Illinois Department of Transportation

Freight Mobility Plan

December 2012

ILLINOIS
STATE TRANSPORTATION PLAN

2012

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1.0 Introduction

Freight movement is one of Illinois' key industries. Illinois freight tonnage is the third largest in the country today, as it was a decade ago.[1] Our State stands third in the nation for trucking volume and third in rail. Illinois is second in rail intermodal traffic, a vital component of U.S. global trade, and its total tonnage by all modes is the highest for states that are not located on a seacoast.

Illinois is the linchpin of the American rail freight network, served by all seven of its Class I railroads, including the leading railroad serving Mexico and the two leading railroads serving Canada. Illinois stands at the juncture of the Ohio and Mississippi river systems, and via the Illinois River connects them to the Great Lakes and the Atlantic Ocean. Chicago's O'Hare International Airport is an important air hub in the world, offering belly space in passenger aircraft to carry cargo all over the globe. Rockford's airport houses a dedicated air cargo hub for the largest freight company in the world. While air freight appears very small by tonnage measures, it is critical to producers of high value goods. Even more importantly, the fail-safe network allows supply chains to compete aggressively with precision operations and tightly controlled inventory costs.

Intermodal service is a principal advantage that Illinois brings to supply chain businesses; this advantage helps drive the State's economy. Businesses are dependent on an integrated system of freight transportation and Illinois' transportation network and freight services provide a full range of options. Despite the State's top standing as a trucking center, the proportion of Illinois freight tonnage moved on its highways is less than the national average – 63 percent versus 74 percent for the U.S. – simply because others modes of transportation also are strong.

International container on I-55 in central Illinois

Freight hubs are essential to Illinois' position in the business logistics system. Originally because of its waterways, and then because industry and modal networks developed on similar patterns, Illinois is a national freight crossroads, bearing goods traffic from all directions. Over half of the truck miles traveled in Illinois begin and end somewhere else (called through traffic). More than a quarter of the rail tonnage touching Illinois also travels through. Because industry in Illinois is not shipping or receiving this through-freight, it can be thought of as a burden rather than a benefit. However, that is misleading, because Illinois' position as a transportation hub provides value-added service.

The virtue of a transportation hub is that it consolidates fragmented activity to achieve volume economies. Once this is done, the number of markets that can be connected efficiently and the quality of the service to them rises dramatically. Through traffic is one key element for a successful hub. Businesses surrounding the hub have far better freight options and performance than would

[1] IHS Global Insight TRANSEARCH (Transearch) database

otherwise be possible because of the through traffic. This greater freight service also attracts businesses, as well as aiding them to compete. Facilitated by its status as a huge metropolitan market, Chicago became one of the three main centers of inland distribution for the United States because of its excellent and robust transportation network. These factors have helped make Illinois and Illinois industry integral to global systems of trade despite being in the interior of the continent. Chicago ranks seventh in the world as a global city, according to the A.T. Kearney 2012 index,[2] and it is the only one of the top ten cities situated far from a coast.

This report, along with the State Rail Plan, represents the freight mobility component of the Illinois State Transportation Plan. It is organized in four chapters following this Introduction:

- Section 2 presents analysis of Illinois freight traffic by mode, industrial commodity, and geography, for a 2010 base year with a 2040 forecast.
- Section 3 describes potential market trends affecting this traffic.
- Section 4 summarizes findings from prior studies of or involving freight transportation from around the State.
- Section 5 treats performance and strategy, describing safety, reliability, and air quality issues in the context of industrial traffic patterns and growth, and presenting main ways forward in freight for the State.

The report identifies a number of opportunities and challenges for the Illinois freight transportation system. While this is an analysis of freight in the state, rail traffic is not highlighted, because the Illinois State Rail Plan treats that subject in depth.

[2] A.T. Kearney, Inc., "2012 Global Cities Index and Emerging Cities Outlook", 2012. www.atkearney.com/gbpc/global-cities-index. Accessed September 4, 2012.

2.0 Freight Traffic Analysis

2.1 Introduction

This chapter describes the existing and forecasted future composition and patterns of freight traffic in Illinois. It begins with an overview of total tonnage: the amounts by mode, and the quantities that enter, leave, and stay within the state. Base year volumes are annual for 2010, and the forecast year is 2040. It should be noted that the 2010 base occurs after the economic trough of 2008, but before any fully robust recovery had taken hold.

The 2040 forecast is derived from the federal Freight Analysis Framework (FAF), developed by the US Department of Transportation (USDOT). The FAF data is a national freight database that provides a comprehensive picture of existing and future estimates of freight shipped to (imports), from (exports), and within (domestic) the United States. The most recent dataset, FAF3, contains estimates of value, tons, and domestic ton-miles, by mode of transportation and type of commodity between and within states and to and from eight foreign regions. The commodity types are identified by the Standard Classification of Transported Goods (SCTG) system. It should also be noted that the version of FAF used in this plan has a base year of 2010 derived from a 2007 framework, with partial adjustment for the recession since.

This section continues with a review of industrial commodity activity, which is the link between the carriage of goods and the businesses and consumers who ship and receive them. It then presents traffic patterns for the trucking, air, and waterborne modes, identifying geographic concentrations, trading partners, and key commodities. The treatment of motor carriage (trucking) is the most extensive, in keeping with its function as the form of freight transportation most heavily relied upon by users and its role as the frequent provider of pickup and delivery service at customer sites for goods carried by other modes

Trucking data have been processed from their original source to improve geographic specificity and to permit assignment to the roadways. Documentation of the truck model appears in an appendix. While rail is part of the total tonnage overview and is included as an aspect of commodity activity, there is only limited discussion of the rail mode in this report, because it receives comprehensive coverage in the Illinois State Rail Plan.

Data sources for the 2010 freight traffic are the FAF for trucking and air freight, the Surface Transportation Board (STB) Carload Waybill Sample for rail, and the Transearch database for waterborne traffic. The US Department of Commerce Bureau of Economic Analysis defines geographic areas of economic activity (commonly called BEAs) that appear in some data sets. Commodity definitions have been reconciled, and commodities have been aggregated into twenty groups for efficiency of reporting and for processing purposes. However, the use of multiple data sources has limited the ability to present freight volumes based on the value of goods because not all of the data sources contain that information.

2.2 Freight Traffic Overview

In the year 2010, 1.26 billion tons[3] of goods moved from, to and within the State of Illinois via its roads, railroads, waterways and air freight facilities. Trucks carried 63 percent of this Illinois-based volume, rail carried 26 percent, the State's waterways transported 11 percent, and air, a tenth of one percent. Figure 2.1 graphically depicts this distribution of goods movement by mode and Table 2.1 details the total tonnage.[4]

Figure 2.1: Illinois-Based Freight Traffic by Mode, 2010

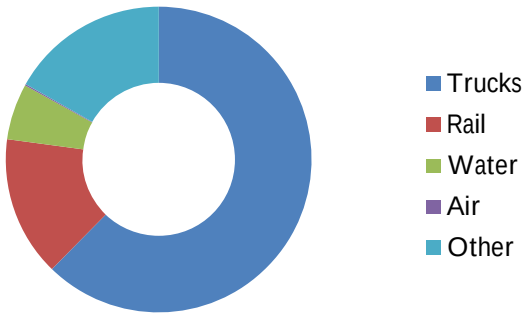


Table 2.1: Illinois-Based Freight Tonnage ('000) by Mode, 2010

Mode	Truck	Rail	Water	Air	Total
Tonnage carried in 2010	797,794	325,273	135,236	1,433	1,259,738
Percentage of Total	63	26	11	.1	100

Sources: FAF, STB, Transearch

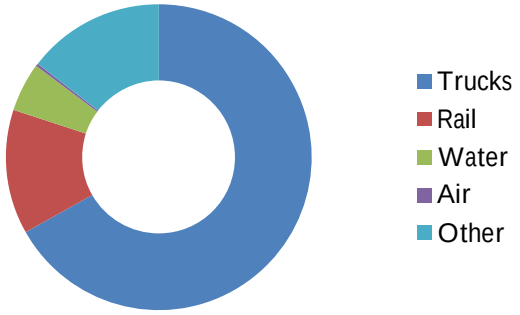
Projecting to 2040, Illinois-based volumes are forecast to total 1.7 billion tons, or 34 percent. Of these tons, 67 percent are expected to move by truck, 24 percent by rail, 9 percent by water, and 0.2 percent by air. Figure 2.2 and Table 2.2 reflect the forecast distribution of freight tonnage by mode.

Trucking posts the largest gain both in absolute tonnage and relative mode share compared to the mode split captured in 2010. Trucks will carry an additional 334.2 million tons in 2040, posting a four point increase in mode share, and a 42 percent increase in tonnage. Air freight is also expected to double its mode share from 0.1 percent to 0.2 percent (growing from 1.4 million tons to 4.4 million tons), perhaps indicative of the mode's growing importance as a back-up for just-in-time production systems as the nation's highway network becomes more prone to congestion and delay. Rail is projected to decline slightly in mode share from 26 to 24 percent in the coming three decades, though in absolute terms it will see a 24 percent increase, adding 79.5 million tons to its 2010 base of 325.3 million. Water is expected to add 13.9 million tons in this interim, an increase of 10.3 percent. However, the large gains projected for trucking's share mean that waterborne modes will experience a decline in comparative mode share.

[3] In this report, the word 'ton' denotes the short ton, or 2,000 pounds.

[4] Pipeline and miscellaneous modes – including U.S. Postal Service - are reported in FAF data under an "Other" category. While large at 215 million additional tons, they are dominated by pipelines, which are private infrastructure dedicated to specialized transport of petroleum. As such, they are omitted from this analysis.

Figure 2.2: Illinois-Based Freight Tonnage by Mode, 2040



Sources: FAF, STB, Transearch

Table 2.2: Forecast Illinois-Based Freight Tonnage ('000) by Mode, 2040

Mode	Truck	Rail	Water	Air	Total
Tonnage carried in 2040	1,131,998	404,737	149,131	4,426	1,690,292
Percentage of Total	67	24	9	.2	100

Sources: FAF, STB, Transearch

Interstate traffic in 2010 (which incorporates international volume) was 724.8 million tons for about 60 percent of the total, and had a diverse modal profile: 42 percent rail, 41 percent truck, 17 percent water and air, with only a fractional amount. Tonnages into and out from the State were about evenly divided, with a small edge to the outbound flow, but were less balanced within modes. Intrastate traffic – or those freight movements both beginning and ending in Illinois – amounted to 534.9 million tons and about 40 percent of the total. However, the in-state market relied almost entirely on trucking, at 94 percent of the tonnage, due to shorter distances that typical make trucking more competitive than the other modal options. Figure 2.3 graphically represents the amount of freight traffic by destination; Table 2.3 shows freight tonnage.

The top three commodity groups in Illinois-based freight traffic accounted for 45 percent of the 2010 tonnage. Petroleum or asphalt products (except gasoline), coal, and live animals/animal feed were the largest commodity flows, reflecting the significance of the agricultural and energy supply chains to Illinois' economy. Figure 2.4 graphically represents the share of freight shipments by all commodity groups.

Figure 2.3: Illinois-Based Freight Traffic by Direction, 2010

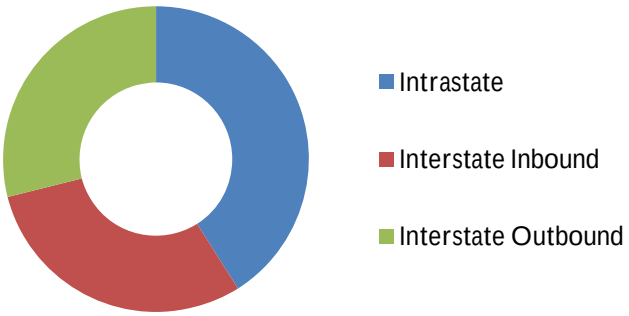
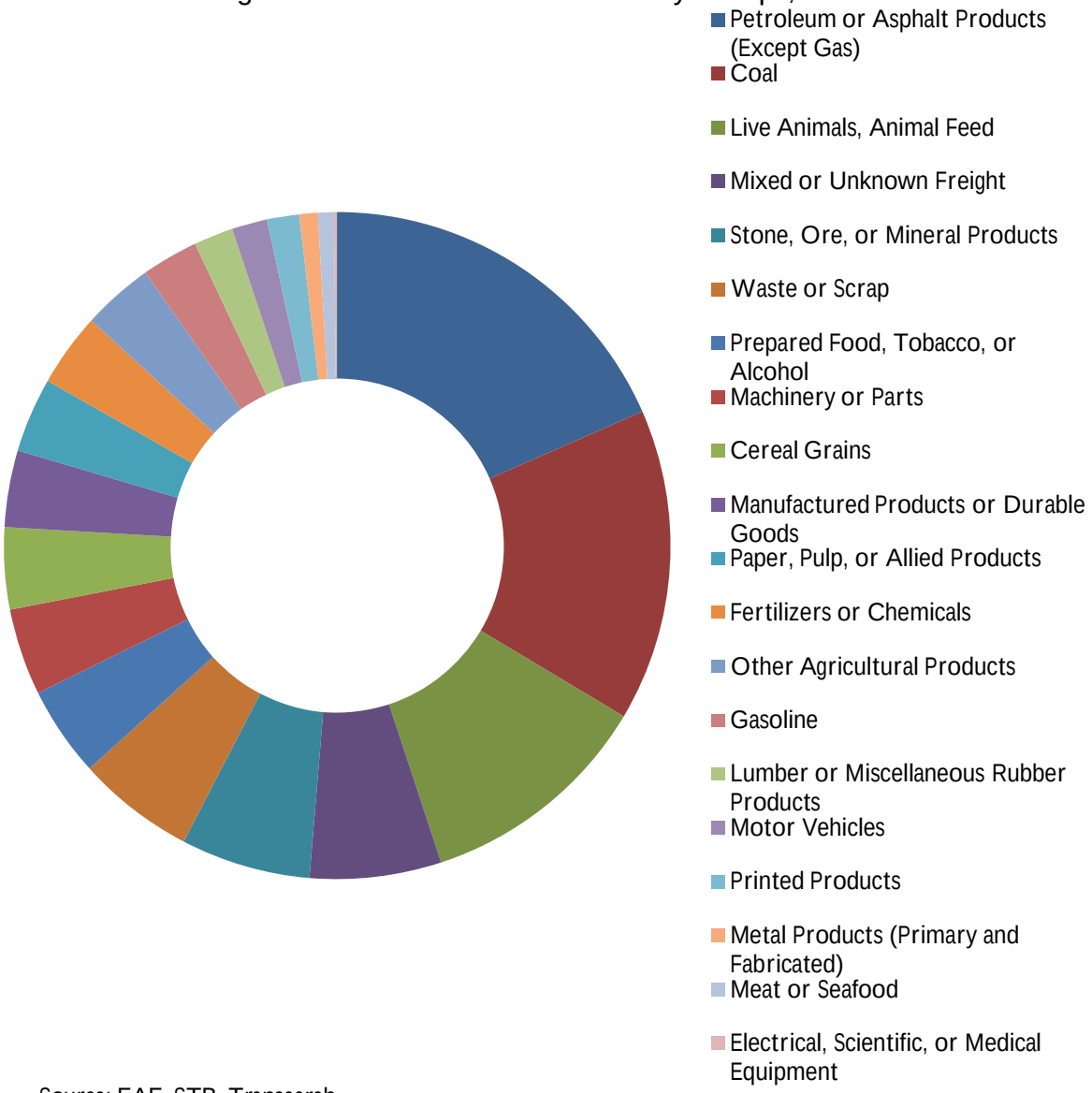


Table 2.3: Illinois-Based Freight Tonnage by Direction, 2010

Direction	Tons ('000)	Percent Total
Intrastate	534,917	42
Interstate Inbound	348,518	28
Interstate Outbound	376,302	30
Grand Total	1,259,738	100

Sources: FAF, STB, Transearch

Figure 2.4: Illinois-Based Commodity Groups, 2010



Source: FAF, STB, Transearch

The modal and directional profiles for Illinois commodity groups are presented below. However, because tonnage is the measure used, it favors heavier bulk goods. A different measure is commodity value, which allows the importance of lighter products of typically more complex manufacturing to emerge. Consistent data by value are not available for the purposes of this report,

but a snapshot can be taken from the FAF database. Table 2.4 presents the top ten commodities by product value for outbound shipping, and reveals a different mix of traffic. By this analysis, machinery and electronics are the two top products representing 20 percent of Illinois-generated traffic. Three more products categories – mixed freight (often classified as intermodal), pharmaceuticals, and motor vehicles and parts – bring the total represented to 42 percent. Analysis through this lens shifts attention to the State's high end manufacturing base and its associated distribution system.

Table 2.4: Illinois Top Outbound Commodities by Value, 2010

Commodity Group	Value ($Mil)	Percent of Total	Cumulative Percent
Machinery	88,422	11	11
Electronics	75,421	9	20
Mixed Freight	65,726	8	28
Pharmaceuticals	59,853	7	36
Motorized Vehicles	49,062	6	42
Base Metals	35,303	4	46
Gasoline	32,125	4	50
Misc. Manufactured Products	30,903	4	54
Plastics or Rubber	30,232	4	58
Articles-Base Metal	30,121	4	62
Sub-total for Top 10	497,168	62	62
Grand Total	806,952	100	100

Source: FAF

Illinois-based tonnage excludes the traffic passing through the state, some of which is staged over Illinois hub facilities, and all of which utilizes network infrastructure. Cargo transferred between aircraft clearly is an important traffic component at Chicago and Rockford airports, although the FAF freight data this report relies on does not capture it well. Through traffic by rail was 122.6 million tons in 2010 or 27 percent of all rail tonnage – yet tons can be a deceiving measure for this kind of activity, because they count equally for any distance of travel. For trucking, an estimate of through volume based on truck miles traveled offers a clearer picture. By this estimate, which is based on the truck model, 55 percent of nearly 21 billion truck miles on Illinois highways were identified as being through traffic.

2.3 Directional Commodity Flow

Within Illinois in 2010, 1.26 billion tons of goods moved via Illinois roads, railroads, waterways and air freight facilities. Intrastate volumes, the term for tonnage attributed to freight movements beginning and ending in Illinois, amounted to 534.9 million tons. Outbound volumes represented the second largest group at 376.3 million tons for all modes, while inbound volumes totaled 348.5 million tons that year. It should be noted that the order of intrastate, outbound, and inbound flows here should not be read as an indication of their importance.

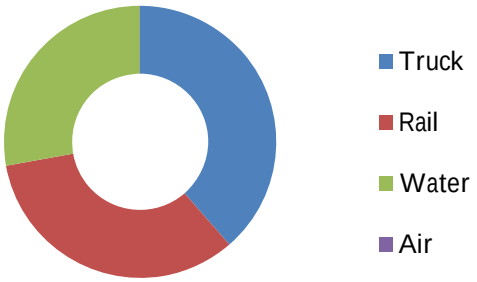
This analysis considers tonnage in constructing relationships between commodity flows, modal share, and outbound/inbound/local orientation. Accordingly, lower value, high-volume commodity flows may at first appear more systemically significant by these comparisons. A discussion of value, outside of the data acquired for this analysis, might present different inferences about the comparative significance of the directional flows. The FAF data, for instance, estimates that in

2010, Illinois outbound commodity flows were valued at $892.4 billion, while inbound commodity flows totaled $861.2 billion. Through tonnages are not addressed in this report, principally due to their limited impact upon Illinois businesses outside of the economies of scale they generate relative to the 'hubbing' function provided by Illinois locations (Chicago, East St. Louis, Peoria) in national supply chains.

2.3.1 Outbound

Outbound commodity flows from Illinois totaled 376.3 million tons in 2010. Trucks carried a plurality of this tonnage (144.9 million tons, or 39 percent), while railroads also carried a substantial amount that year (126.9 million tons, or 34 percent). Water modes on Illinois portions of the Great Lakes and major river systems (Mississippi, Illinois, and Ohio) accounted for 104.2 million tons in 2010, approximately 28 percent of all outbound tonnage that year. Outbound air freight, measured by tonnage, was minimal that year at 268,000 tons (0.07 percent). Figure 2.5 graphically depicts the distribution of outbound freight volume by mode. Table 2.5 and Figure 2.6 reflect the outbound freight by commodity and shipment mode for 2010.

Figure 2.5: Outbound Modal Share



Major outbound commodity flows from Illinois in 2010 included:

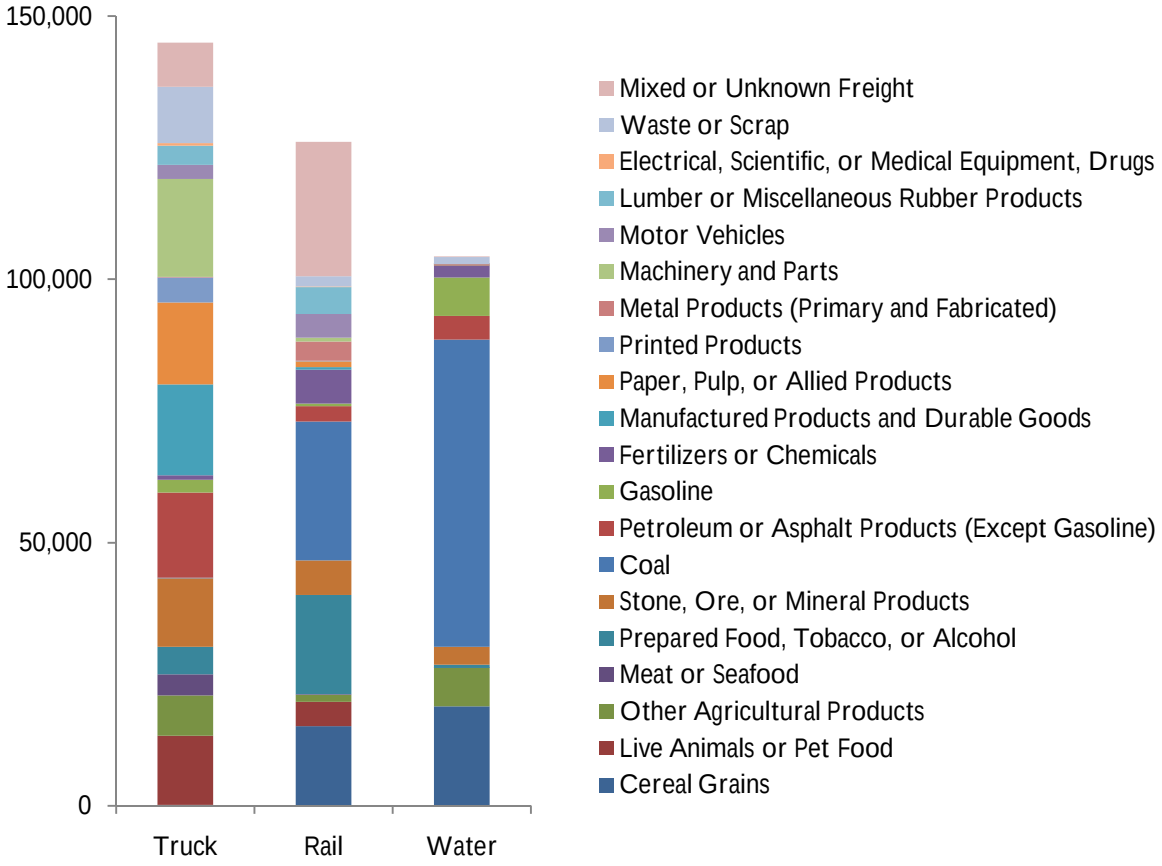
- Coal by water (58.4 million tons) is 69 percent of outbound coal traffic and 56 percent of all outbound freight by water.
- Coal by rail (26.5 million tons) represents 31 percent of all outbound coal and 21 percent of outbound rail tonnage.
- Mixed or unknown freight by rail (26.3 million tons) represents 38 percent of all mixed or unknown freight and 21 percent of all outbound rail tonnage.

Table 2.5: Outbound Commodity Flow by Tonnage, 2010

Commodity Group	Tons ('000)	Truck	Rail	Water	Air
1: Cereal Grains	34,256	184	15,153	18,918	1
2: Live Animals, Animal Feed	17,647	13,090	4,557	0	0
3: Other Agricultural Products	16,373	7,654	1,422	7,293	4
4: Meat or Seafood	4,157	4,085	64	3	5
5: Prepared Food, Tobacco, or Alcohol	24,644	5,182	18,912	549	1
6: Stone, Ore, or Mineral Products	22,888	12,975	6,473	3,434	6
7: Coal	84,983	164	26,453	58,366	0
8: Petroleum or Asphalt Products (Except Gasoline)	23,575	16,130	2,922	4,514	9
9: Gasoline	10,203	2,521	436	7,245	1
10: Fertilizers or Chemicals	9,644	837	6,459	2,348	0
11: Manufactured Products or Durable Goods	17,712	17,226	446	19	21
12: Paper, Pulp, or Allied Products	16,734	15,575	1,083	7	69
13: Printed Products	4,962	4,758	197	0	7
14: Metal Products (Primary and Fabricated)	4,009	130	3,684	195	0
15: Machinery or Parts	19,366	18,615	694	27	30
16: Motor Vehicles	7,161	2,582	4,536	0	43
17: Lumber or Miscellaneous Rubber Products	8,701	3,667	4,990	19	25
18: Electrical, Scientific, or Medical Equipment	736	508	222	3	3
19: Waste or Scrap	13,858	10,711	1,871	1,276	0
20: Mixed or Unknown Freight	34,695	8,347	26,299	5	44
Outbound Total	376,302	144,939	126,872	104,222	268

Source: FAF, STB, Transearch

Figure 2.6: Outbound Commodity Flow by Mode, 2010

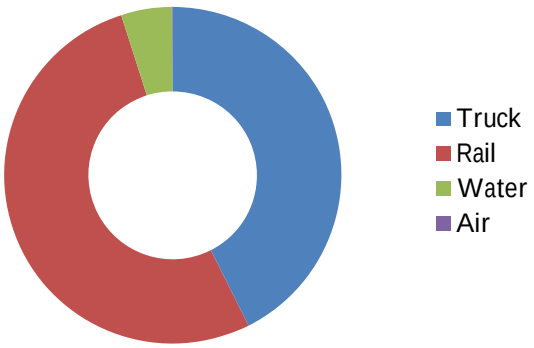


Source: FAF, STB, Transearch

2.3.2 Inbound

Inbound commodity volumes totaled 348.5 million tons in Illinois in 2010. Railroads conveyed 178.1 million tons (51 percent), trucks carried 152.6 million tons (43 percent), water modes moved 17.4 million tons (5 percent), and air freight was responsible for 404,000 tons (0.1 percent). Rail's majority share of the inbound tonnage underscores the State's position as a key railroad hub for interstate surface freight movements. Figure 2.7 graphically represents distribution of inbound freight volume by mode. Table 2.6 and Figure 2.8 reflect the inbound freight by commodity and shipment mode for 2010.

Figure 2.7: Inbound Modal Share



Some of the largest inbound commodity flows entering Illinois in 2010 were:

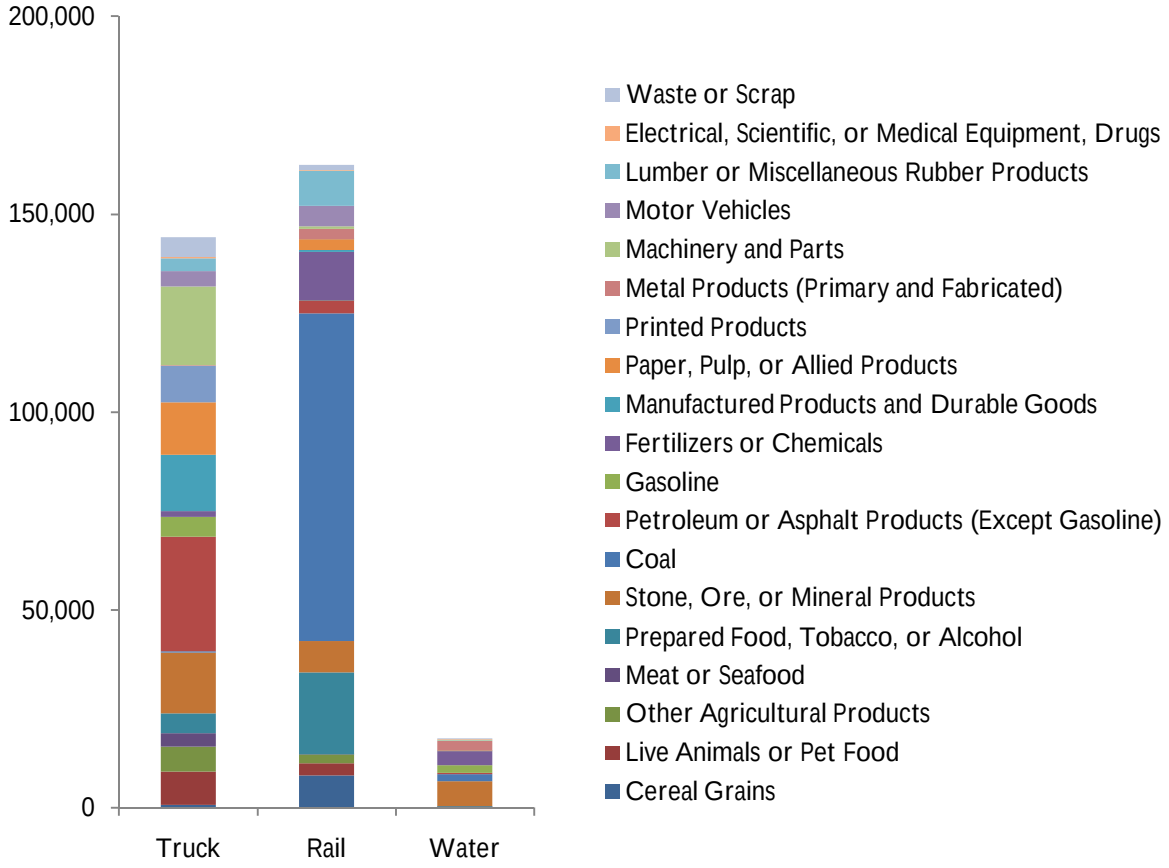
- Coal by rail (82.8 million tons) represents 97 percent of all inbound coal and 44 percent of all inbound rail tonnage.
- Petroleum or asphalt products (except gasoline) by truck (28.9 million tons), representing 89 percent of all inbound petroleum or asphalt products and 19 percent of all inbound truck tonnage.
- Prepared food, tobacco, or alcohol by rail (20.6 million tons) represents 80 percent of all inbound prepared food, tobacco, or alcohol and 12 percent of all inbound rail tonnage.

Table 2.6: Inbound Commodity Flow by Tonnage, 2010

Commodity Group	Tons ('000)	Truck	Rail	Water	Air
1: Cereal Grains	9,195	838	8,150	206	1
2: Live Animals, Animal Feed	11,384	8,283	3,101	0	0
3: Other Agricultural Products	8,859	6,451	2,301	102	4
4: Meat or Seafood	3,405	3,326	77	0	1
5: Prepared Food, Tobacco, or Alcohol	25,668	4,954	20,612	101	0
6: Stone, Ore, or Mineral Products	29,622	15,390	7,943	6,285	3
7: Coal	84,961	387	82,769	1,805	0
8: Petroleum or Asphalt Products (Except Gasoline)	32,601	28,931	3,244	422	5
9: Gasoline	6,864	4,911	32	1,921	0
10: Fertilizers or Chemicals	17,221	1,494	12,253	3,474	0
11: Manufactured Products or Durable Goods	14,812	14,262	458	68	23
12: Paper, Pulp, or Allied Products	16,239	13,253	2,774	0	144
13: Printed Products	9,260	9,195	28	0	37
14: Metal Products (Primary and Fabricated)	5,075	128	2,470	2,477	0
15: Machinery or Parts	20,844	19,973	718	134	19
16: Motor Vehicles	9,096	3,777	5,226	0	93
17: Lumber or Miscellaneous Rubber Products	12,431	3,378	8,756	276	22
18: Electrical, Scientific, or Medical Equipment	526	279	213	28	6
19: Waste or Scrap	6,396	4,958	1,346	92	0
20: Mixed or Unknown Freight	24,131	8,474	15,610	0	47
Inbound Total	348,519	152,643	178,081	17,391	404

Source: FAF, STB, Transearch

Figure 2.8: Inbound Commodity Flow by Mode, 2010



Source: FAF, STB, Transearch

2.3.3 Intrastate

Comprising more tonnage than inbound or outbound commodity flows is the intrastate group, responsible for 534.9 million tons of freight movement in Illinois in 2010. As freight rail is generally price competitive for trips greater than 550 miles, these short to medium length hauls were principally completed by truck in 2010. Of the tonnage originating and ending its movement in Illinois, trucks carry 500.2 million tons, representing 93.5 percent of the total 2010 intrastate volume. In the same year, railroads conveyed 20.3 million tons (3.9 percent) of these intrastate movements by tonnage while water modes (lake and river barging) carried 13.6 million tons (2.6 percent). Finally, air freight volumes were small by tonnage, though high in value, with 404,000 tons moved (0.08 percent).

Key intrastate commodity flows were petroleum or asphalt products and live animals or animal feed. Petroleum and asphalt products comprised 174,600 tons in 2010, representing one third of all intrastate tonnage; 99 percent was moved by truck. Live animals or animal feed comprised 113,840 tons that year, representing 22 percent of all intrastate tonnage in Illinois; 98 percent of this commodity was shipped by truck. Figure 2.9 graphically depicts intrastate freight volume by mode. Table 2.7 and Figure 2.10 reflect the outbound freight by commodity and shipment mode for 2010.

