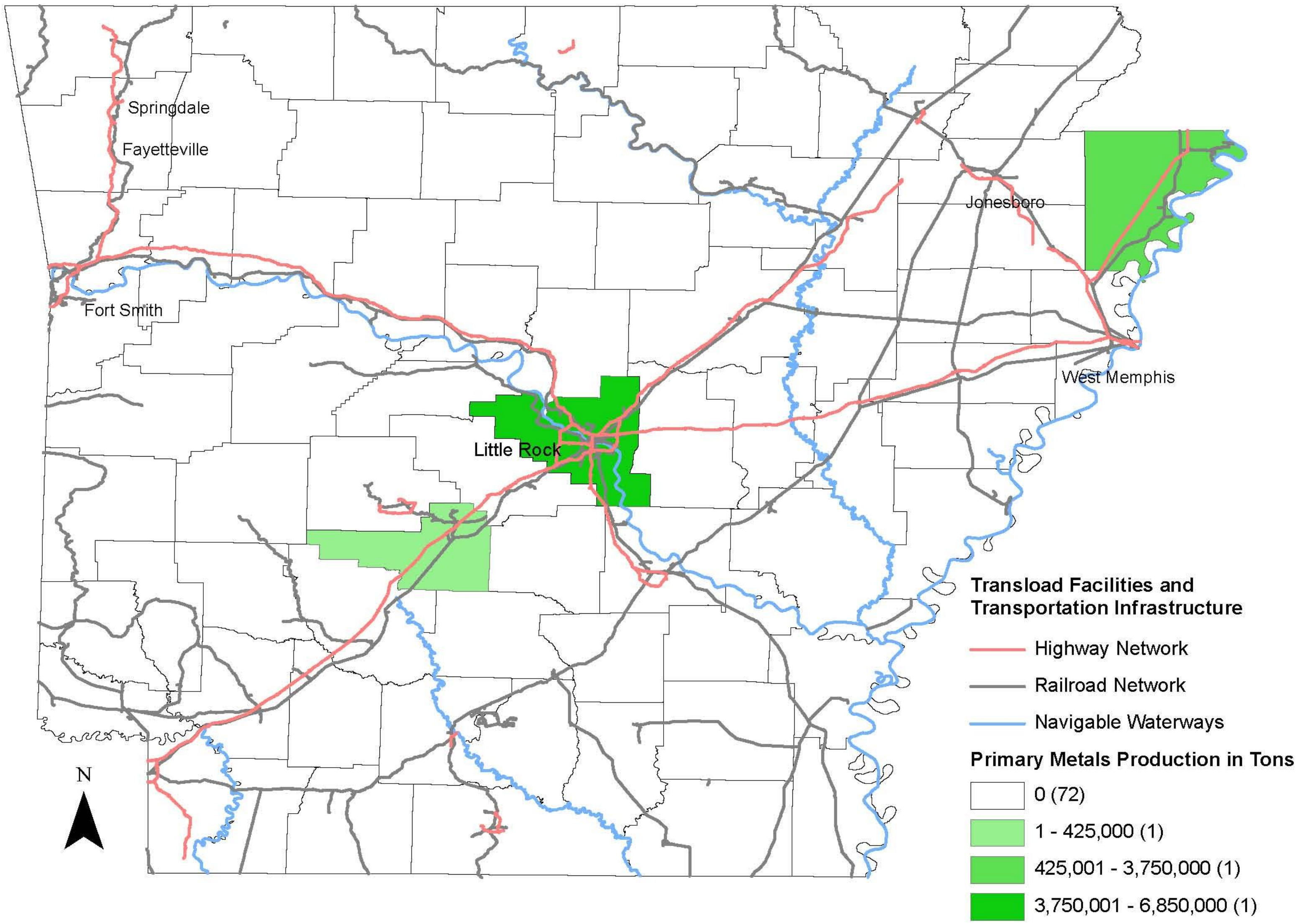

Springdale
Fayetteville
Jonesboro
Fort Smith
West Memphis
Little Rock
N
Transload Facilities and
Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Durable Manufacturing Productio
in Tons
30 - 10,000 (27)
10,001 - 50,000 (32)
50,001 - 100,000 (7)
100,001 - 260,000 (7)
260,001 - 485,000 (2)

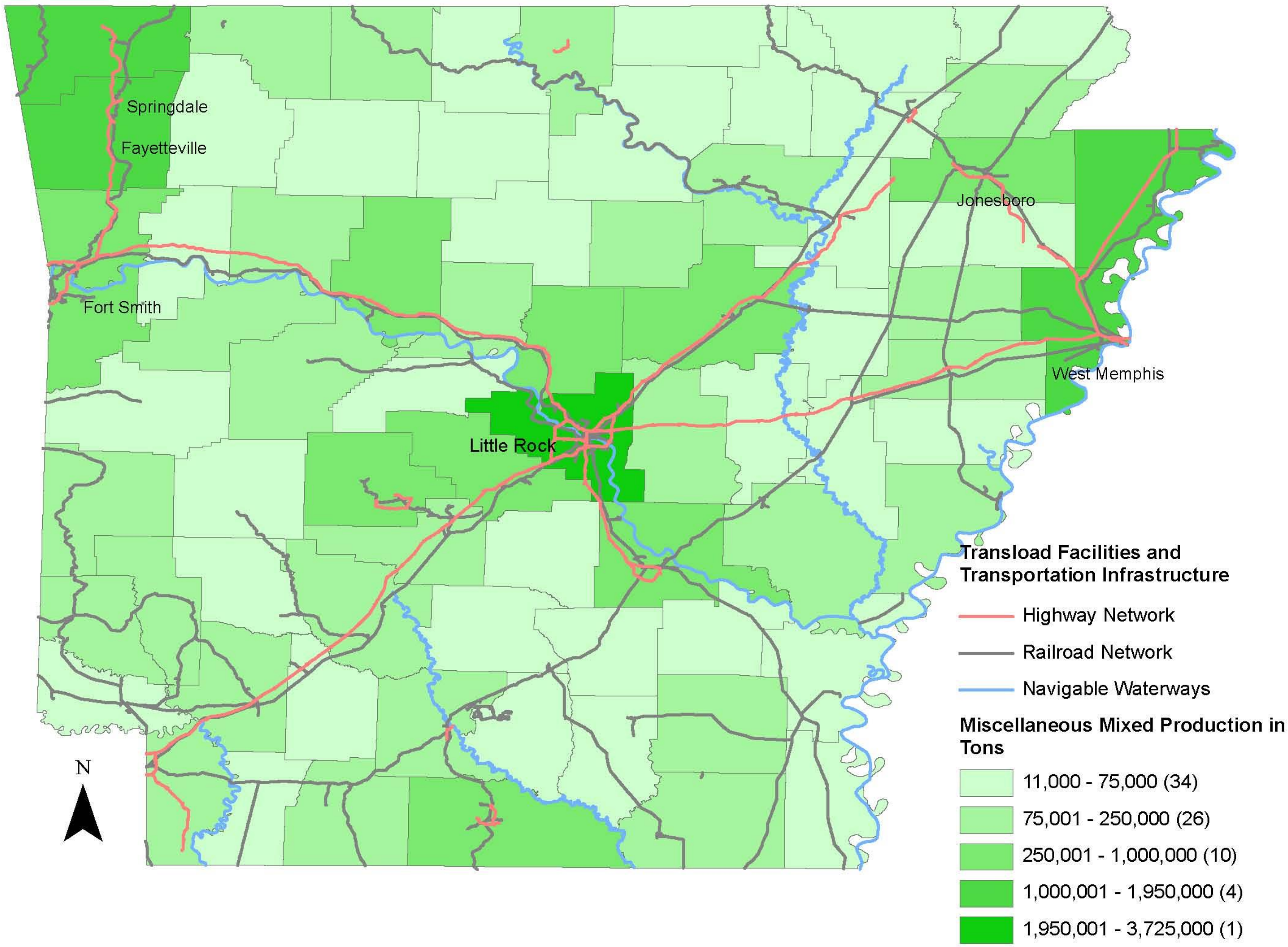

Springdale
Fayetteville
Fort Smith
Little Rock
Jonesboro
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Paper Production in Tons
0 (39)
1 - 10,000 (15)
10,001 - 50,000 (11)
50,001 - 130,000 (6)
130,001 - 300,000 (3)
300,001 - 530,000 (1)


Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Chemicals Production in Tons
0 (24)
1 - 5,000 (29)
5,001 - 20,000 (10)
20,001 - 50,000 (5)
50,001 - 260,000 (5)
260,001 - 680,000 (2)


Springdale
Fayetteville
Fort Smith
Little Rock
Jonesboro
West Memphis
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Petroleum Production in Tons
0 (46)
1 - 20,000 (8)
20,001 - 100,000 (7)
100,001 - 250,000 (7)
250,001 - 800,000 (5)
800,001 - 1,500,000 (2)


Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Clay, Concrete, and Glass Production in Tons
0 (8)
1 - 50,000 (39)
50,001 - 250,000 (12)
250,001 - 775,000 (10)
775,001 - 1,500,000 (4)
1,500,001 - 3,300,000 (2)


