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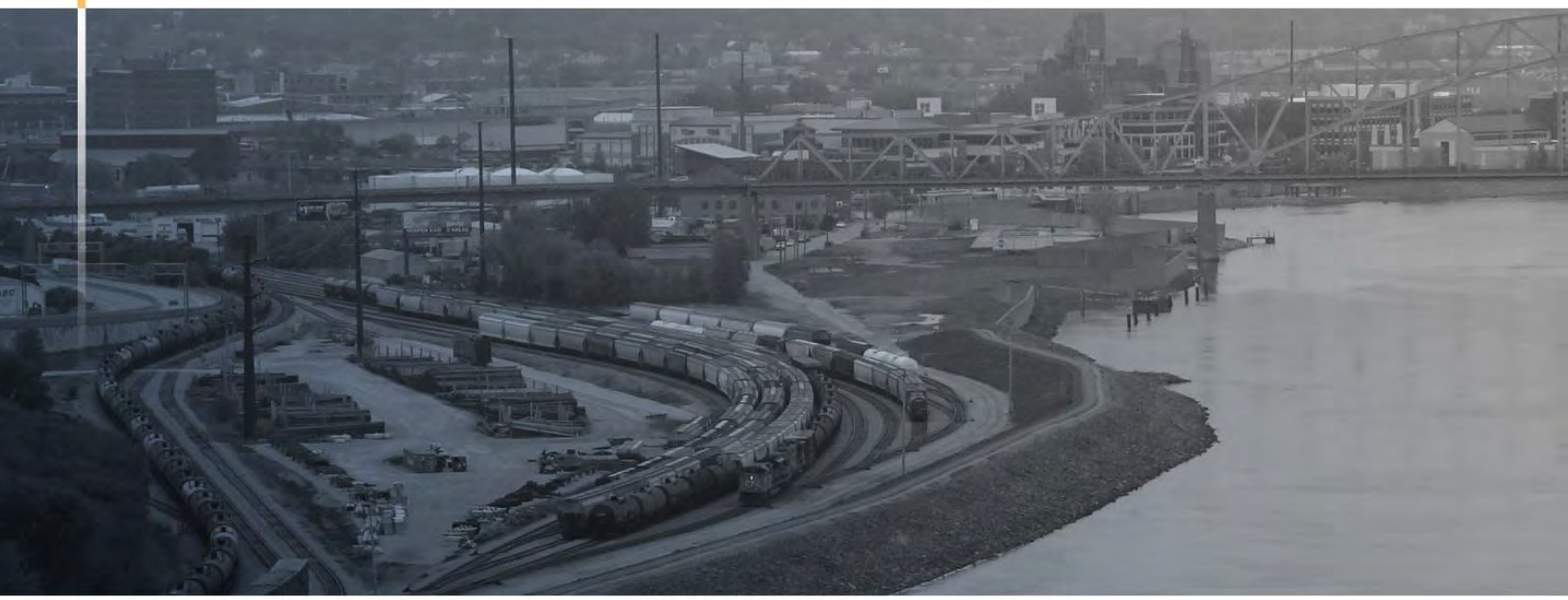

Eight County Freight Plan

Working Paper 2: Existing and Future Commodity Flow Profile

Prepared for:

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Solutions for growing economies

CPCS Ref: 16153
September 18, 2017

Eight County Freight Plan

The objective of the Eight County Freight Plan (Plan) is to develop a better understanding of the multimodal freight system in the bi-state region and to use that information to better inform policy and programming decisions.

Working Paper

This Working Paper is the second in a series of four that together inform the Plan. This Working Paper provides an overview of the existing and future commodity flows in the Region and provides insight into industry supply chains and key trade lanes.

Acknowledgments

The CPCS Team acknowledges and is thankful for the input of those consulted in the development of this Working Paper, as well as the guidance and input of representatives from ECIA, BHRC and their study partners.

Opinions

Unless otherwise indicated, the opinions herein are those of the authors and do not necessarily reflect the views of ECIA or BHRC.

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Table of Contents

Acronyms / Abbreviations

BHRC	Blackhawk Hills Regional Council
CAGR	Compound Annual Growth Rate
DOT	Department of Transportation
ECIA	East Central Intergovernmental Association
FAF	Freight Analysis Framework
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
SCTG	Standard Classification of Transported Goods
US	United States
USD	United States Dollar
USDOT	United States Department of Transportation

Project Sponsors

Executive Summary

The primary objective of the Eight County Freight Plan is to develop a better understanding of the multimodal freight system in the Eight County Region and to use this information to better inform policy and programming decisions.

This Working Paper provides an opportunity to examine the best available industry data regarding freight movement and answer the following questions:

- What are the primary freight flows to, from, and within the Eight County Region? What are the leading directions of trade, commodities, modes, and origin-destination patterns? What is the role of international trade versus domestic trade?
- How are these flows likely to change in the future?
- What do these flows say about the economic competitiveness of the region?

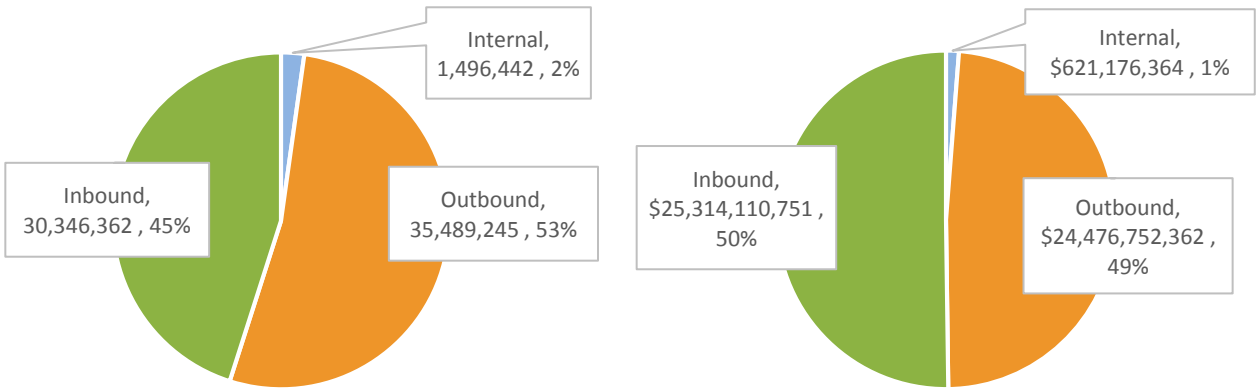
Using the Federal Highway Administration's Freight Analysis Framework (FAF) version 4, a comprehensive picture of the Region's commodity flows was developed.

Eight County Region Commodity Flows

By Tonnage and Value

For the year 2014, the Eight County Region handled approximately 67.3 million tons of freight, worth approximately $50.4 billion dollars, as inbound-outbound-internal movements, including both domestic and international freight. Both tonnage and value flows are extremely balanced between inbound and outbound directions. The tonnage and value moving within the Eight County Region is a very small share of total movement, indicating the Eight County Region economy is largely "outward facing."

Figure ES-1: Total Eight County Region Tonnage (left) and Value (right) by Direction, 2014



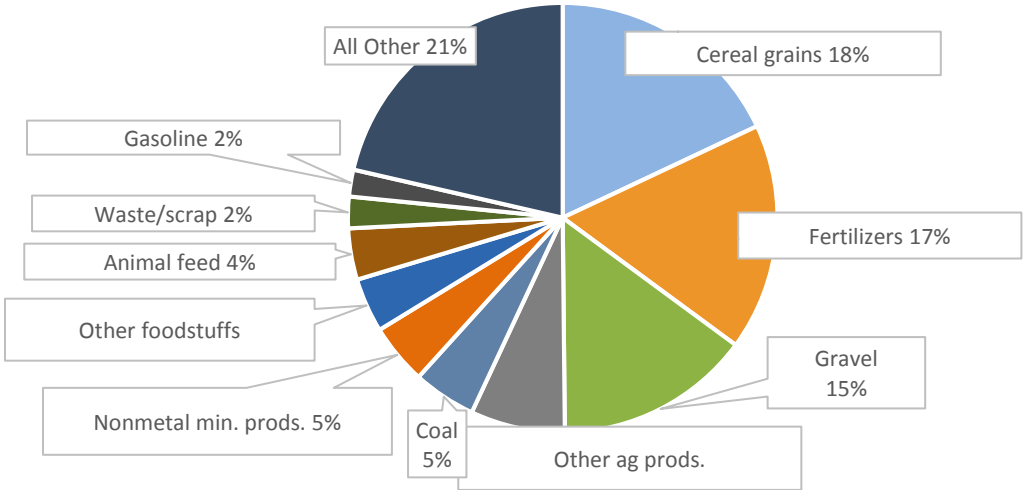
Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

By Commodity Tonnage and Value

In 2014, the leading tonnage commodities for the Eight County Region included cereal grains, fertilizers, and gravel; these three commodities represented 50 percent of the region's tonnage. Other important tonnage commodities included: other agricultural products; coal; nonmetallic mineral products; other foodstuffs; animal feed, commodity waste/scrap; and gasoline.

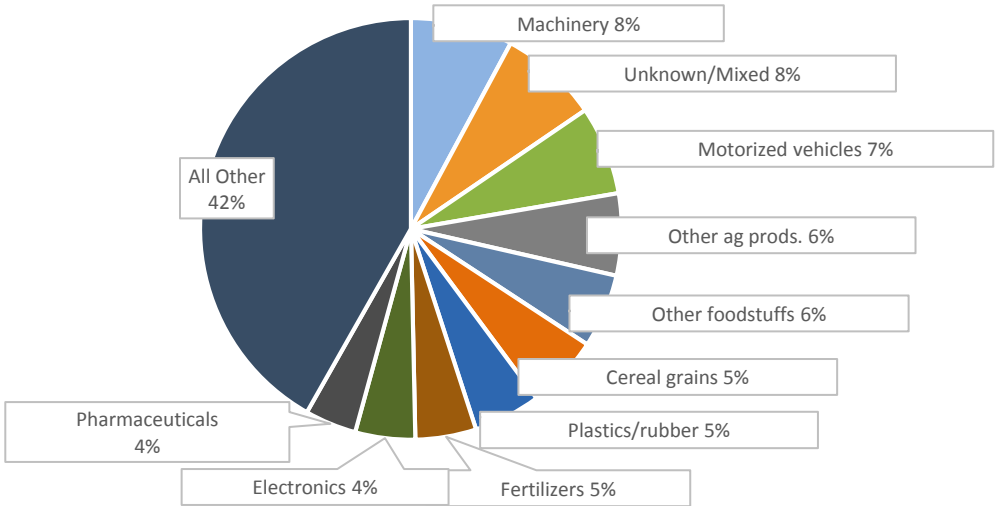
The leading value commodities for the Eight County region in 2014 included: machinery; unknown/mixed (primarily containerized goods and mixed shipments of retail goods); motorized vehicles; other agricultural products; other foodstuffs; cereal grains; plastics/rubber; fertilizers; electronics; and pharmaceuticals. Value is broadly dispersed across a wide range of commodities, with none being dominant.

Figure ES-2: Total Eight County Region Tonnage by Commodity Type, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure ES-3: Total Eight County Region Value by Commodity Type, 2014

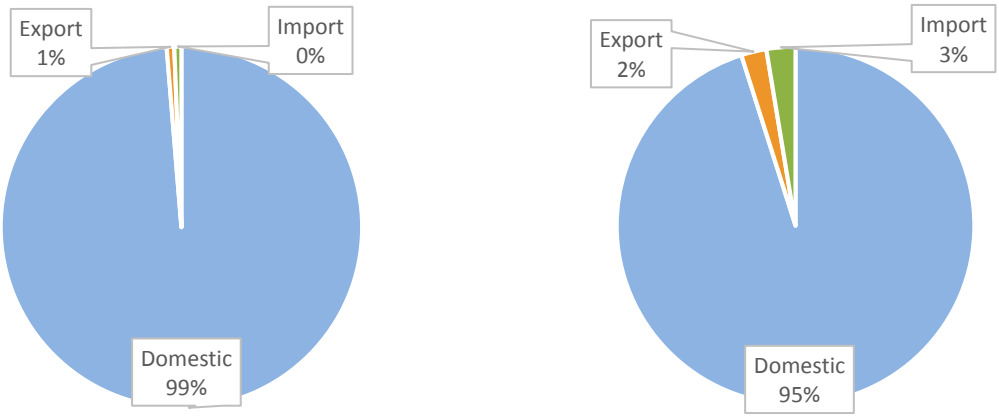


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

By Domestic and International Tonnage and Value

The total tonnages and values described in Sections 2.2.1 and 2.2.2 include both international and domestic freight movements. Looking at the trades separately, we see that 1.3 percent of tonnage and 4.9 percent of value is generated by international movements, with exports and imports being relatively equal in importance. Domestic movements represent 98.7 percent of tonnage and 95.1 percent of value. The leading international commodities by tonnage include: fertilizers (mostly import); cereal grains (mostly export); other agricultural products (almost entirely export); machinery (balanced trade); and animal feed (almost entirely export).

Figure ES-4: Domestic and International Tonnage (left) and Value (right) Shares, Eight County Region, 2014

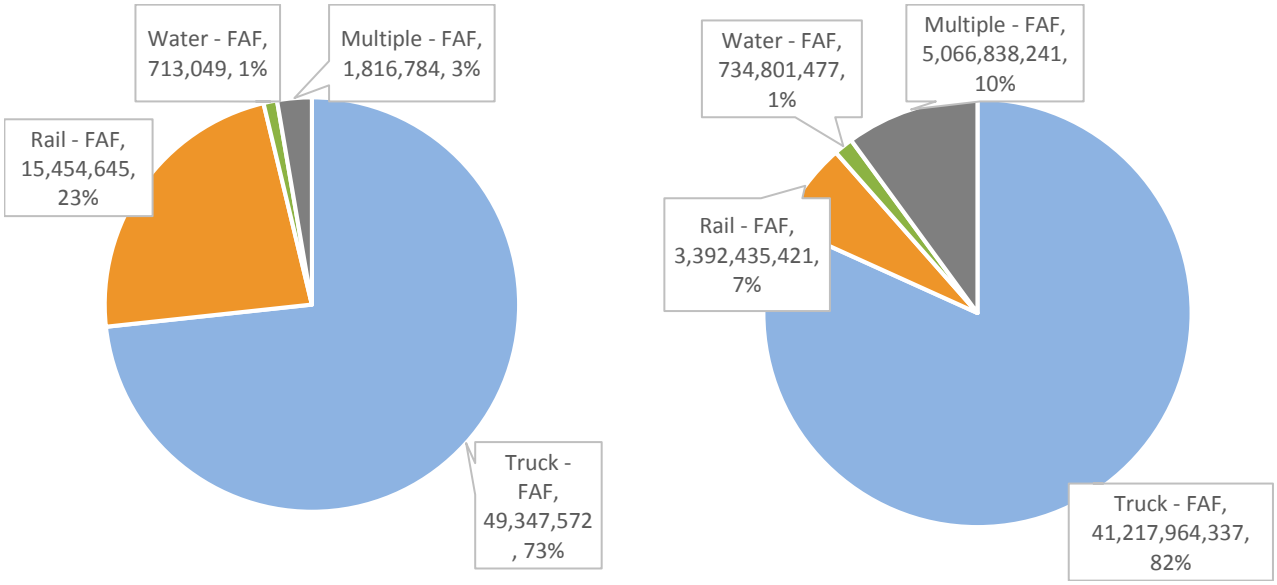


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

By Modal Tonnage and Value

Looking at state-to-state freight transportation modes, trucking represents 73 percent of Eight County Region tonnage and 82 percent of value; rail represents 23 percent of tonnage and 7 percent of value; multiple modes represents 3 percent of tonnage and 10 percent of value; and water represents 1 percent of tonnage and 1 percent of value. Each mode serves a distinct set of commodities and trading partners; the greatest tonnage and value is from trucking between the Eight County Region and the rest of Iowa and Illinois.

Figure ES-5: Eight County Region Tonnage (left) and Value ($) (right) by State-to-State Mode, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The share of freight value carried by truck (82 percent) is greater than the share of freight tonnage (73 percent), suggesting that trucks are being used to carry the Region's higher-value, lower weight manufactured goods. Rail serves a different purpose, carrying 23 percent of the Region's tonnage, but only seven percent of its value, which suggests rail shipments are being used for relatively high-weight, low-value commodities like agricultural products. An interesting category is multiple-mode shipments, which carried only three percent of tonnage, but accounted for 10 percent of value. This category includes intermodal container shipments, which are often used to carry higher-value goods with low to medium weights.

Eight County Region Future Commodity Flows

Tonnage and Value Growth

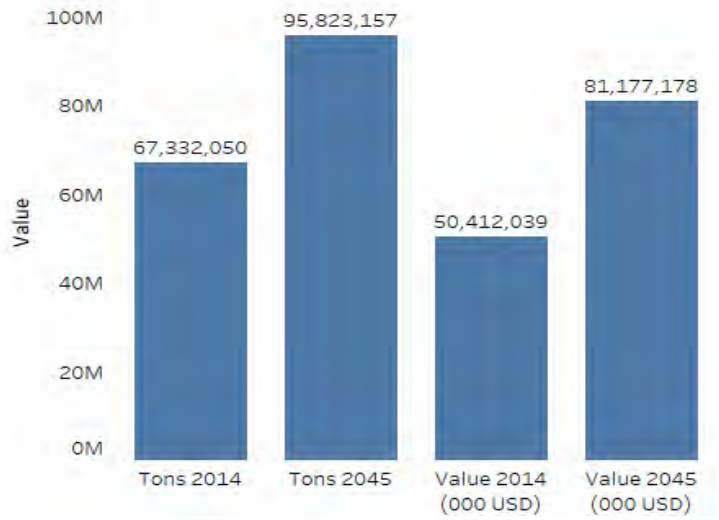
FAF data includes growth forecasts though the year 2045. The FAF forecast provides a useful picture of one possible "baseline scenario" future for the Eight County Region, where the Region and the rest of the country continue to follow historical trends. Between 2014 and 2045, the Eight County Region is projected to add 28.5 million tons of freight (a 42 percent total increase based on an average growth rate of 1.1 percent per year) worth almost $30.8 billion dollars (a 61 percent total increase based on an average growth rate of 1.5 percent per year). In 2045, the region will handle nearly 96 million tons of freight worth over $81 billion dollars.

Figure ES-6: Eight County Tonnage and Value Growth, 2014-2045

Tons 2014	67,332,050
Tons 2045	95,823,157
Tons Added	28,491,108
Percent Growth Tons	42.3%
Tons CAGR	1.1%
Value 2014 (USD)	50,412,039,477
Value 2045 (USD)	81,177,177,934
Value Added	30,765,138,457
Percent Growth Value	61.0%
Value CAGR	1.5%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure ES-7: Eight County Tonnage and Value (000 USD) Comparisons, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Tonnage and Value Growth by Commodity

n 2014, the top five Eight County Region tonnage commodities were cereal grains, fertilizers, gravel, other agricultural products, and coal. In 2045, the leading tonnage commodities are forecast to be cereal grains, fertilizers, gravel, other agricultural products, and non-metallic mineral products.

Figure ES-8: Eight County Commodities Ranked by 2045 Forecast Tonnage

	Tons 2014	Tons 2045	Tons Added	Percent Growth	Tons CAGR
Cereal grains	12,114,601	17,464,810	5,350,209	44.2%	1.2%
Fertilizers	11,517,022	16,333,601	4,816,579	41.8%	1.1%
Gravel	9,926,427	14,412,942	4,486,515	45.2%	1.2%
Other ag prods.	4,792,338	6,833,904	2,041,566	42.6%	1.2%
Nonmetal min. prods.	3,064,298	5,837,700	2,773,402	90.5%	2.1%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

In 2014, the top five Eight County Region value commodities were machinery, unknown/mixed commodities, motorized vehicles, other agricultural products, and other foodstuffs. In 2045, the leading tonnage commodities are forecast to be machinery, unknown/mixed (generally consisting of higher-value goods shipped in intermodal containers or truck vans), pharmaceuticals, motorized vehicles, and electronics.

Figure ES-9: Eight County Commodities Ranked by 2045 Forecast Value

	Value 2014 (USD)	Value 2045 (USD)	Value Added	% Growth	Value CAGR
Machinery	3,958,031,328	8,197,190,967	4,239,159,639	107.1%	2.4%
Unknown/Mixed	3,844,393,817	5,445,134,789	1,600,740,972	41.6%	1.1%
Pharmaceuticals	1,993,475,649	4,969,508,368	2,976,032,719	149.3%	3.0%
Motorized vehicles	3,429,676,018	4,802,950,395	1,373,274,377	40.0%	1.1%
Electronics	2,317,293,231	4,751,774,275	2,434,481,044	105.1%	2.3%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Tonnage and Value Growth by Mode

Between 2014 and 2045, all Eight County region freight modes are forecast to experience growth. State-to-state truck tonnage is projected to increase by 44.1 percent; rail tonnage is projected to increase by 32.0 percent; water tonnage is projected to increase by 42.2 percent; and multiple modes tonnage is projected to increase by 82.4 percent. The Eight County Region's transportation system will need to accommodate and absorb these increases in freight tonnage while maintaining levels of performance that are acceptable to its freight shippers and receivers.

Figure ES-10: Eight County Tonnage and Value Growth by Mode, 2014-2045

	Mode			
	Truck - FAF	Rail - FAF	Water - FAF	Multiple - FAF
Tons 2014	49,347,572	15,454,645	713,049	1,816,784
Tons 2045	71,095,638	20,400,234	1,014,143	3,313,142
Tons Added	21,748,066	4,945,589	301,094	1,496,358
Percent Growth Tons	44.1%	32.0%	42.2%	82.4%
Tons CAGR	1.2%	0.9%	1.1%	2.0%
Value 2014 (USD)	41,217,964,337	3,392,435,421	734,801,477	5,066,838,241
Value 2045 (USD)	63,794,940,850	5,657,484,319	914,339,365	10,810,413,400
Value Added	22,576,976,513	2,265,048,898	179,537,887	5,743,575,158
Percent Growth Value	54.8%	66.8%	24.4%	113.4%
Value CAGR	1.4%	1.7%	0.7%	2.5%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

This forecast lays out a set of baseline expectations. Within this forecast scenario, there are opportunities to capture anticipated growth, and possibly drive faster growth. There are also risks related to transportation capacity and performance within the Eight County Region and its partner trading regions, as well as risks associated with the larger US and global economy.

Leading opportunities are:

- Build on core strengths in established commodity groups (cereal grains, fertilizers, gravel, other agricultural products, machinery, mixed goods, motorized vehicles, and other foodstuffs) and prepare to accommodate growing transportation needs associated with these commodities.
- Look to capture emerging fast-growing commodity groups (pharmaceuticals, precision instruments, plastics/rubber, and other known economic development targets) by providing sufficient and attractive (safe, reliable, cost-effective) freight transportation options and services.
- Focus – first and foremost – on truck corridors and connections linking the Eight County Region to the remainder of Iowa and Illinois. These are critical for today's most important commodities, and for the commodities that are expected to see the most growth in the future.
- Maintain and enhance other modal options – including rail, water, and airport connections – and evaluate the potential for intermodal service improvements to best serve the region.

Potential risks include:

- The FAF forecast is a model. Like all models, it is likely wrong in some respects. We believe it has a sound basis, but its findings and implications should be confirmed where possible with local economic development knowledge and industry input.
- There are larger uncertainties that are not reflected in the forecast. Compared to parts of the country that are heavily dependent on energy products (which are highly cyclic), or lack diversity in their economic and freight transportation profile, the Eight County Region is relatively fortunate – it is not exposed to energy uncertainty, and it has diversity in its economic base. However, changes in the production of grain, for example, could significantly affect both grain and fertilizer movements; if those movements decline, construction and industrial activity could decline, suppressing the need for gravel and machinery; and so on.
- From a transportation perspective, the biggest risk is associated with the potential inability or failure to provide competitive transportation services to freight shippers and receivers. Freight system users demand reliability, cost-effectiveness, speed, safety, and (increasingly) resiliency. Different users weigh these factors differently – for example, coal places a premium on low per-unit costs, while container shippers place the highest value on reliability and speed – but they matter to all stakeholders in the freight ecosystem. If

the Eight County Region can identify and address existing freight transportation deficiencies, and build new advantages for freight shippers, it should be increasingly competitive for the retention, growth, and attraction of freight-dependent industries. If it does not do so, it risks limited growth and loses opportunities.

Eight County Region Benchmarking: Commodities, Modes, Distances, and Costs

In addressing the competitiveness of the Eight County Region in providing freight transportation services, it is useful to compare its performance to national-average benchmarks for truck, rail, water, and multiple modes tonnage in four areas: commodity shares; mode shares; trip distances; and freight transportation costs.

To examine commodities, FAF data was used to generate two sets of metrics:

- **"Commodity Quotients"** (CQ) calculated as the ratio of Eight County Region commodity tonnage shares to US commodity tonnage shares. Commodity Quotients greater than 1.0 reflect a strong concentration Eight County Region tonnage in a given commodity, compared to the national average.
- **"Commodity Growth Quotients"** (CGQ) calculated as the ratio of Eight County Region and US commodity tonnage growth percentages. Commodity Growth Quotients greater than 1.0 mean a commodity is faster growing in the Eight County Region than in the US as a whole, on a percentage basis.

Regarding commodities, the region is more heavily concentrated in fertilizers, cereal grains, and other agricultural products than the nation as a whole; these groups are projected to grow at rates near or exceeding national averages. The region is less heavily concentrated in high-value goods (machinery, electronics, pharmaceuticals, etc.) but growth rates for these commodities are generally near national averages, suggesting the possibility of stronger roles in the regional economy. Overall the region is expected to grow at the same rate as the nation as a whole.

Figure ES-11: Eight County Region CQ and CGQ for Ten Leading Tonnage Groups, 2014

	Eight County Region 2014 Tonnage Share	US Total Tonnage Share	Eight County "Commodity Quotient"	Eight County "Commodity Growth Quotient"
Cereal grains	18.0%	7.7%	2.34	1.12
Fertilizers	17.1%	1.6%	10.70	0.95
Gravel	14.7%	12.7%	1.16	1.07
Other ag prods.	7.1%	3.9%	1.84	0.90
Coal	4.8%	6.8%	0.70	0.56
Nonmetal min. prods.	4.6%	7.5%	0.61	1.17
Other foodstuffs	4.1%	4.9%	0.83	0.96
Animal feed	3.9%	2.3%	1.65	0.84
Waste/scrap	2.4%	4.6%	0.52	1.07
Gasoline	2.0%	5.4%	0.37	1.30

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure ES-12: Eight County Region CQ and CGQ for Ten Leading Value Groups, 2014

	Eight County Region 2014 Tonnage Share	US Total Tonnage Share	Eight County "Commodity Quotient"	Eight County "Commodity Growth Quotient"
Machinery	0.6%	0.9%	0.69	0.84
Unknown/Mixed	1.4%	2.7%	0.53	0.90
Motorized vehicles	0.6%	1.3%	0.45	0.97
Other ag prods.	7.1%	3.9%	1.84	0.90
Other foodstuffs	4.1%	4.9%	0.83	0.96
Cereal grains	18.0%	7.7%	2.34	1.12
Plastics/rubber	1.2%	1.7%	0.70	0.80
Fertilizers	17.1%	1.6%	10.70	0.95
Electronics	0.2%	0.5%	0.34	0.77
Pharmaceuticals	0.0%	0.1%	0.30	0.84

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Similar **"Modal Quotients"** and **"Modal Growth Quotients"** were calculated to examine modes. The region is substantially more dependent on rail than the nation as a whole, and substantially less dependent on water. The region's use of trucking and multiple modes are slightly below national averages. All modes are expected to grow at roughly the national average rates.

Figure ES-13: Eight County Region MQ and MGQ, 2014

	Eight County Region 2014 Tonnage Share	US Total Tonnage Share (excluding Air, Pipeline, Other)	Eight County "Modal Quotient"	Eight County "Modal Growth Quotient"
Truck	73.3%	79.6%	0.92	1.00
Rail	23.0%	12.4%	1.85	1.04
Multiple	2.7%	3.1%	0.88	1.00
Water	1.1%	5.0%	0.21	1.09

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Compared to national averages, the region's average length of haul is longer for truck (even though the most significant truck trade is with Illinois and Iowa) and for water, and shorter for rail (much of the market is in the Midwestern states) and multiple modes.

Figure ES-14: Eight County Region and US Average Trip Lengths by Mode (Provisional), 2014

	Eight County Region Average Miles per Trip	US Total Average Miles per Trip
Truck - FAF	265	177
Rail - FAF	399	802
Multiple - FAF	557	811
Water - FAF	540	453

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Based on national average cost factors, in 2014, an estimated $2 billion dollars was spent in freight transportation services for the Eight County Region. Further work in this study will

address ways to improve the cost-effectiveness of the region's transportation options and services.

Figure ES-15: Order-of-Magnitude Freight Transportation Costs for the Eight County Region, 2014

	Rate per Ton-Mile	Ton-Miles, 2014	Estimated Transportation Cost
Truck	$ 0.108	13,056,538,943	$ 1,410,106,206
Rail	$ 0.083	6,159,485,019	$ 511,237,257
Multiple	$ 0.097	1,012,159,822	$ 98,179,503
Water	$ 0.050	385,064,490	$ 19,253,224
Total			$ 2,038,776,190

Source: WSP.

Conclusions and Next Steps

The material presented in this Working Paper will be used in parallel with other data sources – including ATRI truck GPS data and other sources – to evaluate freight improvement needs and opportunities.

Additionally, a wide range of freight and economic data will be provided in a Data Toolkit for continuing use by ECIA and BHRC. The Toolkit will be built using a commercial software package called Tableau. Tableau combines data analysis capabilities (similar to MS Access or MS Excel) with display and geographic mapping capabilities. Generally, it is much more user friendly than database or GIS software, and allows non-technical users to work with very large databases to answer basic planning questions as they arise.

1 Introduction

1.1 Background

The Eight County Region is at the heart of major US manufacturing and agricultural activity. The Counties of Carroll, Clinton, Delaware, Dubuque, Jackson, Jo Daviess, Stephenson, and Whiteside rely on the multimodal transportation system of roads, rails, air and water ports to both supply the inputs needed for production and to transport goods to consumers inside and outside of the Region – driving their local economies.

The efficiency of the transportation system affects the competitiveness and growth potential of the Region. In order to enable the competitiveness of existing, as well as attract new business, the Region must understand how the freight transportation system is linked to the local economy, identify needs on the transportation system and define opportunities to improve freight transportation in local planning and policy decisions.

1.2 Objectives

The primary objective of the Eight County Freight Plan is

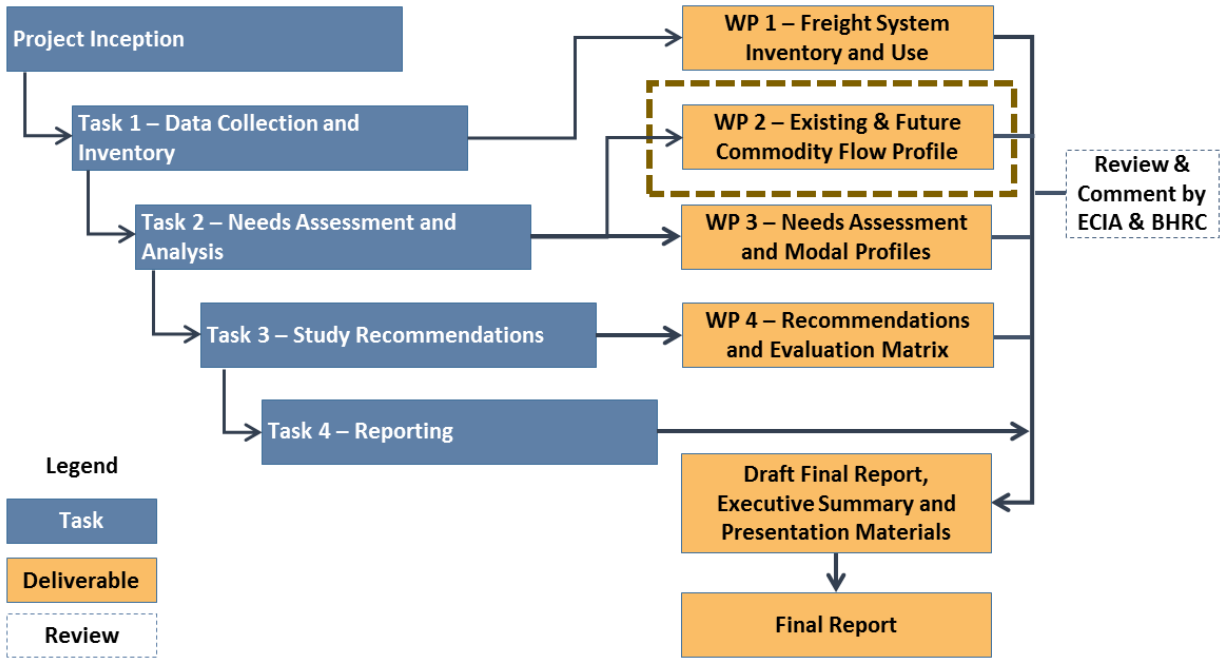
to develop a better understanding of the multimodal freight system in the Eight County Region and to use this information to better inform policy and programming decisions.

Thus, the central output of the study will be the identification of baseline freight movements across modes, the identification of the major freight transportation challenges including truck bottlenecks and how they may impact the performance of key economic sectors, as well as the formulation recommendations on freight policy and projects that will provide the greatest benefit to the Region. This study will also provide the Region with a means of leveraging freight transportation data to help them make better, more informed investment decisions.

1.3 Project Structure

The project is to be developed through four broad tasks, as set out in Figure 1-1. The present Working Paper is the output of Task 2 – Needs Assessment.

Figure 1-1: Project Approach



1.4 Purpose of this Working Paper

This Working Paper provides an opportunity to examine the best available industry data regarding freight movement and answer the following questions:

- What are the primary freight flows to, from, and within the Eight County Region? What are the leading directions of trade, commodities, modes, and origin-destination patterns? What is the role of international trade versus domestic trade?
- How are these flows likely to change in the future?
- What do these flows say about the economic competitiveness of the region?

In subsequent tasks, this information will be combined with an examination of potential improvements to address additional questions:

- What types of flows could or should be improved through infrastructure and/or operational improvements?
- What is the likely bottom-line value of freight flow improvements for the Eight County Region?

This Working Paper is also intended to provide an overview of progress to date and to solicit comments and other feedback on the structure and content of this component part of what will become the Final Report. Revisions to this Working Paper will be reflected in the Draft Final Report.

1.5 Methodology

The consultant team analyzed USDOT's Freight Analysis Framework (FAF) version 4 database to develop a multimodal commodity flow picture for the Eight County Region. FAF is made available at a high-level of aggregation, depicting only state-level or business economic area-level freight flows; however, for this study, a disaggregation of FAF to the county level was available, through concurrent work by WSP Inc. for the Illinois Department of Transportation's Statewide Freight Plan Update. The disaggregated FAF allowed the eight counties to be identified and evaluated both collectively and individually. Work steps included:

1. Documenting tonnage and value flows for the Eight County Region as a whole (presented in Section 2).
2. Forecasting changes in Eight County Region tonnage and value flows (presented in Section 3).
3. Analyzing key Eight County Region industries (presented in Section 4).
4. Benchmarking Eight County Region commodities, modes, length of haul, and freight transportation costs against national averages (presented in Section 5).
5. Addressing Conclusions and Next Steps (presented in Section 6).
6. Creating Freight Profiles for each individual county in the Eight County Region (presented in **Appendix A**).
7. Documenting the Freight Analysis Framework data used in this Working Paper (presented in **Appendix B**).

In other future study tasks, this information will be paired with other data sources (including ATRI truck GPS information, truck counts, interview results, etc.) to evaluate performance, identify potential improvements, and estimate the general value and utility of improvements to enhance the region's economic competitiveness.

1.6 Limitations

Some of the findings in this report are based on the analysis of third party data. While the CPCS team makes efforts to validate data, CPCS cannot warrant the accuracy of third party data.

2 Eight County Region Current Commodity Flows

Key Chapter Takeaway

For the year 2014, the Eight County Region handled approximately 67.3 million tons of freight, worth approximately $50.4 billion dollars, including inbound, outbound, internal movements, as well as accounting for both domestic and international freight. Both tonnage and value flows are extremely balanced between inbound and outbound directions. The tonnage and value moving within the Eight County Region is a very small share of total movement, indicating the Eight County Region economy is largely "outward facing."

In 2014, the leading tonnage commodities for the Eight County Region included cereal grains, fertilizers, and gravel; these three commodities represented 50 percent of the region's tonnage. Other important tonnage commodities included: other agricultural products; coal; nonmetallic mineral products; other foodstuffs; animal feed, commodity waste/scrap; and gasoline. The leading value commodities for the Eight County Region in 2014 included: machinery; unknown/mixed (primarily containerized goods and mixed shipments of retail goods); motorized vehicles; other agricultural products; other foodstuffs; cereal grains; plastics/rubber; fertilizers; electronics; and pharmaceuticals. Value is broadly dispersed across a wide range of commodities, with none being dominant. Around 1.3 percent of tonnage and 4.9 percent of value is generated by international movements, with exports and imports being relatively equal.

Looking at state-to-state freight transportation modes, trucking represents 73 percent of Eight County Region tonnage and 82 percent of value; rail represents 23 percent of tonnage and 7 percent of value; multiple modes represents 3 percent of tonnage and 10 percent of value; and water represents 1 percent of tonnage and 1 percent of value. Each mode serves a distinct set of commodities and trading partners; the greatest tonnage and value is from trucking between the Eight County Region and the rest of Iowa and Illinois.

2.1 Introduction to the Freight Analysis Framework

To develop an overall picture of Eight County Region freight tonnage and value, the consultant team utilized the Federal Highway Administration's (FHWA) Freight Analysis Framework (FAF) version 4. Details on FAF and its use in this study are presented in **Appendix B**. As an introduction, the key features of FAF can be summarized as follows:

- FAF provides estimates of **freight tonnage** and **freight value** for 42 different **commodity groups** and different transportation **modes**:
    - Air

  - Water
  - Truck
  - Rail
  - Pipeline
  - Multiple Modes and Mail[1]
  - Other and Unknown

- FAF provides information by **direction of flow**:
  - Inbound = freight originating outside the region and terminating in the region
  - Outbound = freight originating in the region and terminating outside the region
  - Internal = freight originating and terminating in the region
- FAF provides information on **trade type**:
  - Domestic trade = freight originating and terminating in the US
  - Export trade = freight originating in the US and terminating in another country
  - Import trade = freight originating in another country and terminating in the US

FAF data is limited to 50 states and 132 "business economic area" zones, and the Eight County Region data is combined with data for other regions in two zones (all of Iowa, and Illinois except Chicago and St. Louis). To isolate data flows for the Eight County Region, the team utilized a modified version of FAF developed for Illinois DOT by WSP, which breaks down FAF data to the county level, for analysis years 2014 and 2045.

2.2 Overview of Eight County Region Tonnage, Value, and Commodities

For the year 2014, the Eight County Region handled approximately 67.3 million tons of freight, worth approximately $50.4 billion dollars, as inbound-outbound-internal movements, including both domestic and international freight. For purposes of this Working Paper, this represents the "total" tonnage and value for the Eight County Region; it excludes pass-through freight, which could not be calculated from FAF data.

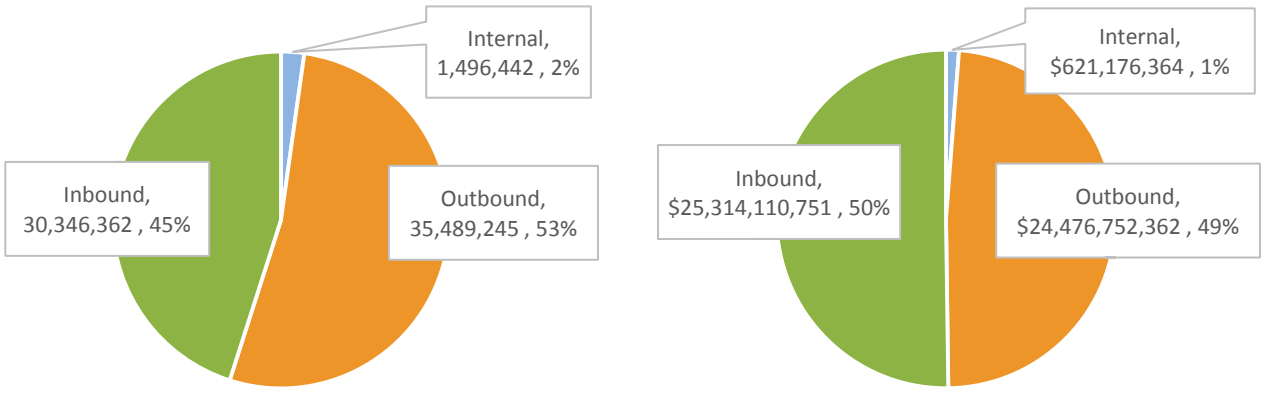
[1] Multiple modes and mail includes any reported combination of two or more modes; this usually represents intermodal containers or mixed freight shipments using multiple modes (air-truck, water-truck, water-rail, rail-truck), or small packages moving generally as air freight.