Figure 2.9: Intrastate Modal Share

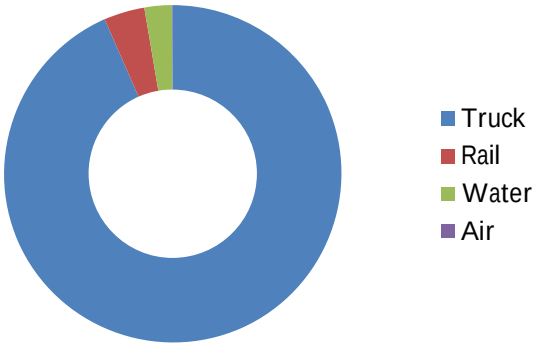
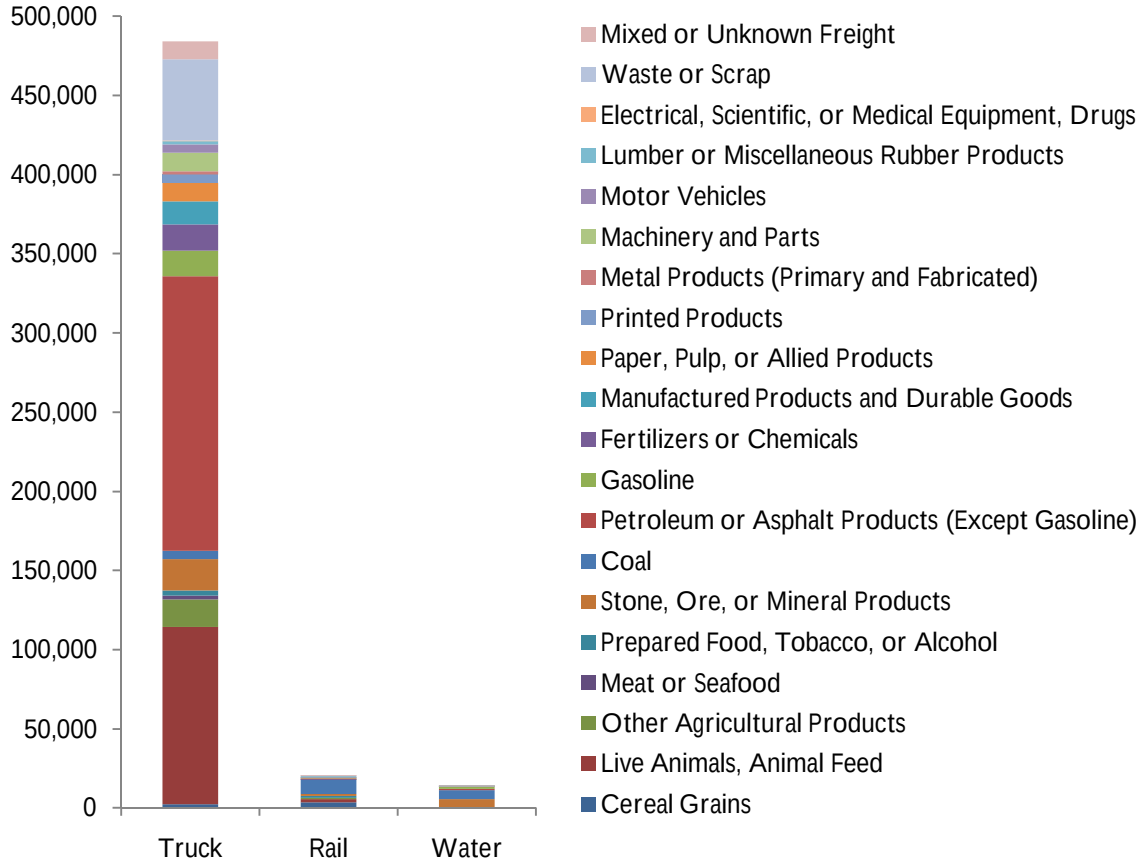


Table 2.7: Intrastate Commodity Flow by Tonnage, 2010

Commodity Group	Tons ('000)	Truck	Rail	Water	Air
1: Cereal Grains	6,204	2,364	3,754	84	2
2: Live Animals, Animal Feed	113,840	112,052	1,788	0	0
3: Other Agricultural Products	18,092	17,326	725	32	9
4: Meat or Seafood	2,282	2,274	0	1	7
5: Prepared Food, Tobacco, or Alcohol	4,690	3,376	1,290	22	2
6: Stone, Ore, or Mineral Products	26,440	19,685	1,348	5,395	12
7: Coal	19,692	5,246	8,777	5,669	0
8: Petroleum or Asphalt Products (Except Gasoline)	174,600	173,527	158	898	17
9: Gasoline	17,199	15,935	6	1,256	2
10: Fertilizers or Chemicals	17,852	16,815	869	168	0
11: Manufactured Products or Durable Goods	14,378	14,308	16	6	48
12: Paper, Pulp, or Allied Products	28,187	27,965	16	0	206
13: Printed Products	5,325	5,270	0	0	55
14: Metal Products (Primary and Fabricated)	1,831	1,730	98	3	0
15: Machinery or Parts	12,258	12,031	149	3	75
16: Motor Vehicles	5,360	4,970	201	1	188
17: Lumber or Miscellaneous Rubber Products	2,893	1,988	866	1	38
18: Electrical, Scientific, or Medical Equipment	697	687	4	2	4
19: Waste or Scrap	51,369	51,214	71	84	0
20: Mixed or Unknown Freight	11,728	11,449	184	0	95
Intrastate Total	534,917	500,213	20,320	13,624	761

Source: FAF, STB, Transearch

Figure 2.10: Intrastate Commodity Flow by Mode, 2010



Source: FAF, STB, Transearch

2.4 Commodity Flow between Illinois and Economic Regions

To better understand the direction of inbound and outbound flows to and from Illinois, six regions across the U.S. were defined. Those are similar to regions defined by the Bureau of Economic Analysis (BEA), but are slightly more aggregate to better describe Illinois-based flows. The Pacific region includes Hawaii and Alaska, which are not shown in Figure 2.11.

Figure 2.11: Six U.S. Domestic Regions

Source: Parsons Brinckerhoff, Bureau of Economic Analysis

In addition, eight international regions are distinguished, which are the eight international FAF zones distinguished in the FAF dataset. These in include Canada, Mexico, Rest of Americas, Europe, Africa, Southern/Central/Western Asia, Eastern Asia and South-Eastern Asia/Oceania.

Table 2.8 summarizes commodity flows into and out of Illinois by origin and destination region.[5] The most important interaction is shown between Illinois and its surrounding neighbors, followed by the South due to exports and the Great Plains and Rocky Mountains due to imports.

Table 2.8: Tonnage ('000) Between Illinois and Major Economic Regions, 2010

Region	OB	IB	Total
Surrounding Illinois	140,607	114,343	254,410
South	89,962	42,477	132,439
Great Plains and Rocky Mountains	12,288	92,238	104,526
Southwest	15,901	32,328	48,229
Canada	7,071	40,579	47,650
Northeast	15,205	12,291	27,496
Eastern Asia	18,679	8,083	26,762
Pacific	8,217	7,404	15,621
Rest of Americas	7,882	4,210	12,092
Southern, Central, and Western Asia	6,830	5,043	11,873
Europe	5,746	4,433	10,179
Mexico	4,084	4,272	8,356
Africa	5,007	2,316	7,323
Southeastern Asia and Oceania	2,268	1,161	3,429
Total	337,479	370,017	706,956

Source: FAF. OB = outbound; IB = inbound

Table 2.9 shows the flows between Illinois and the economic regions for the year 2040. Surrounding Illinois, the South and the Great Plains and Rocky Mountains remain the most important trading partners for Illinois.

Table 2.9: Tonnage ('000) Between Illinois and Major Economic Regions, 2040

Region	OB	IB	Total
Surrounding Illinois	157,166	176,866	334,032
South	87,395	66,816	154,211
Great Plains and Rocky Mountains	18,815	98,125	116,940
Canada	12,393	60,957	73,350
Eastern Asia	38,183	23,406	61,588
Southwest	18,191	41,531	59,722
Northeast	24,211	14,664	38,876
Pacific	8,901	16,297	25,198
Rest of Americas	14,309	8,389	22,697
Europe	12,142	9,201	21,343
Mexico	8,159	12,453	20,611
Southern, Central, and Western Asia	10,283	8,297	18,580
Africa	7,338	3,752	11,090
Southeastern Asia and Oceania	5,411	3,087	8,498
Total	422,897	543,841	958,238

Source: FAF. OB = outbound; IB = inbound

[5] This table and those following aggregate all modes. They derive only from FAF data in order to capture international traffic; as a result, the tonnage totals are slightly different.

2.4.1 Growth by Trading Partner

Ranked by absolute gains in tonnage moved, the surrounding Illinois region can expect an additional 80 million tons (31 percent) moving to and from Illinois in 2040. Movements to and from East Asia will increase by 35 million tons (130 percent). Shipments to and from Canada are projected to increase 26 million tons (54 percent). Freight carried to the south is expected to see a 22 million ton increase (16 percent) in the coming three decades. Table 2.10 reflects the anticipated increases in freight tonnage between Illinois and other regions and countries.

Table 2.10: Tonnage Gains between Illinois and Major Economic Regions, 2040

Region	Gain (000)	Percent Gain
Surrounding Illinois	79,622	31.3
East Asia	34,826	130.1
Canada	25,700	53.9
South	21,722	16.4
Great Plains and Rocky Mountains	12,414	11.9
Mexico	12,255	146.7
Southwest	11,493	23.8
Northeast	11,380	41.4
Europe	11,164	109.7
Rest of Americas	10,605	87.7
Pacific	9,577	61.3
South, Central, and Western Asia	6,707	56.5
Southeast Asia and Oceania	6,069	177.0
Africa	3,767	51.4
Total Incremental Gains	257,301	36.3

Source: FAF

Domestic tonnage growth is driven by modest percentage gains on its larger base, but growth is primarily in inbound tonnage. Inbound volumes from the surrounding Illinois region (the Midwestern U.S.) are estimated to grow by 54 percent from 114 million tons to 177 million tons. Meanwhile outbound volumes to this region are projected to grow 11 percent, from 141 million tons to 157 million. For the South region, growth is in the projected inbound volumes, with a 24.3 million ton (57 percent) gain on inbound tonnage, and a loss of 2.6 million tons (negative three percent) in outbound volumes.

International origins and destinations will see an additional 111 million tons (from 128 million tons to 165 million tons), representing an increase of 30 percent. Domestic origins and destinations can expect an additional 146 million tons (from 583 million tons to 729 million tons), an increase of 25 percent. Driving international growth are America's NAFTA partners Canada and Mexico, and East Asia, responsible for an additional 25.7 million tons, 12.3 million tons, and 34.8 million tons respectively.

While the growth with East Asian trading partners is largely driven by inbound (to Illinois) tonnage growth (15.3 million tons added, an increase of 190 percent), Canada's growth is similarly driven by inbound tonnage added (a gain of 20.4 million, or 50 percent). Meanwhile, East Asia can also expect to double its outbound tonnage from Illinois from 18.6 million tons per year to 38.1 million tons. Canada's outbound tonnage will grow from 7 million tons to 12.4 million tons annually, an increase of 75 percent. Mexico's additional projected tonnage is also based upon a directional gain of 8.1 million inbound tons (192 percent) compared to outbound growth of 4.1 million tons.

2.5 Analysis by Mode

Illinois' transportation assets provide a multiplicity of modal options for freight movement, with service types catering to a spectrum of freight categories ranging from high-value/low-weight to low-value/high-weight commodities. As documented in the USDOT Federal Highway Administration (FHWA) *Quick Response Freight Manual II*,[6] modes associated with higher service costs per volume (such as air freight and truck) offer the benefits of speed and supply chain visibility for shippers of high value, low weight goods. Alternately, modes associated with lower service costs per volume (such as rail and inland marine) are less suited for just-in-time supply chains and largely cater to shippers of generic, high volume commodities (such as construction aggregates) and bulk staples (such as corn and wheat). Commodity values span from cents per pound for construction aggregates traveling by barge, to tens of thousands of dollars per pound for prescription medications that might travel by air.

2.5.1 Truck

A truck model was developed and used to estimate 2010 and 2040 Illinois related truck movements. In 2010, trucks accounted for 798 million tons of freight moved, with 500 million of these tons allocated to local (Illinois-to-Illinois) trips, 153 million tons to inbound, and 145 million to outbound. By 2040, trucks grow 42 percent to 1,132 million tons of freight moved, with 663 million of these tons allocated to local trips, 261 million tons to inbound, and 208 million to outbound. A description of the results of the assessment of 2010 and 2040 truck freight carriage in Illinois follows below. The process by which the truck data were developed and assigned to the roadway network appears in an Appendix on Truck Model Documentation.

2.5.1.1 Commodity Flows By Truck

Trucks are usually used for goods that are not as acutely time-dependent or valuable as those products shipped by air and are not as heavy as those shipped by rail or water. Trucks particularly cover the short-to medium-distance freight flows, even though many trucks travel across the U.S. on long-distance trips.

Table 2.11 shows the volumes of commodity flows by truck in 2010, separated by outbound (OB, from Illinois to anywhere else), inbound (IB, from anywhere to Illinois) and local (Local, both origin and destination are within Illinois).

Commodity groups in Table 2.11 have been ranked by total volume (excluding external-to-external or through trips). The most important commodity with 27 percent of all Illinois-based shipments is Petroleum or Asphalt Products. Most of these shipments are local within the State of Illinois. The second most important commodity is Live Animals /Animal Feed with 17 percent of all Illinois-based shipments. These two commodity groups together make up 44 percent or all Illinois-based commodity flows by truck. Of almost equal importance are Waste (a commonly important commodity for larger states), Paper, Machinery, Stone and Manufactured Products, with each providing six to eight percent of all Illinois-based commodities.

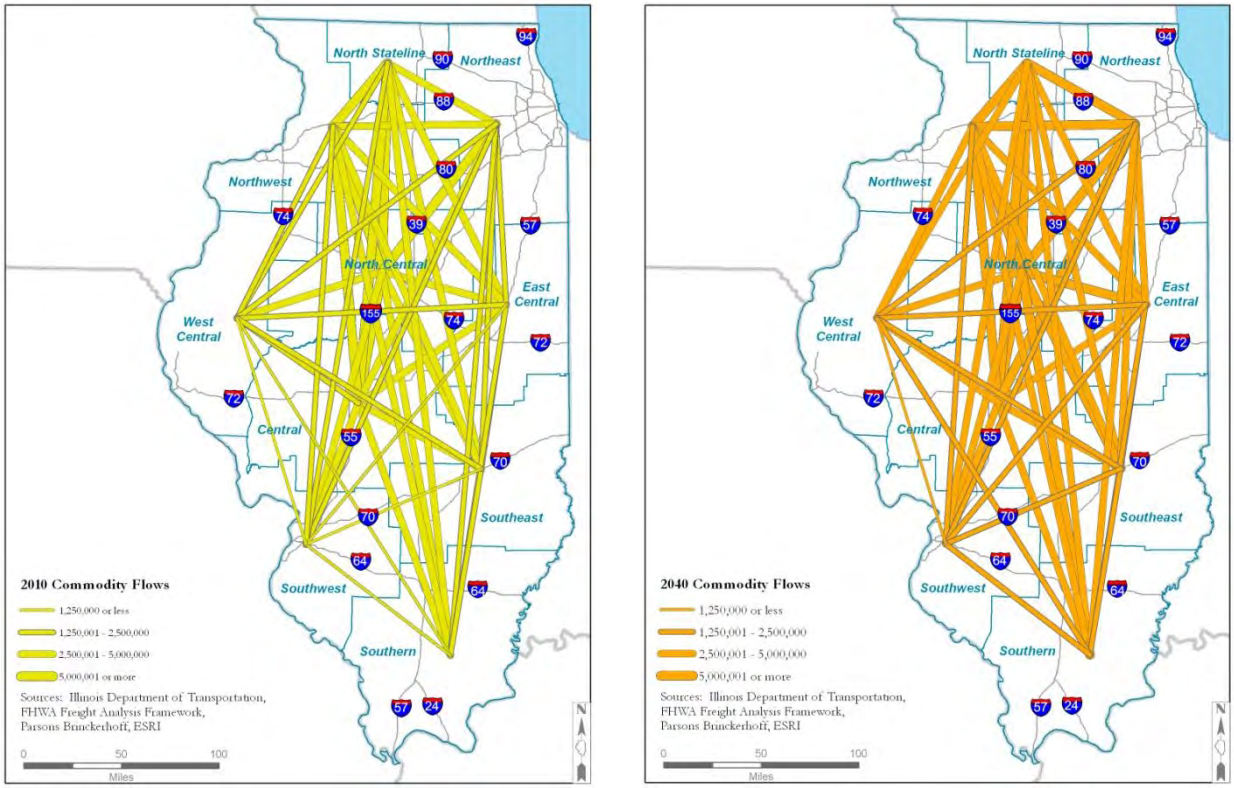
[6] US Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, *Quick Response Freight Manual II*, 2009. www.ops.fhwa.dot.gov/freight/publications/qrfm2/sect04.htm. Accessed September 9, 2012.

Table 2.12 shows the same data for the year 2040. The order of goods has shifted, as the FAF predicts different commodities to grow at different rates. The two most important commodities in 2010, Petroleum and Asphalt Products, and Live Animals /Animal Feed, remain the two most important commodities in 2040, with an almost unchanged share of 26 percent and 18 percent of all Illinois-based commodity flows. Paper becomes the third most important commodity with 12 percent, which is an increase by one rank or five percent points. Across all commodities, Illinois-based commodity flows are forecasted to grow by 42 percent from 2010 to 2040.

2.5.1.2 Analysis of Disaggregated Commodity Flows

Ten districts across Illinois were defined to analyze the magnitude of freight flows across the state. Figure 2.12 shows a desire-line graphic where the width of the lines shows the total volume of goods in tons shipped between any two districts by truck in 2010 and 2040. As the scale in both figures is the same, the two graphics can be compared side by side.

Figure 2.12: 2010 and 2040 Commodity Flows (Tons) by District



Source: Freight Analysis Framework, Parsons Brinckerhoff

Table 2.11: Illinois-based Tons ('000) Moved by Truck, 2010 (Ranked by Total Outbound / Inbound / Local Volume)

Commodity Group	OB	IB	Local	Total	Rank	Cum %	OB % Com	IB % Com	Local % Com	Com % All OB	Com % All IB	Com % All Local	Com % Total
08	16,130	28,931	173,527	218,587	1	27	7	13	79	11	19	35	27
02	13,090	8,283	112,052	133,424	2	44	10	6	84	9	5	22	17
19	10,711	4,958	51,214	66,882	3	53	16	7	77	7	3	10	8
12	15,575	13,253	27,965	56,793	4	60	27	23	49	11	9	6	7
15	18,615	19,973	12,031	50,618	5	66	37	39	24	13	13	2	6
06	12,975	15,390	19,685	48,050	6	72	27	32	41	9	10	4	6
11	17,226	14,262	14,308	45,797	7	78	38	31	31	12	9	3	6
03	7,654	6,451	17,326	31,432	8	82	24	21	55	5	4	3	4
20	8,347	8,474	11,449	28,270	9	85	30	30	40	6	6	2	4
09	2,521	4,911	15,935	23,367	10	88	11	21	68	2	3	3	3
13	4,758	9,195	5,270	19,223	11	91	25	48	27	3	6	1	2
10	837	1,494	16,815	19,146	12	93	4	8	88	1	1	3	2
05	5,182	4,954	3,376	13,512	13	95	38	37	25	4	3	1	2
16	2,582	3,777	4,970	11,328	14	96	23	33	44	2	2	1	1
04	4,085	3,326	2,274	9,684	15	97	42	34	23	3	2	0	1
17	3,667	3,378	1,988	9,033	16	98	41	37	22	3	2	0	1
07	164	387	5,246	5,798	17	99	3	7	90	0	0	1	1
01	184	838	2,364	3,387	18	100	5	25	70	0	1	0	0
14	130	128	1,730	1,987	19	100	7	6	87	0	0	0	0
18	508	279	687	1,474	20	100	34	19	47	0	0	0	0
Total	**144,939**	**152,643**	**500,213**	**797,794**	**-**	**100**	**18**	**19**	**63**	**100**	**100**	**100**	**100**

OB = outbound; IB = inbound; Cum = cumulative; Com = commodity

08: Petroleum or Asphalt Products (Except Gasoline)
02: Live Animals, Animal Feed
19: Waste or Scrap
12: Paper, Pulp, or Allied Products
15: Machinery or Parts
06: Stone, Ore, or Mineral Products
11: Manufactured Products or Durable Goods
03: Other Agricultural Products
20: Mixed or Unknown Freight
09: Gasoline
13: Printed Products
10: Fertilizers or Chemicals
05: Prepared Food, Tobacco, or Alcohol
16: Motor Vehicles
04: Meat or Seafood
17: Lumber or Miscellaneous Rubber Products
07: Coal
01: Cereal Grains
14: Metal Products (Primary and Fabricated)
18: Electrical, Scientific, or Medical Equipment

Table 2.12: Illinois-based Tons ('000) Moved by Truck, 2040 Annual (Ranked by Total Outbound / Inbound / Local Volume)

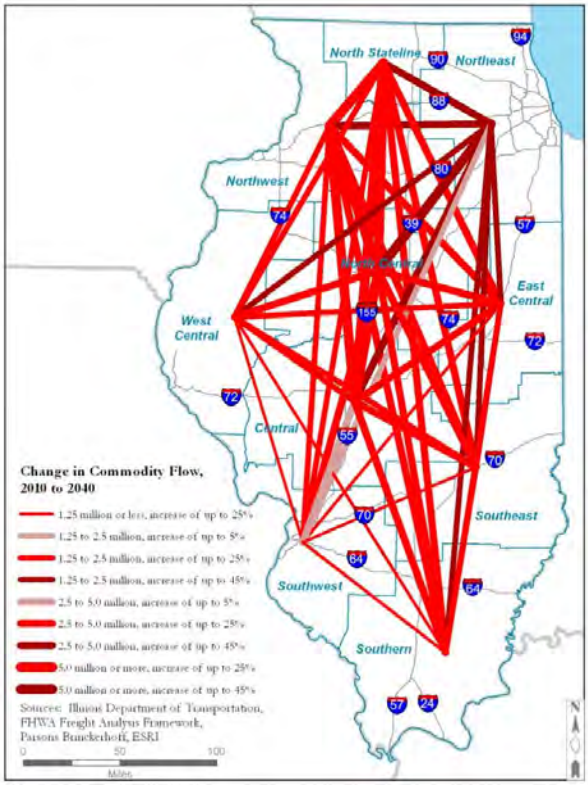
Commodity Group	OB	IB	Local	Total	Rank	Cum %	OB % Com	IB % Com	Local % Com	Com % All OB	Com % All IB	Com % All Local	Com % Total
08	23,641	52,521	215,566	291,729	1	26	8	18	74	11	20	33	26
02	21,480	11,434	167,290	200,205	2	43	11	6	84	10	4	25	18
12	36,563	32,812	62,855	132,229	3	55	28	25	48	18	13	9	12
19	11,245	10,637	57,063	78,946	4	62	14	13	72	5	4	9	7
06	22,278	24,467	31,233	77,978	5	69	29	31	40	11	9	5	7
11	22,638	21,042	17,378	61,057	6	74	37	34	28	11	8	3	5
03	13,706	12,837	23,806	50,349	7	79	27	25	47	7	5	4	4
20	14,051	13,755	15,597	43,402	8	83	32	32	36	7	5	2	4
15	9,490	24,453	6,245	40,188	9	86	24	61	16	5	9	1	4
13	8,147	14,632	8,404	31,184	10	89	26	47	27	4	6	1	3
10	190	3,664	18,026	21,880	11	91	1	17	82	0	1	3	2
16	4,500	8,374	7,191	20,065	12	93	22	42	36	2	3	1	2
05	6,650	9,221	3,817	19,688	13	94	34	47	19	3	4	1	2
09	890	7,649	9,898	18,437	14	96	5	41	54	0	3	1	2
04	6,900	5,546	3,313	15,758	15	97	44	35	21	3	2	0	1
17	3,923	5,370	2,130	11,423	16	98	34	47	19	2	2	0	1
07	221	550	7,163	7,933	17	99	3	7	90	0	0	1	1
01	226	1,695	2,748	4,668	18	100	5	36	59	0	1	0	0
18	815	712	981	2,508	19	100	32	28	39	0	0	0	0
14	318	97	1,956	2,371	20	100	13	4	83	0	0	0	0
Total	**207,870**	**261,468**	**662,659**	**1,131,998**	**-**	**100**	**18**	**23**	**59**	**100**	**100**	**100**	**100**

OB = outbound; IB = inbound; Cum = cumulative; Com = commodity

08: Petroleum or Asphalt Products (Except Gasoline)
02: Live Animals, Animal Feed
12: Paper, Pulp, or Allied Products
19: Waste or Scrap
06: Stone, Ore, or Mineral Products
11: Manufactured Products or Durable Goods
03: Other Agricultural Products
20: Mixed or Unknown Freight
15: Machinery or Parts
13: Printed Products
10: Fertilizers or Chemicals
16: Motor Vehicles
05: Prepared Food, Tobacco, or Alcohol
09: Gasoline
04: Meat or Seafood
17: Lumber or Miscellaneous Rubber Products
07: Coal
01: Cereal Grains
18: Electrical, Scientific, or Medical Equipment
14: Metal Products (Primary and Fabricated)

Figure 2.13shows the growth of commodity flows between districts from 2010 to 2040. The largest growth in terms of absolute value is from the Northeast to the North Central District.

Figure 2.13: 2010 to 2040 Growth in Commodity Flows (Tons) by District



Source: Freight Analysis Framework, Parsons Brinckerhoff

The analysis of commodity flows by truck has shown that largest volumes in terms of weight are shipped within the State of Illinois. This is closely followed by shipments between Illinois and neighboring states.

2.5.1.3 Truck Flows

While the above section discussed commodity flows by tons, this section analyzes flows by converted truck trips. The analysis of commodity flow by tons primarily serves to better understand economic relationships between different geographies within and beyond the State of Illinois. The analysis of truck flows, in contrast, mainly serves to understand traffic flows caused by the transportation of goods.

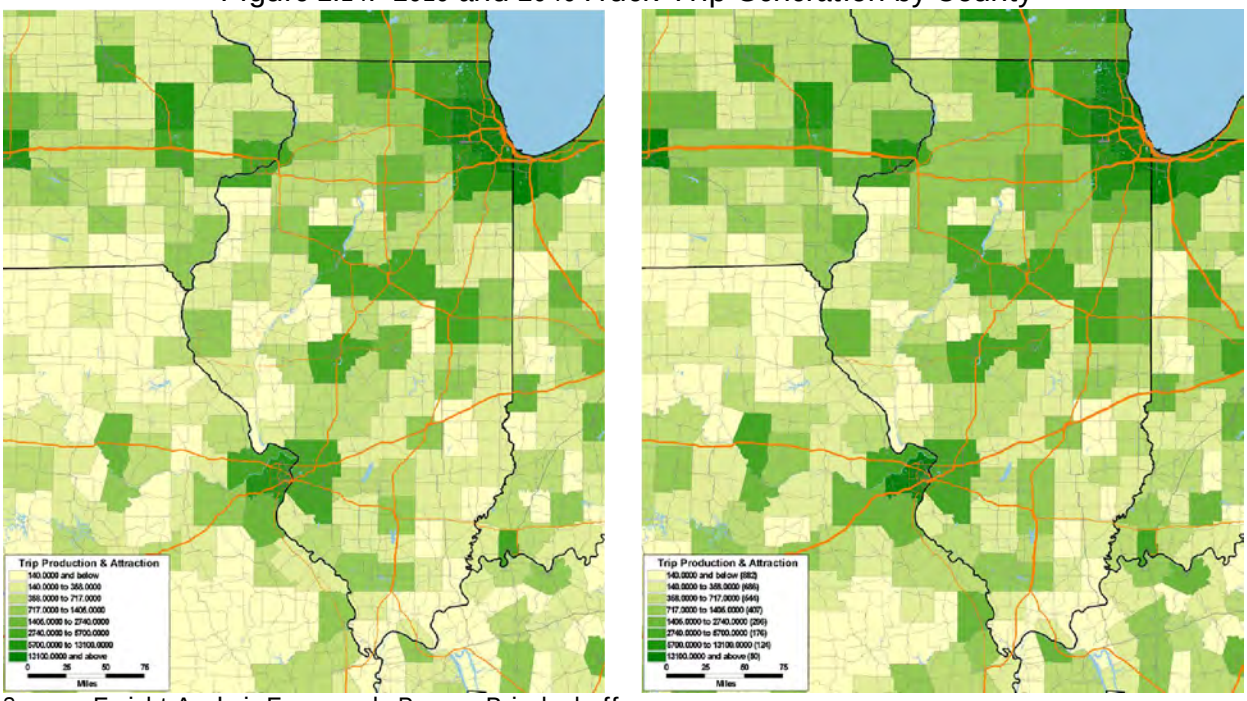
Truck trips were analyzed by their origin and destination. While the truck model distinguishes two truck types (single-unit trucks and multi-unit trucks), the following summaries look at total trucks only. The distinction between two truck types is relevant for modeling purposes, as:

(a) Smaller trucks that carry fewer tons of goods and tend to travel shorter distances, compared to larger trucks, which dominate the long-distance market.
(b) Larger trucks contribute disproportionally to congestion due to their length and slower acceleration.

In these summaries, however, the two truck types are aggregated as total trucks.

Figure 2.14 shows truck trip production by county. The urban areas around Chicago, Bloomington/ Champaign, Springfield and St. Louis stand out as the largest truck trip generators. The left side of Figure 2.14 shows trip production in 2010, and the right side shows 2040. While the right side for 2040 shows slightly darker colors, indicating that the total production volumes are growing from 2010 to 2040, the overall pattern remains largely unchanged. Trip attraction patterns look identical.

Figure 2.14: 2010 and 2040Truck Trip Generation by County



Source: Freight Analysis Framework, Parsons Brinckerhoff

Figure 2.15 shows estimated truck flows in 2010 and 2040. Major flows on I-80 and I-70 as well as I-39, I-55 and I-57 resemble the expected pattern and the truck traffic counts.

Figure 2.16 shows an overlay of 2010 and 2040 truck flows. The pink lines show 2010 truck traffic, and the red lines indicate how much traffic is expected to grow by 2040. The major Interstate highways of I-80 and I-70 crossing Illinois are expected to grow substantially in truck traffic. This indicates that through trips are growing at a larger rate than Illinois-based trips.

Figure 2.15: 2010 and 2040 Truck Flows

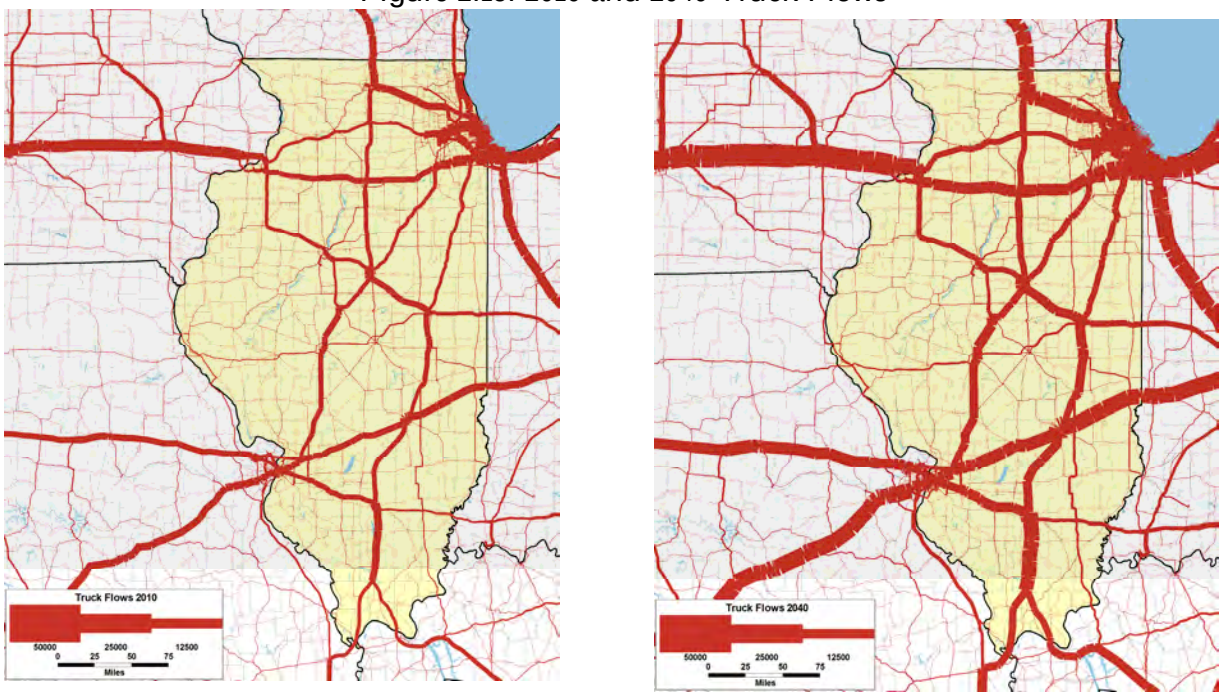
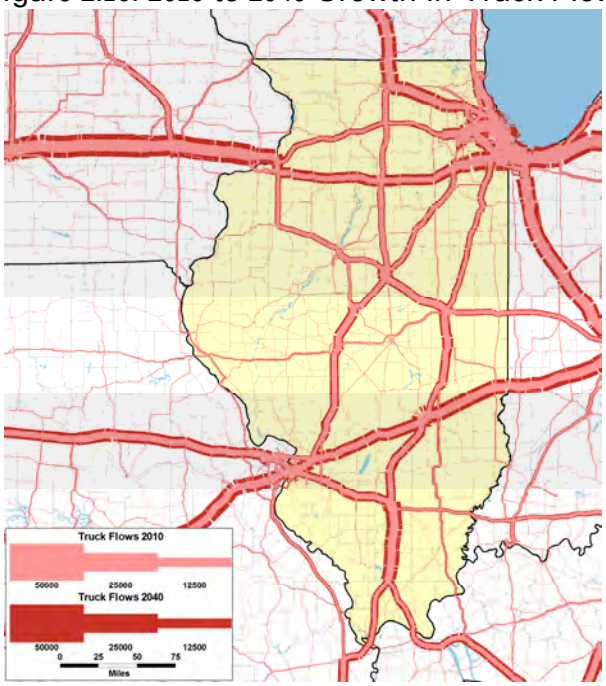


Figure 2.16: 2010 to 2040 Growth in Truck Flow



2.5.1.4 Industrial Shipping on Roadways

This section presents the truck shipping patterns for a selection of Illinois industry important to the State economy, network demand, and supply to citizens. Maps display the concentration by zone of truck tonnage and the roadway flows of trucks for total 2010 Illinois-based traffic – interstate outbound and inbound plus intrastate – in six commodity groups (CG):

- Petroleum & Asphalt (CG 08): the largest for truck tonnage
- Machinery (CG 15): the largest for outbound value
- Stone & Minerals (CG 06): high tonnage bulks important to construction
- Paper (CG 12): the top tonnage for a non-bulk manufactured product
- Manufactured Products (CG 11): a high tonnage and value group
- Prepared Foods (CG 05): lighter volume yet vital supplies for the population

Several significant and overarching observations emerge from these industrial shipping patterns:

- The north/south routes I-55 and I-57, and the east/west route I-88 are relied on heavily by most of the groups, and more so than I-80 and I-70. For Illinois-based shipping, the two latter routes – major east/west corridors for through freight – lose prominence.
- Interstates linking to Central Illinois – I-74, I-155, and I-39 – are depended upon by a number of industrial groups substantially active in that part of the state.
- The roadway network is used differently by different industries, implying that infrastructure investments intended to support an array of critical industries will vary in their points of focus.
- Whether an industry is mainly active in the interstate or the local, intrastate market is consequential to how it uses the roadways.
- Greater Chicago is the top volume zone for every one of these industries, with its local and radial routes and the I-94/90 corridor along the lake important almost across the board.
- An extensive network of secondary routes blankets zones around the State. This network of roads supports much of the industrial shipping, yet none carries substantial volume singularly.

Shipments of petroleum and asphalt (CG 08) account for over quarter of Illinois-based truck tonnage, but with 79 percent of the activity intrastate, they are predominantly local. The Chicago zone has the main volume, reflecting its refineries, deliveries from the lake and pipeline terminals, and need for paving products. However, apart from a few urban corridors, the network used by this industry is quite dispersed, even in the metropolitan area and around the State. Figure 2.17 shows truck volumes for petroleum and asphalt products.

