Red River Navigation Study
Southwest Arkansas

Economics

Executive Summary

Interest in extending navigation along the Red River above Shreveport-Bossier City into southwest Arkansas led to a 2018 report by Gulf Engineers & Consultants (GEC) identifying bulk commodity movements by rail into and out of the study area that could possibly be diverted to the less expensive mode of barge. This information prompted interviews with potentially benefitting companies and ultimately contributed to a transportation rate analysis conducted by the University of Tennessee Knoxville Center for Transportation Research (UT-CTR).

According to UT-CTR's analysis, extending navigation to Garland, AR or Fulton, AR would shift 4,286,600 tons from rail to barge and produce annual shipper savings of $76,847,155 with an average shipper savings per ton of $17.93. Growing this annual shipper savings over the 50-year period of analysis according to commodity forecasts and using costs for a two-lock project (Garland) and a three-lock project (Fulton), B/C ratios of 1.77 and 1.14, respectively, were calculated at the 2019 Federal discount rate of 2.875%. A discount rate of 7% produced B/C ratios of 0.82 for the Garland alternative and 0.50 for the Fulton alternative.

Discount Rate (2.875%)	Garland (2 Locks)	Fulton (3 Locks)
B/C Ratio	1.77	1.14

Discount Rate (7%)	Garland (2 Locks)	Fulton (3 Locks)
B/C Ratio	0.82	0.50

Introduction

The purpose of the Red River Navigation Study is to determine the feasibility of extending navigation along the Red River above Shreveport-Bossier City into southwest Arkansas. Because water is fairly low during most of the year and negligible during the summer, the Red River above Shreveport is presently unsuitable for commercial navigation. Locks and dams will

need to be constructed to provide channel dimensions to support year round commercial navigation. Bank revetments, channel constriction, and stabilization dikes will also be needed to keep the channel in place. The feasibility of extending navigation will evaluate two heads of navigation: Garland and Fulton (both located in Arkansas). Garland, to the east of Texarkana, would require the construction of two locks; Fulton, which is north of Garland, would require the construction of three locks (Figure 1).

The primary national economic development (NED) benefits of a navigation project are transportation cost savings, and, in accordance with ER 1105-2-100, savings in resources from not having to use a more costly mode of transport qualifies as such a benefit. Since barges are a relatively low-cost transport mode, businesses and industries in the region that would be able to use the navigation project may realize reductions in their transportation costs by this shift of mode from rail to barge. This study will identify the potential users of navigation in the region, determine if their commodities can transition from rail to barge, and analyze the transportation cost reductions that would be achieved by switching to barge transport.

In 2007, Vicksburg District concluded that the Garland alternative (2 locks) was not economically justified with a B/C ratio of 0.75 to 1 at the Federal discount rate of 4.875 percent. After the publication of the study, the local sponsor (Arkansas Red River Commission) expressed several concerns regarding the prior transportation savings rate analysis. As a result, an agreement was reached to have the rate analysis conducted again through the USACE Planning Center of Expertise for Inland Navigation (PCXIN) using non-Federal sponsor contributed funds. GEC conducted the analysis and released the results in July 2018. Their findings are discussed in this study.
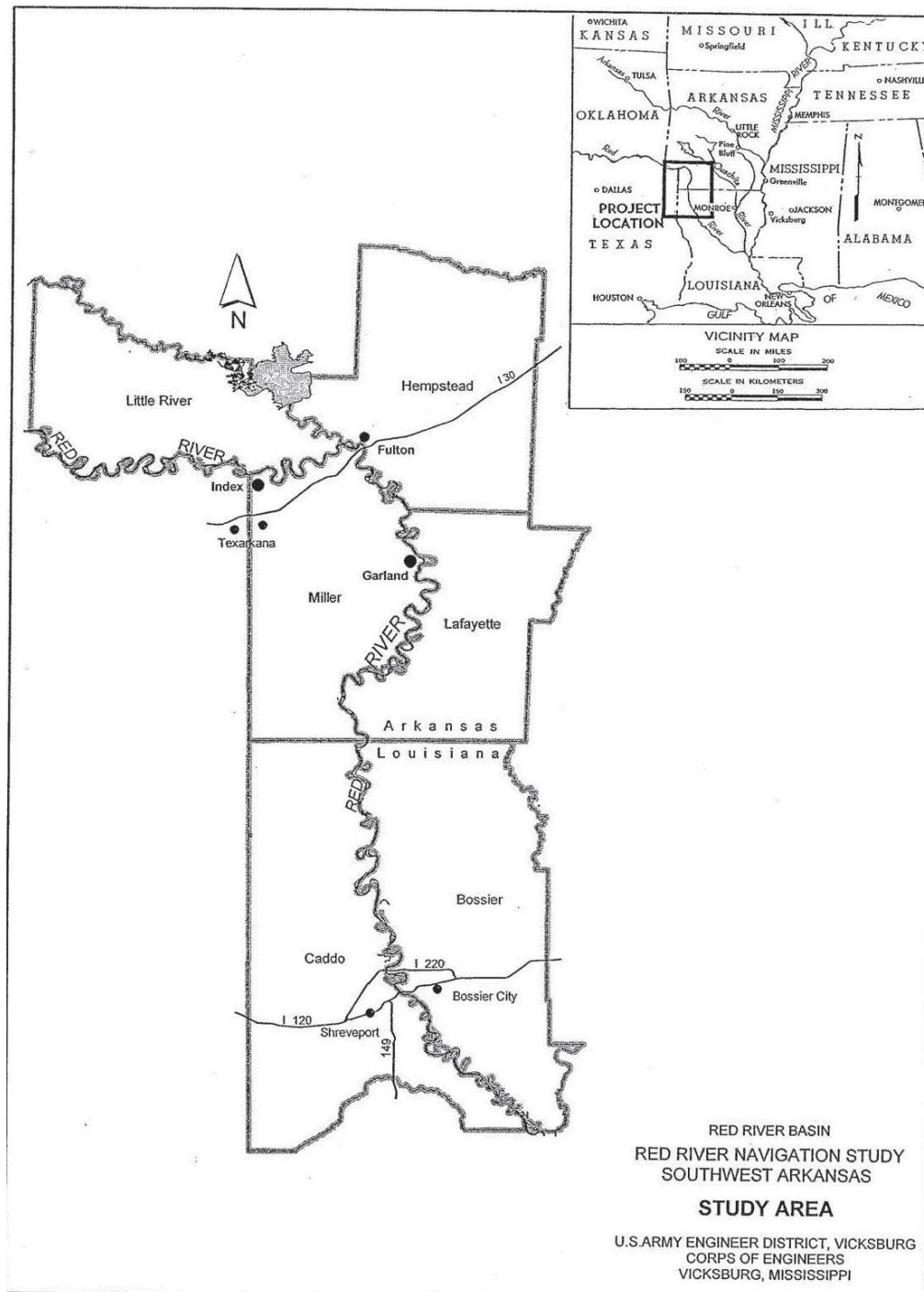
Figure 1: Project Location

Study Area

The 2007 analysis of Red River barge navigation extended beyond Shreveport, LA to the vicinity of Texarkana, TX and AR with specified counties in the states of Arkansas and Texas as the

geographic area of interest. The Red River continued hinterland included nine Arkansas counties (Columbia, Hempstead, Howard, Lafayette, Little River, Nevada, Pike, Polk, and Sevier) and nine Texas counties (Marion, Lamar, Morris, Camp, Red River, Titus, Franklin, Bowie, and Cass).

GEC's analysis expanded the 2007 study area (consisting of the two states and 18 counties listed above) to four states by including three other counties in Arkansas, twelve other counties and parishes in Texas, four counties in Oklahoma, and two parishes in Louisiana for a total of 39 counties. The three additional Arkansas counties are Miller, Clark, and Montgomery; the twelve additional Texas counties are Harrison, Upshur, Wood, Hopkins, Rains, Hunt, Collin, Fanning, Delta, Denton, Cooke, and Grayson. The four Oklahoma counties are Bryan, Choctaw, McCurtain, and Pushmataha; the two parishes from Louisiana are Caddo and Bossier. All 39 counties and parishes are listed in Table 1 and displayed in Figure 2.

Table 1: All Counties in the Study Area

| State	Counties
Arkansas	
2007 Counties:	Columbia, Hempstead, Howard, Lafayette, Little River, Nevada, Pike, Polk, and Sevier
Expanded Counties:	Miller, Clark, and Montgomery
Texas	
2007 Counties:	Marion, Lamar, Morris, Camp, Red River, Titus, Franklin, Bowie, and Cass
Expanded Counties:	Harrison, Upshur, Wood, Hopkins, Rains, Hunt, Collin, Fanning, Delta, Denton, Cooke, and Grayson
Oklahoma	Bryan, Choctaw, McCurtain, and Pushmataha
Louisiana	Caddo and Bossier
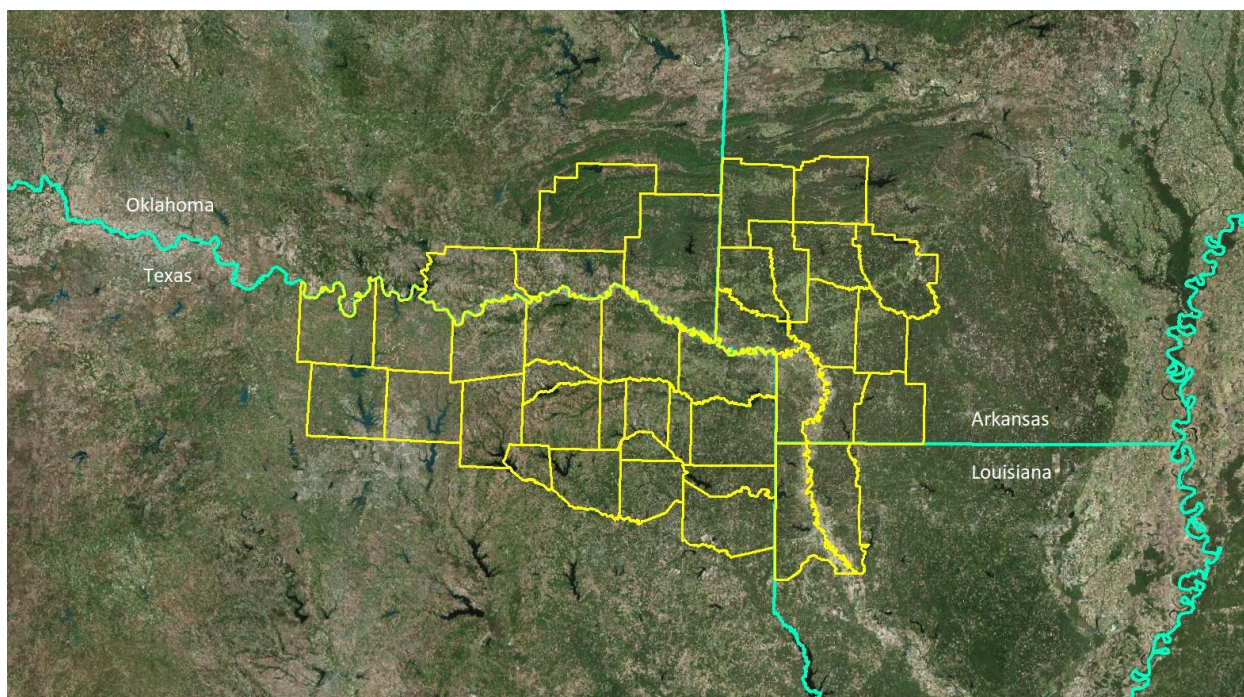
Figure 2: Map of All Counties in the Study Area

GEC Study[1]

GEC conducted a study entitled "Red River Navigation Study" that was submitted to the U.S. Army Corps of Engineers in July 2018. GEC's study described how bulk commodities moved by rail into and out of the Red River hinterland including the vicinity of Texarkana, TX and AR. Next, the study identified barge shipment size equivalent railroad movements that might be diverted to a navigable Red River navigation beyond Shreveport towards Texarkana. Ultimately this data was used by UT-CTR to complete a transportation rate analysis and calculate movement-specific shipper savings that would result from constructing the project.

In GEC's analysis, multiple car railroad shipments more than ten cars were used to approximate the 1,500 tons capacity of a standard dry bulk Mississippi River System barge. Additionally, the Carload Waybill Sample (CWS), a stratified sample of carload waybills for all U.S. rail traffic submitted by those rail carriers terminating 4,500 or more revenue carloads annually and compiled annually by the Surface Transportation Board (STB), was used as the source for railroad freight traffic data. For this study, data was taken from the CWS file for 2014.

To differentiate the railroad cargo flows, GEC established the following two hinterlands: the Mississippi River System hinterland and the national hinterland. The Mississippi River System

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[1] Parts of GEC's study have been directly incorporated into this report.

hinterland includes all states adjacent/near to the navigable portions of the river (Table 2), and the national hinterland encompasses the 48 contiguous states.

Table 2: States within Mississippi River System Hinterland

Alabama
Arkansas
Iowa
Illinois
Indiana
Kentucky
Louisiana
Minnesota
Missouri
Mississippi
Ohio
Pennsylvania
Tennessee
Texas
Wisconsin
West Virginia

Current Region Traffic Statistics

Mississippi River System Hinterland

Establishing the Mississippi River System hinterland helped identify rail movements within the CWS with either origin or destination close to the river and carried bulk commodities in multiple carload lot sizes generally regarded to be equivalent to barge. These categories of movements were chosen because it could be economically advantageous for them to switch to traveling on the extended navigation section of the Red River. Alternatively, if direct substitution of Mississippi River System hinterland origin and/or destination was not practical or economically feasible, it might be possible for the Red River continued hinterland shipper/receiver to use other markets or sources of supply such that the alternative use of Red River extended navigation would be economically feasible.[2] The results of the analysis of rail carloads shipped between the Mississippi River System hinterland states and the 39 counties contiguous to the Red River is summarized in tables 3 through 8.

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[2] Shipper interviews were critical inputs to identifying possible alternative markets for use of the waterway.

Table 3 depicts the total sampled carloads from the CWS that railroads delivered to the counties of interest in the four states of AR, LA, OK, and TX from the Mississippi River System hinterland states. Table 4 depicts the total sampled carloads from the CWS that railroads shipped from the counties of interest in the four states of AR, LA, OK and TX to the Mississippi River System hinterland states. According to this data, the counties of interest received almost three times as many tons from the Mississippi River System hinterland states as they shipped to the Mississippi River System hinterland states (12.1 million vs. 4.2 million).