Springdale
Fayetteville
Fort Smith
Jonesboro
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Primary Metals Production in Tons
0 (72)
1 - 425,000 (1)
425,001 - 3,750,000 (1)
3,750,001 - 6,850,000 (1)


Springdale
Fayetteville
Jonesboro
Fort Smith
West Memphis
Little Rock
N
Transload Facilities and Transportation Infrastructure
Highway Network
Railroad Network
Navigable Waterways
Miscellaneous Mixed Production in Tons
11,000 - 75,000 (34)
75,001 - 250,000 (26)
250,001 - 1,000,000 (10)
1,000,001 - 1,950,000 (4)
1,950,001 - 3,725,000 (1)

Transload Facility Survey

Facility Maps

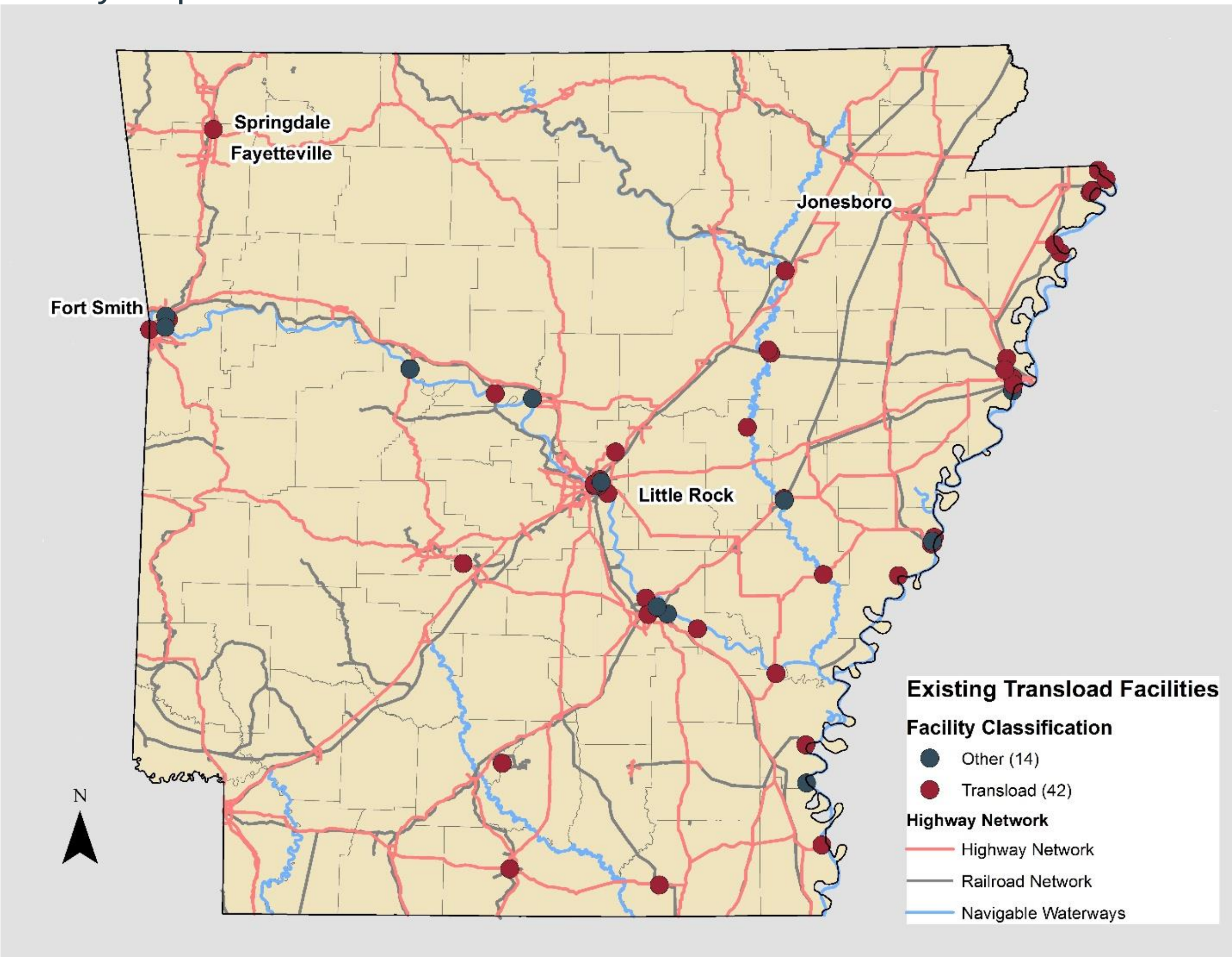


Figure 12.2-1. Map of Freight Transfer Facilities Categorized as Transload or Other