2.2.1 Total Tonnage and Value by Direction

Both tonnage and value flows are extremely balanced between inbound and outbound directions. The tonnage and value moving within the Eight County Region is a very small share of total movement, indicating the Eight County Region economy is largely "outward facing."

Appendix A provides tonnage and value information for each of the eight counties in the Region.

Figure 2-1: Total Eight County Region Tonnage (left) and Value (right) by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

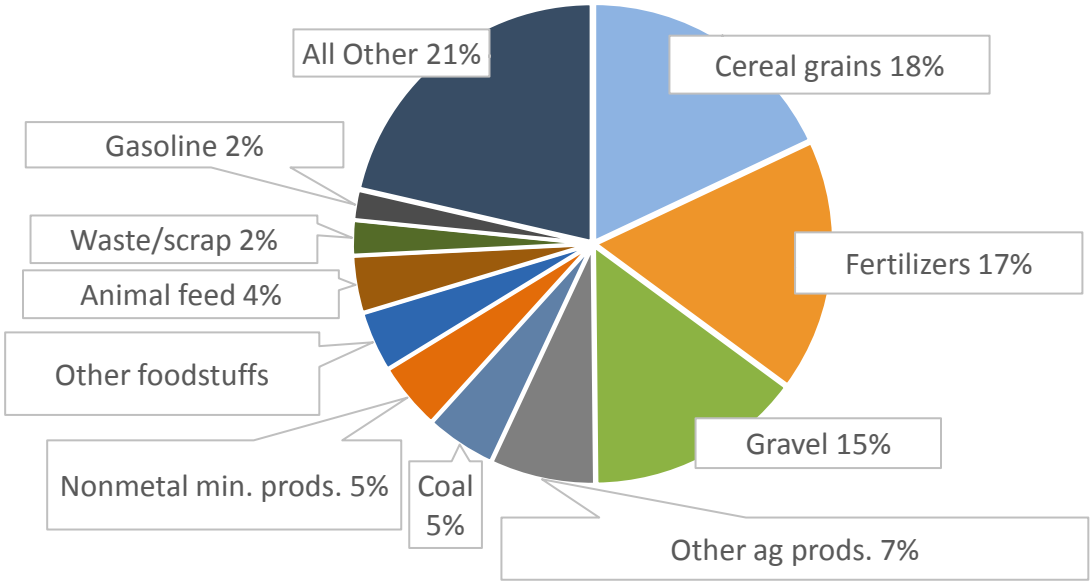
2.2.2 Total Tonnage and Value by Commodity

Tonnage by Commodity

In 2014, the leading tonnage commodities for the Eight County Region included cereal grains, fertilizers, and gravel; these three commodities represented 50 percent of the region's tonnage. Other important tonnage commodities includes: other agricultural products; coal; nonmetallic mineral products; other foodstuffs; animal feed, commodity waste/scrap; and gasoline. Flows of grains and fertilizers were roughly equal, which is important because the two commodities are often handled in the same transportation equipment, minimizing empty equipment moves and supporting lower per unit prices for both commodities.

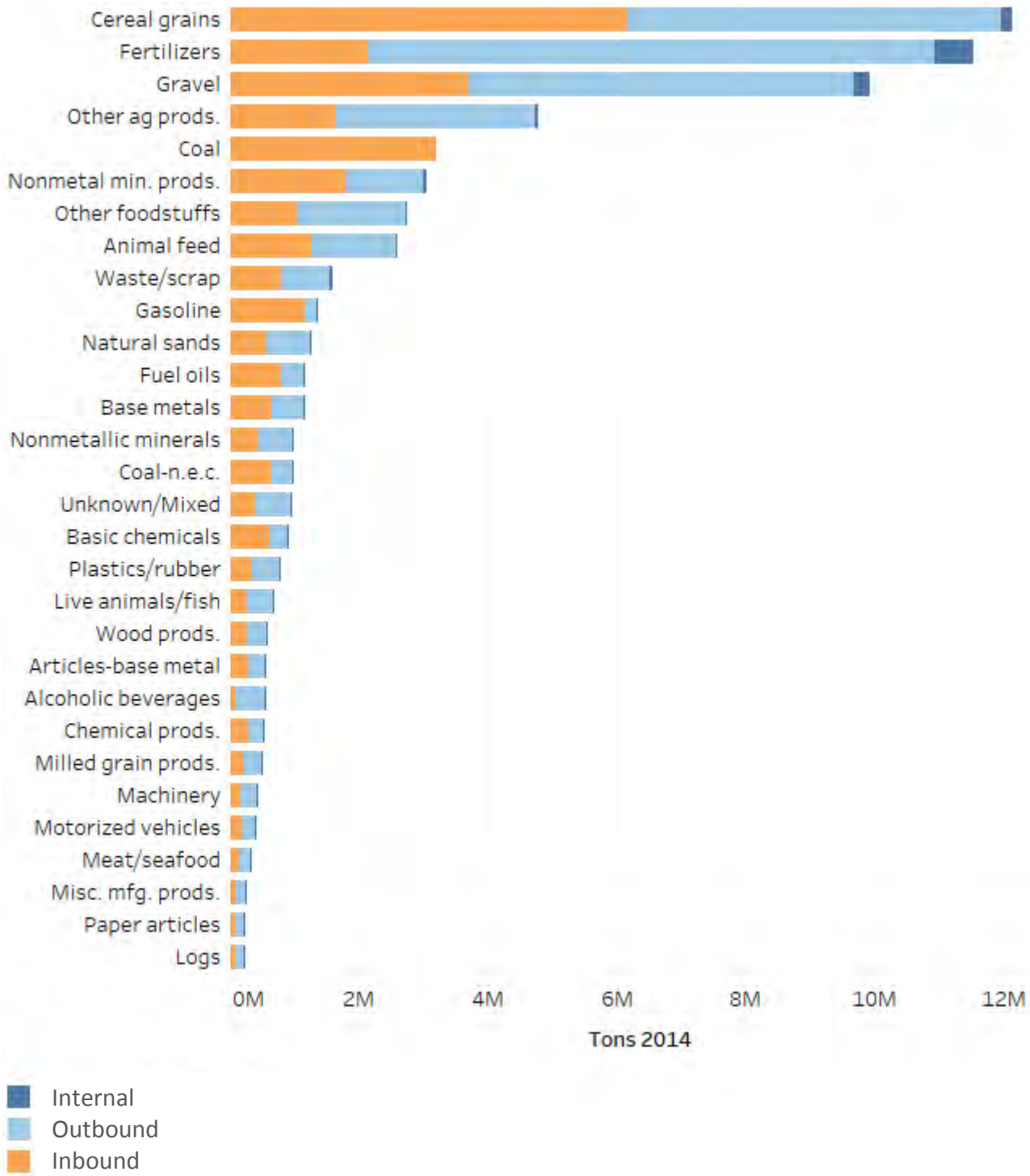
Appendix A provides tonnage by commodity for each of the eight counties in the Region.

Figure 2-2: Total Eight County Region Tonnage by Commodity Type, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-3: Total Eight County Region Tonnage by Commodity Type and Direction, 2014

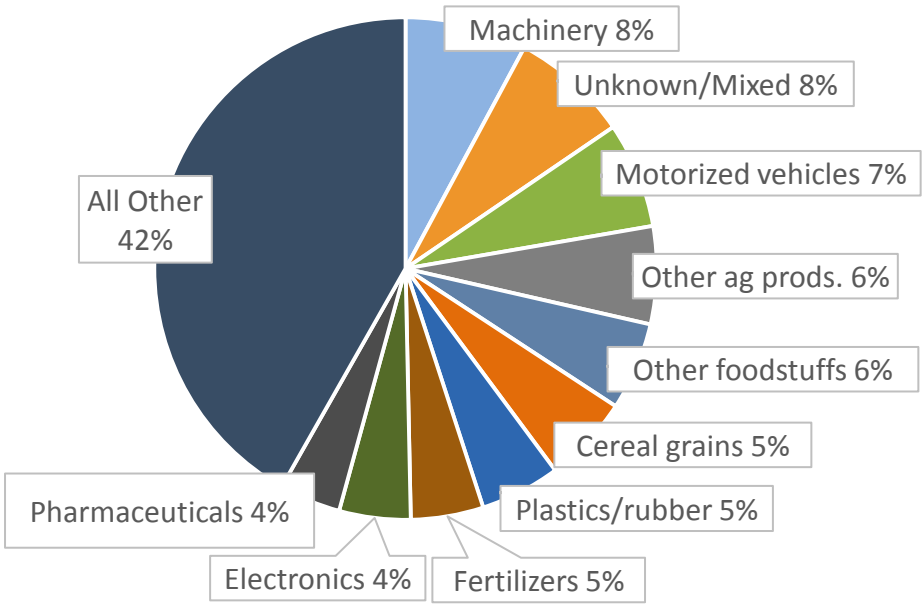


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Value by Commodity

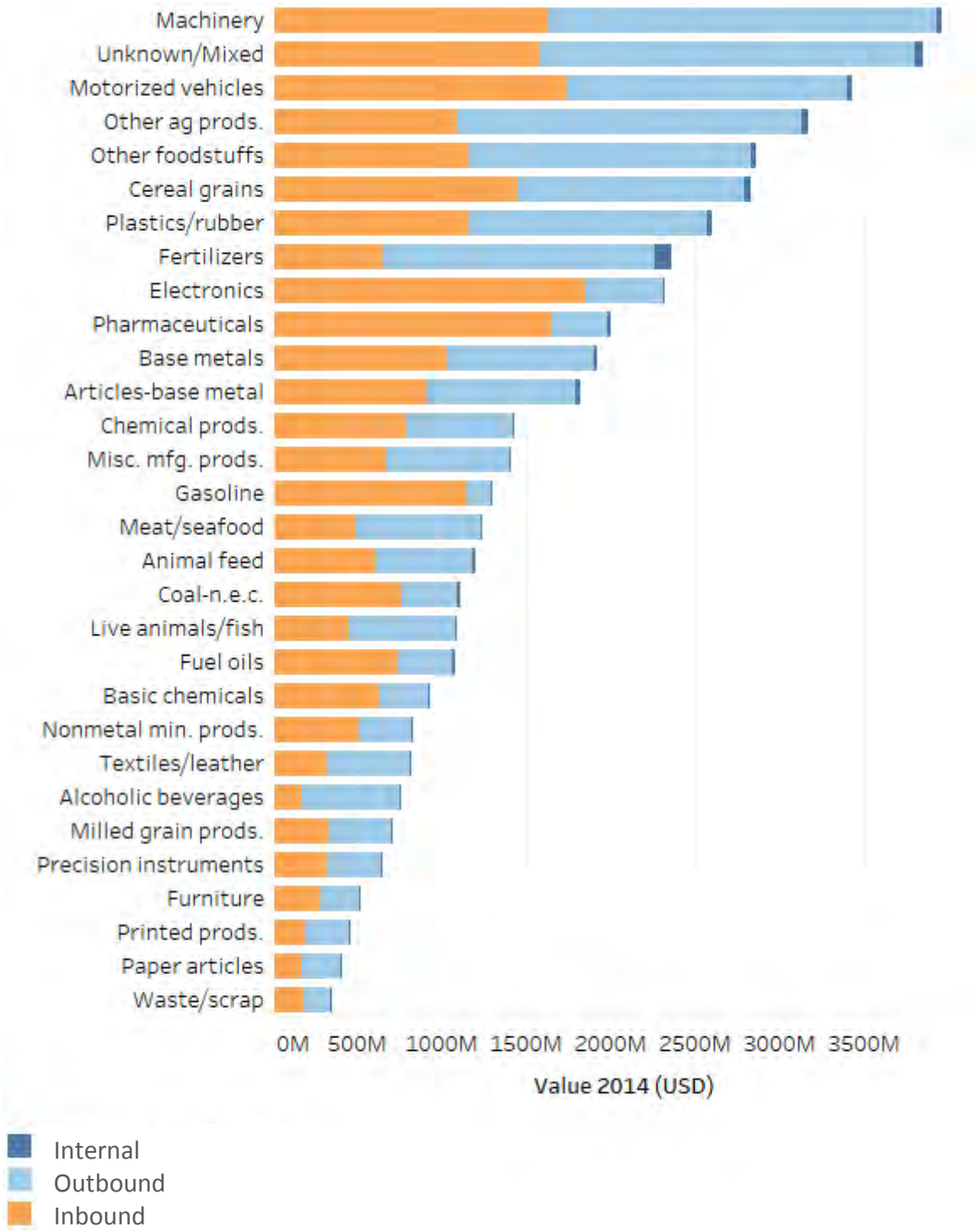
The leading value commodities for the Eight County Region in 2014 included: machinery; unknown/mixed (primarily containerized goods and mixed shipments of retail goods); motorized vehicles; other agricultural products; other foodstuffs; cereal grains; plastics/rubber; fertilizers; electronics; and pharmaceuticals. Unlike tonnage, which was heavily concentrated in three leading commodities, value is broadly dispersed across a wide range of commodities, with none being dominant.

Figure 2-4: Total Eight County Region Value by Commodity Type, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-5: Total Eight County Region Value by Commodity Type and Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

2.2.3 International and Domestic Trades

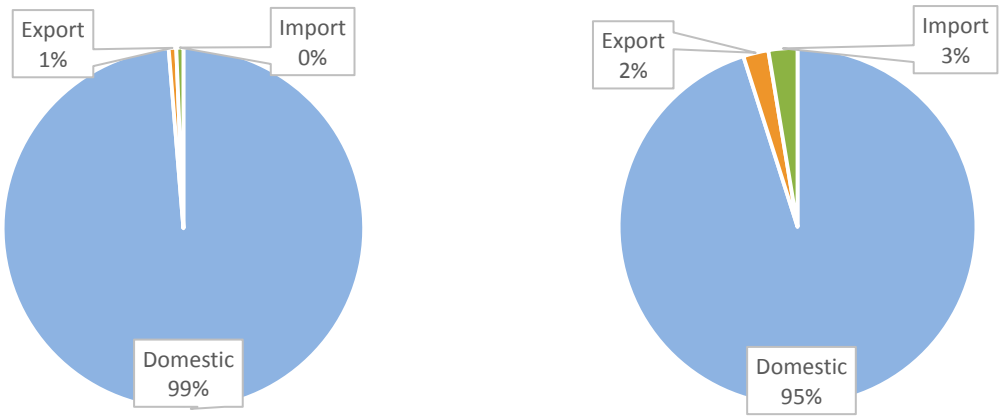
The total tonnages and values described in Sections 2.2.1 and 2.2.2 include both international and domestic freight movements. Looking at the trades separately, we see that 1.3 percent of tonnage and 4.9 percent of value is generated by international movements, with exports and imports being relatively equal in importance. Domestic movements represent 98.7 percent of tonnage and 95.1 percent of value.

Figure 2-6: Domestic and International Tonnage and Value, Eight County Region, 2014

	Tons 2014	Value 2014 (USD)
Domestic	66,453,732	47,942,272,281
Export	453,050	1,151,508,332
Import	425,268	1,318,258,863
Grand Total	67,332,050	50,412,039,477

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-7: Domestic and International Tonnage (left) and Value (right) Shares, Eight County Region, 2014

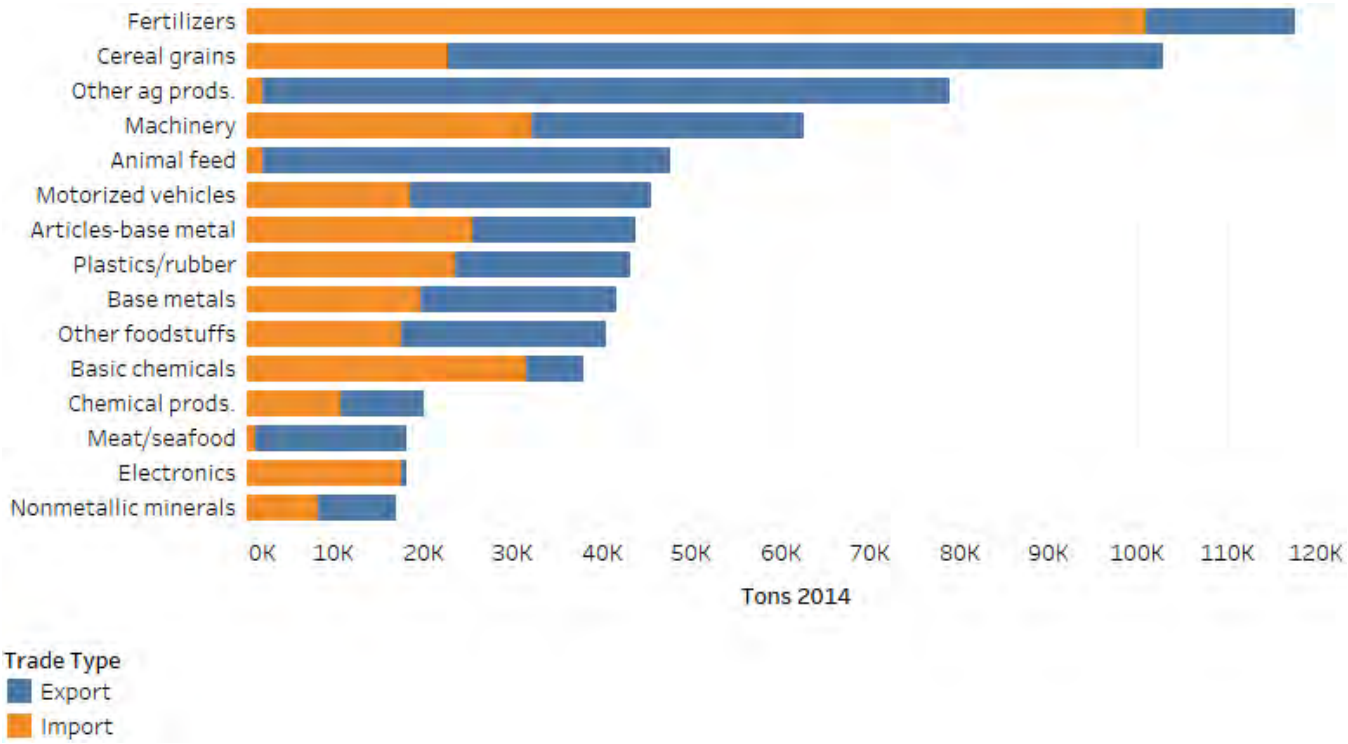


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The leading international commodities by tonnage include:

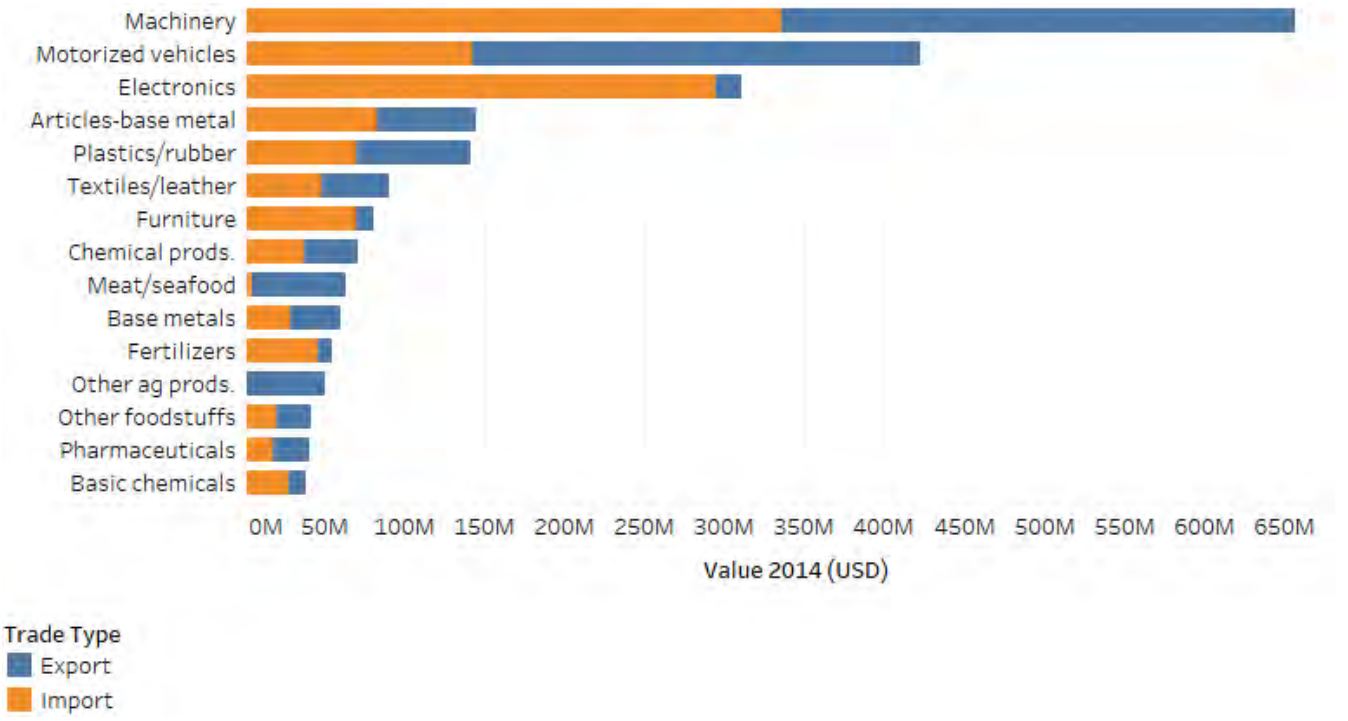
- Fertilizers (mostly import)
- Cereal grains (mostly export)
- Other agricultural products (almost entirely export)
- Machinery (balanced trade)
- Animal feed (almost entirely export)

Figure 2-8: International Tonnage by Commodity and Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-9: International Value by Commodity and Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The leading international commodities by value include:

- Machinery (balanced trade)
- Motorized vehicles (slightly more export)
- Electronics (dominated by imports)
- Articles of base metal (slightly more import)
- Plastics/rubber (generally balanced).

2.3 Eight County Modal Profiles

2.3.1 State-to-State Tonnage and Value by Mode

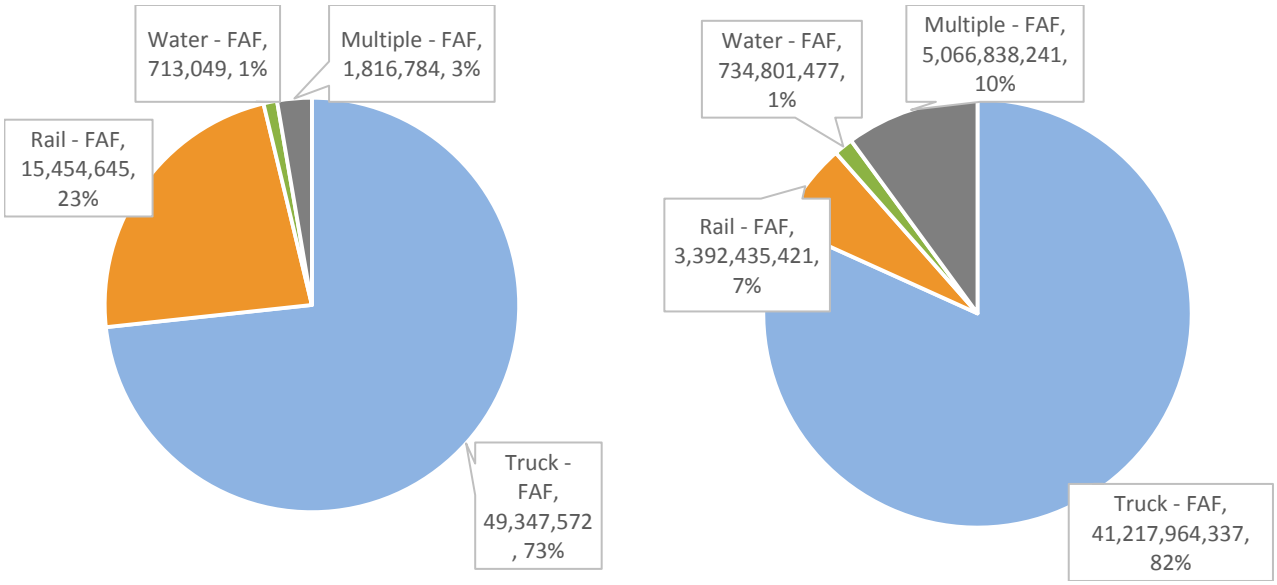
As previously mentioned, the FAF disaggregation provides tonnage and value for truck, rail, water, and multiple modes. It does not include air as a separate mode; however, the majority of Eight County Region air cargo is likely being trucked to and from airports outside the study area (O'Hare, Rockford, et al) and would be captured in trucking or multiple modes.

Looking at state-to-state freight transportation modes[2], trucking represents 73 percent of Eight County Region tonnage and 82 percent of value; rail represents 23 percent of tonnage and 7 percent of value; multiple modes represents 3 percent of tonnage and 10 percent of value; and water represents 1 percent of tonnage and 1 percent of value.

Appendix A provides tonnage information by mode for each of the eight counties in the Region.

Figure 2-10: Eight County Region Tonnage (left) and Value ($) (right) by State-to-State Mode, 2014

[2] It is important to understand how FAF tabulates modal tonnage and value. FAF reports international modes (representing movements between the US and other countries) and domestic modes (representing movements within the US) separately. However – and somewhat confusingly – FAF "domestic mode" tonnage and value mot only captures domestic traffic moving between states, it also captures international traffic moving between states. For example, a move from Dubuque to Chicago is counted in domestic mode tonnage and value; a move from Dubuque to Louisiana to South America is also counted in domestic mode tonnage and value (as a trip between Dubuque and Louisiana). In other words, FAF uses the word "domestic" to mean one thing for trade, and another thing for modal tonnage and value. To make things clearer, we refer to FAF domestic mode tonnage and value as "state to state" tonnage and value, which includes both domestic and international movements.



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The share of freight value carried by truck (82 percent) is greater than the share of freight tonnage (73 percent), suggesting that trucks are being used to carry the Region's higher-value, lower weight manufactured goods. Rail serves a different purpose, carrying 23 percent of the Region's tonnage, but only seven percent of its value, which suggests rail shipments are being used for relatively high-weight, low-value commodities like agricultural products. An interesting category is multiple-mode shipments, which carried only three percent of tonnage, but accounted for 10 percent of value. This category includes intermodal container shipments, which are often used to carry higher-value goods with low to medium weights.

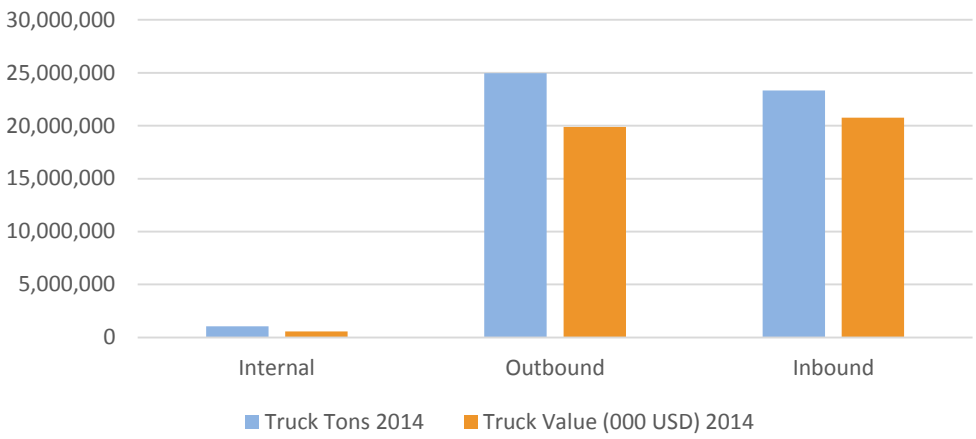
2.3.2 Profile of State-to-State Truck Flows

Truck flows for the Eight County Region in year 2014 are profiled in Figure 2-11 through Figure 2-14.

Tonnage and Value

Trucks represent 49.3 million tons (73 percent of Eight County Region total) worth $41.2 billion dollars (82 percent). Truck trade is very balanced by direction: slightly more tonnage is moving outbound from the region than inbound, while slightly less value is moving outbound than inbound. Internal truck movements are a small share of trucking activity, suggesting there is very little redistribution of goods within the Eight County Region (for example, goods arriving from Chicago to regional warehouses or distribution centers, then being trucked to other Eight County Region locations).

Figure 2-11: Truck Tons and Value by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Commodities

By far, the leading truck commodity is cereal grains, representing more than 20 percent of truck tonnage. Gravel, fertilizers, other agricultural products, and nonmetallic minerals (for construction, etc.) also represent significant tonnage. The leading value commodities are "Unknown/Mixed" (usually representing mixed shipments of higher value goods in containers or trailers), machinery, motorized vehicles, other agricultural products, cereal grains, plastics and rubber, and others.

Figure 2-12: Truck Tons and Value by Commodity, 2014

Truck Commodities	Tons 2014
Cereal grains	10,076,986
Gravel	9,514,989
Fertilizers	4,206,544
Other ag prods.	3,418,598
Nonmetal min. prods.	2,916,398
Animal feed	2,285,944
Other foodstuffs	1,781,752
Waste/scrap	1,383,529
Gasoline	1,208,675
Fuel oils	1,159,313
All Other	11,394,844
Grand Total	49,347,572

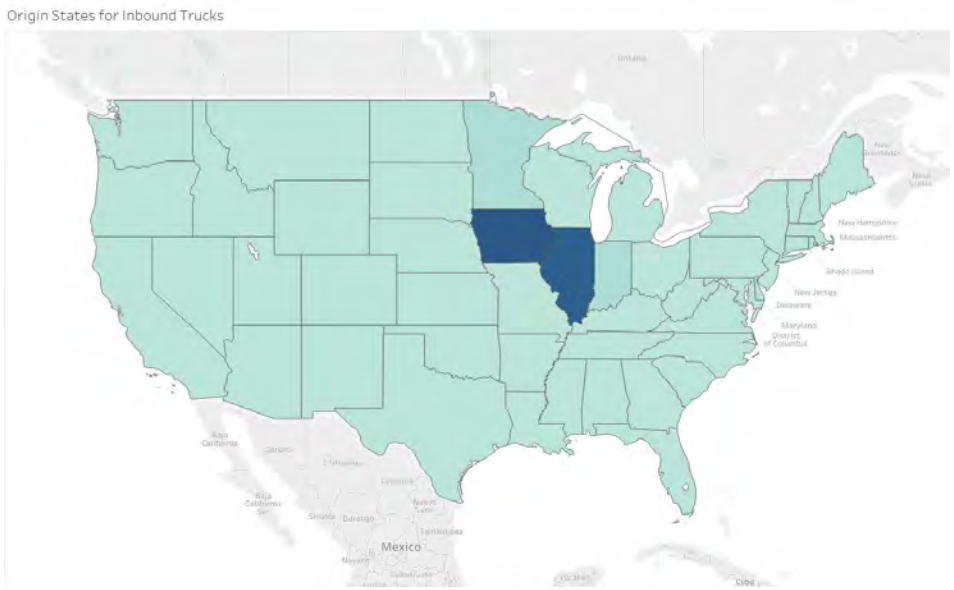
Truck Commodities	Value (USD) 2014
Unknown/Mixed	3,689,363,504
Machinery	3,433,067,624
Motorized vehicles	2,712,922,662
Other ag prods.	2,343,340,221
Cereal grains	2,294,635,986
Plastics/rubber	2,153,360,757
Other foodstuffs	2,133,921,989
Fertilizers	1,849,732,284
Electronics	1,784,076,277
Base metals	1,761,783,320
All Other	17,061,759,714
Grand Total	41,217,964,338

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Trading Partners

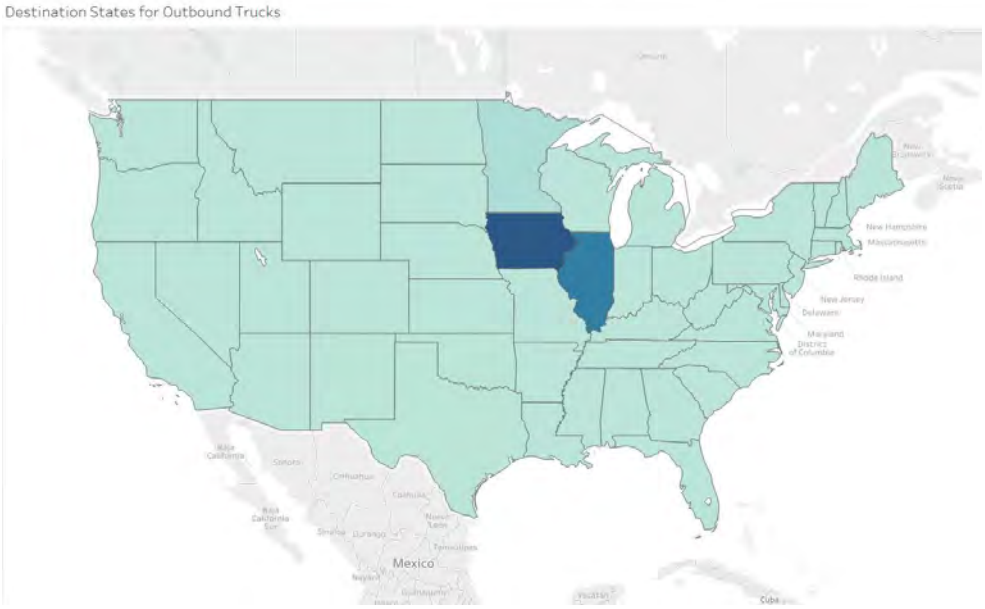
Truck trade for the Eight County Region is completely dominated by movements to and from the rest of Iowa and Illinois. While there is truck trade with every lower 48 state, those numbers are small by comparison. (The maps below include 12 color gradients; most of the US is in the lowest-intensity color.) This clearly shows that most important trucking connections for the Eight County Region are those that provide it with efficient access to the rest of Iowa and Illinois.

Figure 2-13: Origin States for Inbound Truck Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-14: Destination States for Outbound Truck Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

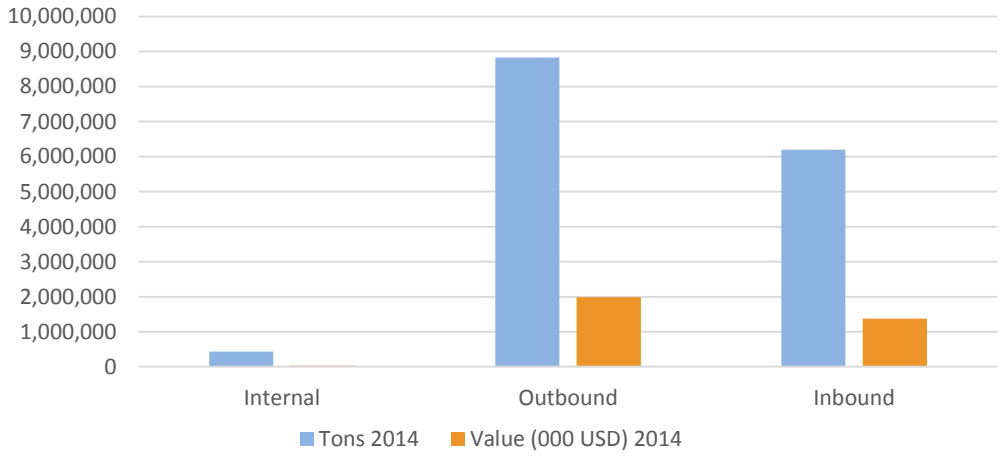
2.3.3 Profile of State-to-State Rail Flows

Rail flows for the Eight County Region in year 2014 are profiled in Figure 2-15 through Figure 2-18.

Tonnage and Value

Rail carries 15.5 million tons (23 percent of Eight County Region total) worth $3.4 billion dollars (7 percent). Rail accounts for substantially more tonnage than value, indicating that its commodity mix is largely comprised of heavier, lower-value commodities. Rail trade is robust in both the inbound and outbound directions, but somewhat less balanced than trucking, with higher tonnage and somewhat higher value in the outbound direction; rail handles very little traffic moving internally within the Eight County Region.

Figure 2-15: Rail Tons and Value by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Commodities

By far, the leading rail commodity is fertilizer, representing almost half of rail tonnage. Coal and cereal grains also represent significant tonnage. There is no dominant commodity for value; leading value commodities include cereal grains, fertilizers, other foodstuffs, other agricultural products, plastics and rubber, chemicals, etc. High-value groups, like Unknown/Mixed or Motorized Vehicles, are not among the leading rail commodities. This can be explained in part by the absence of intermodal container and auto-handling rail facilities in the Eight County Region; higher value goods are trucked to and from rail facilities located elsewhere, primarily in central and eastern Illinois. It can also be explained in part by the fact that FAF data generally assigns intermodal commodities to the "Multiple Modes and Mail" group, even if rail is used for some part of the end-to-end trip.

Figure 2-16: Rail Tons and Value by Commodity, 2014

Rail Commodities	Tons 2014
Fertilizers	7,239,590
Coal	2,972,828
Cereal grains	1,825,846
Other ag prods.	610,696
Other foodstuffs	594,835
Basic chemicals	293,886
Alcoholic beverages	226,582
Animal feed	202,372
Waste/scrap	171,177
Plastics/rubber	163,420
All Other	1,153,413
Grand Total	15,454,645

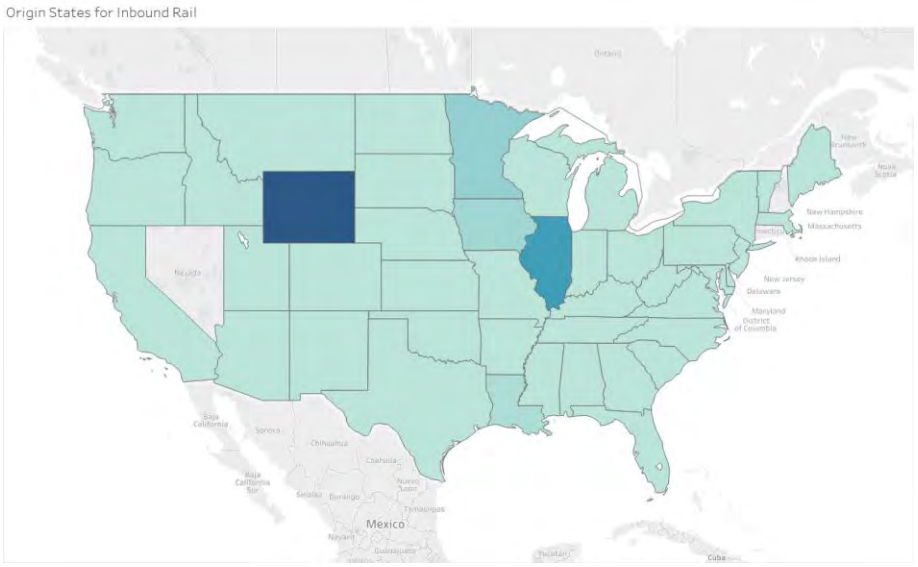
Rail Commodities	Value (USD) 2014
Cereal grains	475,946,628
Fertilizers	468,527,880
Other foodstuffs	396,636,135
Other ag prods.	305,736,883
Plastics/rubber	239,467,617
Basic chemicals	212,585,733
Alcoholic beverages	199,434,596
Chemical prods.	108,676,731
Coal	98,829,902
Articles-base metal	93,891,633
All Other	792,701,684
Grand Total	3,392,435,422

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Trading Partners

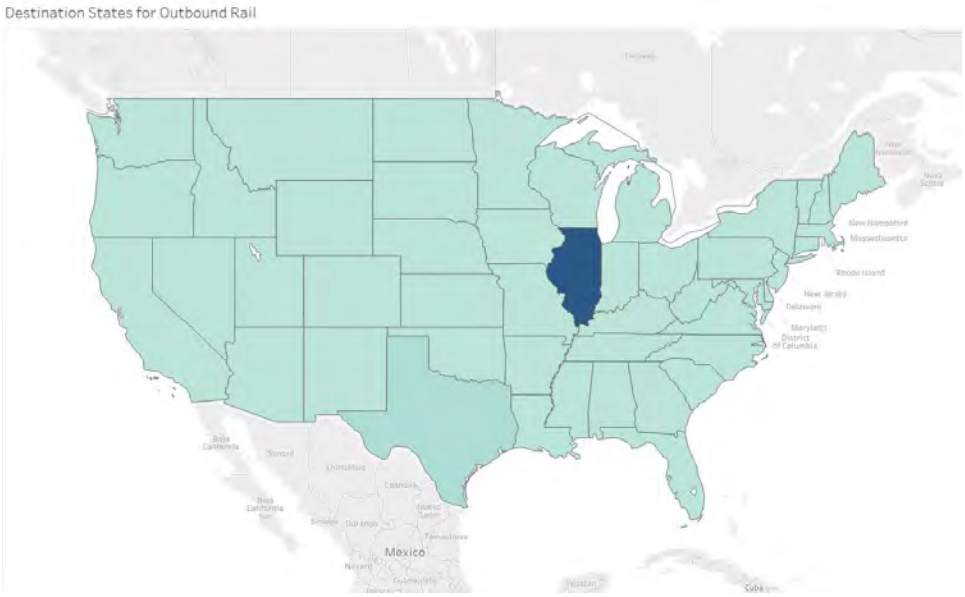
Rail trade for the Eight County Region is more geographically diverse than truck trade on the inbound side, and less diverse on the outbound side. For inbound tonnage, the leading state is Wyoming, a major supplier of coal; other important states for inbound rail tonnage are Illinois, Iowa, and Minnesota. In the outbound direction, the vast majority of Eight County Region rail shipments terminate in Illinois. This suggests that, like trucking, rail connectivity between the Eight County Region and the rest of Iowa and Illinois is of primary importance, but additional connectivity to states west of the Mississippi is also important.