Table 3: Total Railroad Commodity Tons Received by Counties of Interest FROM Mississippi River System Hinterland States

Destination State	Sum Of Number of Carloads	Sum Of Expanded Tons	Sum Of Expanded Carloads
AR	1,066	1,322,971	15,285
LA	6,487	3,333,225	37,236
OK	494	351,921	4,948
TX	16,970	7,114,721	71,065
Subtotal	25,017	12,122,838	128,534

Notes:
Sum of Number of Carloads = sample carloads in waybill sample
Sum of Expanded Tons -= estimated total shipping tons based on sampled carloads
Sum of Expanded Carloads = estimated total carloads based on sampled carloads

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 4: Total Railroad Commodity Tons Shipped by Counties of Interest TO Mississippi River System Hinterland States

Origin State	Sum Of Number of Carloads	Sum Of Expanded Tons	Sum Of Expanded Carloads
AR	3,779	2,119,765	21,562
LA	579	635,792	13,312
OK	1,278	800,721	9,887
TX	605	605,374	10,304
Subtotal	6,241	4,161,652	55,065

Notes:
Sum of Number of Carloads = sample carloads in waybill sample
Sum of Expanded Tons -= estimated total shipping tons based on sampled carloads
Sum of Expanded Carloads = estimated total carloads based on sampled carloads

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 5 shows the composition of the total 12.1 million tons received by the counties of interest from the Mississippi River System hinterland states as summarized in Table 3. Table 6 shows the composition of the total of 4.2 million tons shipped by the counties of interest to the Mississippi River System hinterland states as summarized in Table 4.[3] Table 5 and Table 6 suggest that major bulk commodity movements by rail both received and shipped by the counties of interest in the four states from the Mississippi River System hinterland states will be nonmetallic minerals, largely aggregate (rock, limestone, and sand) used for construction purposes.

Table 5: Cargo Tons Received by Railroad by Counties of Interest by Commodity Group (Two Digit STCC)
FROM Mississippi River System Hinterland States

STCC Two Digit Code	Expanded Tons
Farm Products	918,314
Metallic Ores	20,800
Coal	17,100
Crude Petroleum, Natural Gas or Gasoline	23,240
Nonmetallic Minerals; except Fuels	6,566,080
Ordnance or Accessories	3,672
Food or Kindred Products	839,140
Lumber or Wood Products; except Furniture	147,200
Pulp, Paper or Allied Products	106,480
Chemicals or Allied Products	528,624
Petroleum or Coal Products	92,400
Clay, Concrete, Glass or Stone Products	561,284
Primary Metal Products, including Galvanized; except Coating or other Allied Processing	1,044,600
Transportation Equipment	253,640
Waste or Scrap Materials Not Identified by Producing Industry	118,000
Miscellaneous Freight Shipments	18,008
Hazardous Wastes	49,400
Hazardous Materials	814,856
Total	12,122,838

Notes:

STCC Two Digit Code = Standard Transportation Commodity Code

Expanded Tons = estimated total tons based on commodity tons of sampled carloads

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

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[3] Total expanded tons in Table 6 are listed as 4,157,732 because all 4,161,652 tons were not able to be assigned to an STCC Two Digit Code.

Table 6: Cargo Tons Shipped by Railroad by Counties of Interest by Commodity Group (Two Digit STCC)
TO Mississippi River System Hinterland States

STCC Two Digit Code	Expanded Tons
Farm Products	27,824
Nonmetallic Minerals; except Fuels	1,471,142
Food or Kindred Products	47,560
Apparel, or Other Finished Textile Products or Knit Apparel	2,000
Lumber or Wood Products; except Furniture	302,640
Pulp, Paper or Allied Products	928,800
Chemicals or Allied Products	31,560
Petroleum or Coal Products	310,404
Clay, Concrete, Glass or Stone Products	555,756
Primary Metal Products, including Galvanized; except Coating or other Allied Processing	11,040
Transportation Equipment	113,678
Miscellaneous Products of Manufacturing	400
Waste or Scrap Materials Not Identified by Producing Industry	271,728
Miscellaneous Mixed Shipments	49,600
Hazardous Materials	33,600
Total	4,157,732

Notes:

STCC Two Digit Code = Standard Transportation Commodity Code

Expanded Tons = estimated total tons based on commodity tons of sampled carloads

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 7 depicts multiple rail car shipments traveling from the Mississippi River System hinterland states to the counties of interest. Identifying multiple rail car shipments is important since these shipments are approximately the amount of a large barge load. A total of 22,227 sampled multiple carloads shipments representing an estimated population of 58,893 expanded carloads and 6.445 million tons of cargo were moved from the Mississippi River System hinterland states to the counties of interest in the equivalent of single or multiple barge load shipment sizes (1,500 tons). Trains with 20 to 29 rail cars represent approximately one to two barge loads of dry bulk cargo (1,500 to 3,000 tons); trains with approximately 100 cars represent between five to eight barge loads (7,500 to 12,000 tons).

Multiple barge load equivalent rail car shipments from the Mississippi River System hinterland states to the counties of interest account for a substantial volume of cargo, namely 6.445 million tons and a relatively large number of reoccurring shipments. The numbers of shipments for the

size categories of carloads suggest that in some instances the average volumes are weekly during the course of a full calendar year (carloads of size 70-79 and 90-99). Table 7 provides evidence of large rail car movements between the Mississippi River System hinterland states and the counties of interest equivalent to at least single but often multiple barge load volumes.

Table 7: Distribution of Rail Carloads by Shipment Size (Number of Carloads) TO the Counties of Interest from the Mississippi River System Hinterland States

Number of Carloads	Sample Carloads	Expanded Carloads	Expanded Tons	Shipments
20-29	182	728	55,316	8
30-39	94	376	19,568	3
40-49	283	1,132	110,560	7
50-59	405	1,620	178,548	8
60-69	985	3,675	397,015	16
70-79	3,574	10,722	1,125,951	50
80-89	1,360	4,080	459,411	16
90-99	5,272	15,816	1,768,587	58
100-109	7,625	15,850	1,774,186	75
110-119	220	440	44,132	2
120-129	2,227	4,454	511,504	18
Total	22,227	58,893	6,444,778	261

Notes:

Number of Carloads = shipment size

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads

Expanded Tons = estimated total shipping tons based on sampled carloads

Shipments = number of samples of movements for each group of carload shipment sizes

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 8 depicts the large barge load shipment sizes of multiple rail cars to the Mississippi River System hinterland states from the counties of interest. A total of 4,848 sampled carloads for shipments of multiple carloads representing an estimated population of 16,377 expanded carloads and 1.643 million tons of cargo were moved to the Mississippi River System hinterland states from the counties of interest in the equivalent of single or multiple barge load shipment sizes (1,500 tons).

Multiple barge load equivalent rail car shipments to the Mississippi River System hinterland states from the counties of interest account for an annual volume of cargo in excess of 1.6 million tons and a relatively large number of reoccurring shipments. Table 8 provides further evidence of some large rail car movements between the Mississippi River System hinterland

states and the counties of interest equivalent to at least single but often multiple barge load volumes.

Table 8: Distribution of Rail Carloads by Shipment Size (Number of Carloads) FROM the Counties of Interest to the Mississippi River System Hinterland States

Number of Carloads	Sample Carloads	Expanded Carloads	Expanded Tons	Shipments
20-29	88	352	20,296	4
30-39	241	968	87,028	7
40-49	0	0	0	0
50-59	1,500	6,000	636,344	30
60-69	851	2,553	208,236	13
70-79	363	1,089	86,247	5
80-89	435	1,305	149,364	5
90-99	1,370	4,110	455,364	5
Total	4,848	16,377	1,642,879	69

Notes:

Number of Carloads = shipment size

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads

Expanded Tons = estimated total shipping tons based on sampled carloads

Shipments = number of samples of movements for each group of carload shipment sizes

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

National Hinterland

Examining the rail movements that occurred between the U.S. (national) hinterland and the 39 counties of interest made it possible to identify commodities moving to or from other rail markets that might be divertible to a barge market origin destination. Expanding the geographic origins and destinations of national rail shipments to and from the counties of interest allows for the full universe of rail shipments to be identified beyond the Mississippi River System hinterland. If there are substitutes of alternative waterborne movements for existing rail movements to and from the counties of interest, it is possible that movements from the national hinterland could shift to use the waterway. Shipper interviews would be of paramount importance in determining these market shifts. For example, plants within the counties of interest may switch to barge sourced Appalachian coal in place of Wyoming Powder River Basin coal that is rail dependent.

The results of the analysis of rail carloads shipped between the nation and the counties of interest contiguous to the Red River will be summarized in tables 9 through 15. Table 9 indicates the total annual rail cargo tons terminating and originating in the counties of interest are 28.4 and 7.6 million, respectively, in 2014. Total rail cargo tonnage inbound (terminating) and outbound (originating) for the counties of interest was 36.0 million.

Table 9: Total Rail Cargo Tons Originating and Terminating in Counties of Interest, 2014

In/Outbound	Total Tons (000,000)
Terminating	28.4
Originating	7.6
Total	36.0

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 10 indicates that the 28.4 million tons of rail cargo terminating in the region was primarily to the Texas counties of interest (17.8 million), followed by Louisiana (4.8 million), Arkansas (3.7 million), and Oklahoma (2.1 million). Table 11 indicates that the 7.6 million tons of rail cargo originating in the region was shared nearly evenly between Arkansas (2.3 million) and Louisiana (2.1 million) and to a lesser extent Texas (1.8 million) and Oklahoma (1.3 million).

Table 10: Total Rail Cargo Tons Terminating (Inbound) in Counties of Interest, 2014

In/Outbound	Total Tons (000,000)
Arkansas	3.7
Louisiana	4.8
Oklahoma	2.1
Texas	17.8
Total	28.4

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 11: Total Rail Cargo Tons Originating (Outbound) in Counties of Interest, 2014

In/Outbound	Total Tons (000,000)
Arkansas	2.3
Louisiana	2.1
Oklahoma	1.3
Texas	1.8
Total	7.6

Tables 9, 10, and 11 indicate that the counties of interest are primarily an inbound market for rail. Total annual rail cargo tons terminating in the counties of interest is nearly four times greater than the rail cargo tons originating in the counties of interest (28.4/7.6 = 3.74). Tables 12 through 15 focus on the largest rail tonnage commodity movements between the counties of interest and the nation for terminating (inbound) and originating (outbound) movements.

Table 12 identifies the major rail bulk commodity tonnages shipped into the counties of interest from the nation. The major bulk commodities received by rail from the nation are coal (13.3 million tons), stone (6.5 million tons), corn (1.053 million tons), and cement (0.724 million tons).

Table 12: Major Rail Commodity Tons Destination Market Assessments to Counties of Interest

State	Commodity	State Tons (000,000)
Arkansas	Coal	2.100
Oklahoma	Coal	1.600
Texas	Coal	9.600
Subtotal	Coal	13.300
Louisiana	Stone	2.200
Texas	Stone	4.300
Subtotal	Stone	6.500
Arkansas	Corn	0.262
Oklahoma	Corn	0.181
Texas	Corn	0.610
Subtotal	Corn	1.053
Arkansas	Cement	0.184
Louisiana	Cement	0.088
Texas	Cement	0.452
Subtotal	Cement	0.724
Total		21.577

Notes: Inbound to the counties of interest.

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Coal rail shipments to the counties of interest move primarily to Texas (9.6 million tons), Arkansas (2.1 million tons) and Oklahoma (1.6 million tons). Stone rail shipments to the counties of interest are primarily to Texas (4.3 million tons) and Louisiana (2.2 million tons). Corn rail shipments to the counties of interest are about one million tons total, primarily to Texas (0.610 million tons), Arkansas (0.262 million tons) and Oklahoma (0.181 million tons). Cement shipments by rail to the counties of interest are about three- quarters of one million tons (0.724 million), primarily to Texas (0.452 million tons) and considerably smaller amounts to Arkansas (0.184 million tons) and Louisiana (0.088 million tons).

Table 13 identifies the major rail bulk commodity tonnages shipped from the counties of interest to the nation. The major bulk commodities shipped from the counties of interest are sand and stone (1.406 million tons), pulp (1.550 million tons), and cement (0.431 million tons).

Table 13: Major Rail Commodity Tons Origin Market Assessments from Counties of Interest

State	Commodity	State Tons (000,000)
Arkansas	Sand/Stone	1.100
Oklahoma	Sand/Stone	0.306
Subtotal	Sand/Stone	1.406
Arkansas	Pulp	0.225
Oklahoma	Pulp	0.935
Texas	Pulp	0.390
Subtotal	Pulp	1.550
Arkansas	Cement	0.431
Total		3.387

Notes: Outbound from the counties of interest.

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Sand and stone shipments by rail from the counties of interest are primarily from Arkansas (1.1 million tons) and Oklahoma (0.306 million tons). Pulp rail shipments from the counties of interest traveled primarily to Oklahoma (0.935 million tons), Texas (0.390 million tons), and Arkansas (0.225 million tons). Cement rail shipments from the counties of interest mostly came from Arkansas (0.431 million tons).

Table 14 depicts the most important bulk commodities moving by rail into the counties of interest including coal (13.3 million tons), stone (6.5 million tons), corn (1.053 million tons), and cement

(0.724 million tons). The total tons of the four major bulk commodities moved by rail into the region are 21.577 million with coal accounting for approximately 62 percent of total inbound rail tonnage.

The data in Table 14 indicates that a predominance of the rail commodity tons shipped from the nation to the counties of interest is bulk cargo from the perspective of barge. Of the total 28.456 million tons of rail cargo moved into the region from the nation, slightly more than three-quarters (21.577 / 28.456= 0.76 percent) is considered to be bulk cargo (coal, stone, corn, and cement). .

Table 14: Summary of Major Rail Commodity Markets Inbound to the Counties of Interest

Commodity	Tons (000,000)
Coal	13.300
Stone	6.500
Corn	1.053
Cement	0.724
Subtotal	21.577
All Inbound	28.456

Notes: Inbound from the counties of interest

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 15 depicts the most important bulk commodities moved by rail from the counties of interest. The major bulk commodities moving by rail from the region include pulp (1.55 million tons), sand/stone (1.406 million tons), and cement (0.431 million tons). The total tons of the three major bulk commodities moved by rail to the nation from the region are 3.387 million. If pulp is excluded from the total rail tons of bulk commodities moved to the nation from the region, the total tonnage of sand/stone and cement is 1.837 million.

Table 15: Summary of Major Rail Commodity Markets Outbound from the Counties of Interest

Commodity	Tons (000,000)
Pulp	1.550
Sand/Stone	1.406
Cement	0.431
Subtotal	3.387
Sum Ex Pulp	1.837
All Outbound	7.567

Notes: Outbound from the counties of interest

The data in Table 15 indicates that slightly less than one-half of total rail commodity tons shipped from the counties of interest to the nation are bulk cargo (3.387/7.567 = 0.45). Nearly one-half of total rail bulk cargo tons shipped from the region to the nation is pulp (1.550/3.387 = 0.46). To the extent that pulp is not readily handled by barge, the amount of bulk cargo moving by rail from the region to the nation will be small, less than two million tons (1.406 + 0.431 = 1.837).

Further disaggregation of the CWS was conducted on the individual county/parish and city locations to identify potential rail movements that could be transferred to barges if that option was available. However, public documentation of this analysis could potentially divulge confidential information. Therefore, the above sections serve as a basis for the effort performed to identify potential movements and companies to be surveyed for the transportation rate analysis for the without and with project conditions. What can be seen from the above sections are the industries and commodities that drive the local economies of the counties and parishes within the four state area of interest.

The information gathered from the extensive analysis of the CWS as well as a review of industry directories and local input of chambers of commerce and industry groups led to a diverse list of potential companies located within the four state area of interest. Those interviews were conducted over the period of one year with the results ultimately being used to conduct the transportation benefits discussed in the following section. The data resulting from those surveys is also considered to be confidential and will not be released to the public in order to protect the responders' business interests.

Red River Shipper Rate Analysis

The transportation rate analysis was conducted by UT-CTR. The section below summarizes both UT-CTR's methods and findings regarding the potential transportation benefits of extending Red River commercial navigation from its current terminus at Shreveport to a new terminus at Fulton, Arkansas located in the vicinity of Texarkana, AR and TX.