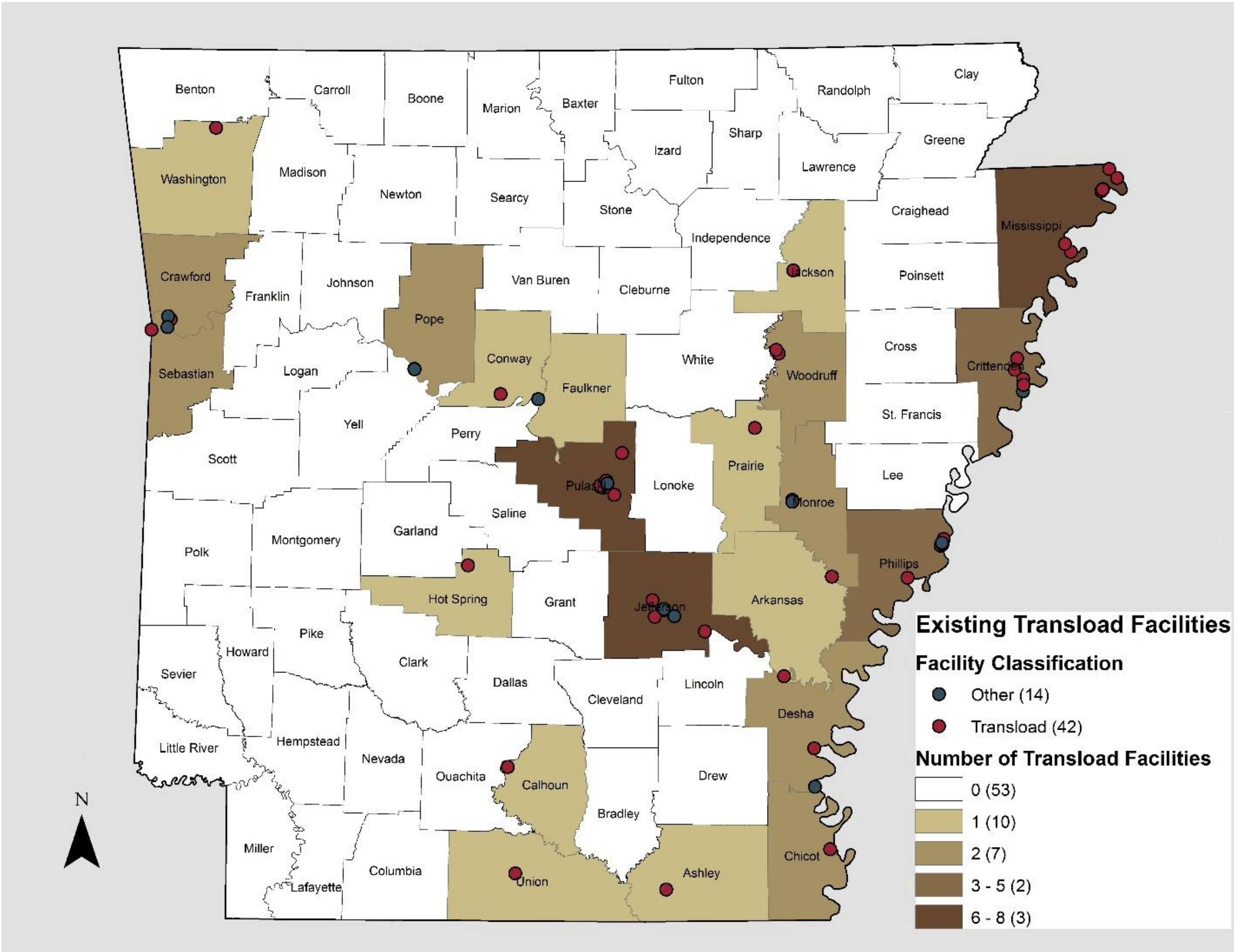


Figure 12.2-2. Map of Freight Transfer Facilities per County

Facility List

Name & Location of Facility	Location Latitude	Location Longitude	Modes of Transportation	Facility Classification
A&M Springdale Transfer Facility	36.185631	-94.128815	Truck/Train	Transload
AKMD Smart Warehousing, Jacksonville	34.88553	-92.13812	Truck/Train	Transload
AKMD Transload, NLR	34.756614	-92.244106	Truck/Train	Transload
AMKD Transload, Malvern	34.43796	-92.886611	Truck/Train	Transload
AR Valley Dredging Co-N Little Rock	34.740093	-92.192642	Not operational	Other
Arkansas Valley Terminal: Paris	35.391472	-93.507683	Not operational	Transload
Arkhola Sand & Gravel: Van Buren	35.428978	-94.352989	Truck/Train/Water	Other
Augusta Port & Elevator	35.276474	-91.369576	Truck/Water	Transload
Blytheville River Rail Terminal	35.900078	-89.762581	Unverified	Transload
BNSF Harvard TOFC/COFC	35.234253	-90.206757	Unverified	Transload
Bunge Corp Augusta Elevator	35.290642	-91.380966	Unverified	Transload
Bunge Corp Clarendon Elevator	34.689262	-91.315132	Truck/Water	Transload
Bunge Corp Des Arc Elevator	34.978981	-91.490128	Truck/Water	Transload
Bunge Corp DeSoto Landing Elevator	33.693165	-91.229279	Truck/Water	Transload
Bunge Corp Huffman Elevator	35.98146	-89.726753	Truck/Water	Transload
Bunge Corp Linwood Elevator	34.167599	-91.746796	Truck/Water	Transload
Bunge Corp Newport Elevator	35.607578	-91.290688	Truck/Water	Transload
Bunge Corp Osceola Elevator	35.655079	-89.927582	Truck/Water	Transload
Bunge Corp Pine Bluff Elevator	34.29454	-91.99736	Truck/Water	Transload
Bunge Grain, St. Charles	34.378986	-91.129837	Truck/Water	Transload
Century Tube Inc: Pine Bluff	34.258709	-91.942635	Unverified	Other
EACH TOFC, East Camden	33.630665	-92.697937	Truck/Train	Transload
Farmers Grain Terminal-Lake Village	33.287617	-91.160942	Truck/Water	Transload
Farmers Soybean Barfield Terminal	35.901466	-89.760643	Truck/Water	Transload
Fort Smith Port Terminal	35.373703	-94.432434	Unverified	Transload
Helena Bridge Terminal	34.498714	-90.592331	Truck/Train/Water	Transload
Helena Port Terminal	34.520103	-90.585663	Truck/Train/Water	Transload
Jeffrey Sand Co Cedar Park Dock	35.103416	-92.544327	Truck/Water	Other
Jeffrey Sand Co Dock 20: Fort Smith*	35.38509	-94.355217	Unverified	Other
Jeffrey Sand Co: North Little Rock	34.749535	-92.241814	Truck/Water	Other
Kinder Morgan- Mid River Region, Armorel	35.944241	-89.68924	Truck/Train/Water	Transload
Marine Terminals of AR- Mid River Region, Blytheville	35.893688	-89.769806	Truck/Water	Transload
McAlister Grain Old Town Terminal	34.368461	-90.764086	Truck/Water	Transload
Mid-South Bulk Services: W Memphis	35.152592	-90.180092	Truck/Train	Transload
Miller Transporters: N Little Rock	34.764259	-92.210144	Unverified	Other
Mobley Construction Co: Clarendon	34.681763	-91.314285	Unverified	Other
Mobley Construction Co: Dardanelle	35.223694	-93.146843	Unverified	Other
Oakley Morrilton Grain Dock	35.123695	-92.727669	Truck/Water	Transload
Oakley North Little Rock Terminal	34.748703	-92.224312	Truck/Train/Water	Transload
Oakley Port of Dardanelle Dock	35.225082	-93.147675	Truck/Train/Water	Transload
Osceola Port Terminal	35.687576	-89.955917	Truck/Water	Transload
Ouachita Railroad, El Dorado, AR	33.204496	-92.663821	Truck/Train	Transload
Ouachita Warehousing & Logistics, LLC, Crossett	33.13521	-91.944879	Truck/Train	Transload
PBW North Little Rock Terminal	34.751202	-92.256821	Not operational	Other
Pendleton Warehouse Inc: Dumas	33.983158	-91.368454	Truck/Water	Transload
Petroleum Fuel & Term-N Little Rock	34.748981	-92.231255	Truck/Water	Other
Petroleum Fuel & Terminal: Pine Bluff	34.256767	-91.942917	Truck/Train/Water	Other
Port of Little Rock Public Terminal	34.718426	-92.177643	Truck/Train/Water	Transload
Port of Pine Bluff Public Terminal	34.253433	-91.945969	Truck/Train/Water	Transload
Producers Rice Mill: Yellow Bend	33.538723	-91.229279	Truck/Water	Other
Quincy Soybean Lower Helena Elev	34.493435	-90.600388	Truck/Train/Water	Transload
Riceland Foods W Memphis Terminal	35.102592	-90.182594	Truck/Water	Other
Southern Farmers Assn-N Little Rock	34.748703	-92.222366	Not operational	Other
SP Pine Bluff TOFC/COFC	34.228157	-91.986526	Unverified	Transload

Name & Location of Facility	Location Latitude	Location Longitude	Modes of Transportation	Facility Classification
TEPPCO Helena Terminal	34.505104	-90.595108	Unverified	Other
Truck Transport Inc: Little Rock	34.70676	-92.187645	Not operational	Other
Union Compress Warehouses of W. Memphis	35.128426	-90.178421	Truck/Train	Transload
UP Gavin Vehicle Ramp	35.189537	-90.218979	Unverified	Transload
UP North Little Rock TOFC/COFC	34.775093	-92.215698	Truck/Train	Transload
Victoria Bend Terminal: Pine Bluff	34.230099	-91.892639	Unverified	Other
West Ark Terminal: Van Buren	35.416203	-94.339661	Truck/Train/Water	Transload
Yell County Port Terminal	35.277306	-93.256561	Not operational	Other

Questionnaire

Part 1. Operations and Coordination

Protocol has been approved by IRB for 50 participants. IRB Protocol #: 16-04-684
Approval start date: 4/18/2016. Approval expiration date: 4/17/2017.

The first four sets of questions address operations and coordination of the terminal. Thank you for taking the time to complete this survey.

*This survey was adapted from Bhamidipati et al (2008) by Sarah Hernandez, and assembled on qualtrics by Benjamin Sutherland.

History of the Terminal

When was the terminal established?

How was the terminal originally funded?

What factors influenced its original location?

What were the private and public roles in establishing the terminal?

Current Operations

What work units (public or private) are involved in the operation of the terminal?

Is the terminal exclusively used for COFC/TOFC freight?

Is the intermodal traffic domestic, international, or both?

What is the extent of the market covered in terms of maximum drayage distance?

What are the various services provided at the terminal?

What are the major commodities handled by the terminal?

Coordination with public and private stakeholders

What are the possible sources of funding for improvements?

What public support, if any, is needed to sustain the terminal?

Future of transload terminals

What are the critical factors that influence a shippers' decision to use transload service?

What are the critical factors that contribute to the success of transload terminals?

What are the deterrents to the success of transload terminals?

Part 2. Facility Information and Equipment

The remaining questions address facility information and equipment. Thank you for taking the time to complete this survey.

Facility Information

Facility Information

	Facility Information	
	Yes	No
Bulk (plastics, chemicals, minerals, ag. products, generally moved in hoppers or tank cars)	○	○

Warehouse (paper, consumer, food, beverage-generally moved in boxcars)	◯	◯
Dimensional (lumber, panel, structural steel-generally moved in flatcars, gondolas, or boxcars)	◯	◯

Type of Facility

Does the facility accommodate the following transportation methods?

	Yes	No
Rail	◯	◯
Truck	◯	◯
Water	◯	◯
Pipeline	◯	◯

Capacity: Rail

Rail: How many railcar spots does the facility have?

How many rail tracks does the facility have?

What is the total length of track?

Capacity: Truck

How many truck spots does the facility have?

Is there a truck scale on site? If so, how many?

Capacity: Water

How many berths/docks do you have?

Storage

What type of storage does the facility have?

	Yes	No
Enclosed storage	○	○
Covered storage	○	○
Outdoor paved storage	○	○
Outdoor unpaved storage (gravel or dirt)	○	○

Storage

What is the square footage and max ceiling height of enclosed storage?

What is the square footage and max ceiling height of covered storage?

What is the area of outdoor-paved storage?

What is the area of outdoor-unpaved storage?

Ownership

Who owns the facility?

- ○ Public agencies
- ○ Private firms
- ○ A combination (explain)

Serving Railroads

Please list all railroads that have access to the facility

Facility Type

Does the facility have any of the following features?

	Yes	No
Refrigerated warehouse	○	○
Frozen warehouse	○	○
Pipe transload	○	○
Dry bulk transload	○	○
Liquid bulk transload	○	○
Machinery transload	○	○
Foreign trade zone	○	○
US Customs bonded	○	○
Warehouse- Dry	○	○
Warehouse- Public	○	○
Multiple commodity	○	○

Haz Mat and Safety

Does the facility have the following haz mat and safety features?

	Yes	No
Dry sprinkler	○	○
Wet sprinkler	○	○
Hazardous handling	○	○
Non-hazardous handling	○	○
Spill containment devices	○	○

Location

Is the facility located near any major ports or highways?

	Yes	No
Interstate highway within 10 miles	○	○
State highway within 10 miles	○	○
Ocean port within 10 miles	○	○
River port within 10 miles	○	○

Rail Equipment Served

What rail equipment is served by the facility?