Three quarters of the machinery (CG 15) tonnage shipped by truck moves interstate, in keeping with its engagement in national and global markets. As the top volume commodity by shipping value, machinery is so significant in Illinois that it also ranks fifth for tonnage. Concentrations extend from Chicago toward St. Louis along the I-55 corridor though Peoria, Bloomington, and Springfield, and west past Rockford to Quad Cities along I-88 and I-39. Figure 2.18 shows the traffic volumes for trucks that carry machinery.

Figure 2.17: 2010 Illinois-Based Truck Volumes, Petroleum & Asphalt

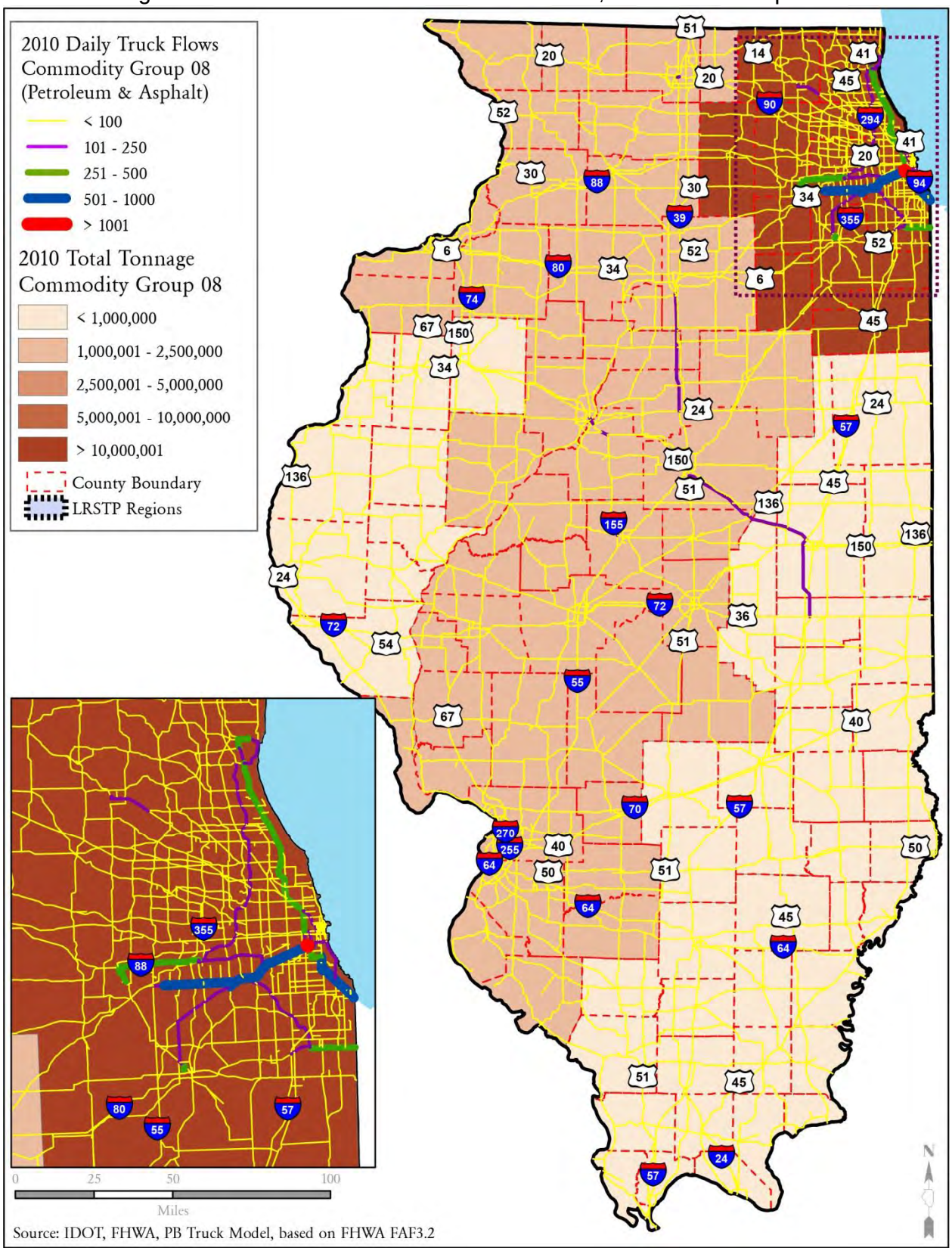
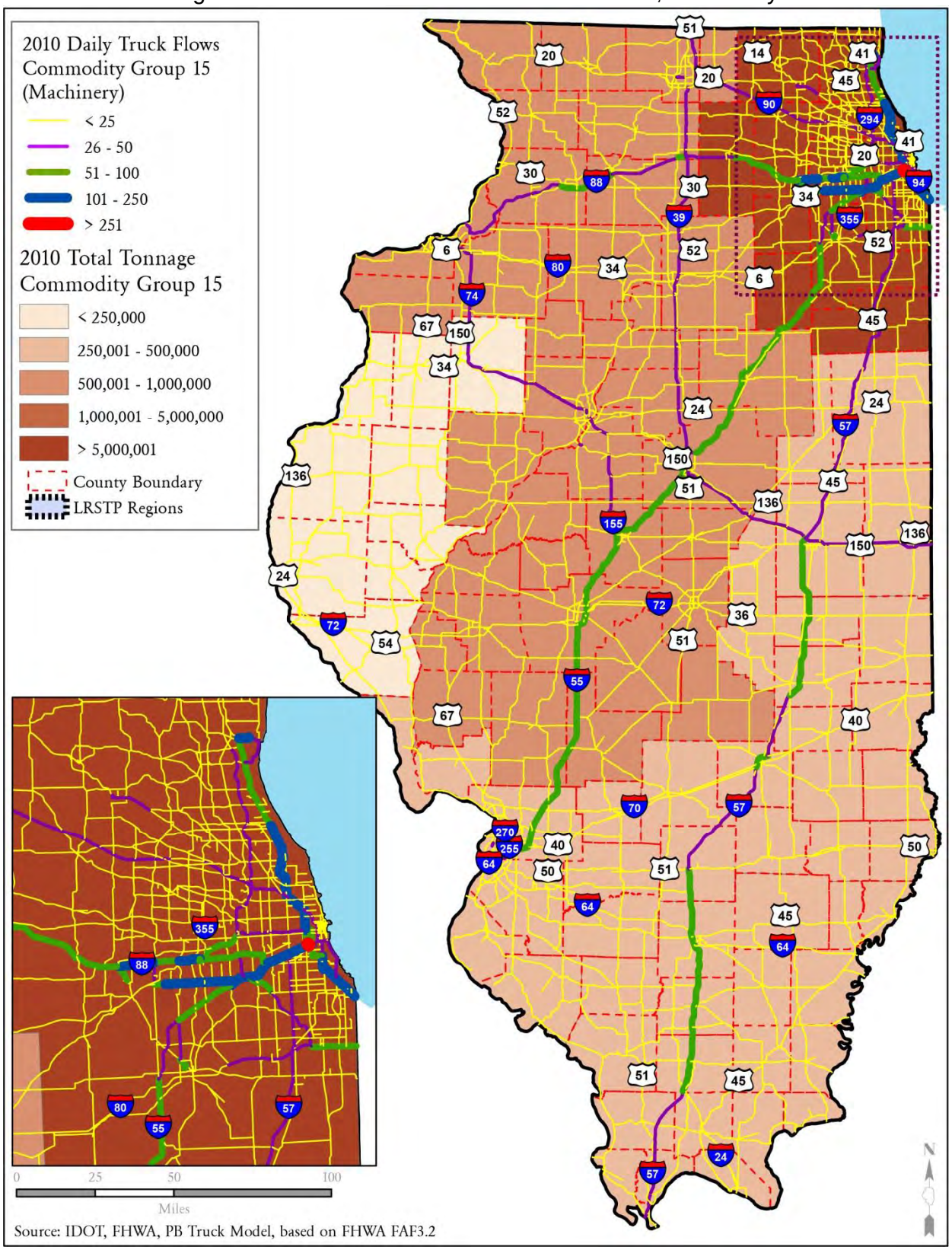


Figure 2.18: 2010 Illinois-Based Truck Volumes, Machinery



Stone and mineral traffic (CG 06) is sixth for truck tonnage and broadly divides as 40 percent intrastate and 60 percent interstate. The former corresponds to short distance construction activity and the latter both to local shipping along the State's borders, and to longer distance movements for specialized ores and minerals. The huge population and industrial center at Chicago creates the largest zone, but activity is spread around the State and generates a greater diversity of mid-volume routes than other groups, as they connect sand pits and gravel quarries to construction sites. Figure 2.19 shows traffic volumes for trucks that carry stone and gravel.

Paper products (CG 12) are the fourth largest for truck tonnage and divide about equally between interstate and interstate activity. The former includes supplies inbound from Wisconsin paper mills and outbound finished products to regional and broader markets; the latter reflects the extensive use of paper in packaging and other applications with a broad base of demand. Top zones are in Chicago and Central Illinois, but volume otherwise is spread around the State. I-94/90, I-55, I-57, and I-88 are principal corridors connecting to a web of secondary routes, as well as to suppliers and users outside Illinois. Figure 2.20 shows traffic volumes for trucks that carry paper products as freight.

Manufactured goods (CG 11) rank seventh for truck tonnage. Shipping is almost 70 percent interstate with more traffic outbound than in. A diverse group of furniture, textile and miscellaneous products, have traffic centers in Chicago, Rockford, and Central Illinois. Routes emanating from Chicago receive heaviest reliance, notably I-88 and I-94/90, followed by I-55 and I-57moving downstate. Figure 2.21 shows truck volumes for manufactured goods.

Prepared food products (CG 05) have an unsurprisingly extensive network. Three quarters of the traffic is interstate, with an even split of inbound and outbound indicative of widespread production and demand. Chicago and Rockford are prominent zones utilizing I-88, I94/90 and other routes, but there is substantial activity in Central Illinois traveling I-74, I-39, I-55 and I-57 serving the east and south of the state. Figure 2.22 shows the volume of prepared foods that travel by truck in Illinois.

Figure 2.19: 2010 Illinois-Based Truck Volumes, Stone & Minerals

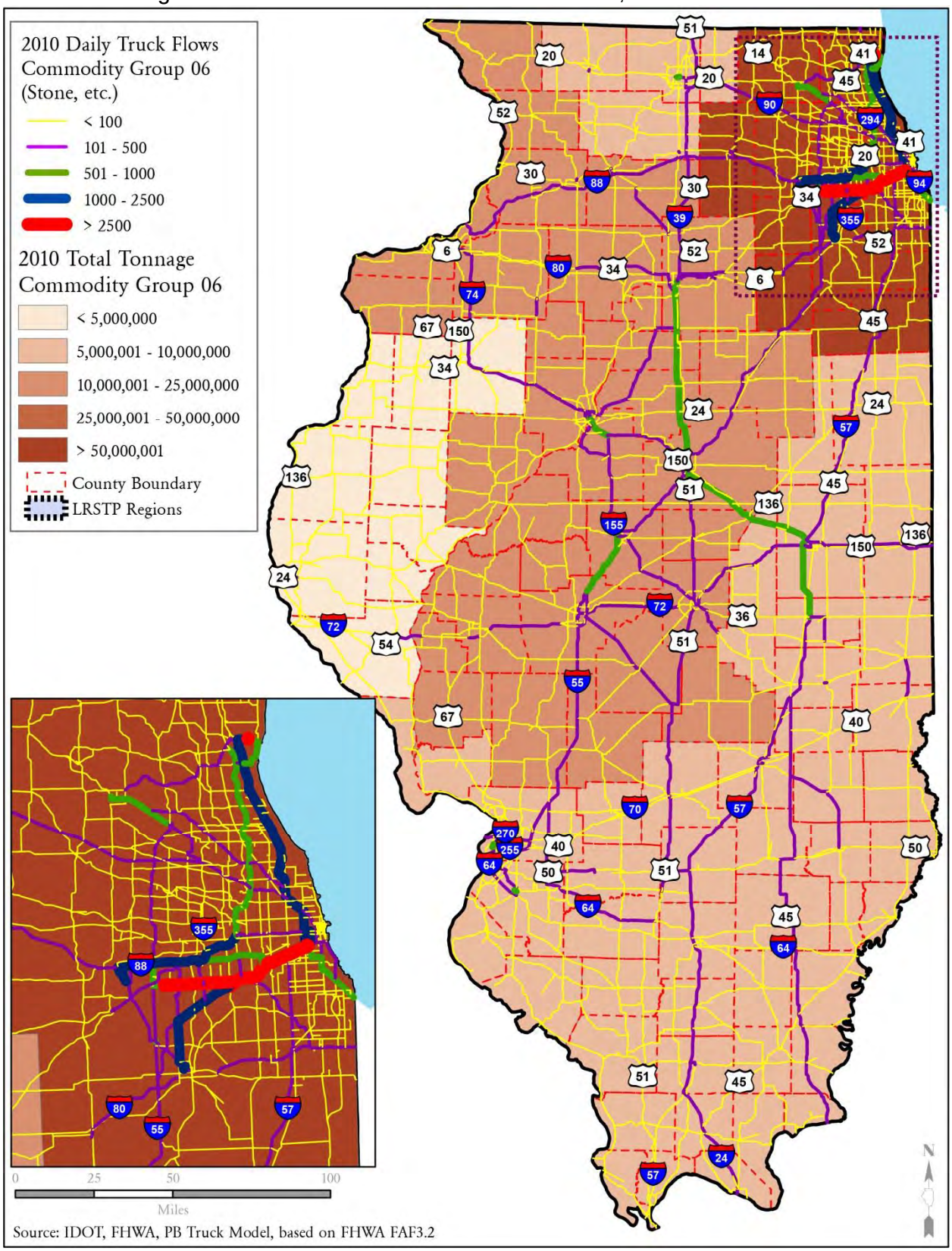


Figure 2.20: 2010 Illinois-Based Truck Volumes, Paper Products

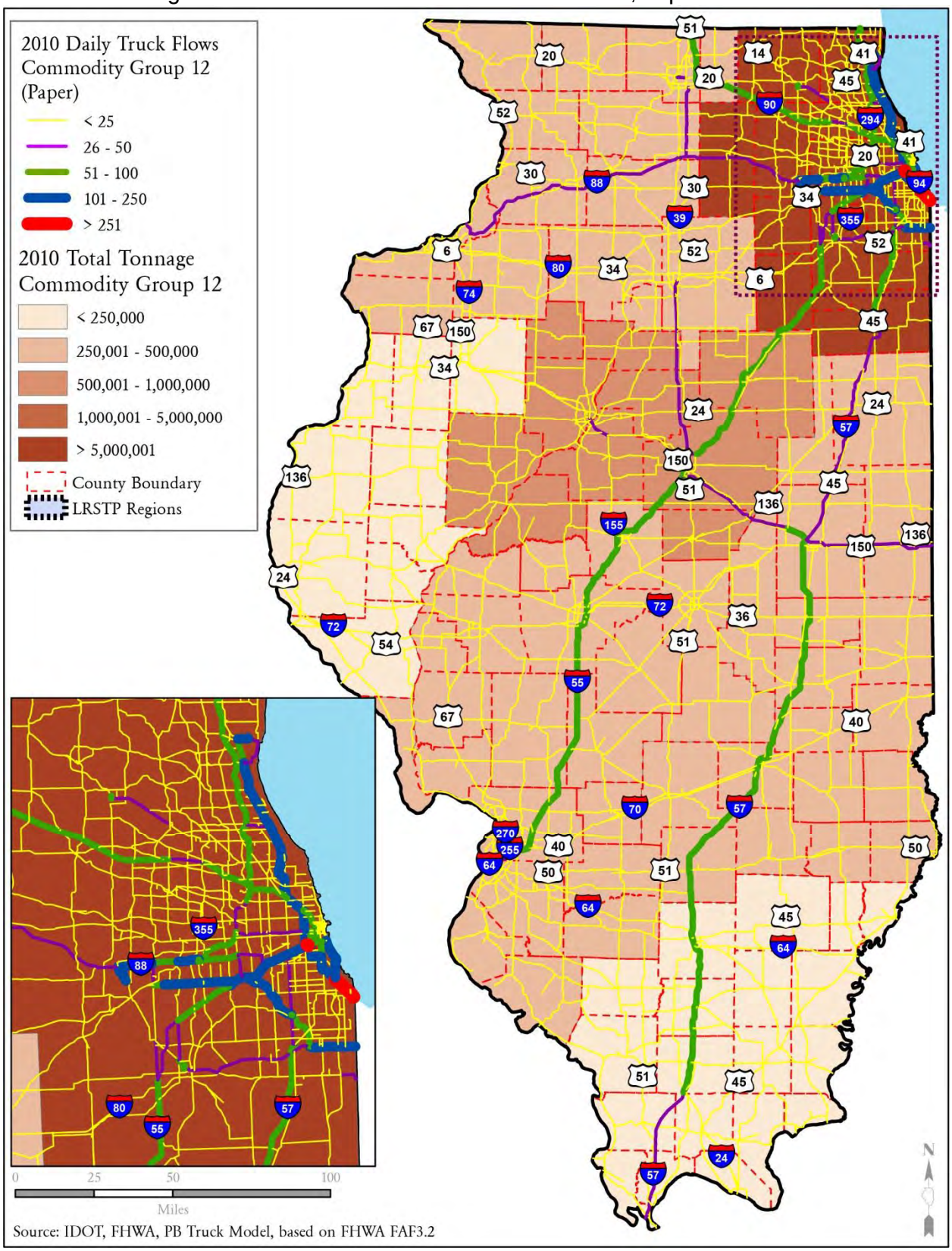


Figure 2.21: 2010 Illinois-Based Truck Volumes, Manufactured Products

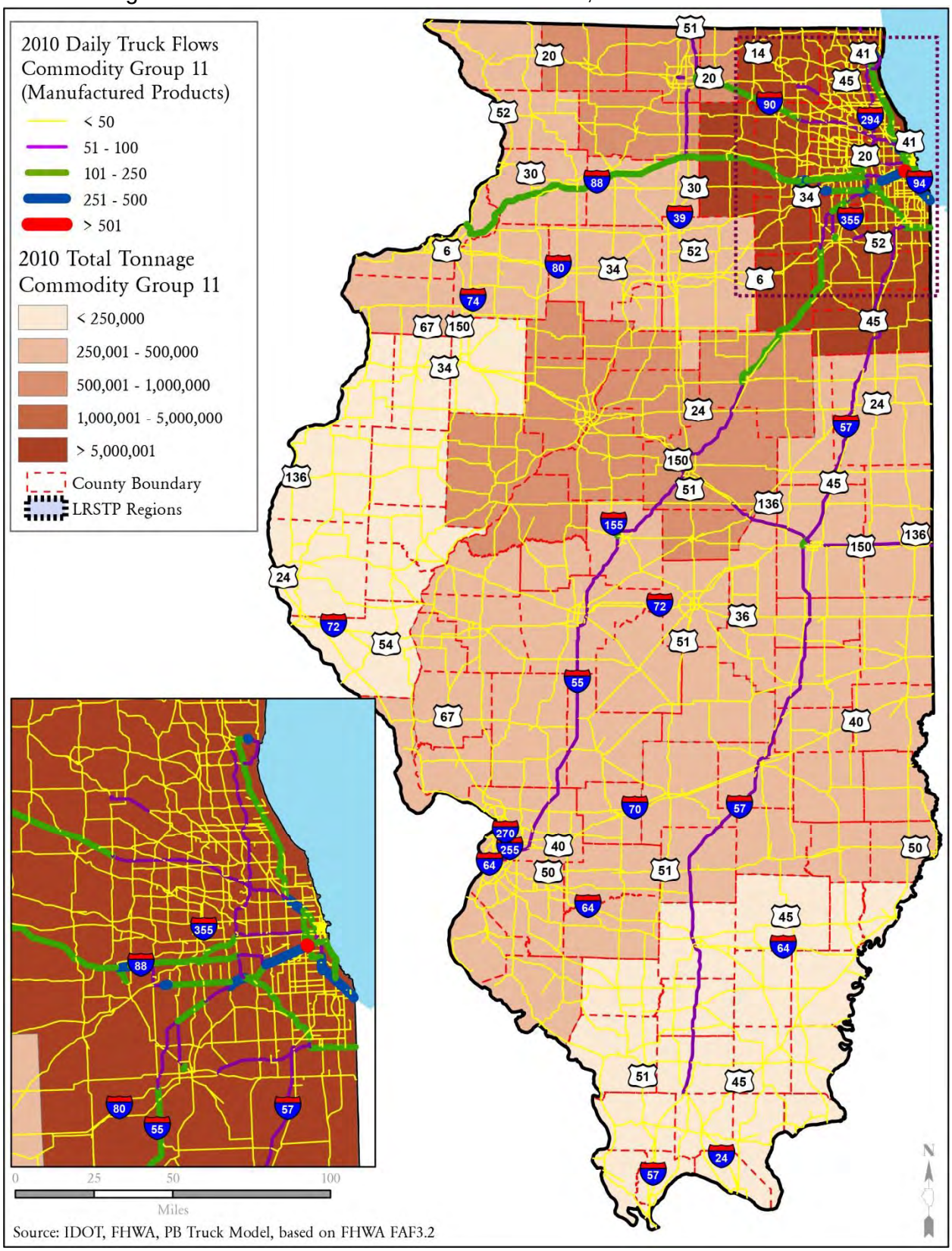
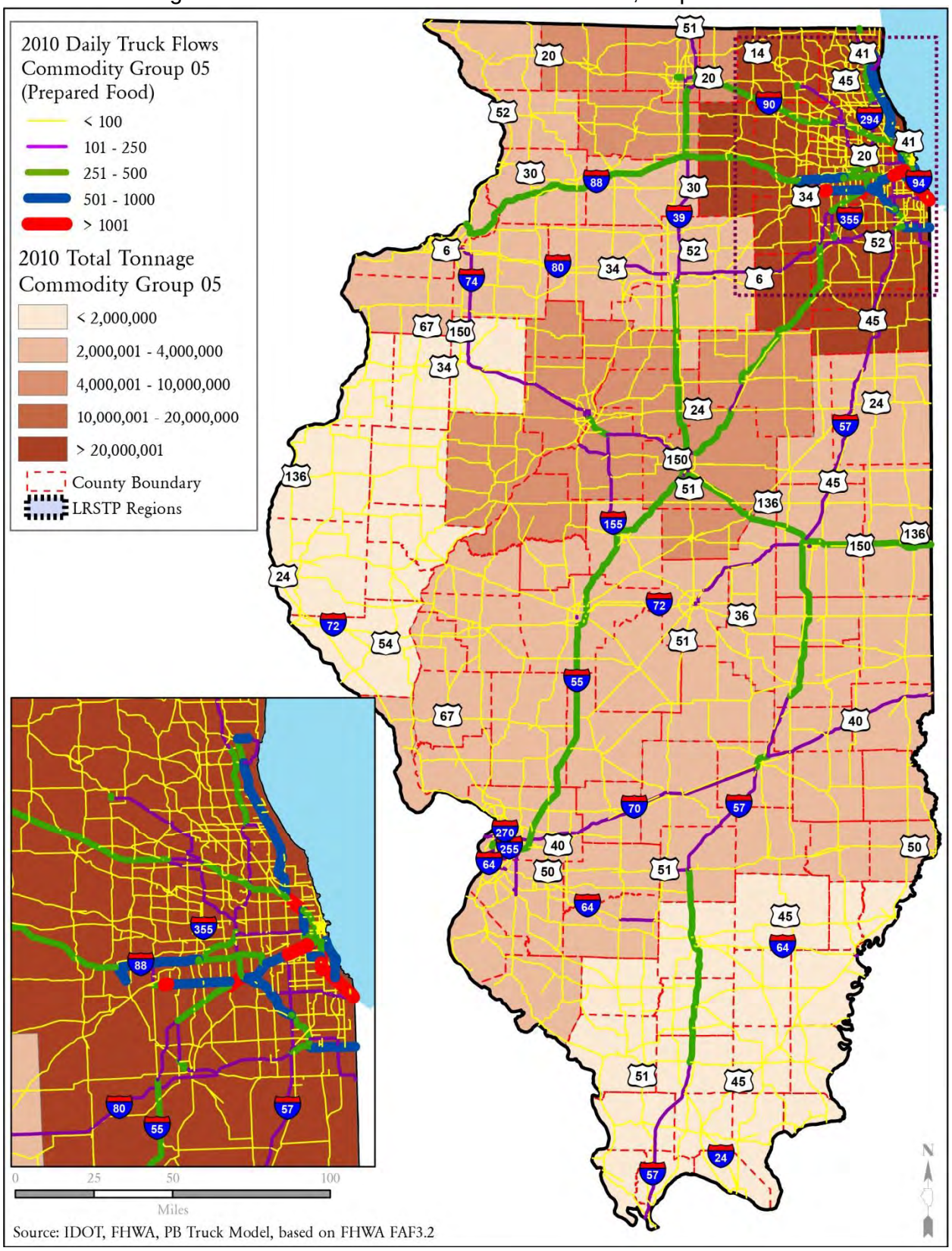


Figure 2.22: 2010 Illinois-Based Truck Volumes, Prepared Food



2.5.1.5 Commodity Group Details

Commodities moved by truck in Illinois in 2010 amounted to 800 million tons (62 percent of freight moved) and is expected to grow to 1.1 billion tons (67 percent) in the next three decades. This analysis ranked commodity movements by volume in 2010 and 2040, noting the commodity groups for which the largest changes are expected both in terms of mode share gained or lost, and increasing or decreasing commodity volumes.

Year 2010 Base

Of the approximately 800 million tons of freight moved by truck in Illinois in 2010, more than 500 million tons (63 percent) were freight movements both originating and ending in Illinois. The other 300 million tons of inbound and outbound tonnage were nearly evenly divided.

Examining directional flows of specific commodities, local (Illinois-to-Illinois) flows predominate. The largest single flow was the local movement of petroleum or asphalt products, representing 174 million tons (35 percent of all local movements, but 79 percent of all petroleum or asphalt movements). Second, 112 million tons of live animals / animal feed represented 84 percent of that commodity moved, but only 22 percent of local truck traffic. Third, 51 million tons of waste or scrap moved locally by truck in Illinois in 2010, constituting 77 percent of waste or scrap moved in Illinois, and 10 percent of all local traffic. Combined, these three commodity groups total 53 percent of the truck freight moved inbound, outbound, and locally in Illinois in 2010.

Year 2040 Directional Orientation

Forecasts predicts that by 2040, 1.1 billion tons of freight will move by truck annually in Illinois, an amount equal to 67 percent of all freight moved in the State in 2040. In that year, 59 percent of this tonnage will be local, 23 percent will be inbound, and 18 percent will be outbound. Compared to 2010 (when 63 percent of tonnage was local, 19 percent was inbound, and 16 percent was outbound), this represents a pronounced increase in Illinois-to-Illinois based truck flows, both in relative and absolute terms. Local tonnage is expected to increase by 25 percent from 500 million tons to 663 million tons. While inbound flows increase 42 percent from 153 million tons to 261 million tons, outbound flows increase 30 percent from 145 million to 208 million.

Commodity Groups Demonstrating Incremental Growth, 2010 to 2040

The following growth in trucking tonnage is expected by 2040:

- Pulp, paper, and allied products grow 133 percent in tonnage, a gain of 75 million tons over the 2010 base of 57 million.
- Motor vehicles and their components are expected to see an incremental gain of 8.7 million tons over their 2010 base of 11.3 million tons, an increase of 77 percent.
- Meat or seafood movements are expected to increase 63 percent, a gain of 6 million tons over the 2010 base of 9.7 million tons.
- Stone, ore, or mineral products are projected to increase in tonnage by 62 percent, an increase of 30 million tons over the 2010 amount of 48 million tons.
- The two largest commodity groups by truck in 2040 (petroleum or asphalt products, 291 million tons, and live animals /animal feed, 200 million tons) are projected to see gains of 73 million tons (33 percent increase) and 67 million tons (50 percent increase) respectively.

Commodities driving growth in trucking's modal share are paper, pulp, and allied products, (responsible for 23 percent of trucking's modal gains by tonnage), petroleum or asphalt products (responsible for 22 percent), and live animals / animal feed (responsible for 20 percent). By 2040, trucking is expected to lose three percent of its mode share due to losses in the machinery and parts category, and one percent of its mode share due to losses in the petroleum refining products category.

Some commodities are projected to experience incremental gains by 2040 that will nearly exclusively be carried by truck. The additional 1.3 million tons of cereal grains, for instance, are expected to be carried by a truck for 98 percent of those tons moved. Of the 78 million additional tons of petroleum or asphalt products carried by 2040, 94 percent of those tons will be carried by truck.

Trucks will also carry 93 percent of the additional 6 million tons of meat or seafood, 92 percent of the additional 2.1 million tons of coal, and 85 percent of the additional 88.9 million tons of paper, pulp, or allied products gained in the next three decades. On the opposite end of the spectrum, 10.6 million tons of machinery and parts will no longer be carried in Illinois, with 98 percent of this volume decreasing from trucking's modal share of this commodity flow.

Commodity Groups Demonstrating Little Change, 2010 to 2040

Commodity groups that are projected to see little change in truck tonnage include fertilizers and chemicals, gaining 14 percent (2.7 million tons over a 2010 base of 19.1 million tons), and metal products, gaining 19 percent (384,000 tons over a 2010 base of two million tons). The largest incremental gain attributed to a low growth commodity group is that of waste or scrap movements, projecting an additional 12 million tons by 2040, an 18 percent gain. As these are the 'little change' scenarios, impacts on modal growth are small.

Waste or scrap gains account for five percent of trucking additional tonnage by 2040, with fertilizer and chemicals responsible for one percent, and metal products responsible for adding less than one percent to trucking's share. Trucking should account for 76 percent of the growth in the waste or scrap commodity group, and 63 percent of the growth in metal products. For fertilizers, though the commodity group will experience a net decline by all modes of 8.9 million, trucking's modal share will increase by 2.7 million.

Commodity Groups Demonstrating Volume Decline, 2010 to 2040

Two commodity flows by truck are projected to experience a decline in the volume of tonnage conveyed by this mode. Both machinery and parts, and petroleum refining products will experience declines of 21 percent. Petroleum refining products by truck are expected to decrease by 4.9 million tons, while machinery and parts are expected to decrease 10.4 million tons. These losses from trucking's modal share represent 98 percent of the losses in machinery and parts by all modes and 43 percent of the losses for petroleum refining products by all modes.

2.5.2 Water

More than 135 million tons of freight moved by water in Illinois in 2010, with this amount projected to increase to 149 million tons by 2040. Accounting for 11 percent of Illinois freight movement by volume in 2010, the State's inland waterways are a vital asset in delivering products harvested, extracted or transshipped in Illinois to domestic and international markets.

Nationwide, the FAF estimates that in 2010, 612 million tons of cargo was moved by water in the United States, representing $222 billion in value. Illinois has 1,118 miles of navigable waterways (of the nation's 25,000) that traverse the State and establish its boundaries. These waterways provide connections with both the Atlantic Ocean, via the Great Lakes and St. Lawrence Seaway, and the Gulf of Mexico. Illinois has 16 port districts, including the Port of Chicago (Illinois International Port District), with many offering extensive intermodal connections to rail and interstate.

Most relevant to Illinois is the cost competitive nature of the inland waterway system for lower value-to-weight commodities, such as gravel, sand, grain and coal. This is due largely to the mode's impressive fuel economy, but comparatively slow pace. While a gallon of fuel moves a ton of freight roughly 90 miles in a truck or 430 miles by rail, the same amount of fuel can move a ton of freight 600 miles by barge.

In a Tennessee Valley Authority report, shipping by inland barge produces a savings of $12 per ton (2012 dollars) on average, compared to modal alternatives.[7] Nationally, more than 60 percent of grain exports move by barge, in addition to 22 percent of domestic petroleum movements and 20 percent of coal used to power utility plants.[8] Due to Illinois' strength as a producer of grain, seeds, kernels, oil, and (increasingly) coal, it is ranked second (behind Louisiana) in domestic movements on the inland waterway system.[9]

2.5.2.1 Outbound/Inbound Directional Flow

Waterborne commodity flows in Illinois are overwhelmingly outbound, with 104 million tons leaving Illinois for other states in 2010, while 17 million tons entered Illinois from other states. In-state flows, both originating and ending in Illinois BEAs,[10] were counted at nearly 14 million tons in 2010. In the in-state category, more than one third (4.9 million tons) of these 14 million tons both originate and are destined for the Chicago BEA, emphasizing the critical importance of the lock and canal system, as well as the Great Lakes freighter sector. Table 2.13 compiles the freight activity on Illinois' waterways. Figure 2.23 maps the BEAs in Illinois.

Table 2.13: Waterborne Commodity Flow by Direction, 2010 Annual

Direction	Tons ('000)	Percent of Total
Intrastate	13,624	10.1
Inbound to Illinois	17,391	12.9
Outbound from Illinois	104,222	89.9
Grand Total	135,237	100.0

Source: Transearch, 2010

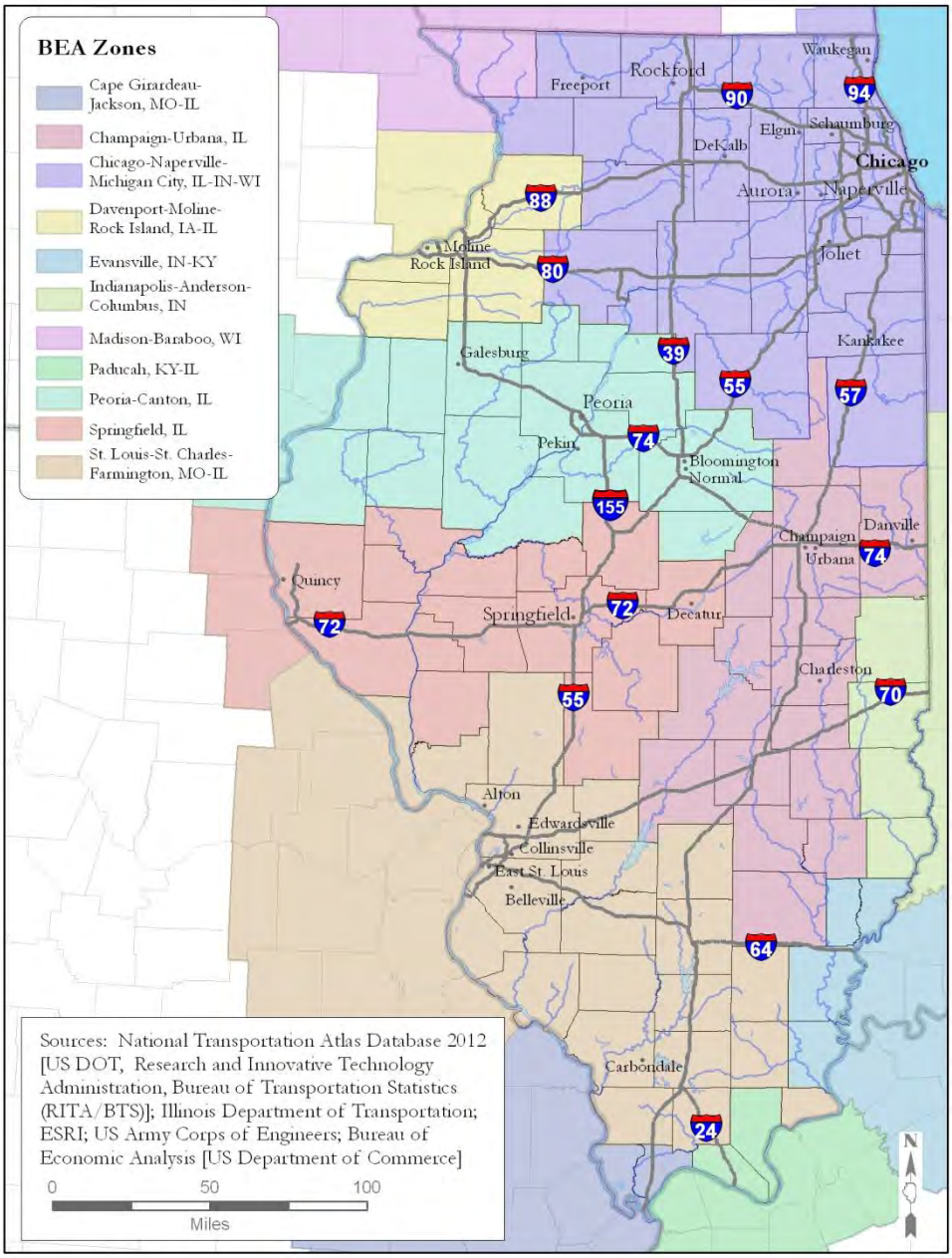
[7] Tennessee Valley Authority, Annual Performance Report-FY 2002. www.tva.com/abouttva/pdf/gprafy02_perfrpt.pdf. Accessed August 23, 2012.