Subject Traffic

Using CWS data and shipper interviews, UT-CTR identified 13 businesses and 25 unique freight traffic flows that might benefit from extending navigation from Shreveport to Texarkana. Summary statistics for this traffic are provided in Table 16. As this table indicates, potential traffic is dominated by Farm Products and Non-Metallic Minerals (combined total of 60 percent), with the remaining tonnage being divided relatively evenly between seven additional commodity

groups. Roughly two-thirds (63 percent) of the subject traffic originates within the study area and terminates elsewhere, while the other one-third is inbound traffic. Similarly, one-third of the traffic is moved by rail and two-thirds is currently moved via truck-only routings.

Table 16: Traffic Summary

Commodity Description	Study Tonnage[1]	Share
Farm Products	1,536,600	35.8%
Non-Metallic Minerals	1,060,000	24.7%
Food & Kindred Products	266,000	6.2%
Lumber & Wood Products	250,000	5.8%
Pulp, Paper & Paper Products	543,000	12.7%
Chemicals	145,000	3.4%
Concrete, Clay, Glass & Stone	200,000	4.7%
Primary Metal Products	170,000	4.0%
Scrap Material	116,000	2.7%
TOTAL (All Commodities)	4,286,600	100.0%
Inbound Tons	1,591,600	37.1%
Outbound Tons	2,695,000	62.9%
Currently Rail	1,402,046	32.7%
Currently Truck	2,884,554	67.3%

[1] Commodity tonnage for year 2017.

Benefits

Calculating potential project benefits requires the comparison of the transportation costs currently incurred by shippers with the costs that would be achievable if the proposed project is developed. These are referred to as *with* and *without* project costs.

Without-Project Cost

When shippers indicated an all-truck movement for existing routings, motor-carrier charges were estimated through costing tools based on the American Transportation Research Institute's (ATRI) annual motor carrier cost data. For line-haul rail movements, shipper charges were modeled through an application of Surface Transportation Board (STB) waybill data. Both methods were recently developed and are fully described within the context of a study performed on behalf of the National Waterways Foundation and the USDOT's Maritime Administration (MARAD).[4]

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[4] See, "The Impacts of Unscheduled Lock Closures," National Waterways Foundation and U.S. Department of Transportation, Maritime Administration, October 2017.

With-Project Cost

Evaluating shipper costs in the wake of the proposed project's development required the development of hypothetical, barge-inclusive routings. In most cases, these movements involved the transloading of cargoes at Fulton, Arkansas.[5] Inbound traffic was routed from a water origin to Fulton, transloaded to truck, then moved to final destinations. Outbound freight required the reverse of this. Motor carrier costs were calculated using the same methods described for the without-project estimates. Waterborne costs were estimated by applying the U.S. Corps of Engineers' Barge Costing Model (BCM). Finally, transloading cost estimates were based on assessorial data developed for use in past Corps studies.

Calculating Shipper Savings

Calculating movement-specific shipper savings involves simply subtracting the with-project costs from the without-project shipper costs. Although shipper savings were developed according to the transloading of cargoes at Fulton, it was determined that approximately the same level of savings are applicable to the Garland alternative and thus were kept the same. The results of this process are reported in Table 17 at 2017 price levels.

Table 17: Shipper Savings by Commodity Group

Commodity Description	Study Tonnage	Annual Savings	Average Savings Per Ton[1]
Farm Products	1,536,600	$24,808,883	$16.89
Non-Metallic Minerals	1,060,000	$15,361,775	$18.45
Food & Kindred Products	266,000	$2,168,958	$8.15
Lumber & Wood Products	250,000	$8,446,900	$33.21
Pulp, Paper & Paper Products	543,000	$13,580,083	$24.70
Chemicals	145,000	$4,195,575	$28.94
Concrete, Clay, Glass & Stone	200,000	$2,546,060	$12.73
Primary Metal Products	170,000	$2,806,890	$14.75
Scrap Material	116,000	$2,932,032	$25.28
TOTAL (All Commodities)	**4,286,600**	**$76,847,155**	

[1] Some commodity descriptions comprise more than a single commodity. Therefore, the average savings per ton is not simply the annual savings divided by the tonnage.

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[5] Fulton was chosen as the transloading point primarily because of its access to I-30. Garland, however, is a viable location as well with its access to US Highway 82.

Because it is unlikely the total tonnage of 4,286,600 shown in Table 17 will be transferred from rail to barge immediately after construction of the project, tonnage is grown from zero to this amount over a five-year period (years 2017 – 2021). The annual shipper savings of $76,847,155 likewise is grown to this amount over the same time period. Using the *Annual Energy Outlook 2018 (AEO2018)* by the U.S. Energy Information Administration (EIA) and the *USDA Agricultural Projections to 2027* by the United States Department of Agriculture, growth was then projected for the nine commodity groups listed above. Because long-term projections are uncertain at best and because there is risk in extending forecasts beyond their intended scope, the growth rates for this study are kept constant up to year 2058 (25 years after the base year of 2034), after which no growth is assumed until the end of the study's scope in 2083. The tonnage and the annual savings for each commodity category were multiplied by their corresponding compound annual growth rates and then summed for each year of the project's period of analysis.

Compound annual growth rates are shown in Table 18. Projected annual tonnage and projected annual savings are shown in Table 19. Projected annual tonnage for each commodity category is shown in Figure 3.

Table 18: Compound Annual Growth Rate

Farm Products[1]	1.5%
Non-Metallic Minerals[2]	0.5%
Food & Kindred Products[1]	2.4%
Lumber & Wood Products[2]	1.1%
Pulp, Paper & Paper Products[2]	1.1%
Chemicals[2]	0.7%
Concrete, Clay, Glass & Stone[2]	1.1%
Primary Metal Products[2]	1.1%
Scrap Material[2]	1.1%

[1] Source is *USDA Agricultural Projections to 2027 (*Feb 2018).

[2] Source is *Annual Energy Outlook 2018 with Projections to 2050* (Feb 2018).

Table 19: Projected Annual Tonnage &Savings

Year	Tons	Savings
2017	857,320	$ 15,369,431
2018	1,714,640	$ 30,738,862
2019	2,571,960	$ 46,108,294
2020	3,429,280	$ 61,477,725
2021	4,286,600	$ 76,847,155

2022	4,337,087	$ 77,724,453
2023	4,388,280	$ 78,613,194
2024	4,440,190	$ 79,513,544
2025	4,492,829	$ 80,425,669
2026	4,546,207	$ 81,349,740
2027	4,600,336	$ 82,285,928
2028	4,655,229	$ 83,234,409
2029	4,710,897	$ 84,195,361
2030	4,767,354	$ 85,168,963
2031	4,824,610	$ 86,155,401
2032	4,882,681	$ 87,154,858
2033	4,941,577	$ 88,167,526
2034	5,001,313	$ 89,193,596
2035	5,061,902	$ 90,233,263
2036	5,123,357	$ 91,286,726
2037	5,185,693	$ 92,354,187
2038	5,248,925	$ 93,435,849
2039	5,313,065	$ 94,531,921
2040	5,378,129	$ 95,642,614
2041	5,444,133	$ 96,768,143
2042	5,511,090	$ 97,908,726
2043	5,579,018	$ 99,064,584
2044	5,647,930	$ 100,235,942
2045	5,717,845	$ 101,423,030
2046	5,788,777	$ 102,626,078
2047	5,860,744	$ 103,845,325
2048	5,933,763	$ 105,081,008
2049	6,007,850	$ 106,333,373
2050	6,083,023	$ 107,602,666
2051	6,159,301	$ 108,889,139
2052	6,236,701	$ 110,193,049
2053	6,315,242	$ 111,514,655
2054	6,394,943	$ 112,854,221
2055	6,475,823	$ 114,212,015
2056	6,557,902	$ 115,588,310
2057	6,641,199	$ 116,983,383
2058	6,725,734	$ 118,397,517
2059	6,725,734	$ 118,397,517
2060	6,725,734	$ 118,397,517
2061	6,725,734	$ 118,397,517
2062	6,725,734	$ 118,397,517
2063	6,725,734	$ 118,397,517
2064	6,725,734	$ 118,397,517
2065	6,725,734	$ 118,397,517
2066	6,725,734	$ 118,397,517
2067	6,725,734	$ 118,397,517

2068	6,725,734	$ 118,397,517
2069	6,725,734	$ 118,397,517
2070	6,725,734	$ 118,397,517
2071	6,725,734	$ 118,397,517
2072	6,725,734	$ 118,397,517
2073	6,725,734	$ 118,397,517
2074	6,725,734	$ 118,397,517
2075	6,725,734	$ 118,397,517
2076	6,725,734	$ 118,397,517
2077	6,725,734	$ 118,397,517
2078	6,725,734	$ 118,397,517
2079	6,725,734	$ 118,397,517
2080	6,725,734	$ 118,397,517
2081	6,725,734	$ 118,397,517
2082	6,725,734	$ 118,397,517
2083	6,725,734	$ 118,397,517
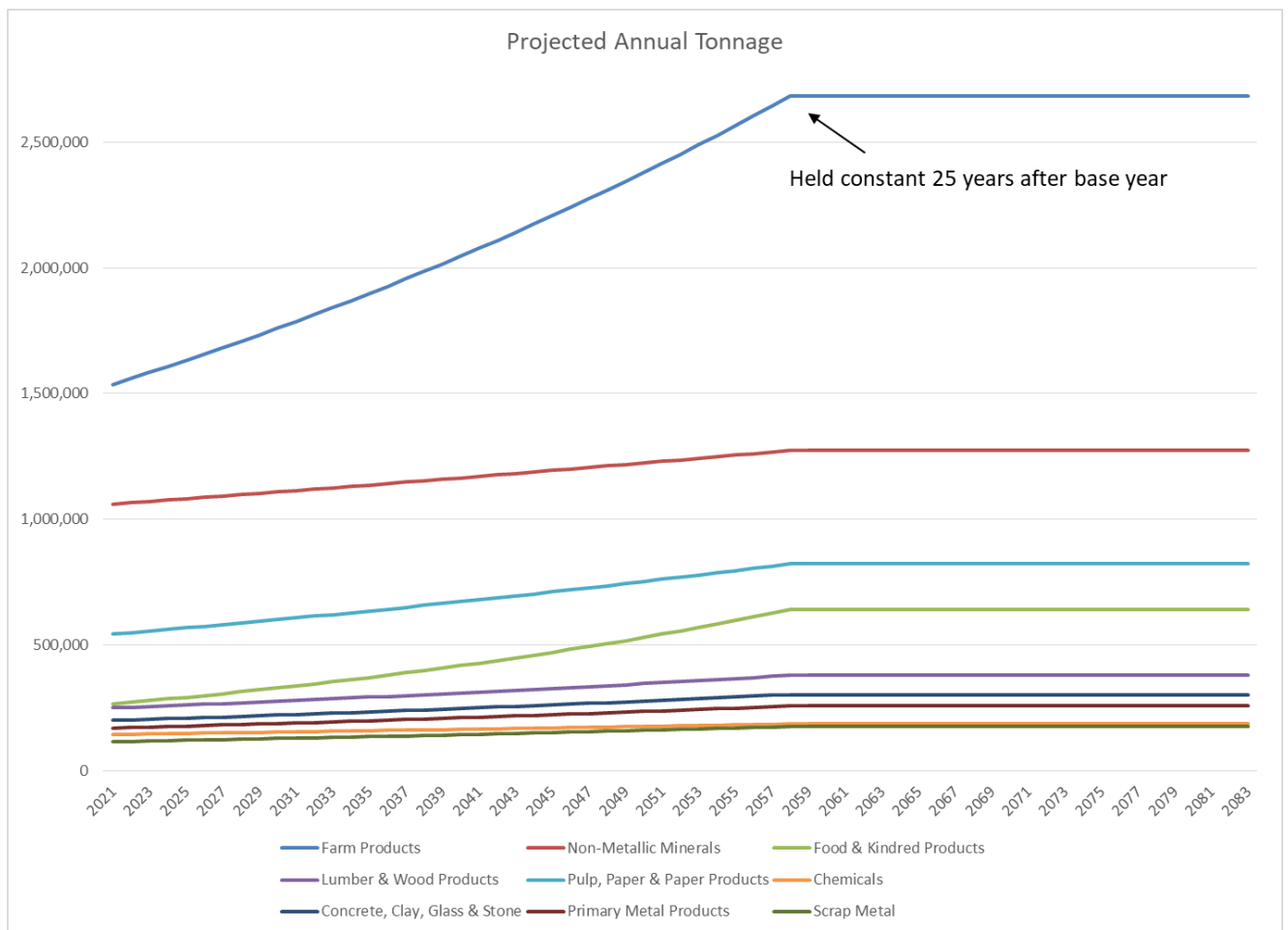
Figure 3: Projected Annual Tonnage for Commodity Categories

Benefit streams for the 50-year period of analysis and the calculation of average annual benefits are shown in Table 20. Benefits reflect 2018 price levels and were annualized at the 2019 Federal discount rate of 2.875% using a mid-year construction period.