Figure 2-17: Origin States for Inbound Rail Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-18: Destination States for Outbound Rail Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

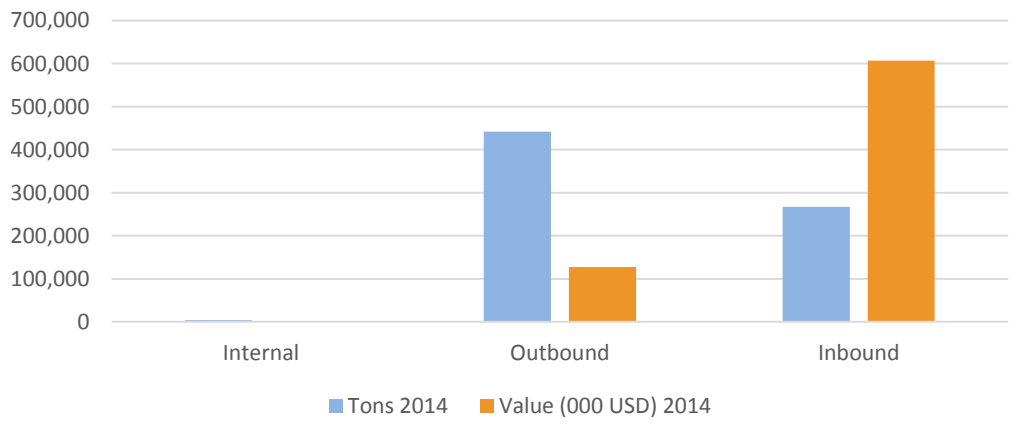
2.3.4 Profile of State-to-State Water Flows

Water flows for the Eight County Region are profiled in Figure 2-19 through Figure 2-22.

Tonnage and Value

Water carries 0.7 million tons (1 percent of Eight County Region total) worth $0.7 billion dollars (1 percent). While it provides a useful modal alternative, it is not a major "reliever" for truck or rail flows. The majority of water tonnage moves outbound, while the majority of value moves inbound.

Figure 2-19: Water Tons and Value by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Commodities

The dominant water commodities by tonnage are gravel, other agricultural products, and cereal grains; these are heavy, lower-value commodities that can take advantage of per-unit cost advantages for water shipping, and are less sensitive to water's speed disadvantage compared to truck or rail. The leading water commodities by value are electronics and machinery, which is likely oversize/overweight equipment that is difficult to move by truck or rail.

Figure 2-20: Water Tons and Value by Commodity, 2014

Water Commodities	Tons 2014
Gravel	248,056
Other ag prods.	147,323
Cereal grains	146,054
Nonmetal min. prods.	29,504
Nonmetallic minerals	25,822
Fertilizers	22,794
Electronics	13,617
Natural sands	13,485
Machinery	10,142
Waste/scrap	8,082
All Other	48,170
Grand Total	713,049

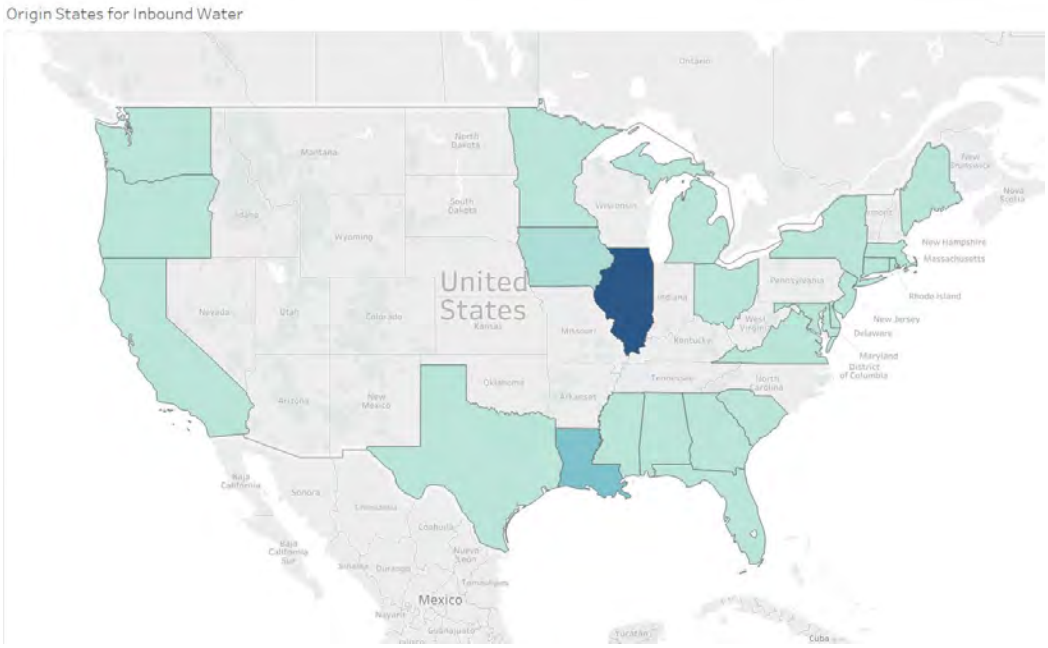
Water Commodities	Value (USD) 2014
Electronics	219,883,214
Machinery	140,543,398
Other ag prods.	95,270,782
Furniture	40,848,316
Cereal grains	40,165,933
Motorized vehicles	36,241,181
Plastics/rubber	31,135,097
Chemical prods.	22,679,249
Articles-base metal	19,831,907
Precision instruments	13,762,265
All Other	74,440,135
Grand Total	734,801,477

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Trading Partners

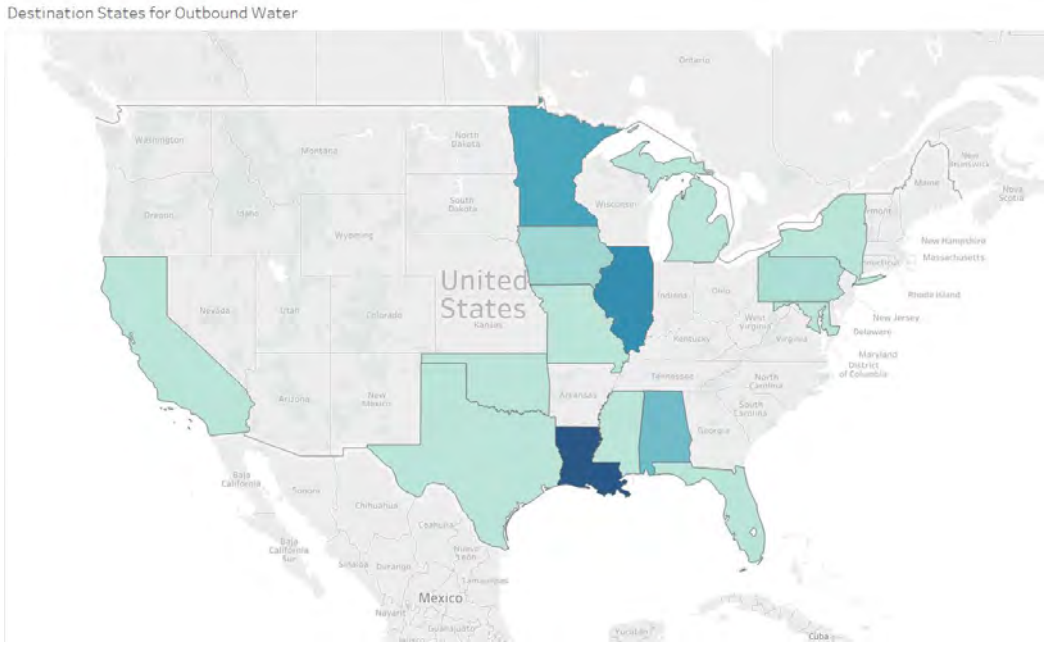
Water trade for the Eight County Region is very geographically diverse, reaching along the extent of the Mississippi River and other waterway systems accessible via the Mississippi, including the Illinois and Ohio Rivers, Great Lakes, Gulf of Mexico, and Atlantic and Pacific coasts. For inbound tonnage, the leading state is Illinois, with Louisiana ranking second. For outbound tonnage, Louisiana is the leading state (primarily for cereal grains being exported via Louisiana's deep-water ports), with Illinois and Minnesota also being important.

Figure 2-21: Origin States for Inbound Water Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-22: Destination States for Outbound Water Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

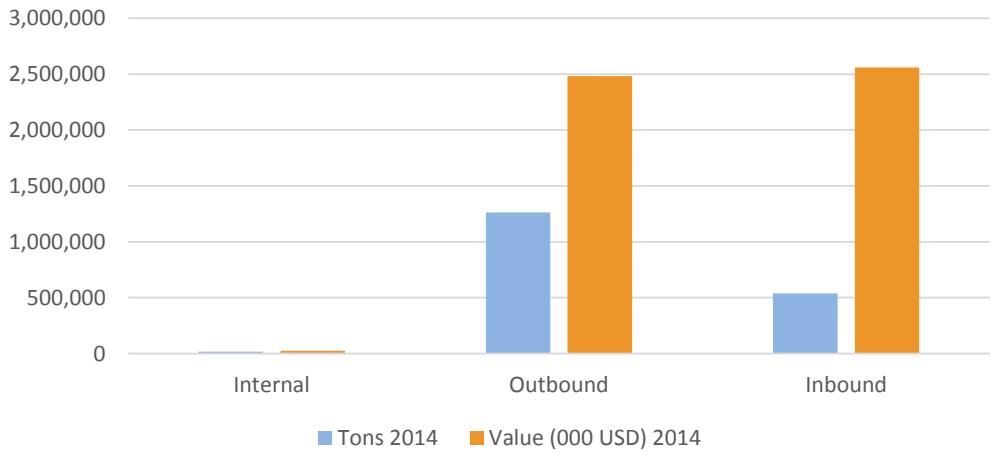
2.3.5 Multiple Modes Flows Profile

"Multiple Modes" is a FAF modal category that includes any reported combination of two or more modes; this usually represents intermodal containers or mixed freight shipments using multiple modes (air-truck, water-truck, water-rail, rail-truck, rail-water), or small packages (moving generally as air freight). Multiple Modes flows for the Eight County Region in year 2014 are profiled in Figure 2-23 through Figure 2-26.

Tonnage and Value

Multiple Modes carry 1.8 million tons (3 percent of Eight County Region total) worth $5.1 billion dollars (10 percent). While Multiple Modes are a relatively small share of tonnage, they are a very significant share of value, and specialize in handling important high-value commodities. The majority of multiple modes tonnage is moving outbound, but value flows are well-balanced in the inbound and outbound directions.

Figure 2-23: Multiple Modes Tons and Value by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Commodities

More than half of Multiple Modes tonnage is comprised of other agricultural products and other foodstuffs; other important commodities include "not specified" (could not be reported by FAF due to survey limitations), animal feed, and others. Around half of Multiple Modes value is in pharmaceuticals, motorized vehicles, and other agricultural products; other foodstuffs, machinery, electronics, and miscellaneous manufactured products. Although FAF does not specify which commodities are handled by which combination of modes, we suspect that pharmaceuticals are largely being handled by trucking in the region and airports outside the region; we suspect the other leading commodities are largely being handled by trucking in the region and rail terminals and/or port facilities outside the region. For transportation purposes, it is believed to represent primarily truck traffic within the Eight County Region itself.

Figure 2-24: Multiple Modes Tons and Value by Commodity, 2014

Multiple Mode Commodities	Tons 2014
Other ag prods.	615,722
Other foodstuffs	371,026
Not specified	162,278
Animal feed	109,219
Cereal grains	65,715
Nonmetal min. prods.	59,117
Fertilizers	48,094
Motorized vehicles	42,907
Plastics/rubber	38,013
Base metals	36,363
All Other	268,330
Grand Total	1,816,784

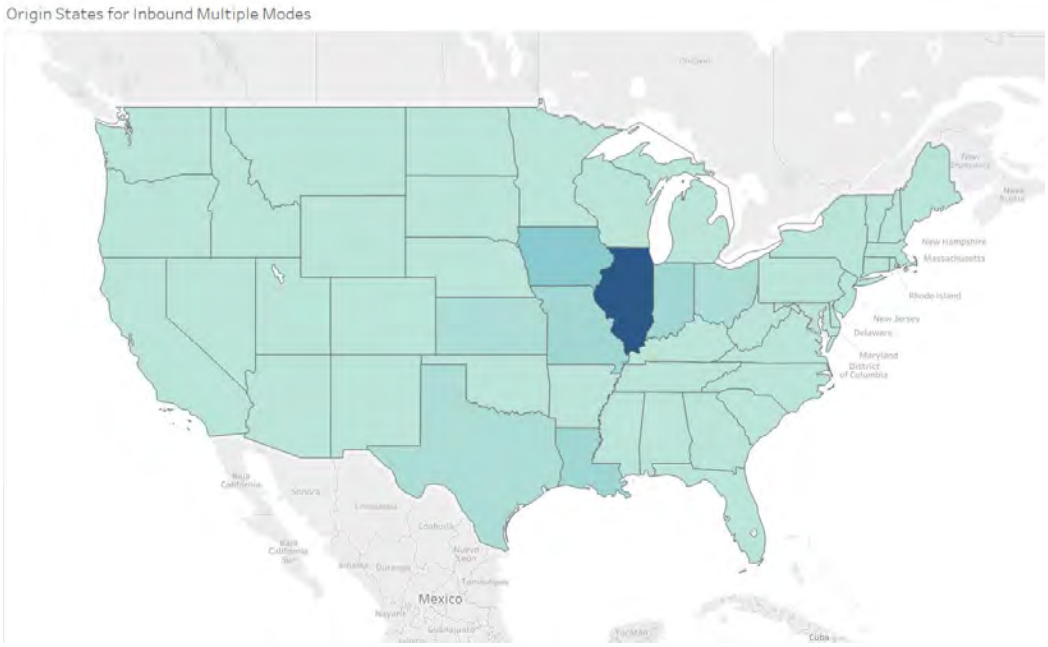
Multiple Mode Commodities	Value (USD) 2014
Pharmaceuticals	1,228,197,189
Motorized vehicles	633,820,908
Other ag prods.	426,743,799
Other foodstuffs	318,238,964
Machinery	301,973,997
Electronics	292,687,479
Misc. mfg. prods.	234,443,036
Not specified	208,015,905
Articles-base metal	204,620,174
Textiles/leather	192,551,963
All Other	1,025,544,827
Grand Total	5,066,838,241

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Key Trading Partners

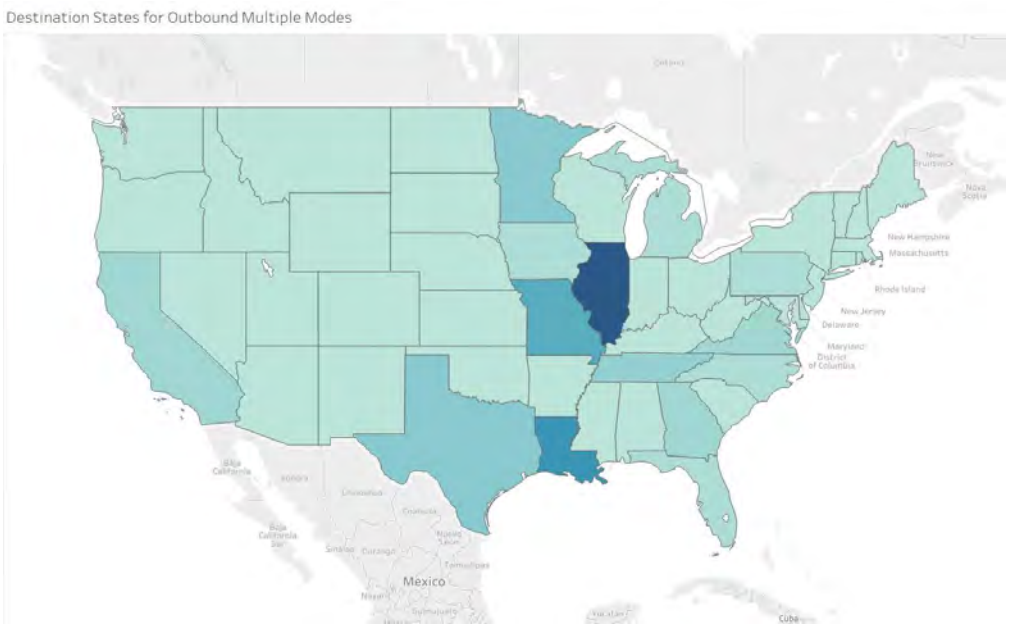
For inbound tonnage, Multiple Modes trade is largely coming from Illinois, but other states – Iowa, Indiana, Ohio, Kansas, Texas, and Louisiana – are also important. For outbound tonnage, Multiple Modes trade reaches a very diverse set of states, including not only the "usual suspects" (Illinois, Minnesota, Louisiana), but also many that are not significant for other modes (Missouri, Virginia, North Carolina, Georgia, Florida, Texas, and California).

Figure 2-25: Origin States for Inbound Multiple Modes Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 2-26: Destination States for Outbound Multiple Modes Tonnage, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

3 Eight County Region Future Commodity Flows

Key Chapter Takeaway

FAF data includes growth forecasts though the year 2045. The FAF forecast provides a useful picture of one possible "baseline scenario" future for the Eight County Region, where the region and the rest of the country continue to follow historical trends. Between 2014 and 2045, the Eight County Region is projected to add 28.5 million tons of freight (a 42 percent total increase based on an average growth rate of 1.1 percent per year) worth almost $30.8 billion dollars (a 61 percent total increase based on an average growth rate of 1.5 percent per year). In 2045, the region will handle nearly 96 million tons of freight worth over $81 billion dollars.

In 2014, the top five Eight County Region tonnage commodities were cereal grains, fertilizers, gravel, other agricultural products, and coal. In 2045, the leading tonnage commodities are forecast to be cereal grains, fertilizers, gravel, other agricultural products, and non-metallic mineral products. In 2014, the top five Eight County Region value commodities were machinery, unknown/mixed commodities, motorized vehicles, other agricultural products, and other foodstuffs. In 2045, the leading tonnage commodities are forecast to be machinery, unknown/mixed (generally consisting of higher-value goods shipped in intermodal containers or truck vans), pharmaceuticals, motorized vehicles, and electronics.

Between 2014 and 2045, all Eight County Region freight modes are forecast to experience growth. State-to-state truck tonnage is projected to increase by 44.1 percent; rail tonnage is projected to increase by 32.0 percent; water tonnage is projected to increase by 42.2 percent; and multiple modes tonnage is projected to increase by 82.4 percent. The Eight County Region's transportation system will need to accommodate and absorb these increases in freight tonnage while maintaining levels of performance that are acceptable to its freight shippers and receivers.

3.1 Origin and Interpretation of the FAF Forecast

FAF data includes growth forecasts though the year 2045. These forecasts were developed by USDOT based on macroeconomic forecasts provided by IHS Global Insight. The forecasts consider changes in demand for produced and consumed commodities, changes in the location of production and consumption, and changes in international trade. The forecasts do not consider the effects of changes in logistics (such as shipper decisions to shift freight from truck to other modes), local or regional changes in transportation system capacity or efficiency (such as improved highways or new intermodal facilities), or local or regional economic development activities (leading to greater or lesser attraction of freight users).

The FAF forecast provides a useful picture of one possible "baseline scenario" future for the Eight County Region, where the region and the rest of the country continue to follow historical trends. However, it is important to recognize that policy actions and investments may be applied in a way that leads to different --and more desirable -- outcomes. The key steps are to: understand the "baseline" scenario; be prepared to address anticipated issues and opportunities arising in that scenario; and consider opportunities to achieve the most desirable future conditions.

3.2 Overview of Tonnage and Value Growth

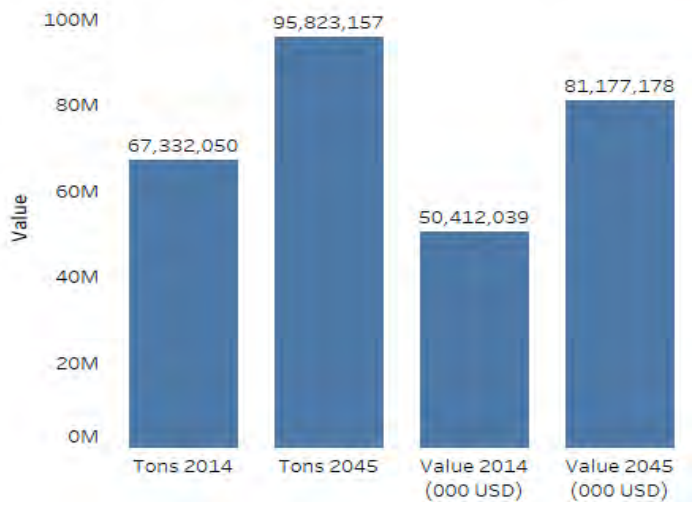
Between 2014 and 2045, the Eight County Region is projected to add 28.5 million tons of freight (a 42 percent increase based on a Compound Annual Growth Rate of 1.1 percent per year) worth almost $30.8 billion dollars (a 61 percent increase based on a CAGR of 1.5 percent per year). In 2045, the region will handle nearly 96 million tons of freight worth over $81 billion dollars.

Figure 3-1: Eight County Tonnage and Value Growth, 2014-2045

Tons 2014	67,332,050
Tons 2045	95,823,157
Tons Added	28,491,108
Percent Growth Tons	42.3%
Tons CAGR	1.1%
Value 2014 (USD)	50,412,039,477
Value 2045 (USD)	81,177,177,934
Value Added	30,765,138,457
Percent Growth Value	61.0%
Value CAGR	1.5%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 3-2: Eight County Tonnage and Value (000 USD) Comparisons, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

3.3 Commodity Growth

3.3.1 Commodity Tonnage

In 2014, the top five Eight County Region tonnage commodities were cereal grains, fertilizers, gravel, other agricultural products, and coal. In 2045, the leading tonnage commodities are forecast to be cereal grains, fertilizers, gravel, other agricultural products, and non-metallic mineral products.

Figure 3-3: Eight County Commodities Ranked by 2045 Forecast Tonnage

	Tons 2014	Tons 2045	Tons Added	Percent Growth	Tons CAGR
Cereal grains	12,114,601	17,464,810	5,350,209	44.2%	1.2%
Fertilizers	11,517,022	16,333,601	4,816,579	41.8%	1.1%
Gravel	9,926,427	14,412,942	4,486,515	45.2%	1.2%
Other ag prods.	4,792,338	6,833,904	2,041,566	42.6%	1.2%
Nonmetal min. prods.	3,064,298	5,837,700	2,773,402	90.5%	2.1%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The top five 2045 tonnage commodities – cereal grains, fertilizers, gravel, other agricultural products, and non-metallic mineral products – are also the leaders in terms of tonnage added.

Figure 3-4: Eight County Commodities Ranked by Tons Added, 2014-2045

	Tons 2014	Tons 2045	Tons Added	Percent Growth	Tons CAGR
Cereal grains	12,114,601	17,464,810	5,350,209	44.2%	1.2%
Fertilizers	11,517,022	16,333,601	4,816,579	41.8%	1.1%
Gravel	9,926,427	14,412,942	4,486,515	45.2%	1.2%
Nonmetal min. prods.	3,064,298	5,837,700	2,773,402	90.5%	2.1%
Other ag prods.	4,792,338	6,833,904	2,041,566	42.6%	1.2%
Other foodstuffs	2,750,001	4,538,756	1,788,755	65.0%	1.6%
Waste/scrap	1,597,567	2,829,218	1,231,650	77.1%	1.9%
Nonmetallic minerals	1,011,205	2,086,574	1,075,369	106.3%	2.4%
Animal feed	2,603,088	3,415,164	812,076	31.2%	0.9%
Basic chemicals	901,051	1,435,756	534,704	59.3%	1.5%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The leading tonnage growth commodities measured by percent growth – which captures some smaller, fast growing commodities – include precision instruments, transportation equipment, crude petroleum, pharmaceuticals, and machinery. The crude petroleum volume is statistically insignificant and can be ignored, but the other commodity volumes are meaningful, and in fact many of these fast-growing tonnage commodities also show up as emerging value commodities.

Figure 3-5: Eight County Commodities Ranked by Percent Growth in Tonnage, 2014-2045

	Tons 2014	Tons 2045	Tons Added	Percent Growth	Tons CAGR
Precision instruments	18,392	48,171	29,779	161.9%	3.2%
Transport equip.	8,785	21,668	12,883	146.6%	3.0%
Crude petroleum	229	549	320	140.0%	2.9%
Pharmaceuticals	28,317	66,516	38,199	134.9%	2.8%
Machinery	417,393	879,865	462,472	110.8%	2.4%
Building stone	42,887	89,809	46,922	109.4%	2.4%
Nonmetallic minerals	1,011,205	2,086,574	1,075,369	106.3%	2.4%
Electronics	116,706	240,551	123,845	106.1%	2.4%
Furniture	104,381	208,925	104,544	100.2%	2.3%
Nonmetal min. prods.	3,064,298	5,837,700	2,773,402	90.5%	2.1%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Looking at the top five Eight County Region tonnage commodities in 2014 – cereal grains, fertilizers, gravel, other agricultural products, and coal:

- Cereal grains are forecast to add 5.4 million tons (44.2 percent growth at a CAGR of 1.2 percent), growing from 12.1 to 17.4 million tons.
- Fertilizers are forecast to add 4.8 million tons (41.8 percent growth at a CAGR of 1.1 percent), growing from 11.5 to 16.3 million tons.
- Gravel is forecast to add 4.5 million tons (45.2 percent growth at a CAGR of 1.2 percent), growing from 9.9 to 14.4 million tons.
- Other agricultural products are forecast to add 2.0 million tons (42.6 percent growth at a CAGR of 1.2 percent), growing from 4.8 to 6.8 million tons.
- Coal is forecast to lose 1.9 million tons (-58.4 percent growth at a CAGR of -2.8 percent), declining from 3.2 to 1.4 million tons.

Figure 3-6: Eight County Commodities Ranked by 2014 Tonnage

	Tons 2014	Tons 2045	Tons Added	Percent Growth	Tons CAGR
Cereal grains	12,114,601	17,464,810	5,350,209	44.2%	1.2%
Fertilizers	11,517,022	16,333,601	4,816,579	41.8%	1.1%
Gravel	9,926,427	14,412,942	4,486,515	45.2%	1.2%
Other ag prods.	4,792,338	6,833,904	2,041,566	42.6%	1.2%
Coal	3,198,349	1,331,432	-1,866,918	-58.4%	-2.8%
Nonmetal min. prods.	3,064,298	5,837,700	2,773,402	90.5%	2.1%
Other foodstuffs	2,750,001	4,538,756	1,788,755	65.0%	1.6%
Animal feed	2,603,088	3,415,164	812,076	31.2%	0.9%
Waste/scrap	1,597,567	2,829,218	1,231,650	77.1%	1.9%
Gasoline	1,358,411	1,443,895	85,484	6.3%	0.2%
Natural sands	1,275,564	1,659,010	383,446	30.1%	0.9%
Fuel oils	1,183,082	973,051	-210,031	-17.8%	-0.6%
Base metals	1,175,908	1,692,068	516,160	43.9%	1.2%
Nonmetallic minerals	1,011,205	2,086,574	1,075,369	106.3%	2.4%
Coal-n.e.c.	1,010,413	1,085,764	75,351	7.5%	0.2%
Unknown/Mixed	963,238	1,356,483	393,245	40.8%	1.1%
Basic chemicals	901,051	1,435,756	534,704	59.3%	1.5%
Plastics/rubber	783,791	1,318,273	534,482	68.2%	1.7%
Live animals/fish	675,904	908,223	232,319	34.4%	1.0%
Wood prods.	587,711	844,279	256,567	43.7%	1.2%
Articles-base metal	566,830	1,009,780	442,949	78.1%	1.9%
Alcoholic beverages	550,424	973,378	422,954	76.8%	1.9%
Chemical prods.	533,246	1,011,947	478,701	89.8%	2.1%
Milled grain prods.	494,827	818,888	324,061	65.5%	1.6%
Machinery	417,393	879,865	462,472	110.8%	2.4%
Motorized vehicles	394,350	550,290	155,940	39.5%	1.1%
Meat/seafood	331,658	527,569	195,911	59.1%	1.5%
Misc. mfg. prods.	253,990	464,918	210,928	83.0%	2.0%
Paper articles	235,119	343,553	108,433	46.1%	1.2%
Logs	231,107	228,387	-2,720	-1.2%	0.0%
Newsprint/paper	202,230	191,877	-10,353	-5.1%	-0.2%
Printed prods.	125,443	133,929	8,486	6.8%	0.2%
Electronics	116,706	240,551	123,845	106.1%	2.4%
Furniture	104,381	208,925	104,544	100.2%	2.3%
Textiles/leather	77,815	73,872	-3,943	-5.1%	-0.2%
Building stone	42,887	89,809	46,922	109.4%	2.4%
Pharmaceuticals	28,317	66,516	38,199	134.9%	2.8%
Metallic ores	25,588	14,115	-11,473	-44.8%	-1.9%
Precision instruments	18,392	48,171	29,779	161.9%	3.2%
Transport equip.	8,785	21,668	12,883	146.6%	3.0%
Tobacco prods.	2,284	155	-2,129	-93.2%	-8.3%
Crude petroleum	229	549	320	140.0%	2.9%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

3.3.2 Commodity Value

In 2014, the top five Eight County Region value commodities were machinery, unknown/mixed commodities, motorized vehicles, other agricultural products, and other foodstuffs. In 2045,

the leading tonnage commodities are forecast to be machinery, unknown/mixed (generally consisting of higher-value goods shipped in intermodal containers or truck vans), pharmaceuticals, motorized vehicles, and electronics.

Figure 3-7: Eight County Commodities Ranked by 2045 Forecast Value

	Value 2014 (USD)	Value 2045 (USD)	Value Added	% Growth	Value CAGR
Machinery	3,958,031,328	8,197,190,967	4,239,159,639	107.1%	2.4%
Unknown/Mixed	3,844,393,817	5,445,134,789	1,600,740,972	41.6%	1.1%
Pharmaceuticals	1,993,475,649	4,969,508,368	2,976,032,719	149.3%	3.0%
Motorized vehicles	3,429,676,018	4,802,950,395	1,373,274,377	40.0%	1.1%
Electronics	2,317,293,231	4,751,774,275	2,434,481,044	105.1%	2.3%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The top five 2045 value commodities – machinery, unknown/mixed commodities, motorized vehicles, other agricultural products, and other foodstuffs – are also among the leaders in terms of value added. Other foodstuffs and plastics/rubber, which rank just slightly below the top five 2045 value commodities, are among the top-five gainers in value.

Figure 3-8: Eight County Commodities Ranked by Value Added, 2014-2045

	Value 2014 (USD)	Value 2045 (USD)	Value Added	% Growth	Value CAGR
Machinery	3,958,031,328	8,197,190,967	4,239,159,639	107.1%	2.4%
Pharmaceuticals	1,993,475,649	4,969,508,368	2,976,032,719	149.3%	3.0%
Electronics	2,317,293,231	4,751,774,275	2,434,481,044	105.1%	2.3%
Other foodstuffs	2,854,288,875	4,686,703,125	1,832,414,250	64.2%	1.6%
Plastics/rubber	2,598,610,454	4,415,281,786	1,816,671,332	69.9%	1.7%
Unknown/Mixed	3,844,393,817	5,445,134,789	1,600,740,972	41.6%	1.1%
Articles-base metal	1,819,227,812	3,200,746,447	1,381,518,635	75.9%	1.8%
Motorized vehicles	3,429,676,018	4,802,950,395	1,373,274,377	40.0%	1.1%
Other ag prods.	3,171,091,685	4,479,539,061	1,308,447,376	41.3%	1.1%
Chemical prods.	1,433,021,568	2,736,241,758	1,303,220,190	90.9%	2.1%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The leading value growth commodities measured by percent growth include precision instruments, transportation equipment, pharmaceuticals, crude petroleum, building stone, and machinery, and others. Again, the crude petroleum volume is statistically insignificant and can be ignored, but the other commodity volumes are meaningful. For machinery, pharmaceuticals, electronics, and precision instruments in particular, we see strong percentage growth combined with large values, suggesting these are especially important groups for targeted economic growth.

Figure 3-9: Eight County Commodities Ranked by Percent Growth in Value, 2014-2045

	Value 2014 (USD)	Value 2045 (USD)	Value Added	% Growth	Value CAGR
Precision instruments	640,837,402	1,775,694,600	1,134,857,198	177.1%	3.3%
Transport equip.	73,182,922	187,175,858	113,992,936	155.8%	3.1%
Pharmaceuticals	1,993,475,649	4,969,508,368	2,976,032,719	149.3%	3.0%
Crude petroleum	158,140	379,463	221,323	140.0%	2.9%
Building stone	6,093,044	13,778,964	7,685,921	126.1%	2.7%
Machinery	3,958,031,328	8,197,190,967	4,239,159,639	107.1%	2.4%
Nonmetallic minerals	97,793,680	200,940,991	103,147,310	105.5%	2.4%
Electronics	2,317,293,231	4,751,774,275	2,434,481,044	105.1%	2.3%
Furniture	518,612,994	1,041,639,901	523,026,907	100.9%	2.3%
Nonmetal min. prods.	828,390,984	1,594,489,695	766,098,711	92.5%	2.1%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Looking at the top five Eight County Region value commodities – machinery, unknown/mixed commodities, motorized vehicles, other agricultural products, and other foodstuffs:

- Machinery is forecast to add 4.2 million tons (107.1 percent growth at a CAGR of 2.4 percent), growing from $4.0 to $8.2 billion tons.
- Unknown/mixed commodities (primarily moved in containers or trailers) are forecast to add 1.6 million tons (41.6 percent growth at a CAGR of 1.1 percent), growing from $3.8 to $5.4 billion dollars.
- Motorized vehicles are forecast to add 1.4 million tons (40.0 percent growth at a CAGR of 1.1 percent), growing from $3.4 to $4.8 billion dollars.
- Other agricultural products are forecast to add 1.3 million tons (41.3 percent growth at a CAGR of 1.1 percent), growing from $3.2 to $4.5 billion dollars.
- Other foodstuffs are forecast to add 1.8 million tons (64.2 percent growth at a CAGR of 1.6 percent), growing from $2.9 to $4.7 billion dollars.

These findings provide good indicators of the types of commodities and volumes the Eight County Region transportation system will need to accommodate by the year 2045. Additional discussion of leading commodities is provided in Section 4 of this Working Paper.

Figure 3-10: Eight County Commodities Ranked by 2014 Value

	Value 2014 (USD)	Value 2045 (USD)	Value Added	Percent Growth ..	Value CAGR
Machinery	3,958,031,328	8,197,190,967	4,239,159,639	107.1%	2.4%
Unknown/Mixed	3,844,393,817	5,445,134,789	1,600,740,972	41.6%	1.1%
Motorized vehicles	3,429,676,018	4,802,950,395	1,373,274,377	40.0%	1.1%
Other ag prods.	3,171,091,685	4,479,539,061	1,308,447,376	41.3%	1.1%
Other foodstuffs	2,854,288,875	4,686,703,125	1,832,414,250	64.2%	1.6%
Cereal grains	2,828,668,134	4,053,812,057	1,225,143,923	43.3%	1.2%
Plastics/rubber	2,598,610,454	4,415,281,786	1,816,671,332	69.9%	1.7%
Fertilizers	2,353,370,694	3,233,419,215	880,048,521	37.4%	1.0%
Electronics	2,317,293,231	4,751,774,275	2,434,481,044	105.1%	2.3%
Pharmaceuticals	1,993,475,649	4,969,508,368	2,976,032,719	149.3%	3.0%
Base metals	1,920,788,667	2,735,101,301	814,312,634	42.4%	1.1%
Articles-base metal	1,819,227,812	3,200,746,447	1,381,518,635	75.9%	1.8%
Chemical prods.	1,433,021,568	2,736,241,758	1,303,220,190	90.9%	2.1%
Misc. mfg. prods.	1,411,208,570	2,705,804,019	1,294,595,449	91.7%	2.1%
Gasoline	1,293,048,303	1,328,584,399	35,536,095	2.7%	0.1%
Meat/seafood	1,235,005,082	1,980,392,464	745,387,382	60.4%	1.5%
Animal feed	1,195,068,581	1,588,770,890	393,702,309	32.9%	0.9%
Coal-n.e.c.	1,108,316,582	1,260,345,522	152,028,940	13.7%	0.4%
Live animals/fish	1,093,495,962	1,447,843,697	354,347,735	32.4%	0.9%
Fuel oils	1,080,900,145	887,678,470	-193,221,675	-17.9%	-0.6%
Basic chemicals	922,546,231	1,464,134,467	541,588,237	58.7%	1.5%
Nonmetal min. prods.	828,390,984	1,594,489,695	766,098,711	92.5%	2.1%
Textiles/leather	823,185,993	870,266,988	47,080,996	5.7%	0.2%
Alcoholic beverages	757,867,219	1,320,662,998	562,795,778	74.3%	1.8%
Milled grain prods.	706,410,866	1,150,163,556	443,752,690	62.8%	1.6%
Precision instruments	640,837,402	1,775,694,600	1,134,857,198	177.1%	3.3%
Furniture	518,612,994	1,041,639,901	523,026,907	100.9%	2.3%
Printed prods.	456,679,080	489,630,578	32,951,498	7.2%	0.2%
Paper articles	400,536,536	585,607,231	185,070,695	46.2%	1.2%
Waste/scrap	347,067,465	637,789,629	290,722,164	83.8%	2.0%
Wood prods.	302,096,255	434,992,212	132,895,957	44.0%	1.2%
Newsprint/paper	209,905,887	197,792,830	-12,113,057	-5.8%	-0.2%
Coal	109,261,249	43,745,389	-65,515,860	-60.0%	-2.9%
Gravel	102,723,393	149,387,656	46,664,263	45.4%	1.2%
Nonmetallic minerals	97,793,680	200,940,991	103,147,310	105.5%	2.4%
Tobacco prods.	81,054,878	5,576,705	-75,478,173	-93.1%	-8.3%
Transport equip.	73,182,922	187,175,858	113,992,936	155.8%	3.1%
Natural sands	26,045,408	37,936,828	11,891,420	45.7%	1.2%
Metallic ores	21,018,449	10,434,029	-10,584,421	-50.4%	-2.2%
Logs	16,465,317	19,044,190	2,578,873	15.7%	0.5%
Building stone	6,093,044	13,778,964	7,685,921	126.1%	2.7%
Crude petroleum	158,140	379,463	221,323	140.0%	2.9%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

3.4 State-to-State Modal Growth

Between 2014 and 2045, all Eight County Region freight modes are forecast to experience growth. State-to-state truck tonnage is projected to increase by 44.1 percent; rail tonnage is projected to increase by 32.0 percent; water tonnage is projected to increase by 42.2 percent; and multiple modes tonnage is projected to increase by 82.4 percent. The Eight County Region's transportation system will need to accommodate and absorb these increases in freight tonnage while maintaining levels of performance that are acceptable to its freight shippers and receivers.