[8] Texas Transportation Institute: Center for Ports and Waterways, A Modal Comparison of Domestic Freight Transportation Effects on the General Public (2007, amended 2009). www.americanwaterways.com/press_room/news_releases/NWFSTudy.pdf. Accessed August 23, 2012.

[9] U.S. Army Corps of Engineers, Institute for Water Resources, Waterborne Commerce of the United States-Calendar Year 2010: Part 5-National Summaries. www.ndc.iwr.usace.army.mil/wcsc/pdf/wcusnatl10.pdf. Accessed August 23, 2012.

[10] Eleven BEAs cover Illinois. A BEA is a unit of economic analysis, and is independent of state boundaries. For example, the Chicago-Naperville-Michigan City BEA encompasses four counties in northwestern Indiana and one county in southeast Wisconsin. It also extends to the Illinois state line on the west side of the state and includes Carroll County.

Figure 2.23: BEA Zones in Illinois



Major Outbound Commodity Flows

The predominating direction of water-based commodity flow in Illinois is outbound, largely based upon the volume of southbound coal and grain. While coal by itself accounts for 56 percent of the tonnage, at least half of its volume represents transshipments from non-Illinois origins. The evidence for this is indirect because the data sources simply depict where commodities begin their journey on water. However, total tonnage for coal shipments beginning in Illinois (including intrastate as well as interstate flows) is about double the total production of Illinois coal mines as reported by the US Energy Information Administration – 64 million tons versus 33 million tons in 2010, respectively. Moreover, the vast majority of coal originations on water are at St. Louis, which

serves both the downstate coal fields and railroad transshipment terminals for trains arriving from Wyoming mines.

Looking ahead, Illinois-originating coal movements are forecast by the FAF to decline by 2040, with the Coal-n.e.c. category losing 73 percent of its volume. This projection probably understates production from Illinois mines, which have new growth opportunities (as Chapter 3 describes), but it is consistent with the national outlook for coal from other sources. In addition, the predicted growth of outbound shipments of cereal grains and other agricultural products to southern river ports will sufficiently buttress the total outbound flow on water to maintain a strong directional orientation.

Of the 104 million outbound tons originating in Illinois in 2010, including transshipments, 82 percent of these movements originated in the Illinois counties of the St. Louis BEA. A much smaller portion (nine percent) originated in the Chicago BEA economic area. Of the shipments leaving the St. Louis BEA in 2010, a plurality (24 percent, at 23 million tons) headed to New Orleans, and international markets beyond that port. Eleven percent (10 million tons) of the St. Louis BEA shipments in 2010 were destined for the Evansville, Indiana BEA area. A third of the Chicago BEA-originated shipments also had destinations in that same city as of 2010.

The Illinois portion of the St. Louis BEA economic area is overwhelmingly the largest origination point and staging area for outbound commodity flows in the state. Of the 85.5 million tons leaving that BEA in 2010, 22.7 million tons (26.5 percent) were destined for New Orleans. Nearly all of this St. Louis-New Orleans trade was grain (48.0 percent), bituminous coal (23.2 percent), and oil kernels, nuts or seeds (18.8 percent). Similarly, the dominance of coal holds for the St. Louis-Evansville trade (11.9 percent of St. Louis originations), with coal constituting 95.8 percent of that corridor's waterborne movements.

Moving downriver to Baton Rouge, the commodity mix is alternately more varied, which can be attributed to the city's status as the most inland port on the Mississippi River that can be accessed by larger oceangoing freight vessels. Freight movements to Baton Rouge – representing 10.7 percent of St. Louis originations – are still largely coal (48.3 percent), grain (27.2 percent), and oil kernels, nuts, or seeds (7.3 percent) though asphalt, pavement products, and other petroleum related commodities represent a large share the tonnage at 17.0 percent.

The Chicago BEA is very large, and its inclusion of Lake Michigan, the Illinois River and its connecting lock and canal system, and the Mississippi River explain its ranking as the second largest originating BEA behind St. Louis. Again, New Orleans ranks first as a destination, at 22.9 percent of Chicago originations, Baton Rouge at 16.8 percent, and Memphis at 11.0 percent. Disaggregating Carroll County from the other outbound volumes attributed to the Chicago BEA, 172,114 tons are likely traveling on the Mississippi River, representing less than two percent of the volumes originating in the Chicago BEA.

In terms of commodity mix, there is a clear divide between the outbound, southern flows on the Mississippi River that are loaded for export, compared to the outbound eastward flows on the Ohio River. The freight movements on the Mississippi are largely bulk commodities and staples such as grain, much of which is headed for export in New Orleans or Baton Rouge. Illinois-originated coal has a large presence on both the Ohio and the Mississippi. Though with the complement of metal scrap or tailings, chemical preparations, and industrial organic chemicals headed eastward on the

Ohio River, it is easy to see the more industrial character of the commercial activity in the Ohio River region. Table 2.14 shows the flow of outbound waterborne freight as of 2010.

Table 2.14: Outbound Waterborne Freight by Origin / Destination BEA, 2010 Annual

Origin BEA (IL)	Tons ('000)	Pct of Total		Destination BEA	Tons ('000)	Pct of Total
St. Louis, MO	85,521	82.1		New Orleans, LA	29,208	28.0
Chicago, IL	9,384	9.0		Baton Rouge, LA	12,144	11.7
Peoria, IL	4,949	4.7		Evansville, IN	11,052	10.6
Springfield, IL	1,721	1.7		Nashville, TN	9,342	10.0
Davenport, IL	1,419	1.4		Louisville, KY	7,569	7.3
Des Moines, IA	667	0.6		Charleston, WV	4,863	4.7
Paducah, KY	515	0.5		Lafayette, LA	4,310	4.1
Madison, WI	85	0.1		Cincinnati, OH	4,108	3.9
Grand Total	104,222	100.0		Memphis, TN	3,825	3.7
				St. Louis, MO	2,015	1.9
				Top 10 Sub-total	88,436	84.9
				Grand Total	104,222	100.0

Source: Transearch, 2010

Major Inbound Commodity Flows

Much smaller than Illinois' outbound waterborne commodity flow, inbound shipments via water modes totaled 13 percent of all waterborne commerce in Illinois in 2010, with 17.4 million tons of freight being carried that year. A majority of these shipments were destined for the Chicago BEA in 2010. Examining the movements headed to Chicago from outside Illinois in 2010, roughly 31 percent (2.7 million tons) began in New Orleans, with 29 percent (2.5 million) beginning in Northern Michigan. Fifteen percent (1.3 million tons) began in Baton Rouge BEA that year. In the group of inbound flows originating outside Illinois in 2010 that ended in the Illinois portion of the St. Louis BEA economic area, New Orleans again featured prominently as an origin at 31 percent of tonnage (1.3 million tons), with Baton Rouge (17 percent, at 744,000 tons) following. Table 2.15 shows the flow of inbound waterborne freight as of 2010.

Looking toward 2040, much of these patterns should hold constant, as several of the key commodity flows originating in New Orleans (such as fertilizer) are expected by the FAF to increase robustly or maintain share. As an origin-destination pair, Michigan-Illinois water freight movements will also likely remain constant or increase, as the commodities conveyed (principally cement, stone, and building materials) will increase by 25 percent between 2010 and 2040, according to the FAF.

Table 2.15: Inbound Waterborne Freight by Origin / Destination BEA, 2010 Annual

Origin BEA	Tons ('000)	Pct of Total		Destination BEA	Tons ('000)	Pct of Total
New Orleans, LA	5,367	30.9		Chicago, IL	8,704	50.1
Baton Rouge, LA	2,747	15.8		St. Louis, MO	4,354	25.0
Northern Michigan	2,704	15.5		Peoria, IL	3,343	19.2
St. Louis, MO	1,414	8.1		Springfield, IL	393	2.3
Houston, TX	694	4.0		Davenport, IL	308	1.8
Evansville, IN	619	3.6		Des Moines, IA	138	0.8
Corpus Christi, TX	500	2.9		Paducah, KY	123	0.7
Paducah, KY	461	2.7		Madison, WI	27	0.2
Charleston, WV	450	2.6		Grand Total	17,391	100.0
Memphis, TN	407	2.3				
Grand Total	17,391	100.0				

Source: Transearch, 2010

Major Intrastate Commodity Flows

Table 2.16 shows the freight flows between BEA regions for 2010. Chicago-to-Chicago freight movements represent 36.6 percent of all intrastate commodity flow, and Illinois to Chicago is 46.2 percent of the total. As the disaggregated Carroll County sub-totals suggest the Mississippi River is a minor portion of this volume, this analysis assumes that the remainder of these movements are taking place on Lake Michigan, the canal system, and the Illinois River within the Chicago BEA.

Table 2.16: Intrastate Waterborne Freight by Illinois Destination BEA, 2010 Annual

Destination BEA (IL)	Origin BEA (IL)	Tons
Chicago, IL	Chicago, IL	4,983,234
	St. Louis, MO	979,627
	Peoria, IL	205,643
	Springfield, IL	71,147
	Des Moines, IA	26,975
	Davenport, IA	15,602
	Paducah, KY	11,823
Chicago, IL Sub-total		6,294,050
Peoria, IL	St. Louis, MO	4,235,663
	Chicago, IL	202,784
Peoria, IL Sub-total		4,438,447
St. Louis, MO	St. Louis, MO	2,346,910
	Chicago, IL	410,528
	Peoria, IL	10,130
	Springfield, IL	4,095
	Davenport, IA	3,020
	Des Moines, IA	1,581
	Paducah, KY	425
	Madison, WI	162
St. Louis, MO Sub-total		2,776,850
Madison, WI	Chicago, IL	37,374
	St. Louis, MO	7,994
Madison, WI Sub-total		45,368
Paducah, KY	Chicago, IL	29,896
	St. Louis, MO	6,220
Paducah, KY Sub-total		36,116
Davenport, IA	Chicago, IL	13,098
	St. Louis, MO	2,801
Davenport, IA Total		15,899
Springfield, IL	Chicago, IL	11,862
	St. Louis, MO	2,456
Springfield, IL Sub-total		14,319
Des Moines, IA	Chicago, IL	2,567
	St. Louis, MO	533
Des Moines, IA Sub-total		3,100
Intrastate Total		13,624,149

Major Trade Lanes

As depicted in the previous outbound and inbound comparison, the outbound category is the predominant trade direction. For Illinois's inland waterways and its connections via Lake Michigan, this has traditionally meant a north-to-south trade flow. This north-to-south confluence is most pronounced in the Great Lakes within Lake Superior and Lake Huron, with some of those commodities entering Lake Michigan bound for the Chicago economic region.

For the inland portion of the State, the Illinois River demonstrates a more balanced flow of commerce with northbound and southbound commodity volumes nearly equal, though slightly stronger in the southbound direction. Northbound commodity flows in Mississippi River south of St. Louis are robust, proving the St. Louis region as a site of transshipment and value-adding processing. The Mississippi River north of St. Louis carries commodities in a strongly southbound orientation, gradually increasing in volume in the approach to St. Louis as the agricultural production of Illinois and Missouri are added into the totals.

Opposing this trend is the Ohio River, whose volumes are more northbound, representing the large amount of coal and other industrial inputs such as chemical mixes and treatments headed northeast from Cairo, Illinois, to Paducah, Kentucky; Evansville, Indiana; and eventually Pittsburgh, Pennsylvania. Tables 2.17 and 2.18 show the tons of freight shipped on the rivers.

Table 2.17: Outbound Waterborne Freight by Waterway, Annual

Waterway	2010 ('000)	Percent of OB	Percent of All	2040 ('000)
Lake/Illinois River	12,989	12	10	15,123
Illinois/Mississippi River	48,008	46	35	55,152
Mississippi River Only	1,755	2	1	1,815
Mississippi/Ohio River	41,470	40	31	47,640
Total Outbound	104,222	100	77	119,730

Source: Transearch, 2010

Table 2.18: Inbound Waterborne Freight by Waterway, Annual

Waterway	2010 ('000)	Percent of IB	Percent of All	2040 ('000)
Lake/Illinois River	9,024	52	7	12,115
Illinois/Mississippi River	6,175	36	5	8,289
Mississippi River Only	421	2	0	565
Mississippi/Ohio River	1,771	10	1	2,377
Total Inbound	17,391	100	13	23,347

Source: Transearch, 2010

Intrastate tonnage, constituting 13.6 million tons of the Illinois 2010 total (135.2 million) is not disaggregated by water route, as the size of the BEA economic areas (averaging 5,265 square miles) relative to the short journey length, prevents a detailed analysis of which water routes were taken between origin and destination points within Illinois.

2.5.2.2 Commodity Group Details

Drawing upon the resources of Transearch and the FAF, this section analyzes the outbound, inbound, and intrastate waterborne flows in Illinois by commodity group. Commodity activity is highly concentrated, with a handful accounting for most of the volume, as Table 2.19 shows.

Table 2.19: Top Seven Illinois-based Tons ('000) Moved by Water, 2010 and 2040 Annual (Ranked by Total Outbound/Inbound/Local Volume)

Commodity Group	2010				
	OB	IB	L	Total	Cum%
7: Coal	58,366	1,805	5,669	65,839	49
1: Cereal Grains	18,918	206	84	19,208	63
6: Stone, Ore, or Mineral Products	3,434	6,285	5,395	15,115	74
9: Gasoline	7,245	1,921	1,256	10,422	82
3: Other Agricultural Products	7,293	102	32	7,427	87
10: Fertilizers or Chemicals	2,348	3,474	168	5,991	92
8: Petroleum or Asphalt Products (Except Gasoline)	4,514	422	898	5,834	96
Top 7 Commodities Sub-total	102,118	14,215	13,502	129,836	96
All Other Commodities	2,104	3,176	122	5,401	4
Total	104,222	17,391	13,624	135,237	100

Commodity Group	2040				
	OB	IB	L	Total	Cum%
7: Coal	58,366	2,005	5,669	66,040	44
1: Cereal Grains	26,296	206	84	26,586	62
6: Stone, Ore, or Mineral Products	3,777	7,856	6,044	17,677	74
9: Gasoline	7,245	1,959	1,256	10,460	81
3: Other Agricultural Products	11,815	182	46	12,043	89
10: Fertilizers or Chemicals	1,644	5,107	168	6,919	94
8: Petroleum or Asphalt Products (Except Gasoline)	1,219	528	180	1,927	95
Top 7 Commodities Sub-total	110,362	17,843	13,477	141,652	95
All Other Commodities	1,684	5,639	156	7,479	5
Total	112,046	23,482	13,603	149,131	100

Source: Transearch, FAF

Year 2010 Base

Nearly three quarters of the freight tonnage carried by water in Illinois in 2010 (inclusive of outbound, inbound, and intrastate directional flows) was grouped as either coal (49 percent of water freight); cereal grains (14 percent); and stone, ore, or mineral products. While the largest two groups are strongly outbound in their directional orientation (with 89 percent of coal destined for outside of Illinois, and 99 percent of cereal grains similarly leaving), the construction aggregates in the stone, ore, or mineral products group are only 23 percent outbound, with 42 percent of these movements being inbound, and 36 percent being local. Finally, gasoline constituted another eight percent of freight conveyed by water, also with a strong outbound directional orientation (70 percent of gas by water), with inbound movements representing 18 percent, and local movements representing 12 percent of the gasoline movements in this mode for 2010.

Year 2040 Directional Orientation

By 2040, the total tonnage of water freight is expected to increase from 135.2 million tons to 149.1 million tons, a gain of 10 percent in three decades. Still driven by coal and grain exports, this mode will maintain a strong directional orientation, with 75 percent of tonnage outbound, 16 percent inbound, and nine percent local in 2040. Compared to 2010 (with 77 percent local, 13 percent inbound, and ten percent local) this represents a notable increase in inbound trade to Illinois via water, principally driven by growth in the inbound traffic of construction aggregates in the stone, ore or mineral products group.

Commodity Groups Demonstrating Incremental Growth, 2010 to 2040

Tracking incremental growth predictions for the 2010 to 2040 period here focuses on the largest commodity flows for waterborne commerce in Illinois: coal; cereal grains; and stone, ore, or mineral products. Additional comments follow for the gains and losses associated with other smaller commodity flows.

Coal

The largest outbound commodity flow, outbound coal shipments, numbered 58.4 million tons in 2010, though the FAF forecasts this volume to hold constant, or decline slightly, by 2040. Inbound coal movements totaled 1.8 million tons in 2010. While most of the markets for outbound coal laid to the east and south, ten percent of shipments were bound for economic areas adjacent to the Great Lakes. Table 2.20 shows the 2010 and 2040 top ten destinations for coal.

Table 2.20: Outbound Coal by Destination, 2010 and 2040

BEA Economic Area	2010 ('000)	2040 ('000)	Cumulative % 2010
Evansville, IN	10,449	10,443	20
Nashville, TN	8,437	8,432	16
Louisville, KY	7,356	7,352	14
Baton Rouge, LA	5,619	5,613	11
New Orleans, LA	5,409	5,406	11
Charleston, WV	3,540	3,538	7
Lafayette, LA	3,382	3,380	7
Cincinnati, OH	2,868	2,866	6
Memphis, OH	2,371	2,370	5
Columbus, OH	1,733	1,732	3
Coal Sub-total (Top 10)	51,164	51,132	88

Source: Transearch, 2010

As most of these trips begin in the St. Louis economic area, this data asserts the importance of the Ohio River system as a key portion of the coal supply chain. While carrying a minority of coal volumes nationwide, barges are the most economic means of transporting this bulk commodity to regions served by navigable waterways.

Many of the decisions shaping the coal supply chain are the effect of environmental regulations such as the Clean Air Act Amendment of 1990. Powder River Basin coal has been the most economic to mine and transport since that time, as its lower sulfur content means affordable compliance with the Act. However, the increasing presence of scrubbers at power generation sites may correlate with a future in which the higher heat content of eastern coal positions product mined in these regions as more competitive, especially where extraction costs are lower. As transportation costs constitute a significant portion of the total delivery price of coal, and have a large impact upon the cost of electricity, the combined effect of these changes will be substantial. Because 90 percent of coal is used to generate electricity, future regulatory actions in domestic energy policy will be the predominant drivers of change in this supply chain.

Grain

Illinois was the origin point for 19 million tons of grain in 2010. Demonstrating the strong export orientation of the Illinois grain market, only 289,000 tons of grains were shipped inbound to Illinois in 2010, posting an outbound-inbound ratio of 65-to-1. This outbound orientation will only

strengthen as 2040 approaches, as the FAF forecasts inbound grain shipments to hold constant, while outbound volumes will increase by 39 percent, to 26 million outbound tons of grain that year.

Lake traffic in this outbound commodity flow is not substantial, and with Memphis, Baton Rouge, and New Orleans receiving 95 percent of these outbound shipments in 2010, the Mississippi River is the primary trade lane. A supermajority (76 percent, 14 million tons) of the grain was destined for New Orleans in 2010, with Baton Rouge taking an additional three million tons that year (17 percent of Illinois outbound grain). New Orleans and Baton Rouge are large destinations for bulk staple commodities, both for processing and transfer to ocean-going vessels, which can travel no farther upriver than Baton Rouge.

The BEA economic areas served by the Tennessee-Tombigbee River system (Huntsville, Mobile, and Birmingham, Alabama; Jackson, Mississippi and Paducah, Kentucky) received three percent (570,000 tons) of outbound grain shipments in 2010. Traffic to BEA economic areas served by the Ohio River was also minor (3,700 tons). Table 2.21 shows the top ten destinations of Illinois grain in 2010, and predicted tonnage for 2040.

Table 2.21: Outbound Grain by Destination, 2010 and 2040

BEA Economic Area	2010 ('000)	2040 ('000)	Cumulative % 2010
New Orleans, LA	14,343	19,937	76
Baton Rouge, LA	3,276	4,554	93
Memphis, TN	540	751	96
Huntsville, AL	374	520	98
Jackson, MS	205	285	99
Mobile, AL	52	72	99
Fort Smith, AR	49	68	99
St. Louis, MO	25	35	99
Little Rock, AR	17	24	99
Paducah, KY	13	18	99
Grain Total	18,894	26,263	100

Source: Transearch, 2010

Incremental Growth in Other Commodity Groups, 2010 to 2040

Seven million tons of non-grain agricultural products also travelled outbound on Illinois waterways in 2010 (compared to the 100,000 tons of inbound in that category). The FAF predicts a 62 percent increase in outbound freight movements of this commodity group by 2040. Inbound shipments in 2010 were negligible at 102,000 tons, and the FAF predicts that this volume will increase 78 percent by 2040, totaling 182,000 tons in that year.

Fertilizers or chemicals accounted for 3.5 million inbound tons on Illinois waterways in 2010. The FAF predicts a 50 percent increase in this inbound volume by 2040. Outbound tonnage totaled 2.4 million in this commodity group, with the FAF predicting a 30 percent decrease in outbound tonnage.

The inbound flow for metal products to Illinois demonstrates remarkable volume, at 2.5 million tons in 2010, and is expected to grow 71 percent by 2040, resulting in a significant increase in volume. Outbound flows for this commodity group were smaller in comparison, totaling 195,000 tons in 2010. The FAF predicts that the outbound volumes will decrease by 85 percent by 2040.

The small volume of manufactured or durable goods moved by water in 2010 (less than 90,000 tons) is expected to double by 2040.

Commodity Groups Demonstrating Little Change, 2010 to 2040

Outbound tonnage of petroleum refining products totaled 7.2 million tons in 2010, with the FAF predicting this volume to remain stable until 2040. St. Louis (1.3 million tons, 17.6 percent) and New Orleans (1.2 million tons, 16.2 percent) lead the destinations in terms of volume received. Of this trade, 5.1 million tons were moved to BEA economic areas served primarily by the Mississippi River, while 2.1 million tons (29.1 percent) were moved to economic areas served by the Ohio and Tennessee Rivers. Inbound tonnage was smaller in comparison at 1.9 million tons. St. Louis and Chicago claimed 675,000 and 670,000 tons, respectively, to total 70.0 percent of this inbound trade.

Approximately 1.3 million tons of waste or scrap moved outbound from Illinois in 2010. The FAF predicts these outbound volumes will decrease by 16 percent by 2040, however. Inbound scrap flows were smaller in 2010, totaling only 92 thousand tons. The FAF predicts this inbound volume to increase 32 percent to 121 thousand by 2040.

Commodity Groups Demonstrating Volume Decline, 2010 – 2040

The largest absolute decline projected for 2040 is expected in the petroleum or asphalt products group. While 4.5 million outbound tons were carried on Illinois waterways in 2010, the FAF predicts this commodity group will decline substantially (73 percent) by 2040. Inbound volumes (420,000 tons in 2010) are expected to increase 155 percent, though not enough to arrest the diminution of the total carried by water. Most strikingly, intrastate movements within this group (totaling 900,000 in 2010) are expected to decline by 80 percent.

As carried on inland waterways, the prepared foods, tobacco and alcohol group is primarily composed of refined sugar and vegetable oil. River carriers shipped 540,000 outbound tons of these goods in 2010 (compared to 70,000 inbound tons), and the FAF predicts that by 2040, this outbound commodity flow will decrease by 15 percent. However, by 2040, this commodity group's inbound presence on Illinois waterways will increase 115 percent, largely driven by a substantial increase in the volume of alcoholic beverages shipped.

2.5.2.3 Regional Modal Issues for Lakes and Inland Waterways

Freight transportation on inland waterways presents a competitive strength for commodities that do not require time-sensitive, high-visibility transportation. Generic bulk staples such as coal, grain, oil kernels and nuts, with a low value per ton are the most suited for movement by barge. Very few finished, containerized goods move by this mode, due to the length of time required to move goods by water.

Many of these goods require little interaction with other modes other than relatively short truck drayage to waterside (and not always that). Direct connections to rail often are not present in many areas outside of the St. Louis and Chicago regions, and that mode is more apt to compete with water than combine with it. For circumstances where connection may make sense (such as new coal mines seeking access to water), more detailed analysis is required to deduce the costs and benefits of providing more comprehensive linkage to rail assets for potential marine-rail transshipment points.

Water shipping constraints include the nature of the Harbor Maintenance Tax, requiring shippers to pay for the upkeep of the underlying transportation asset that supports waterborne commerce.

While a profoundly economic idea to assess these costs to the principal users of an asset, this practice disadvantages water-based freight activity, vis-à-vis truck shipping which (like private automobile travel) enjoys movement upon a highly subsidized network of roadways and interstates.

Additionally, pilotage requirements and ballast water regulations, though necessary for control of invasive species, are said to make waterborne freight movement less competitive in terms of price. The lock and dam system requires continual upkeep, and times of drought create uncertainty about capacity on primary trade lanes such as the Mississippi. Aside from these factors, there remain few endemic physical capacity constraints in the inland waterway system connections to Illinois.

2.5.3 Rail

Railroads carry one quarter of Illinois freight tonnage and half of the inbound to the State, as Table 2.22 shows. A significant portion of the inbound volume is transferred for onward movement in three ways: by water, as the preceding discussion of waterborne coal traffic indicated; by truck, for short and long distance delivery of trailers and containers on flatcars (called Intermodal traffic in the industry) and of some bulk and break-bulk goods; and by connection to other railroads. Because all of the nation's Class I railroads serve Illinois, and the State is the meeting place of western, eastern, and northern systems, rail-to-rail transfers are common, both on the railway and on local roads between rail yards (so-called "steel wheel" and "rubber tire" interchanges). Thus while rail shipments through the State (shown in the Table) are themselves a large volume, there is additional volume relayed into and beyond the State by a number of means. Some of this appears as outbound traffic by rail and other modes, which in one sense double counts the tonnage, but in another sense signifies a different type of activity.

Table 2.22: Illinois Rail Tons, 2010 (Millions)

Direction	Tons	Percent of Rail	Percent of All Modes
Outbound	126.8	39%	34%
Inbound	178.1	55%	51%
Intrastate	20.3	6%	4%
Total Illinois Based	325.2	100%	26%
Through	122.6		

Source: STB

The Intermodal business in Illinois is exceptionally important. The Transearch database (which attempts to correct for rail-to-rail transfers) identifies 32 million tons of inbound rail as Intermodal, and 44 million tons of outbound, almost all of it handled at Chicago. These volumes respectively represent 20 and 27 percent of *national* intermodal activity, revealing first the concentrated nature of the intermodal network, second the role of the State as a crossroads for the country, and third – because the intermodal system is the workhorse of foreign trade – the crucial contribution of Chicago to global supply chain logistics. The range, frequency, and quality of intermodal service offered at Chicago are unsurpassed and probably unparalleled anywhere in North America. Businesses around the Midwest truck to Chicago to reach this service because it is better than they can obtain locally.

The Illinois State Rail Plan is a comprehensive treatment of the mode that is being issued contemporaneously with this report. The discussion here is therefore brief, but there is one further

point evident in Table 2.22 that is meaningful for overall freight planning. Intrastate rail traffic can be seen to be quite small; this is because railroading is most economical and effective at long distances on dense routes. Even short line railroads, which certainly handle some local (typically bulk) traffic, still interchange the majority of their business with larger railways for longer hauls. This implies that the especially good rail service that Illinois industry enjoys nevertheless is best for certain shipments, and is not a broad substitute for other modes.

2.5.4 Air

Air freight is a small yet vital component of Illinois modal spectrum, most efficiently providing a back-up system for industries in which just-in-time production is the norm. Most of these goods are lightweight and high-value, such as automotive components, supplied to producer and industries that face high inventory costs and thus have a low tolerance for delay. Additionally, the analysis of air freight movements in Illinois documented the present and growing trend of motor vehicle components moving by air as a back-up to support the just-in-time manufacturing philosophy of many automotive manufacturers in the State. However, in absolute terms by weight, the volumes conveyed are now, and are expected to remain, comparatively small next to those of other modes. To place air freight in one perspective, trucks in Illinois annually carry more than 550 times the freight volumes conveyed by air in the State.

Table 2.23 shows the volume of the commodity groups shipped by air in 2010. Cargo transferred between aircraft clearly is an important traffic component at O'Hare International and Chicago/Rockford International, although the FAF freight data this report relies on does not capture it. In line with the truck flow tables, outbound (OB), inbound (IB) and local (Local) are distinguished.

The most important Illinois-based commodity group shipped by air is paper, pulp or allied products, which ranked as the third most important commodity group for truck flows. (Note that paper products do not include mail and express shipments, which the FAF data source does not identify clearly by mode.) Together with the second most important commodity group, motor vehicles (or their components in the case of air), these two commodities make up 52 percent of all Illinois-based shipments by air. Approximately 13 percent of air freight is of mixed or unknown contents, and nine percent are machinery and parts. Printed products, manufactured products and lumber or miscellaneous rubber products make up six or seven percent each. The remaining 13 commodity groups provide a mere seven percent of all Illinois-based commodity flows by air.

Table 2.24 shows commodity flows by air for 2040. Similarly as for trucks, the order of commodities has changed slightly due to different growth assumptions for each commodity group. The first four commodities of 2010 remain the most important commodity groups in 2040. Their total share grows from 73 to 79 percent of all Illinois-based commodity flows by air.

Table 2.23: Illinois-based Tons ('000) Moved by Air, 2010
(Ranked by Total Outbound/Inbound/Local Volume)

Commodity Group	OB	IB	Local	Total	Rank	Cum %	OB % Com	IB % Com	Local % Com	Com % All OB	Com % All IB	Com % All Local	Com % Total
12	69	144	206	419	1	29	16	34	49	26	36	27	29
16	43	93	188	324	2	52	13	29	58	16	23	25	23
20	44	47	95	185	3	65	24	25	51	16	12	12	13
15	30	19	75	125	4	73	24	15	60	11	5	10	9
13	7	37	55	99	5	80	8	37	55	3	9	7	7
11	21	23	48	92	6	87	23	25	53	8	6	6	6
17	25	22	38	85	7	93	30	26	45	9	5	5	6
08	9	5	17	31	8	95	30	15	55	3	1	2	2
06	6	3	12	21	9	96	29	15	57	2	1	2	1
03	4	4	9	17	10	98	22	25	53	1	1	1	1
04	5	1	7	13	11	98	38	7	55	2	0	1	1
18	3	6	4	12	12	99	22	47	31	1	1	0	1
01	1	1	2	4	13	100	17	27	56	0	0	0	0
09	1	0	2	4	14	100	34	9	58	0	0	0	0
05	1	0	2	2	15	100	25	9	66	0	0	0	0
02	0	0	0	0	16	100	21	16	63	0	0	0	0
07	0	0	0	0	17	100	0	0	0	0	0	0	0
10	0	0	0	0	18	100	0	0	0	0	0	0	0
14	0	0	0	0	19	100	0	0	0	0	0	0	0
19	0	0	0	0	20	100	0	0	0	0	0	0	0
Total	**268**	**404**	**761**	**1,433**	**-**	**100**	**19**	**28**	**53**	**100**	**100**	**100**	**100**

Note: Through freight, common at O'Hare International and Chicago/Rockford International, is not accounted for in the FAF.
OB = outbound; IB = inbound; Cum = cumulative; Com = commodity

12: Paper, Pulp, or Allied Products
16: Motor Vehicles
20: Mixed or Unknown Freight
15: Machinery or Parts
13: Printed Products
11: Manufactured Products or Durable Goods
17: Lumber or Miscellaneous Rubber Products
08: Petroleum or Asphalt Products (Except Gasoline)
06: Stone, Ore, or Mineral Products
03: Other Agricultural Products
04: Meat or Seafood
18: Electrical, Scientific, or Medical Equipment
01: Cereal Grains
09: Gasoline
05: Prepared Food, Tobacco, or Alcohol
02: Live Animals, Animal Feed
07: Coal
10: Fertilizers or Chemicals
14: Metal Products (Primary and Fabricated)
19: Waste or Scrap

Table 2.24: Illinois-based Tons ('000) Moved by Air, 2040
(Ranked by Total Outbound/Inbound/Local Volume)

Commodity Group	OB	IB	Local	Total	Rank	Cum %	OB % Com	IB % Com	Local % Com	Com % All OB	Com % All IB	Com % All Local	Com % Total
12	263	511	698	1,472	1	33	18	35	47	33	37	31	33
16	117	325	604	1,047	2	57	11	31	58	15	23	27	24
20	180	217	288	686	3	72	26	32	42	22	16	13	15
15	53	50	187	291	4	79	18	17	65	7	4	8	7
11	60	83	133	276	5	85	22	30	48	7	6	6	6
13	21	100	140	261	6	91	8	38	54	3	7	6	6
17	13	41	53	106	7	93	12	38	50	2	3	2	2
08	29	11	48	88	8	95	33	12	54	4	1	2	2
06	24	8	28	60	9	97	40	13	46	3	1	1	1
03	10	12	23	45	10	98	22	26	52	1	1	1	1
04	27	1	13	41	11	99	65	3	32	3	0	1	1
18	5	20	7	32	12	100	17	61	22	1	1	0	1
01	2	3	5	10	13	100	16	30	54	0	0	0	0
09	2	1	3	5	14	100	37	16	47	0	0	0	0
05	0	1	4	5	15	100	10	17	74	0	0	0	0
02	0	0	0	1	16	100	25	21	54	0	0	0	0
07	0	0	0	0	17	100	0	0	0	0	0	0	0
10	0	0	0	0	18	100	0	0	0	0	0	0	0
14	0	0	0	0	19	100	0	0	0	0	0	0	0
19	0	0	0	0	20	100	0	0	0	0	0	0	0
Total	**807**	**1,384**	**2,235**	**4,426**	**-**	**100**	**18**	**31**	**51**	**100**	**100**	**100**	**100**

OB = outbound; IB = inbound; Cum = cumulative; Com = commodity

12: Paper, Pulp, or Allied Products
16: Motor Vehicles
20: Mixed or Unknown Freight
15: Machinery or Parts
11: Manufactured Products or Durable Goods
13: Printed Products
17: Lumber or Miscellaneous Rubber Products
08: Petroleum or Asphalt Products (Except Gasoline)
06: Stone, Ore, or Mineral Products
03: Other Agricultural Products
04: Meat or Seafood
18: Electrical, Scientific, or Medical Equipment
01: Cereal Grains
09: Gasoline
05: Prepared Food, Tobacco, or Alcohol
02: Live Animals, Animal Feed
07: Coal
10: Fertilizers or Chemicals
14: Metal Products (Primary and Fabricated)
19: Waste or Scrap

2.5.4.1 Commodity Group Details

For the air mode, this analysis ranked commodity movements by volume in 2010 and 2040, noting the commodity groups for which air carried the largest portion of those incremental gains, and documenting the largest drivers of increased mode share for air freight. In total, all commodities moved by air in Illinois represented less than one percent of freight moved in 2010, and will likely remain less than one percent by 2040.