Table 20: Average Annual Benefits (2.875%, 2018 Price Levels)

Year	Year	Navigation Benefits	Present Value
2025	-8.5		
2026	-7.5		
2027	-6.5		
2028	-5.5		
2029	-4.5		
2030	-3.5		
2031	-2.5		
2032	-1.5		
2033	-0.5		
2034	0.5	$ 89,193,596	$ 87,938,438
2035	1.5	$ 90,233,263	$ 86,477,254
2036	2.5	$ 91,286,726	$ 85,041,911
2037	3.5	$ 92,354,187	$ 83,631,930
2038	4.5	$ 93,435,849	$ 82,246,839
2039	5.5	$ 94,531,921	$ 80,886,178
2040	6.5	$ 95,642,614	$ 79,549,494
2041	7.5	$ 96,768,143	$ 78,236,344
2042	8.5	$ 97,908,726	$ 76,946,291
2043	9.5	$ 99,064,584	$ 75,678,909
2044	10.5	$ 100,235,942	$ 74,433,779
2045	11.5	$ 101,423,030	$ 73,210,492
2046	12.5	$ 102,626,078	$ 72,008,644
2047	13.5	$ 103,845,325	$ 70,827,840
2048	14.5	$ 105,081,008	$ 69,667,693
2049	15.5	$ 106,333,373	$ 68,527,824
2050	16.5	$ 107,602,666	$ 67,407,859
2051	17.5	$ 108,889,139	$ 66,307,434
2052	18.5	$ 110,193,049	$ 65,226,190
2053	19.5	$ 111,514,655	$ 64,163,775
2054	20.5	$ 112,854,221	$ 63,119,844
2055	21.5	$ 114,212,015	$ 62,094,060
2056	22.5	$ 115,588,310	$ 61,086,090
2057	23.5	$ 116,983,383	$ 60,095,610
2058	24.5	$ 118,397,517	$ 59,122,299

2059	25.5	$ 118,397,517	$ 57,470,035
2060	26.5	$ 118,397,517	$ 55,863,947
2061	27.5	$ 118,397,517	$ 54,302,743
2062	28.5	$ 118,397,517	$ 52,785,169
2063	29.5	$ 118,397,517	$ 51,310,007
2064	30.5	$ 118,397,517	$ 49,876,070
2065	31.5	$ 118,397,517	$ 48,482,206
2066	32.5	$ 118,397,517	$ 47,127,296
2067	33.5	$ 118,397,517	$ 45,810,252
2068	34.5	$ 118,397,517	$ 44,530,014
2069	35.5	$ 118,397,517	$ 43,285,554
2070	36.5	$ 118,397,517	$ 42,075,873
2071	37.5	$ 118,397,517	$ 40,899,998
2072	38.5	$ 118,397,517	$ 39,756,985
2073	39.5	$ 118,397,517	$ 38,645,915
2074	40.5	$ 118,397,517	$ 37,565,895
2075	41.5	$ 118,397,517	$ 36,516,058
2076	42.5	$ 118,397,517	$ 35,495,561
2077	43.5	$ 118,397,517	$ 34,503,583
2078	44.5	$ 118,397,517	$ 33,539,327
2079	45.5	$ 118,397,517	$ 32,602,019
2080	46.5	$ 118,397,517	$ 31,690,906
2081	47.5	$ 118,397,517	$ 30,805,255
2082	48.5	$ 118,397,517	$ 29,944,354
2083	49.5	$ 118,397,517	$ 29,107,513
TOTAL PRESENT VALUE ==>			$ 2,857,925,556
AVERAGE ANNUAL BENEFIT ==>			**$ 108,452,805**

Federal	Fraction	Decimal
Discount Rate	2 7/8	2.875
0.037948	50 Yr. Amortization Factor	

Project Costs

Table 21 shows the construction costs for the Garland alternative (2 locks) and the Fulton
alternative (3 locks). Lock size and cost were based on existing locks (Lock & Dam #4 and #5)
on the J Bennett Johnston Waterway with dimensions 705 ft. by 84 ft. An index factor of 2.1
from the Civil Works Construction Cost Index System (CWCCIS) EM 1110-2-1304 was used to
update the 1992 construction costs to 2018 levels. For relocations, an index factor of 1.4
(CWCCIS) was used to update the cost from the original study estimate in 2005 to 2018 levels.
Table 22 and Table 23 show the NED costs for the Garland alternative (2 locks) and the Fulton

alternative (3 locks). Values are at 2018 price levels and amortized at the 2019 Federal discount rate of 2.875% using a mid-year construction period.

Table 21: Construction Costs

Description	Garland (2 Locks)	Fulton (3 Locks)
Lands and Damages	$ 9,902,364	$ 14,400,146
Relocations	$ 105,422,263	$ 209,438,408
Dams	$ 176,054,294	$ 258,296,311
Locks	$ 463,262,218	$ 696,160,048
Bank Stabilization	$ 411,610,281	$ 575,152,259
Planning, Engineering and Design	$ 143,879,950	$ 200,925,355
Construction Management	$ 76,165,650	$ 113,634,375
TOTAL	**$ 1,386,297,018**	**$ 2,068,006,898**
Annual Operations & Maintenance (O&M)	$ 4,020,000	$ 5,880,000

Table 22: Garland Alternative (2 Locks)

Year	Year	Construction	Annual O&M	Present Value of Costs
2025	-8.5	-	-	-
2026	-7.5	-	-	-
2027	-6.5	-	-	-
2028	-5.5	$ 231,049,503	-	$ 270,028,251
2029	-4.5	$ 231,049,503	-	$ 262,481,897
2030	-3.5	$ 231,049,503	-	$ 255,146,437
2031	-2.5	$ 231,049,503	-	$ 248,015,977
2032	-1.5	$ 231,049,503	-	$ 241,084,790
2033	-0.5	$ 231,049,503	-	$ 234,347,305
TOTAL		$ 1,386,297,018	-	-
TOTAL PRESENT VALUE ==>				$ 1,618,550,866
FIRST COST ==>				$ 1,386,297,018
INTEREST DURING CONSTRUCTION ==>				$ 124,807,638
AVERAGE ANNUAL COST ==>				**$ 61,420,907**

Note: Annual O&M costs over the 50-year period of analysis are $4,020,000 and begin in year 2034.

Table 23: Fulton Alternative (3 Locks)

Year	Year	Construction	Annual O&M	Present Value of Costs
2025	-8.5	$ 229,778,544	-	$ 292,376,985
2026	-7.5	$ 229,778,544	-	$ 284,206,061
2027	-6.5	$ 229,778,544	-	$ 276,263,486
2028	-5.5	$ 229,778,544	-	$ 268,542,878
2029	-4.5	$ 229,778,544	-	$ 261,038,034
2030	-3.5	$ 229,778,544	-	$ 253,742,925
2031	-2.5	$ 229,778,544	-	$ 246,651,689
2032	-1.5	$ 229,778,544	-	$ 239,758,629
2033	-0.5	$ 229,778,544	-	$ 233,058,205
TOTAL		$ 2,068,006,898	-	-
TOTAL PRESENT VALUE ==>				$ 2,512,799,021
FIRST COST ==>				$ 2,068,006,898
INTEREST DURING CONSTRUCTION ==>				$ 287,631,994
AVERAGE ANNUAL COST ==>				$ 95,355,913

Note: Annual O&M costs over the 50-year period of analysis are $5,880,000 and begin in year 2034.

Results

Net Benefits and Benefit-Cost Ratio

Having calculated the benefits and costs associated with extending navigation along the Red River, identification of the proposed alternative requires a comparison of the average annual net benefits resulting from each location. In accordance with USACE guidance (ER 1105-2-100), a project is considered worthwhile if its benefits exceed its costs and is considered optimal if it produces the greatest excess of benefits over costs. Table 24 contains the NED annual costs and benefits for the Garland alternative (2 locks) and the Fulton alternative (3 locks) as well as the resulting net benefits and benefit-cost ratios at the 2019 Federal discount rate of 2.875%. Although both alternatives generate positive net benefits, the Garland alternative produces the greater amount with average annual net benefits totaling $47,032,000 and a corresponding B/C ratio of 1.77 to 1.

Table 24: Average Annual Benefits and Costs (2.875%)

Average Annual Benefits and Costs (2.875%)

Alternative	Garland (2 Locks)	Fulton (3 Locks)
First Cost of Construction	$ 1,386,297,000	$ 2,068,007,000
Interest During Construction	$ 124,808,000	$ 287,632,000
Total Investment	$ 1,511,105,000	$ 2,355,639,000
Average Annual Const. Cost	$ 57,344,000	$ 89,392,000

Average Annual Increm. O&M	$	4,077,000	$	5,964,000
Total Average Annual Cost	$	61,421,000	$	95,356,000
Total Average Annual Benefits	$	108,453,000	$	108,453,000
Net Excess Benefits	$	47,032,000	$	13,097,000
B/C Ratio		1.77		1.14

7 percent OMB rate

A discount rate of 7% may be used for executive branch budgeting for USACE projects. At this discount rate, the Garland alternative has average annual costs of $128,038,000 and average annual benefits of $105,530,000. Average annual net benefits are $-22,508,000 and the B/C ratio is 0.82 to 1. The Fulton alternative has average annual costs of $212,374,000 and average annual benefits of $105,530,000. Average annual net benefits are $-106,844,000 and the B/C ratio is 0.50 to 1 (Table 25).

Table 25: Average Annual Benefits and Costs (7%)

Average Annual Benefits and Costs (7%)		
	Garland	Fulton
Alternative	**(2 Locks)**	**(3 Locks)**
First Cost of Construction	$ 1,386,297,000	$ 2,068,007,000
Interest During Construction	$ 323,336,000	$ 778,979,000
Total Investment	$ 1,709,633,000	$ 2,846,986,000
Average Annual Const. Cost	$ 123,538,000	$ 207,875,000
Average Annual Increm. O&M	$ 4,500,000	$ 4,500,000
Total Average Annual Cost	$ 128,038,000	$ 212,374,000
Total Average Annual Benefits	$ 105,530,000	$ 105,530,000
Net Excess Benefits	**$ (22,508,000)**	**$ (106,844,000)**
B/C Ratio	**0.82**	**0.50**

Appendix

RED RIVER NAVIGATION STUDY

Submitted to

U.S. Army Corps of Engineers
Vicksburg District
Vicksburg, Mississippi

Submitted by

Metairie, Louisiana

July 2018

RED RIVER NAVIGATION STUDY

Submitted to

**U.S. Army Corps of Engineers
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July 2018

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RED RIVER NAVIGATION STUDY

I.   INTRODUCTION

I.1.   Purpose

The purpose of this report is to describe the universe of bulk commodity movements by railroad into and out of the Red River hinterland in the vicinity of Texarkana, TX and AR. The universe of U.S. railroad shipments is detailed in the Carload Waybill Sample (CWS) as compiled annually by the Surface Transportation Board (STB). Multiple car railroad shipments in the range of more than ten cars would come close to the 1,500 tons capacity of a standard dry bulk Mississippi River System barge. The capability of using the CWS to identify barge shipment size equivalent railroad movements of bulk commodities into and out of the Red River hinterland in the vicinity of Texarkana would establish a baseline for potential traffic that might be diverted to a continuation of Red River navigation beyond Shreveport towards Texarkana with possible port sites at Garland, Fulton and Index, AR.

Rather than rely on third party observations or industrial directories the CWS will define with a high level of accuracy the characteristics of rail cargo flows into and out of the region with respect to detailed commodity code (Standard Transportation Commodity Code), origin and destination, shipment size (tons), number of carloads, railroads and routes. The origins and destinations of the rail movements can be sufficiently disaggregated such that the geographic proximity of the shipments relative to the waterway can be assessed. Once the baseline of barge size shipments of bulk commodities into and out of the region by rail is determined the potential for substitution of barge for rail can be assessed from an economic least total cost transportation analysis. Thus the ultimate purpose of the CWS is to identify the universe of large movements of railroad bulk commodities that might be shifted to barge under of continuation of the Red River waterway toward Texarkana, TX and AR.

I.2.   Methodology

The CWS file for calendar year 2014 was obtained from the Army Corps of Engineers (Corps) Huntington District. The complete file contains 666,394 waybills for inclusion in the 2014 CWS.[1] The CWS will contain a sample of waybills for all US rail domestic movements as well as international movements between the US and Canada and Mexico.[2] The record layout for each waybill contains 62 fields describing each movement down to the details of the freight car size characteristics for the shipment.

The first step for practical use of the CWS with respect to the geographic region of interest, rail movements into and out of the Red River hinterland in the vicinity of Texarkana, TX and AR, is to focus on the data fields germane to the description of commodity flows. Table 1, shown in Section IV.2, contains the fields retained for each waybill record that could be germane to determining the commodity flow characteristics for possible shift to barge from rail shipments into and out of the Red River hinterland in the vicinity of Texarkana, TX and AR.

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[1] The full documentation of the Surface Transportation Carload Waybill Sample is contained in a Reference Guide produced by Raillinc Business Services Division. The Reference Guide can be downloaded from the STB web site. [2] The waybill is the shipping documentation of the full details of a for-hire railroad commodity movement whether by common carriage or contract.

II. HINTERLAND

II.1. Original Study Area

Prior economic feasibility analyses of Red River barge navigation continued beyond Shreveport to the vicinity of Texarkana, TX and AR specified counties in the states of Arkansas and Texas as the geographic area of interest. The Red River continued hinterland included nine Arkansas counties (BEA number in parenthesis) as follows: (1) Columbia (088); (2) Hempstead (088); (3) Howard (090); (4) Lafayette (088); (5) Little River (127); (6) Nevada (090); (7) Pike (090); (8) Polk (127) and; (9) Sevier (127). The Red River continued hinterland included nine Texas counties (BEA number in parenthesis) as follows: (1) Marion (127); (2) Lamar (127); (3) Morris (127); (4) Camp (127); (5) Red River (127); (6) Titus (127); (7) Franklin (127); (8) Bowie (127) and; (9) Cass (127).

II.2. Expanded Study Area

The study area of interest is the continued Red River navigation up to the vicinity of Texarkana, TX and AR. Previously the study area states of interest contiguous to the continuation of commercial navigation beyond Shreveport to the vicinity of Texarkana were identified as Texas and Arkansas. The Bureau of Economic Analysis (BEA) areas of interest for the original Red River hinterland are 088 (Caddo Bossier), 090 (Little Rock) and 127 (Dallas).[3] The first order of reducing the number of CWS records will be to exclude any waybill records not originating or terminating in the BEA regions of interest, 088, 090 and 127.

Subsequently the Red River hinterland BEA regions can be further delineated to the county level of interest. The original study area consisting of two states and eighteen counties was expanded to four states by including three other contiguous counties in Arkansas, twelve contiguous counties in Texas, two parishes in Louisiana and four counties in Oklahoma. The additional counties in Arkansas and Texas shared the same BEA region as the original counties. The three additional Arkansas counties (BEA number in parenthesis) are as follows: (1) Miller (127); Clark (090) and; (3) Montgomery (090). The twelve additional Texas counties (BEA number in parenthesis) are as follows: (1) Harrison (127); (2) Upshur (127); (3) Wood (127); (4) Hopkins (127); (5) Rains (127); (6) Hunt (127); (7) Collin (127); (8) Fanning (127); (9) Delta (127); (10) Denton (127); (11) Cooke (127) and; (12) Grayson (127).

The original study area did not contain any Oklahoma counties. Four Oklahoma counties (BEA number in parenthesis) were added as follows: (1) Bryan (127); (2) Choctaw (127); McCurtain (127) and; (4) Pushmataha (127). Two parishes from Louisiana were added as follows (BEA number in parenthesis); (1) Caddo (088) and; (2) Bossier (088).

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[3] Bureau of Economic Analysis (BEA) Economic Areas consist of homogeneous sub-regional markets that surround metropolitan statistical areas, for example Little Rock, AR, Dallas, TX and Shreveport, LA.

III. CARLOAD WAYBILL SAMPLE

III.1. Introduction

The CWS is widely recognized as the authoritative source for studies of railroad freight traffic characteristics. As such the CWS has been used by the STB and its predecessor, Interstate Commerce Commission (ICC), to evaluate railroad traffic for purposes of economic regulation particularly public policy matters related to competition between railroads and the effects of railroad mergers.

III.2. Data

For the purposes of this study to describe and compile the universe of railroad bulk commodity shipments of barge size or larger into or out of the Red River continued hinterland a subset of the 62 data fields was used. The most important data fields in were as follows: (1) Number of Carloads; (2) Commodity Code (STCC); (3) Actual Weight; (4) Rebill Code; (5) Origin FSAC; (6) Termination FSAC; (7) Origin SPLC; (8) Destination SPLC; (9) Theoretical Expansion Factor; (10) Expanded Carloads; (11) Expanded Tons; (12) Origin State Alpha; (13) Termination State Alpha; (14) Origin BEA Area; (15) Termination BEA Area; (16) Origin FIPS Code; (17) Destination FIPS Code; (18) Origin SMSA; (19) Destination SMSA; (20) Origin Freight Station Rating ZIP; (21) Destination Freight Station Rating ZIP; and (22) Exact Expansion Factor.