Figure 3-11: Eight County Tonnage and Value Growth by Mode, 2014-2045

	Mode			
	Truck - FAF	Rail - FAF	Water - FAF	Multiple - FAF
Tons 2014	49,347,572	15,454,645	713,049	1,816,784
Tons 2045	71,095,638	20,400,234	1,014,143	3,313,142
Tons Added	21,748,066	4,945,589	301,094	1,496,358
Percent Growth Tons	44.1%	32.0%	42.2%	82.4%
Tons CAGR	1.2%	0.9%	1.1%	2.0%
Value 2014 (USD)	41,217,964,337	3,392,435,421	734,801,477	5,066,838,241
Value 2045 (USD)	63,794,940,850	5,657,484,319	914,339,365	10,810,413,400
Value Added	22,576,976,513	2,265,048,898	179,537,887	5,743,575,158
Percent Growth Value	54.8%	66.8%	24.4%	113.4%
Value CAGR	1.4%	1.7%	0.7%	2.5%

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Growth forecasts for each mode, and their implications for the Eight County Region, are discussed below.

3.4.1 Truck Forecast

Growth

Truck tonnage is projected to grow from 49.3 to 71.1 million tons (44.1 percent growth at a CAGR of 1.2 percent); value is projected to grow from $41.2 billion to $63.8 billion dollars (54.8 percent growth at a CAGR of 1.4 percent).

Implications

By 2045, the region will need to accommodate an additional 21.7 million tons of truck traffic. If a fully loaded truck carries 22 tons, this means an additional 1,000,000 truck trips per year, compared to 2014. The region will also need to accommodate trucks arriving empty (to pick up loads) and leaving empty (after delivering loads); assuming a 72 percent loaded/28 percent empty ratio (roughly the national average), the region would need to handle close to 1.4 million additional truck moves. Given that the region's leading tonnage commodities will remain generally the same, truck travel patterns (which are heavily focused on moves to and from the remainder of Iowa and Illinois) are expected to remain the same. Ensuring safe, reliable, and

efficient movement on the region's critical Iowa-Illinois connections is important today, and will be increasingly important in the future.

3.4.2 Rail Forecast

Growth

Rail tonnage is projected to grow from 15.5 to 20.4 million tons (32.0 percent growth at a CAGR of 0.9 percent); value is projected to grow from $3.4 billion to $5.7 billion dollars (66.8 percent growth at a CAGR of 1.7 percent).

Implications

By 2045, the region will need to accommodate an additional 4.9 million tons of rail traffic. If a fully loaded bulk railcar carries 80 tons, this means an additional 60,000 loaded railcars per year, compared to 2014. The region will also need to accommodate railcars arriving empty (to pick up loads) and leaving empty (after delivering loads); some rail trades are balanced, but others are one-way, but assuming a 72 percent loaded/28 percent empty ratio (same as trucking), the region would need to handle close to 85,000 additional railcar moves. Rail travel patterns are expected to remain generally the same, except for a loss in Wyoming rail traffic due to declining coal volumes. Rail lines and services will need to be positioned to accommodate this overall growth.

3.4.3 Water Forecast

Growth

Water tonnage is projected to grow from 0.7 to 1.0 million tons (42.2 percent growth at a CAGR of 1.1 percent); value is projected to grow from $0.7 to $0.9 billion dollars (24.4 percent growth at a CAGR of 0.7 percent).

Implications

By 2045, the region will need to accommodate an additional 300,000 tons of water traffic. If a hopper barge carries 1,500 tons, this means an additional 200 loaded barges per year. This does not appear to represent significant pressure on the region's infrastructure.

3.4.4 Multiple Modes Forecast

Growth

Multiple modes tonnage is projected to grow from 1.8 to 3.3 million tons (82.4 percent growth at a CAGR of 2.0 percent); value is projected to grow from $5.1 billion to $10.8 billion dollars (113.4 percent growth at a CAGR of 2.5 percent).

Implications

As previously mentioned, we believe that multiple modes traffic appears in the Eight County Region primarily as truck traffic. By 2045, the region will need to accommodate an additional 1.5 million tons of multiple modes traffic, representing around 75,000 loaded truck vans or

intermodal containers. The growth is largely associated with high-value goods, and may generate a corresponding need for warehouse/distribution facilities in the region. Growth in multiple modes demand may represent an opportunity for intermodal rail service development, including but not limited to the new facility being developed at Cedar Rapids, although any such service would have to be more attractive and efficient than currently available or planned services offered elsewhere in Iowa and Illinois. When considering intermodal transfer facilities, the ultimate service decisions are up to the operators and rail carriers, and experience suggests their buy-in -- particularly if backed by their own investment money -- is a strong indicator of likely success.

3.5 Opportunities and Risks

This forecast lays out a set of baseline expectations. Within this forecast scenario, there are opportunities to capture anticipated growth, and possibly drive faster growth. There are also risks related to transportation capacity and performance within the Eight County Region and its partner trading regions, as well as risks associated with the larger US and global economy. Some of these opportunities and risks are discussed below, along with possible actions to benefit from opportunities and reduce exposure to risks.

3.5.1 Opportunities

Leading opportunities are:

- Build on core strengths in established commodity groups (cereal grains, fertilizers, gravel, other agricultural products, machinery, mixed goods, motorized vehicles, other foodstuffs) and prepare to accommodate growing transportation needs associated with these commodities.
- Look to capture emerging fast-growing commodity groups (pharmaceuticals, precision instruments, plastics/rubber, and other known economic development targets) by providing sufficient and attractive (safe, reliable, cost-effective) freight transportation options and services.
- Focus -- first and foremost -- on truck corridors and connections linking the Eight County Region to the remainder of Iowa and Illinois. These are critical for today's most important commodities, and for the commodities that are expected to see the most growth in the future.
- Maintain and enhance other modal options – including rail, water, and airport connections – and evaluate the potential for intermodal service improvements to best serve the region.

3.5.2 Risks

- The FAF forecast is a model. Like all models, it is an approximation of real-world conditions. Actual conditions may vary, and its findings and implications should be

confirmed where possible with local economic development knowledge and industry input.

- There are larger uncertainties that are not reflected in the forecast. Compared to parts of the country that are heavily dependent on energy products (which are highly cyclic), or lack diversity in their economic and freight transportation profile, the Eight County Region is relatively fortunate – it is not exposed to energy uncertainty, and it has diversity in its economic base. However, changes in the production of grain, for example, could significantly affect both grain and fertilizer movements; if those movements decline, construction and industrial activity could decline, suppressing the need for gravel and machinery; and so on.

- From a transportation perspective, the biggest risk is associated with the potential inability or failure to provide competitive transportation services to freight shippers and receivers. Freight system users demand reliability, cost-effectiveness, speed, safety, and (increasingly) resiliency. Different users weigh these factors differently – for example, coal places a premium on low per-unit costs, while container shippers place the highest value on reliability and speed – but they matter to all stakeholders in the freight ecosystem. If the Eight County Region can identify and address existing freight transportation deficiencies, and build new advantages for freight shippers, it should be increasingly competitive for the retention, growth, and attraction of freight-dependent industries. If it does not do so, it risks limited growth and loses opportunities.

4 Eight County Region Leading Commodity Profiles

Key Chapter Takeaway

The Commodity Flow assessments presented in this Working Paper will be combined with the findings of interviews and key industry location analyses to create a set of "supply chain profiles" for up to ten leading industries in the study area. The top five tonnage commodities are: cereal grains; fertilizers; gravel; other agricultural products; and coal. The top five value commodities are: machinery; unknown/mixed commodities; motorized vehicles; other agricultural products; and other foodstuffs.

It seems valuable for supply chain profiling to address each of these leading commodities. This Section builds on the data from Sections 2 and 3 with additional detail on: volumes, modes, and directions; trading partners (including the introduction of "desire line" mapping; and future forecasts.

This Section also discusses implications for supply chain analysis. One finding is that future work in this study should develop more detailed, county-level pictures of all Iowa and Illinois origin and destination flows, to help identify transportation corridors that support key commodity groups. Another finding is that the analyses in this Section – which are based on the FAF model – should be confirmed where possible by other data, and especially by public and private stakeholders.

4.1 Overview

The Commodity Flow assessments presented in this Working Paper will be combined with the findings of interviews and key industry location analyses to create a set of "supply chain profiles" for up to ten leading industries in the study area. These profiles will highlight major commodities by tonnage and value, where they are coming from/going to, the mode they are traveling, whether the flow is expected to increase/decrease in the future, and the kinds of industries generating the activity. This information will provide insight into how the region is connected to the greater Midwest, as well as the national and global economy, and how it can maximize its competitiveness for freight-dependent industries.

Combining the top five tonnage and value lists, the commodities profiled include:

Figure 4-1: Cereal Grains Tonnage and Value, 2014

Commodity		Top 5 Tonnage	Top 5 Value
1	Cereal grains	X	
2	Fertilizers	X	
3	Gravel	X	
4	Coal	X	
5	Other agricultural products	X	X
6	Machinery		X
7	Unknown/mixed commodities		X
8	Motorized vehicles		X
9	Other foodstuffs		X

As input to these supply chain profiles, this Section presents additional key information on these nine commodity groups, including:

- Typical commodities within each group
- Volume, mode, and direction of trade
- Trading partner states
- Forecasts
- Implications for supply chain profiling

4.2 Cereal Grains Commodity Profile

4.2.1 Representative Commodities

The **Cereal Grains** commodity class includes: wheat; corn (other than sweet); rye; barley; oats; grain sorghum; rice; and other cereal grains. It does not include soybeans and other seeds.

4.2.2 Current Volumes, Modes, and Directions

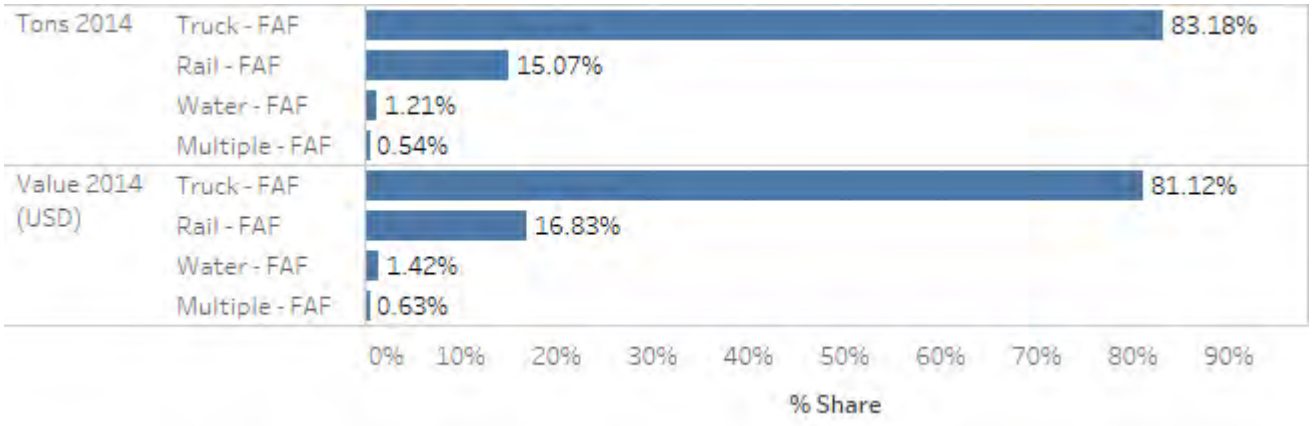
In 2014, cereal grains were the region's leading tonnage commodity group, representing 12.1 million tons and 2.8 billion in value. 83 percent of tonnage and 81 percent of value was moved by truck, with rail accounting for most of the remainder.

Figure 4-2: Cereal Grains Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	5,208,646	153,914	4,714,426	10,076,986
	Rail - FAF	917,314	17,544	890,988	1,825,846
	Water - FAF	15,736	612	129,706	146,054
	Multiple - FAF	19,594		46,121	65,715
	Total	6,161,290	172,070	5,781,241	12,114,601
Value 2014 (USD)	Truck - FAF	1,193,676,129	34,486,186	1,066,473,671	2,294,635,986
	Rail - FAF	244,182,017	4,519,915	227,244,696	475,946,627
	Water - FAF	5,091,073	198,397	34,876,463	40,165,933
	Multiple - FAF	4,909,515		13,010,073	17,919,588
	Total	1,447,858,733	39,204,498	1,341,604,903	2,828,668,134

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-3: Cereal Grains Modal Share, 2014

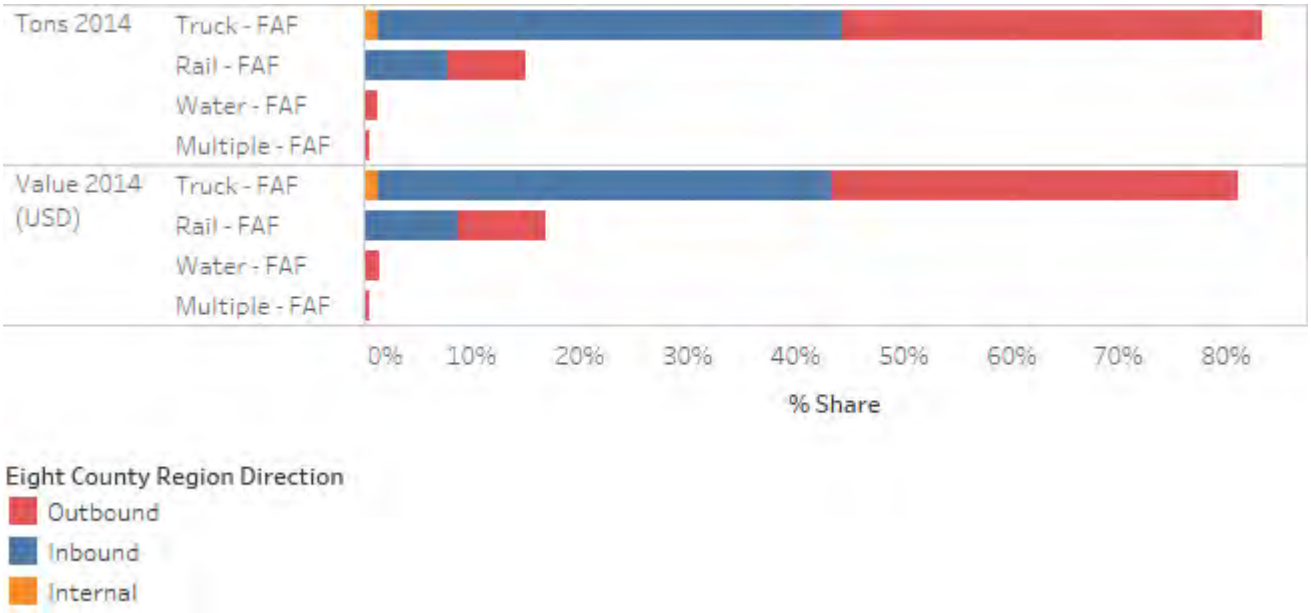


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.2.3 Trading Regions

Cereal grains trade flows are generally balanced between inbound and outbound directions for truck and rail modes; water and multiple modes focus on outbound moves. The dominant states for inbound and outbound flows are remainder of Illinois and remainder of Iowa.

Figure 4-4: Cereal Grains Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-5: Cereal Grains Trading Partner States (Showing Top Five by Tonnage), 2014

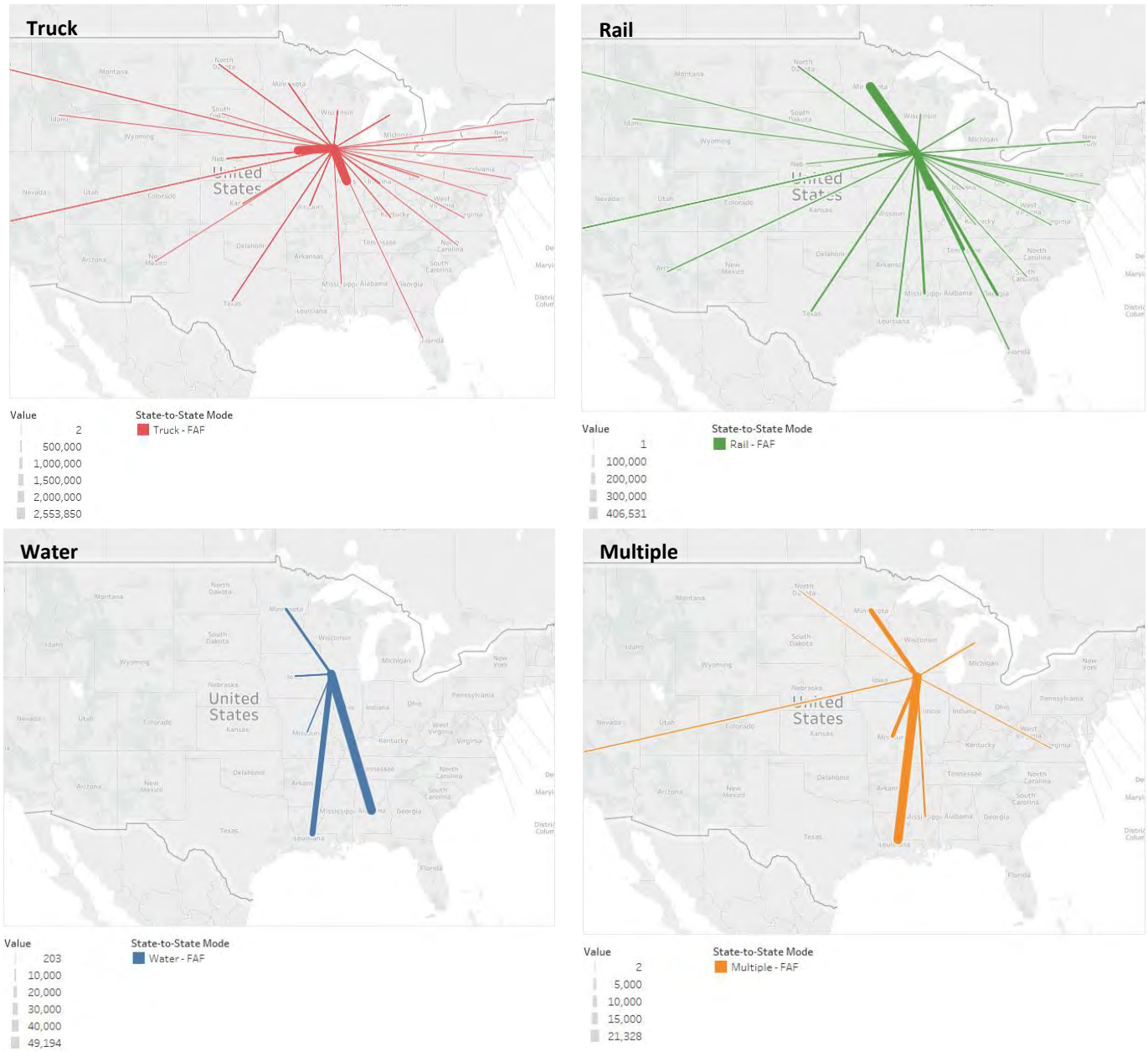
Origin State	Tons 2014	Value 2014 (USD)
IL	2,772,526	607,093,456
IA	2,689,306	650,089,937
MN	425,442	115,259,975
IN	99,474	29,762,899
NE	62,250	15,068,685
Grand Total	6,161,290	1,447,858,733

Destination State	Tons 2014	Value 2014 (USD)
IL	2,928,710	641,249,966
IA	1,866,892	451,650,004
MN	193,850	46,775,068
NE	152,782	36,562,712
AL	51,176	12,788,116
Grand Total	5,781,241	1,341,604,903

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Cereal grains truck flows are strongest with Illinois and Iowa; rail flows are strongest with Minnesota, Illinois, and Iowa; water flows are strongest with Alabama and Louisiana; and multiple modes flows are strongest with Louisiana and Minnesota.

Figure 4-6: Cereal Grains "Desire Lines" for Tonnage Flows (Both Directions), 2014

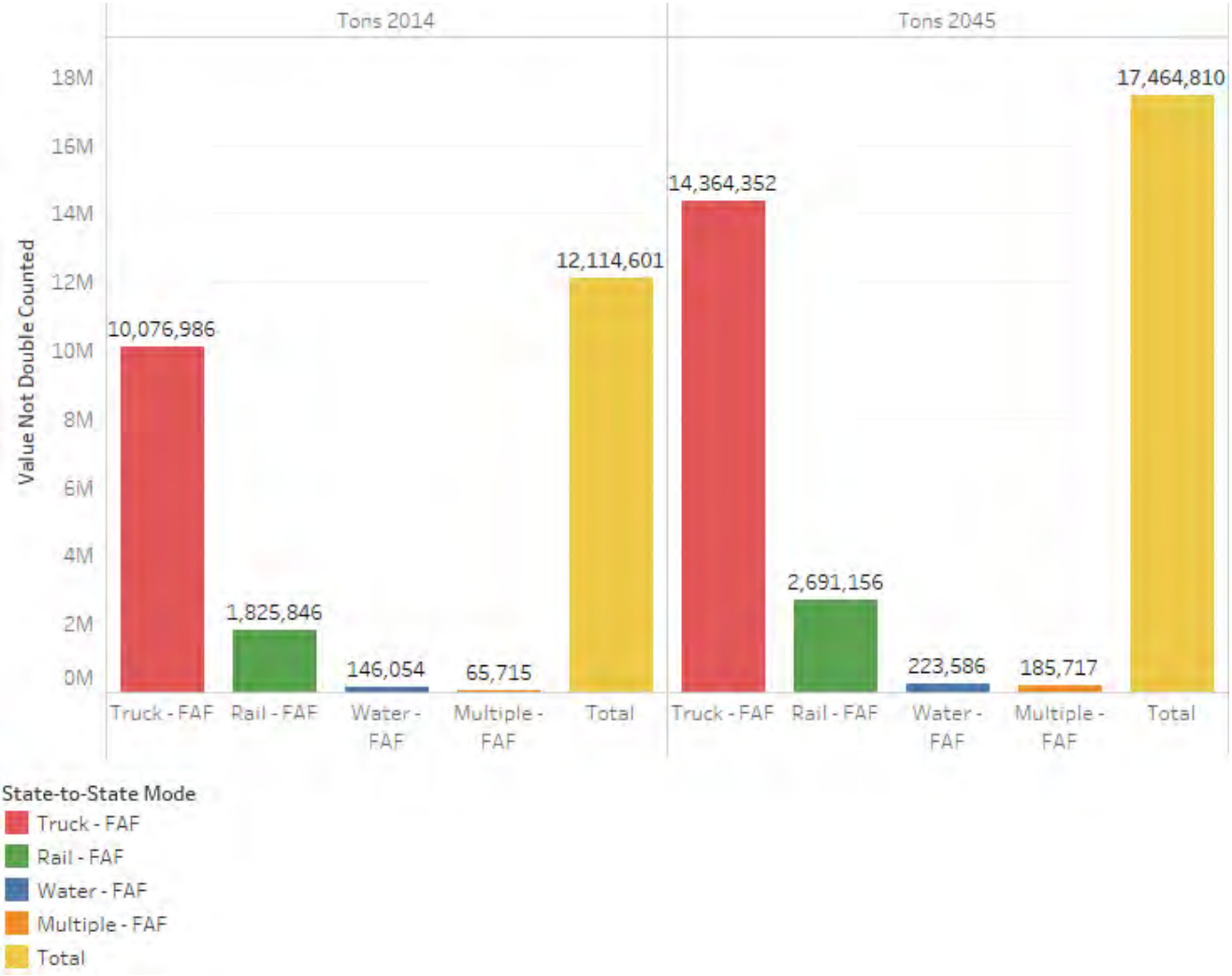


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.2.4 Future Growth

Between 2014 and 2045, cereal grains are forecast to add 5.4 million tons (44.2 percent growth at a CAGR of 1.2 percent), growing from 12.1 to 17.4 million tons.

Figure 4-7: Cereal Grains Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.3 Fertilizers Commodity Profile

4.3.1 Representative Commodities

The **Fertilizers** commodity class includes: animal and vegetable fertilizers; nitrogen, ammonia, and other chemical fertilizers; phosphates; and potash.

4.3.2 Current Volumes, Modes, and Directions

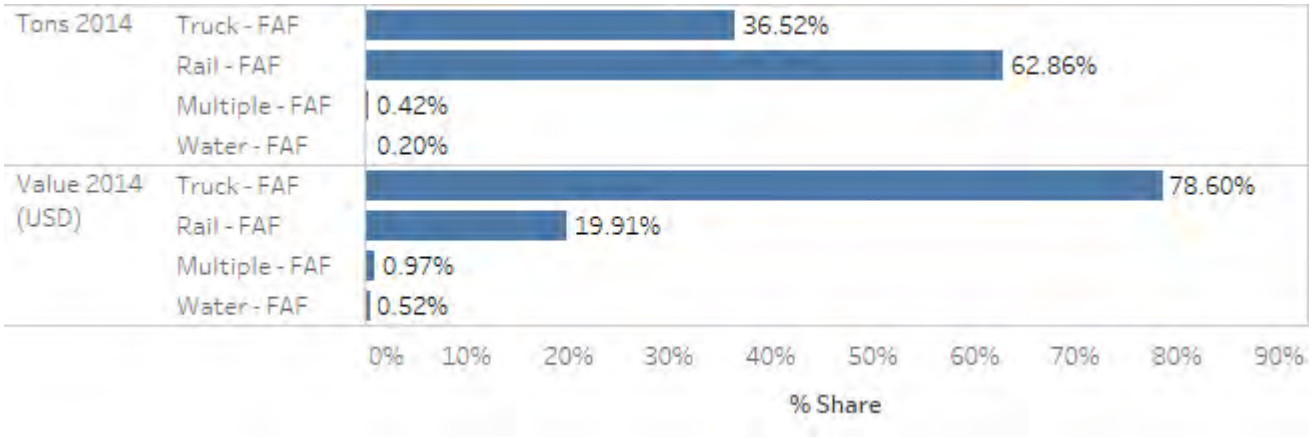
In 2014, fertilizers were the region's second-leading tonnage commodity group, representing 11.5 million tons and 2.4 billion dollars in value. 63 percent of tonnage and 79 percent of value was moved by rail, with truck accounting for most of the remainder.

Figure 4-8: Fertilizers Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	942,515	195,602	3,068,427	4,206,544
	Rail - FAF	1,153,566	397,034	5,688,990	7,239,590
	Multiple - FAF	44,869	227	2,998	48,094
	Water - FAF	21,979		815	22,794
	Total	2,162,929	592,863	8,761,230	11,517,022
Value 2014 (USD)	Truck - FAF	448,404,356	80,554,774	1,320,773,154	1,849,732,283
	Rail - FAF	170,925,632	18,533,498	279,068,750	468,527,880
	Multiple - FAF	21,390,432	106,975	1,426,232	22,923,640
	Water - FAF	11,846,420		340,471	12,186,891
	Total	652,566,839	99,195,247	1,601,608,607	2,353,370,694

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-9: Fertilizers Modal Share, 2014

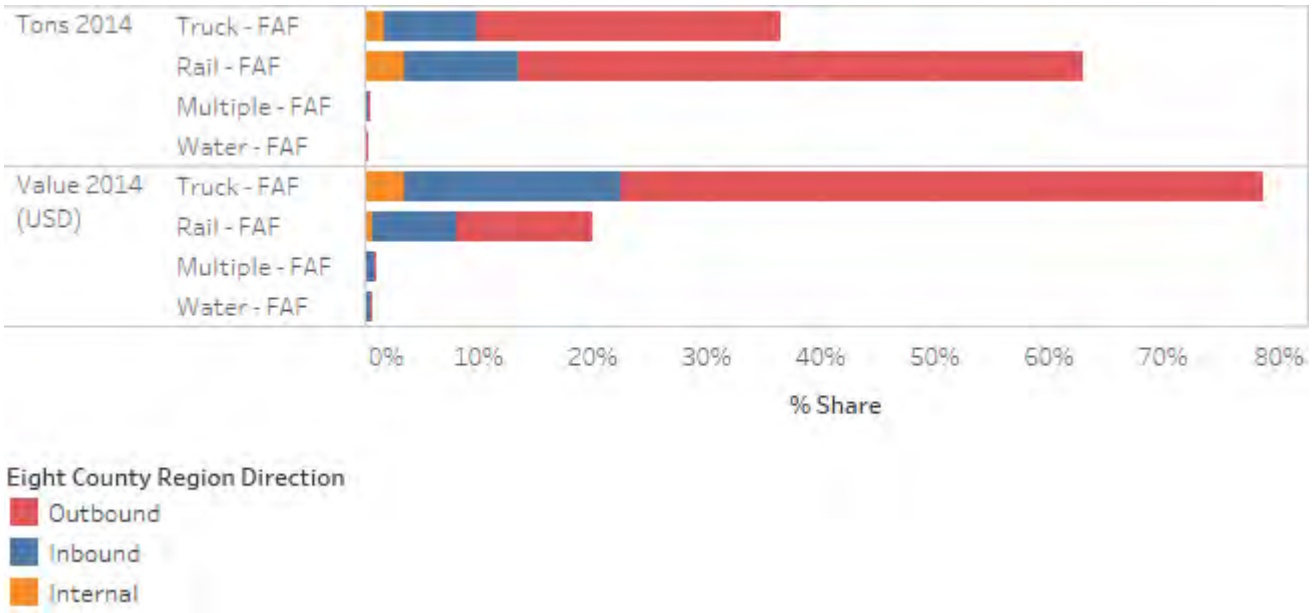


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.3.3 Trading Regions

Fertilizer trade flows are significantly heavier in the outbound direction than the inbound direction, for both truck and rail. The vast majority of outbound flows are to remainder of Illinois; the remainder of Illinois is also the leading state for inbound flows, followed by Iowa.

Figure 4-10: Fertilizers Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-11: Fertilizers Trading Partner States (Showing Top Five by Tonnage), 2014

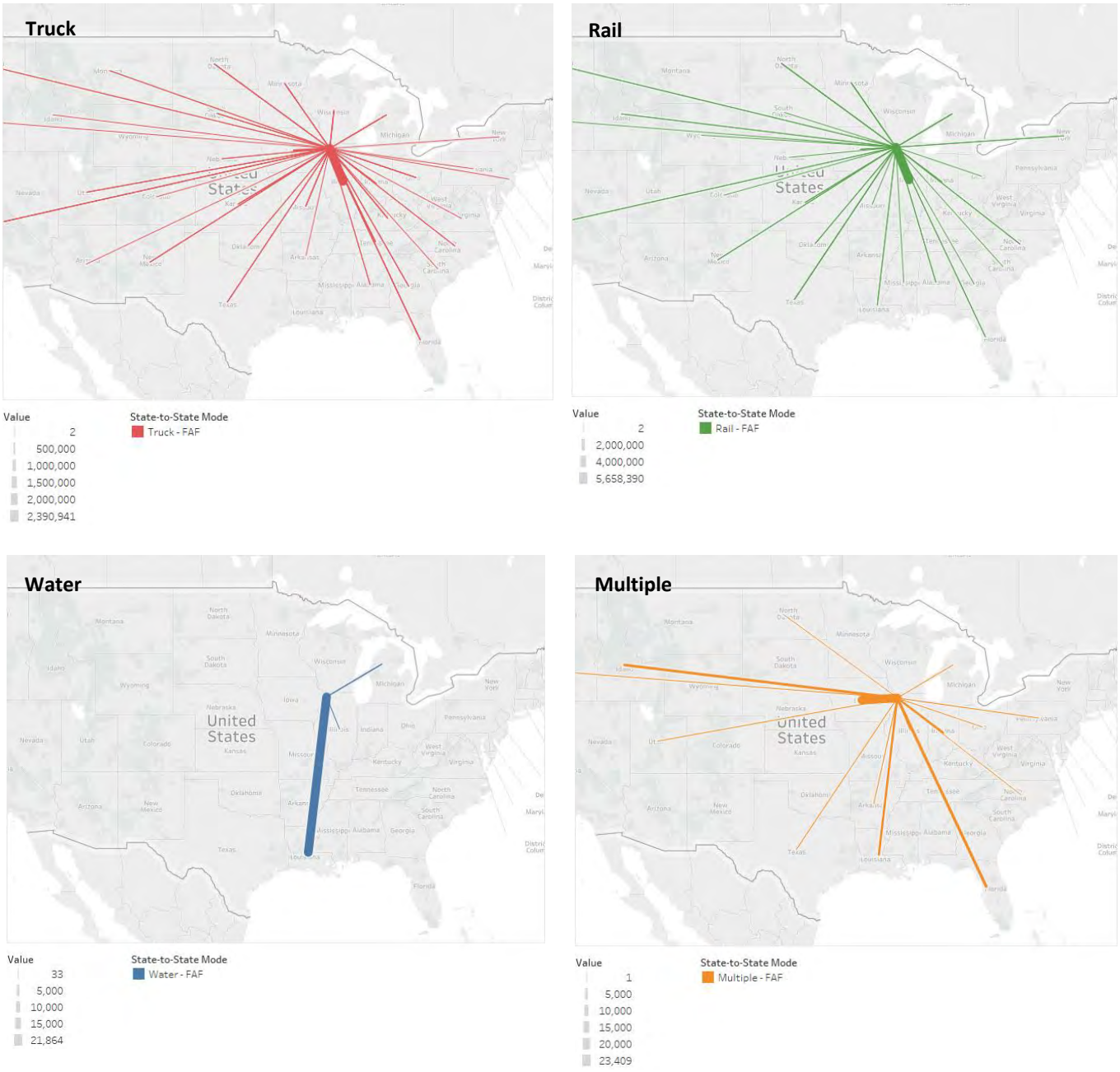
Origin State	Tons 2014	Value 2014 (USD)
IL	1,351,183	247,286,894
IA	375,006	188,986,562
LA	97,926	45,409,884
FL	65,465	36,680,554
MN	49,562	22,037,601
Grand Total	2,162,929	652,566,839

Destination State	Tons 2014	Value 2014 (USD)
IL	8,049,592	1,152,535,073
IA	386,953	243,561,376
KY	130,097	83,914,842
WI	92,831	59,830,489
IN	15,376	9,903,500
Grand Total	8,761,230	1,601,608,607

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Fertilizer rail flows are strongest Illinois; truck flows are strongest with Illinois and Iowa; water flows are strongest with Louisiana; and multiple modes flows are strongest with Iowa.

Figure 4-12: Fertilizers "Desire Lines" for Tonnage Flows (Both Directions), 2014

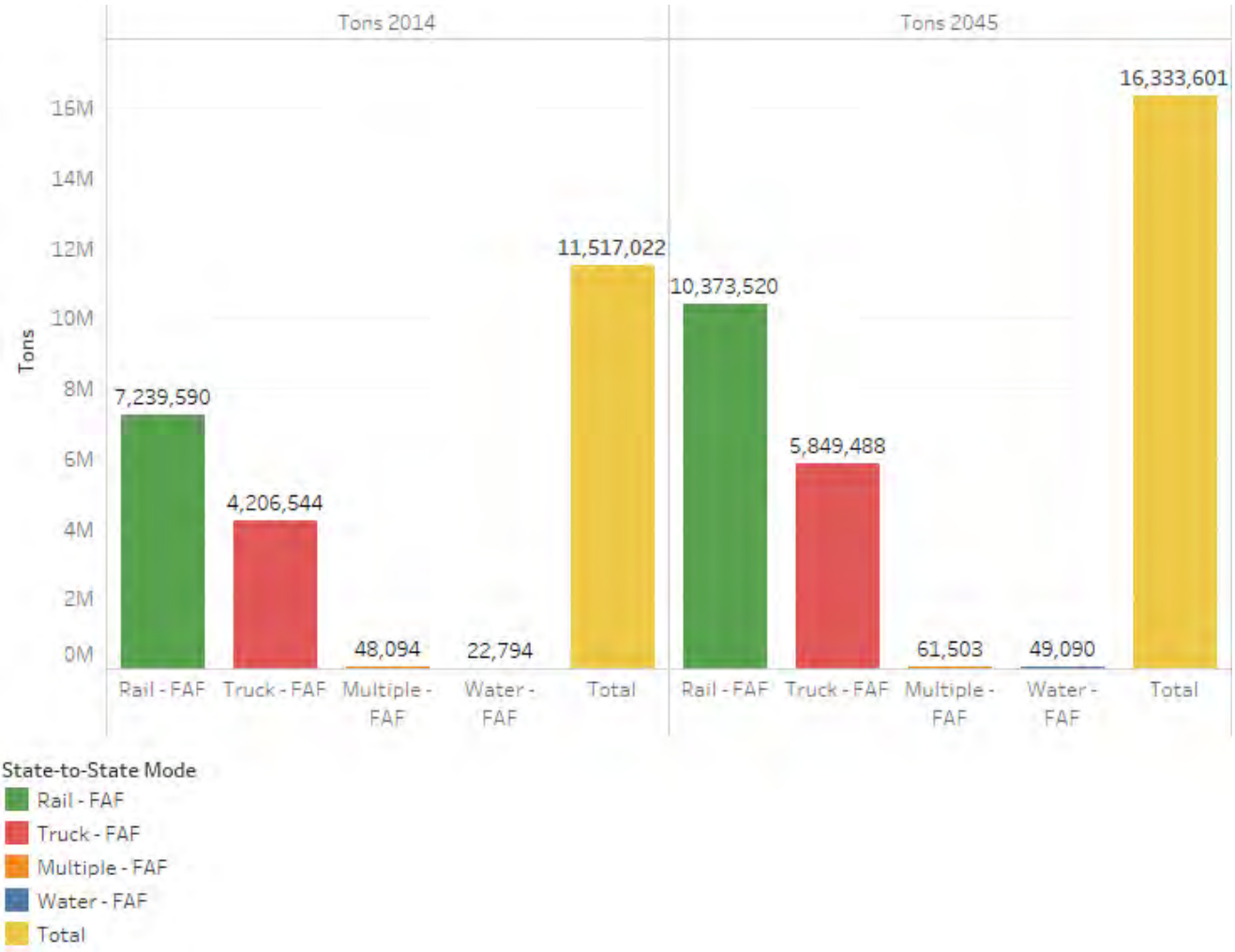


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.3.4 Future Growth

Between 2014 and 2045, fertilizers are forecast to add 4.8 million tons (41.8 percent growth at a CAGR of 1.1 percent), growing from 11.5 to 16.3 million tons.

Figure 4-13: Fertilizers Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.4 Gravel Commodity Profile

4.4.1 Representative Commodities

The **Gravel** commodity class includes various types of gravel, broken limestone and chalk, and other crushed stone, excluding dolomite and slate.

4.4.2 Current Volumes, Modes, and Directions

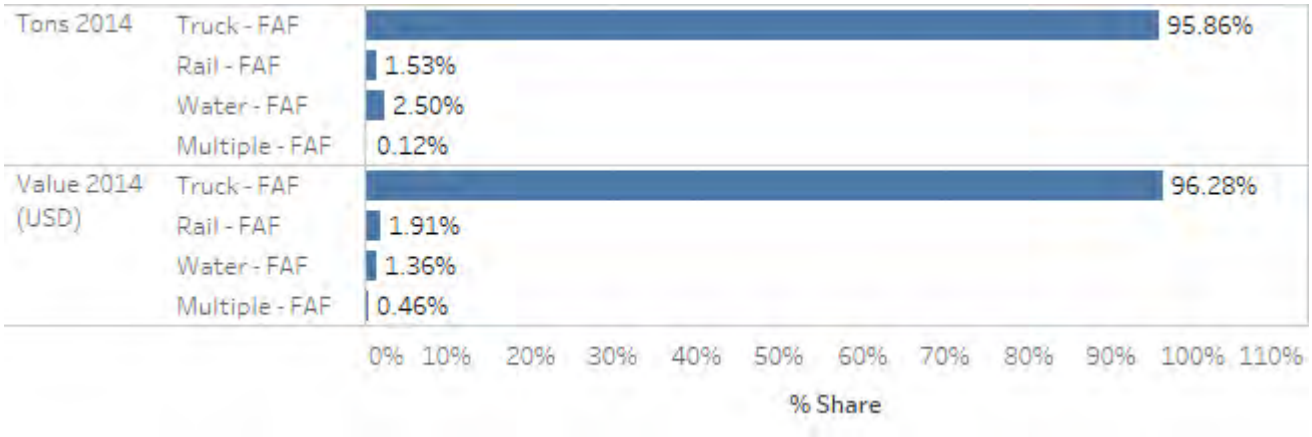
In 2014, gravel was the region's third-leading tonnage commodity group, representing 9.9 million tons and 102 million dollars in value. 96 percent of tonnage and 96 percent of value was moved by truck, with rail and water accounting for most of the remainder.