Year 2010 Base

In 2010, 1.4 million tons of freight moved through air cargo facilities in Illinois. This section addresses inbound, outbound, and local sub-totals. Local tonnage amounted to 761,000 tons (53 percent of all air freight) in 2010. Inbound air freight tonnage totaled 404,000 tons (28 percent), and outbound volumes were recorded at 268,000 tons (19 percent).

In terms of commodity flows by inbound/outbound/local orientation, the single largest commodity moved in any direction was the intrastate movement of paper, pulp, and allied products within Illinois at 206,000 tons (49 percent of that commodity in any direction, but 76 percent of all intrastate air tonnage in 2010). Inbound volumes of the same commodity group ranked third at 144,000 tons (34 percent of that commodity movement in Illinois, and 36 percent of all inbound tonnage).

Local movements of automotive components ranked second at 188,000 tons both originating and ending movements in Illinois. This represents 58 percent of automotive components moving by air, and 25 percent of intrastate air tonnage. Finally, local movements of mixed or unknown freight are also a substantial portion of the traffic at 95,000 tons, constituting 51 percent of all mixed or unknown freight moving by air, and 13 percent of all local air freight volumes.

Year 2040 Directional Orientation

Projected for the year 2040, air freight is expected to remain less than one percent of all freight moved in Illinois, growing from 1.4 million tons in 2010 to 4.4 million tons in three decades. Directionally, local traffic will likely still predominate – though to a lesser degree than in 2010 – at 2.2 million tons (50 percent of air freight). Inbound volumes are projected at 1.4 million tons (31 percent) and outbound volumes totaling 807,000 tons that year (18 percent). Inbound air freight volumes in 2040 (31 percent) represent a small increase from the share held in 2010 (28 percent), while outbound volumes (18 percent) are expected to post a small decrease from the 19 percent held in 2010.

The change in the proportion of directional share in the air freight mode can be attributed to a projected 242 percent increase in inbound tonnage, compared to the 208 percent expected for local tonnage and 201 percent expected for outbound. These trends, when coupled with analysis of the types of commodities being moved by air in these years, suggest that Illinois will retain its position as an assembly point for value added components in time-sensitive supply chains.

Commodity Groups Demonstrating Incremental Growth, 2010 to 2040

Air freight in expected to only carry one percent of the commodity growth added between 2010 and 2040, representing a continuation of air freight's modal share claimed today. Of the twenty commodity groups forecast in this freight analysis, the incremental amounts carried by air in 2040 (compared to 2010) constitute one to two percent of the commodity growth in seven groups, with

air freight claiming six percent of the incremental tonnage moved in the motor vehicle component category. With two percent of the additional tonnage in mixed or unknown freight being moved by air, the mode will only claim one percent of the additional tonnage in 2040 in the following commodity groups: manufactured products and durable goods; paper, pulp, or allied products; printed products; lumber or miscellaneous rubber products; and electrical, scientific, or medical equipment.

Absolute increases in the volumes conveyed by the air freight sector are principally driven by two commodity groups: paper, pulp, or allied products and mixed or unknown freight. Together, these two commodity groups constitute an additional 1,554 tons in 2040, or 52 percent of incremental air freight that year. Mixed or unknown freight moved by air is projected to grow by 270 percent, an addition of 500,000 tons in 2040. Paper products by air are expected to increase 252 percent from 2010 to 2040, though it is likely that this will be as part of the packaging supply chain rather than expedited printed matter.

The large growth percentage affects a very small volume of air freight even in 2040, approximately one million additional tons of the 413 million additional tons expected to travel by air that year. To a lesser extent, this is also the case for stone and iron ore products traveling by air. Though expected to increase by 192 percent in three decades, the marginal increment remains negligible at 40,000 tons. The share of meat or seafood by carried by air (at 367,000 tons in 2040) is expected to grow 225 percent in the next three decades, but remain a small, but high-value, commodity volume.

Commodity Groups Demonstrating Little Change, 2010 to 2040

In absolute terms, the volume of goods in every category carried by air in 2010 is expected to post, at minimum, a 25 percent increase in volume carried. Waste or scrap, metals, fertilizers, and coal were not carried in 2010 and are not expected to be in 2040. Commodity groups experiencing the lowest growth rate in tonnage carried by air are lumber or miscellaneous rubber products (26 percent), live animals /animal feed (30 percent), and petroleum refining products (43 percent).

Commodity Groups Demonstrating Volume Decline, 2010 to 2040

Of the commodity groups carried by air in 2010, none is projected to experience a decline in 2040.

2.6 Summary

This chapter describes the existing and forecasted future composition and patterns of freight traffic in Illinois. Its major characteristics and their significance are summarized as follows:

- Illinois freight is a substantial user of all modes. The 1.3 billion tons of freight based in Illinois is five-eighths truck, two-eighths rail, and one-eighth water. Air is small, but significant in value, and is a crucial backstop for supply chain logistics. Modal transfers are important, encompassing not only pick-up and delivery services by truck for rail, water, and air shipping, but also rail relays to water. By 2040, Illinois-based freight will grow by one-third to 1.7 billion tons, with air freight doubling and growing far the fastest, but trucks absorbing four-fifths of the traffic added in the State. This projected 42 percent increase in truck freight tonnage in Illinois has long-term implications for maintaining and enhancing truck routes in the State. The multi-modal and inter-modal character of the Illinois freight system and the powerful position as a hub that it

confers are strengths that must be preserved, while the pressures of growth on this system must be effectively managed.

- Commodities are concentrated. Four groups of mainly bulk products account for half the Illinois-based volume by weight: petroleum products, coal, livestock and feed, and stone and minerals. By product value, five commodities account for 40 percent of the volume: machinery, electronics, pharmaceuticals, motor vehicles and parts, and a mixed class of chiefly manufactured products. The bulk shipping relies on truck, rail, and water in that order; the high value shipping relies on truck and air. The significance is that different parts of the modal system serve different industries, and assurance of transportation performance for a relative handful of industries will support a large portion of activity. These different modal freight markets must be monitored to better understand future industry needs.

- Directional patterns in round numbers are 30 percent outbound, 30 percent inbound, and 40 percent intrastate, with somewhat more tonnage outbound than in. However, patterns are very different by mode. Intrastate volume is almost entirely trucked, while interstate volumes are modally diverse and often imbalanced. Interstate truck tonnage is roughly equal between outbound and inbound flows, yet rail has 40 percent more tonnage inbound than out and air has 50 percent more. For water, the situation is reversed. Six times more waterborne tonnage is outbound than inbound, with over 80 percent of the traffic on the Mississippi, Illinois, and Ohio Rivers and the rest on the Great Lakes. The implication is that in-state and interstate activity require distinct forms of support, and that system demands in some cases are weighted heavily by direction. The Illinois freight traffic by direction (inbound, outbound, or intrastate) must be monitored to better understand modal needs.

- Volume by trading partner (excluding in-state tonnage) is 82 percent domestic and 18 percent foreign, and over one-third is regional trade with neighboring states. However, foreign trade does not always take second place: there is more freight to and from Canada than the U.S. Northeast, and more with Eastern Asia than the U.S. Pacific (although Asian shipping typically moves via the Pacific Coast). The heaviest imports are from Canada, the heaviest exports to Asia, and Canadian tonnage overall is six times bigger than that traded with Mexico. By 2040, the picture changes. Foreign trade climbs to 24 percent of the traffic and captures almost half the growth, with new import tonnage somewhat ahead of new export. Canada and Eastern Asia become bigger than three out of six areas of the U.S., and only regional traffic adds more tonnage. Canada remains larger than Mexico, but by three and a half times instead of six. The meaning of these patterns is that Illinois is a regional, national, and international freight center, the international component rising, and all of these dimensions will require monitoring and support to retain and expand upon our global freight traffic position.

- Differences in the use of the roadway network matter to investment decisions, and Illinois roads are used differently in two key ways: first by through trucks versus trucks carrying Illinois-based freight, and second by sectors of industry. The east-west highways I-70 and I-80 are prominent routes for through freight, but for Illinois traffic I-88 and the north/south routes I-55 and I-57 are more important. Industries mainly serving interstate or in-state markets (for example, machinery versus petroleum products) diverge in the corridors they depend on, and those active in Central Illinois make particular use of I-74, I-155, and I-39. Greater Chicago is a high volume zone for top industries, making its local and radial routes as well as the I-94/90 corridor along

the lake important almost across the board. An extensive network of secondary routes appears less significant by individual segment yet in total reaches much of the industry around the State, underscoring the fact that effective freight service must be door-to-door. The implications of these points are that management and investment in transportation performance to support Illinois industry will not focus on the same roadways facing external demand, the focus will vary with the industry supported and its location in the State, and secondary roadways cannot be overlooked.

3.0 Freight Trends and Implications

Freight transportation is highly dynamic because it reflects forces across a wide cross section of the economy. This is true at almost any level: the state, its cities and its rural areas, and also the multi-state region, the nation and the world. This chapter examines a series of current trends affecting Illinois business and industry, the freight transportation sector that serves them and the population they support and supply. The sectors affected by these trends range from shipping of bulk commodities like coal and grain, to industrial production, distribution of goods and changes in freight carriage systems. Important themes that appear in many of them are the costs of production and delivery, service to market, and risk.

The chapter begins with an overview of potential market trends and implications for the State, and then discusses each in detail. The potentially significant trends affecting bulk goods are presented first, followed by ramifications of Panama Canal expansion, which touches bulk shipping as well as goods shipped in containers. Potential trends affecting manufactured products follow, including sourcing and distribution shifts, and presentation concludes with general changes in freight carriage.

3.1 Overview of Trends and Implications

Coal Trends: Illinois' coal output is concentrated in ten counties along or near the Mississippi and Wabash Rivers in Southern Illinois, with other significant coal reserves that could be developed. If Illinois coal production is increased over the next decade or longer for shipment to neighboring states for consumption by utilities, or for export down the Mississippi River, then the capacity of connecting highway, truck, rail and barge services may need to be improved to handle this volume. This would also be the case for new coal mining, exploiting the lower cost of extraction in locations that have not previously handled such traffic.

Grain Trends: Total U.S. corn production is forecast to increase 24 percent by 2021, and corn exports by 32 percent according to USDA. Total U.S. soybean production is projected to grow a more modest 8 percent by 2021, and soybean exports only 6 percent. Assuming production and export growth in line with projections for the U.S. as a whole, then Illinois could experience significant growth in corn shipments, both domestic and exports, and minor growth in soybeans. Water and rail represent the largest outbound freight tonnage modes for cereal grains and would requiring improved capacity and connections.

Panama Canal Expansion could affect three types of Illinois freight traffic: containerized cargo, and exports of coal and grain. Illinois and the City of Chicago have been the crossroads and exchange point of the Class I railroads for moving containerized goods from West Coast ports to Ohio and points east. If the expansion of the Panama Canal tips some cargo to the East Coast this will tend to incrementally lessen the volume of rail traffic moving through the State from the west and reduce pressure on Chicago exchanges of containers. Growth at the CSX Northwest Ohio freight hub depends in part on routing rail traffic around Chicago, and its success could tend to minimize container volumes being shifted to East Coast ports.

- *Coal:* The United States is a marginal supplier in world coal trade, and it is not expected that Illinois coal exports will significantly increase because of lower transportation costs resulting

from the Panama Canal expansion. This is especially unlikely because a) any growth in coal exports is likely to be concentrated in metallurgical rather than steam coal; and b) the use of larger ships through the Canal will also lower transportation costs for competitive coal producing countries such as Colombia. If there is potential for increased coal exports to Asia, it may be in metallurgical coal flowing through Illinois coal terminals on the Mississippi River, where there would be minimal impacts on Illinois transportation.

- *Grain:* The US Army Corps of Engineers (Corps) anticipates that U.S. grain exports will not increase significantly due to the Panama Canal expansion, but that the *routing* of grain exports could be more focused on use of the Mississippi River and other inland waterways. The implications are that grain exports originating from states to the west of Illinois could increase shipments to grain handling terminals for export on the Mississippi River and other inland waterways, rather than by rail through the West Coast. Like coal moving through Illinois, these grain shipments would not be expected to have a significant impact on Illinois transportation. Neither would there be expected impacts for grain produced in Illinois, where shipment down the Mississippi River is already the norm.

On-shoring: Seven manufacturing industries appear likely to return production to the United States from Asia primarily due to narrowing wage differentials and higher transportation costs. The seven range from machinery, electronics, and transportation goods to fabricated metals products, plastics and furniture. These industries account for 36 percent of the value of goods shipped outbound from Illinois today, and half of its top ten outbound commodities ranked by value. There is no guarantee that "on-shoring" will be a boon to Illinois, yet the magnitude of its existing activity in these industries implies a strong base of skills and suppliers, and Illinois' powerful transportation system offers attractive time to market over a large area. Supporting and strengthening those factors could be a path to growth for the State, including for exports to the developed world. Trucks are the dominant freight mode for manufacturing in the State, so trends in these manufacturing areas should be closely monitored. In addition, the State should use its strong manufacturing base and freight system to attract more than its fair share of these growing industries.

Supply Chain Risk: The long-term trend in manufacturing and distribution is to supply systems that are highly responsive to local market conditions with little inventory exposure. Reliance on minimal inventory and the use of the transportation system as warehouse has created acute sensitivity to disruption risks in the transportation system and surrounding environment. For Illinois, this means that its advantages of location and transportation alternatives aid its economic prospects, and are supported by natural factors like a lower incidence of destructive weather events. However, system factors like reduction of transportation risk from deteriorated infrastructure or bottleneck-induced delivery failures will also play a role in supply chain decisions. Management of risks as they affect supply chain performance thus will be an appropriate tool of economic stewardship for the State. The State must continue to invest in maintaining its transportation infrastructure and to reduce bottlenecks.

Change in Distribution: Rising fuel costs, carbon footprint management, and the need to improve market responsiveness are causing redesign of supply chain networks and utilization of larger numbers of distribution centers placed closer to end markets. For Illinois, this can mean a) national distribution from Chicago will be less important than regional distribution; b) facilities may be viable closer to urban centers and so impose less truck VMT; c) network redesign will offer an economic

opportunity to be captured with strong transportation system performance and appropriate facilities and policies. This need for strong transportation system performance will require continued performance monitoring, and effective freight infrastructure investments and policies.

Change in Retail: Competition between brick-and-mortar stores and on-line retailers has induced new strategies that combine storefront convenience with large web selections, along with offers of fast home delivery. Distribution centers (DCs) will be positioned at shorter distances to fulfill the service promise, home delivery should grow even more rapidly, and freight transportation performance will be fundamental to the entire business model. In Illinois, DC location and land use management would benefit from improved alignment with delivery service requirements, and reduction of delivery risks from freight bottlenecks and infrastructure condition would help the new retail systems reach more of the State's consumers. This will required increased coordination with industry, as well as continued focus on the freight transportation system performance.

- *Big Box:* Big box retailers are now moving into central business districts where they have traditionally not operated, using new store designs better suited to the environment. Urban costs of living are apt to benefit from the highly competitive cost structures these stores bring, which to a significant degree are founded on their global logistics systems, and the reliable levels of logistics performance they have been able to achieve in locations less challenging than downtown centers. For Illinois, it will be important to recognize that the realization of cost of living benefits will be connected to this logistics performance, both inside the cities and in the networks that feed them.

Freight Carriage: Significant trends affecting freight carriers are natural gas fuels, the truck driver shortage, and rail intermodal growth.

- *Natural Gas:* Freight vehicles fueled by natural gas (NG) have been active in cites for some time. They now seem poised to transition from niche to mainstream, primarily because of the much lower cost of the fuel, which recently was about half the cost of diesel. For Illinois, three advantages are available from the encouragement of NG conversion and expansion of the fueling network: first as a support to the supply chain costs of Illinois industry, second for attraction of new businesses to the State, and third as an increasingly pragmatic route to air quality improvement. However, some method of taxing NG should be explored if it serves a diesel substitute, in order to maintain investment in the State's freight transportation system.

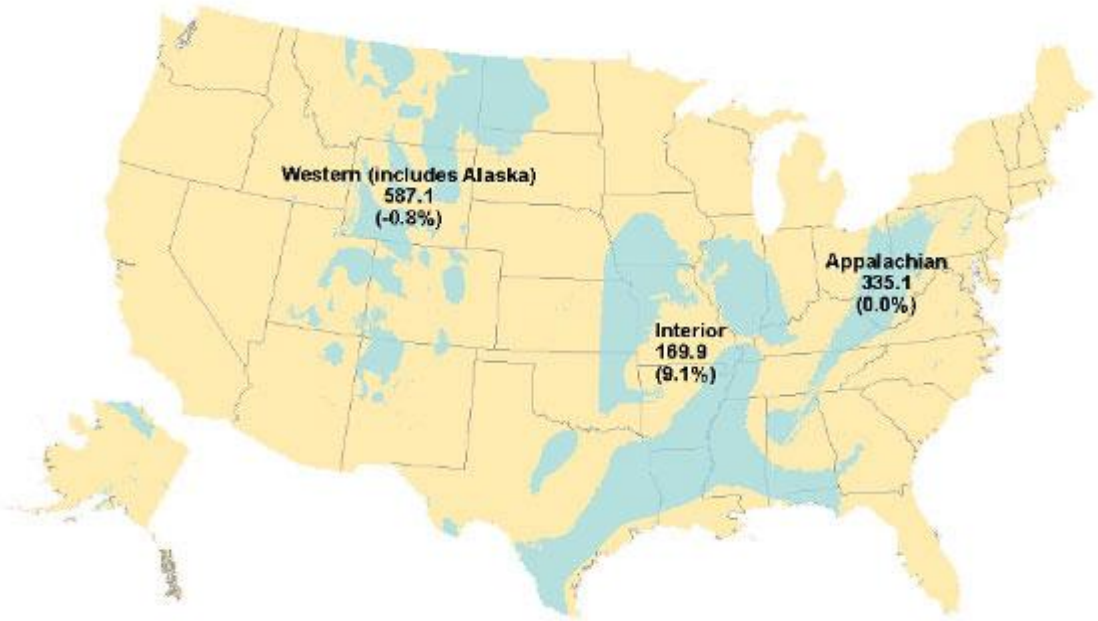
- *Driver Shortage and Intermodal Growth:* A shortage of truck drivers has plagued the freight industry for many years and has reduced its productivity. The problem is getting worse due to a rapidly aging workforce, safety regulations that also tighten the effective supply, and wages. As economic growth strengthens, freight rates could rise and driver wages along with them. One potential solution to driver supply is substitution of rail intermodal for over-the-road trucking, and the industry has seen continuing growth in domestic intermodal and the shortening of distances at which it competes. This will be a private sector decision based largely on cost. This potential trend will require monitoring to support necessary connections.

3.2 Trends in Bulk Commodities

3.2.1 Illinois Coal

Illinois is located in one of the three major coal-producing regions in the U.S. – the Interior region – as defined by the US Energy Information Administration (USEIA), which stretches from Illinois and Iowa south to the Gulf states. Illinois ranked as the eighth largest State in terms of total coal production in 2010 with 33 million short tons, or 3.3 percent of the U.S. total. Wyoming was first with 443 million short tons. Figure 3.1 shows the change in coal production from 2010 to 2011 by the three regions.

Figure 3.1: 2011 Coal Production by Region, Million Short Tons
(Percent Change from 2010)



Source: US Energy Information Administration, Quarterly Coal Report, April 2012

According to the USEIA, the demonstrated reserve base of coal in 2010 was estimated to contain 486 billion short tons. Illinois' estimated reserve base of 104 billion short tons was the second largest of all states, just below Montana, and represents over 20 percent of U.S total reserves.

Coal is one of the principal products that moved both into and out of Illinois. The 85 million metric tons of inbound coal in 2010 was about the same volume as that moved out-of-state with each flow representing nearly a quarter of total freight tons moved in each direction. However, almost all of the inbound tons are transported by rail while outbound tonnage is reported as moving by water, at a rate of 2:1 over rail. As further described, this overall balance shows that a large portion of coal volumes are imported by rail (e.g. from Wyoming and Western states) and then shipped out-of-state via the Mississippi River. This transloading (the transfer from rail to water) is implied if not specifically demonstrated in the freight traffic data: Illinois water originations of coal are double the State's production.

There are two primary flows of coal movement reflected in these aggregate numbers. Most coal produced in Illinois comes from the Illinois Basin in Southern Illinois and is transported within and out-of-state to utilities where it is used for power generation. According to the USEIA data, 33 million tons (about 30 million metric tons) were produced in Illinois compared to approximately 14 million tons moving within the State (excluding water). Data do not support a complete accounting of all these flows, but the in-state flows likely represent in-state production transported to in-state utilities.

In addition coal is transported into the State from the Powder River Basin in Wyoming and from other states and is then moved by water for use in the U.S., but also as part of U.S. international exports. For example, the Union Pacific Railroad (UPRR) serves the Cahokia Marine Services terminal in Sauget, Illinois, across the Mississippi River from the Port of St. Louis, and the Cora Terminal located in Cora (Rockwood), Illinois. Both of these terminals are owned by Kinder Morgan and connect the UPRR rail lines with river barge services operating on the Mississippi River. Together they have storage capacities of 1.5 million tons of coal and provide blending of up to three coals. Figure 3.2 shows the major coal handling ports and docks on the UPRR network.

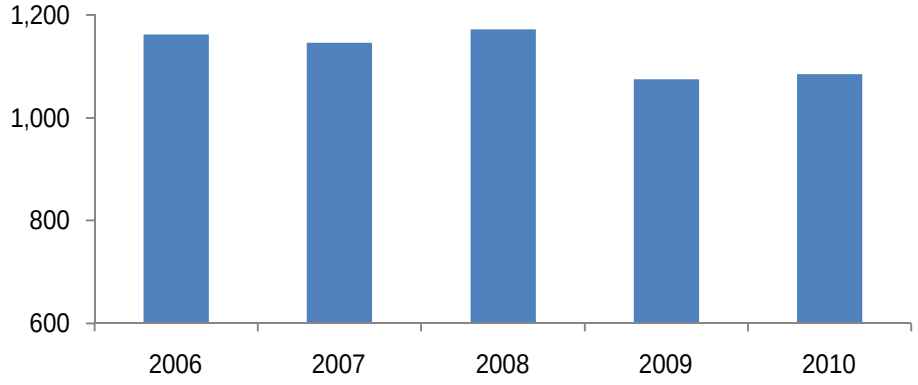
Figure 3.2.: Coal Handling Ports and Docks Served by Union Pacific

Source: Union Pacific Rail Road, www.uprr.com/customers/energy/ports/index.shtml

3.2.1.1 Trends

Data from the USEIA displayed in Figure 3.3 shows that total U.S. coal production increased one percent in 2010 from 2009 levels. This was a decline of about five percent from the 2006 to 2008 levels.

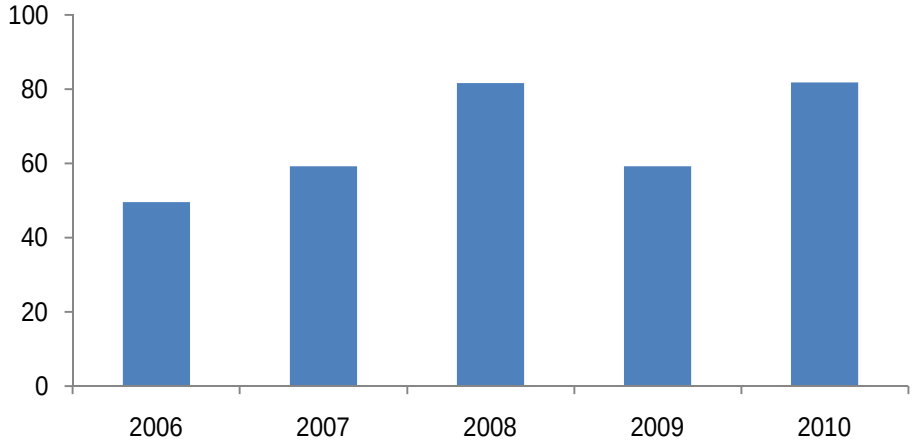
Figure 3.3: Total U.S Coal Production in Millions of Short Tons



Source: USEIA, U.S. Coal Supply and Demand: 2010 Year in Review, June 1, 2011

U.S. coal exports represented about eight percent of U.S. production in 2010 and exports rose sharply for the year. U.S. coal exports totaled 81.7 million short tons, an increase of 22.6 million short tons over 2009 levels. Except for a steep decline in 2009, exports have grown since 2006 as shown in Figure 3.4, with most of the increase occurring in metallurgical coal rather than steam coal.

Figure 3.4: U.S. Coal Exports in Millions of Short Tons



Source: USEIA, U.S. Coal Supply and Demand: 2010 Year in Review, June 1, 2011

For Illinois shipments and for coal that is transported through the State, long-term prospects are for higher growth. Coal production in Illinois headed to utilities could be boosted by the State's lower costs of extraction compared to Appalachian sources, and by the more widespread use by utilities of scrubbing technology to reduce emissions from the relatively high sulfur content of Illinois coal.[11] The long-term outlook for U.S. coal demand is a gradual tapering; this is reflected in the freight forecasts included in this report, which are based on broad trends. However, there is opportunity for Illinois coal shipping to run against that trend, with new mines opening and new transportation services required.

[11] Stifel, Nicolaus & Company, Inc, "U.S. Coal Market: Current Trends and the Potential Impact upon U.S. Railroad Traffic Volumes", March 20, 2012

For coal being transported through Illinois to export markets, volumes could be increased for two reasons. First, difficulties are being experienced in expanding terminal and mainline rail capacity for coal exports out of West Coast ports. Second, expansion of the Panama Canal, which is expected to be completed in 2015, will tend to lower transportation costs through the use of much larger ships, and these lower costs could improve the attractiveness of using Gulf ports to move coal to Asia through the Panama Canal. This could increase use of the Mississippi River as a route for shipment as well as induce more U.S. export volumes.

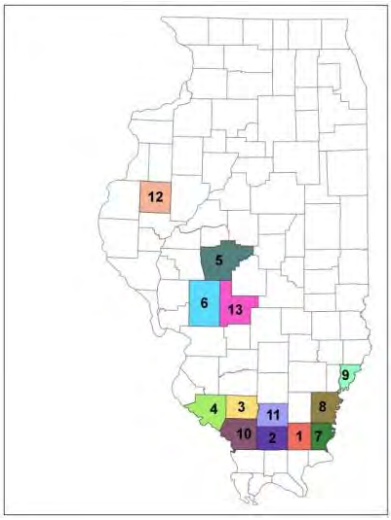
However, taking into account most of these factors, the USEIA concludes in its last International Energy Outlook (September 2011) that the U.S. will remain a marginal supplier in world coal trade:

> *In the short term, low bulk rates and the expansion of the Panama Canal may improve U.S. competitiveness in coal export markets. In addition, sustained high international demand and prices and supply constraints in other coal-exporting countries support expectations of larger U.S. export volumes. On the other hand, new supplies of coal (including additional supplies of coal from Mongolia, Africa, and Australia) and the resolution of transportation bottlenecks in other supply countries could provide substantial increases in international coal supply and, as a result, reduce international coal prices. Thus, in the* IEO2011 *Reference case, the United States remains a marginal supplier in world coal trade despite achieving higher export levels than in the early 2000s.*

3.2.1.2 Regional Implications

Illinois' coal output is concentrated in ten counties that currently produce 98 percent of total output, as shown in Figure 3.5. These counties are largely located along or near the Mississippi and Wabash Rivers in Southern Illinois. There are other significant coal reserves in the Illinois Basin and these could be developed requiring transportation to river and other modes of transport.

Figure 3.5: Illinois Coal Production by County in 2010



County	Tons ('000)	Share of State
1. Saline	10,060	30.3
2. Williamson	5,795	17.4
3. Perry	3,202	9.6
4. Randolph	3,198	9.6
5. Sangamon	2,475	7.4
6. Macoupin	2,338	7.0
7. Gallatin	2,246	6.8
8. White	1,657	5.0
9. Wabash	1,080	3.2
10. Jackson	650	2.0
11. Franklin	324	1.0
12. McDonough	195	0.6
13. Montgomery	21	0.1
Statewide Total	33,241	100.0

If Illinois coal production is increased over the next decade or longer for shipment to neighboring states for consumption by utilities, or for export down the Mississippi River, then the capacity of connecting highway, truck, rail and barge services may need to be improved to handle this volume. This would be the case for new coal mining, exploiting the lower cost of extraction in locations that have not previously handled such traffic. For coal transported into Illinois from Wyoming and

other Western states and then moved by barge down the Mississippi River, transportation impacts are very local (largely limited to rail operations and terminals along the Mississippi River) and impacts are largely related to increased coal volumes handled at and nearby those terminals.

3.2.2 Illinois Grain

Illinois agriculture is a key part of the U.S. agricultural sector, representing 6.4 percent of total U.S. farm income in 2011. Within the State's agricultural sector, corn and soybean production comprise the largest share of total farm output at $11.8 billion out of $15.4 billion in total farm marketings in 2010, according to the Bureau of Economic Analysis. In terms of volumes, corn is the largest crop at 2.0 billion bushels produced in 2010, compared to 0.5 billion bushels of soybeans.

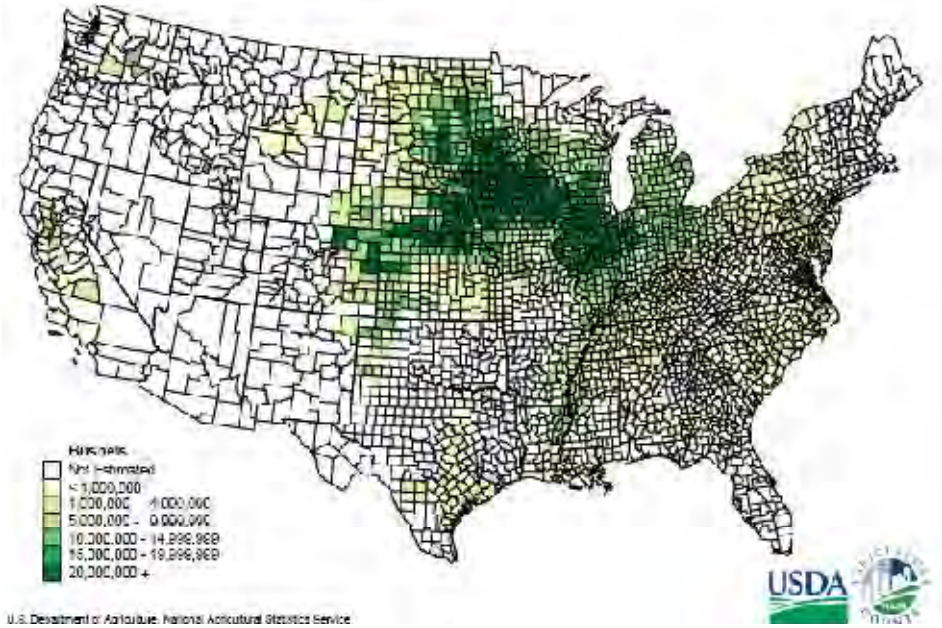
The 34 million tons of grain moving out of Illinois is the second largest commodity group by volume. Grain represented about nine percent of all freight tons moving out from the State. The majority (55 percent) of this volume is transported by water, reflecting the significance of exports carried down the Mississippi River.

Given these measures of the importance of Illinois grain, looking at trends that may influence grain production and shipments is critical, not just in assessing transportation needs, but in considering the potential for State economic growth. Particularly salient is the potential for increasing exports.
In addition to comprising a large part of Illinois agriculture, production of corn and soybeans are an important part of U.S. production and exports of these crops. According to the Illinois Department of Agriculture and the US Department of Agriculture (USDA), Illinois usually ranks as the second largest State in both corn and soybeans.

3.2.2.1 U.S. Corn Producing Regions

Figure 3.6 displays U.S. corn production by county. This shows that Illinois is in the center of the corn producing center of the country, along with Iowa.

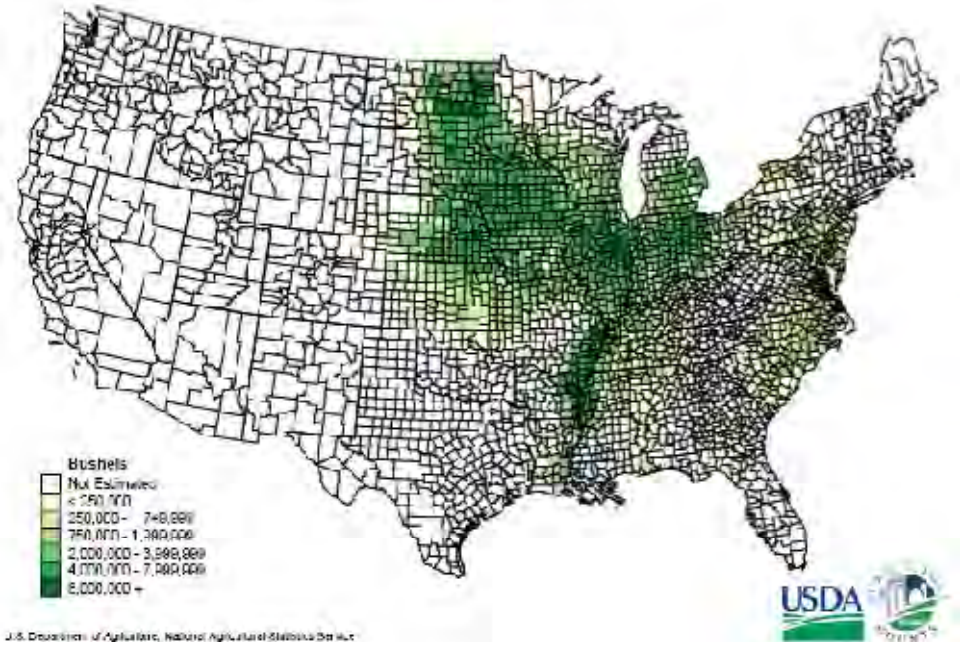
Figure 3.6: Corn for Grain, 2011 Production by County for Selected States



3.2.2.2 U.S. Soybean Producing Regions

Figure 3.7 displays U.S. soybean production by county. Illinois is also in the center of the soybean producing areas of the country.