IV. DESCRIPTION OF RAILROAD CARGO FLOWS

IV.1. Introduction

The study area of interest beyond the Red River continued hinterland in the vicinity of Texarkana, TX and AR was established for a Mississippi River System hinterland and a national hinterland. The Mississippi River System hinterland was established for all of the states adjacent to the navigable portions of the Mississippi River System including: (1) AL; (2) AR; (3) IA; (4) IL; (5) IN; (6) KY; (7) LA; (8) MN; (9) MO; (10) MS; (11) OH; (12) PA; (13) TN; (14) TX; (15) WI and; (16) WV. The national hinterland was established for all of the 48 states. The perspective of the two hinterlands was to identify all of the rail movements of bulk commodities in multiple carload units similar to barge shipment size, 1,500 tons, into or out of the Red River continued hinterland.

IV.2. Mississippi River System Hinterland

The premise of the Mississippi River System hinterland was that it was possible for barge competitive rail movements (bulk commodities in multiple carload lot sizes generally regarded to be equivalent to barge shipment size) to be identified sufficiently close to the river at both origin and or destination such that a direct substitute of Red River continued navigation could be economically feasible. Alternatively, if direct substitution of Mississippi River System hinterland origin and or destination was not practical or economically feasible it might be possible for the Red River continued hinterland shipper/receiver to use other markets or sources

of supply such that the alternative use of Red River continued navigation would be economically feasible.[4]

The results of the analysis of rail carloads shipped between the Mississippi River System hinterland states and the four state counties of interest contiguous to the Red River continued   will be summarized in tables 1 through 10. Table 1, Destination Railroad Total Commodity Tons Received by State (Counties of Interest), depicts the total sampled carloads from the CWS that railroads delivered to the counties of interest in the four states of AR, LA, OK and TX from the Mississippi River System hinterland states. The sampled carloads and the sampled commodity tons (not shown) are expanded in the CWS to reflect an estimate of the total population of all railroad commodity tons and carloads delivered to the counties of interest in the four states of AR, LA, OK and TX from the Mississippi River System hinterland. The population estimates of cargo tons and carloads total 12.122 million and 128,534 for the four states (counties of interest), respectively. The largest state from the perspective of total expanded   tons and expanded carloads is Texas with 7.114 million tons and 71,065 carloads for the counties of interest, respectively. Louisiana was the second largest state with 3.333 million tons and 37,236 carloads for the parishes of interest, respectively. Arkansas was the third largest state   with respect to the total expanded commodity tons and expanded carloads delivered to the counties of interest, 1.322 million tons and 15,285 carloads. Oklahoma had the lowest volumes of expanded tons and carloads for the counties of interest, 0.351 million tons and 4,948 carloads, respectively.

Table 1. Total Railroad Commodity Tons Received by State Counties of Interest from Mississippi River System Hinterland States

Destination State	Sum Of Number of Carloads	Sum Of Expanded Tons	Sum Of Expanded Carloads
AR	1,066	1,322,971	15,285
LA	6,487	3,333,225	37,236
OK	494	351,921	4,948
TX	16,970	7,114,721	71,065
Subtotal	25,017	12,122,838	128,534

Notes:
Sum of Number of Carloads = sample carloads in waybill sample
Sum of Expanded Tons -= estimated total shipping tons based on sampled carloads
Sum of Expanded Carloads = estimated total carloads based on sampled carloads Source: 2014

Carload Waybill Sample and G.E.C., Inc.

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[4] Shipper interviews will be critical inputs to the identify possible alternative markets for use of the waterway.

Table 2, Origin Railroad Total Commodity Tons Shipped by State (Counties of Interest), depicts the total sampled carloads from the CWS that railroads shipped from the counties of interest in the four states of AR, LA, OK and TX to the Mississippi River System hinterland states. The sampled carloads and the sampled commodity tons (not shown) are expanded in the CWS to reflect an estimate of the total population of railroad commodity tons and carloads shipped from the counties of interest in the four states of AR, LA, OK and TX to the Mississippi River System hinterland. The population estimates of tons and carloads total 4.161 million and 55,065 for the four states (counties of interest), respectively. The largest state from the perspective of total expanded tons and expanded carloads is Arkansas with 2.119 million tons and 21,562 carloads from the counties of interest, respectively. Oklahoma is the second largest state with 0.800 million tons and 9,887 carloads shipped from the counties of interest, respectively. Louisiana is the third largest with state with respect to the total expanded commodity tons and expanded carloads shipped from the counties of interest, 0.635 million tons and 13,312 carloads, respectively. Texas has the lowest volumes of expanded tons and carloads shipped from the counties of interest, 0.605 million tons and 10,304 carloads, respectively.

Table 2. Total Railroad Commodity Tons Shipped by State Counties of Interest to Mississippi River System Hinterland States

Origin State	Sum Of Number of Carloads	Sum Of Expanded Tons	Sum Of Expanded Carloads
AR	3,779	2,119,765	21,562
LA	579	635,792	13,312
OK	1,278	800,721	9,887
TX	605	605,374	10,304
Subtotal	6,241	4,161,652	55,065

Notes:
Sum of Number of Carloads = sample carloads in waybill sample
Sum of Expanded Tons -= estimated total shipping tons based on sampled carloads
Sum of Expanded Carloads = estimated total carloads based on sampled carloads Source: 2014

Carload Waybill Sample and G.E.C., Inc.

Table 3, Destination Tons Received by Railroad by Commodity Group (Two Digit STCC Code), shows the composition of the total of 12.122 million commodity tons received by the four states counties of interest from the Mississippi River System hinterland states as summarized in Table 1. The major STCC commodity groups with respect to expanded tons are as follows: (1) Nonmetallic minerals, except fuels, 6.566 million tons; (2) Primary metal products, 1.044 million tons; (3) Farm products, 0.918 million tons; (4) Food or kindred products, 0.839 million tons and; (5) Hazardous materials, 0.814 million tons. Nonmetallic minerals accounts for just over one-half of total commodity tons shipped into the four states counties of interest (6.566/12.122 = 0.54). The other four commodity groups, primary metal products, farm

products, food and hazardous materials account for 30 percent of total railroad commodity tons shipped into the four states counties of interest (3.166/12.122 = 0.30). Table 3 suggests that major bulk commodity movements by rail received by the counties of interest in the four states from the Mississippi River System hinterland states will be nonmetallic minerals, largely aggregate (rock, limestone and sand) used for construction purposes.

Table 3. Cargo Tons Received by Railroad by State Counties of Interest by Commodity Group (Two Digit STCC) from Mississippi River System Hinterland States

STCC Two Digit Code	Expanded Tons
Farm Products	918,314
Metallic Ores	20,800
Coal	17,100
Crude Petroleum, Natural Gas or Gasoline	23,240
Nonmetallic Minerals; except Fuels	6,566,080
Ordnance or Accessories	3,672
Food or Kindred Products	839,140
Lumber or Wood Products; except Furniture	147,200
Pulp, Paper or Allied Products	106,480
Chemicals or Allied Products	528,624
Petroleum or Coal Products	92,400
Clay, Concrete, Glass or Stone Products	561,284
Primary Metal Products, including Galvanized; except Coating or other Allied Processing	1,044,600
Transportation Equipment	253,640
Waste or Scrap Materials Not Identified by Producing Industry	118,000
Miscellaneous Freight Shipments	18,008
Hazardous Wastes	49,400
Hazardous Materials	814,856
Total	12,122,838

Notes:

STCC Two Digit Code = Standard Transportation Commodity Code

Expanded Tons = estimated total tons based on commodity tons of sampled carloads

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 4, Origin Tons Shipped by Railroad by Commodity Group (Two Digit STCC Code), shows the composition of the total of 4.157 million commodity tons shipped by the four states counties of interest to the Mississippi River System hinterland states as summarized in Table 2. The major STCC commodity groups with respect to expanded tons are as follows: (1) Nonmetallic minerals, except fuels, 1.471 million; (2) Pulp, paper or allied products, 0.928

million; (3) Clay, concrete, glass or stone products, 0.555 million; (4) Petroleum or coal products, 0.310 million and; (5) Lumber and wood products, excluding furniture, 0.302 million. Nonmetallic minerals accounts for just over one-third of total commodity tons shipped from the four states counties of interest (1.471/4.157 = 0.35). The other four commodity groups, pulp and paper products, clay, concrete, stone and glass, petroleum or coal products, and lumber or wood products, account for 50 percent of total railroad commodity tons shipped from the four states counties of interest (2.097/4.157 = 0.50). Table 4 suggests that major bulk commodity movements by rail shipped from the counties of interest in the four states will be nonmetallic minerals, largely aggregate (rock, limestone and sand) used for construction purposes.

Table 4. Cargo Tons Shipped by Railroad by State Counties of Interest by Commodity Group (Two Digit STCC) to Mississippi River System Hinterland States

STCC Two Digit Code	Expanded Tons
Farm Products	27,824
Nonmetallic Minerals; except Fuels	1,471,142
Food or Kindred Products	47,560
Apparel, or Other Finished Textile Products or Knit Apparel	2,000
Lumber or Wood Products; except Furniture	302,640
Pulp, Paper or Allied Products	928,800
Chemicals or Allied Products	31,560
Petroleum or Coal Products	310,404
Clay, Concrete, Glass or Stone Products	555,756
Primary Metal Products, including Galvanized; except Coating or other Allied Processing	11,040
Transportation Equipment	113,678
Miscellaneous Products of Manufacturing	400
Waste or Scrap Materials Not Identified by Producing Industry	271,728
Miscellaneous Mixed Shipments	49,600
Hazardous Materials	33,600
Total	4,157,732

Notes:

STCC Two Digit Code = Standard Transportation Commodity Code

Expanded Tons = estimated total tons based on commodity tons of sampled carloads

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 5, Destination Shipment Sizes Less Than Twenty Cars, identifies the numbers of shipments into the four states counties of interest from the Mississippi River System hinterland states that are less than twenty rail cars. The purpose of Table 5 is to identify the extent of small shipments by rail (100 to 110 tons per loaded freight car maximum capacity) to the four state region counties that would not be barge compatible with respect to shipment size because barge

is about 1,500 tons (dry bulk). Table 5 indicates that the total sample carloads, 25,017, translated into expanded carloads, 128,534, and expanded tons, 12.122 million, are represented by 1,847 records (waybills) in the CWS for the four state counties of interest shipments from the Mississippi River System hinterland states.

Table 5. Rail Shipment Sizes Less Than Twenty Cars Received by State Counties of Interest from Mississippi River System Hinterland States

Number of Carloads Shipped (Shipment Size)	Sample Carloads	Expanded Carloads	Expanded Tons	Records (Waybills)	Cumulative Expanded Ton	Cumulative Percent	Cumulative Records	Cumulative Percent
All Cars	25,017	128,534	12,122,838	1,847				
One Car	1,411	56,440	4,657,280	1,411	4,657,280	38.42%	1,411	76.39%
Two Cars	46	1,840	152,160	23	4,809,440	39.67%	1,434	77.64%
Three Cars	102	1,224	89,232	34	4,898,672	40.41%	1,468	79.48%
Four Cars	84	1,008	64,620	21	4,963,292	40.94%	1,489	80.62%
Five Cars	125	2,829	231,984	25	5,195,276	42.86%	1,514	81.97%
Six Cars	54	648	37,788	9	5,233,064	43.17%	1,523	82.46%
Seven Cars	105	1,260	84,432	15	5,317,496	43.86%	1,538	83.27%
Eight Cars	96	1,152	106,536	12	5,424,032	44.74%	1,550	83.92%
Nine Cars	36	432	18,120	4	5,442,152	44.89%	1,554	84.14%
Ten Cars	70	840	61,224	7	5,503,376	45.40%	1,561	84.52%
Eleven Cars	11	132	13,980	1	5,517,356	45.51%	1,562	84.57%
Twelve Cars	12	144	16,428	1	5,533,784	45.65%	1,563	84.62%
Thirteen Cars	0	0	0	0	5,533,784	45.65%	1,563	84.62%
Fourteen Cars	28	336	20,460	2	5,554,244	45.82%	1,565	84.73%
Fifteen Cars	60	720	76,572	4	5,630,816	46.45%	1,569	84.95%
Sixteen Cars	32	128	8,400	2	5,639,216	46.52%	1,571	85.06%
Seventeen Cars	102	408	24,928	6	5,664,144	46.72%	1,577	85.38%
Eighteen Cars	36	144	8,856	2	5,673,000	46.80%	1,579	85.49%
Nineteen Cars	19	76	7,760	1	5,680,760	46.86%	1,580	85.54%

Notes

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads Expanded

Tons = estimated total shipping tons based on sampled carloads

Records = number of samples of movements for each group of carload shipment sizes Source:

2014 Carload Waybill Sample and G.E.C., Inc.

Table 5 illustrates the effects of excluding small rail shipments less than barge capacity from the estimated population of total (expanded) rail carloads and total (expanded) tons of cargo shipped to the four state counties of interest from the Mississippi River System hinterland states. Single (one) rail car shipments to the four state region counties of interest account for 1,411 records (waybills), 56,440 carloads and 4.657 million tons. Single (one) rail car shipments to the region account for nearly 40 percent (38.42%) of total rail tons shipped to the region and constitute over 75 percent (76.39%) of the total waybills for rail shipments into the region. Single rail car

shipments would likely have no possible form of aggregation into a barge shipment size, 1,500 tons.[5]

Table 5 incrementally compiles the effects of aggregating small rail shipments to the four state counties of interest from the Mississippi River System hinterland states increasing from single (one) rail car shipments upwards to 19 rail car shipments. For heavy loading bulk cargo such as nonmetallic minerals a barge load shipment size, 1,500 tons, would be about 13 to 15 rail cars, depending on whether the cars were loaded with 110 or 100 tons, respectively. Table 5 indicates that excluding rail car shipments to the region from the Mississippi River System hinterland states would comprise about 5.6 million cargo tons and account for 1,569 records. Cumulatively rail car shipments to the region 15 cars or less would comprise just under 50 percent of total cargo tons shipped to the region (46.45%) and just under 85 percent of total shipments (84.95%).

Table 5 indicates that small rail shipment sizes from the Mississippi River System hinterland states to the four state counties of interest dominate the total number of movements. However, the inverse is true for the proportion of total cargo tons shipped to the region in large (barge size) shipment sizes at least 1,500 tons. Rail shipments to the four state counties of interest from the Mississippi River System hinterland states larger than 15 cars, presumably equivalent of barge shipment size, 1,500 tons, are slightly more than 50 percent of total rail cargo tons shipped into the region (100 - 46.45 = 53.55%) but only about 15 percent of total shipments (100 - 84.95 = 15.05%). Consequently, a significant amount of the rail cargo tons shipped to the four state counties of interest from the Mississippi River System hinterland states is in barge load sizes of 1,500 tons or greater. This is precisely the market information that is being sought through the use of the CWS.

Table 6, Effect on Total Destination Carloads by Excluding Small Shipment Sizes Less than Twenty Cars, represents the reductions in sample carloads, expanded carloads and expanded tons shipped to the four state counties of interest from the Mississippi River System hinterland states from excluding small shipment sizes less than barge load, 1,500 tons. When single (one) car shipments are excluded the universe of all carloads and tons shipped to the region from the Mississippi River System hinterland states declines from 128,534 and 12.122 million to 72,094 and 7.465 million, respectively. Excluding rail shipment sizes less than 15 cars into the region from the Mississippi River System hinterland states results in 59,501 expanded carloads and 6.492 million tons remaining. Table 6 represents the converse of Table 5 to show that there is a large volume of carloads and tons of cargo shipped into the four state counties of interest from the Mississippi River System hinterland states that is at least equal to or greater than barge size capacity of 1,500 tons.