Figure 4-14: Gravel Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	3,512,536	261,816	5,740,637	9,514,989
	Rail - FAF	94,133	2,231	55,300	151,664
	Water - FAF	102,974	2,454	142,628	248,056
	Multiple - FAF	5,620	92	6,005	11,718
	Total	3,715,262	266,593	5,944,571	9,926,427
Value 2014 (USD)	Truck - FAF	35,274,770	2,768,226	60,861,703	98,904,699
	Rail - FAF	1,154,171	30,955	772,752	1,957,878
	Water - FAF	488,120	11,634	893,366	1,393,121
	Multiple - FAF	384,852	1,777	81,067	467,695
	Total	37,301,912	2,812,593	62,608,888	102,723,393

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-15: Gravel Modal Share, 2014

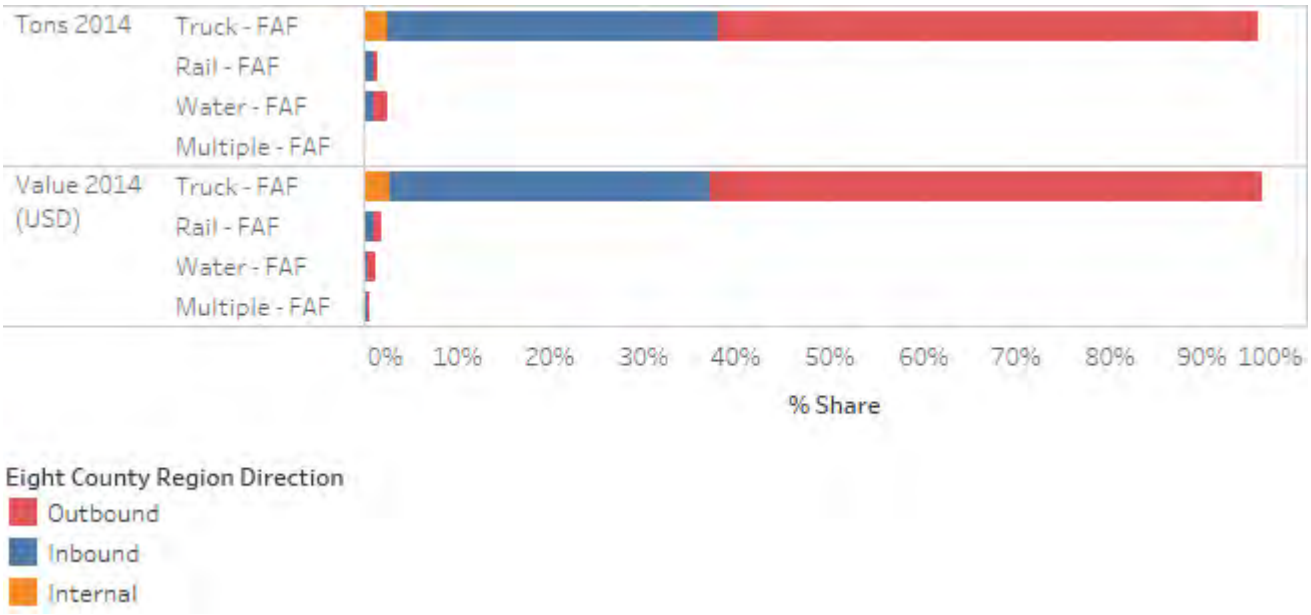


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.4.3 Trading Regions

Gravel trade flows are substantial in both directions, but heavier in the outbound direction than in the inbound direction, for all modes. Most of the outbound flows are to remainder of Iowa, but Illinois is also significant; most of the inbound flows are from remainder of Iowa and remainder of Illinois.

Figure 4-16: Gravel Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-17: Gravel Trading Partner States (Showing Top Five by Tonnage), 2014

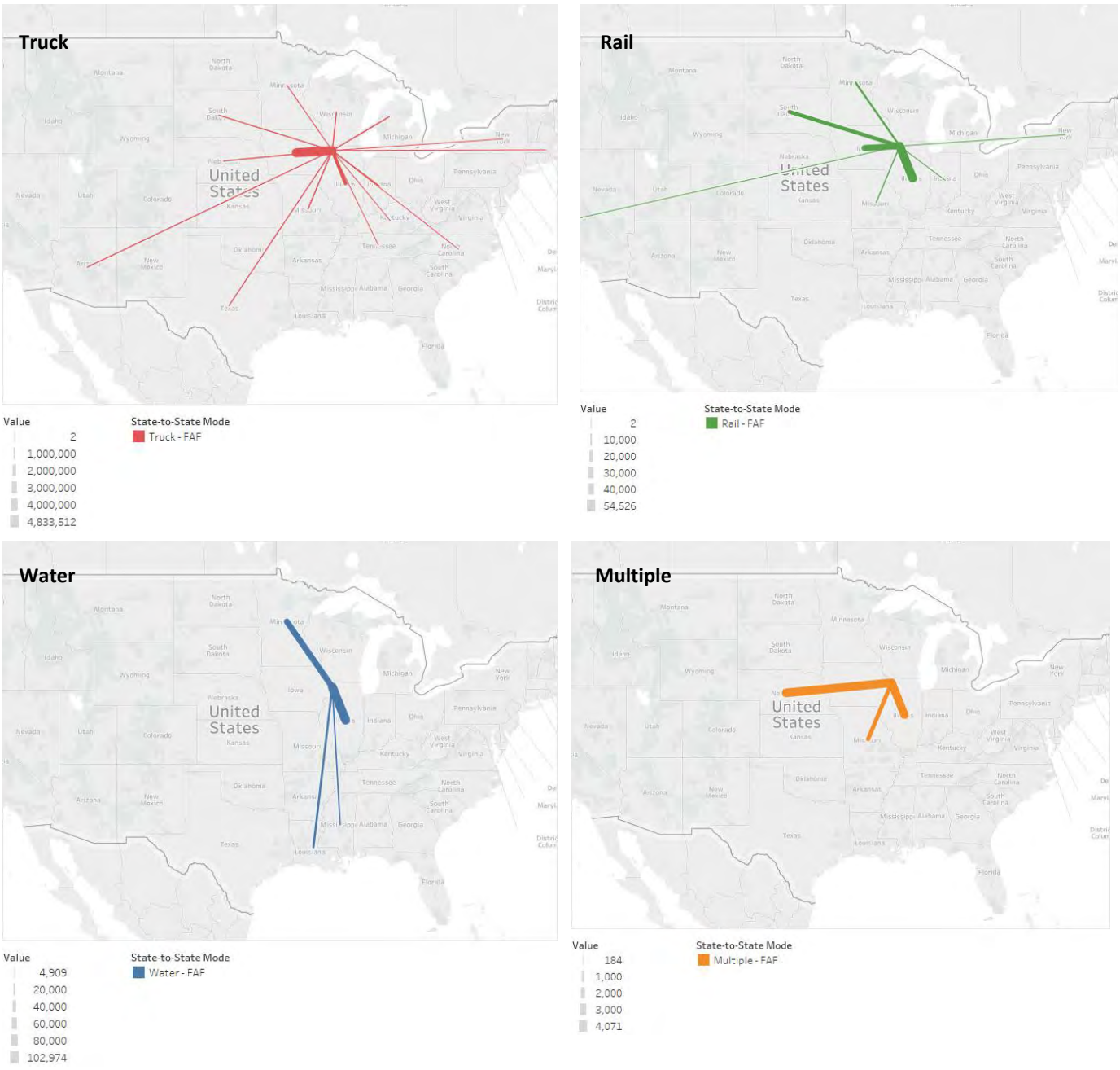
Origin State	Tons 2014	Value 2014 (USD)
IA	1,985,951	21,611,596
IL	1,593,166	13,321,613
NE	41,064	444,931
SD	35,753	466,093
MO	31,599	891,567
Grand Total	3,715,262	37,301,912

Destination State	Tons 2014	Value 2014 (USD)
IA	4,871,200	52,920,384
IL	773,345	6,721,528
MN	162,151	1,616,973
WI	54,876	594,593
MO	33,616	364,235
Grand Total	5,944,571	62,608,888

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Gravel truck flows are strongest with Iowa and Illinois; rail flows are strongest with Illinois, Iowa, Minnesota, and South Dakota; water flows are strongest with Minnesota; and multiple modes flows (negligible volume) are strongest with Nebraska and Illinois.

Figure 4-18: Gravel "Desire Lines" for Tonnage Flows (Both Directions), 2014

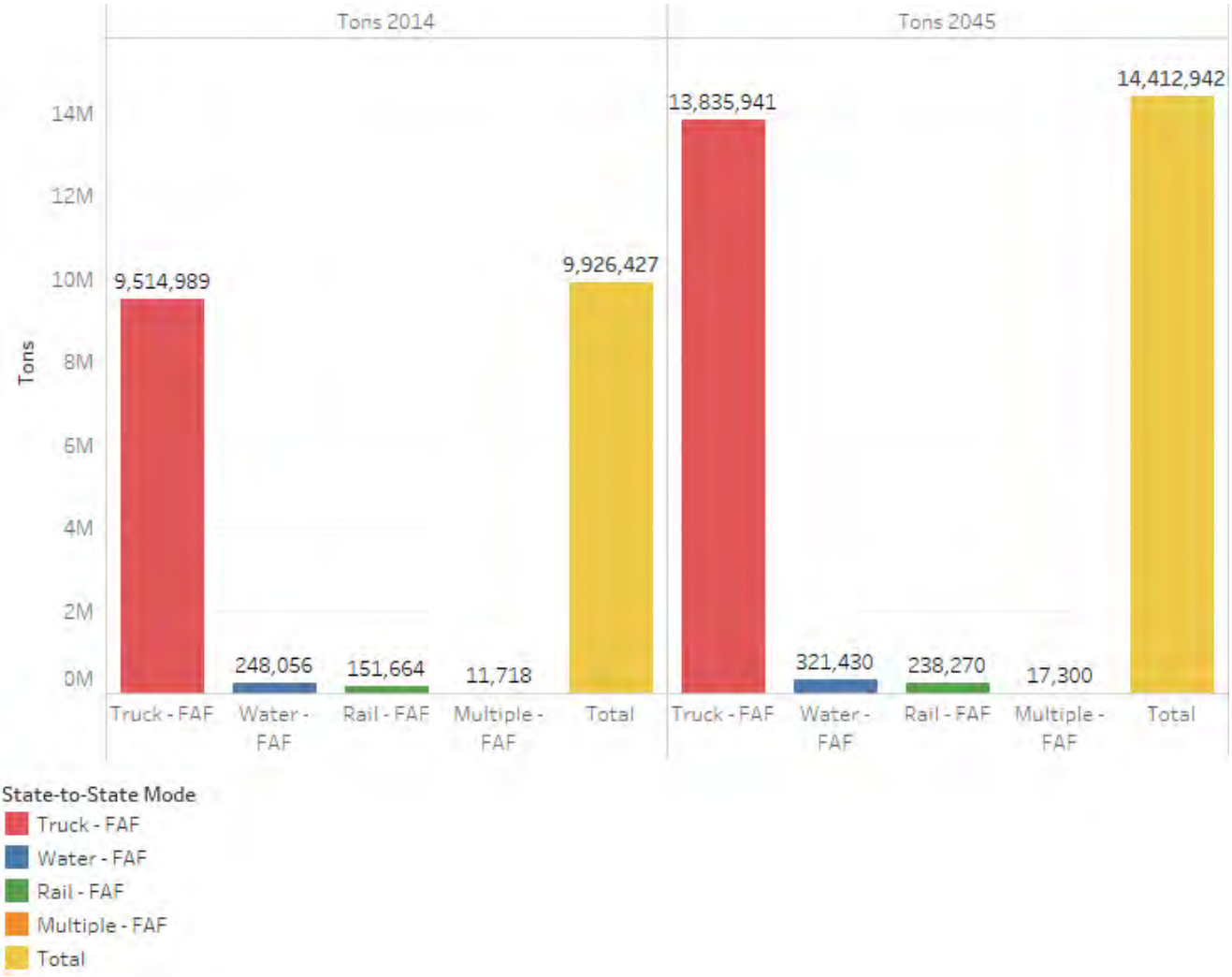


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.4.4 Future Growth

Between 2014 and 2045, gravel is forecast to add 4.5 million tons (45.2 percent growth at a CAGR of 1.2 percent), growing from 9.9 to 14.4 million tons.

Figure 4-19: Gravel Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.5 Coal Commodity Profile

4.5.1 Representative Commodities

The **Coal** commodity class includes loose coal of all kinds, plus 'agglomerated' coal such as briquettes.

4.5.2 Current Volumes, Modes, and Directions

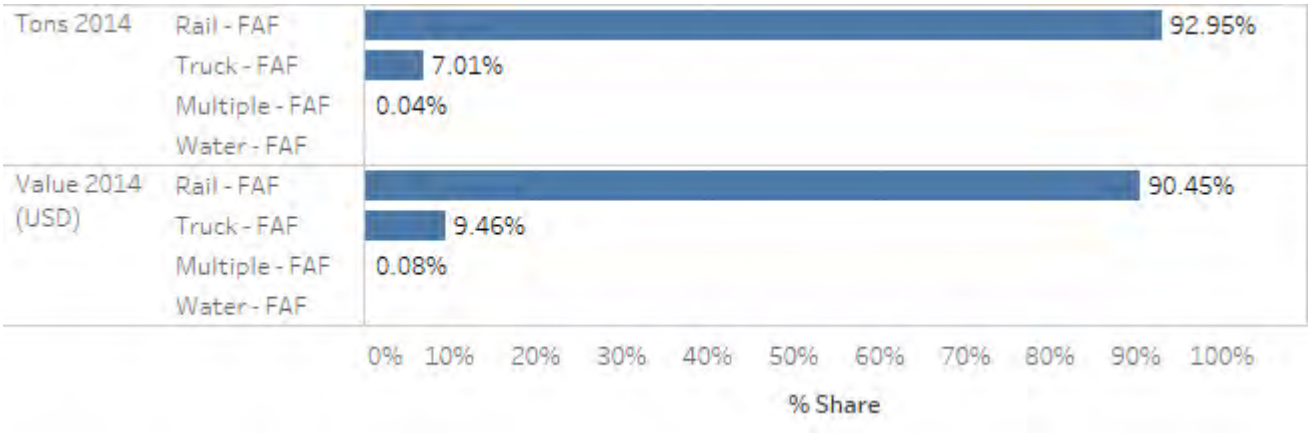
In 2014, coal was the region's fifth-leading tonnage commodity group, representing 3.2 million tons (a significant drop in tonnage from #3 ranked gravel) and 109 million dollars in value. 93 percent of tonnage and 90 percent of value was moved by truck, with truck accounting for most of the remainder. Note that all tonnage was inbound; FAF reported no outbound or internal tonnage.

Figure 4-20: Coal Tonnage and Value, 2014

		Eight County Region Direction	
Measure	State-to-State Mode	Inbound	Grand Total
Tons 2014	Rail - FAF	2,972,828	2,972,828
	Truck - FAF	224,197	224,197
	Multiple - FAF	1,325	1,325
	Water - FAF		
	Total	3,198,349	3,198,349
Value 2014 (USD)	Rail - FAF	98,829,902	98,829,902
	Truck - FAF	10,340,101	10,340,101
	Multiple - FAF	91,247	91,247
	Water - FAF		
	Total	109,261,249	109,261,249

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-21: Coal Modal Share, 2014

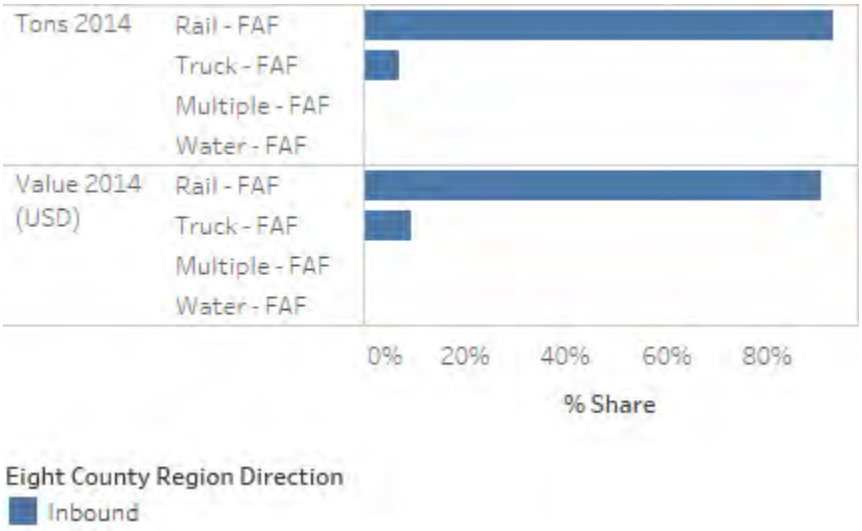


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.5.3 Trading Regions

As noted above, coal trade flows are entirely in the inbound direction. By far the leading source of coal is Wyoming, where Powder River Basin coal is mined and distributed primarily by rail throughout the country.

Figure 4-22: Coal Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

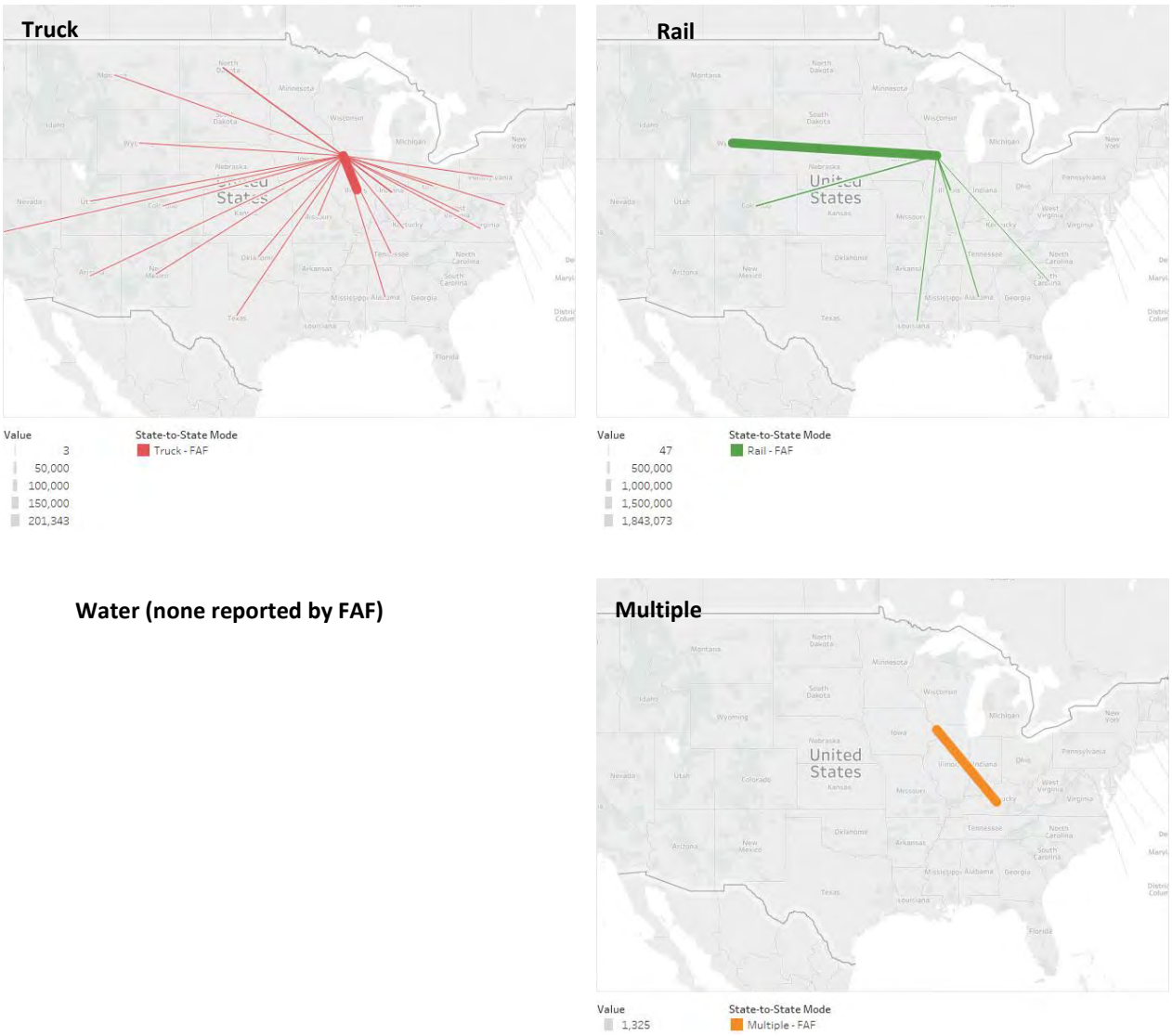
Figure 4-23: Coal Trading Partner States (Showing Top Five by Tonnage), 2014

Origin State	Tons 2014	Value 2014 (USD)
WY	2,807,221	93,337,258
IL	312,049	13,301,091
CO	54,625	975,999
ND	12,450	814,023
IN	9,704	692,841
Grand Total	3,198,349	109,261,249

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Coal rail flows are strongest with Wyoming; truck flows are strongest with Illinois, and multiple modes flows (very small) are strongest with Kentucky. FAF did not report any water tonnage for coal.

Figure 4-24: Coal "Desire Lines" for Tonnage Flows (Both Directions), 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.5.4 Future Growth

Between 2014 and 2045, coal is forecast to lose 1.9 million tons (-58.4 percent growth at a CAGR of -2.8 percent), declining from 3.2 to 1.4 million tons. Coal will no longer be one of the region's top five tonnage commodities. This will have a significant impact on rail tonnage, since coal is a major customer for the railroads.

Figure 4-25: Coal Tonnage Growth by Mode, 2014-2045

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.6 Other Agricultural Products Commodity Profile

4.6.1 Representative Commodities

The **Other Agricultural Products** commodity class includes: vegetables (fresh, chilled, dried); fruits and nuts; soybeans and other oil seeds; live plants; cut flowers; and related. It excludes animal feed, cereal grains, and forage products.

4.6.2 Current Volumes, Modes, and Directions

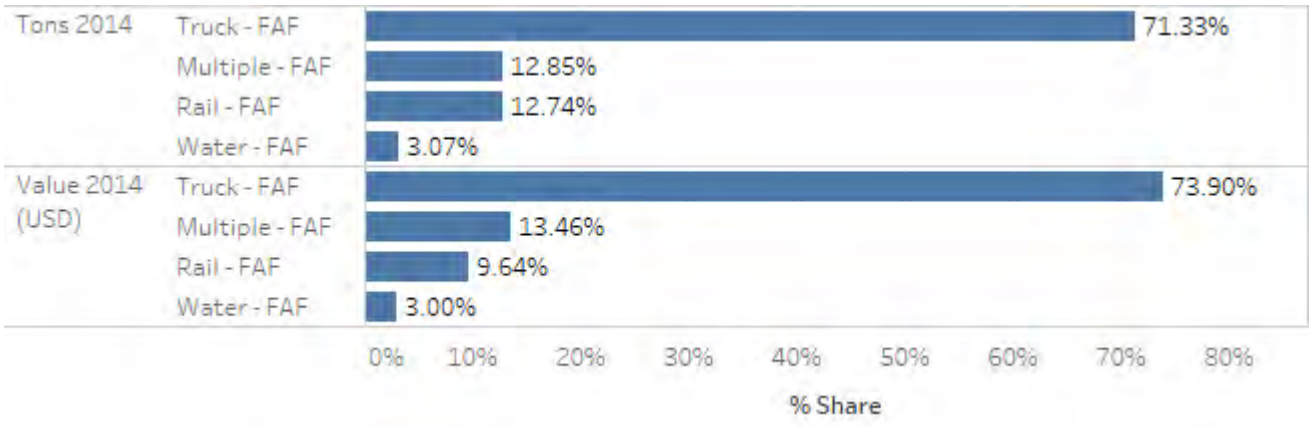
In 2014, other agricultural products were the region's fourth-leading tonnage commodity group and its fourth-leading value commodity group – the only commodity group ranking in the top five for both tonnage and value. Other agricultural products represented 4.8 million tons and 3.2 billion in value. 71 percent of tonnage and 74 percent of value was moved by truck; rail and multiple modes had significant and roughly equal shares, and water had 3 percent of tons and value.

Figure 4-26: Other Agricultural Products Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	1,349,833	55,240	2,013,525	3,418,598
	Multiple - FAF	176,611	9,127	429,984	615,722
	Rail - FAF	100,282	5,968	504,446	610,696
	Water - FAF	20,696	1,149	125,478	147,322
	Total	1,647,421	71,484	3,073,433	4,792,338
Value 2014 (USD)	Truck - FAF	915,504,165	36,158,075	1,391,677,981	2,343,340,221
	Multiple - FAF	106,638,691	5,131,974	314,973,134	426,743,798
	Rail - FAF	48,514,048	2,831,206	254,391,629	305,736,884
	Water - FAF	15,628,485	893,649	78,748,648	95,270,782
	Total	1,086,285,389	45,014,904	2,039,791,392	3,171,091,685

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-27: Other Agricultural Products Modal Share, 2014

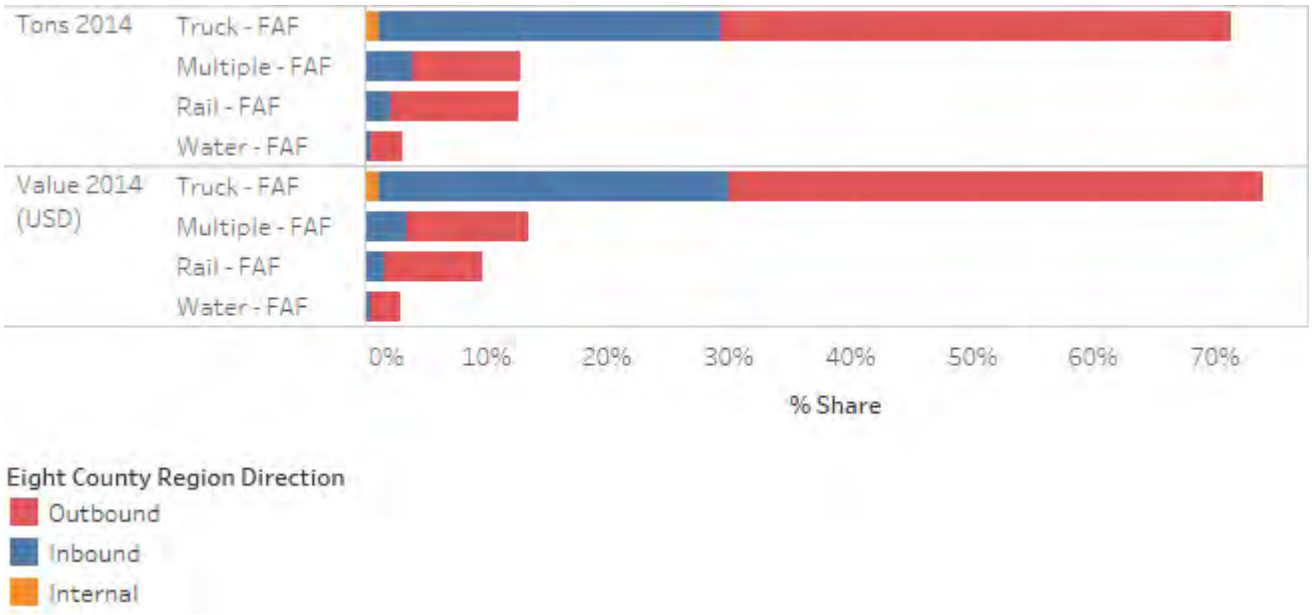


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.6.3 Trading Regions

Other agricultural products flows are largely in the outbound direction. Rail, water, and multiple modes flows are strongly in the outbound direction, while truck is the most significant mode for inbound flows. The leading destinations for outbound flows are: remainder of Illinois; remainder of Iowa; Missouri; Minnesota; and Louisiana. The leading origins for inbound flows are: remainder of Illinois; remainder of Iowa; Nebraska; Indiana; and Missouri.

Figure 4-28: Other Agricultural Products Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-29: Other Agricultural Products Trading Partner States (Showing Top Five by Tonnage), 2014

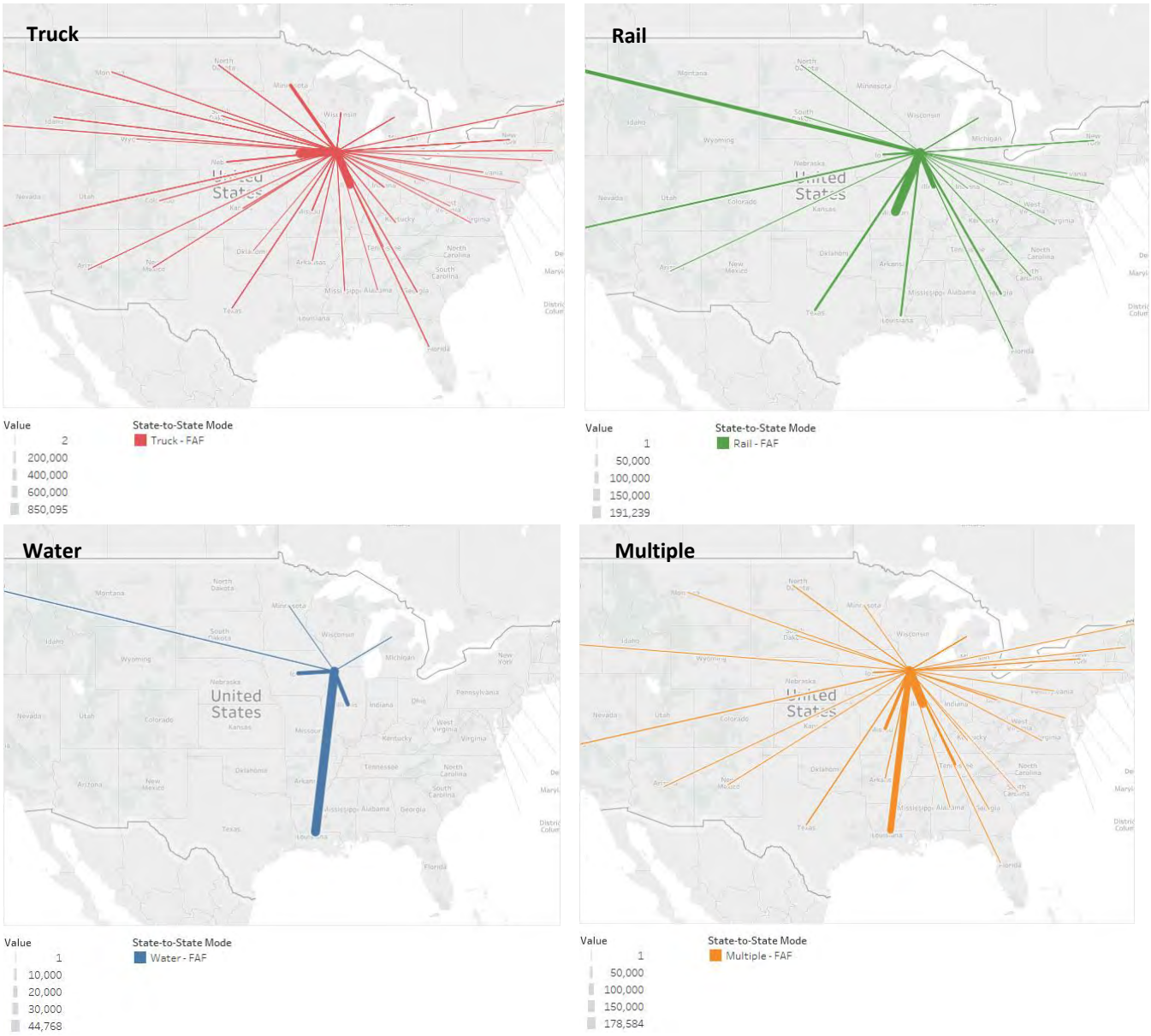
Origin State	Tons 2014	Value 2014 (USD)
IL	773,838	440,106,551
IA	599,310	430,759,468
NE	64,627	46,394,165
IN	49,910	44,027,185
MO	48,496	36,346,187
Grand Total	1,647,421	1,086,285,389

Destination State	Tons 2014	Value 2014 (USD)
IL	1,074,621	615,642,033
IA	903,777	654,006,553
MO	337,778	227,442,601
MN	252,931	181,743,501
LA	241,345	158,926,564
Grand Total	3,073,433	2,039,791,392

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Other agricultural products truck flows are strongest with the remainder of Illinois and Iowa, but reach many different states. Water flows are strongest for Louisiana; multiple modes flows are strongest for Louisiana and Illinois.

Figure 4-30: Other Agricultural Products "Desire Lines" for Tonnage Flows (Both Directions), 2014

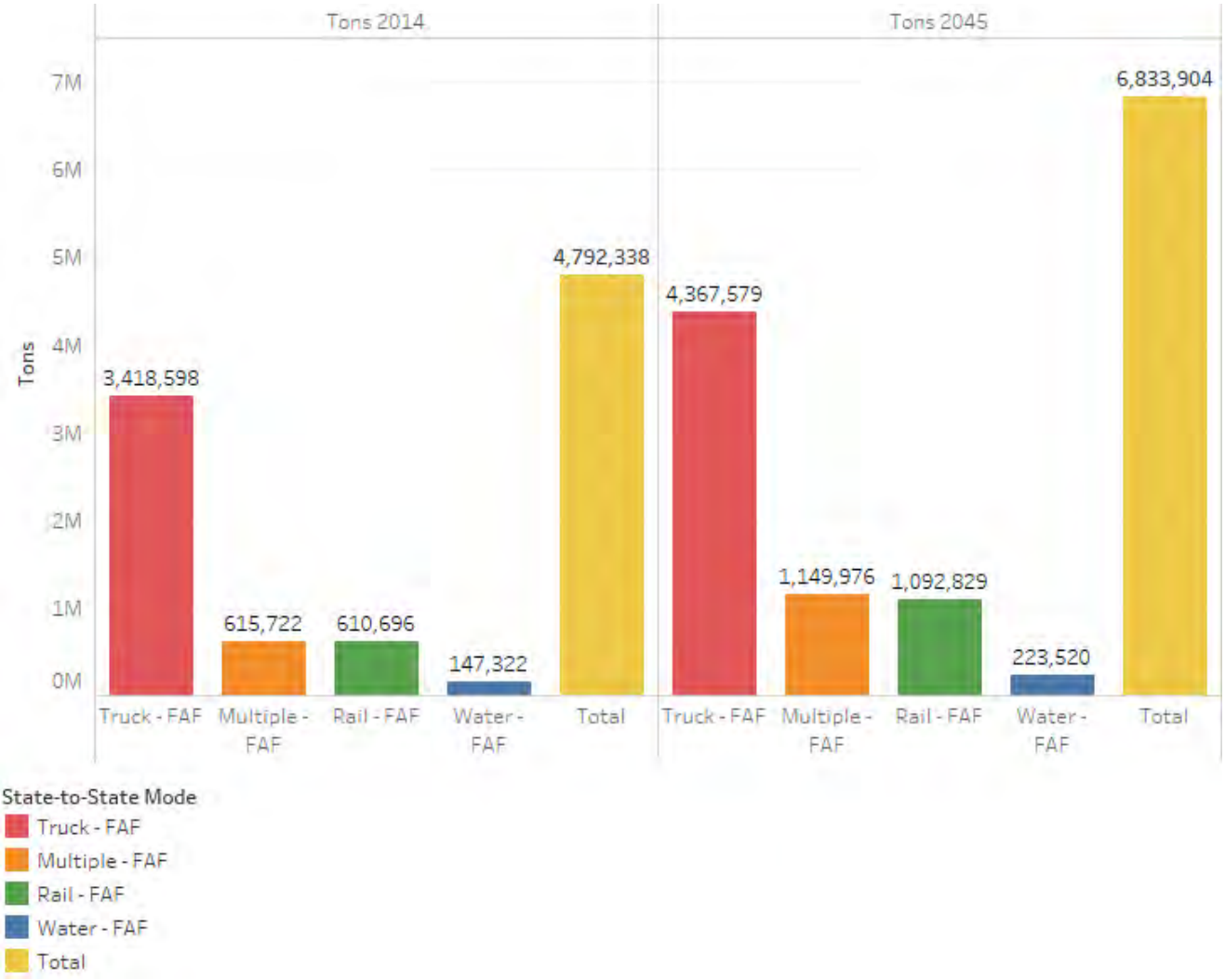


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.6.4 Future Growth

Between 2014 and 2045, other agricultural products are forecast to add 2.0 million tons (42.6 percent growth at a CAGR of 1.2 percent), growing from 4.8 to 6.8 million tons. During this time they are forecast to add 1.3 billion dollars in value (41.3 percent growth at a CAGR of 1.1 percent), growing from $3.2 to $4.5 billion dollars.

Figure 4-31: Other Agricultural Products Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.7 Machinery Commodity Profile

4.7.1 Representative Commodities

The **Machinery** commodity class includes a wide range of manufactured products: turbines, boilers, internal combustion engines, non-electric motors and engines; pumps, compressors, fans; air-conditioning, refrigerating, and freezing equipment; materials handling, excavating, boring, and related machinery and equipment; and machine tools and industrial machines.

4.7.2 Current Volumes, Modes, and Directions

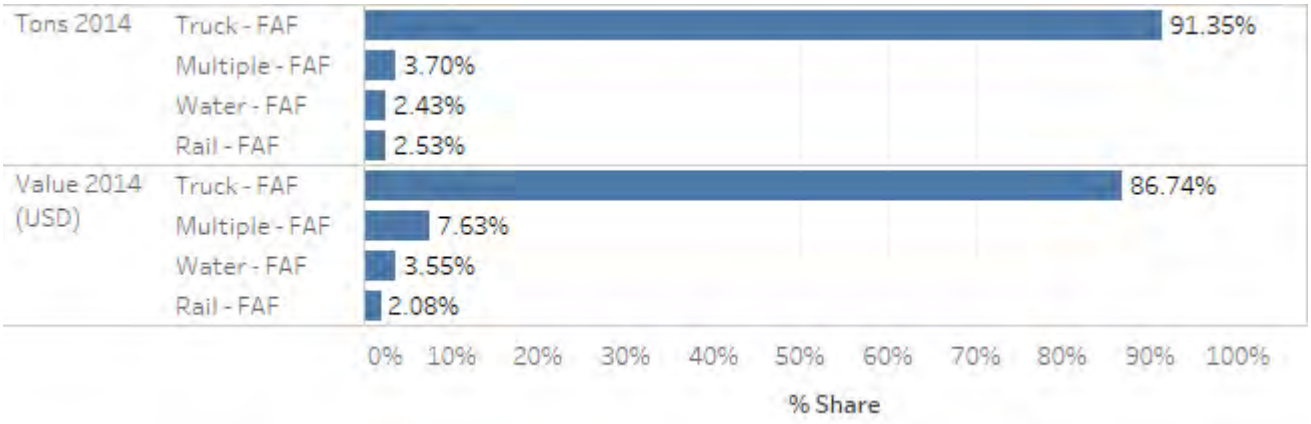
In 2014, machinery was the region's leading value commodity group, representing less than half a million tons but nearly 4 billion dollars in value. 91 percent of tonnage and 87 percent of value was moved by truck; rail, water, and multiple modes each had roles in handling the remainder.

Figure 4-32: Machinery Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	154,709	3,898	222,664	381,270
	Multiple - FAF	7,638	34	7,769	15,441
	Water - FAF	9,911		231	10,142
	Rail - FAF	5,918		4,621	10,539
	Total	178,176	3,932	235,284	417,393
Value 2014 (USD)	Truck - FAF	1,328,059,482	33,254,526	2,071,753,616	3,433,067,624
	Multiple - FAF	123,931,245	916,151	177,126,601	301,973,997
	Water - FAF	138,357,160		2,186,238	140,543,397
	Rail - FAF	36,648,442		45,797,868	82,446,310
	Total	1,626,996,328	34,170,677	2,296,864,323	3,958,031,328

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-33: Machinery Modal Share, 2014

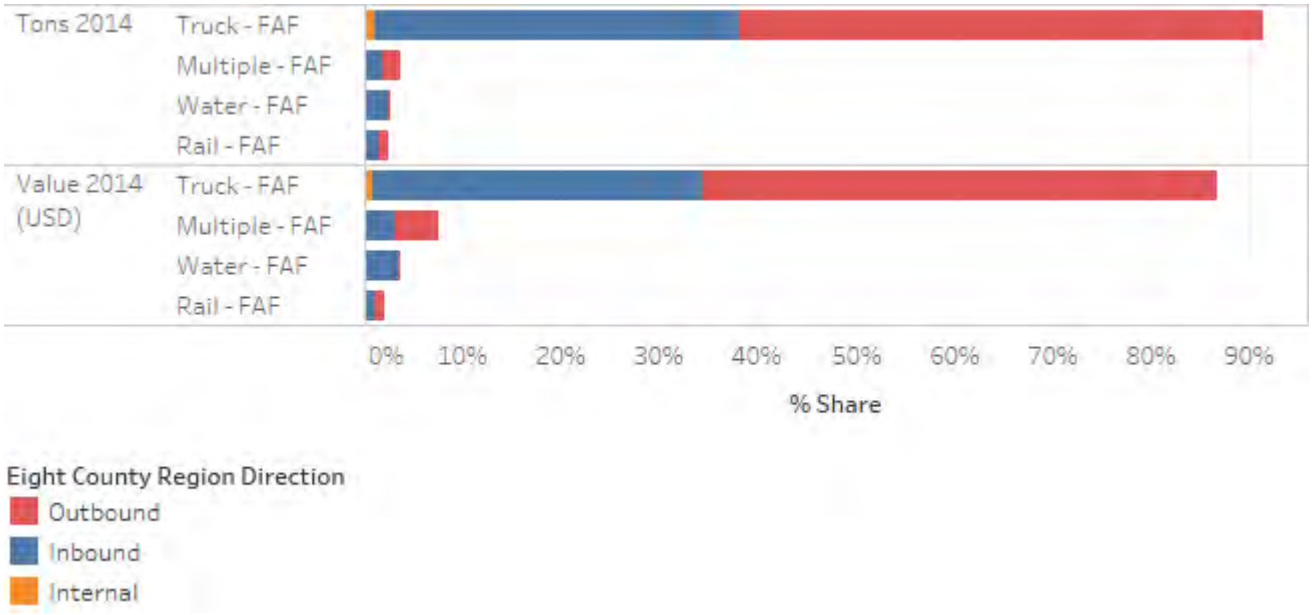


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.7.3 Trading Regions

Machinery flows are substantial in both directions but tend to be more in the outbound direction. Truck flows tend to be more outbound; water tends to be inbound; and rail and multiple modes are generally balanced. The leading destinations for outbound tonnage are remainder of Iowa and Illinois, followed by Michigan, Texas, and North Dakota. The leading origins for inbound tonnage are remainder of Illinois and Iowa, followed by Wisconsin, Texas, and Minnesota.