Figure 3.7: Soybeans, 2011 Production by County for Selected States



3.2.2.3 The Importance of Exports

The U.S. is a major exporter of agricultural products, and corn and soybeans are important components of these exports. According to Census Bureau data, the U.S. exported $14 billion of corn and $18 billion of soybeans in 2011. Over half of the corn was exported to Northeast Asian countries including China, Hong Kong, South Korea Japan and Taiwan. For soybeans, over 70 percent of exports went to these countries. Mexico was the next largest destination for both corn (19 percent of U.S. total exports) and soybeans (nine percent of total exports).

Census Bureau data on State exports records the majority of these exports as originating in Louisiana and the State of Washington, but this clearly represents intermediate locations reflecting the grain storage and transloading facilities near the major Gulf and Pacific Northwest export ports. To reach these port locations, grain may be transported in bulk by railroad, on barge or in containers.

<u>Trends Affecting Production and Exports</u>

Three principal factors may affect the production of, and shipment of grains from Illinois:

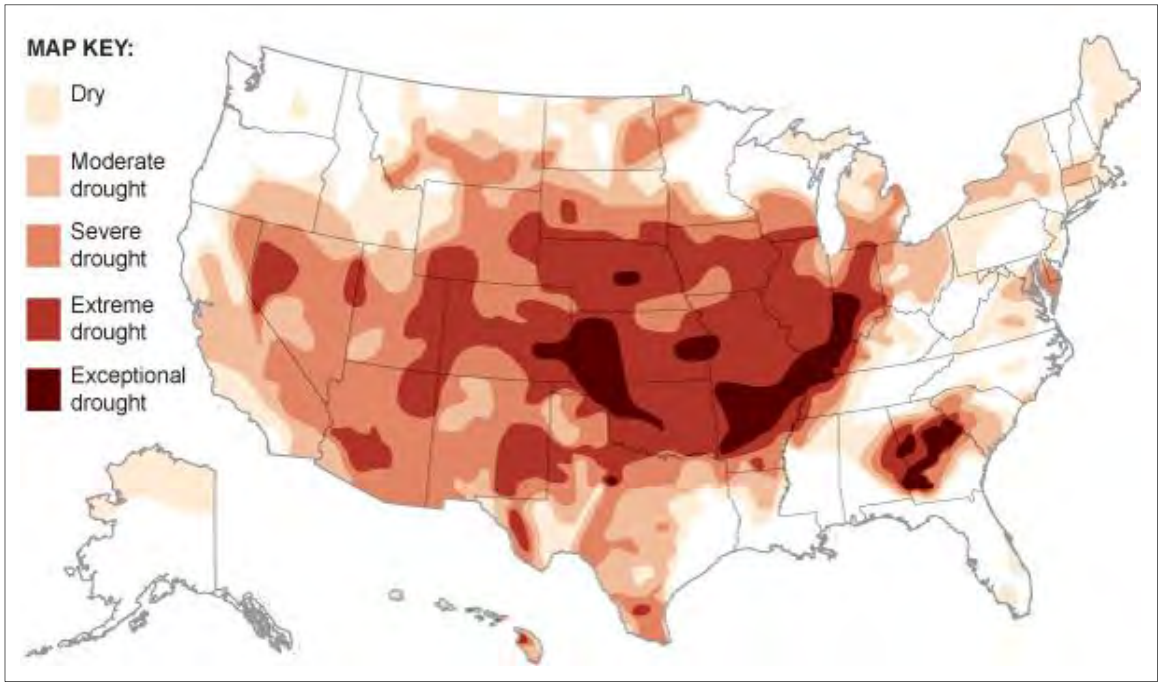
- Potential for longer-term drought conditions
- Projected growth in international grain exports
- Possible changes in transportation economics resulting from the Panama Canal expansion

Potential of Longer-Term Drought Conditions

Drought conditions experienced in the U.S. during 2012 have caused significant damage to crop production across agricultural sectors. According to the USDA Economic Research Service:[12]

- As of late July 2012, 65 percent of farms in the United States were experiencing drought. About 21 percent of farms were in counties where most of the land is under moderate drought; 21 percent of farms were experiencing severe drought; and 23 percent were experiencing extreme or exceptional drought. Figure 3.8 reflects the geographic distribution of drought conditions throughout the nation.

Figure 3.8: National Drought Conditions, July 2012



Source: U.S. Drought Monitor, University of Nebraska-Lincoln Published August 11, 2012 by the New York Times.

- U.S. 2012 corn production is now estimated at 10.8 billion bushels, down from the 12.4 billion bushels harvested in 2011 and down from early-season projections of 14.8 billion.
- A significant amount of soybean acreage is also in the drought-affected region soybean yields are estimated at 36.1 bushels per acre in August, down from forecasts of 43.9 earlier in the year. Soybean yields at this level would be the lowest since 2003.
- In contrast with corn yields, soybean yields typically are more influenced by weather later in the summer, during pod development. However, rainfall this summer and soil moisture conditions have been deficient for sustaining crops up to that time. Thus, the soybean crop's potential may have been stunted more than usual this year by the early moisture deficit.

In considering trends affecting Illinois grain exports, there are two questions concerning the 2012 and future potential droughts. First, is the recent drought an indicator of an emerging trend that will

[12] US Department of Agriculture. http://www.ers.usda.gov/newsroom/us-drought-2012-farm-and-food-impacts.aspx#crop. Accessed September 7, 2012.

depress long-term production of Illinois grains? Second, if droughts are likely to become more prevalent, will they also tend to reduce water flows on the Mississippi and other rivers that are used for transporting grain?

Weather prediction aside, it is clear that an increasing prevalence of droughts would depress grain production in Illinois. If these conditions remain severe enough to affect river levels, as they were in 2012, transportation costs on U.S. rivers could also increase, potentially affecting rail shipping costs, if diverted water volumes made substantial demands on capacity.

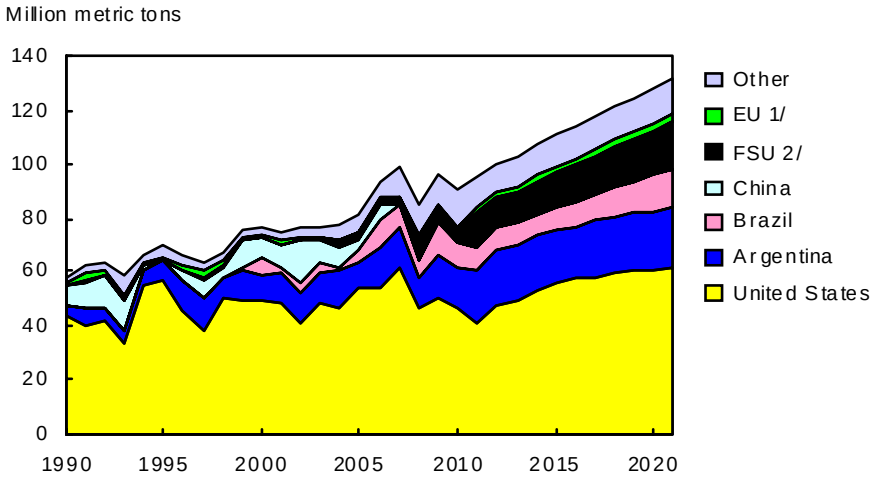
Projected Export Volumes

The following discussion reviews USDA baseline projections for corn and soybean exports. Produced in February 2012, the projections did not account for the 2012 drought.

Corn Exports

The most recent long-term baseline projection for agriculture from the USDA includes an expectation for growing U.S. corn exports, as shown in Figure 3.9.

Figure 3.9: Global Corn Exports, Historical and Projected (1990-2020)



1/ Excludes intra-EU trade.
2/ Former Soviet Union.
Source: USDA Long-term Projections, February 2012

This baseline projection is based in part on the following USDA findings and assumptions:[13]

- Corn is the dominant feed grain traded in international markets. Corn's share of total world coarse grain trade continues to rise slowly and averages 80 percent through the projection period. Barley has the next largest share (13 percent), followed by sorghum (five percent). The trade share of the other coarse grains, mostly oats and rye, continues to decline slowly, to about two percent by 2021.
- Corn's increasing share of world production and trade of coarse grains is attributable to yield growth that is more rapid than for other grains, to new varieties that enable it to be competitive in a wider range of climatic regions, and to its preferred qualities for feed, biofuels and other industrial uses. Worldwide, average corn yields are projected to trend

[13] US Department of Agriculture, *Long-Term Projections*, February 2012

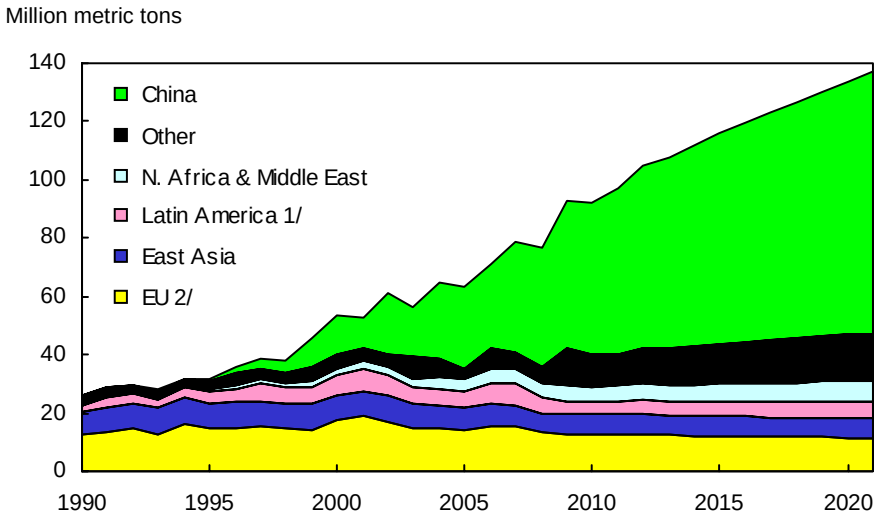
upwards at one percent a year, while barley and sorghum yields both increase less than two-thirds of a percent a year.

- U.S. corn exports are anticipated to rise in response to stronger global demand for feed grains to support growth in meat production. Export gains are particularly strong to China, which accounts for almost half the overall growth in global corn imports. The U.S. remains the world's largest corn exporter, but its share of global corn trade is lower than was once typical, averaging less than 50 percent over the projection period. The decline in share is due in part to larger use of corn for ethanol production in the U.S.

Soybean Exports

Total global soybean trade is projected to increase more rapidly than that of corn, driven by growth in imports from China as shown in Figure 3.10.

Figure 3.10: Global Soybean Imports, Historical and Projected (1990-2020)

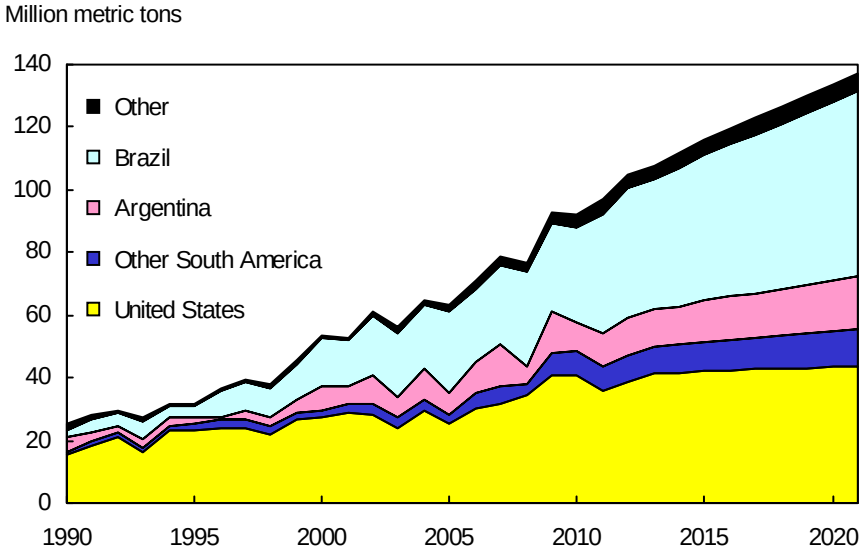


1/ Includes Mexico. 2/ Excludes intra-EU trade.

Source: USDA Long-term Projections, February 2012

While U.S. soybean exports are projected by the USDA to increase over the next decade, Brazil's exports are expected to rise most dramatically, as shown in Figure 3.11. As a result, while U.S. soybean exports are forecast to climb over the period, this growth is not expected to be as much as that of corn exports.

Figure 3.11: Global Soybean Exports, Historical and Projected (1990-2020)



Source: USDA Long-term Projections, February 2012

USDA projections are based on the following assumptions:[14]

- Strong global demand for soybeans, particularly in China, boosts soybean trade over the projection period. Even though U.S. soybean exports are projected to rise, competition from South America leads to a reduction in the U.S. share of global soybean trade from 37 percent in 2011/12 to about 32 percent by 2021/22.
- The three leading soybean exporters – the U.S., Brazil, and Argentina – accounted for slightly more than 90 percent of world trade prior to 2009/10. Since then, exports from Uruguay, Paraguay, Bolivia and other countries have increased – a trend that is expected to continue during the coming decade. However, the share held by the traditional exporters only slips to 87 percent.
- Brazilian soybean exports are projected to rise 18 million tons (43 percent) to 59.2 million tons during the 2012/13 to 2021/22 forecast period, enabling the country to strengthen its position as the world's leading exporter of soybeans and soybean products. As world oilseed prices rise relative to grain prices, soybeans remain more profitable than other crops in most areas of Brazil. With increasing soybean plantings in the Cerrado region and expansion extending into the region defined as the "Amazon Legal," the increase in area planted to soybeans is projected to average about two percent per year during the coming decade.
- Argentina's export tax rates are higher for soybeans than for soybean products, a policy that favors domestic crushing of whole seeds and exporting of the products. In response to world demand for soybeans for crushing, Argentina's exports have risen sharply and are projected to continue doing so, rising about 38 percent to nearly 17 million tons by 2021/22. Most of the soybeans exported by Argentina go to China.
- Other South American countries, principally Uruguay, Paraguay and Bolivia, respond to higher oilseed prices by expanding the area planted to soybeans. Exports by these countries increase 50 percent to nearly 12 million tons.

[14] US Department of Agriculture, ibid.

- Although Ukraine's soybean exports are small, the country is expected to respond to higher international market prices for oilseeds by increasing production of rapeseed and soybeans. Ukraine's soybean exports are projected to rise 40 percent to two million tons by 2021/22.

Summary of U.S. Production and Export Potential

A summary of grain production and exports is as follows:

- Total U.S. corn production is forecast by the USDA to rise from 12,447 million bushels in 2010 to 15,435 million bushels in 2021, an increase of 24 percent.
- From 2010 to 2021, corn exports are projected to increase from 1,835 million bushels to 2,425 million bushels, or 32 percent.
- Total U.S. soybean production is projected to grow more modestly than corn, from 3,239 million bushels in 2010 to 3,610 bushels in 2021, an increase of eight percent.
- Despite large increases in soybean imports, especially into China, U.S. exports are projected to grow only six percent from 2010 to 2021.

Assuming production and export growth in line with USDA projections for the U.S. as a whole, Illinois could experience growth in corn shipments, both domestic and exports.

3.3 Expansion of the Panama Canal

Impending completion of Panama Canal expansion, expected in 2015, has led to widespread anticipation of major shifts in Northeast Asia – U.S. container trade. Expectations are that some shipments will transfer from West Coast ports to U.S. Gulf and East Coast ports, as a result of lowered transportation costs that may result from the use of larger ships that will be able to transit the new Canal locks and channels. Larger container ships will be able to carry about 13,000 twenty-foot equivalent units (TEUs), or 2.5 times more than current "Panamax" vessels, which can handle a maximum of about 5,000 TEUs.

The expanded Panama Canal will also allow passage of larger bulk vessels raising the possibility of lowered transportation costs for bulk commodities such as grain and coal. Such lowered costs could potentially result in changes in the routing of such commodities through the Panama Canal and induce increased U.S. exports due to their increased competitiveness.

There are three questions concerning the impacts of Panama Canal expansion on Illinois that will be answered in the following sections:

- Will Canal expansion shift the flow of containerized goods into and out of Illinois?
- Will expansion lead to shifts in containerized goods flowing through Illinois?
- Will expansion lead to shifts in bulk commodities originating in Illinois or moving through the State?

3.3.1 Factors That May Influence Coastal Shifts

There are a variety of reasons to believe that the expectations for significant shifts in container trade between coasts have been over-estimated. Five principal factors will determine possible coastal shifts:

- Market segments and drivers
- Supply chain network development

- Remaining potential for shifts
- Port readiness and inland infrastructure
- Transportation cost reductions and competition

3.3.1.1 Container Market Segments: Products and Geography

The U.S. import market is large, diverse and highly differentiated in terms of geographic regions and products being imported. Geographic factors and product values are both critical in determining the potential for future shifts in coastal shipment patterns from Northeast Asia.

Concerning geography, no matter what the product, goods destined for U.S. Western and Central regions (as far east as Chicago, Memphis and Dallas) from Northeast Asia will always tend to be moved through West Coast ports because the alternative routes are more costly and take longer.

To illustrate, Figure 3.12 shows the major routes for moving containerized goods to Chicago from Northeast Asia (Shanghai). From Figure 3.12 it can be seen that it takes about 15 days to move a container from Shanghai to Chicago via Pacific Northwest ports. This travel time is faster than a typical 25 days trip through the Panama Canal and East Coast ports (which excludes time in port). This ten day difference could be acceptable to shippers if the costs for shipping were considerably less (e.g. enough to compensate for the inventory carrying costs of the goods being transported).

Figure 3.12: Major Alternative Routes from Shanghai to Chicago

Source: Parsons Brinckerhoff

Comparing rail link distances to Chicago, Pacific Northwest ports (Seattle, Tacoma, Portland) are about 2,400 miles and costs are about $480 per TEU. From the Port of Norfolk (East Coast) to Chicago, the distance is about 1,000 miles with a cost per TEU of about $300.[15] Based only on

[15] These approximate costs are based on data supplied by the railroads to the Federal Railroad Administration and are not actual rates charged, which are negotiated and confidential.

inland rail transportation, the cost for moving a TEU from ports to Chicago is about $180 less through the East Coast.

However, the ocean legs of alternative routes more than make up this cost differential. From Shanghai to Seattle, the sailing distance is 5,000 miles and the cost for moving a TEU is about $640, while the distance to Norfolk via the Panama Canal is 11,000 miles and the cost is about $1,260. Thus, the ocean leg is approximately $620 more via the East Coast, or $440 more than the rail difference.

In summary, it is both faster and less expensive to move Northeast Asian goods to Chicago through U.S. Northwest Coast ports than via the Panama Canal and U.S. ports on the East Coast based on carrier costs.

In addition to geographic considerations affecting transportation costs, higher-value products also tend to be shipped through West Coast ports no matter what their destination in the Eastern U.S. For such products, the value of time associated with longer transit times and the resulting inventory carrying costs tends to outweigh lower transportation costs available from "all water" shipping services. The principal conclusion is that only limited product volumes are contestable by East Coast ports, inland ports and railroads, and this naturally restricts potential coastal shifts.

3.3.1.2 Supply Chain Networks

The second major factor to consider in assessing potential coastal shifts is the influence of supply chain network structures. While the marginal costs of transporting goods have an impact on how supply chains are designed and how goods are shipped to distribution nodes, there are overriding factors that may be far more important. These include flexibility in distributing goods, overall time to market, network redundancy for minimizing risks of disruption, and the strategic location of distribution networks close to end markets.

The development of supply chain networks may be the single biggest factor in determining how the flow of goods shifts over time. The historic growth of the Inland Empire shipping hub located east of the Los Angeles metropolitan area has solidified the position of the Ports of Los Angeles and Long Beach as the principal trade gateway into the U.S. The development of distribution center clusters near Atlanta has likewise been correlated with growth at the Port of Savannah.

Two important points arise out of this understanding. First, marginal changes in transportation costs that could result from Panama Canal expansion may be just a small part of the overall supply chain network cost equation. Second, large complex supply chain networks cannot be easily altered based on transitory fluctuations in transportation costs. Put another way, shifts in shipping patterns may best be explained by how supply chains evolve over time rather than by simple and limited changes in one component of transportation costs.

3.3.1.3 Remaining Potential for Shifts

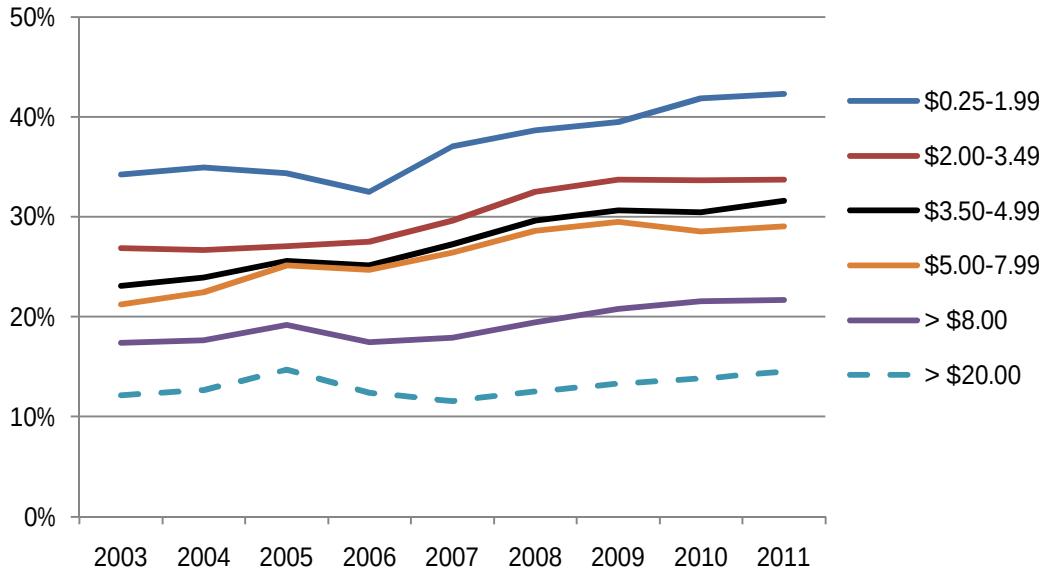
A third factor in assessing potential coastal shifts is how much such shifts have already occurred, and what the remaining potential may be. Figure 3.13 shows Gulf and East Coast shares of Northeast Asia – U.S. container cargo based on 2011 product value, displaying cargo transported via all routes including the Panama and Suez Canals.

Figure 3.13 clearly shows two things:

- Gulf and East Coast shares for lower-value products are consistently greater than shares for higher-value products, with shares of low-value products exceeding 42 percent in 2011 compared to higher-valued products having East Coast percentages at half that share, at about 22 percent.
- Over the past eight years, shifts toward the Gulf and East Coast have occurred across all product value groups, with shares increasing by about one-third from an average of 24 percent in 2003 to 32 percent in 2011

It is not possible to project from the simple historic data whether the shares shown will continue to trend upwards or whether they will flatten out. However, it is important to note that these shifts have already occurred, and that if these trends continue through 2015 the potential for further shifts will necessarily be limited.

Figure 3.13: Gulf and East Coast Shares of Total U.S. Containerized Import Tons from Northeast Asia by Product Value ($/kg)



Source: US Census Bureau, Parsons Brinckerhoff
Note: Solid lines each represent about 20 percent of total containerized tons. Products are categorized based on value per kilogram in 2011 at the four-digit Harmonized System commodity code level. The dashed line represents a subset of the $8.00 and over segment.

3.3.1.4 Port Readiness and Transshipment

While the expanded Panama Canal will allow passage of container ships up to about 13,000 TEU capacity, ships of that size will not be able to call on some U.S. East Coast and most Gulf Coast ports. This is due to limited depths at many ports or, in the case of the Port of New York and New Jersey, due to the current height limitation of the Bayonne Bridge, which restricts access to four out of five of the Port's major container terminals.

It is expected that the U.S. North Atlantic ports of New York and New Jersey, Baltimore and Norfolk have (or will all have within the next few years) channel depths of 50 feet, and that the

Bayonne Bridge deck will be raised as quickly as fast-track permitting and construction will allow. It is therefore anticipated that ports in this coastal region will generally be able to serve much larger ships not long after the Panama Canal expansion is completed.

Looking at current container ship service patterns, it is clear that most liner companies prefer to schedule calls at multiple ports along the U.S. Atlantic Coast, usually calling at one or more North Atlantic ports and one or more South Atlantic ports. However, maintaining this preference while deploying larger ships will become difficult since the largest South Atlantic ports, Savannah and Charleston, are not on the same timetable for handling large ships as North Atlantic ports. Savannah has grown to become the second largest container port on the U.S. East Coast; even so, a final report recommending dredging of the Savannah Harbor and River to 47 feet was only just released in April 2012 by the Corps.

The Port of Charleston is closer to the Atlantic Ocean and has 48 feet of channel depth, but further deepening has not yet been recommended by the Corps. In addition, the Port of Miami is also moving towards a 50-foot depth, but there are questions as to whether it will be able to serve as a gateway port for Northeast Asia imports to Atlanta and the U.S. Southeast due to rail connectivity problems, added overland costs traveling up the Florida peninsula, and capacity concerns.

In short, South Atlantic ports are lagging behind North Atlantic ports in the ability to handle much larger ships, and the critical question is how liner companies will react to these differences. There are three basic options:

1. Deploy the largest ships possible along the Atlantic Coast. That is, maintain current calling patterns, and utilize the "least common denominator" ship size to maintain services to South Atlantic ports.
2. Develop differentiated services using the largest possible ships on dedicated express services to North Atlantic ports, and use smaller ships for South Atlantic port services.
3. Develop services using transshipment at Panamanian or Caribbean ports. This would allow use of the largest ships possible on the longest leg of transpacific services while serving some U.S. ports with feeder services using smaller ships out of the Caribbean/Panamanian transshipment hubs. The drawback is that transshipment always involves extra moves, both dropping off and picking up each container involved. These extra moves translate to extra time and costs, which may or may not be offset by better utilization of larger more expensive vessels.

These options are not mutually exclusive, nor are all shipping companies likely to follow the same strategies. Even within single companies or alliances, these options could be mixed and matched.

3.3.1.5 Cost Reductions and Ultimate Benefits

A fifth major factor that will affect possible coastal shifts is transportation cost savings actually realized by consumers and beneficial cargo owners (BCO). All else being equal, including transit times and reliability, if a transportation option costs less, consumers or cargo owners could prefer the less expensive option.

A transportation cost reduction on the order of $400 per TEU might be possible using the largest 13,000 TEUs container ships versus current Panamax vessels. For $400 per TEU, many BCOs and consumers would likely prefer changed transportation routing even with minor increases in delivery

times. However, the full $400 per TEU cost reduction is not likely to be passed on to the consumer or cargo owner. Given that liner companies have risked billions of dollars on new large ships (and expanding aggregate capacity that may not have very positive returns), they will likely want to retain some of the cost savings they have directly provided.

In addition, the Panama Canal Authority, having taken on the risk of expanding the Panama Canal, not only need to repay the debts it has incurred, but also will want to achieve an additional return on the value of the asset it has developed. Other participants in the transportation network, some of whom have also made significant investments, will also desire to retain some of the transportation cost reductions that they have helped enable. The net result is that some portion of aggregate cost reductions realized will be retained by transportation providers. The magnitude of probable retained savings is difficult to predict, but an assumption of 50 percent is not unreasonable. Based on this assumption, the net cost reductions that would be passed on to consumers and BCOs could approximate $200 per TEU. This is still a savings that could influence shipping route preferences.

3.3.1.6 Relative Cost Reductions

One additional factor to consider is that transportation cost reductions will occur on the West Coast as well as on East Coast routes. Deployment of larger ships is likely on the transpacific route from Asia to the West Coast, especially if growth in Asia-Europe trade does not absorb excess large-ship capacity. In addition, most West Coast ports do not have channel depth or other restrictions faced by U.S. East and Gulf Coast ports and could actually serve ships larger than those able to transit the expanded Panama Canal. Reduced West Coast costs will therefore minimize the relative value of the cost reductions expected on the East Coast. Projecting these relative cost reductions is difficult, but final differences could be on the order of $100 or less per TEU.

Considering that these estimated cost reductions are based on maximum savings (using a 13,000 TEU vessel to the East Coast) and that these maximum savings are not likely to develop quickly, cost savings could be too small to drive significant shifts between coasts for a number of years after the Panama Canal expansion is completed.

3.3.1.7 Competitive Dynamics

A final consideration for looking at the potential for coastal shifts is the misconception that the Panama Canal will compete head-to-head with North American West Coast ports and the rail intermodal system. This competition may be less than imagined, for three reasons.

First, the Panama Canal and West Coast interests have widely different objectives. In particular, West Coast railroads may be more interested in maximizing the return on their significant capital investments than simply competing for market share. While the Panama Canal Authority can be expected to seek the highest possible financial return from its multi-billion dollar investment, its broader interests are in maximizing the economic benefits to Panama, including boosting Panama as a logistics center and as a transshipment hub. Although it is uncertain how these differing objectives may translate into competitive strategies, the expectation that they will compete for market share based on pricing may be incorrect.

Second, for many regions of the U.S. and for particular product groups, the Panama Canal and the West Coast ports (working with the North American intermodal system) do not compete at all. Trade between Northeast Asia and the U.S. Western, Mountain and West Central regions, for

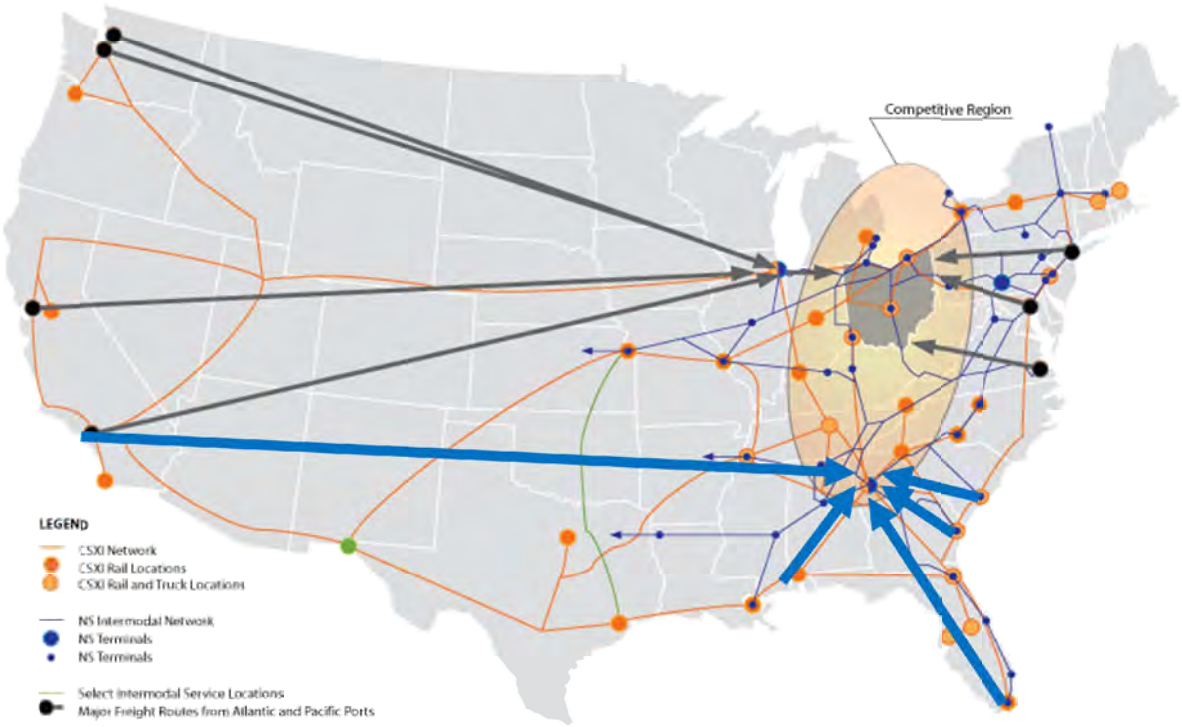
example, will remain natural markets for the West Coast given the advantages in transportation costs and transit times for reaching these markets.

Finally, West Coast transportation interests have vastly more control over how they can segment markets and price services than the Panama Canal. A prime example is that ocean carriers and their railroad partners can differentiate services and pricing on a point-to-point basis while the Panama Canal has no similar market levers to manage. The Panama Canal's primary tool for interacting with the market is tolls that apply relatively simply to all containers independent of contents, origins or destinations, or timing of service. In other words, West Coast interests can price discretely to different markets in ways the Panama Canal cannot.

3.3.1.8 Where Competition Might Occur

It has just been argued that anticipated coastal shifts may be minimal and that competition affecting such shifts may be illusory. If competition does occur, where will impacts most likely be seen? From a geographic perspective, competition between routes can be anticipated to play out in the area highlighted in Figure 3.14.

Figure 3.14: Competitive Regions for Panama Canal Expansion Impacts



In the Midwest, Ohio is at the center of the geographic area that could be affected by such shifts. Competition will most likely be centered in the Ohio River Valley with the principal competition to West Coast routes (including U.S. and Canadian ports and North American Class I railroads) being offered through North Atlantic ports and the improved Eastern rail connections previously discussed.

On the East Coast, the development of the Norfolk Southern Heartland Corridor will improve capacity and connections from the Port of Norfolk, Virginia to the Ohio River Valley and Chicago.

CSX's National Gateway program will also improve connections from Atlantic Coast ports to the Midwest through the development of a hub and spoke system centered in Northwest Ohio. On balance, how much the CSX development will improve East Coast competitiveness is unclear since it will also improve rail connections for freight from the West Coast.

3.3.1.9 Implications for Illinois

The major implication for Illinois is that the State and the City of Chicago in particular have been the crossroads and exchange point of the Class I railroads for moving containerized goods from West Coast ports to Ohio and points east. If the expansion of the Panama Canal tips some cargo to the East Coast this will tend to incrementally lessen the volume of rail traffic moving through the State from the west and reduce pressure on Chicago exchanges of containers.

It should be noted that the successful development of the Northwest Ohio freight hub noted depends in part on routing rail traffic around Chicago, and its success could tend to minimize container volumes being shifted to East Coast ports.

3.3.2 Bulk Cargos: Coal and Grain

By enabling use of larger ships, Panama Canal expansion will also tend to reduce transportation costs for moving bulk goods through the Canal. For Illinois, the impacts would most likely be on commodities exported to Northeast Asia via the Mississippi River, specifically coal and grain.

3.3.2.1 Coal

Based on the USEIA projection for coal exports that "the United States remains a marginal supplier in world coal trade despite achieving higher export levels than in the early 2000s" it is not expected that Illinois coal exports will significantly increase over the foreseeable future as a result of lower transportation costs resulting from the Panama Canal expansion. This is especially unlikely since growth in coal exports has been, and is likely in the future to be, concentrated in metallurgical rather than steam coal. It should be noted that the use of larger ships will also lower transportation costs for competitive coal producing countries such as Colombia. If there is potential for increased coal exports to Asia, it may be in metallurgical coal flowing through Illinois coal terminals on the Mississippi River, where there would be minimal impacts on Illinois transportation.