	Yes	No
Boxcar	◯	◯
Flatcar	◯	◯
Pneumatic hopper	◯	◯
Bulkhead flat	◯	◯
Gondola	◯	◯
Reefer	◯	◯
Centerbeam flat	◯	◯
Covered gondola	◯	◯
Tank	◯	◯
Coil car	◯	◯
Hopper	◯	◯

Transload Equipment Available

What transload equipment is available at the facility?

	Click to write Column 1	
	Yes	No
Fork lift	◯	◯
Bale clamp	◯	◯
Conveyor	◯	◯
Excavator	◯	◯
Man baskets	◯	◯
Slip sheets	◯	◯
Ramp- portable	◯	◯
Ramp- end	◯	◯
Ramp- side	◯	◯
Roll clamp	◯	◯
Air compressor	◯	◯
Auger	◯	◯
C hook	◯	◯
Containment pans	◯	◯
Front loader	◯	◯
Pallet Jacks	◯	◯
Back hoe	◯	◯
Car puller	◯	◯
Crane	◯	◯
Lift	◯	◯

Pneumatic	○	○

Commodities

What dimensional commodities are transloaded?

	Click to write Column 1	
	Yes	No
Pulpmill feedstocks (paper waste, saw logs)	○	○
Panel products (plywood, wall board, particle board)	○	○
Lumber	○	○
Manufactured products (bricks, roofing, etc)	○	○
Steel Products	○	○
Aluminum and non-ferrous	○	○
Aviation machinery	○	○
Other machinery	○	○
Rail equipment	○	○
Generators/transformers	○	○
Government equipment	○	○

What warehouse commodities are transloaded?

	Yes	No
Paper (printing paper, pulpboard, wood pulp, etc.)	○	○
Food and beverages (grocery products, canned food, beer, wine, etc.)	○	○
Perishables (fresh or frozen meat, poultry, frozen fish, fruits/vegetables, dairy, etc.)	○	○
Household products (cotton, grass seeds, household appliances)	○	○

What bulk commodities are transloaded?

	Yes	No
Fertilizers	○	○
Chemicals	○	○
Petroleum products	○	○
Ethanol	○	○
LPG	○	○
Plastics	○	○

Clays	◯	◯
Minerals	◯	◯
Aggregates	◯	◯
Oils (canola, cottonseed, soybean, sunflower)	◯	◯
Manufactured products (roofing granules)	◯	◯
Pulpmill feedstocks (chips and kaolin)	◯	◯
Bulk foods (corn starch, corn syrup, feed, lard, sugar, animal refuse)	◯	◯
Seeds/grains (barley, corn, popcorn, rice, rye, milo, oats, soybeans, popcorn)	◯	◯
Cement	◯	◯
Flour/mill products	◯	◯
Feeds	◯	◯

Expansion

Are you constrained by capacity for with any commodities?

Is there a potential need to expand any of your existing operations?

What operations or commodities could be considered for expansion?

Identification

What is the name and location of your facility?

Transload Equipment Survey

Transload Equipment by Commodity

Instructions: To fill out this form, place an "x" in the box next to the equipment that is needed to transload each commodity group. If you have questions, please contact, Sarah Hernandez by email sarahvh@uark.edu or phone 479-575-4182.

1. Crushed Stone, Sand, Gravel

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane
☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

2. Food Products

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane
☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

3. Metals

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane
☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

4. Feed Products

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane

☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

5. Manufactured Products

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane
☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

6. Chemicals

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane
☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

7. Waste

☐	Fork Lift	☐	Air Compressor	☐	Back Hoe
☐	Bale Clamp	☐	Auger	☐	Car Puller
☐	Conveyor	☐	C Hook	☐	Crane
☐	Excavator	☐	Containment Pans	☐	Lift
☐	Man Baskets	☐	Front End Loads	☐	Pneumatic
☐	Ramp - Portable	☐	Pallet Jacks	☐	Ramp – Side
☐	Roll Clamp	☐	Ramp - End	☐	Slip Sheets

Transload Facility Location Summaries

Site Characteristics

Area: Pulaski County

New facility

298 Pike Ave
North Little Rock, AR
72114

- **Coordinates:** **34.7575, -92.2811**
- **Size:** **6.5 Acres**
- **Perimeter:** **1,650 ft. x 430 ft.**
- **Land Price:** **Not available**
- **Construction:** **$13,034,700**
- **Rail-front:** **575 ft.**
- **Waterfront:** **285+ ft.**

Nearest Transportation		Distance (route miles)
Road	Interstate I-30	1.3 miles
Rail	Union Pacific	0 (east boundary)
Water	Port of Little Rock	9.8 miles

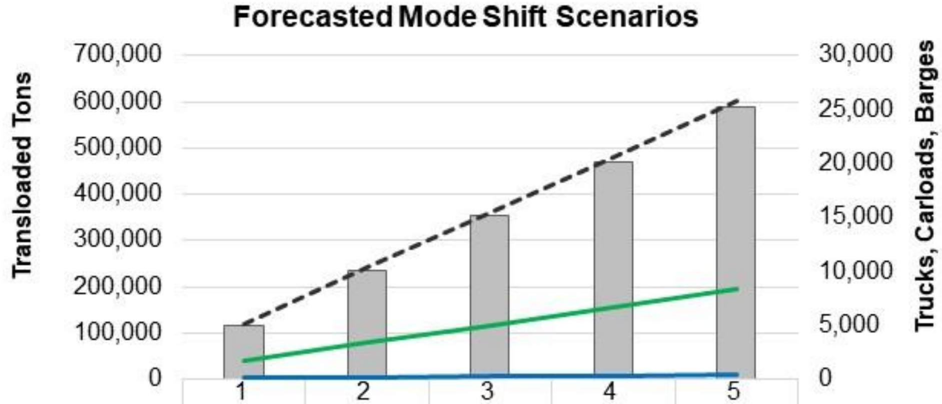
Forecast Annual Commodity Flow (CG of the Arkansas Statewide Travel Demand Model)	Tons	Trucks
Nonmetallic Minerals (CG4)	6,186,000	254,482
Durable Manufacturing (CG9)	882,000	55,866
Primary Metal (CG14)	2,630,000	105,717
Secondary & Miscellaneous Mixed (CG15)	2,046,000	99,501

Facility Cost Type	Construction Cost Estimate
Site Preparation	$ 19,050
Infrastructure	$ 9,698,950
Truck Access	$ 385,450
Rail Access	$ 1,813,000
Barge Access	$ 543,300
Equipment	$ 575,000

Area: Pulaski County

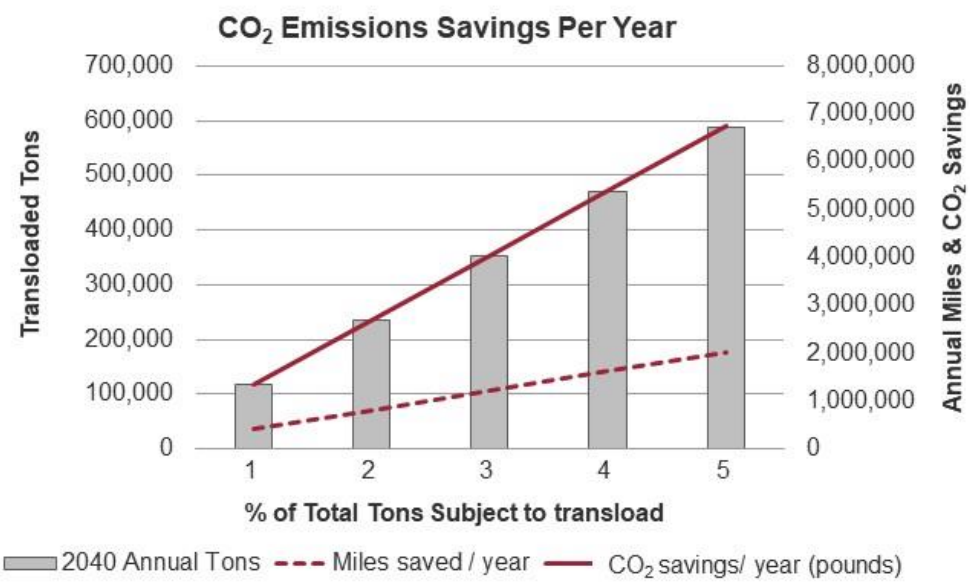
New facility

298 Pike Ave
North Little Rock, AR 72114



	1	2	3	4	5
2040 Annual Tons	117,440	234,880	352,320	469,760	587,200
2040 Annual trucks	5,156	10,311	15,467	20,623	25,778
2040 Annual carloads	1,669	3,338	5,007	6,676	8,345
2040 Annual Barges	78	157	235	313	391

% of Annual Tons Subject to Transload



Area: Benton / Washington

New facility

520 E Apple Blossom Ave
Bethel Heights, AR
72764

- **Coordinates:** 36.2375, -94.1266
- **Size:** 61 Acres
- **Perimeter:** 1,300 ft. x 2,00 ft.
- **Land Price:** Not available
- **Construction:** $25,255,825
- **Rail-front:** 4,000 ft.
- **Waterfront:** Not available

Nearest Transportation		Distance (route miles)
Road	Interstate I-49	2.5
Rail	Arkansas & Missouri	0 (west boundary)
Water	Port of Forth Smith	67.5