Figure 4-34: Machinery Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-35: Machinery Trading Partner States (Showing Top Five by Tonnage), 2014

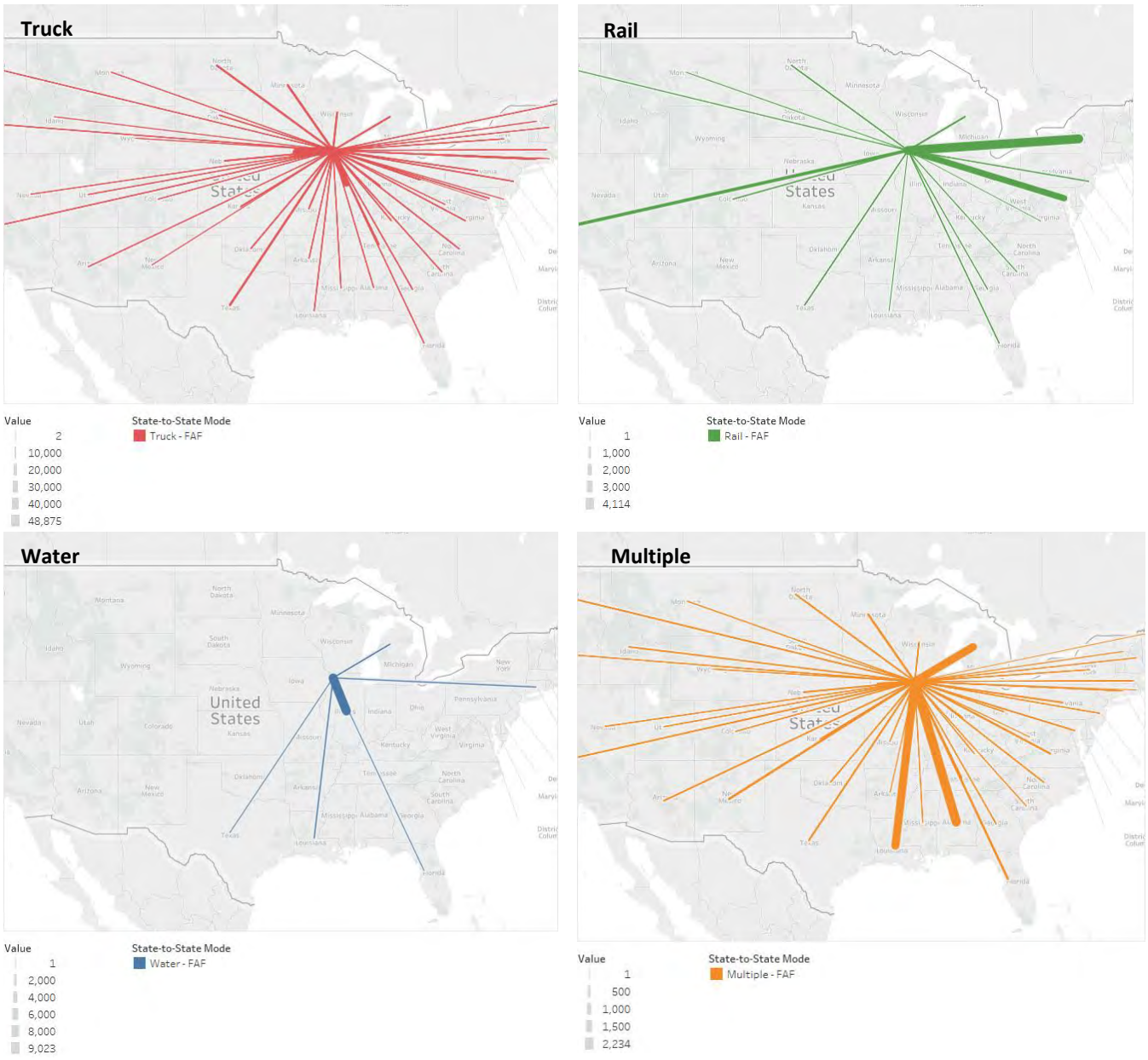
Origin State	Tons 2014	Value 2014 (USD)
IL	48,082	583,729,096
IA	43,766	342,974,666
WI	9,962	79,191,301
TX	9,457	74,587,517
MN	7,483	59,366,013
Grand Total	178,176	1,626,996,328

Destination State	Tons 2014	Value 2014 (USD)
IA	51,984	425,748,470
IL	44,573	439,094,244
MI	10,770	128,464,279
TX	10,674	122,454,130
ND	10,286	94,845,157
Grand Total	235,284	2,296,864,323

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Machinery truck flows are strongest with Illinois and Iowa, but connect to all parts of the US. Rail flows show a profile very different from previous commodities, focusing on trade with New York, Maryland, and California. Water flows are largely with Illinois; multiple modes flows are primarily with Louisiana, Alabama, and Michigan.

Figure 4-36: Machinery "Desire Lines" for Tonnage Flows (Both Directions), 2014

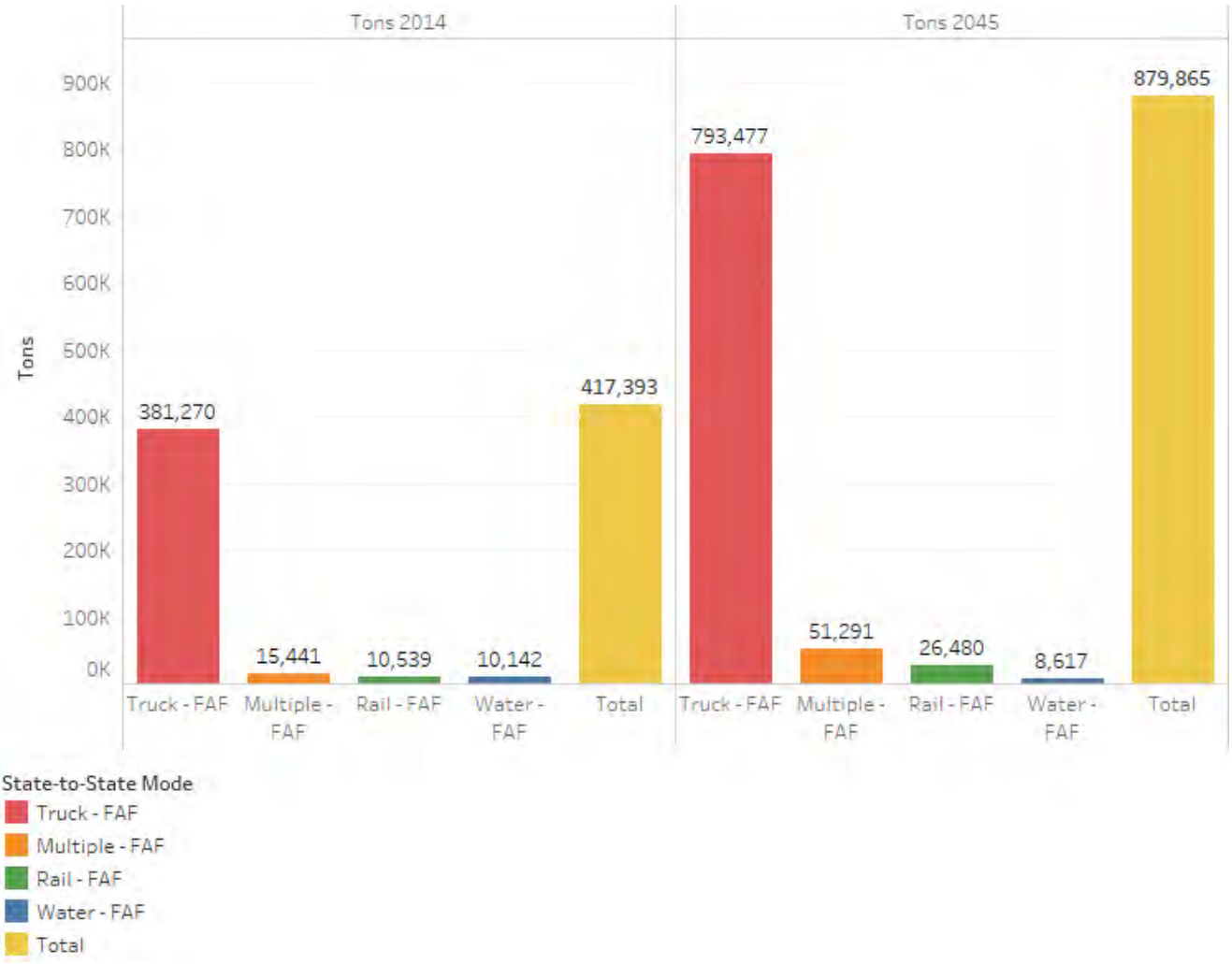


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.7.4 Future Growth

Between 2014 and 2045, machinery is forecast to add nearly 0.5 million tons (110.8 percent growth at a CAGR of 2.4 percent), growing from 0.4 to 0.9 million tons. During this time, machinery is forecast to add $4.2 billion dollars (107.1 percent growth at a CAGR of 2.4 percent), growing from $4.0 to $8.2 billion dollars.

Figure 4-37: Machinery Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.8 Unknown/Mixed Commodities Profile

4.8.1 Representative Commodities

The **Unknown/Mixed** commodity class includes SCTG code 43 (Mixed Freight including groceries, convenience items, hardware or plumbing supplies, office supplies, and miscellaneous goods), as well as commodities that FAF could not assign to a more specific code due to data quality, sample size, or other reasons. In cases where commodities associated with containerized and "less than truckload"/distribution center shipments could not be assigned to other categories, they are largely represented as Unknown/Mixed freight.

4.8.2 Current Volumes, Modes, and Directions

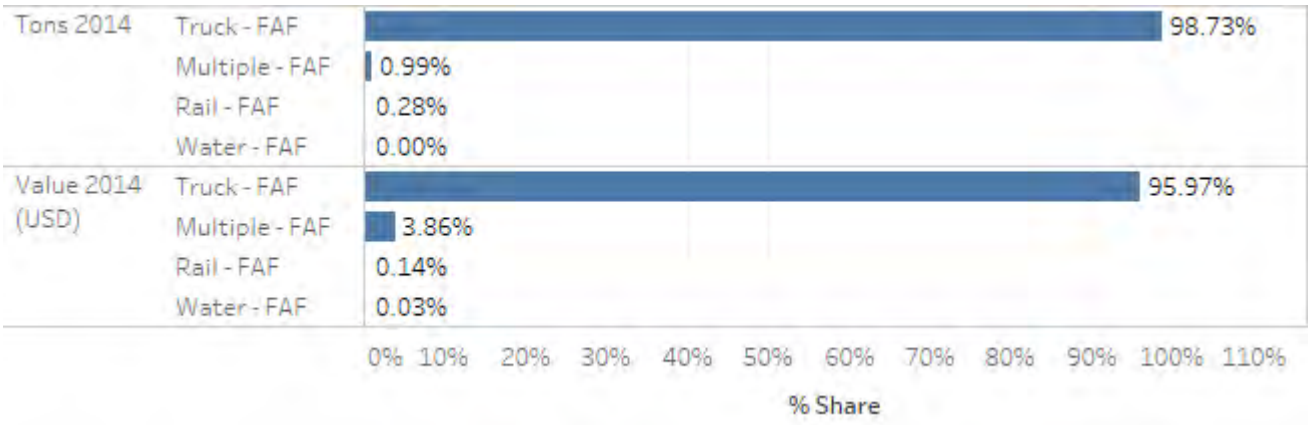
In 2014, unknown/mixed freight was the region's second-leading value commodity group, representing nearly 1 million tons worth over $3.8 billion dollars in value. 99 percent of tonnage and 96 percent of value was moved by truck.

Figure 4-38: Unknown/Mixed Freight Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	402,186	12,290	536,509	950,985
	Multiple - FAF	4,927	44	4,597	9,569
	Rail - FAF	192		2,459	2,651
	Water - FAF	28		5	33
	Total	407,334	12,334	543,570	963,238
Value 2014 (USD)	Truck - FAF	1,501,241,298	45,402,574	2,142,719,632	3,689,363,504
	Multiple - FAF	75,818,293	792,076	71,873,155	148,483,524
	Rail - FAF	393,007		4,935,415	5,328,422
	Water - FAF	1,062,888		155,478	1,218,366
	Total	1,578,515,487	46,194,650	2,219,683,680	3,844,393,817

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-39: Unknown/Mixed Freight Modal Share, 2014

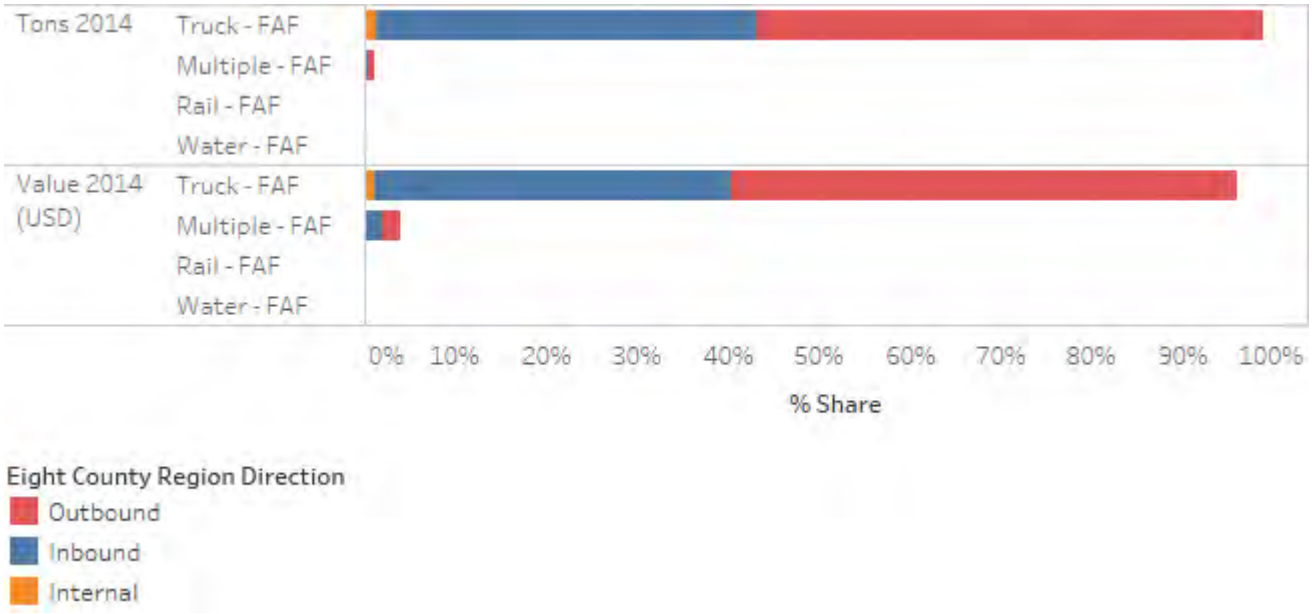


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.8.3 Trading Regions

Unknown/Mixed Freight flows are strong in both directions but tend to be heavier in the outbound direction. Truck flows, which account for nearly all Unknown/Mixed Freight, reflect this pattern. The leading destinations for outbound flows include: remainder of Illinois and Iowa; Missouri; Indiana; and Minnesota. The leading origins for inbound flows include: remainder of Iowa and Illinois; Missouri; Wisconsin; and Minnesota.

Figure 4-40: Unknown/Mixed Freight Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-41: Unknown/Mixed Freight Trading Partner States (Showing Top Five by Tonnage), 2014

Origin State	Tons 2014	Value 2014 (USD)
IA	126,125	465,295,228
IL	116,014	455,120,924
MO	36,920	138,913,837
WI	23,659	90,108,588
MN	19,390	71,555,860
Grand Total	407,334	1,578,515,487

Destination State	Tons 2014	Value 2014 (USD)
IL	136,224	503,841,746
IA	128,107	481,334,530
MO	62,117	275,145,381
IN	24,781	115,913,075
MN	20,651	79,682,782
Grand Total	543,570	2,219,683,680

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Unknown/mixed freight truck flows are strongest with Illinois and Iowa; rail flows are strongest with Minnesota, Illinois, and Iowa; water flows are strongest with Alabama and Louisiana; and multiple modes flows are strongest with Louisiana and Minnesota.

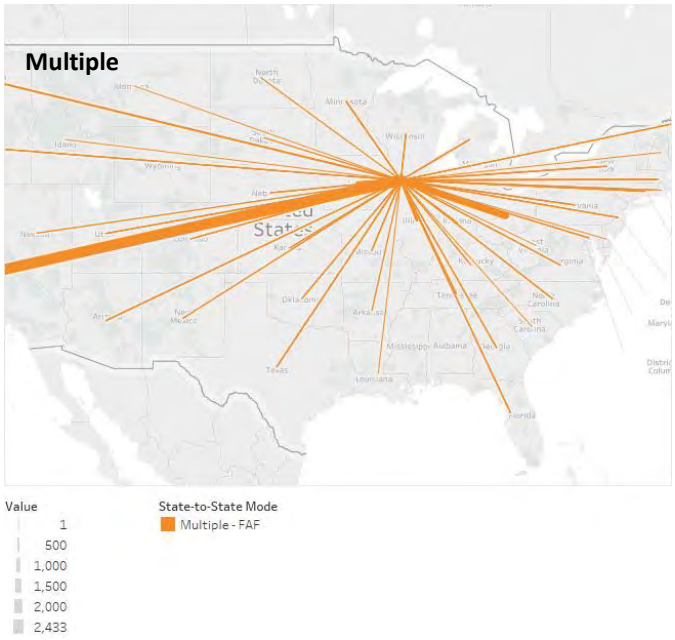
Figure 4-42: Unknown/Mixed Freight "Desire Lines" for Tonnage Flows (Both Directions), 2014

Truck

Rail – FAF reports negligible flows

Water – FAF reports negligible flows

Multiple

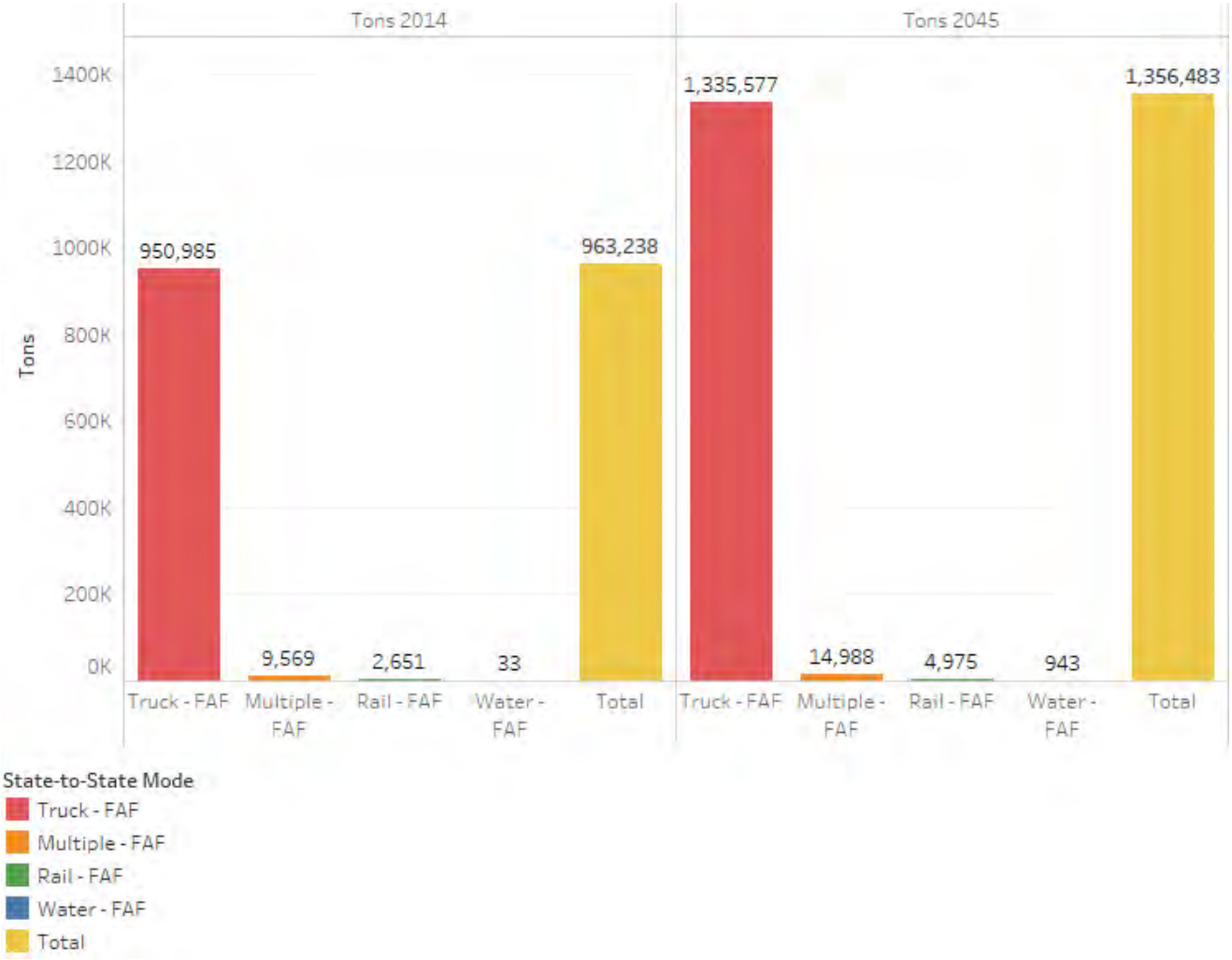


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.8.4 Future Growth

Between 2014 and 2045, unknown/mixed freight is forecast to add nearly 0.4 million tons (40.8 percent growth at a CAGR of 1.1 percent), growing from nearly 1.0 million tons to nearly 1.4 million tons. During this time, unknown/mixed commodities are forecast to add $1.6 billion dollars (41.6 percent growth at a CAGR of 1.1 percent), growing from $3.8 to $5.4 billion dollars.

Figure 4-43: Unknown/Mixed Freight Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.9 Motorized Vehicles Commodity Profile

4.9.1 Representative Commodities

The **Motorized Vehicles** commodity class includes: private automobiles trucks, and other personal transport; on and off-road commercial vehicles; mobile cranes; buses; bicycles; motorcycles; tractors; military vehicles; and motor vehicle parts.

4.9.2 Current Volumes, Modes, and Directions

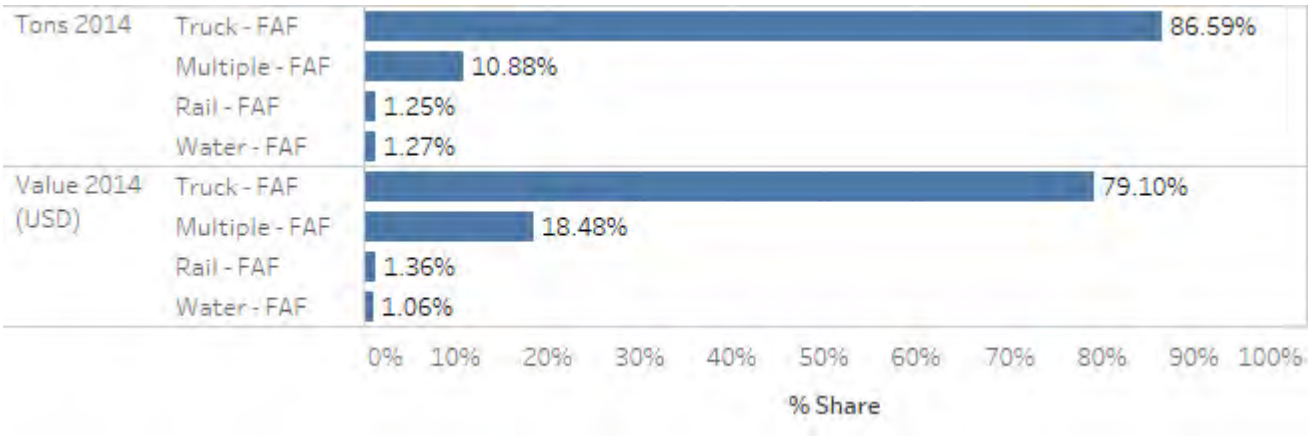
In 2014, motorized vehicles was the region's fourth-leading tonnage commodity group, representing nearly 0.4 million tons worth over $3.4 billion dollars in value. 87 percent of tonnage and 79 percent of value moved by truck; 11 percent of tonnage and 18 percent of value moved by multiple modes; and small shares moved by rail and water.

Figure 4-44: Motorized Vehicles Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	184,648	3,852	152,981	341,480
	Multiple - FAF	15,336	123	27,448	42,908
	Rail - FAF	3,899		1,037	4,936
	Water - FAF	5,019		7	5,026
	Total	208,903	3,975	181,473	394,350
Value 2014 (USD)	Truck - FAF	1,436,983,874	30,137,995	1,245,800,793	2,712,922,663
	Multiple - FAF	230,297,535	1,712,950	401,810,423	633,820,907
	Rail - FAF	37,908,762		8,782,504	46,691,266
	Water - FAF	36,194,077		47,104	36,241,182
	Total	1,741,384,249	31,850,945	1,656,440,824	3,429,676,018

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-45: Motorized Vehicles Modal Share, 2014

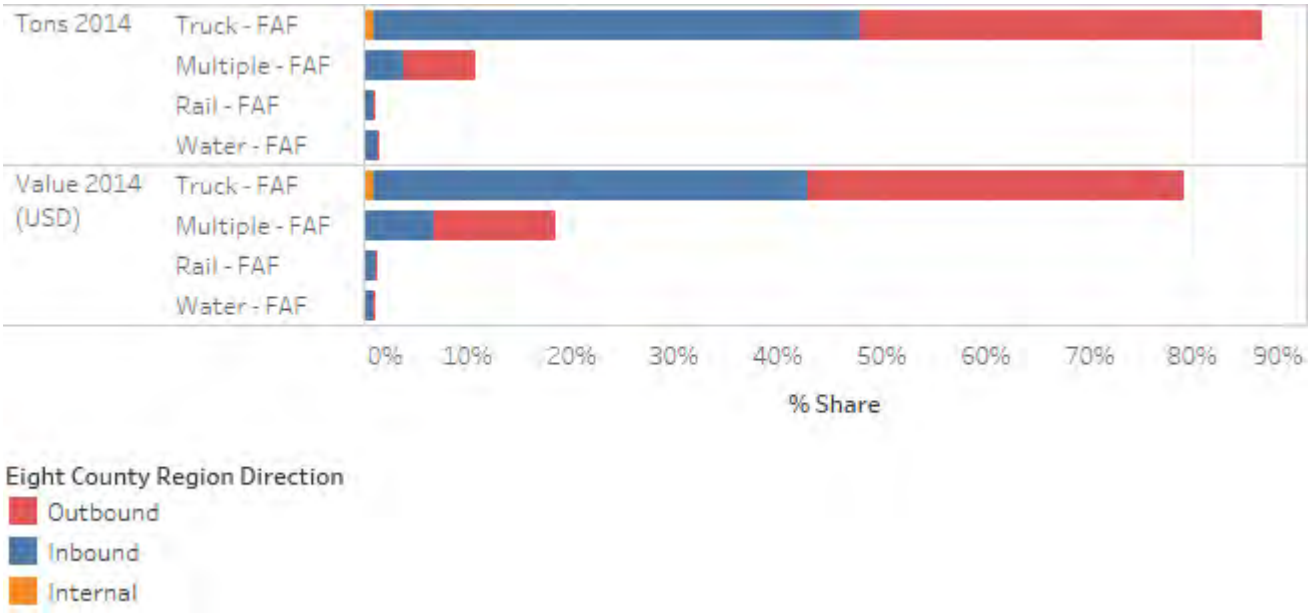


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.9.3 Trading Regions

Motorized vehicle flows are very balanced between inbound and outbound directions; trucking and multiple modes generally reflect this balance. The leading destinations for outbound tonnage are: remainder of Illinois and Iowa; Texas; Minnesota; and Maryland. The leading origins for inbound tonnage are: remainder of Illinois and Iowa; Michigan; Indiana; and Texas.

Figure 4-46: Motorized Vehicles Trading Partner States (Showing Top Five by Tonnage), 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-47: Motorized Vehicles Modal Share by Direction, 2014

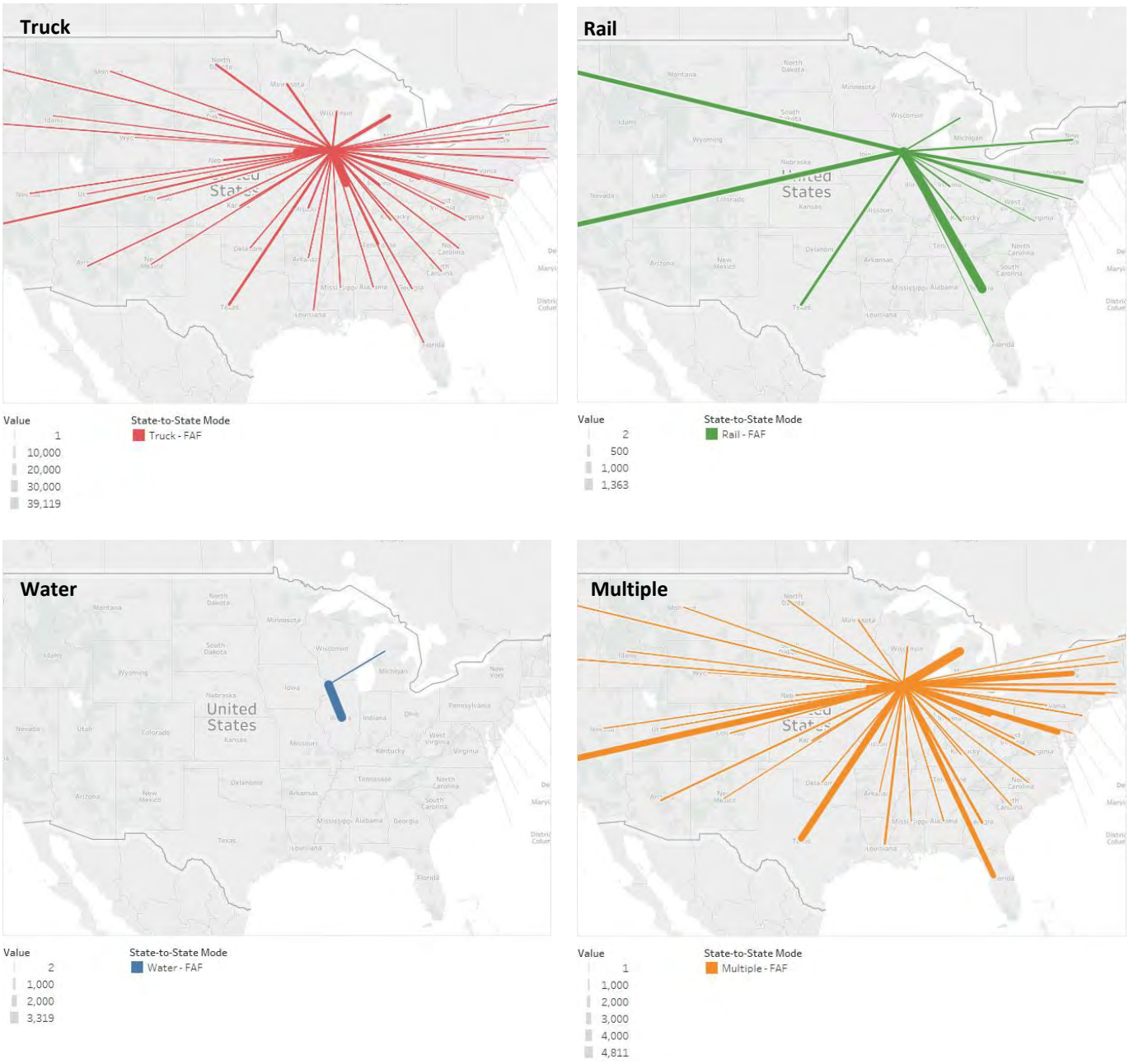
Origin State	Tons 2014	Value 2014 (USD)
IL	53,898	467,101,870
IA	35,109	272,432,931
MI	25,580	248,569,068
IN	14,974	114,142,252
TX	12,705	97,468,798
Grand Total	208,903	1,741,384,249

Destination State	Tons 2014	Value 2014 (USD)
IL	39,436	315,660,631
IA	32,823	264,332,585
TX	10,210	111,391,146
MN	8,431	67,833,800
MD	8,277	87,945,647
Grand Total	181,473	1,656,440,824

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

For motorized vehicles, truck flows are strongest for remainder of Iowa and Illinois; multiple modes is strongest for Michigan, Maryland, Texas, California, New York, and Florida. Water (with very low volumes) is strongest for Illinois, while rail (also with very low volumes) is strongest for Florida, Washington state, California, Ohio, and New Jersey.

Figure 4-48: Motorized Vehicles "Desire Lines" for Tonnage Flows (Both Directions), 2014

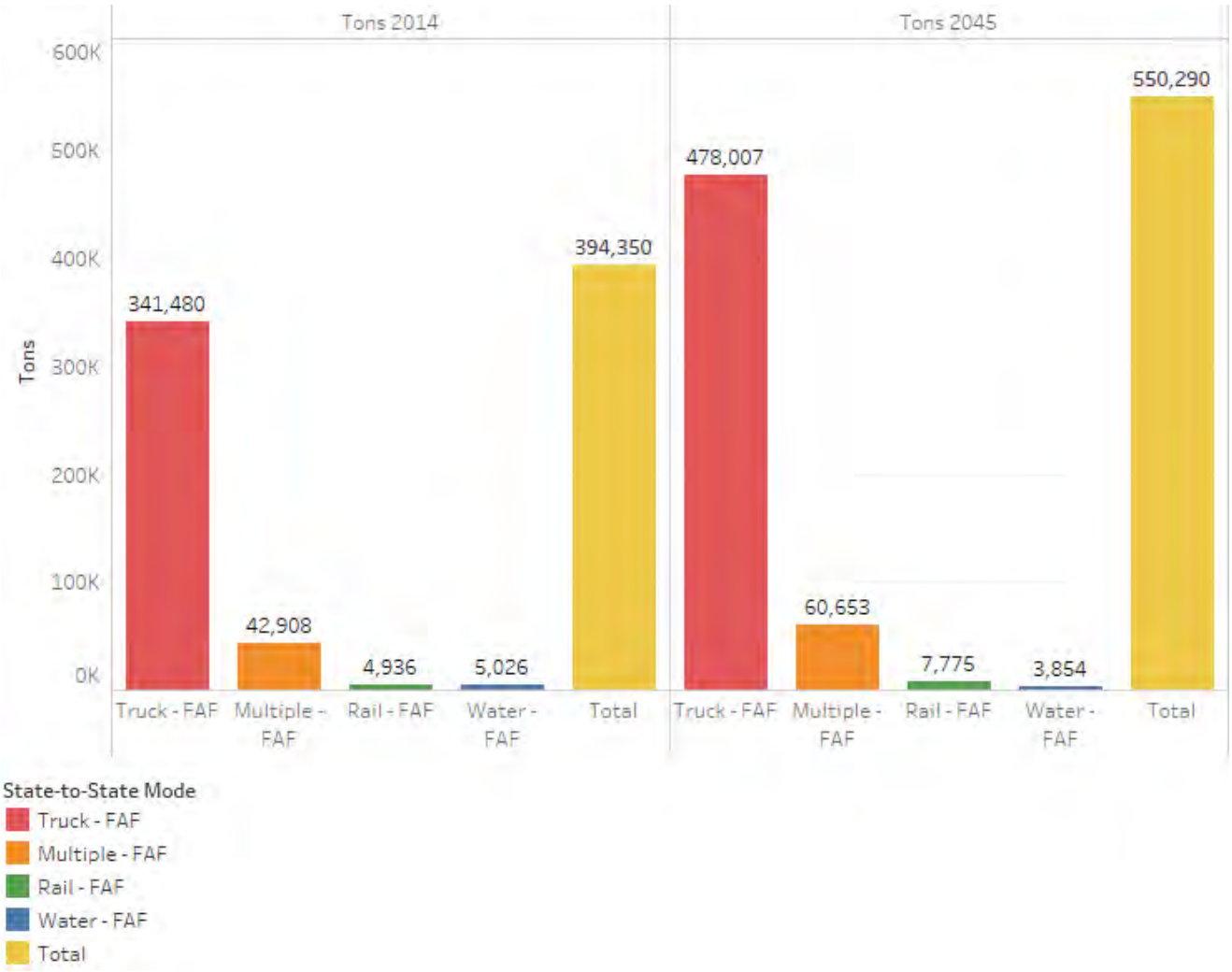


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.9.4 Future Growth

Between 2014 and 2045, motorized vehicles is forecast to add more than 0.15 million tons (39.5 percent growth at a CAGR of 1.1 percent), growing from nearly 0.4 million tons to more than 0.55 million tons. During this time, motorized vehicles are forecast to add 1.4 million tons (40.0 percent growth at a CAGR of 1.1 percent), growing from $3.4 to $4.8 billion dollars.

Figure 4-49: Motorized Vehicles Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.10 Other Foodstuffs Commodity Profile

4.10.1 Representative Commodities

The **Other Foodstuffs** commodity class includes a variety of prepared foodstuffs, fats, and oils, including: dairy products (excluding milk): processed or prepared vegetables, fruit or nuts (other than dried or juice products); coffee, tea and spices; vegetable oils, animal fats, and oilseed flours; solid sugars and cocoa; vinegars; confections; sauces; soups; and related.

4.10.2 Current Volumes, Modes, and Directions

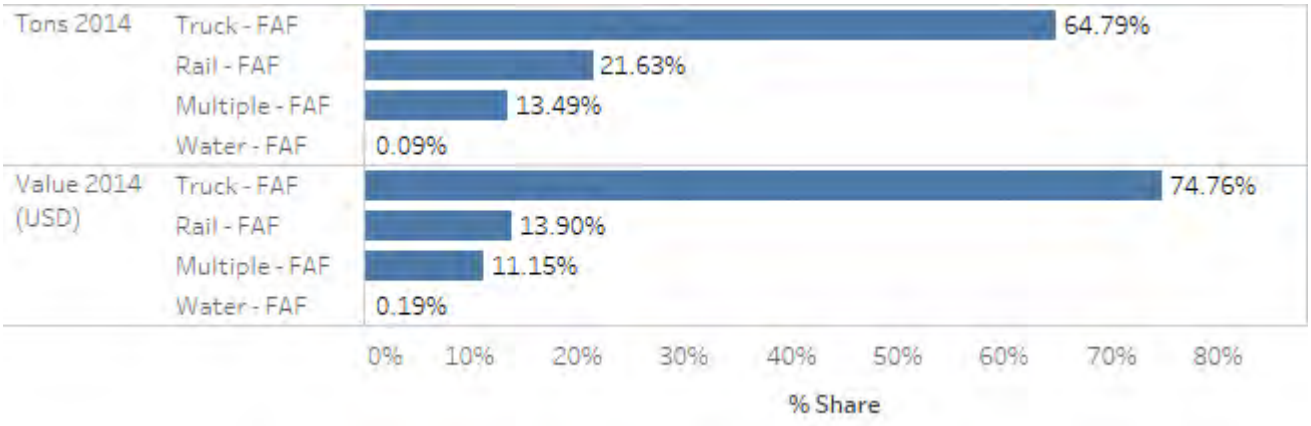
In 2014, other foodstuffs was the region's fifth-leading value commodity group, representing 2.8 million tons and $2.9 billion in value. 65 percent of tonnage and 75 percent of value moved by truck; 22 percent of tonnage and 14 percent of value moved by rail; and 14 percent of tonnage and 11 percent of value moved by multiple modes.