3.3.2.2 Grain

The impact of the Panama Canal expansion on U.S. grain exports has most recently been studied by the Corps. In its June 2012 report to Congress,[16] the Corps stated:

> *The ability to employ larger bulk vessels could potentially lower the delivery cost of U.S. agricultural exports to Asia. This is not likely to have a significant impact on the mix or quantity of total U.S. agricultural or other commodities exported, but could have a significant impact on the mix or quantity of U.S. agricultural or other commodities moving down the Mississippi River for export at New Orleans.*

The Corps also concluded that the impacts on inland waterways would not be extensive, at least through 2020:

[16] US Army Corps of Engineers, "U.S. Port and Inland Waterways Modernization: Preparing for *Post-Panamax* Vessels", June 2012

The export of agricultural and other bulk commodities depends on the inland waterways. A comparison of the current system capacity with forecast increases in agricultural exports indicates adequate capacity through 2020 and possibly beyond. To take advantage of these export opportunities will require the maintenance of inland waterway capacity that serves these exports. The impact of post-Panamax vessels is not anticipated to necessitate the expansion of inland waterway locks.

In summary, the Corps anticipates that U.S. grain exports will not increase significantly due to the Panama Canal expansion, but that the *routing* of grain exports could be more focused on use of the Mississippi River and other inland waterways. The implications of this are that grain exports originating from states to the west of Illinois could increase shipments to grain handling terminals for export on the Mississippi River and other inland waterways, rather than by rail through the West Coast. Like coal moving through Illinois, these grain shipments would not be expected to have a significant impact on Illinois transportation. Neither would there be expected impacts for grain produced in Illinois, where shipment down the Mississippi River is already the norm. If drought conditions persist, then river capacity may diminish, but the volume of grain to be transported would diminish as well.

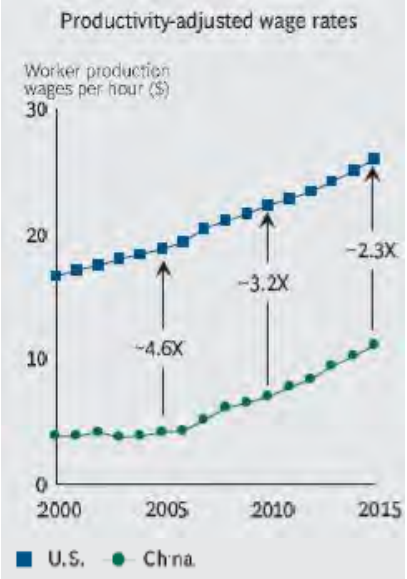
3.4 Near-shoring, On-shoring and Supply Chain Risk

Where goods are produced and how they are brought to market are principal determinants of freight traffic. Today, the trend of transferring American manufacturing activity (off-shoring) to other nations – to Asia, and especially to China – has begun to reverse. The original motivations for transferring manufacturing activity were much lower Asian wage rates, backed by inexpensive transportation; both are changing. The Boston Consulting Group (BCG) reports[17] that increases in Chinese wages and benefits averaged 19 percent annually between 2005 and 2010 versus less than four percent in the U.S., and projects wages to rise 18 percent annually through 2015 for Chinese workers. Adjusted for productivity, the wage advantage of production in China will have been cut in half in that ten-year period. Figure 3.15 shows the historic and forecast differences in wages between American and Chinese workers.

In terms of transportation costs, A McKinsey & Company study[18] published in 2008, when oil prices had reached $100 a barrel, pointed out that fuel costs embedded in shipping equated to an 11 percent tariff on imported goods, triple what it had been in 2000. Now in 2012, oil again hovers around $100 a barrel and diesel fuel costs three times what it did ten years ago. Even allowing for the volatility of fuel prices, the long-term trend evident in Figure 3.16 is of higher costs sustained through recent years. Supply chains serving the U.S. market from overseas production were designed for more affordable transportation; those supply chains managing their carbon footprints find more cause for concern, because greenhouse gas emissions accompany fuel usage.

[17] The Boston Consulting Group, "U.S. Manufacturing Nears the Tipping Point", March 2012.
[18] McKinsey & Company, "Time to Rethink Offshoring?", The McKinsey Quarterly, September 2008.

Figure 3.15: U.S. and China Wage Differential



Source: Boston Consulting Group

Figure 3.16: Diesel Price Trends (1994-2012)

The McKinsey study offered a useful illustration, shown in Figure 3.17, of how the factors of wage and transportation costs come together. It utilized calculations of total landed cost to capture a complete picture of the economics of serving American markets from Asian compared to U.S. sources. Examining a typical imported electronic product over the five-year span from 2003 to 2008, it found that a compelling Asian cost advantage was completely reversed by the combined effect of shrinking wage differentials and rising transport costs.

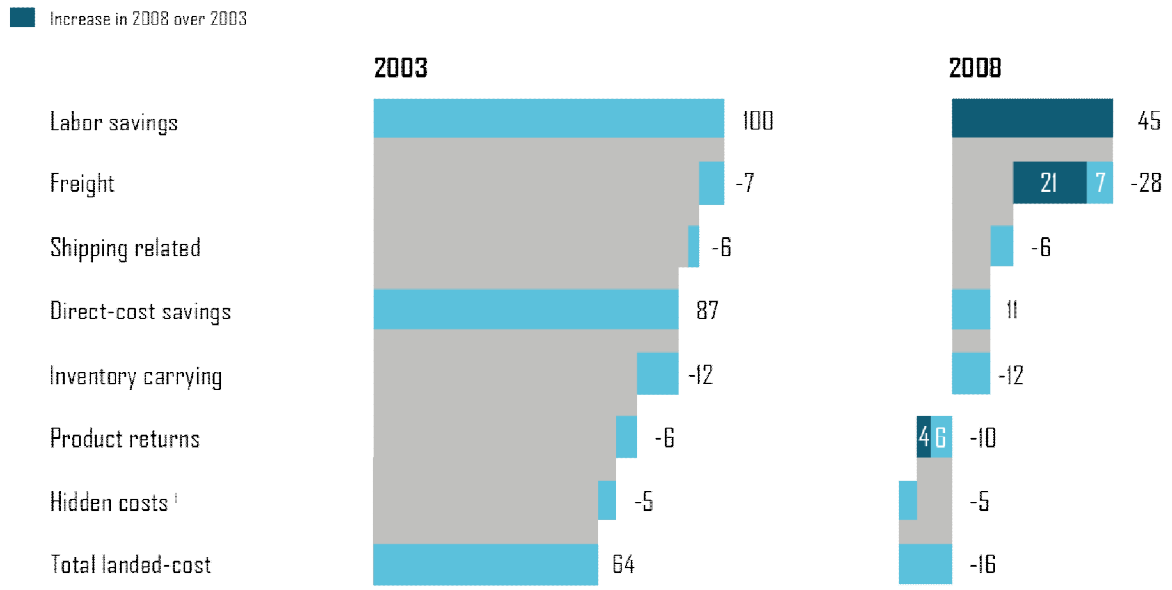
Specifically, the report noted that:

- Labor savings markedly declined because of comparative wage inflation.
- Freight transportation costs markedly grew (chiefly from fuel), and were magnified as a percentage offset to labor savings because those savings became smaller.
- Transportation cost increases also affected product return expenses and created a further offset to labor savings.

Supply chain costs vary substantially by product and labor content, and even favorable landed costs do not make a shift back to North America automatic; it is influenced by labor skills, manufacturing productivity, embedded capital and infrastructure, and other factors that make changes slow or undesirable. Standing against this is the less quantified but meaningful risk of loss of intellectual property and brand protection, due to Chinese practices that do not conform to western standards.[19] The result all in all appears to be that production in Asia is far less competitive than it once was, the critical cost trends are against it, and companies have reason to reconsider location in Mexico ("near-shoring") and the U.S. ("on-shoring").

Figure 3.17: Total Landed Cost Components and Example Savings/Loss

Total landed-cost savings or losses for producing midrange server in Asia instead of United States; index: labor savings in 2003 = $100



[1] Include costs for reworking errors, incremental financing, and exchange-rate risk.
Source: McKinsey & Company

A 2011 study by Alix Partners, LLP[20] surveyed 80 senior executives at manufacturing oriented firms selling to the U.S. market from 15 different industries. More than two out of five respondents (42 percent) reported that their firms either were returning some Asian/Indian operations to the Americas now, or would be within one to three years. The first choice location was Mexico for 63 percent of those respondents, followed by 19 percent favoring the U.S. By contrast, in the BCG report cited previously, three-quarters of the manufacturing re-shored from China in the next ten years are anticipated to come to the U.S. Acknowledging its lower labor costs, improving productivity, and the advantage of free trade, BCG believes the skilled labor supply, infrastructure, supplier networks, and safety risks in Mexico place it behind the U.S., especially for the manufacturing industries most likely to return.

[19] The New York Times, "Entrepreneur's Rival in China: the State" 12/7/11 and "Inflaming Trademark Dispute, Second City in China Halts Sales of the iPad" 2/14/12 are just two recent references.
[20] Reported in "Mexico – The New Low Cost Location for 'Off-shored' Manufacturing?", Stifel, Nicolaus & Company, Inc., July 13, 2011.

Manufacturing of seven sector industries is anticipated to relocate back to the U.S. These seven "tipping point industries" account for almost $200 billion of U.S. imports from China. The seven sectors are:

1. Machinery
2. Computers & Electronics
3. Transportation Goods
4. Fabricated Metal Products
5. Appliances & Electrical Equipment
6. Plastics & Rubber Products
7. Furniture

The BCG report notes that Mexico has a cost advantage for all of these industries, yet asserts that the size and skills of the U.S. labor force, time to market, and security factors will trump them. This is important to Illinois because:

- These seven industries account for 36 percent of the value of goods shipped outbound in the State, according to the 2010 Freight Analysis Framework.
- These industries account for half of the top ten outbound commodities ranked by value.

The BCG report does not conclude that "on-shoring" will be a boon to Illinois or any particular state, and might argue that states with less organized labor (i.e., labor unions) will be favored. Nevertheless, the magnitude of Illinois' existing activity in the seven industries implies a strong base of skills and suppliers, and its powerful transportation system offers attractive time to market over a large area. Supporting and strengthening those factors would then be a path to growth, including for exports to the developed world.

The matter of risk has been touched on in relation to property rights and security, but it is a larger and increasing concern for supply chain management and design. The logistics consultancy Tompkins Associates maintains a benchmarking consortium for over 350 U.S. manufacturers and retail distributers, including leading companies of many types. Top disruption risks affecting supply chain location decisions for these companies appear in the accompanying chart, and include labor, weather, capacity, and systems failures. Moreover, Tompkins reports that attention to risk has heightened, and is moving from a subjective aspect of decision making, to an explicit factor in network design models. Table 3.1 lists the various risks and the consideration that businesses in the report placed on those risks.

Table 3.1: Risk Considerations in Supply Chain Network Decisions

Disruption Category	Not Considered	Considered Subjectively
Labor disruptions at plants or distribution centers	44 %	56 %
Natural disasters at plants or distribution centers	53 %	47 %
Mechanical or systems breakdowns (internal or external)	59 %	41 %
Labor disruptions at ports or carriers	59 %	41 %
Capacity shortages at ports or carriers	61 %	39 %
Natural disasters impacting ports or carriers	79 %	21 %
Political unrest or conflict in sourcing country	86 %	14 %
Political unrest or conflict in destination market	93 %	7 %

Source: Tompkins Associates

Underlying this trend is the long-term movement in manufacturing and distribution industries to supply systems that are highly responsive to discrete market demand, ideally with nothing made that is not sold and nothing held until it is needed. Calling these systems "just-in-time" understates their attempt to be acutely sensitive to local market conditions with little inventory exposure. The Tompkins analysis anecdotally relates that several companies already operating on lean inventories have cut those stocks again in half, creating a potent competitive edge. However, minimal inventories mean that companies rely instead on transportation and information systems connecting them to alert suppliers, and they are vulnerable to disruptions affecting this network. The more they succeed in fine attunement to demand, the more fragile their networks become and the more crucial it is to remove or reduce risk.

For Illinois, this reliance on minimal inventory and the use of the transportation system as warehouse means that the State's advantages of location and transportation alternatives aid its economic prospects, and are supported by natural factors like a lower incidence of destructive weather events. However, system factors like reduction of transportation risk from deteriorated infrastructure or bottleneck-induced delivery failures will also play a role in supply chain decisions. Management of risks as they affect supply chain performance thus becomes an appropriate tool of economic stewardship.

3.5 Change in Distribution and Retail

Redesign of supply chain networks due to suboptimal operation is another development highlighted by the Tompkins benchmarking consortium. Virtually no aspect of any company's network is deemed optimized by the analysis, and most aspects are not deemed close. Table 3.2 reflects the report's assessment of supply chain optimization. A good part of this dissatisfaction can be attributed to the need to adapt to shifting dynamics of the sort described in the previous section. However, such factors play out differently in domestic distribution, and there are additional forces at work.

Table 3.2.: Need for Supply Chain Network Redesign

Operations	Network Optimized	Network Close to Optimum	Not Optimized
Master distribution centers	7 %	52 %	40 %
Regional distribution centers	3 %	40 %	57 %
Inbound consolidation operations	4 %	29 %	67 %
Inland ports	4 %	25 %	71 %
Outbound pool distribution centers	3 %	21 %	76 %
Ocean ports	0 %	23 %	77 %
Transload operations	3 %	17 %	80 %
Product manufacturing operations	0 %	17 %	83 %
Component manufacturing operations	0 %	7 %	93 %

Source: Tompkins Associates

As an example, an effect of rising fuel costs and carbon management is the utilization of larger numbers of distribution centers (DCs) placed closer to end markets, as a means of reducing travel in the most fragmented and least fuel efficient stage of distribution, which is final delivery. This leads to less dependence on centralized distribution from master DCs, and more regionalization. Regional facilities sited close to urban markets face greater land costs, which can be addressed through

buildings with smaller footprints, compensated for by higher ceilings that are reached with automated and robotic inventory handling equipment.

Moreover, improving market responsiveness calls for flexible networks able to adapt to shifting demand, by adding or subtracting facilities relatively rapidly. Consequently, the Tompkins analysis reports a growing preference for leases in existing buildings instead of new, company-owned construction, because they can be made operational one year sooner, on average.

For Illinois, this set of trends could mean:

- National distribution from Chicago will be less important than regional distribution from there or elsewhere.
- Facilities may be viable closer to the urban centers and so impose less built-in truck VMT.
- Economic development may occur through property companies instead of distributers, who would arrive as tenants.
- Network redesign will offer an economic opportunity to be captured with strong transportation system performance and appropriate facilities and policies.

A significant change in the retail sector is the emergence of multi-channel strategies. These are hybrids of e-commerce and storefront retail precipitated in part by the spread of smart phones. The storefront carries a locally selective array of merchandise backed up by a very large and diverse inventory maintained at DCs and accessed on-line. The shopper views goods in the store, but is guided by clerks to find more variety on the retailer's website, using either the clerk's smart phone or the shopper's. The on-line sale can be rung up in the store, with delivery there or directly to the customer's home.

This new retail strategy is partially defensive by traditional retailers against pure on-line sellers, yet it has substantial productivity benefits, first through fast-turning inventory, and second through potentially smaller storefronts devoting almost all square footage to display. The speed and dependability of service from the DC becomes vital, both to replace in-store merchandise and to deliver for customers – and all the more so as on-line sellers like Amazon have begun to offer same day delivery from their own DCs, itself a response to the convenience of in-store shopping.

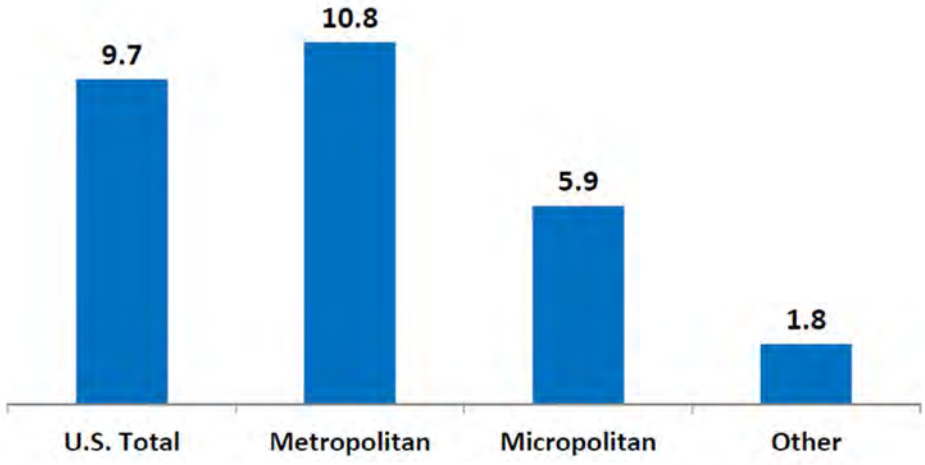
These developments imply that DCs will be positioned at distances able to fulfill the service promise, and freight transportation performance will be fundamental to the entire business model. In addition, home delivery should grow all the faster, replacing passenger vehicle trips with truck trips, and the efficiency with which homes can be accessed will affect the viability of same day services. For this reason, Amazon has begun to experiment with neighborhood drop boxes (not a new idea in itself) as a means to consolidate and accelerate deliveries. Once again, this is a demanding, productive and fragile supply chain system for which transportation risks are critical, and facility sites bear strategic importance.

In Illinois, DC location and land use management would benefit from alignment with delivery service requirements, while diminishment of risks from freight bottlenecks and infrastructure condition would help the productivity benefits of this system reach the State's consumers.

A further trend in retail is the penetration of big box companies into metropolitan centers. Major chains such as Wal-Mart traditionally have not appeared within urban perimeters, both because their

stores required significant building space (footprint) and because of community resistance. However, American population over the last decade grew fastest in metropolitan areas, and as reflected in Figure 3.18, urban growth set the pace for the nation.

Figure 3.18: Population Growth Rates Fastest in Metro Areas



Source: US Census Bureau Census 2000 and 2010 Census data, from a presentation to Transportation Research Board, "Population Trends in the United States". January 2012.

The "big box" chain stores are responding with "city" stores, reconfigured for the urban environment: smaller, with a tailored selection of merchandise deemphasizing volume purchases, avoiding bulky items, and cognizant of the different requirements from one neighborhood to the next. An example is a Target "city" store opened in 2012 in an iconic building on State Street – itself formerly home to a department store from an earlier era. By adapting to the cities – even employing union labor for construction – the chains are making themselves more welcome to communities as well as better suited to their residents.[21]

Urban "city" store in Chicago

Urban costs of living are apt to benefit from the highly competitive cost structures these stores bring, which to a significant degree are founded on their global logistics systems. The stores will be supplied from regional DCs linked to domestic and overseas sources of goods through integrated networks of marine, rail, trucking, and air transport, and will seek the reliable levels of logistics performance they have been able to achieve in locations less challenging than downtown centers. For Illinois, it will be useful to recognize that the realization of cost of living benefits will be connected to this logistics performance, both inside the cites and in the networks that feed them.

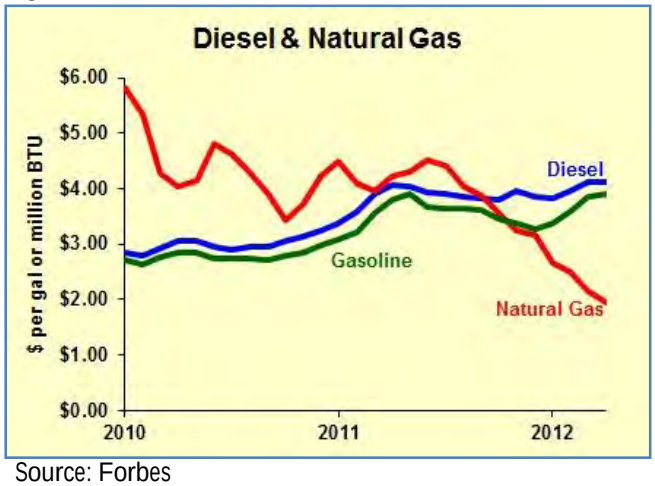
[21] The New York Times, "Retailers' Idea: Think Smaller in Urban Push". July 25, 2012.

3.6 Freight Carriage Trends

3.6.1 Emergence of Natural Gas-Fueled Trucking

Freight vehicles fueled by compressed natural gas have been active in cites for some time, mainly as an experimental or niche application meant to reduce emissions for trucks that return frequently to a home terminal for refueling. Natural gas now seems poised to transition from niche to mainstream, first and foremost because of its much lower cost, which recently was about half the cost of diesel on an equivalent basis.[22] On-highway diesel averaged $3.82 per gallon in the summer of 2012, according to the US Energy Information Administration,[23] versus a diesel-equivalent price point for compressed natural gas of about $1.90 during the same period.[24] Moreover, natural gas prices have been declining while diesel has moved the other way, as Figure 3.19 demonstrates.

Figure 3.19: Natural Gas and Diesel Price Trends



Source: Forbes

Natural gas fueling

The drop in natural gas prices is attributable to the aggressive development of large domestic reserves, made possible by "fracking" (hydraulic fracturing and horizontal drilling) techniques in shale deposits. Prices also are expected to remain low[25] as the market organizes and efficiencies are achieved, suggesting that even the imposition of fuel taxes, which it is currently free of, would not make natural gas unattractive.

Increasing fuel costs have been a pervasive concern for freight carriers and supply chains managers. There were approximately 22,000 heavy duty trucks using natural gas on U.S. roads in 2010, versus more than 700,000 traditional fuel long haul trucks for hire and in private operation.[26] Nevertheless, more than

[22] Because natural gas and diesel are different substances, their costs are commonly compared through their BTU energy content, or converted through BTUs to the energy equivalent of a gallon of diesel.
[23] US Energy Information Administration. www.eia.gov/petroleum/gasdiesel. Accessed September 1, 2012.
[24] Quoted by Cascade Sierra Solutions in a Stifel, Nicolaus & Company, Inc. transcript, "Fuel Efficiency and Alternative Fuels," July 25, 2012.
[25] Cascade Sierra Solutions, ibid.
[26] Bloomberg, "Trucks Run on Natural Gas in Pickens Clean Energy Drive: Freight", February 29, 2012.

half of large truck carriers are considering buying natural gas (NG) fueled trucks, according to a recent survey by Transport Capital Partners and ACT Research.[27] "Considering" does not connote wholesale fleet conversion, but this is a telling finding in a conservative industry, and by some projections, the higher cost of an NG truck in long haul service can be recovered in fuel savings within two years,[28] or about half the typical truck replacement cycle in such fleets. Furthermore, the push for conversion will come not only from carriers seeking operating cost reductions, but also from their customers seeking reductions in supply chain costs. Reflecting this kind of market demand, the major truck manufacturer Navistar expects one out of three trucks it sells to be NG-fueled within just a few years.[29]

The chief restraint on proliferation of NG-powered trucks may be the availability of fueling stations. Trucks returning to a home base daily – as many private fleets do, and common carriers in short haul operations – are able to maintain their own fuel supply, although it is clearly desirable to have sources available away from the base. Trucks with longer or more irregular routes simply need access to natural gas as they have it for diesel, in order to sustain an efficient operation. Natural gas in compressed form (CNG) will support an operating range of 300 to 400 miles for contemporary truck engines; in the denser, liquefied form (LNG, which requires temperatures 260 degrees below zero and equipment to create them), the operating range reaches 500 to 600 miles.[30]

These distances correspond rather well to the daily work shift ranges of regional and long haul fleets, which means that a refueling network has to be extensive but not necessarily ubiquitous for conversions to start. This network has begun to develop, from a literal handful of public facilities supporting the more difficult LNG distribution to several hundred being introduced over the next few years by each of two leading truck stop chains: Pilot Travel Centers and TravelCenters of America.[31] Dual fuel engines able to use NG with diesel back-up are an option while the fueling stations evolve.

The NG fueling network is arising on its own, but MAP-21 legislation allows funding support for these facilities under both the Surface Transportation and Congestion Mitigation and Air Quality (CMAQ) programs. One reason is the air quality benefit of natural gas, offering greatly lower emissions of particulate matter and nitrogen oxide (NOx) compared to diesel, and 20 to 30 percent less carbon.[32] For the management of criteria air pollutants, this is highly favorable; for greenhouse gases the picture is mixed, because methane released in natural gas production and distribution is a potent greenhouse agent, and unless controlled it can more than offset the lower carbon released by NG fuels.[33]

Natural gas can replace diesel in freight modes other than motor carriage, but it is most significant there because of the relative fuel intensity of trucking and its role as the workhorse of logistics, moving the greatest volume and frequently linking other modes to their customers. To the extent

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[27] Truckinginfo, "Carriers Looking at Natural Gas, See Fuel Availability, Equipment Cost as Hurdles" August 22, 2012, truckinginfo.com/news/news-detail.asp?news_id=77805, referenced August 25, 2012.
[28] Bloomberg, ibid.
[29] Wall Street Journal, "Will Truckers Ditch Diesel," May 23, 2012.
[30] Cascade Sierra Solutions, ibid.
[31] Cascade Sierra Solutions, ibid.
[32] Cascade Sierra Solutions, ibid.
[33] Proceedings of the National Academy of Sciences, "Greater Focus Needed on Methane Leakage from Natural Gas Infrastructure", Alvarez et al, 2/13/12

that natural gas reduces fuel expense, it softens the effect of that cost on supply chain redesign, although the softening will be gradual and how substantial remains to be seen. For Illinois, evident advantages are available from the encouragement of NG conversion and expansion of the fueling network: first as a support to the supply chain costs of Illinois industry, second for attraction of new businesses to the State, and third as an increasingly pragmatic route to air quality improvement. However, some method of taxing NG would be necessary if it serves a diesel substitute, to aid investment in the network and to prevent losses in State revenue.

3.6.2 Truck Driver Capacity and Rail Intermodal Growth

Shortages of qualified drivers have afflicted the trucking industry since at least the late 1980s, with 100 percent personnel turnover the norm in long haul fleets, while freight has continued to move. Expectations of a capacity crunch in driver supply need to be approached with that history in mind, yet a confluence of current factors point to future difficulty. Factors include an aging workforce, safety regulations and wages.

The average age of a truck driver is 50 years,[34] and the industry has not done well attracting a new generation for reasons ranging from life style to high insurance rates for young drivers at the age when career choices start to be settled. New federal CSA (Compliance, Safety, Accountability) regulations are trimming marginal drivers from the supply; federal Hours of Service regulations have tightened work time definitions, and MAP-21 calls for electronic duty logs. The net effect is a safer but shrinking labor pool whose standard eleven-hour work shift is a fixed asset. This is causing some in the industry to begin thinking of pricing in terms of rate per hour instead of the prevailing rate per mile,[35] indicating that time factors are catching up with distance as the main determinant of cost. As economic growth strengthens, freight rates should rise and driver wages along with them.

One solution to driver supply that motor carriers and shippers continue to adopt is substitution of rail intermodal service for over-the-road trucking, in lanes where service is available. U.S. intermodal volumes have recorded year-over-year monthly increases for more than two and a half years,[36] and although traffic overall remains somewhat below its 2006 peak, July 2012 set a seasonal record. International container traffic was the great engine of growth prior to the recession, yet in recent years, domestic traffic has been the greater growth contributor.[37] While this picture is muddied by the transloading of international goods into domestic equipment, diversion of U.S. truck volume to rail has been substantial.

An important aspect of this substitution of intermodal for over-the-road trucking is that domestic growth has been occurring in two distinct mileage groups: the over-2,000 mile distances where rail has traditionally excelled, and the 750 to 1,000 mile distances where trucking has been dominant. Figure 3.20 shows this change. These groups tend to correspond as well to Class I railroads operating in the west and east: western railroads have more options for high-mileage business than eastern railroads simply because of the nation's economic geography. With limited system capacity and more revenue per mile to be earned from long hauls, railroads have tended to stay out of the shorter haul market. The dividing line between west and east lies in Illinois.

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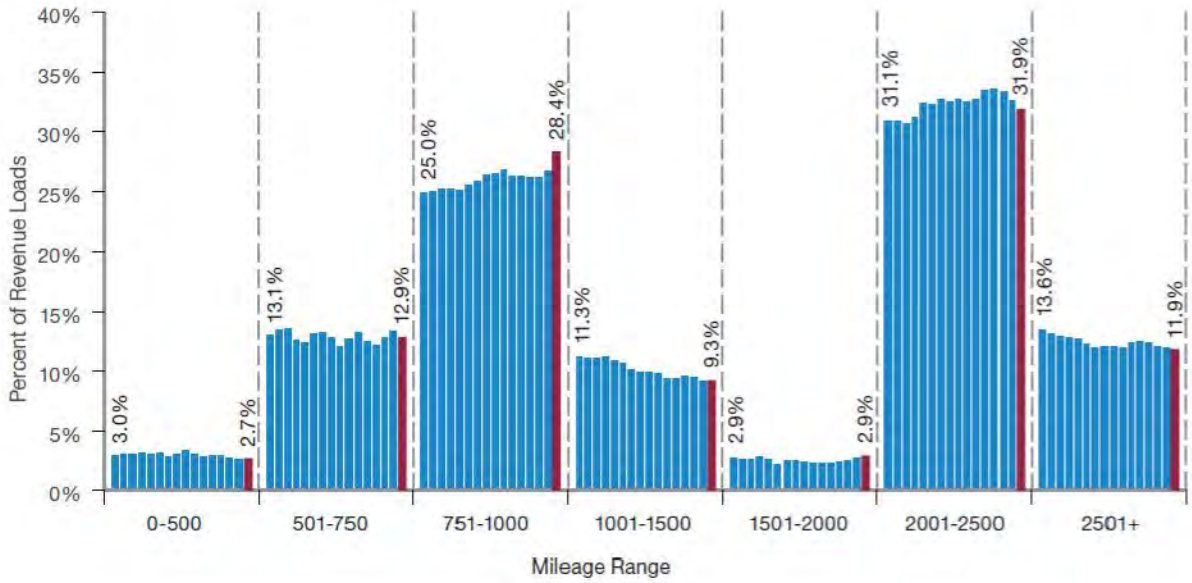
[34] Stifel, Nicolaus & Company, Inc., "Economic Implications of the FMCSA's Regulations on the Trucking Industry", February 8, 2012.
[35] Transport Capital Partners in Stifel, Nicolaus & Company, Inc., "The State of U.S. Truckload Fleets", 8/9/12
[36] Association of American Railroads, "Rail Time Indicators" 8/3/12
[37] Intermodal Association of America, Industry Data & Statistics. www.intermodal.org/statistics_files/index.shtml.

Figure 3.20: Domestic Intermodal Traffic by Distance (Quarterly to mid-2010)



Percentage of domestic revenue intermodal movements by mileage range (rail length of haul)
Sources: IANA ETSO, FTR Analysis

CSX, with its entire track east of the Mississippi River, recently identified 550 miles the distance at which its intermodal services can begin to compete with trucking[38] – in other words, at about the maximum distance a single truck driver can travel in an eleven-hour work shift. Driver supply and high fuel costs explain some of the traffic trend, but the eastern rail system has been transforming in two ways. First, the network capable of handling low-cost double-stack trains has been extending through projects like the NS Heartland and Crescent Corridors and the CSX National Gateway, and second, wide span cranes have been introduced in existing and new intermodal facilities.

The introduction of wide span cranes substantially improve the efficiency and speed with which intermodal containers can be moved between trains, and have enabled the establishment of hubs like that of CSX near Toledo, Ohio, instead of the point-to-point system on which the railways previously relied. The effect has been many more cities becoming connected in intermodal service, and many more opportunities for railroads and their trucking partners to remove freight from the highways. For the railway center that is Illinois, this portends more prospects for modal diversion of intercity trucking, at least in the eastward direction.

[38] Bloomberg Businessweek, "CSX Stacks Boxes Higher for 10% Gain Threatening Trucks," August 16, 2012.

4.0 Summary of Prior Studies

Improvements to the efficiency and cost effectiveness of freight operation in Illinois and the greater region have been proposed and studied in various formats. This section summarizes these reports and notes recurring issues and trends present at the statewide level. Much of Illinois' freight movement takes place in the Chicago metropolitan area, a region with commodity flow volumes that would rank it among the most active ports worldwide, had these goods traveled by ocean carrier rather than truck or rail. The metropolitan St. Louis and Peoria areas are also important freight centers, along the Mississippi and Illinois Rivers. Accordingly, it is not surprising that Chicago, the Illinois portions of metropolitan St. Louis, and the Peoria metropolitan area are the focus of research for many of these studies. However, as these main nodes are the primary locations of modal conflict and operational bottlenecks, addressing inefficiencies in these key regions can deliver improvement to businesses and consumers statewide.

The greatest problem addressed in many of the studies is roadway congestion, cited as a driving factor in the degradation of efficient freight movement operations within Illinois and the surrounding region. FHWA data support these assessments: for truck trips longer than 500 miles, Chicago and northwest Indiana occupy seven of the top 25 truck freight bottlenecks in the United States, as ranked by annual hours of vehicle delay. Congestion costs are not only experienced by shippers and passed on to consumers via high total landed costs for consumables, but also transmitted to local drivers in dense urban areas that find themselves losing increasing amounts of time waiting behind at-grade rail crossings.

While most of these impacts are concentrated in Chicago, the Illinois portion of the St. Louis metropolitan area and the Peoria metropolitan area are forecasted to demonstrate degraded levels of service in the next 15 years, which could substantially hinder the flow of inputs and finished goods in the region. Several means of addressing congestion being considered in these studies include preservation of rail assets for a future in which the mode is more time-competitive to a congested roadway system, a system of dedicated truck lanes in selected interstate highway corridors, intersection grade separation and redesign, and increased investment in intelligent transportation systems (ITS) and transportation management centers (TMCs).

Another means of improving the efficiency of the freight movement network, and hence bolstering the economic competitiveness of the region, are intermodal ports and transfer stations suggested in several studies. The impact of these facilities upon load consolidation and separation of local and long haul loads should be demonstrable in the form of decreased roadway congestion, and sustained use of a rail asset that diverts loads from oversubscribed roadways.

Several key portions of the studies reviewed planning efforts by IDOT and regional MPOs to mitigate conflict between residential and commercial activities and freight movement and associated industrial activities. This has taken the form of localities studying locations of conflict between truck and private automobile congestion, passenger and freight train congestion, relocation of freight-driven impacts away from dense urban cores, and the systemic preservation of industrial and freight related assets (as well as 'greenfield' agro-industrial assets).

The studies also focus upon the means of implementation for designing, building, financing, and operating public freight-supporting facilities. Corridor length improvements such as dedicated truck

lanes and other large investments may involve memoranda of understanding or more formal interstate compacts. At a more local scale, risks may be mitigated and funding secured through public-private partnership. Finally, the role of competing and overlapping jurisdictions is mentioned in several summaries of inland port investment plans, as regionally (rather than geographically) defined port districts face different economies of agglomeration than coastal ports with captive hinterlands.