Forecast Annual Commodity Flow (CG of the Arkansas Statewide Travel Demand Model)	Tons	Trucks
Food (CG5)	1,436,000	62,449
Durable Manufacturing (CG9)	973,000	61,645
Chemicals (CG11)	101,000	4,908
Secondary & Miscellaneous Mixed (CG15)	1,661,000	80,802

Facility Cost Type	Construction Cost Estimate
Site Preparation	$ 15,500
Infrastructure	$ 22,905,700
Truck Access	$ 231,800
Rail Access	$ 1,527,850
Barge Access	*None provided*
Equipment	$ 575,000

Rounded up to $50 increments

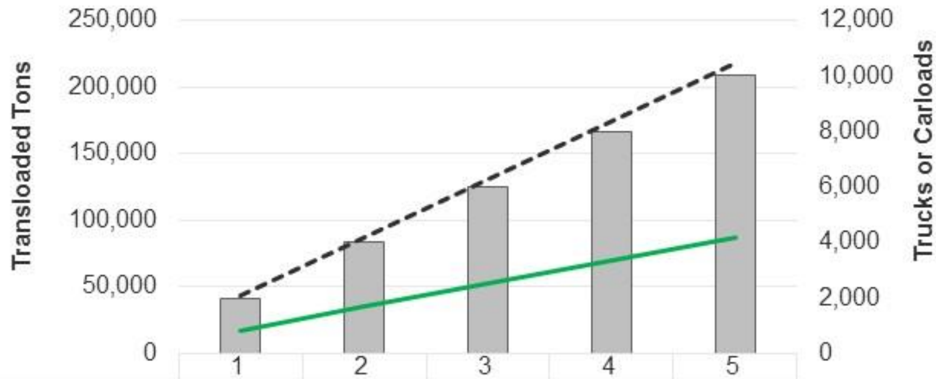
Estimated Site Impacts

Area: Benton / Washington

New facility

520 E Apple Blossom Ave
Bethel Heights, AR 72764

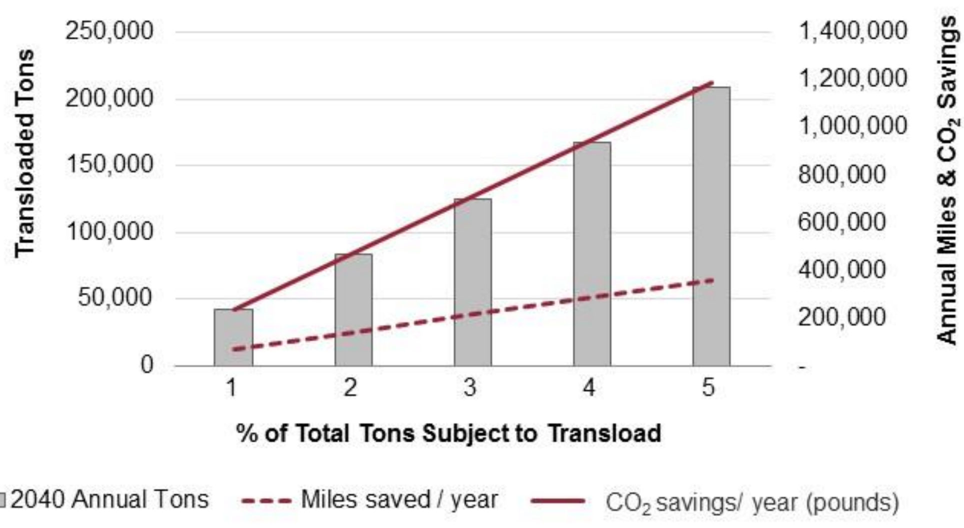
Forecasted Mode Shift Scenarios



	1	2	3	4	5
2040 Annual Tons	41,710	83,420	125,130	166,840	208,550
2040 Annual Trucks	2,098	4,195	6,293	8,391	10,488
2040 Annual Carloads	839	1,678	2,518	3,357	4,196

% of Total Tons Subject to Transload

CO_2 Emissions Savings Per Year



Area: Jefferson County

New facility

4589 Emmet Sanders Road
Pine Bluff, AR
71601

- **Coordinates: 34.2607, -91.9396**
- **Size: 20 Acres**
- **Perimeter: 610 x 1290 ft.**
- **Land Price: Not available**
- **Construction: $21,598,235**
- **Rail-front: 610 ft.**
- **Waterfront: 655 ft.**

Nearest Transportation		Distance (route miles)
Road	Interstate I-530	5.7 miles
Rail	Union Pacific	0 (east boundary)
Water	Port of Pine Bluff	0 (west boundary)

Forecast Annual Commodity Flow (CG of the Arkansas Statewide Travel Demand Model)	Tons	Trucks
Farm Products (CG1)	138,000	8,514

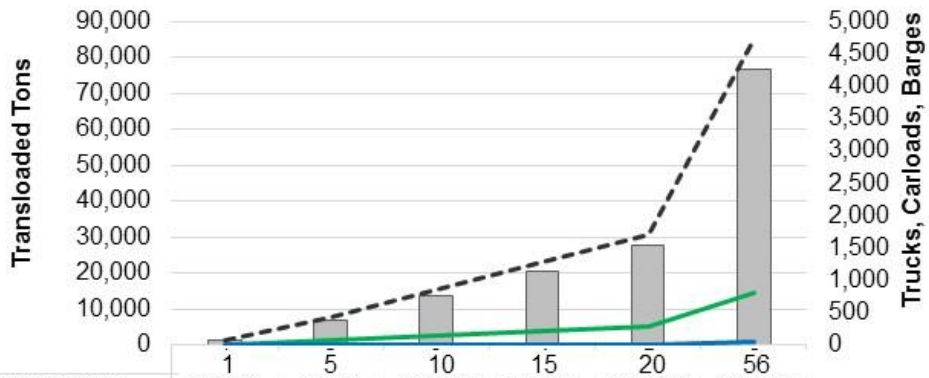
Facility Cost Type	Construction Cost Estimate
Site Preparation	$ 25,550
Infrastructure	$ 19,137,300
Truck Access	$ 131,550
Rail Access	$ 1,349,650
Barge Access	$ 543,300
Equipment	$ 411,000

Rounded up to $50 increments

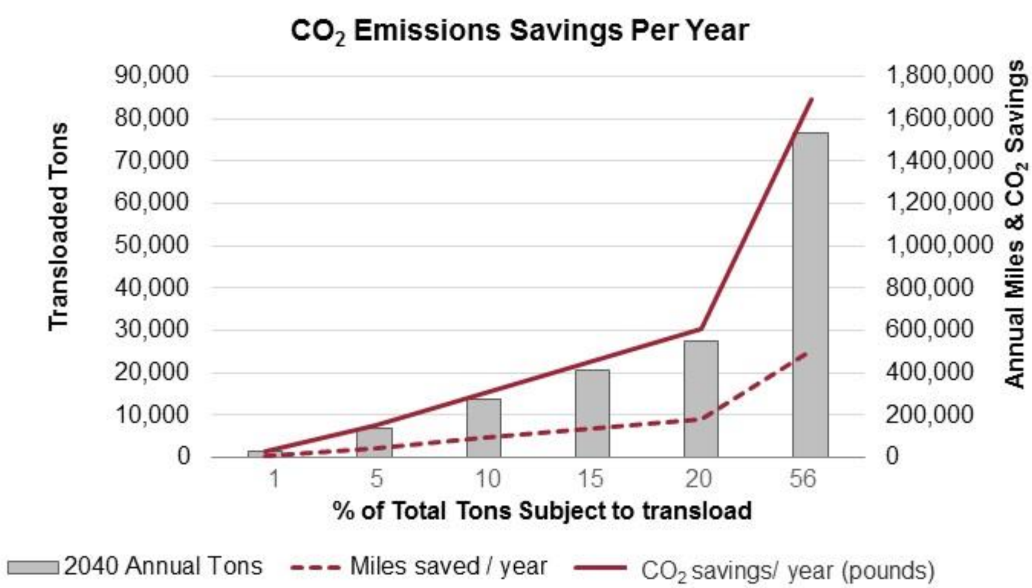
Area: Jefferson County

New facility

4589 Emmet Sanders Road
Pine Bluff, AR
71601



	1	5	10	15	20	56
2040 Annual Tons	1,380	6,900	13,800	20,700	27,600	76,800
2040 Annual trucks	85	424	849	1,273	1,697	4,720
2040 Annual carloads	14	71	143	214	286	800
2040 Annual Barges	1	5	9	14	18	51



Site Characteristics

Area: Hot Spring County

New facility

I-30 & Industrial Rd.
Malvern, AR
72104

- **Coordinates:** **34.3981, -92.8216**
- **Size:** **141 Acres**
- **Land Price:** **$1,269,000**
- **Construction:** **$20,903,950**
- **Rail-front:** **Spur available**
- **Waterfront:** **Not available**

Nearest Transportation		Distance (route miles)
Road	Interstate I-30	0.2
Rail	Arkansas Midland Railroad Company	0 (within Industrial Park)
Water	Little Rock Port Authority	42.9

Forecast Annual Commodity Flow (CG of the Arkansas Statewide Travel Demand Model)	Tons	Trucks
Lumber (CG8)	493,000	19,477