Figure 4-50: Other Foodstuffs Tonnage and Value, 2014

		Eight County Region Direction			
Measure	State-to-State Mode	Inbound	Internal	Outbound	Grand Total
Tons 2014	Truck - FAF	827,263	19,195	935,294	1,781,752
	Rail - FAF	82,323	744	511,768	594,834
	Multiple - FAF	127,456	5,158	238,412	371,026
	Water - FAF	2,350		39	2,388
	Total	1,039,392	25,097	1,685,512	2,750,001
Value 2014 (USD)	Truck - FAF	995,288,535	20,322,463	1,118,310,991	2,133,921,989
	Rail - FAF	64,327,119	629,003	331,680,013	396,636,135
	Multiple - FAF	93,620,531	2,973,087	221,645,346	318,238,964
	Water - FAF	5,439,047		52,741	5,491,787
	Total	1,158,675,232	23,924,553	1,671,689,090	2,854,288,875

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-51: Other Foodstuffs Modal Share, 2014

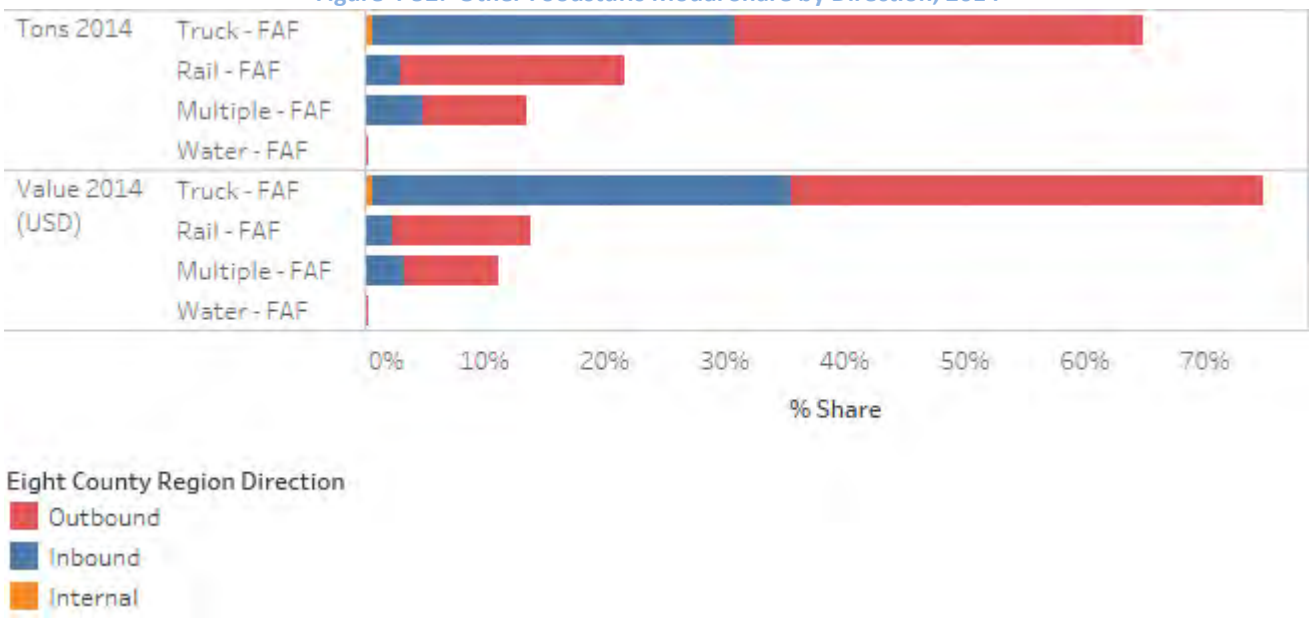


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.10.3 Trading Regions

Other foodstuffs flows are substantial in both directions, but outbound flows are larger than inbound flows. Truck flows tend to be relatively balanced between outbound and inbound flows, but rail and multiple modes flows are heavily weighted to outbound flows. The leading destination for outbound flows is remainder of Illinois; remainder of Iowa is also significant. The leading origins for inbound flows are the remainder of Illinois and Iowa.

Figure 4-52: Other Foodstuffs Modal Share by Direction, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 4-53: Other Foodstuffs Trading Partner States (Showing Top Five by Tonnage), 2014

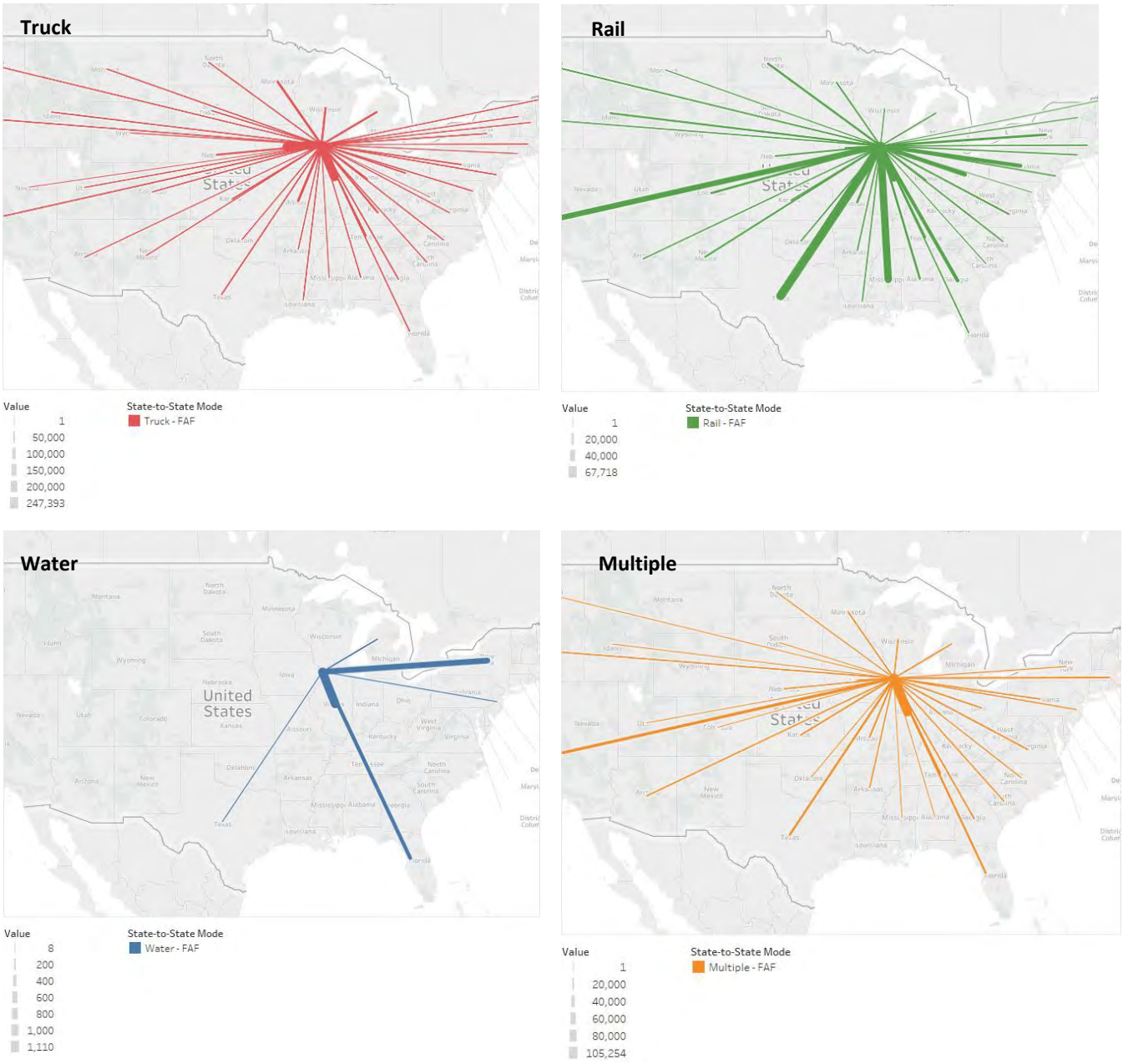
Origin State	Tons 2014	Value 2014 (USD)
IL	376,249	342,451,277
IA	268,092	287,663,882
MN	57,234	63,309,364
IN	44,079	71,050,103
MO	42,300	60,999,195
Grand Total	1,039,392	1,158,675,232

Destination State	Tons 2014	Value 2014 (USD)
IL	458,867	435,369,533
IA	231,314	246,915,842
TX	102,672	89,817,707
MO	88,294	117,834,705
CA	76,303	76,428,062
Grand Total	1,685,512	1,671,689,090

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Other foodstuffs truck flows are strongest with Illinois and Iowa; rail flows are strongest with Illinois, Iowa, Texas, Mississippi, and California; water flows are strongest with Illinois, New York, and Florida; and multiple modes are strongest with Illinois but reach many other states.

Figure 4-54: Other Foodstuffs "Desire Lines" for Tonnage Flows (Both Directions), 2014

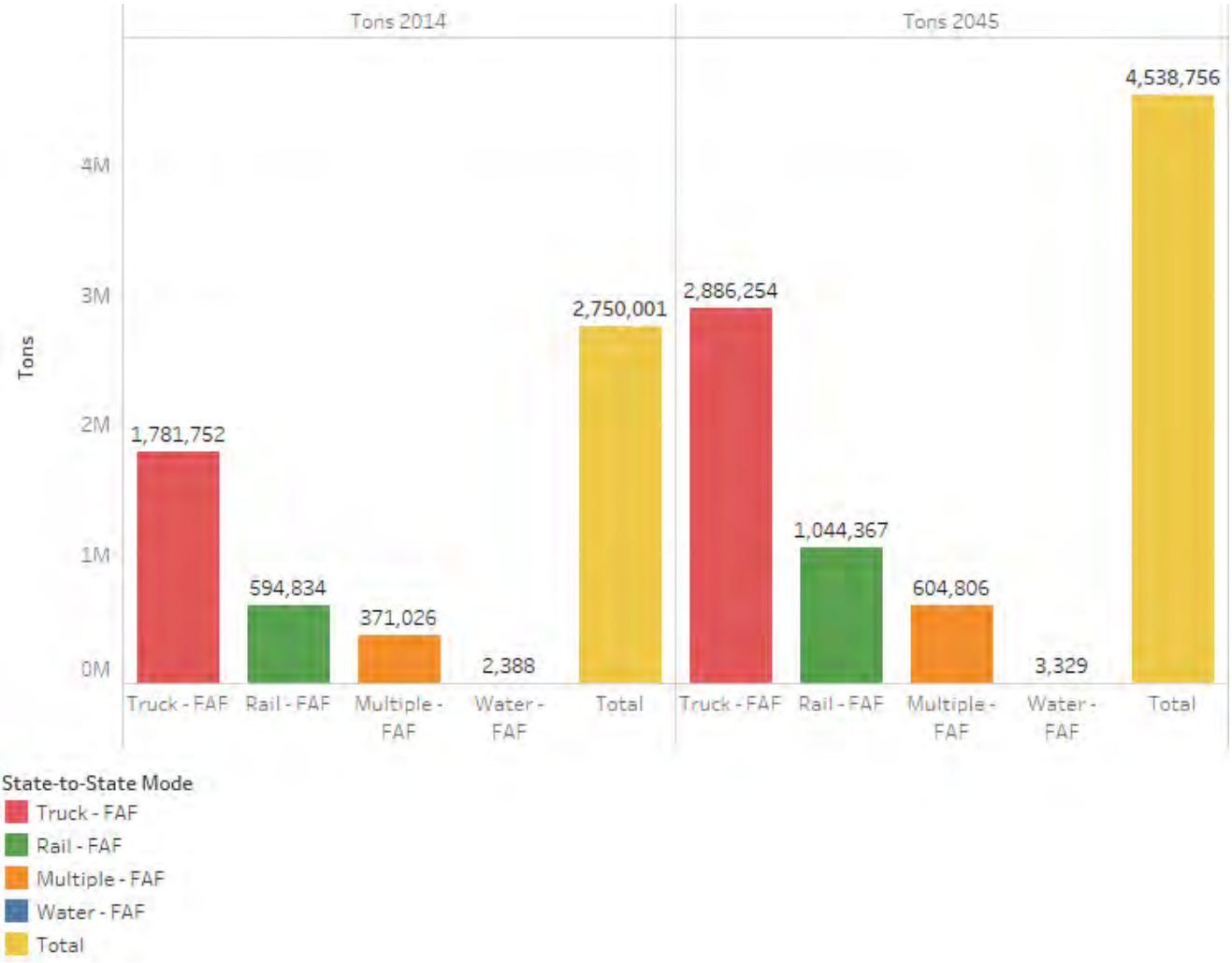


Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.10.4 Future Growth

Between 2014 and 2045, other foodstuffs are forecast to add nearly 1.8 million tons (65.0 percent growth at a CAGR of 1.6 percent), growing from nearly 2.8 million tons to more than 4.5 million tons. During this time, other foodstuffs are forecast to add 1.8 million tons (64.2 percent growth at a CAGR of 1.6 percent), growing from $2.9 to $4.7 billion dollars

Figure 4-55: Other Foodstuffs Tonnage Growth by Mode, 2014-2045



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

4.11 Key Issues to Address in Developing Supply Chain Profiles

Looking ahead to the final Supply Chain profiles, some key findings from this Section include:

- For the commodities examined, the majority of tonnage and value flows have origins and destinations in the remainder of Iowa and Illinois. Future work should provide a breakdown of volumes at the county level in these two states, to allow flows to be identified with logical transportation corridors according to their compass orientation (due northeast, east, southeast, south, etc.). However, in providing county-level estimates, the FAF information becomes more "modeled" and less reliable.
- To improve the reliability of county-level analysis, and to validate (or modify as needed) the information presented in this Section should be confirmed where possible by other data (including but not limited to ATRI truck flows and industry location data), and especially by the direct review and input of public and private sector stakeholders.

5 Eight County Region Benchmarking: Flows, Distances, and Costs

Key Chapter Takeaway

In addressing the competitiveness of the Eight County Region in providing freight transportation services, it is useful to compare its performance to national-average benchmarks for truck, rail, water, and multiple modes tonnage in four areas: commodity shares; mode shares; trip distances; and freight transportation costs.

Regarding commodities, the region is more heavily concentrated in fertilizers, cereal grains, and other agricultural products than the nation as a whole; these groups are projected to grow at rates near or exceeding national averages. The region is less heavily concentrated in high-value goods (machinery, electronics, pharmaceuticals, etc.) but growth rates for these commodities are generally near national averages, suggesting the possibility of stronger roles in the regional economy. Overall the region is expected to grow at the same rate as the nation as a whole.

Regarding modes, the region is substantially more dependent on rail than the nation as a whole, and substantially less dependent on water. The region's use of trucking and multiple modes are slightly below national averages. All modes are expected to grow at roughly the national average rates.

Compared to national averages, the region's average length of haul is longer for truck (even though the most significant truck trade is with Illinois and Iowa) and for water, and shorter for rail (much of the market is in the Midwestern states) and multiple modes.

Based on national average cost factors, in 2014, an estimated $2 billion dollars was spent in freight transportation services for the Eight County Region. Further work in this study will address ways to improve the cost-effectiveness of the region's transportation options and services.

5.1 Commodity Shares

The most recent national (not disaggregated) version of the Freight Analysis Framework was used to determine tonnages by commodity class for all freight moving between or within the US, for current and forecast years. The data was adjusted to eliminate double-counting of tonnage moving within single states, and filtered to include only the four modes – truck, rail, water, and multiple modes – addressed in the Eight County Region data. Next, the shares of US

tonnage and Eight County region associated with each commodity class were tabulated. This allowed two metrics to be generated:

- **"Commodity Quotients"** (CQ) calculated as the ratio of Eight County Region commodity tonnage shares to US commodity tonnage shares. Commodity Quotients greater than 1.0 reflect a strong concentration Eight County Region tonnage in a given commodity, compared to the national average; Commodity Quotients less than 1.0 mean a commodity is proportionally less represented in the Eight County Region than in the country as a whole.

- **"Commodity Growth Quotients"** (CGQ) calculated as the ratio of Eight County Region and US commodity tonnage growth percentages. Commodity Growth Quotients greater than 1.0 mean a commodity is faster growing in the Eight County Region than in the US as a whole, on a percentage basis. Commodity Growth Quotients less than 1.0 reflect slower than national growth in the Eight County Region.

Looking at Commodity Quotients and Commodity Growth Quotients for the Eight County Region's top ten tonnage commodities – which account for 78.6 percent of the region's total tonnage – there are several interesting findings.

- Fertilizers has the highest CQ, at 10.70. This reflects an extremely strong concentration compared to national averages. Fertilizers has a CGQ of 0.95, suggesting continuing growth at close to the national average.

- Cereal grains (CQ of 2.34), other agricultural products (CQ of 1.84), and animal feed (CQ of 1.65) are also well above national averages. Cereal grains should see stronger than average growth (CGQ of 1.12), while other agricultural products (0.90) and animal feed (0.84) are forecast to grow slower than national averages but not significantly so.

- Gravel (CQ of 1.16 and CGQ of 1.07) is above the national average for both commodity quotient and commodity growth quotient, suggesting strength and continued growth.

- Coal has a below average CQ of 0.70 and a well below average CGQ of 0.56, which reflects the declining growth forecast for coal in the region.

- Other foodstuffs, nonmetallic minerals products, waste and scrap, and gasoline have commodity quotients below 1.00, but commodity growth quotients near or above 1.00, suggesting growing representation of these commodities in the region's economy.

Figure 5-1: Eight County Region CQ and CGQ for Ten Leading Tonnage Groups, 2014

	Eight County Region 2014 Tonnage Share	US Total Tonnage Share	Eight County "Commodity Quotient"	Eight County "Commodity Growth Quotient"
Cereal grains	18.0%	7.7%	2.34	1.12
Fertilizers	17.1%	1.6%	10.70	0.95
Gravel	14.7%	12.7%	1.16	1.07
Other ag prods.	7.1%	3.9%	1.84	0.90
Coal	4.8%	6.8%	0.70	0.56
Nonmetal min. prods.	4.6%	7.5%	0.61	1.17
Other foodstuffs	4.1%	4.9%	0.83	0.96
Animal feed	3.9%	2.3%	1.65	0.84
Waste/scrap	2.4%	4.6%	0.52	1.07
Gasoline	2.0%	5.4%	0.37	1.30

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure 5-2: Eight County Region CQ and CGQ for Ten Leading Value Groups, 2014

	Eight County Region 2014 Tonnage Share	US Total Tonnage Share	Eight County "Commodity Quotient"	Eight County "Commodity Growth Quotient"
Machinery	0.6%	0.9%	0.69	0.84
Unknown/Mixed	1.4%	2.7%	0.53	0.90
Motorized vehicles	0.6%	1.3%	0.45	0.97
Other ag prods.	7.1%	3.9%	1.84	0.90
Other foodstuffs	4.1%	4.9%	0.83	0.96
Cereal grains	18.0%	7.7%	2.34	1.12
Plastics/rubber	1.2%	1.7%	0.70	0.80
Fertilizers	17.1%	1.6%	10.70	0.95
Electronics	0.2%	0.5%	0.34	0.77
Pharmaceuticals	0.0%	0.1%	0.30	0.84

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Looking at Commodity Quotients for the Eight County Region's top ten value commodities – which account for 58.2 percent of the region's total value – additional findings include:

- The region's three leading value commodities – machinery (CQ of 0.69), unknown/mixed (CQ of 0.53), and motorized vehicles (CQ of 0.45) – all have relatively low CQ values. Although they are value leaders in the Eight County Region, they are not represented in the region as well as they are in the US as a whole. However, their growth quotients are at or near national averages (between 0.84 and 0.97) suggesting the potential for increased shares of the region's economy.
- Electronics (CQ of 0.34) and pharmaceuticals (CQ of 0.30) – which are important growth commodities for the region and the US – both have very low current CQ values, suggesting

they are substantially under-represented in the region's economy. However, they both show CGQ values (0.77 and 0.84) closer to the national average, suggesting the potential for increased shares of the region's economy.

Comparing all commodities, the Eight County Region has a total CGQ of 1.00, meaning it is projected to grow at the same rate as the US as a whole.

5.2 Mode Shares

To supplement the commodity analysis, a similar analysis was performed for mode shares. Two metrics were generated:

- **"Modal Quotients"** (MQ) calculated as the ratio of Eight County Region modal tonnage shares to US modal tonnage shares. Commodity Quotients greater than 1.0 reflect a strong concentration Eight County Region tonnage in a given mode, compared to the national average; Commodity Quotients less than 1.0 mean a mode is proportionally less represented in the Eight County Region than in the country as a whole. (Note that for purposes of this analysis, only FAF truck, FAF rail, FAF water, and FAF Multiple Modes tonnage was considered.)
- **"Modal Growth Quotients"** (MGQ) calculated as the ratio of Eight County Region and US modal tonnage growth percentages. Modal Growth Quotients greater than 1.0 mean a mode is faster growing in the Eight County Region than in the US as a whole, on a percentage basis. Modal Growth Quotients less than 1.0 reflect slower than national growth in the Eight County Region.

Figure 5-3: Eight County Region MQ and MGQ, 2014

	Eight County Region 2014 Tonnage Share	US Total Tonnage Share (excluding Air, Pipeline, Other)	Eight County "Modal Quotient"	Eight County "Modal Growth Quotient"
Truck	73.3%	79.6%	0.92	1.00
Rail	23.0%	12.4%	1.85	1.04
Multiple	2.7%	3.1%	0.88	1.00
Water	1.1%	5.0%	0.21	1.09

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Looking at Modal Quotients and Commodity Growth Quotients for the Eight County Region's freight modes, key findings include:

- The region's truck share is slightly lower than the national truck share, resulting in a Modal Quotient of 0.92. The Modal Growth Quotient of 1.00 suggests that Eight County Region truck tonnage will grow at the same rate as national truck tonnage. The region is somewhat less dependent on trucking than the nation as a whole, but trucking is still its most important mode for tonnage and value.

- The region's rail share is extremely strong at 23.0 percent, compared to a national rail share of 12.4 percent, resulting in a MQ of 1.85. The region's economy is highly concentrated in commodities for which rail is a suitable transportation mode, and as a result the region's rail utilization – and rail dependency – is higher than average. The Modal Growth Quotient of 1.04 suggests that Eight County Region rail tonnage will grow slightly faster than the national average.

- The region's multiple modes share is slightly lower than the national average at 2.7 percent, resulting in a MQ of 0.88. The Modal Growth Quotient of 1.00 suggests that Eight County Region multiple modes tonnage will grow at the national average rate.

- The region's water share is well below the national average, with a MQ of just 0.21. The low MQ reflects the fact that water utilization is relatively low -- whether due to shipper preferences, availability of water services that can compete with other modes, or both. This is not necessarily a sign that anything is wrong, or that policy makers should automatically attempt to increase the share of freight being moved by water. Investigations of whether improved water services can attract business and sustain themselves financially would be necessary to inform public policy determinations.

5.3 Trip Distances

Total national ton-mileage and tonnage was extracted from the national Freight Analysis Framework, and for each mode, ton-miles were divided by tonnage to calculate the average trip distance for each mode. Matching estimates for Eight County trip distances were created by developing national state-to-state distance tables for each mode (from FAF), adjusting the distances for the location of the Eight County Region, multiplying state-to-state distances times state-to-state tonnages (generating ton-mileage estimates) for each mode, summing the ton-mileage estimates by mode, and then dividing the modal ton-mileage by the modal tonnage.

The material presented in Sections 2, 3, and 4 clearly demonstrates that the great majority of the Eight County Region's tonnage is moving to and from the remainder of Iowa and the remainder of Illinois.

With so much "in state" traffic, the expectation might be that trip distances by truck would be lower than the national average, but it appears the average truck trip distance for Eight County Region freight is actually higher than the national average, at 265 miles per trip for the Eight County Region, versus 177 miles per trip for the US as a whole.

- One reason is that Iowa and Illinois are big states, with hauls between the region and the center of each state requiring as many as 350 miles in Iowa and 450 miles Illinois. Based on provisional mapping analysis of county-level tonnages, average trip distances of 214 and 220 miles were chosen as representative. However, this estimate should be considered provisional until confirmed by further analysis and stakeholder input.

- Another reason is that national data includes a mix of long-haul intercity trips and short-haul metropolitan area trips, which reduces the average trip distance. The Eight County

Region has very little local truck traffic, so the moderating effect of short-haul trips on average mileage is fairly small.

Figure 5-4: Eight County Region and US Average Trip Lengths by Mode (Provisional), 2014

	Eight County Region Average Miles per Trip	US Total Average Miles per Trip
Truck - FAF	265	177
Rail - FAF	399	802
Multiple - FAF	557	811
Water - FAF	540	453

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

On the other hand, looking at rail, the Eight County Region relies on rail for service at much shorter distances (399 miles on average) than the nation as a whole (802 miles on average).

- The national average is high in part because much of its traffic is intermodal containers (moving long distances across the country, between ports and inland distribution centers) and coal (moving long distances primarily from Wyoming to every state).
- The Eight County Region does not receive intermodal rail containers; it does receive Wyoming coal, but it is located closer to the source (the Powder River Basin) than many other states. Although it has some long-distance rail freight, most of its rail tonnage is fertilizers and other bulk moving relatively short distances (less than 400 miles).
- For intermodal rail service, the "market break even" service distance is generally around 500 miles, although it can be shorter under certain conditions (with high and reliable daily volumes, double-stack unit trains, and revenue-generating loads in both directions). For bulk rail, the break-even distance is far shorter. By using bulk rail at shorter distances, the region avoids or reduces the need to handle heavy commodities in trucks over its highway system.

For multiple modes, the average trip distance for the Eight County Region (557 miles) is lower than the national average (811 miles). The national average reflects a considerable amount of long-haul intermodal container traffic being handled by multiple modes. The Eight County Region, on the other hand, is using multiple modes generally to serve a smaller market radius.

For water, the average trip distance for the Eight County Region (550 miles) is longer than the national average (453 miles). This largely reflects geography; the region is a long way from the Gulf of Mexico and other major deep-water ports. The combination of local moves between the two states and long-haul moves to the Gulf and other ports generates the longer average distance.

5.4 Freight Transportation Costs

Freight transportation costs are relatively easy to benchmark in terms of averages, but extremely difficult to measure in specific applications. For each mode, there are many different

variables that impact the costs incurred by the service provider (or providers), as well as the price that is passed on to the customer. The value of general benchmarks is to: first, quantify the relative costs of different transportation modes; and second, to provide an order-of-magnitude sense of how much the region as a whole may be spending on freight transportation.

The following information is adapted in part from work in progress being conducted for the American Association of State Highway and Transportation Officials to update their Freight Rail Bottom Line Report (FRBL). The FRBL update addresses current best practice in benefit-cost analysis for truck to rail diversion projects.

5.4.1 Truck Price Benchmarking

Baseline Estimates

Trucking revenues per mile were obtained from a survey of trucking companies by TransCore in 2011 and indexed to 2015 by the Cass Truckload Linehaul Index™.[3] The survey found that average truckload motor carrier revenue per mile was $2.03 in 2011.[4] When indexed to 2014, the national rate is $2.24 per vehicle mile. This represents an average for commodities and geographies, and accounts for empty (zero tonnage) movements.

Estimated truck revenue per mile was converted to revenue per ton-mile by dividing the revenue per mile figure by an estimated average truck payload of 20.70 tons. The average payload was developed using average truck payload figures for truck movements over 500 miles as reported in the *Quick Response Freight Manual*.[5] The 20.70 tons figure represents a weighted average for selected commodity types that are typically moved either by truck or by intermodal or merchandise rail. The resulting estimated shipper price for trucking was found to be **$0.108 per ton-mile**.

Key Variables

The following variables can significantly affect the baseline estimate.

- Length of haul (short trips usually incur a higher per-mile cost, due to fixed costs such as loading/unloading/waiting at either end; longer trips may have a shorter per-mile cost, since recovery of fixed costs is spread over more miles)
- Reliability of haul (truckers who expect to be stuck in traffic will price their trips assuming more hours are needed; for example, a truck trip between Northern New Jersey and Queens, NY can cost as much as $600 because the trucker expects the 80-mile round trip will take a full day in traffic)

[3] Carrier Benchmark Survey, TransCore 2011, Cass Information Systems, Inc., Cass Truckload Linehaul Index, December 2015.
[4] TransCore, 2011. Carrier Benchmark Survey, DAT Special Report.
[5] U.S. Federal Highway Administration, *Quick Response Freight Manual II*, September 2007, Table 4.20.

- Availability/location of a loaded return trip (without a loaded "backhaul" return trip, the "headhaul" has to pay for both the outbound and the return trip
- Fluctuations in fuel cost
- Seasonality of demand (harvest season trucking may cost more because trucks are in higher demand and shorter supply)
- Availability of modal alternatives, such as rail or barge
- Differences in cost structures within local operating regions
- Provision of equipment to the customer (container, chassis, etc.)
- Utilization of specialized equipment (refrigerated, hazmat, food-grade, etc.)
- Specialized delivery requirements (over-dimensional, etc.)

5.4.2 Rail Price Benchmarking

Availability of Rail Service

The first and most important issue in rail pricing is service availability: would a railroad actually provide the service, and if so, at what price? This depends on many factors, including: availability and sufficiency of rail networks and transfer terminals; shipment volume and frequency; customer utilization of railroad equipment; requirements for specialized equipment or specialized handling; ability to generate rail revenues in both directions; need to interchange with other railroads; availability of alternative rail service options (e.g. intermodal terminals within a half-day driving distance); competitive position versus other railroads and other modes; and other factors.

Truckers can serve any customer that has access to a road. Railroads, on the other hand, can only go where the rails go, and they own and build and maintain those rails. Railroads act like for-profit businesses, because they are. In many cases, freight customers who want rail service, or cheaper rail service, are disappointed by railroad decisions not to serve them, or to provide service at a rate that offers little discount compared to trucking. This is often due to the customer not having enough volume or revenue potential to justify the railroad's investment and commitment to providing the service, although other factors certainly come into play.

In any case, it must be understood that the rail price benchmarks calculated below apply only to conditions where the railroads have elected, or are likely to elect, to provide services.

Pricing strategies differ depending on the type of rail service. Estimates are provided separately for the following service types:

- **Intermodal** – single or double-stacked shipping containers in dedicated "well cars", containers on flatcars, truck trailers on flatcars, trucks on flatcars

- **Bulk Unit Train** – long trains (up to 10,000 feet) consisting of a single bulk commodity type (coal, grain, etc.)
- **Merchandise** – all other services, generally consisting of mixed railcar types and commodities

Intermodal

Experience working with Class I railroads suggests that intermodal traffic can be diverted from truck to rail when the rail option – including truck drayage at one or both ends – offers a discount of 10 percent versus the equivalent cost of trucking. Intermodal service involves costs (drayage, inventory, etc.) to shippers that may not be fully reflected in railroad revenues. As a result, railroads target their pricing so that on average, the total logistics costs experienced by a shipper – rail revenues plus other costs – still represent a discount versus truck. With an average trucking cost of $0.108 per ton mile for trucking, the estimated intermodal rate is **$0.097 per ton mile for rail** (based on highway equivalent miles).

Merchandise

Rail revenue per ton-mile was estimated using the Association of American Railroads' Railroad Ten-Year Trends. The analysis also includes assumed truck drayage costs, which were derived from data by the Surface Transportation Board (STB) Uniform Railroad Cost (URCS) model. The resulting average railroad revenue per ton-mile for divertible traffic was $0.70. Average revenue per ton-mile was then adjusted for the additional circuity that trains need to travel to deliver shipments relative to trucking. Analysis by WSP of the relative truck and rail distances between Freight Analysis Framework (FAF) zones using the FAF-3 suggest that to ship products to or from the same locations using truck or rail, requires 1.19 times the mileage by rail as by truck. This is roughly consistent with other studies, such as by Upper Great Plains Transportation Institute.[6] After this adjustment, the ton-miles weighted revenue for rail was found to be $0.083/ton-mile. With an average trucking cost of $0.108 per ton mile for trucking and an average cost of **$0.083 per ton mile for rail** (based on highway equivalent miles), rail offers a potential savings versus trucking of up to $0.025 (23 percent) per ton mile.

Bulk Unit Train

According to the Association of American Railroads, in year 2014, total freight revenues for all Class I railroads were $0.041 per ton-mile (based on rail miles) or $0.048 per ton-mile (based on highway equivalent miles). This is far lower than the costs cited above for Merchandise and Intermodal service, because it excludes non-railroad service costs such as truck pickup/delivery. While some types of unit train service do not require drayage (for example, coal moving from mines to power plants), other types do (such as grain moving to/from regional transload centers). However, this is a good figure for estimating the cost of bulk unit train service, which may not require drayage at either end of the rail trip. With a model of a 500-mile trip and $200

[6] Denver Tolliver, Pan Lu, Douglas Benson of the Upper Great Plains Transportation Institute, *Analysis of Railroad Energy Efficiency in the United States*, May 2013.

dollars in total drayage costs, the adjusted cost is **$0.068 per ton-mile** (based on highway equivalent miles).

5.4.3 Multiple Modes Price Benchmarking

FAF does not provide sufficient detail to develop benchmarks for Multimodal Modes pricing, since we cannot know what modes are involved, in what proportions. As a surrogate, we recommend using the Intermodal Rail benchmark of **$0.097 per ton mile for rail** (based on highway equivalent miles), which is representative of one common type of multimodal move.

5.4.4 Water Price Benchmarking

As with rail, with the first question to ask is whether the service is available at all. Inland barge service has proven to be a robust provider of services for bulk commodities and for oversize/overweight equipment and machinery; and there is increasing interest in determining whether and how the inland waterways can serve higher-value, more time-sensitive commodities.

The US Department of Agriculture publishes transportation cost statistics for a variety of modes. Their Grain Transportation Report of September 3, 2015, cites southbound rates of $18.09 to $20.32 per ton for mid-Mississippi River origins. Assuming a 1000-mile highway equivalent trip to Louisiana and a rate of $20.00 per ton, the equivalent cost is $0.02 per ton-mile – attractively low, but impractically low, as it does not include the cost of returning the barge, nor the cost of drayage to/from barge loading facilities. Factoring in $200 for drayage and the cost of returning an empty barge, the adjusted cost can be estimated at **$0.05 per ton-mile** (based on highway equivalent miles). This is approximately 75 percent of the cost of bulk unit train service. (Interestingly, the US Bureau of Transportation Statistics published modal cost comparisons for barges through the year 2004; and in 2004, barge costs were 77.6 percent of rail costs.)

5.4.5 Eight County Region Freight Costs

The benchmark costs presented above can be combined with the tonnage and ton-mileage data developed in this Working Paper to estimate the total freight transportation costs associated with Eight County Region freight movement. The cost factors assumed are:

- Trucking = $0.108 per ton-mile
- Rail = $0.083 per ton-mile (based on highway equivalent miles), using the merchandise rail rate
- Multiple Modes = $0.097 per ton-mile (based on highway equivalent miles), using the intermodal rail rate
- Water = $0.050 per ton-mile (based on highway equivalent miles)

Figure 5-5: Order-of-Magnitude Freight Transportation Costs for the Eight County Region, 2014

	Rate per Ton-Mile	Ton-Miles, 2014	Estimated Transportation Cost
Truck	$ 0.108	13,056,538,943	$ 1,410,106,206
Rail	$ 0.083	6,159,485,019	$ 511,237,257
Multiple	$ 0.097	1,012,159,822	$ 98,179,503
Water	$ 0.050	385,064,490	$ 19,253,224
Total			$ 2,038,776,190

Source: WSP.

In 2014, an estimated $2 billion dollars was spent in freight transportation services for the Eight County Region. Further work in this study will address ways to improve the cost-effectiveness of the region's transportation options and services.

6 Conclusions and Next Steps

6.1 Conclusions

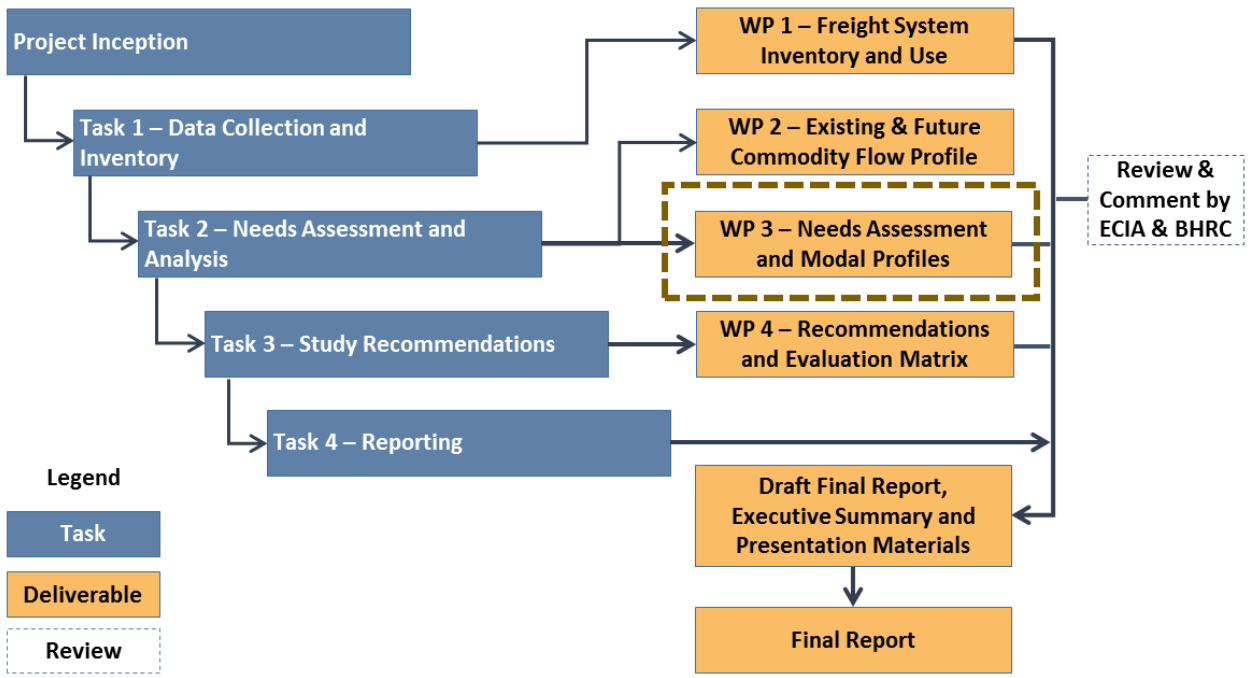
The material presented in this Working Paper will be used in parallel with other data sources – including ATRI truck GPS data and other sources – to evaluate freight improvement needs and opportunities.

Additionally, a wide range of freight and economic data will be provided in a Data Toolkit for continuing use by ECIA and BHRC. The Toolkit will be built using a commercial software package called Tableau. Tableau combines data analysis capabilities (similar to MS Access or MS Excel) with display and geographic mapping capabilities. Generally, it is much more user friendly than database or GIS software, and allows non-technical users to work with very large databases to answer basic planning questions as they arise.

6.2 Next Steps

The present Working Paper is the output of Task 2.2 and is provided for review and comment by ECIA and BHRC. A revised Working Paper will be provided in due time, based on comments and updates based on future consultations and research. The next Working Paper (Working Paper 3 – Needs Assessment) will reflect the remainder of Task 2 activities.