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[5] There are some very rare instances where multiple less than barge load shippers have been able to aggregate sufficient tonnage to share in barge load traffic such as imported steel through New Orleans, etc. destined to a regional hinterland such,as Oklahoma, etc.

Table 6. Effect on Total Rail Carloads Received by State Counties of Interest by Excluding Small Shipment Sizes Less than Twenty Cars

Number of Carloads Shipped (Shipment Size)	Sample Carloads	Expanded Carloads	Expanded Tons	Records (Waybills)
All Cars	25,017	128,534	12,122,838	1,847
Exclude One Car Shipments	23,606	72,094	7,465,558	427
Exclude Two Car Shipments	23,560	70,254	7,313,398	406
Exclude Three Car Shipments	23,458	69,030	7,224,166	374
Exclude Four Car Shipments	23,374	68,022	7,159,546	352
Exclude Five Car Shipments	22,858	65,193	6,927,562	327
Exclude Six Car Shipments	22,804	64,545	6,889,774	318
Exclude Seven Car Shipments	22,699	63,285	6,805,342	303
Exclude Eight Car Shipments	22,603	62,133	6,698,806	291
Exclude Nine Car Shipments	22,567	61,701	6,680,686	287
Exclude Ten Car Shipments	22,497	60,861	6,619,462	280
Exclude 11 Car Shipments	22,486	60,729	6,605,482	279
Exclude 12 Car Shipments	22,474	60,585	6,589,054	278
Exclude 13 Car Shipments	22,474	60,585	6,589,054	278
Exclude 14 Car Shipments	22,446	60,249	6,568,594	276
Exclude 15 Car Shipments	22,386	59,529	6,492,022	272
Exclude 16 Car Shipments	22,354	59,401	6,483,622	270
Exclude 17 Car Shipments	22,252	58,993	6,458,694	264
Exclude 18 Car Shipments	22,216	58,849	6,449,838	262
Exclude 19 Car Shipments	22,197	58,773	6,442,078	261

Notes

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads

Expanded Tons = estimated total shipping tons based on sampled carloads

Records = number of samples of movements for each group of carload shipment sizes

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 7, Origin Shipment Sizes Less Than Twenty Cars, identifies the numbers of shipments from the four states counties of interest to the Mississippi River System hinterland states that are less than twenty rail cars. The purpose of Table 7 is to identify the extent of small shipments by rail (100 to 110 tons per loaded freight car maximum capacity) from the four state region counties that would not be barge compatible with respect to shipment size because barge is about 1,500 tons (dry bulk). Table 7 indicates that the total sample carloads, 6,241, translated into expanded carloads, 55,065, and expanded tons, 4.161 million, are represented by 979 records (waybills) in the CWS for the four state counties of interest shipments to the Mississippi River System hinterland states.

Table 7. Rail Shipment Sizes Less Than Twenty Cars Shipped by State Counties of Interest to Mississippi River System Hinterland States

Number of Carloads Shipped (Shipment Size)	Sample Carloads	Expanded Carloads	Expanded Tons	Records (Waybills)	Cumulative Expanded Tons	Cumulative Percent	Cumulative Records	Cumulative Percent
All Cars	6,241	55,065	4,161,652	979				
One Car	818	32,720	2,097,120	818	2,097,120	50.39%	818	83.55%
Two Cars	14	560	30,680	7	2,127,800	51.13%	825	84.27%
Three Cars	39	468	21,084	13	2,148,884	51.64%	838	85.60%
Four Cars	32	384	30,624	8	2,179,508	52.37%	846	86.41%
Five Cars	80	960	58,000	16	2,237,508	53.76%	862	88.05%
Six Cars	48	576	46,208	8	2,283,716	54.88%	870	88.87%
Seven Cars	21	252	12,168	3	2,295,884	55.17%	873	89.17%
Eight Cars	48	576	58,176	6	2,354,060	56.57%	879	89.79%
Nine Cars	36	432	26,424	5	2,380,484	57.20%	884	90.30%
Ten Cars	50	600	58,656	5	2,439,140	58.61%	889	90.81%
Eleven Cars	0	0	0	0	2,439,140	58.61%	889	90.81%
Twelve Cars	0	0	0	0	2,439,140	58.61%	889	90.81%
Thirteen Cars	0	0	0	0	2,439,140	58.61%	889	90.81%
Fourteen Cars	42	504	24,240	3	2,463,380	59.19%	892	91.11%
Fifteen Cars	0	0	0	0	2,463,380	59.19%	892	91.11%
Sixteen Cars	32	128	7,648	2	2,471,028	59.38%	894	91.32%
Seventeen Cars	0	0	0	0	2,471,028	59.38%	894	91.32%
Eighteen Cars	18	72	1,620	1	2,472,648	59.42%	895	91.42%
Nineteen Cars	114	456	45,248	6	2,517,896	60.50%	901	92.03%

Notes

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads Expanded

Tons = estimated total shipping tons based on sampled carloads

Records = number of samples of movements for each group of carload shipment sizes Source:

2014 Carload Waybill Sample and G.E.C., Inc.

Table 7 illustrates the effects of excluding small rail shipments less than barge capacity from the estimated population of total (expanded) rail carloads and total (expanded) tons of cargo shipped from the four state counties of interest to the Mississippi River System hinterland states. Single (one) rail car shipments from the four state region counties of interest account for 818 records (waybills), 32,720 carloads and 2.097 million tons. Single (one) rail car shipments from the region account for nearly 50 percent (50.39%) of total rail tons shipped from the region and constitute over 80 percent (83.55%) of the total waybills for rail shipments from the region.

Table 7 incrementally compiles the effects of aggregating small rail shipments from the four state counties of interest to the Mississippi River System hinterland states increasing from single (one) rail car shipments upwards to 19 rail car shipments. For heavy loading bulk cargo such as nonmetallic minerals a barge load shipment size, 1,500 tons, would be about 13 to 15 cars, depending on whether the cars were loaded with 110 or 100 tons, respectively. Table 7 indicates that excluding rail car shipments from the region to the Mississippi River System hinterland states would comprise about 2.463 million cargo tons, and account for 892 records.

Cumulatively rail car shipments from the region 15 cars or less would comprise just under 60 percent of total cargo tons shipped to the Mississippi River System hinterland states (59.19%) and just over 90 percent of total shipments (91.11%).

Table 7 indicates that small rail shipment sizes to the Mississippi River System hinterland states dominate the total number of rail movements from the four state counties of interest resulting in a smaller proportion of total cargo tons shipped from the region in large (barge size) shipment tons at least 1,500 tons. Rail shipments from the four state counties of interest to the Mississippi River System hinterland states larger than 15 cars, presumably equivalent of barge shipment size, 1,500 tons, are slightly more than 40 percent of total rail cargo tons shipped from the region (100 - 59.19 = 40.81%) and constitute less than 10 percent of total shipments (100 - 91.11 = 8.89%). Consequently, there is a large amount of the rail cargo tons shipped from the four state counties of interest to the Mississippi River System hinterland states that is in barge load sizes of 1,500 tons or greater.

Table 8, Effect on Total Origin Carloads by Excluding Small Shipment Sizes Less than Twenty Cars, represents the reductions in sample carloads, expanded carloads and expanded tons shipped from the four state counties of interest to the Mississippi River System hinterland states from excluding small shipment sizes less than barge load, 1,500 tons. When single (one) car shipments are excluded the universe of all carloads and tons shipped from the region to the Mississippi River System hinterland states declines from 55,065 carloads and 4.161 million tons to 22,345 carloads and 2.064 million tons, respectively. Excluding rail shipment sizes less than 15 cars from the region to the Mississippi River System hinterland states results in 17,033 expanded carloads and 1.698 million tons remaining. Table 8 represents the converse of Table 7 to show that there is a large volume of carloads and tons of cargo shipped from the four state counties of interest to the Mississippi River System hinterland states that is at least equal to or greater than barge size capacity of 1,500 tons.

Table 8. Effect on Total Rail Carloads Shipped by State Counties of Interest by Excluding Small Shipment Sizes Less than Twenty Cars

Number of Carloads Shipped (Shipment Size)	Sample Carloads	Expanded Carloads	Expanded Tons	Records (Waybills)
All Cars	6,241	55,065	4,161,652	979
Exclude One Car Shipments	5,423	22,345	2,064,532	161
Exclude Two Car Shipments	5,409	21,785	2,033,852	154
Exclude Three Car Shipments	5,370	21,317	2,012,768	141
Exclude Four Car Shipments	5,338	20,933	1,982,144	133
Exclude Five Car Shipments	5,258	19,973	1,924,144	117
Exclude Six Car Shipments	5,210	19,397	1,877,936	109
Exclude Seven Car Shipments	5,189	19,145	1,865,768	106
Exclude Eight Car Shipments	5,141	18,569	1,807,592	100
Exclude Nine Car Shipments	5,105	18,137	1,781,168	95
Exclude 10 Car Shipments	5,055	17,537	1,722,512	90
Exclude 11 Car Shipments	5,055	17,537	1,722,512	90

Table 8 (cont'd). Effect on Total Rail Carloads Shipped by State Counties of Interest by Excluding Small Shipment Sizes Less than Twenty Cars

Number of Carloads Shipped (Shipment Size)	Sample Carloads	Expanded Carloads	Expanded Tons	Records (Waybills)
Exclude 12 Car Shipments	5,055	17,537	1,722,512	90
Exclude 13 Car Shipments	5,055	17,537	1,722,512	90
Exclude 14 Car Shipments	5,013	17,033	1,698,272	87
Exclude 15 Car Shipments	5,013	17,033	1,698,272	87
Exclude 16 Car Shipments	4,981	16,905	1,690,624	85
Exclude 17 Car Shipments	4,981	16,905	1,690,624	85
Exclude 18 Car Shipments	4,963	16,833	1,689,004	84
Exclude 19 Car Shipments	4,849	16,377	1,643,756	78

Notes

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads

Expanded Tons = estimated total shipping tons based on sampled carloads

Records = number of samples of movements for each group of carload shipment sizes

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 9, Destination (Inbound) Distribution of Carloads by Shipment Size (Number of Carloads), depicts the large barge load shipment sizes of multiple rail cars from the Mississippi River System hinterland states to the four state counties of interest. A total of 22,227 sampled carloads for shipments of multiple carloads representing an estimated population of 58,893 expanded carloads and 6.444 million tons of cargo were moved from the Mississippi River System hinterland states to the four state counties of interest in the equivalent of single or multiple barge load shipment sizes (1,500 tons). The smaller shipment sizes in the range of 20 to 29 rail cars represent between one to two barge loads of dry bulk cargo (1,500 to 3,000 tons). The larger shipment sizes reflect train load lots in the range of 100 cars represent between five to eight barge loads (7,500 to 12,000 tons).

Barge or multiple barge load equivalent rail car shipments from the Mississippi River System hinterland states and the four state counties of interest account for a substantial volume of cargo, 6.444 million tons and a relatively large number of reoccurring shipments. The numbers of shipments for the size categories of carloads suggest that in some instances the average volumes are weekly during the course of a full calendar year. Table 9 provides ample evidence of large rail car movements between the Mississippi River System hinterland states and the four state counties of interest equivalent to at least single but often multiple barge load volumes.

Table 9. Distribution of Rail Carloads by Shipment Size (Number of Carloads) to the Four State Counties of Interest from the Mississippi River System Hinterland States

Number of Carloads	Sample Carloads	Expanded Carloads	Expanded Tons	Shipments
20-29	182	728	55,316	8
30-39	94	376	19,568	3
40-49	283	1,132	110,560	7
50-59	405	1,620	178,548	8
60-69	985	3,675	397,015	16
70-79	3,574	10,722	1,125,951	50
80-89	1,360	4,080	459,411	16
90-99	5,272	15,816	1,768,587	58
100-109	7,625	15,850	1,774,186	75
110-119	220	440	44,132	2
120-129	2,227	4,454	511,504	18
Total	22,227	58,893	6,444,778	261

Notes

Number of Carloads = shipment size

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads

Expanded Tons = estimated total shipping tons based on sampled carloads

Shipments = number of samples of movements for each group of carload shipment sizes

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 10, Origin (Outbound) Distribution of Carloads by Shipment Size (Number of Carloads), depicts the large barge load shipment sizes of multiple rail cars to the Mississippi River System hinterland states from the four state counties of interest. A total of 4,848 sampled carloads for shipments of multiple carloads representing an estimated population of 16,377 expanded carloads and 1.642 million tons of cargo were moved to the Mississippi River System hinterland states from the four state counties of interest in the equivalent of single or multiple barge load shipment sizes (1,500 tons). The smaller shipment sizes in the range of 20 to 29 rail cars represent between one to two barge loads of dry bulk cargo (1,500 to 3,000 tons). The larger shipment sizes reflect train load lots in the range of 100 cars represent between five to eight barge loads (7,500 to 12,000 tons).

Barge or multiple barge load equivalent rail car shipments to the Mississippi River System hinterland states from the four state counties of interest account for an annual volume of cargo in excess of 1.6 million tons and a relatively large number of reoccurring shipments. The number of total shipments for the size categories of carloads, 69, suggests that the average volumes are weekly during the course of a full calendar year. Table 10 provides further evidence of some large rail car movements between the Mississippi River System hinterland states and the four state counties of interest equivalent to at least single but often multiple barge load volumes.

Table 10. Distribution of Rail Carloads by Shipment Size (Number of Carloads) from the Four State Counties of Interest to the Mississippi River System Hinterland States

Number of Carloads	Sample Carloads	Expanded Carloads	Expanded Tons	Shipments
20-29	88	352	20,296	4
30-39	241	968	87,028	7
40-49	0	0	0	0
50-59	1,500	6,000	636,344	30
60-69	851	2,553	208,236	13
70-79	363	1,089	86,247	5
80-89	435	1,305	149,364	5
90-99	1,370	4,110	455,364	5
Total	4,848	16,377	1,642,879	69

Notes

Number of Carloads = shipment size

Sample Carloads = sample carloads in waybill sample

Expanded Carloads = estimated total carloads based on sampled carloads

Expanded Tons = estimated total shipping tons based on sampled carloads

Shipments = number of samples of movements for each group of carload shipment sizes

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

IV.3.   National Hinterland

The premise of a U.S. (national) hinterland was that it was possible for barge competitive rail movements (bulk commodities in multiple carload lot sizes generally regarded to be equivalent   to barge shipment size) to be identified moving to or from other rail markets that might be divertible to a barge market origin destination. In effect the national hinterland for the four state   counties of interest represents a compilation of all rail movements regardless of the national   origin or destination. Expanding the geographic origins and destinations of national rail shipments to and from the four state counties of interest allows for the full universe of rail   shipments to be identified beyond the Mississippi River System hinterland. If there are substitutes of alternative waterborne movements for existing rail movements to and from the four   state counties of interest it is possible that national markets could shift to use the waterway.

Shipper interviews would be of paramount importance in determining these market shifts, for example substitution of barge sourced coal from Appalachian or Illinois markets in place of Wyoming Powder River Basin coal that is rail dependent or sourcing of petroleum coke from waterway based refineries as opposed to land (rail) based refineries.