Facility Cost Type	Construction Cost Estimate
Site Preparation	$ 140,165
Infrastructure	$ 8,048,929
Truck Access	$ 133,670
Rail Access	$ 1,349,640
Barge Access	*None provided*
Equipment	$ 11,231,550

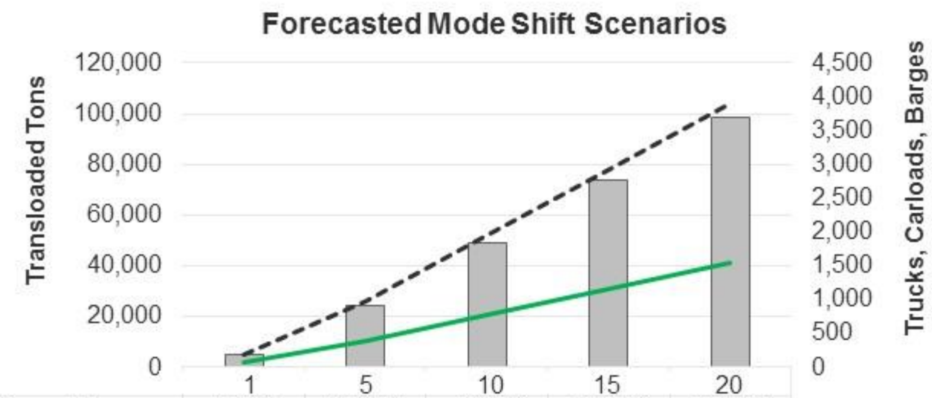
Rounded up to $50 increments

Estimated Site Impacts

Area: Hot Spring County

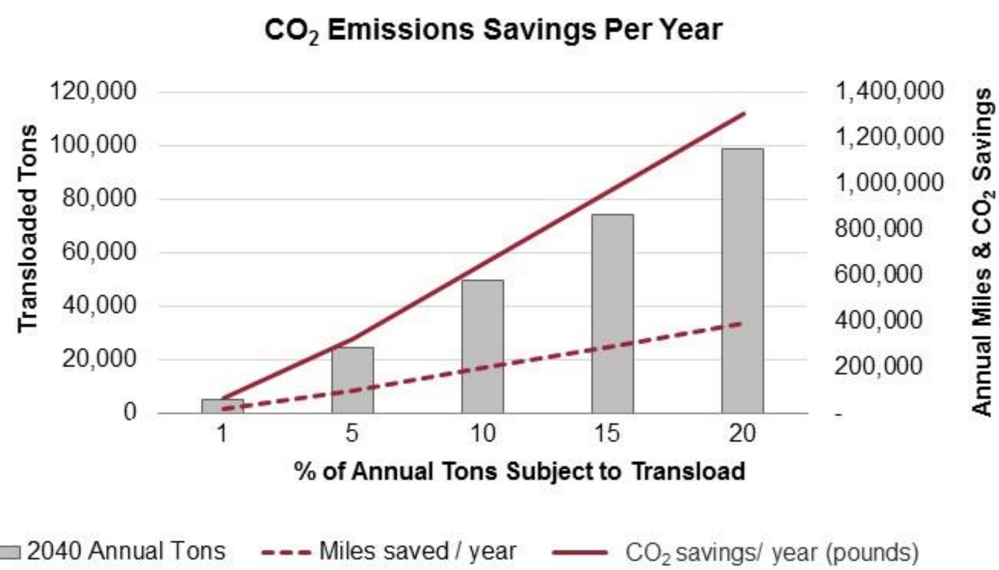
New facility

I-30 & Industrial Rd.
Malvern, AR 72104



	1	5	10	15	20
2040 Annual Tons	4,930	24,650	49,300	73,950	98,600
2040 Annual trucks	195	974	1,949	2,923	3,897
2040 Annual carloads	77	384	769	1,153	1,538

% of Annual Tons Subject to Transload



Site Characteristics

Area: Sebastian / Crawford Co.

Expansion of existing facility

1800 Riverfront Rd.
Van Buren, AR
72956

- **Coordinates:** 35.4259, -94.3463
- **Size:** 22.5 Acres
- **Perimeter:** 890 ft. x 1,000 ft.
- **Land Price:** Not available
- **Construction[1]:** $ 21,598,350
- **Rail-front:** 1,000 ft.
- **Waterfront:** 1,000 ft.

1. Construction cost is for a new facility.

Nearest Transportation		Distance (route miles)
Road	Interstate I-49	0.9 miles
Rail	Union Pacific	0 (north boundary)
Water	Port of Little Rock	0 (south boundary)

Forecast Annual Commodity Flow (CG of the Arkansas Statewide Travel Demand Model)	Tons	Trucks
Farm Products (CG1)	162,000	9,937

Facility Cost Type	Construction Cost Estimate
Site Preparation	$ 25,550
Infrastructure	$ 19,137,300
Truck Access	$ 131,550
Rail Access	$ 1,349,650
Barge Access	$ 543,300
Equipment	$ 411,000

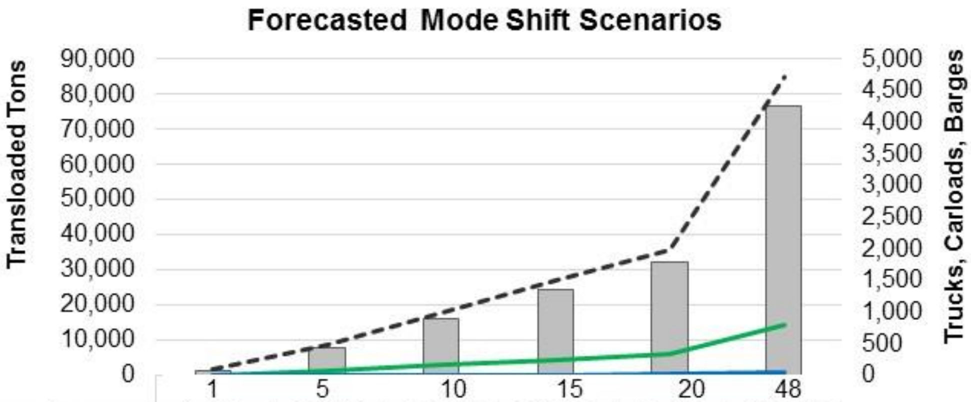
Rounded up to $50 increments

Estimated Site Impacts

Area: Sebastian / Crawford Co.

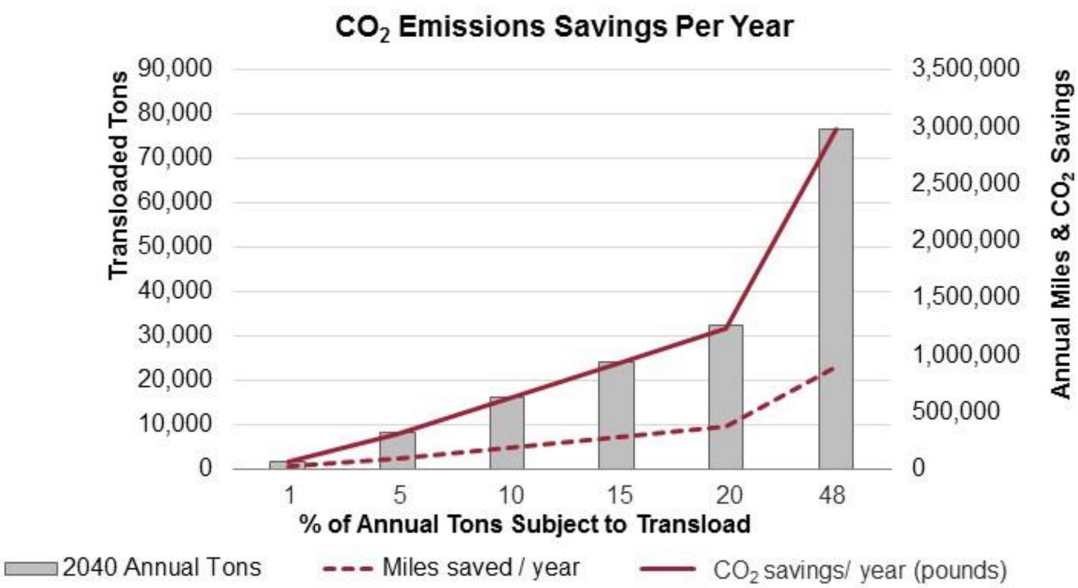
Expansion of existing facility

1800 Riverfront Rd.
Van Buren, AR
72956



% of Annual Tons Subject to Transload	1	5	10	15	20	48
2040 Annual Tons	1,620	8,100	16,200	24,300	32,400	76,800
2040 Annual trucks	100	498	996	1,494	1,993	4,720
2040 Annual carloads	17	84	168	251	335	800
2040 Annual Barges	1	5	11	16	22	51

% of Annual Tons Subject to Transload



Detailed Transload Facility Location Costs

Pulaski County Facility

(a) Site Preparation

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Site Clearing	G10101201000	Remove trees & stumps up to 6" diameter by cut & chip & stump haul away	1 Acre	$ 7,150.00	0.50	$ 3,545.45
Site Earthwork	G10301201000	Excavate common earth, 1/2 CY backhow, two 8 CY dump trucks, 1 MRT	Cubic Yard	$ 9.61	28,949.66	$ 15,504.10
					Subtotal	**$ 19,049.56**