Figure 6-1: Project Approach

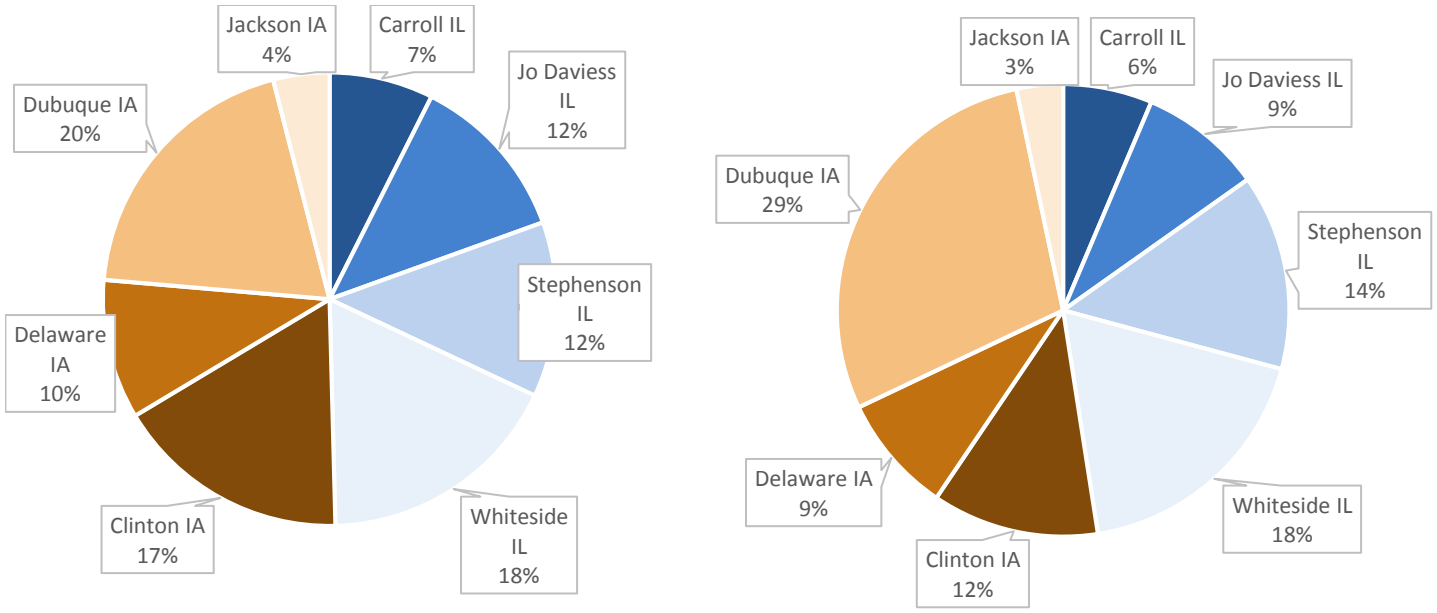


Appendix A – County-Level Commodity Flows

A.1 Tonnage and Value by County

Freight tonnage is broadly distribution among all counties in the region. The largest shares of tonnage are in Dubuque, Clinton, and Whiteside counties, which represent 55 percent of all Eight County Region tonnage. Similarly, freight value is broadly distributed among all counties in the region. The largest shares of value are in Dubuque, Whiteside, and Stephenson counties, which represent 61 percent of all Eight County Region value. For Dubuque and Stephenson in particular, the share of value is higher than the share of tonnage, indicating that the goods moved by these counties tend to include more high-value commodities. For counties where the share of value is lower than the share of tonnage, like Clinton and Jo Daviess, the goods moved tend to be lower in value

Figure A-1: Total Eight County Region Tonnage (left) and Value (right) by County, 2014



Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

The figure above represents each county's share of the Eight County Region's total tonnage and value. To support county-level planning activities, additional more detailed estimates of freight tonnage were developed for each individual county in year 2014. Section B.2 presents

summaries of county-level tonnage by mode and direction; Section B.3 presents summaries of county-level tonnage by commodity and direction.

A.2 County-Level Tonnage by Mode and Direction

County-level tonnage estimates for year 2014 by mode and direction are presented below.[7]

Figure A-2: Carroll, IL Total Tonnage by Mode and Direction, 2014-2045

	17015 Carroll IL			
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	1,819,718	1,888,989	13,674	3,722,381
Rail - FAF	384,600	667,965	4,693	1,057,258
Water - FAF	60,822	88,567	529	149,918
Multiple - FAF	55,849	98,033	312	154,194
Grand Total	2,320,989	2,743,553	19,209	5,083,752

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-3: JoDaviess, IL Total Tonnage by Mode and Direction, 2014-2045

	17085 Jo Daviess IL			
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	1,626,340	2,767,018	23,049	4,416,406
Rail - FAF	528,642	3,163,688	42,498	3,734,829
Water - FAF	29,590	35,767	44	65,401
Multiple - FAF	60,105	118,436	404	178,945
Grand Total	2,244,677	6,084,910	65,994	8,395,580

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

[7] There is a minor but important difference when calculating region-level flows and county-level flows. With region-level analysis, freight moving between the eight counties represents internal tonnage, and is counted only once. With county-level analysis, freight moving between the eight counties represents an outbound move for one county and an inbound move for the other, and is therefore counted twice – once at each end of the trip. Movements within individual counties are treated as "within" county moves, and counted only once. As a result, the sum of all Eight County Region county-level tonnages is slightly higher than the totals from the region-level analysis. The difference however is extremely small, and has no significant impact on the analysis or findings.

Figure A-4: Stephenson, IL Total Tonnage by Mode and Direction, 2014-2045

	17177 Stephenson IL			
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	4,166,176	2,336,703	30,519	6,533,397
Rail - FAF	832,484	586,106	3,947	1,422,538
Water - FAF	58,848	76,942	343	136,133
Multiple - FAF	175,399	200,314	2,392	378,106
Grand Total	5,232,907	3,200,065	37,201	8,470,173

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-5: Whiteside, IL Total Tonnage by Mode and Direction, 2014-2045

	17195 Whiteside IL			
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	3,391,164	3,672,131	43,191	7,106,487
Rail - FAF	1,399,509	3,120,721	59,513	4,579,743
Water - FAF	49,590	68,112	148	117,850
Multiple - FAF	124,379	158,559	984	283,922
Grand Total	4,964,643	7,019,524	103,836	12,088,002

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-6: Clinton, IA Total Tonnage by Mode and Direction, 2014-2045

	19045 Clinton IA			
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	3,121,391	6,073,352	55,271	9,250,015
Rail - FAF	1,281,726	659,737	998	1,942,462
Water - FAF	18,315	66,167	81	84,563
Multiple - FAF	27,754	213,830	137	241,720
Grand Total	4,449,186	7,013,086	56,487	11,518,759

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-7: Delaware, IA Total Tonnage by Mode and Direction, 2014-2045

19055 Delaware IA				
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	2,752,155	2,909,596	19,323	5,681,074
Rail - FAF	459,697	363,927	762	824,386
Water - FAF	10,002	44,668	27	54,697
Multiple - FAF	19,478	221,319	19	240,816
Grand Total	3,241,332	3,539,510	20,131	6,800,974

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-8: Dubuque, IA Total Tonnage by Mode and Direction, 2014-2045

19061 Dubuque IA				
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	6,494,988	4,300,783	104,202	10,899,974
Rail - FAF	1,537,356	484,840	2,441	2,024,637
Water - FAF	40,441	36,042	52	76,534
Multiple - FAF	78,939	207,099	359	286,397
Grand Total	8,151,724	5,028,764	107,054	13,287,542

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-9: Jackson, IA Total Tonnage by Mode and Direction, 2014-2045

19097 Jackson IA				
	Inbound	Outbound	Within County	Grand Total
Truck - FAF	723,326	1,763,509	3,273	2,490,108
Rail - FAF	89,947	95,661	40	185,648
Water - FAF	2,457	28,481	4	30,941
Multiple - FAF	8,386	55,395	1	63,783
Grand Total	824,117	1,943,046	3,318	2,770,480

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

A.3 County Level Tonnage by Commodity and Direction

County-level tonnage estimates for year 2014 by commodity and direction are presented below.

Figure A-10: Carroll, IL Total Tonnage by Commodity and Direction, 2014-2045

	17015 Carroll IL			
	Inbound	Outbound	Within County	Grand Total
Gravel	704,303	389,998	6,996	1,101,298
Cereal grains	403,210	640,049	2,590	1,045,850
Fertilizers	330,975	585,899	5,839	922,713
Other ag prods.	135,186	272,189	1,027	408,402
Nonmetal min. prods.	79,410	217,376	1,148	297,935
Natural sands	28,402	178,978	495	207,875
Other foodstuffs	72,423	104,148	222	176,793
Gasoline	95,516			95,516
Wood prods.	76,627	14,723	202	91,552
Chemical prods.	12,313	73,789	145	86,247
Basic chemicals	45,333	37,475	57	82,865
Animal feed	42,598	38,869	91	81,558
Fuel oils	52,077	22,698	85	74,860
Unknown/Mixed	20,311	34,427	42	54,780
Coal-n.e.c.	34,497	6,122	41	40,659
Live animals/fish	15,949	17,010	110	33,069
Paper articles	31,372	755	7	32,135
Milled grain prods.	14,045	15,583	13	29,641
Coal	25,308			25,308
Waste/scrap		24,159		24,159
Machinery	7,303	14,995	17	22,316
Base metals	17,233	5,047	3	22,283
Nonmetallic minerals	16,386	4,095	25	20,506
Meat/seafood	6,404	10,358	5	16,768
Plastics/rubber	14,982	666	2	15,650
Articles-base metal	7,765	6,132	11	13,908
Alcoholic beverages	8,330	2,541	9	10,881
Misc. mfg. prods.	1,186	6,370	3	7,558
Pharmaceuticals	7,227			7,227
Building stone	686	6,463	23	7,173
Textiles/leather	112	5,822		5,934
Motorized vehicles	5,916			5,916
Electronics	725	2,826		3,550
Printed prods.	3,349	76		3,426
Null	282	2,983		3,265
Logs	1,632			1,632
Transport equip.	1,061			1,061
Furniture		830		830
Metallic ores	428			428
Precision instrumen..	51	75		126
Newsprint/paper	71			71
Crude petroleum		27		27
Grand Total	2,320,989	2,743,553	19,209	5,083,752

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-11: JoDaviess, IL Total Tonnage by Commodity and Direction, 2014-2045

	17085 Jo Daviess IL			
	Inbound	Outbound	Within County	Grand Total
Fertilizers	395,906	4,410,727	59,610	4,866,243
Cereal grains	366,764	582,063	2,141	950,968
Other ag prods.	139,937	327,655	1,281	468,873
Gravel	265,374	36,631	242	302,247
Other foodstuffs	84,453	153,943	382	238,778
Waste/scrap	110,071	95,798	1,075	206,944
Coal	151,884			151,884
Basic chemicals	104,841	27,765	98	132,704
Nonmetal min. prods.	83,589	39,242	218	123,049
Gasoline	95,516			95,516
Natural sands	68,497	24,862	166	93,524
Base metals	48,662	37,291	67	86,020
Chemical prods.	11,319	73,800	133	85,253
Animal feed	46,503	37,093	94	83,691
Fuel oils	52,077	22,698	85	74,860
Logs		45,845		45,845
Motorized vehicles	16,530	24,109	62	40,701
Coal-n.e.c.	34,497	6,122	41	40,659
Wood prods.	35,981	1,827	13	37,821
Live animals/fish	15,335	18,357	115	33,807
Unknown/Mixed	17,965	10,762	12	28,739
Paper articles	4,907	21,850	28	26,785
Newsprint/paper	17,160	6,848	42	24,049
Plastics/rubber	15,727	6,752	17	22,496
Milled grain prods.	8,476	12,291	6	20,773
Printed prods.	2,736	13,951	14	16,701
Articles-base metal	6,400	9,232	14	15,646
Meat/seafood	5,543	9,975	4	15,523
Machinery	13,520	1,414	4	14,938
Alcoholic beverages	2,411	7,779	8	10,199
Misc. mfg. prods.	2,204	6,367	5	8,577
Pharmaceuticals	7,252	391	5	7,648
Furniture		5,698		5,698
Electronics	2,474	2,228	1	4,703
Nonmetallic minerals	3,530	356		3,886
Building stone	1,680	1,067	9	2,756
Metallic ores	2,604			2,604
Textiles/leather	889	722		1,610
Null	364	939		1,303
Tobacco prods.	771	328	3	1,103
Transport equip.	318			318
Precision instrumen..	8	67		76
Crude petroleum		64		64
Grand Total	2,244,677	6,084,910	65,994	8,395,580

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-12: Stephenson, IL Total Tonnage by Commodity and Direction, 2014-2045

	17177 Stephenson IL			
	Inbound	Outbound	Within County	Grand Total
Cereal grains	1,379,442	1,152,283	16,194	2,547,919
Other ag prods.	472,047	462,032	6,166	940,245
Gravel	494,522	209,664	2,615	706,801
Other foodstuffs	278,101	391,668	3,217	672,987
Fertilizers	604,796	58,178	1,055	664,030
Gasoline	573,114			573,114
Fuel oils	310,115	133,754	3,061	446,929
Nonmetal min. prods.	163,243	59,166	642	223,051
Natural sands	168,405	51,937	855	221,198
Animal feed	94,249	85,825	441	180,515
Coal	151,884			151,884
Unknown/Mixed	52,444	90,386	281	143,110
Coal-n.e.c.	102,757	37,211	729	140,696
Basic chemicals	28,234	62,226	59	90,520
Plastics/rubber	15,576	71,709	168	87,453
Motorized vehicles	42,559	33,829	221	76,609
Milled grain prods.	38,726	35,952	81	74,758
Alcoholic beverages	38,453	33,964	585	73,002
Waste/scrap	18,280	54,537	101	72,918
Live animals/fish	36,807	29,752	449	67,008
Base metals	24,667	37,324	34	62,025
Machinery	24,645	21,090	80	45,815
Meat/seafood	12,766	32,141	30	44,937
Chemical prods.	11,423	15,807	29	27,260
Articles-base metal	15,563	10,838	37	26,438
Wood prods.	22,359	1,832	8	24,198
Nonmetallic minerals	9,547	1,581	6	11,135
Furniture	9,508	1,489	14	11,011
Electronics	6,059	3,825	5	9,889
Misc. mfg. prods.	5,063	4,228	7	9,299
Null	815	7,739		8,554
Paper articles	5,234	3,041	4	8,280
Printed prods.	5,485	1,857	4	7,345
Building stone	4,150	1,053	23	5,226
Textiles/leather	3,535	720	2	4,257
Newsprint/paper	2,199	803		3,002
Metallic ores	2,604			2,604
Transport equip.	2,022			2,022
Pharmaceuticals	1,110	396		1,506
Precision instrumen..	285	119		405
Tobacco prods.	111	41		152
Crude petroleum		67		67
Grand Total	5,232,907	3,200,065	37,201	8,470,173

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-13: Whiteside, IL Total Tonnage by Commodity and Direction, 2014-2045

	17195 Whiteside IL			
	Inbound	Outbound	Within County	Grand Total
Fertilizers	587,720	4,091,060	81,759	4,760,539
Cereal grains	858,688	1,158,396	10,081	2,027,165
Coal	949,319			949,319
Other ag prods.	265,957	397,265	2,965	666,188
Gravel	198,231	174,461	865	373,557
Other foodstuffs	183,556	185,551	1,000	370,107
Gasoline	343,866			343,866
Base metals	116,029	226,570	960	343,559
Nonmetal min. prods.	269,337	23,601	428	293,366
Fuel oils	186,746	80,980	1,102	268,829
Unknown/Mixed	82,026	108,259	527	190,812
Waste/scrap	110,376	68,599	770	179,745
Plastics/rubber	59,181	110,349	960	170,491
Animal feed	73,505	73,108	293	146,906
Chemical prods.	134,493	11,730	254	146,476
Natural sands	86,195	27,248	228	113,671
Articles-base metal	45,309	48,005	466	93,779
Coal-n.e.c.	62,951	22,391	267	85,609
Machinery	26,648	40,751	164	67,563
Motorized vehicles	41,334	22,480	143	63,957
Live animals/fish	29,952	27,409	336	57,698
Electronics	47,859	4,874	48	52,780
Basic chemicals	46,285	4,365	7	50,658
Milled grain prods.	21,302	26,590	33	47,926
Misc. mfg. prods.	39,784	6,318	79	46,181
Wood prods.	8,369	31,044	48	39,461
Meat/seafood	14,097	20,066	21	34,183
Metallic ores	16,383			16,383
Logs	16,238			16,238
Alcoholic beverages	9,598	2,540	11	12,149
Paper articles	5,279	6,546	9	11,833
Printed prods.	10,149	1,542	6	11,697
Null	1,301	9,300		10,601
Nonmetallic minerals	6,982	1,097	3	8,082
Textiles/leather	102	4,960		5,062
Transport equip.	4,147			4,147
Building stone	2,126			2,126
Newsprint/paper	1,620	260		1,880
Pharmaceuticals	1,110	396		1,506
Precision instrumen..	493	510	2	1,005
Furniture		830		830
Crude petroleum		71		71
Grand Total	4,964,643	7,019,524	103,836	12,088,002

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-14: Clinton, IA Total Tonnage by Commodity and Direction, 2014-2045

	19045 Clinton IA			
	Inbound	Outbound	Within County	Grand Total
Gravel	368,613	2,944,299	21,599	3,334,511
Cereal grains	718,426	819,751	4,787	1,542,963
Coal	929,576			929,576
Animal feed	397,902	444,291	3,709	845,902
Other ag prods.	384,612	422,030	3,814	810,455
Other foodstuffs	211,499	473,180	2,278	686,957
Nonmetal min. prods.	218,173	311,838	2,860	532,871
Nonmetallic minerals	212,928	279,552	9,457	501,937
Waste/scrap	120,617	243,882	2,771	367,270
Basic chemicals	252,795	24,465	681	277,942
Natural sands	48,230	197,408	1,741	247,379
Gasoline	3,651	175,620	66	179,337
Live animals/fish	82,427	86,051	684	169,162
Plastics/rubber	10,395	156,089	129	166,614
Milled grain prods.	68,969	85,174	629	154,771
Fertilizers	114,565	9,397	90	124,052
Unknown/Mixed	46,458	53,639	263	100,360
Meat/seafood	29,547	62,941	183	92,672
Base metals	30,255	62,182	138	92,575
Coal-n.e.c.	23,217	27,453	105	50,775
Chemical prods.	36,636	6,036	38	42,710
Motorized vehicles	21,818	13,157	57	35,033
Misc. mfg. prods.	16,440	17,112	60	33,612
Fuel oils	10,780	22,269	112	33,161
Machinery	14,859	9,191	22	24,072
Alcoholic beverages	8,935	14,320	14	23,269
Wood prods.	10,388	11,138	32	21,558
Articles-base metal	6,306	11,702	16	18,024
Newsprint/paper	12,573	4,497	20	17,091
Paper articles	5,690	9,550	19	15,259
Electronics	11,124	1,864	15	13,004
Null	5,964	5,170	71	11,205
Printed prods.	3,094	5,611	14	8,719
Building stone	3,426	1,080	13	4,519
Logs	4,332			4,332
Precision instrumen..	1,090	1,019		2,109
Metallic ores	1,368	120		1,489
Pharmaceuticals	1,253			1,253
Transport equip.	151			151
Tobacco prods.	103	6		109
Grand Total	4,449,186	7,013,086	56,487	11,518,759

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-15: Delaware, IA Total Tonnage by Commodity and Direction, 2014-2045

	19055 Delaware IA			
	Inbound	Outbound	Within County	Grand Total
Cereal grains	1,796,533	674,796	9,929	2,481,258
Gravel	237,752	1,035,306	4,706	1,277,764
Other ag prods.	50,760	478,171	569	529,500
Animal feed	232,516	239,838	1,163	473,518
Alcoholic beverages	478	339,573	20	340,072
Nonmetal min. prods.	156,726	99,661	651	257,038
Fertilizers	177,988	9,348	140	187,475
Nonmetallic minerals	44,704	102,399	693	147,795
Basic chemicals	63,353	69,927	478	133,757
Live animals/fish	39,247	85,793	324	125,363
Base metals	86,094	20,771	132	106,998
Waste/scrap	28,252	77,641	204	106,097
Natural sands	23,761	74,421	315	98,497
Articles-base metal	47,194	35,917	350	83,461
Unknown/Mixed	25,429	38,883	104	64,416
Plastics/rubber	56,982	5,566	26	62,574
Coal-n.e.c.	23,270	13,705	53	37,028
Machinery	13,172	21,794	44	35,011
Other foodstuffs	22,958	8,938	5	31,900
Milled grain prods.	2,139	25,984	6	28,130
Meat/seafood	15,528	12,197	19	27,744
Motorized vehicles	8,869	17,898	32	26,799
Chemical prods.	13,583	8,080	18	21,681
Wood prods.	9,913	11,140	31	21,083
Fuel oils	10,868	4,548	23	15,439
Coal	13,210			13,210
Textiles/leather	2,988	8,123	34	11,146
Furniture	6,453	1,957	13	8,423
Paper articles	5,706	1,476	3	7,185
Null	2,585	3,809	22	6,416
Printed prods.	4,986	831	4	5,821
Misc. mfg. prods.	2,511	2,740	2	5,252
Electronics	1,239	3,797	4	5,039
Logs	4,332			4,332
Gasoline	3,717			3,717
Pharmaceuticals	1,441	1,904	8	3,353
Building stone	1,634	1,087	6	2,727
Newsprint/paper	1,737	636		2,373
Precision instrumen..	535	735		1,270
Metallic ores	70	120		191
Transport equip.	120			120
Grand Total	3,241,332	3,539,510	20,131	6,800,974

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-16: Dubuque, IA Total Tonnage by Commodity and Direction, 2014-2045

	19061 Dubuque IA			
	Inbound	Outbound	Within County	Grand Total
Gravel	1,556,425	367,952	11,090	1,935,467
Nonmetal min. prods.	819,188	484,087	17,204	1,320,478
Cereal grains	547,067	737,366	3,273	1,287,706
Coal	977,168			977,168
Other ag prods.	224,063	463,423	2,434	689,920
Animal feed	310,863	331,422	2,154	644,439
Waste/scrap	435,973	160,325	6,723	603,021
Coal-n.e.c.	348,764	228,089	14,297	591,150
Other foodstuffs	177,339	348,081	1,401	526,822
Base metals	329,970	123,744	3,022	456,735
Unknown/Mixed	158,067	210,068	3,546	371,680
Wood prods.	113,894	221,816	7,052	342,762
Fertilizers	299,545	40,002	989	340,536
Articles-base metal	168,802	140,873	5,024	314,699
Fuel oils	183,971	74,621	7,119	265,712
Plastics/rubber	179,101	84,521	1,164	264,786
Nonmetallic minerals	187,294	52,341	1,502	241,136
Natural sands	162,396	67,966	2,011	232,373
Machinery	70,183	116,212	1,204	187,599
Live animals/fish	58,702	86,804	491	145,997
Logs	86,561	46,928	6,373	139,862
Misc. mfg. prods.	37,761	99,879	788	138,428
Motorized vehicles	64,462	72,564	895	137,921
Newsprint/paper	97,077	37,929	1,262	136,268
Chemical prods.	89,319	38,710	568	128,597
Milled grain prods.	57,232	70,511	432	128,174
Paper articles	46,390	77,810	1,282	125,481
Basic chemicals	84,147	31,011	282	115,441
Meat/seafood	48,229	40,044	190	88,463
Furniture	39,294	36,726	1,331	77,352
Alcoholic beverages	21,365	54,416	125	75,905
Gasoline	65,046			65,046
Printed prods.	18,753	44,902	639	64,295
Null	16,629	19,900	805	37,335
Textiles/leather	24,781	1,343	50	26,174
Electronics	20,222	4,058	57	24,336
Building stone	11,065	6,331	252	17,648
Precision instrumen..	5,803	5,554	15	11,372
Pharmaceuticals	5,641	240	5	5,886
Metallic ores	1,651	120		1,771
Tobacco prods.	734	75	5	814
Transport equip.	787			787
Grand Total	8,151,724	5,028,764	107,054	13,287,542

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Figure A-17: Jackson, IA Total Tonnage by Commodity and Direction, 2014-2045

	19097 Jackson IA			
	Inbound	Outbound	Within County	Grand Total
Gravel	106,486	1,002,704	2,035	1,111,225
Cereal grains	213,997	139,372	240	353,609
Other ag prods.	27,889	303,699	198	331,786
Animal feed	110,656	56,605	131	167,392
Nonmetallic minerals	5,381	96,700	80	102,161
Fertilizers	94,816			94,816
Natural sands	18,756	64,646	216	83,618
Waste/scrap	14,021	49,421	65	63,507
Other foodstuffs	25,633	36,574	21	62,229
Nonmetal min. prods.	48,526	6,532	14	55,072
Live animals/fish	9,807	40,746	38	50,591
Coal-n.e.c.	19,739	13,713	45	33,497
Textiles/leather	60	24,744	4	24,808
Logs	4,223	19,240	109	23,572
Basic chemicals	19,471	3,680	8	23,158
Machinery	10,222	12,212	20	22,454
Newsprint/paper	12,567	5,919	27	18,512
Unknown/Mixed	12,188	4,698	7	16,893
Fuel oils	10,868	4,548	23	15,439
Base metals	14,985			14,985
Milled grain prods.	4,668	8,558	5	13,231
Wood prods.	3,042	10,084	9	13,135
Meat/seafood	7,958	4,707	4	12,670
Motorized vehicles	9,979			9,979
Paper articles		9,569		9,569
Printed prods.	2,595	5,613	12	8,220
Alcoholic beverages	644	6,155		6,799
Misc. mfg. prods.	3,580	2,739	2	6,321
Articles-base metal	2,220	4,063	2	6,286
Electronics	1,014	2,717	2	3,734
Gasoline	3,717			3,717
Null	1,911	474	2	2,387
Precision instrumen..	920	1,128		2,048
Building stone	1,294			1,294
Plastics/rubber		703		703
Furniture		653		653
Transport equip.	180			180
Metallic ores		120		120
Tobacco prods.	103	6		109
Grand Total	824,117	1,943,046	3,318	2,770,480

Source: WSP Analysis of FHWA Freight Analysis Framework version 4 (FAF4) data.

Appendix B – About the Freight Analysis Framework

B.1 Overview of the USDOT Freight Analysis Framework (FAF)

To develop an overall picture of Eight County Region freight tonnage and value, the consultant team utilized the Federal Highway Administration's Freight Analysis Framework (FAF) version 4. FAF is based on year 2012 Commodity Flow Surveys performed by the US Census department. Survey responses were aggregated for purposes of confidentiality, then modeled and processed to reflect other information available to USDOT; then reported out for public use in the form of a large database.

It is important to keep in mind that FAF represents the results of a freight model – it is not an actual comprehensive survey or empirical accounting of commodity flows, and it has known limitations and deficiencies. One should not expect FAF to provide decimal-point accuracy. However, it does represent the best available comprehensive approximation of multimodal freight flows, and it can be extremely useful for telling "big picture" stories.

FAF provides estimates of freight tonnage (usually reported as thousands of tons, or *KTons*) and freight value (usually reported as millions of dollars, or *M$*), with the ability to distinguish the following:

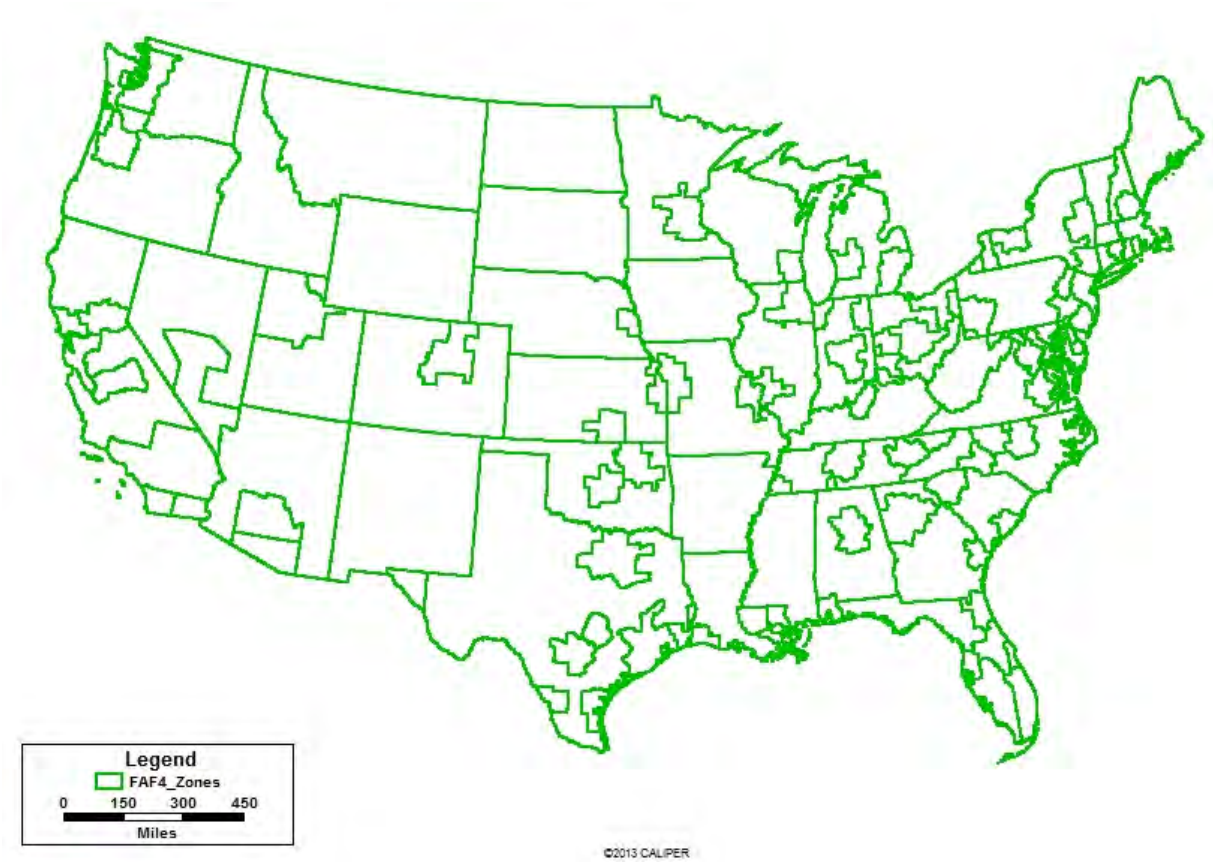
- **Commodity type**. FAF reports the tonnage and value for 42 different commodity groups, representing "2-digit" level groups from the Standard Classification of Transported Goods (SCTG)
- **Direction**. Directional flows are not specified in the database itself, but can be easily determined since the origins and destinations of all flows are specified. Typically, directions are reported as follows:
    - Inbound = freight originating outside the study area and terminating in the study area
    - Outbound = freight originating in the study area and terminating outside the study area
    - Internal = freight originating and terminating in the study area
    - Pass-through = freight that neither originates nor terminates in the study area; this information cannot be determined from FAF itself, and requires network routing analysis to assign FAF origin destination flows, to determine which flows may be routed through the study area

- **Trade type components**. These include:
  - Domestic trade = freight originating and terminating in the US
  - Export trade = freight originating in the US and terminating in another country
  - Import trade = freight originating in another country and terminating in the US
- **Transportation modes**. FAF data distinguishes between domestic modes and international modes. International modes are the specific modes that connect to other countries. However, international moves often have a domestic component – for example, freight can move from the Eight County Region to Chicago by truck, then by air to a foreign country. The state-to-state movement of international freight is counted and assigned to corresponding domestic modes, along with state-to-state tonnage and value that is not associated with international trade (e.g. domestic trade). FAF uses the following modal classifications, which are defined in the US Census Commodity Flow Survey of 2012:
  - Air (including truck-air), which includes air not in combination with any other modes except truck
  - Water, which includes water not in combination with any other modes
  - Truck, which includes truck not in combination with any other modes
  - Rail, which includes rail not in combination with any other modes
  - Pipeline, which includes pipeline not in combination with any other modes
  - Multiple modes and mail, which includes any reported combination of two or more modes; this usually represents intermodal containers or mixed freight shipments using multiple modes (air-truck, water-truck, water-rail, rail-truck), or small packages moving generally as air freight
  - No domestic mode which includes imports and exports directly to/from shipping and receiving locations
  - Other and unknown, which includes all other volumes not assigned to the modes above
- **Analysis years**. FAF has a base year of 2012, with annual projections currently through 2015 and five-year projections through 2045, based on forecasts provided to FHWA by IHS Global Insight Inc.
- **Geographic coverage**. FAF is available at two levels of aggregation: 50 states, or 132 analysis zones representing major US Business Economic Areas (BEAs).

One of the major challenges in freight analysis for the Eight County Region is that Iowa is represented as a single FAF zone, while Illinois is represented in three FAF zones. The Eight

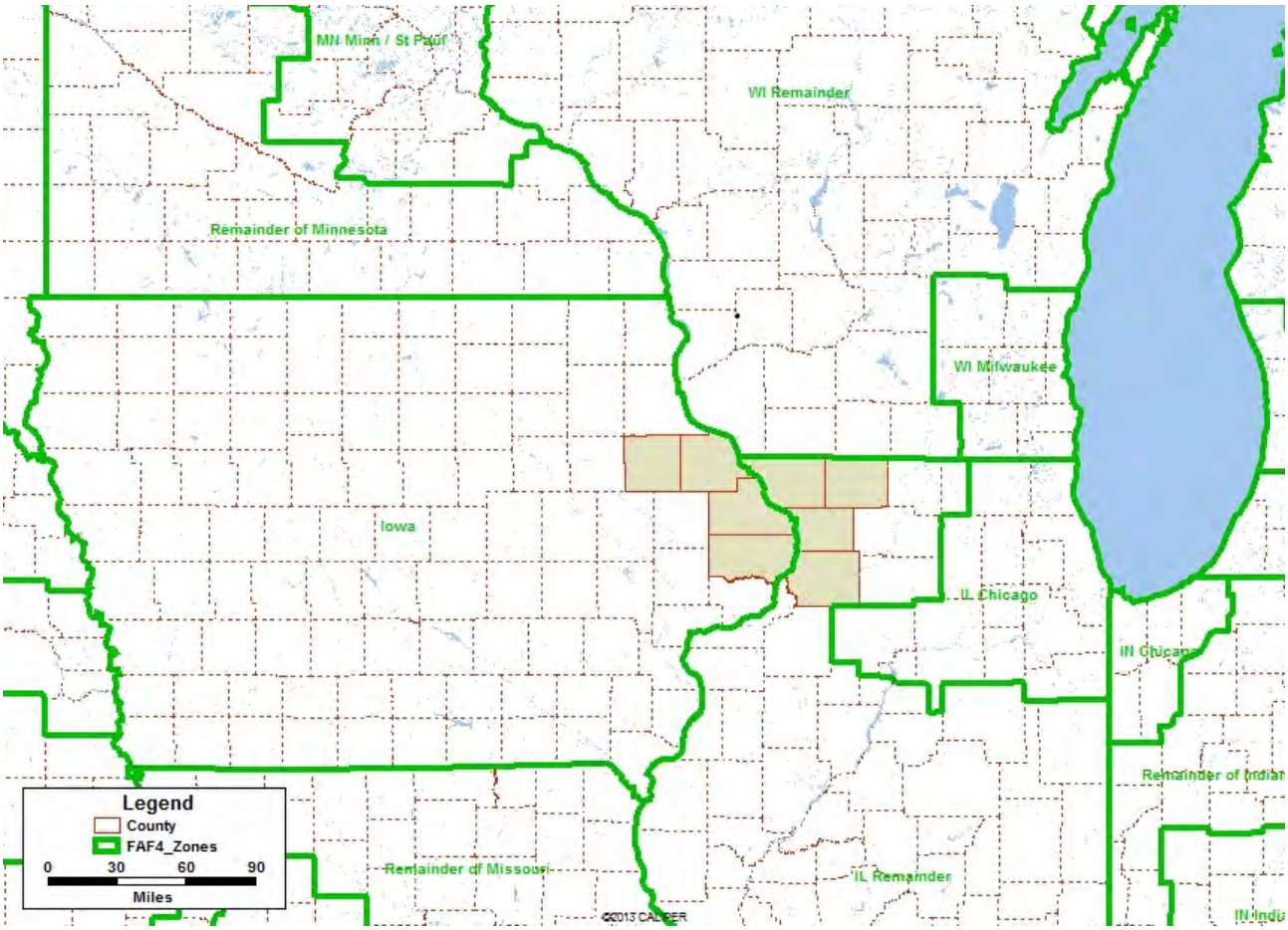
County Region itself is represented in two zones – Iowa and "Remainder of Illinois" (a zone that covers all of Illinois except the Chicago and St. Louis metropolitan areas).

Figure B-1: Freight Analysis Framework BEA Zone Structure



Source: Federal Highway Administration

Figure B-2: FAF BEA Zone Structure and the Eight County Region

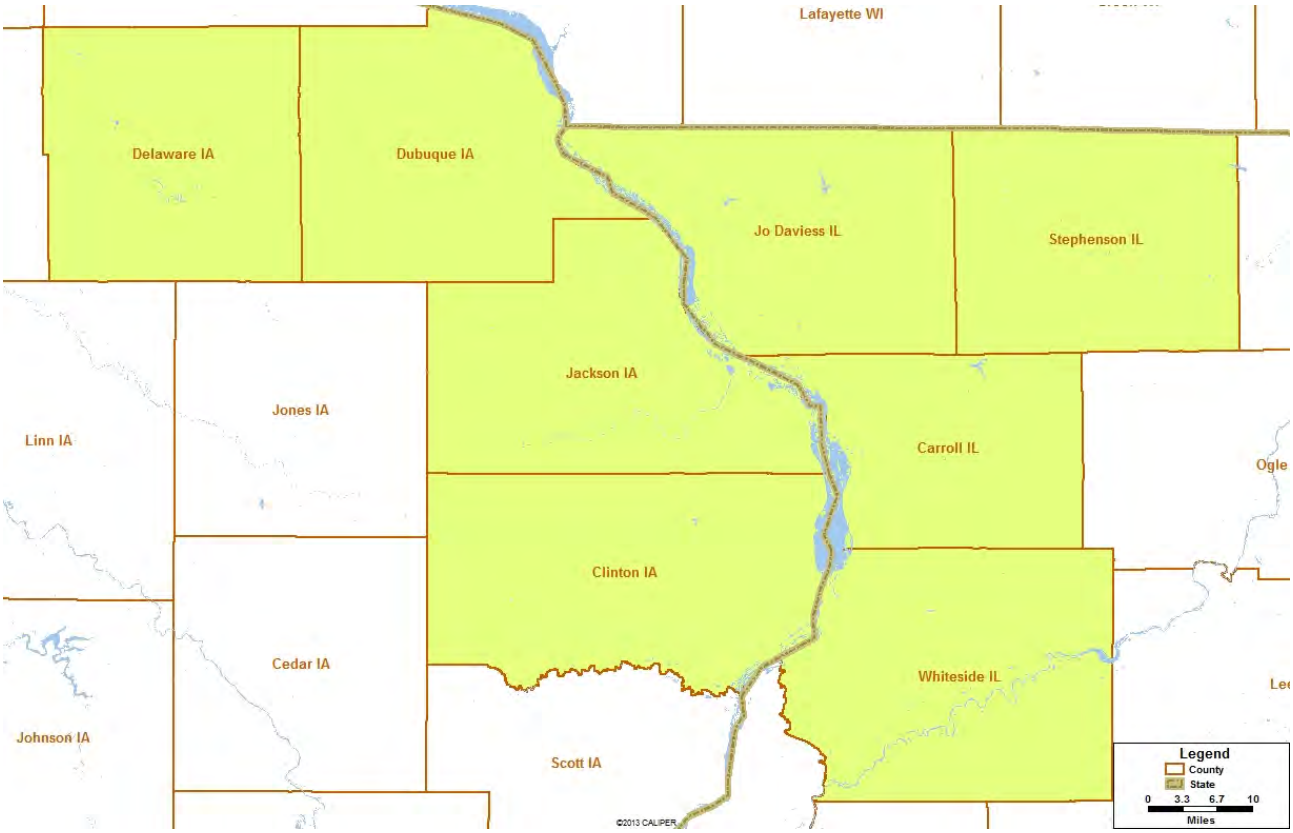


Source: WSP

To address this FAF geography limitation, the consultant team utilized a disaggregated version of FAF 4 (release 4.2) developed by WSP Inc. for the Illinois Department of Transportation for use in the Illinois Statewide Freight Plan update. The disaggregation expanded FAF from 132 zones to 3,123 counties, based on county level industry employment and factors relating industry codes to corresponding demand for inbound and outbound commodities. The disaggregation is for year 2014 and includes truck, rail, water, and multiple modes tonnage and value. (Air is omitted because its tonnage is much lower than other modes, making it difficult to disaggregate reliably.) It includes inbound, outbound, and internal flows. (Pass-through flows would have to be estimated with additional network modeling.)

The disaggregation allows FAF-4 estimates to be created for the Eight County Region and each of its individual counties, for base year 2014 and for future forecast years. However, it is important to remember that because FAF is a model based on survey data, and because the disaggregation introduces further modeling assumptions, the results are best taken as general approximations and characterizations of freight activity. FAF estimates should be compared and confirmed with other sources where available.

Figure B-3: Eight County Region Counties Analyzed Using Disaggregated FAF-4



Source: WSP