The results of the analysis of rail carloads shipped between the nation and the four state counties of interest contiguous to the Red River continued will be summarized in tables 11 through 23. Table 11, Total Rail Cargo Tons Originating and Terminating in Four State Counties of Interest, 2014, indicates the total annual rail cargo tons terminating and originating in the four state counties of interest, 28.4 and 7.6 million respectively in 2014. Total rail cargo tonnage inbound (terminating) and outbound (originating) for the four state counties of interest was 36 million.

Table 11. Total Rail Cargo Tons Originating and Terminating in Four State Counties of Interest, 2014

In/Outbound	Total Tons (000,000)
Terminating	28.4
Originating	7.6
Total	36

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 12, Total Rail Cargo Tons Terminating (Inbound) in Four State Counties of Interest, 2014, indicates that the 28.4 million tons of rail cargo terminating in the region was primarily to the Texas counties of interest, 17.8 million, followed by Louisiana (4.8 million), Arkansas (3.7 million) and Oklahoma (2.1 million). Table 13, Total Rail Cargo Tons Originating (Outbound) in Four State Counties of Interest, 2014, indicates that the 7.6 million tons of rail cargo originating in the region was shared nearly evenly between Arkansas (2.3 million) and Louisiana (2.1 million) and to a lesser extent Texas (1.8 million) Oklahoma (1.3 million).

Table 12. Total Rail Cargo Tons Terminating (Inbound) in Four State Counties of Interest, 2014

In/Outbound	Total Tons (000,000)
Arkansas	3.7
Louisiana	4.8
Oklahoma	2.1
Texas	17.8
Total	28.4

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Tables 11, 12 and 13 indicate that the four state counties of interest is primarily an inbound market for rail. Total annual rail cargo tons terminating in the four state counties of interest is nearly four times greater than the rail cargo tons originating in the four state counties of interest (28.4/7.6 = 3.74). Tables 14 through 17 focus on the largest rail tonnage commodity movements between the four state counties of interest and the nation for terminating (inbound) and originating (outbound) movements.

Table 13. Total Rail Cargo Tons Originating (Outbound) in Four State Counties of Interest, 2014

In/Outbound	Total Tons (000,000)
Arkansas	2.3
Louisiana	2.1
Oklahoma	1.3
Texas	1.8
Total	7.6

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 14, Largest Single State Commodity Origins and Percentage of State Counties of Interest Total Rail Inbound Cargo Tons, identifies the largest tonnage of a commodity group (STCC two digit aggregation) from a single state delivered to each of the four states counties of interest. For example, rail receipts of coal coming from one state into Arkansas account for just over one-half (55%) to total rail tons from the nation into the Arkansas counties of interest. Receipts of cement from one state into the Arkansas counties of interest account for 4.3 percent of total rail cargo tons received from the nation. Corn and cake meal receipts from one state comprise 3.5 and 2.0 percent of total rail cargo tons into the Arkansas counties of interest, respectively. For Arkansas, four commodity movements from single states into the counties of interest comprise nearly 65 percent of total rail cargo tons received from the nation (64.80%). The very high concentration of coal receipts from one state into the Arkansas counties of interest dominate the total inbound rail cargo tons from the nation. The other single state major rail commodity flows into the Arkansas counties of interest, cement, corn and cake meal, collectively account for less than ten percent of total rail cargo tons receipts from the nation (4.3% + 3.5% +2.05% = 9.8%).

Table 14. Largest Single State Commodity Origins and Percentage of State Counties of Interest Total Rail Inbound Cargo Tons

State	Commodity	Percent of State Tons
Arkansas	Coal	55.00%
	Cement	4.30%
	Corn	3.50%
	Cake Meal	2.00%
	Subtotal	64.80%
Louisiana	FAK	15.00%
	Pebbles	9.00%
	Stone	9.00%
	Sand	7.70%
	Limestone	4.30%
	Subtotal	45.00%

Table 14 (cont'd). Largest Single State Commodity Origins and Percentage of State Counties of Interest Total Rail Inbound Cargo Tons

State	Commodity	Percent of State Tons
Oklahoma	Coal	76.00%
	Corn	3.20%
	Corn	3.20%
	Cake Meal	2.30%
	Subtotal	84.50%
Texas	Coal	54.00%
	Stone	10.00%
	Rock	5.10%
	Stone	3.90%
	Subtotal	73.00%

Notes: The commodity percentages represent the largest share of commodity inbound tons from any particular state to the four state counties of interest
FAK = Freight of All Kinds an expression usually connoting mixed general merchandise such as clothing, appliances, etc.

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

The largest single state rail commodity movement into Louisiana parishes of interest from the nation in Table 14 is FAK (freight of all kinds) which suggests that these are likely marine containers of imports. The balance of the single state largest tonnage commodity rail receipts into the two Louisiana parishes represent bulk commodities, pebbles (9.0%), stone (9.0%), sand (7.70%) and limestone (4.30%). The single state large tonnage for bulk commodities collectively represents 30 percent of total rail tonnage into the two parishes of interest from the nation (9%+9%+7.7%+4.3% = 30%)..

The largest single state rail commodity movement into Oklahoma counties of interest from the nation in Table 14 is coal which is over three-quarters (76%) of total rail tonnage from the nation to the Oklahoma counties of interest. The balance of the largest tonnage of rail commodity movement from a single state into the Oklahoma counties of interest consists of receipts of corn from two states (3.2% each of total Oklahoma counties of interest inbound rail tonnage from the nation) and cake meal (2.3%). The predominance of coal tonnage receipts from a single state to the Oklahoma counties of interest and three other smaller bulk cargo movements collectively account for over 80 percent (84.50%)of total rail tonnage from the nation to the Oklahoma counties of interest.

In Table 14 Texas is another state where the single largest commodity tonnage into the counties of interest is coal, representing just over one-half (54%) of total rail tonnage received by these counties from the nation. Three other large rail commodity movements from a single state to the Texas counties of interest are stone (10%), rock (5.1%) and stone (3.9%). These three state

commodity movements collectively account for just under 20 percent (19.0%) of total rail commodity tons from the nation to the Texas counties of interest (10%+5.1%+3.9% = 19.0%).

Table 14 indicates that coal from a single state is a major share of total rail commodity tons from the nation to three of the four state counties of interest. Texas and Arkansas are nearly identical with respect to the share of coal from a single state of the entire rail tonnage received from the nation, 54 and 55 percent, respectively. The share of rail coal tons from a single state to the Oklahoma counties of interest is considerably higher, slightly more than three-quarters (76%) of total rail tonnage received. However, rail receipts of coal from a single state are comparatively unimportant relative to total rail cargo tons received by the two Louisiana parishes from the nation.

Table 15, Largest Bulk Commodity Tons Inbound to the Four State Counties of Interest, quantifies the commodity tonnages from Table 14 pertaining to bulk commodities. Some of the non-bulk commodities in Table 14 are omitted such as FAK in Louisiana parishes of interest. Table 15 demonstrates the order of magnitude of the largest bulk commodity tonnages received from a single state by the four states counties of interest. Coal is a major rail tonnage receipt for the counties of interest for Arkansas, 2.1 million tons, Oklahoma, 1.6 million tons, and Texas, 9.6 million tons.

Table 15. Largest Bulk Commodity Tons Inbound to the Four State Counties of Interest

State	Commodity	Percent of State Tons
Arkansas	Coal	2.100
	Corn	0.262
	Cake Meal	0.190
	Cement	0.184
	Subtotal	2.736
Louisiana	Stone	2.200
	Steel	0.200
	Cement	0.088
	Corn	0.036
	Subtotal	2.524
Oklahoma	Coal	1.600
	Corn	0.181
	Cake Meal	0.064
	Subtotal	1.845
Texas	Coal	9.600
	Stone	4.300
	Steel	0.864
	Corn	0.610
	Cement	0.492
	Subtotal	15.866
Total		22.971

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Coal tons received from a single state dominates the largest rail bulk commodity tons received by the Arkansas and Oklahoma counties of interest. Coal is 2.1 million tons for Arkansas counties of interest compared to a subtotal of 2.736 million tons when the next three largest single state bulk commodity receipts are included, corn (0.262 million tons), cake meal (0.190 million tons) and cement (0.184 million tons). Coal is 1.6 million tons for Oklahoma counties of interest compared to a subtotal of 1.845 million tons when the next two largest single state bulk commodity receipts are included, corn (0.181 million tons) and cake meal (0.064 million tons).

Rail tons of stone from a single state to the Texas counties of interest, 4.3 million tons, is sufficiently important compared to coal, 9.6 million tons received from a single state. The other major bulk commodities received from a single state for the Texas counties of interest are steel, 0.864 million tons, corn, 0.610 million tons, and cement, 0.492 million tons.

Rail receipts of stone by the Louisiana parishes of interest is a major commodity representing 2.2 million tons that dwarfs all other major bulk commodity tons received from a single state for these parishes. Other largest bulk commodities received by the two parishes from a single state are steel, 0.200 million tons, cement, 0.088 million tons and corn, 0.036 million tons.

Table 16, Largest Single State Commodity Destinations and Percentage of State Counties of Interest Total Rail Outbound Cargo Tons, identifies the largest tonnage of a commodity group (STCC two digit aggregation) to a single state from each of the four states counties of interest. For example, rail shipments of stone coming from the Arkansas counties of interest to one state account for nearly one-half (48%) to total rail tons shipped to the nation from the Arkansas counties of interest. Shipments of cement from the Arkansas counties of interest to two states account for a total of 17 percent (11% + 6% = 17%) of total rail cargo tons shipped to nation. Cake meal shipments from the Arkansas counties of interest to one state comprise three percent of total rail cargo tons shipped from the Arkansas counties of interest. For Arkansas, the four largest commodity movements to single states from the counties of interest comprise roughly two-thirds (68 percent) of total rail cargo tons shipped to the nation. The high concentration of stone shipments from the Arkansas counties of interest to one state dominate the total outbound rail cargo tons to the nation. The other single state major rail commodity flows from the Arkansas counties of interest, cement and cake meal, collectively account for twenty percent of total rail cargo tons shipped to the nation (11% + 6% +3% = 20%).

Table 16. Largest Single State Commodity Destinations and Percentage of State Counties of Interest Total Rail Outbound Cargo Tons

State	Commodity	Percent of State Tons
Arkansas	Stone	48.00%
	Cement	11.00%
	Cement	6.00%
	Cake Meal	3.00%
	Subtotal	68.00%
Louisiana	FAK	23.00%

Table 16 (cont'd). Largest Single State Commodity Destinations and Percentage of State Counties of Interest Total Rail Outbound Cargo Tons

State	Commodity	Percent of State Tons
	Dry Goods	6.60%
	Cement	4.00%
	FAK	3.00%
	Subtotal	36.90%
Oklahoma	Pulp Board	12.10%
	Limestone	10.50%
	Pulp Board	6.40%
	Stone	5.90%
	Subtotal	34.90%
Texas	Coke	26.00%
	Hazardous	6.90%
	Pulp Board	5.30%
	Scrap Iron	4.90%
	Subtotal	43.10%

Notes: The commodity percentages represent the largest share of commodity outbound tons to any particular state to the four state counties of interest

FAK = Freight of All Kinds an expression usually connoting mixed general merchandise such as clothing, appliances, etc.

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

The largest single state rail commodity movement from two Louisiana parishes of interest to the nation in Table 16 is FAK which suggests that these are likely marine containers of exports. The balance of the single state largest tonnage commodity rail receipts from the two Louisiana parishes do not represent bulk commodities except for cement which is four percent of the total volume of rail cargo tons shipped from the two parishes to the nation, The largest cargo tonnages shipped to another state(s) from the two Louisiana parishes are not bulk commodities but include FAK, 26% (23% + 3% = 26%) and dry goods, 6.6%.

The largest single state rail commodity movement from Oklahoma counties of interest to the nation in Table 16 is pulp board which moves to two states and accounts for just under 20 percent (12.1% + 6.4% = 18.5%) of total rail tonnage from the Oklahoma counties of interest to the nation. The balance of the largest tonnage of rail commodity movement to a single state from the Oklahoma counties of interest consists of shipments of limestone and stone which account for 10.5% and 5.9%, respectively, of total OK counties of interest outbound rail tonnage to another state(s) in the nation.

Table 16 indicates that Texas moves substantial amounts of coke which are 26 percent of the total rail cargo shipped from the counties of interest to the nation. The other largest commodity shipments to a single state from the Texas counties of interest are hazardous goods, pulp board

and scrap iron each consisting of 6.9, 5.3 and 4.9 percent, respectively, of the total rail cargo tons shipped from the counties of interest to the nation.

Table 16 indicates that the counties of interest in Arkansas are different than the other three states because of very large shipments of stone to one other state accounting for nearly one-half of total rail shipments to the nation from the Arkansas counties of interest. The counties of interest in the other three states, Louisiana, Oklahoma and Texas, do not have any relatively large rail commodity tonnage shipped to another state in the nation relative to the total tons of rail shipments from these states. Total rail tonnage of four largest commodity shipments to another state comprise roughly two-thirds (68%) of total Arkansas counties of interest rail tonnage shipped to the nation. However, the same total tons for the counties of interest in Louisiana (parishes), Oklahoma and Texas shipments to another state are considerably less than Arkansas, in the range of 35 to 45 percent (Louisiana 36.9%; Oklahoma 34.0% and Texas 43.1%). Moreover in the case of Louisiana a substantial portion of the major commodities shipped from the parishes of interest to the nation are not bulk cargo in the sense of candidates for typical river barges.

Table 17, Largest Bulk Commodity Tons Outbound from the Four State Counties of Interest, quantifies the commodity tonnages from Table 16 pertaining to bulk commodities. Some of the non-bulk commodities in Table 16 are omitted such as FAK and dry goods from Louisiana parishes of interest. Table 17 demonstrates the order of magnitude of the largest bulk commodity tonnages shipped to a single state from each of the four state counties of interest. No single commodity dominates the rail landscape for shipments to the nation from the four state counties of interest. Aggregates such as stone and sand are relatively important in a setting of generally low volumes shipped to the nation from each of the four states counties of interest.

Table 17. Largest Bulk Commodity Tons Outbound from Four State Counties of Interest

State	Commodity	State Tons (000,000)
Arkansas	Stone	1.100
	Cement	0.431
	Lumber	0.304
	Pulp	0.225
	Subtotal	2.060
Louisiana	Pet. Lube Oil	0.384
	Cement	0.083
	Sand	0.044
	Subtotal	0.511
Oklahoma	Pulp Board	0.935
	Sand/Stone	0.306
	Subtotal	1.241
Texas	Coke	0.461
	Pulp Board	0.390
	Scrap Iron	0.149
	Subtotal	1.000
Total		4.812

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Stone shipped from the Arkansas counties of interest is about one half (1.1/2.06 = 0.53) of the total identified for the major movements of the largest tons of commodities to another state. The volumes of other bulk cargoes shipped by rail from the Arkansas counties of interest to a single state decline sharply to 0.431 million tons of cement, 0.304 million tons of lumber, and 0.225 million tons of pulp. The total of the four largest tons of cargoes shipped by rail from the Arkansas counties of interest to other states in the nation is just over 2.0 million (2.060) tons.

Rail outbound tons from each of the other three states counties of interest to the nation for the largest commodity tons shipped to a single state are much less than Arkansas. The largest commodity tons shipped to another state from the counties of interest in Louisiana, Oklahoma and Texas are 0.511, 1.241 and 1.0 million tons, respectively. Unlike Arkansas, dominated by stone shipments from the counties of interest to another state, Louisiana, Oklahoma and Texas do not have any characteristically commodity shipments from the respective counties of interest to other single states.