(b) ***Infrastructure***

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Enclosed Storage	501700-0010	Warehouses & Storage Buildings	Square Foot	$ 113.00	62,647.00	$ 7,079,111.00
Covered Storage	107316.20-1700	Metal canopies, aluminum prefinished, 12'x40'	Each	$ 17,347.50	130.52	$ 2,264,195.70
Paved Storage	321216.13-0020	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 1" Topping	Square Foot	$ 2.64	62,647.00	$ 165,388.08
Unpaved Storage	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$ 11.45	2,320.26	$ 26,566.97
Employee Parking	321216.13-0025	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 2" Topping	Square Foot	$ 3.12	1,920.00	$ 5,990.40
Office	501700-0010	Offices Low Rise (1 to 4 Story)	Square Foot	$ 176.00	896.00	$ 157,696.00
					Subtotal	**$ 9,698,948.15**

(c) Truck

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost

Loading Dock	111319.10-3200	Dock Boards, 60"x60", aluminum, 15,000 lb. capacity	Each	$1,900.00	11.00	$20,900.00
	111319.10-4500	Dock leveler, hinged for trucks, 10 ton capacity, 6'x8'	Each	$6,975.00	11.00	$76,725.00
	111316.10-6300	Shelters, Fabric, for truck or train	Each	$3,775.00	11.00	$41,525.00
Pavement Under Loaded Trucks	321216.14-0030	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 3" Binder Course, 2" Topping	Square Foot	$3.57	48,905.00	$174,590.85
Truck Scales	108805.10-1640	Truck Scales, Digital, Electric, 60'x10' Platform	Each	$52,500.00	1.00	$52,500.00
	108805.10-2700	Concrete Foundation Pit, 70'x10' Platform, 40 C.Y. Required	Each	$19,200.00	1.00	$19,200.00
					Subtotal	**$385,441**

(d) Rail

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Railroad Sidings	347216.50-0820	Wood ties and ballast, 100 lb. new rail	Linear Foot	$198.00	8,520.00	$1,686,960.00
Railroad Turnouts	347216.60-2300	Turnout, #8 complete, w/rails, plates, bars, frog, switch point, timbers, and ballast to 6" below bottom of ties	Each	$63,000.00	2.00	$126,000.00
					Subtotal	**$ 1,812,960.00**

(e) Barge

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost

Dredging	352023.23-110	Hydraulic method, pumped 1000' to shore dump maximum	B.C.Y.	$17.15	560.00	$9,604.00
Elevated Slab	03053.40-2700	Elevated Slab (4000 psi), one-way beam & slab, 125 psf sup. Load, 15' span	Cubic Yard	$1,100.00	266.67	$293,333.33
Concrete Caisson	316326.16-1500	Concrete caissons for marine construction; cased shafts, 140 to 175 ton capacity, 19" diameter, 40' depth	Vertical Linear Foot	$74.50	1,600.00	$119,200.00
Concrete Revetment	353119.18-0110	Concrete revetment matt 8'x20'x4-1/2", excluding site prep, includes all labor, material and equip. for installation	Each	$3,700.00	31.50	$116,550.00
Gravel Base Course	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$11.45	400.00	$4,580.00
					Subtotal	**$ 543,267.33**

(f) Equipment

Type	Estimated Price
Fork Lift	$ 77,500.00
Conveyor	-
Excavator	$ 210,000.00
Ramp	-
Roll Clamp	-
Air Compressor	$ 45,000.00
C Hook	-
Wheel Loader	$ 152,500.00
Pallet Jacks	-
Back Hoe	$ 90,000.00
Car Puller	-
Crane	-
Lift	-
Subtotal	**$575,000.00**

Benton/Washington County Facility

(a) Site Preparation

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Site Earthwork	G10301201000	Excavate common earth, 1/2 CY backhoe, two 8 CY dump trucks, 1 MRT	Cubic Yard	$9.61	92,103.67	$ 15,504.10
					Subtotal	**$ 15,504.10**

(b) Infrastructure

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Enclosed Storage	501700-0010	Warehouses & Storage Buildings	Square Foot	$ 113.00	88,180.00	$ 9,964,339.75
Covered Storage	107316.20-1700	Metal canopies, aluminum prefinished, 12'x40'	Each	$ 17,347.50	618	$ 10,720,755.00
Storage Tank	331613.13-0910	Steel, ground level, ht./diam. Less than 1, not incl. foundation, 100,000 gallons	Each	$ 244,500.00	1	$ 244,500.00
Paved Storage	321216.13-0020	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 1" Topping	Square Foot	$ 2.64	296,250.00	$ 782,100.00
Unpaved Storage	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$ 11.45	10,972.22	$ 125,631.94
Employee Parking	321216.13-0025	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 2" Topping	Square Foot	$ 3.12	16,205.00	$ 50,559.60
Office	501700-0010	Offices Low Rise (1 to 4 Story)	Square Foot	$ 176.00	5,783.00	$ 1,017,808.00
					Subtotal	**$ 22,905,694.29**

(c) Truck Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Loading Dock	111319.10-3200	Dock Boards, 60"x60", aluminum, 15,000 lb. capacity	Each	$ 1,900.00	5	$ 9,500.00
	111319.10-4500	Dock leveler, hinged for trucks, 10 ton capacity, 6'x8'	Each	$ 6,975.00	5	$ 34,875.00
	111316.10-	Shelters, Fabric, for	Each	$ 3,775.00	5	$ 18,875.00

	6300	truck or train				
Pavement Under Loaded Trucks	321216.14-0030	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 3" Binder Course, 2" Topping	Square Foot	$ 3.57	27,125.00	$ 96,836.25
Truck Scales	108805.10-1640	Truck Scales, Digital, Electric, 60'x10' Platform	Each	$ 52,500.00	1	$ 52,500.00
	108805.10-2700	Concrete Foundation Pit, 70'x10' Platform, 40 C.Y. Required	Each	$ 19,200.00	1	$ 19,200.00
Subtotal						**$ 231,786.25**

(d) Rail Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Railroad Sidings	347216.50-0820	Wood ties and ballast, 100 lb. new rail	Linear Foot	$ 198.00	7080	$ 1,401,840
Railroad Turnouts	347216.60-2300	Turnout, #8 complete, w/rails, plates, bars, frog, switch point, timbers, and ballast to 6" below bottom of ties	Each	$ 63,000.00	2	$ 126,000
					Subtotal	**$ 1,527,840**

(e) Equipment

Type	Estimated Price
Fork Lift	$ 77,500
Conveyor	-
Excavator	$ 210,000
Ramp	-
Roll Clamp	-
Air Compressor	$ 45,000
Containment Pans	-
Wheel Loader	$ 152,500
Pallet Jacks	-
Back Hoe	$ 90,000
Lift	-
Car Puller	-
Crane	-
Subtotal	**$ 575,000**

Jefferson County Facility

(a) Site Preparation

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Site Clearing	G1010120 1000	Remove trees & stumps up to 6" diameter by cut & chip & stump haul away	1 Acre	$ 7,150.00	1	$ 10,020.83
Site Earthwork	G1030120 1000	Excavate common earth, 1/2 CY backhoe, two 8 CY dump trucks, 1 MRT	Cubic Yard	$ 9.61	47,806	$ 15,504.10
					Subtotal	**$ 25,524.93**

(b) Infrastructure

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Enclosed Storage	501700-0010	Warehouses & Storage Buildings	Square Foot	$ 113.00	118,500	$ 13,390,500.00
Covered Storage	107316.20-1700	Metal canopies, aluminum prefinished, 12'x40'	Each	$ 17,347.50	247	$ 4,284,832.50
Silo	133453.50-0500	Steel, factory fab., 30,000 gallon capacity, painted, economy	Each	$ 30,500.00	1	$ 30,500.00
Paved Storage	321216.13-0020	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 1" Topping	Square Foot	$ 2.64	118,500	$ 312,840.00
Unpaved Storage	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$ 11.45	4,389	$ 50,252.78
Employee Parking	321216.13-0025	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 2" Topping	Square Foot	$ 3.12	16,205	$ 50,559.60
Office	501700-0010	Offices Low Rise (1 to 4 Story)	Square Foot	$ 176.00	5,783	$ 1,017,808.00
					Subtotal	**$19,137,292.88**

(c) Truck Access

Component	Item	Description	Unit	Unit Price	Quantity	Extended Cost

	Number					
Loading Dock	111319.10-3200	Dock Boards, 60"x60", aluminum, 15,000 lb. capacity	Each	$ 1,900.00	1	$ 1,900.00
	111319.10-4500	Dock leveler, hinged for trucks, 10 ton capacity, 6'x8'	Each	$ 6,975.00	1	$ 6,975.00
	111316.10-6300	Shelters, Fabric, for truck or train	Each	$ 3,775.00	1	$ 3,775.00
Pavement Under Loaded Trucks	321216.14-0030	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 3" Binder Course, 2" Topping	Square Foot	$ 3.57	13,210	$ 47,159.70
Truck Scales	108805.10-1640	Truck Scales, Digital, Electric, 60'x10' Platform	Each	$ 2,500.00	1	$ 52,500.00
	108805.10-2700	Concrete Foundation Pit, 70'x10' Platform, 40 C.Y. Required	Each	$ 9,200.00	1	$ 19,200.00
					Subtotal	**$ 131,509.70**

(d) ***Rail Access***

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Railroad Sidings	347216.50-0820	Wood ties and ballast, 100 lb. new rail	Linear Foot	$ 198.00	6,180	$ 1,223,640.00
Railroad Turnouts	347216.60-2300	Turnout, #8 complete, w/rails, plates, bars, frog, switch point, timbers, and ballast to 6" below bottom of ties	Each	$ 63,000.00	2	$ 126,000.00
					Subtotal	**$ 1,349,640.00**

(e) Barge Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost

Dredging	352023.23-110	Hydraulic method, pumped 1000' to shore dump maximum	B.C.Y.	$ 17.15	560	$ 9,604.00
Elevated Slab	03053.40-2700	Elevated Slab (4000 psi), one-way beam & slab, 125 psf sup. Load, 15' span	Cubic Yard	$ 1,100.00	267	$ 293,333.33
Concrete Caisson	316326.16-1500	Concrete caissons for marine construction; cased shafts, 140 to 175 ton capacity, 19" diameter, 40' depth	Vertical Linear Foot	$ 74.50	1,600	$ 119,200.00
Concrete Revetment	353119.18-0110	Concrete revetment matt 8'x20'x4-1/2", excluding site prep, includes all labor, material and equip. for installation	Each	$ 3,700.00	32	$ 116,550.00
Gravel Base Course	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$ 11.45	400	$ 4,580.00
					Subtotal	**$5 43,267.33**

(f) Equipment

Type	Estimated Price
Conveyor	-
Excavator	$ 210,000
Air Compressor	$ 45,000
Auger	$ 3,500.00
Wheel Loader	$ 152,500
Car Puller	-
Crane	-
Subtotal	**$ 411,000.00**

Hot Spring County Facility

(a) Site Preparation

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Site Clearing	G10101201000	Remove trees & stumps up to 6" diameter by cut & chip & stump haul away	1 Acre	$ 7,150.00	15.53	$ 111,012.86
Site Earthwork	G10301201000	Excavate common earth, 1/2 CY backhoe, two 8 CY dump trucks, 1 MRT	Cubic Yard	$ 9.61	50,098.11	$ 15,504.10
	G10301151000	Earth cut & fill, 80 HP dozer & compactor, 50' haul, 4" lift, 2 passes	Cubic Yard	$ 8.46	448,530.54	$ 13,648.77
					Subtotal	**$140,165**

(b) Infrastructure

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Covered Storage	107316.20-1700	Metal canopies, aluminum prefinished, 12'x40'	Each	$17,347.50	371.00	$6,435,922.50
Paved Storage	321216.13-0020	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 1" Topping	Square Foot	$2.64	177,750.0	$469,260.00
Unpaved Storage	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$11.45	6,583.33	$75,379.17
Employee Parking	321216.13-0025	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 2" Topping	Square Foot	$3.12	16,205.00	$50,559.60
Office	501700-0010	Offices Low Rise (1 to 4 Story)	Square Foot	$176.00	5,783.00	$1,017,808
					Subtotal	**$8,048,929.**

(c) Truck Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Loading Dock	111319.10-3200	Dock Boards, 60"x60", aluminum, 15,000 lb. capacity	Each	$1,900.00	1	$1,900.00
	111319.10-4500	Dock leveler, hinged for trucks, 10 ton capacity, 6'x8'	Each	$6,975.00	1	$6,975.00

	111316.10-6300	Shelters, Fabric, for truck or train	Each	$3,775.00	1	$3,775.00
Pavement Under Loaded Trucks	321216.14-0030	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 3" Binder Course, 2" Topping	Square Foot	$3.57	13,815.00	$49,319.55
Truck Scales	108805.10-1640	Truck Scales, Digital, Electric, 60'x10' Platform	Each	$52,500.00	1	$52,500.00
	108805.10-2700	Concrete Foundation Pit, 70'x10' Platform, 40 C.Y. Required	Each	$19,200.00	1	$19,200.00
					Subtotal	**$133,670**

(d) Rail Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Railroad Sidings	347216.50-0820	Wood ties and ballast, 100 lb. new rail	Linear Foot	$198.00	6,180.00	$ 1,223,640.00
Railroad Turnouts	347216.60-2300	Turnout, #8 complete, w/rails, plates, bars, frog, switch point, timbers, and ballast to 6" below bottom of ties	Each	$63,000.00	2	$ 126,000.00
Subtotal						**$ 1,349,640**

(e) Equipment

Type	Estimated Price
C Hook	$ 11,000.00
Car Puller	-
Crane	$ 1,100,000.00
Excavator	$ 210,000.00
Fork Lift	$ 77,500.00

Lift	$ 3,500.00
Ramp	$ 2,600.00
Roll Clamp	$ 2,000.00
Wheel Loader	$ 152,500.00
Subtotal	**$ 11,231,505**

Crawford/Sebastian County Facility

(a) Site Preparation

Component	Item Number	Description	Unit	Unit Price ($)	Quantity	Extended Cost
Site Clearing	G10101201000	Remove trees & stumps up to 6" diameter by cut & chip & stump haul away	1 Acre	7,150.00	1.40	$ 10,020.83
Site Earthwork	G10301201000	Excavate common earth, 1/2 CY backhoe, two 8 CY dump trucks, 1 MRT	Cubic Yard	9.61	47,806.44	$ 15,504.10
					Subtotal	**$ 25,524.93**

(b) Infrastructure

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Enclosed Storage	501700-0010	Warehouses & Storage Buildings	Square Foot	$113.00	118,500.00	$13,390,500.00
Covered Storage	107316.20-1700	Metal canopies, aluminum prefinished, 12'x40'	Each	$17,347.50	247.00	$4,284,832.50
Silo	133453.50-0500	Steel, factory fab., 30,000 gallon capacity, painted, economy	Each	$30,500.00	1	$30,500.00
Paved Storage	321216.13-0020	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 2" Binder Course, 1" Topping	Square Foot	$2.64	118,500.00	$312,840.00
Unpaved Storage	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$11.45	4,388.89	$50,252.78
					Subtotal	**$19,137,292.88**

(c) Truck Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Loading Dock	111319.10-3200	Dock Boards, 60"x60",	Each	$1,900.00	1	$1,900.00

		aluminum, 15,000 lb. capacity				
	111319.10-4500	Dock leveler, hinged for trucks, 10 ton capacity, 6'x8'	Each	$6,975.00	1	$6,975.00
	111316.10-6300	Shelters, Fabric, for truck or train	Each	$3,775.00	1	$3,775.00
Pavement Under Loaded Trucks	321216.14-0030	Asphalt Concrete Paving, Parking lots & driveways; 6" Stone Base, 3" Binder Course, 2" Topping	Square Foot	$3.57	13,210.00	$47,159.70
Truck Scales	108805.10-1640	Truck Scales, Digital, Electric, 60'x10' Platform	Each	$52,500.00	1	$52,500.00
	108805.10-2700	Concrete Foundation Pit, 70'x10' Platform, 40 C.Y. Required	Each	$19,200.00	1	$19,200.00
					Subtotal	**$131,510**

(d) Rail Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Railroad Sidings	347216. 50-0820	Wood ties and ballast, 100 lb. new rail	Linear Foot	$ 198.00	6,180.00	$ 1,223,640.00

Railroad Turnouts	347216.60-2300	Turnout, #8 complete, w/rails, plates, bars, frog, switch point, timbers, and ballast to 6" below bottom of ties	Each	$ 63,000.00	2	$ 126,000.00
Subtotal						**$1,349,640.00**

(e) Barge Access

Component	Item Number	Description	Unit	Unit Price	Quantity	Extended Cost
Dredging	352023.23-110	Hydraulic method, pumped 1000' to shore dump maximum	B.C.Y.	$17.15	560.00	$9,604.00
Elevated Slab	03053.40-2700	Elevated Slab (4000 psi), one-way beam & slab, 125 psf sup. Load, 15' span	Cubic Yard	$1,100.00	266.67	$293,333.33
Concrete Caisson	316326.16-1500	Concrete caissons for marine construction; cased shafts, 140 to 175 ton capacity, 19" diameter, 40' depth	Vertical Linear Foot	$74.50	1,600.00	$119,200.00
Concrete Revetment	353119.18-0110	Concrete revetment matt 8'x20'x4-1/2", excluding site prep, includes all labor, material and equip. for installation	Each	$3,700.00	31.50	$116,550.00
Gravel Base Course	321123.23-0303	Crushed 1-1/2" stone base, compacted to 8" deep	Square Yard	$11.45	400.00	$4,580.00
					Subtotal	**$543,267.33**

(f) Equipment

Type	Estimated Price
Conveyor	-
Excavator	$210,000.00
Air Compressor	$45,000.00
Auger	$3,500.00
Wheel Loader	$152,500.00
Car Puller	-
Crane	-
Subtotal	**$411,000.00**