Louisiana parishes have relatively low volumes of bulk commodities shipped to a single state in the nation other than petroleum lube oil, 0.384 million tons. The next largest single state shipment volumes of cement and sand from the parishes of interest to a single state are cement, 0.083 million tons and sand, 0.044 million tons.

Oklahoma has two major large commodity movements from the counties of interest to a single state, pulp board, about one million tons (0.935 million tons) and sand and stone about 0.3 million tons. The Texas counties of interest ship coke, 0.461 million tons, pulp board, 0.390 million tons, and scrap iron, 0.149 million tons, to another state in the nation as the largest single commodity shipment to another state.

Table 18, Summary of Bulk Commodity Rail Tons Inbound to Four State Counties of Interest, depicts the total rail cargo tons shipped to the four state counties of interest from the nation and the major bulk cargo tons subcomponent. Two states counties of interest, Oklahoma and Texas, have a very high percentage of total rail tons shipped into the counties of interest from the nation as bulk cargo, 86 and 90 percent, respectively. About three quarters (73%) of the total rail cargo tons shipped to the Arkansas counties of interest from the nation are bulk cargo. For Louisiana parishes only about one-half (52%) of the total rail cargo tons shipped from the nation to the two parishes of interest are bulk cargo.

Table 18. Summary of Bulk Commodity Rail Tons Inbound to Four State Counties of Interest

State	Total Tons (000,000)	Major Bulk Tons (000,000)	Share of Total (Percent)
Arkansas	3.691	2.736	73%
Louisiana	4.815	2.524	52%
Oklahoma	2.101	1.845	86%
Texas	17.849	15.866	90%
Total	28.456	22.971	81%

Notes: Inbound to the four state counties of interest

Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 18 indicates that the Texas counties of interest are the largest recipients of rail bulk cargo tons from other states in the nation, nearly 16 million (15.866) tons. Although bulk cargo tons received by Oklahoma counties of interest are a very large portion of total rail cargo tons received, the magnitude of Oklahoma rail cargo tons received by the counties of interest from the nation is dwarfed by Texas, nearly 16 million (15.866) tons compared to less than two million (1.845) tons received by Oklahoma. Louisiana and Arkansas parishes and counties of interest have slightly more rail inbound bulk cargo tons from the nation than the counties of interest in Oklahoma, 2.524 and 2.736 million tons, respectively compared to 1.845 million tons for Oklahoma.

Table 19, Summary of Bulk Commodity Rail Tons Outbound from Four State Counties of Interest, depicts the total rail cargo tons shipped from the four state counties of interest to the nation and the major bulk cargo tons subcomponent. Two states counties of interest, Arkansas and Oklahoma, have a very high percentage of total rail tons shipped from their respective counties of interest to the nation as bulk cargo at 90 percent each. About one half (55%) of the total rail cargo tons shipped from Texas counties of interest to the nation are bulk cargo. For Louisiana parishes only about one-quarter (26%) of the total rail cargo tons shipped to the nation from the two parishes of interest are bulk cargo.

Table 19. Summary of Bulk Commodity Rail Tons Outbound from Four State Counties of Interest

State	Total Tons (000,000)	Major Bulk Tons (000,000)	Share of Total (Percent)
Arkansas	2.324	2.060	90%
Louisiana	2.089	0.511	26%
Oklahoma	1.337	1.241	90%
Texas	1.816	1.000	55%
Total	7.566	4.812	64%

Notes: Outbound from the four state counties of interest Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 19 indicates that the four state counties of interest are relatively low volume originators of total rail traffic and corresponding rail bulk cargo tons to other states in the nation. Despite the high percentages of rail bulk cargo of total rail cargo tons shipped from the Arkansas and Oklahoma counties of interest the actual bulk cargo volumes are relatively small, about two million tons from Arkansas (2.060) and one million tons (1.241) from Oklahoma counties of interest. Similarly, Texas and Louisiana with nearly the same volumes of total rail cargo tons shipped from their respective counties of interest to the nation but lower percentages of bulk cargo have only one million tons and about 0.5 million tons, respectively.

Table 20, Major Rail Commodity Tons Destination Market Assessments to Four State Counties of Interest, identifies the major rail bulk commodity tonnages shipped into the four state counties of interest from the nation. The major bulk commodities received by rail from the nation are

coal, 13.3 million tons, stone, 6.5 million tons, corn, 1.053 million tons and cement, 0.724 million tons.

Table 20. Major Rail Commodity Tons Destination Market Assessments to Four State Counties of Interest

State	Commodity	State Tons (000,000)
Arkansas	Coal	2.100
Oklahoma	Coal	1.600
Texas	Coal	9.600
Subtotal	Coal	13.300
Louisiana	Stone	2.200
Texas	Stone	4.300
Subtotal	Stone	6.500
Arkansas	Corn	0.262
Oklahoma	Corn	0.181
Texas	Corn	0.610
Subtotal	Corn	1.053
Arkansas	Cement	0.184
Louisiana	Cement	0.088
Texas	Cement	0.452
Subtotal	Cement	0.724
Total		21.577

Notes: Inbound to the four state counties of interest Source: 2014 Carload

Waybill Sample and G.E.C., Inc.

Coal shipments by rail from the nation to the four state counties of interest are primarily to Texas, 9.6 million tons, followed by Arkansas, 2.1 million tons, and Oklahoma, 1.6 million tons. Stone shipments by rail from the nation to the four state counties of interest are primarily to Texas, 4.3 million tons and Louisiana, 2.2 million tons. Corn shipments by rail from the nation to the four state counties of interest are about one million tons total, primarily to Texas, 0.610 million tons, followed by Arkansas, 0.262 million tons and Oklahoma, 0.181 million tons. Cement shipments by rail from the nation to the four state counties of interest are about three-quarters of one million tons (0.724 million), primarily to Texas, 0.452 million tons, and considerably smaller amounts to Arkansas, 0.184 million tons and Louisiana, 0.088 million tons.

Table 21, Major Rail Commodity Tons Origin Market Assessments from Four State Counties of Interest, identifies the major rail bulk commodity tonnages shipped from the four state counties of interest to the nation. The major bulk commodities shipped by rail to the nation are sand and stone, 1.406 million tons, pulp, 1.550 million tons and cement, 0.431 million tons.

Table 21. Major Rail Commodity Tons Origin Market Assessments from Four State Counties of Interest

State	Commodity	State Tons (000,000)
Arkansas	Sand/Stone	1.100
Oklahoma	Sand/Stone	0.306
Subtotal	Sand/Stone	1.406
Arkansas	Pulp	0.225
Oklahoma	Pulp	0.935
Texas	Pulp	0.390
Subtotal	Pulp	1.550
Arkansas	Cement	0.431
Total		3.387

Notes: Outbound from the four state counties of interest Source: 2014 Carload

Waybill Sample and G.E.C., Inc.

Sand and stone shipments by rail from the four state counties of interest to the nation are primarily from Arkansas, 1.1 million tons and secondly from Oklahoma, 0.306 million tons. Pulp shipments by rail from the four state counties of interest to the nation are primarily from Oklahoma, nearly one million tons (0.935) and Texas, 0.390 million tons and Arkansas, 0.225 million tons. Cement shipments by rail from the four state counties of interest to the nation are from Arkansas, 0.431 million tons.

Table 22, Summary of Major Rail Commodity Markets Inbound to the Four State Counties of Interest, depicts the most important bulk commodities moved by rail from the nation to the four state counties of interest. The major bulk commodities moving by rail into the region include coal, 13.3 million tons, stone, 6.5 million tons, corn, 1.053 million tons and cement, 0.724 million tons. The total tons of the four major bulk commodities moved by rail from the nation to the region are 21.577 million. If coal is excluded from the total rail tons of bulk commodities moved from the nation to the region the total tonnage of stone, corn and cement is 8.277 million.

The data in Table 22 indicates that a predominance of the rail commodity tons shipped from the nation to the four state counties of interest is bulk cargo from the perspective of barge. Of the total 28.456 million tons of rail cargo moved into the region from the nation, slightly more than

three-quarters (28.456/21.577 = 0.76) is considered to be bulk cargo (coal, stone, corn and cement). Predominant among the bulk cargo is coal which is nearly two-thirds (13.300/21.577 = 0.62) of the major rail bulk cargo shipments into the four state counties of interest from the nation.

Table 22. Summary of Major Rail Commodity Markets Inbound to the Four State Counties of Interest

Commodity	Tons (000,000)
Coal	13.300
Stone	6.500
Corn	1.053
Cement	0.724
Subtotal	21.577
Sum Ex Coal	8.277
All Inbound	28.456

Notes: Inbound from the four state counties of interest Source: 2014 Carload Waybill Sample and G.E.C., Inc.

Table 23, Summary of Major Rail Commodity Markets Outbound from the Four State Counties of Interest, depicts the most important bulk commodities moved by rail to the nation from the four state counties of interest. The major bulk commodities moving by rail from the region include pulp, 1.55 million tons, sand/stone, 1.406 million tons, and cement, 0.431 million tons. The total tons of the three major bulk commodities moved by rail to the nation from the region are 3.387 million. If pulp is excluded from the total rail tons of bulk commodities moved to the nation from the region the total tonnage of sand/stone and cement is 1.837 million,

Table 23. Summary of Major Rail Commodity Markets Outbound from the Four State Counties of Interest

Commodity	Tons (000,000)
Pulp	1.550
Sand/Stone	1.406
Cement	0.431
Subtotal	3.387
Sum Ex Pulp	1.837
All Outbound	7.567

Notes: Outbound from the four state counties of interest Source: 2014 Carload Waybill Sample and G.E.C., Inc.

The data in Table 23 indicate that slightly less than one-half of total rail commodity ton shipped from the four state counties of interest to the nation are bulk cargo (3.387/7.567 = 0.45). Nearly one-half of total rail bulk cargo tons shipped from the region to the nation is pulp (1.550/3.387 = 0.46). To the extent that pulp is not readily handled by barge the amount of bulk cargo moving by rail from the region to the nation will be small, less than two million tons (1.406 + 0.431 = 1.837).

V. SUMMARY

Further disaggregation of the CWS was conducted on the individual county/parish and city locations to identify potential rail movements that could be transferred to barges if that option was available. However, public documentation of this analysis could potentially divulge confidential information. Therefore, the above sections serve as a basis for the effort performed to identify potential movements and companies to be surveyed for the transportation rate analysis for the without and with project conditions. What can be seen from the above sections are the industries and commodities that drive the local economies of the counties within the four state area of interest.

The information gathered from the extensive analysis of the CWS as well as review of industry directories and local input of chambers of commerce and industry groups led to a diverse list of potential companies located within the four state region of interest. Those interviews were conducted over the period of one year with the results ultimately being used to conduct the transportation benefits discussed in the next section. The data resulting from those surveys is also considered to be confidential and will not be released to the public in order to protect the responders business interest.

VI. RED RIVER SHIPPER RATE ANALYSIS

The transportation rate analysis was conducted by the University of Tennessee Knoxville Center for Transportation Research (UT). The section below is provided to summarize both UT's methods and findings regarding the potential transportation benefits of extending Red River commercial navigation from its current terminus at Shreveport to a new terminus at Fulton Arkansas located in the vicinity of Texarkana AR and TX.

VI.1 Subject Traffic

The shipper interviews identified 25 unique freight traffic flows that might benefit from extending navigation from Shreveport to Texarkana. Summary statistics for this traffic are provided in Table 24. As this table indicates, potential traffic is dominated by Farm Products and Non-Metallic Minerals (combined total of 60 percent), with the remaining tonnage being divided relatively evenly between seven additional commodity groups. Roughly two-thirds (63 percent) of the subject traffic originates within the study area and terminates elsewhere, while the other one-third is inbound traffic. Similarly, one-third of the traffic is moved by rail and two-thirds is currently moved via truck-only routings.

Table 24. Traffic Summary

Commodity Description	Study Tonnage	Share
Farm Products	1,536,600	35.8%
Non-Metallic Minerals	1,060,000	24.7%
Food & Kindred Products	266,000	6.2%
Lumber & Wood Products	250,000	5.8%
Pulp, Paper & Paper Products	543,000	12.7%
Chemicals	145,000	3.4%
Concrete, Clay, Glass & Stone	200,000	4.7%
Primary Metal Products	170,000	4.0%
Scrap Material	116,000	2.7%
TOTAL (All Commodities)	4,286,600	100.0%
Inbound Tons	1,591,600	37.1%
Outbound Tons	2,695,000	62.9%
Currently Rail	1,402,046	32.7%
Currently Truck	2,884,554	67.3%

VI.2   Without-Project Costs

Calculating potential project benefits requires the comparison of the transportation costs currently incurred by shippers with the costs that would be achievable if the proposed project is developed. These are referred to as *with* and *without* project costs. When shippers indicated an all-truck movement for existing routings, motor-carrier charges were estimated through costing tools based on the American Transportation Research Institute's (ATRI) annual motor carrier cost data. For line-haul rail movements, shipper charges were modeled through an application of Surface Transportation Board (STB) waybill data. Both methods were recently developed and are fully described within the context of a study performed on behalf of the National Waterways Foundation and the USDOT's Maritime Administration (MARAD).[6]

VI.3   With-Project Cost

Evaluating shipper costs in the wake of the proposed project's development required the development of hypothetical, barge-inclusive routings. In most cases, these movements involved the transloading of cargoes at Fulton, Arkansas. Inbound traffic was routed from a water origin   to Fulton, transloaded to truck then moved to final destinations. Outbound freight required the reverse of this. Motor carrier costs were calculated using the same methods described for the without-project estimates. Waterborne costs were estimated by applying the Corps of Engineers' Barge Costing Model (BCM). Finally, transloading cost estimates were based on assessorial data developed for use in past Corps of Engineer studies.

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[6] See, "The Impacts of Unscheduled Lock Closures," National Waterways Foundation and U.S. Department of Transportation, Maritime Administration, October 2017.

VI.4   Calculating Shipper Savings

Calculating movement-specific shipper savings involves simply subtracting the with-project costs from the without-project shipper costs. The results of this process are reported in Table 25. This table also includes present value calculations at a 7 percent real discount rate as prescribed by the federal Office of Management and Budget (OMB).

Table 25. Shipper Savings by Commodity Group

Commodity Description	Study Tonnage	Annual Savings	Average Savings Per Ton
Farm Products	1,536,600	$24,808,883	$16.89
Non-Metallic Minerals	1,060,000	$15,361,775	$18.45
Food & Kindred Products	266,000	$2,168,958	$8.15
Lumber & Wood Products	250,000	$8,446,900	$33.21
Pulp, Paper & Paper Products	543,000	$13,580,083	$24.70
Chemicals	145,000	$4,195,575	$28.94
Concrete, Clay, Glass & Stone	200,000	$2,546,060	$12.73
Primary Metal Products	170,000	$2,806,890	$14.75
Scrap Material	116,000	$2,932,032	$25.28
TOTAL (All Commodities)	**4,286,600**	**$76,847,155**	
Present Value (25-Year)		**$895,544,719**	
Present Value (35-Year)		**$994,991,787**	
Present Value (50-Year)		**$1,060,548,096**	