4.1 Northern Illinois and the Chicago Region

Chicago is the State's dominant freight hub, claiming the overwhelming majority of truck and rail activity in Illinois. Although regional growth has leveled, the strategic location of the rail and intermodal assets in the metropolitan Chicago region retain their national importance.

Maintaining these critical assets means addressing congestion in the freight rail and surface roadway networks. The Chicago Region Environment and Transportation Efficiency (CREATE) program was established as a partnership that includes IDOT, the Class I Railroads, the City of Chicago, and Metra and includes strategies to build grade-separated rail overpasses to expedite movement in the system. Separating roadway and rail modes would also lessen impacts to local traffic, including 'last mile' goods movement. Aside from the redesign of overpasses and more complex signaling, most of the plans for this region focus upon preservation of rail assets for a future in which rail is more cost and time competitive.

New facilities being considered include an additional airport in the south suburbs, whose proximity to a number of freight related businesses in that corridor suggests a strong cargo role, and the proposed Illiana Expressway, which is a proposed limited access east-west highway between I-55 in Will County and I-65 in northwest Indiana. This new facility would allow long haul truck movements to better bypass urban congestion in the northeast Illinois/northwest Indiana metropolitan area.

4.1.1 Chicago Metropolitan Agency for Planning: *Go To 2040*

The Go To 2040 plan highlights the economic impacts of freight transportation in the Chicago region: in northeastern Illinois, four percent of private sector employments and $13 billion in payroll are directly related to transportation and warehousing; 30 percent of the region's private sector employment and $80 billion in payroll is associated with manufacturing, and wholesale and regional trade.

While enjoying the benefits of this trade, Chicago is also the epicenter of the negative impacts of congestion and delay in both its truck and rail network, which encompasses 97 percent of the trade moving through the region. Citing not only the costs to shippers experiencing these delays and greater inventory costs, the plan also considers the impacts on local communities of extended waits behind at-grade rail crossings in light of what is projected to be an increase in both rail and truck traffic.

Six (of seven) Class I railroads have major terminals in Chicago, drawing 500 freight trains per day into northeastern Illinois. The maximization of resources prompts train lengths to expand from 125 to 175 cars, further increasing the prospect of railroad yard congestion and extended demands upon

at-grade crossings with local roads. By 2040, CMAP projects freight volumes (by weight) to increase by 60 percent.

Truck movements, another significant source of congestion on the region's transportation network, are also expected to increase their volume of freight conveyed by 70 percent. Now carrying 2.3 times more tonnage than rail (67 percent of all freight moving through the region), this also portends a large impact upon northeastern Illinois roadways. The plan addresses issues in maintaining the region's economic competitiveness through freight mobility, system preservation of key corridors, and increased safety and environmental benefits.

The CMAP plan offers the key recommendation to develop a national strategy for freight, assisted by federal resources and guidance. Finally, the CMAP plan recommends the ongoing improvement of public policy in such forms as the inclusion of freight asset condition and needs assessments into regional infrastructure prioritization exercises conducted by the public sector.

4.1.2 The Metropolis Freight Plan - Delivering the Goods

This 2004 report by Chicago Metropolis 2020 (now Metropolis Strategies) highlights the increasing amount of congestion associated with the conveyance of freight throughout the metropolitan Chicago region, noting that the negative impacts of that congestion include extended travel and wait times for local motorists and shippers, while also threatening the economic competitiveness of the region. According to the report, roughly 700 passenger trains per day add to the capacity demands of Chicago's rail system, which also conveys 500 freight trains daily. By 2030, the report projects 170 percent growth in the freight rail volumes traveling through Chicago, adding still more congestion to a system in which cars now only move at nine miles per hour. In the same period, the report projects freight truck traffic to increase by 80 percent, an economically beneficial circumstance for the region that does not come without congestion costs.[39]

With much of the rail freight growth in the Chicago region being associated with intermodal service and highly dependent upon trucking and distribution services, roadway congestion issues become directly linked with considerations of rail capacity. Additionally, air freight volumes were projected to double by 2030, and this mode is dependent upon trucking and roadway capacity as well. In this context, there is not yet a regional plan connecting land use, roadway capacity, public transportation, and freight demands.

The plan seeks to retain and build upon the reputation of metropolitan Chicago as the nation's freight capital. Key recommendations can broadly be categorized as:

- organizing government for coordinated action on items of related to freight
- preserving Chicago's freight centers and supporting infrastructure
- creating a more efficient roadway network
- expanding rail freight capacity in the Chicago region

In terms of public policy response to freight, the report recommends the merger and reorientation of several existing agencies with transportation planning responsibility in the metropolitan Chicago region, with dedicated staff available for freight-related projects. The Metropolis Freight Plan

[39] As this report was drafted in 2004, it is important to note that the timetable of this projected growth may need to be reconsidered in light of the economic recession.

proposes the creation of several new inter-jurisdictional freight zones that sit at the intersection of rail, intermodal, and expressway flows, as a way to augment the City of Chicago's efforts to preserve the City's 24 designated industrial corridors for freight.

4.1.3 Illiana Corridor Study and Expressway Feasibility Study

IDOT and the Indiana DOT are studying alternatives for improving regional mobility, reducing local congestion and improving freight movement between I-55 in Illinois and I-65 in Indiana. This area is expected to experience high population and employment growth, resulting in increased roadway traffic volumes to the point of not only delaying passenger travel, but also congesting freight movement in the region. Called the Illiana Corridor, this study analyzes several proposed alternatives designed to address the growth of population and travel demand in Will and Kankakee Counties in Illinois, and Lake County in Indiana. The benefits of this proposed facility include provision of an alternative route to I-90/94, abatement of traffic congestion on I-80 and US 30, allowing trucks to more completely bypass urban congestion, and facilitating access to a proposed airport in the suburbs south of Chicago.

The Illiana Corridor Study and Expressway Feasibility Study and its antecedents have indicated that one of the primary beneficiaries of the project would be users engaging in long-haul freight and passenger trips that originate and end outside of the region. Because Chicago handles as much freight tonnage as any American port, with several large scale intermodal facilities generating substantial freight trips to the corridor, freight is also projected to be an important component of the traffic on the proposed Illiana facility. Following the completion of the three economic and feasibility analyses in 2009 and 2010, the Governors of Illinois and Indiana signed a Memorandum of Agreement that formalized the two states' commitment to planning, building, financing, and operating a 50-mile east-west limited access highway.

4.2 Central Illinois

The tri-county Peoria region is the population center of Central Illinois. Much of the recent investment there has been in the form of capacity expansion to support the growing suburban populations of Tazewell and Woodford Counties, as growth within the city limits of Peoria has stalled. New corridors, such as the Eastern Bypass and Illinois 336 address growing demand outside the central core. In the case of the Eastern Bypass, the facility will redirect long-haul truck traffic away from the moderately congested downtown Peoria area.

The Heart of Illinois Regional Port District encompasses 100 miles of riverfront on the Illinois, and supports a massive flow of staple bulk commodities headed for the Port of New Orleans and international markets. Industrial land-banking is ongoing to take advantage of these locations near river, rail and truck transfer points. Peoria International airport serves a population of 1.5 million people within a 90 minute drive and hosts operations by package delivery firms FedEx, DHL, Emery and UPS. Finally, the rural roadway network of Illinois requires some design changes to respond to the increased bulk and weight of equipment used in industrial-scale agriculture.

4.2.1 Peoria/Pekin Urbanized Area Transportation Study 2010 - 2035 Long Range Transportation Plan

Peoria is the largest city on the Illinois River and a historical link between Lake Michigan, the Mississippi River, and the central and southern United States. Its metropolitan population is the third largest in the State, after Chicago and the Illinois portion of the Saint Louis metropolitan region. The population of the planning area of the Tri-County RPC is counted at approximately 350,000 as of 2010. While population growth in the city limits of Peoria amounted to a mere one percent from 1950 to 2000, the suburban areas of Tazewell and Woodford Counties have demonstrated a cumulative population growth of 68.7 and 66.3 percent in that time, respectively.

Looking forward to 2030, Peoria's population is only forecast to grow 0.5 percent, with Tazewell and Woodford growing 29 percent and 32 percent from their 2000 population bases in that time period. Generally, these trends portend a growth in the urban footprint of metropolitan Peoria, and decreasing population density. Movement to the urban fringe may mean greater vehicle miles traveled for local commutes in the region, with the prospect of accompanying congestion costs and delays for people and goods traveling in the metropolitan area.

The Long Range Transportation Plan (LRTP) is produced and published every five years by the Regional Planning Commission, and delineates the framework of goals maintained by localities within the RPC jurisdiction. The LRTP highlights existing assets moving people and goods, presents a case for future investment in system preservation or new capacity yielding improvements, and supports these claims with a basic financial plan. The Tri-County RPC uses the LRTP to pursue eight strategic goals through transportation investment: supporting economic development and vitality, increasing user safety, increasing user security, widening accessibility options for people and freight, protecting the environment, enhancing connectivity of the transportation system, promoting efficient facility operations, and emphasizing preservation of existing facilities over expansion.

The Peoria metropolitan region is a strategically important shipping hub for bulk commodity flows traveling between the Midwest and the Gulf of Mexico, as well as the site of manufacturing and industrial activity. While the Heart of Illinois Regional Port District was incorporated in 2003 to maximize use of river-based freight assets in the surrounding counties, the primary planning concern of the Tri-County RPC has been addressing the prospect of future congestion in the urban core.

4.3 Southern Illinois

Population centers in Southern Illinois are based in the St. Louis metropolitan area, largely in Madison and St. Clair Counties. This is the second largest population cluster in Illinois, though the population is aging. Congestion impacts are moderate, but have a notable effect upon freight mobility. Domestic hauls predominate over international truck flows by a ratio of 36:1. Planned investments that have the potential to positively impact Southern Illinois include the construction of 800 miles of Dedicated Truck Lanes (called 'DTLs') that would run from the Ohio/West Virginia border to Kansas City, Missouri along the I-70 corridor. The disappearance of TWA as a major hub has diminished the role of air cargo for the region, though ongoing support for MidAmerica St. Louis Airport has yielded some results in attracting new tenants. Monroe and St. Clair Counties would also benefit from system preservation efforts, such as land banking for logistics and intermodal use.

4.3.1 East-West Gateway Council of Governments: Legacy 2035 – Regional Long Range Transportation Plan

This long range planning document identifies regional goals transportation planning goals as asset management and system preservation, economic development, environmental sustainability, aesthetic context for urban design, improved health and safety, and greater integration of land use and transportation planning. Placing these goals within the current economic and demographic context, the plan adapts its strategy to a future for St. Louis marked by slow to moderate population growth, further density losses in the city center, growth in suburban counties, and an aging regional population base.

Relevant to freight movement, the long range plan focuses upon sustaining and developing multimodal capacity in the region by strengthening its highway network, seven Class I railroads and supporting short lines, pipelines, two cargo airports, major river ports on the Missouri and Mississippi Rivers, and intermodal terminals. As a mode, trucking has conveyed the majority of the St. Louis BEA's freight by value and tonnage, though truck movements in the region carry domestic shipments over international cargo at a 36:1 ratio as of 2005. Major domestic destinations are local: Illinois, Missouri and Kansas (with Texas and Louisiana playing a smaller role). Major international routes are to Detroit, Los Angeles, Canada via I-29, and Laredo, Texas.

In terms of roadway congestion, the long range plan identifies the metropolitan St. Louis region as ranking 26th nationally, with an average congestion delay of 36 hours per year per road user (compared to Los Angeles at 93 hours per year, San Francisco at 73 hours, and Washington, D.C. at 67 hours). This regional ranking, combined with the low congestion impacts documented in the three Illinois counties represented by the MPO, suggest low demand for capacity creation and a justified focus on system preservation. Regionally, congestion delays are concentrated in St. Louis County, Missouri. Local roadway congestion impacts in Illinois vary within the region, and what little is documented in Illinois is concentrated in northeastern St. Clair County. With the exception of temporary impacts caused by construction projects, no severe congestion is documented in the Illinois portion of the MPO area.

Projects are ranked by the MPO according to beneficial impacts, in six priority areas: preservation, safety, congestion, access to opportunity, sustainable development, and goods movement. The current TIP, covering FY 2012 to FY 2015, has no goods movement projects in queue for Illinois, though some projects are intended to mitigate general roadway congestion. These Illinois congestion-related projects include enhancements to IL 3 in Monroe County, IL 158 Gateway Connector: I-255 to I-55/70/US 40, and a new four-lane road at IL 3 from River Park to St. Clair Avenue. Additionally, several transit marketing and paratransit improvement efforts are categorized as addressing roadway congestion.

5.0 Performance and Strategy

The freight industry in Illinois relies heavily on the State's robust highway network to move goods within, into, out of and through the State. While a significant portion of the State's highway freight activity occurs within or through the greater metropolitan Chicago region, the State also serves significant highway freight traffic near urban centers in Peoria and Springfield, as well as national traffic associated with St. Louis, Indianapolis, and Louisville. This mix of highway freight traffic is illustrated in the numerous datasets reviewed to determine where the most significant safety, reliability, or emissions-related deficiencies currently exist or may exist in the future.

This section includes a review of existing and future truck volumes with respect to safety, system reliability, and air quality. These discussions are followed by a set of strategies aimed at mitigating identified safety, reliability, or air quality issues, as well as strategies that will raise performance, encourage industry, and proactively measure and minimize future impacts to the freight network.

Highway freight-focused safety analyses indicate locations where truck crash clusters and/or rollover locations may impact the goods movement industry, either directly via a crash risk or indirectly via nonrecurring congestion associated with crash incidents. Given the level of truck volumes in the Chicago region, it is not surprising that the highest levels of truck crash incidence are found along major truck routes in and around the city. Continuing attention is warranted in areas of known concern, and in locations where rising volumes could create new pressures.

The service reliability section provides insight on the impact that increased freight volumes may have on the statewide freight network, most notably at locations where existing or future congestion levels are highest or at locations where bottlenecks are readily apparent. This features a review of volumes for commodities most critical to Illinois or most sensitive to changes in the transportation network. This includes the identification of locations where structurally deficient bridges could restrict the movement of the heaviest freight loads. Investment and management in roadways important to critical industry and subject to performance risk is a key way to heighten their competitiveness, capitalize on growth opportunities, and build the economy of the State.

Air quality can be affected by freight in areas where congestion is highest, as evident in the two non-attainment areas in Illinois. Projected increases in truck volumes in these areas and the potential for those increases to be offset by improvements in green technologies, including alternative fuels like compressed or liquefied natural gas are reviewed. Because the viability of natural gas as a freight fuel appears to be gaining, possibly offering economic as well as environmental advantages, support for expansion should be considered.

Three overarching strategies will help the State prepare for the future, capitalize on its strengths and opportunities, expand on the global stage, respond to new federal MAP-21 legislation, and build prosperity for its businesses and citizens:

- First, implement freight performance measures, so that the quality of performance can be known and enriched, and ultimately employed as a competitive advantage. The information from this Freight Mobility Plan will aid in the determination of specific freight performance measures.

- Second, enhance knowledge of industry transportation needs, so that responsive policies and investments can be implemented in the long term interest of the Illinois economy and jobs. Public-private coordination should be encouraged to ensure efficient freight system operation.

- Third, expand freight multimodal planning, in order to enjoy the benefits of every mode, improve their connection, and sustain the State's position as the primary freight hub of the United States. This will need to occur both at the State and local level, as well as expanded coordination with neighboring states and other major economic regions where Illinois freight moves.

For orientation to the freight performance dynamics set forth next in this chapter, 2010 and 2040 daily truck volumes[40] are illustrated in Figures 5.1 and 5.2, while daily truck volume growth is included in Figure 5.3. A review of 2010 daily truck volumes illustrates the most critical roadways for the logistics industry. While the heaviest truck volumes are evident in the Chicago region, including I-80, I-90 and I-94, downstate locations where two interstate highways run concurrently carry large freight volumes as well, including I-55/70 (East St. Louis), I-57/70 (Effingham), I-55/72 (Springfield), and I-57/64 (Mt. Vernon). The 2040 data exhibits a similar phenomenon, but also illustrates significant growth along I-70 between Indianapolis and St. Louis and the increasing importance of I-57 between I-24 and I-64, where no major parallel roadway exists.

[40] Daily truck volume data is derived from the Parsons Brinckerhoff Truck Model, based on FAF 3.2, and is limited to primary routes statewide.

Figure 5.1: 2010 Daily Truck Flows

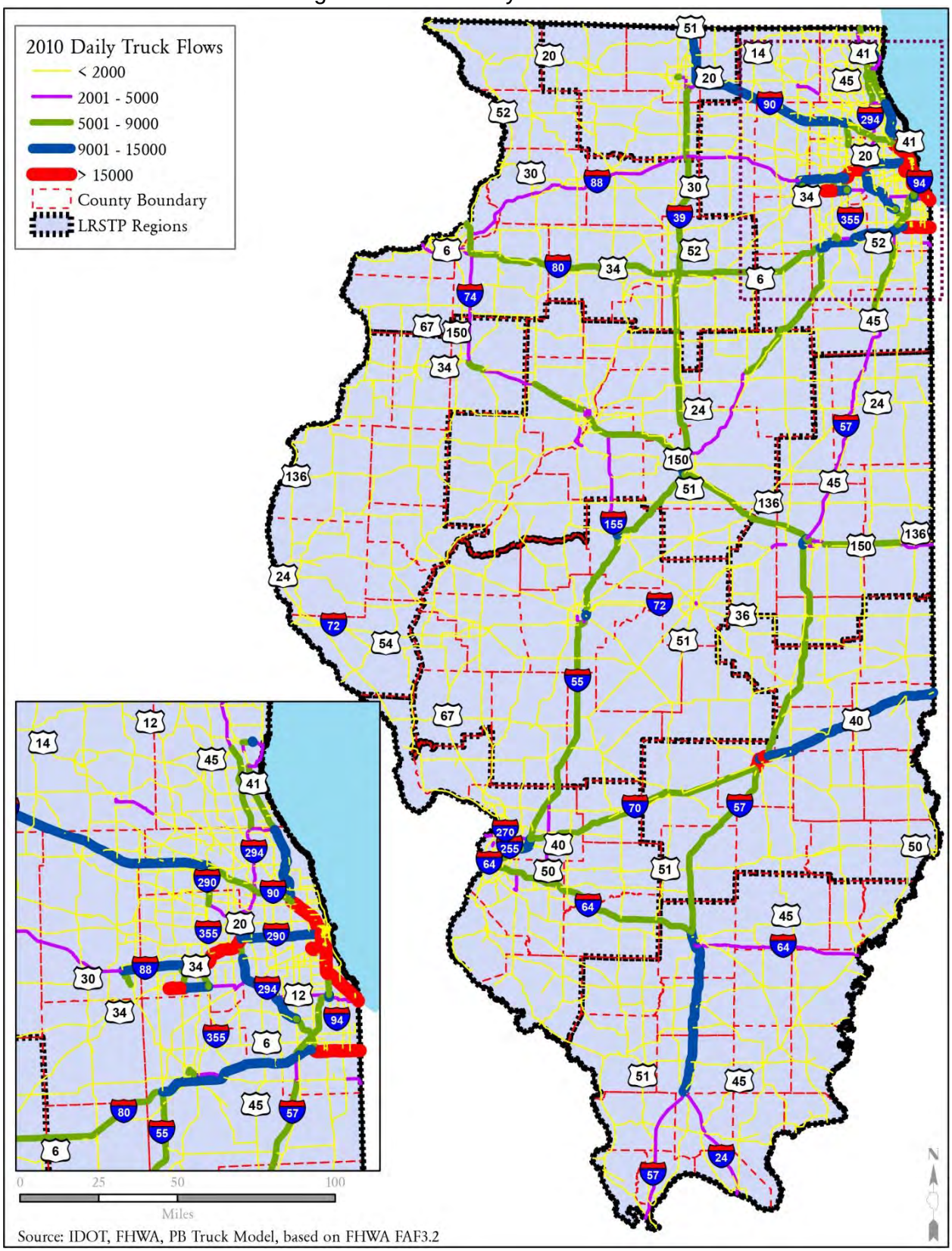


Figure 5.2: 2040 Daily Truck Flows

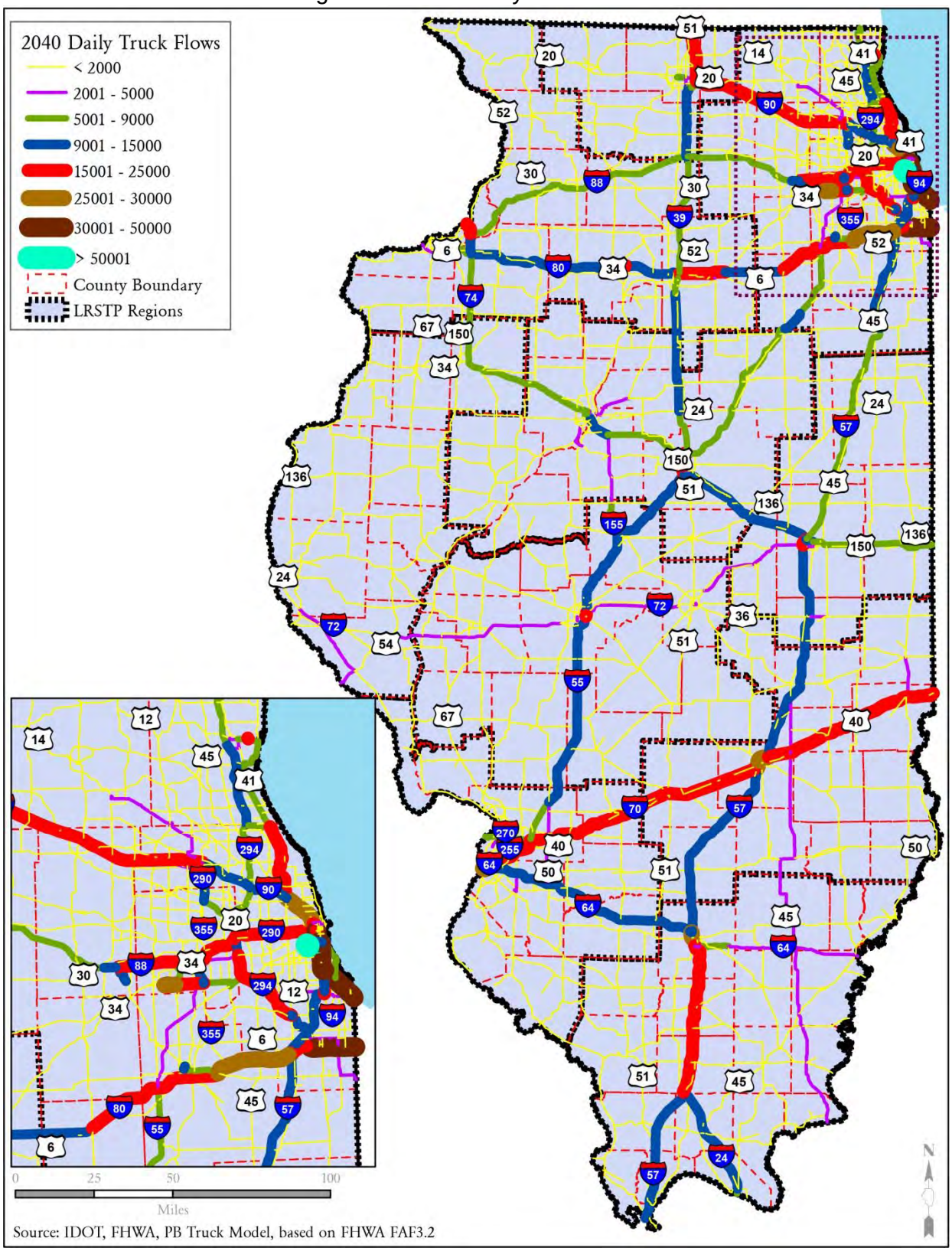
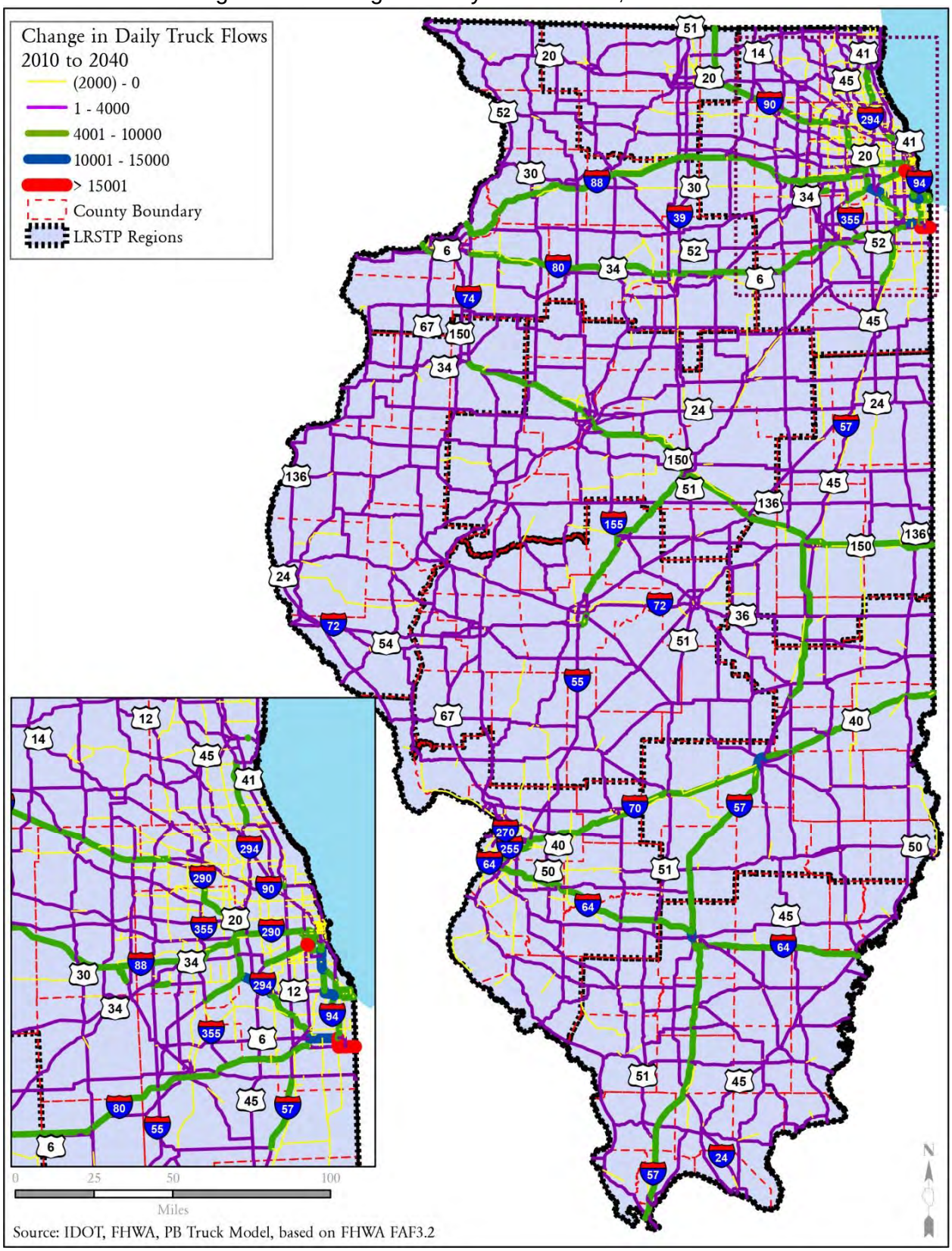


Figure 5.3: Change in Daily Truck Flows, 2010 to 2040



5.1 Safety

While all crashes impact traffic flows and affect delivery times for the trucking industry, crashes involving heavy trucks are more likely to have injuries and fatalities and often result in more damage to other vehicles or properties. Crashes also result in non-recurring delays, which can affect the on-time delivery of goods.

Three years of IDOT crash data (2009, 2010 and 2011) were reviewed to identify "hot-spot" locations where the incidence of truck crashes[41] was highest. A high truck crash rate may be an indication of existing geometry or capacity issues, or locations where truck movements are especially challenging. Similarly, a review of top rollover location data[42] indicated specific points where a review of existing geometry or enforcement may be prudent. Finally, crash and rollover data were reviewed with relation to identified interchange, lane drop, and signalized intersection bottlenecks located along major routes within the State.[43]

Truck crash clusters within Illinois are concentrated in the greater Chicago region, where truck throughput is generally highest. There are few truck crash clusters outside of the Chicago region, with no notable locations apparent based on the data reviewed. As truck volumes increase along the heaviest traveled routes in and around Chicago, the pressures around existing bottlenecks could increase and concerns could begin to appear in new locations. The same consideration pertains to downstate, where truck traffic is forecast to rise on corridors like I-70 and I-57, potentially creating new stresses that do not occur under today's volumes. Safety reviews and investment should continue in locations where truck crash clusters, bottlenecks, and anticipated overall truck volume growth are concurrent.

The crash data review indicated that the most significant cluster within Illinois is located along I-90/94 between North Avenue and the southern split of I-90/94, as shown in Figure 5.4. This section of roadway also carries among the highest volume of trucks throughout the State and includes closely spaced interchanges where crashes are most prevalent. This section of roadway also includes one of the top truck rollover locations in Illinois, at the intersection of I-90/94 and I-55. A more detailed review of crash incidence along this corridor may indicate common factors amongst these crashes.

A review of other top rollover locations indicated a cluster of three interchange locations within an approximately ten mile segment of I-294, as well as a fourth interchange located on I-55 one mile east of I-294, shown in Figure 5.5. All four of these locations are already identified by the State as truck crash clusters. As noted above, crash clustering of this nature may indicate a geometry issue affecting truck traffic that merits continuing review.

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[41] The overall crash database was reduced to only crashes involving Vehicle Type (VEHT) 6 (Truck – single use), 7 (Tractor w/ semi-trailer), 8 (Tractor w/o semi-trailer) or 16 (Other) where readily available information indicated the involvement of a heavy vehicle.

[42] "Mapping Large Truck Rollovers: Identification and Mitigation Through Spatial Data Analysis," American Transportation Research Institute, May 2012

[43] Guo, Jessica, *Assessment of Multimodal Freight Bottlenecks and Alleviation Strategies for the Upper Midwest Region,* TUSALAB/CFIRE

Figure 5.4: 2010 Daily Truck Flows and Crash Clusters, Chicago

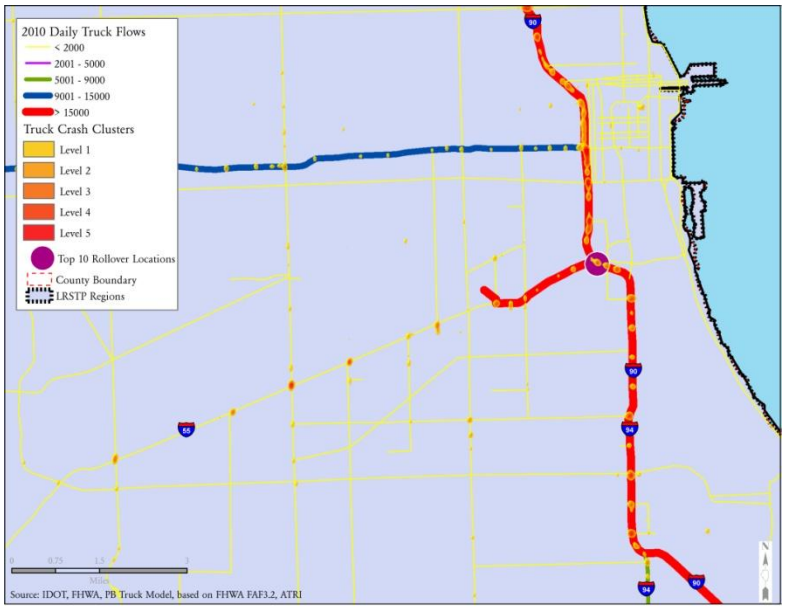

Figure 5.5: 2010 Daily Truck Flows and Crash Clusters/Rollover Locations

Moving forward, a targeted review of crash incidence along locations where growth in truck volumes and tonnage exists will focus investments on corridors most in need of significant improvements to ensure that impacts to the logistics chain and risks to the traveling public are kept to a minimum. This will be evident as truck volumes, congestion, and truck crashes increase, causing further degradation of traffic flow at existing and future bottlenecks. In order to prioritize future infrastructure investments, a more detailed review of truck crash incidence and existing geometry concerns at crash clusters, rollover locations, and bottlenecks would fully identify causes, define location-specific strategies for each problem area, and forestall the emergence of new clusters.

5.2 Service Reliability

As businesses shift to smaller inventories and use real-time tracking of purchases to replenish those inventories, there is an inherent need to ensure that the supply chain operates efficiently and reliably to restock popular items quickly. The supply chain risks associated with limitations of the freight infrastructure network can prevent on-time deliveries and stunt commercial growth along major routes. Bottlenecks, high crash locations caused by substandard roadway designs, and structural weight limits all can have a significant impact on the ability for the logistics industry to do business in Illinois.

CMAP's *GO TO 2040* regional plan noted that "the biggest challenge to trucking (in the Chicago region) is highway congestion."[44] As part of *GO TO 2040*, CMAP developed the *Freight System Planning Recommendations Project*, which included a detailed analysis of numerous datasets for several freight modes. This report included a review of highway freight-specific analyses. Highway congestion is illustrated in an index measurement comparing peak period travel time to free-flow travel time.[45] Within the Chicago region, a review of 2007 data indicates that the Interstate highway system generally exhibits severe or very high levels of congestion during peak periods.[46] These extreme levels of delay significantly limit the throughput of traffic and result in significant lost driver time and additional fuel expenditures. *GO TO 2040* notes that "on several corridors where truck volumes are over 10,000 per day, congestion during morning peak periods increases travel times by an *average of 60 percent*."[47] This recurring delay forces highway freight traffic to consider alternate routes, off-peak travel schedules, or in extreme cases, shift operations to a location where congestion plays less of a role in the logistics industry.

Bottleneck data was reviewed with respect to anticipated daily truck volume growth by 2040. Figures 5.6 and 5.7 illustrate this relationship for greater Chicago and the metropolitan region, respectively. Three bottleneck types were identified within Illinois: Interchange, Lane Drop, and Signalized Intersection.[48] These locations experience the highest levels of recurring congestion within the State and significantly impact the on-time delivery of goods.

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[44] *GO TO 2040*, Chicago Metropolitan Agency for Planning, p 309.
[45] Index levels between 1.41 and 1.60 indicate high congestion; 1.61 to .180 indicates very high congestion; levels greater than 1.80 indicate severe congestion.
[46] *Regional Freight System Planning Recommendations Study*, Cambridge Systematics, Inc., 2010.
[47] *GO TO 2040*, Chicago Metropolitan Agency for Planning, p 309.
[48] Interchange bottlenecks are those where traffic congestion constricts truck movements on ramps or main highways due to high volumes of traffic, vehicles weaving, merging movements, and poor ramp design. Lane Drop bottlenecks are those where traffic congestion constricts truck movement due to the decrease in the number of through lanes. Signalized Intersection bottlenecks are those where intersection operations reduce the speed of truck movement.

Figure 5.6: Projected Change in Daily Truck Flow and Existing Bottlenecks, Chicago Central Business District and Adjacent Neighborhoods

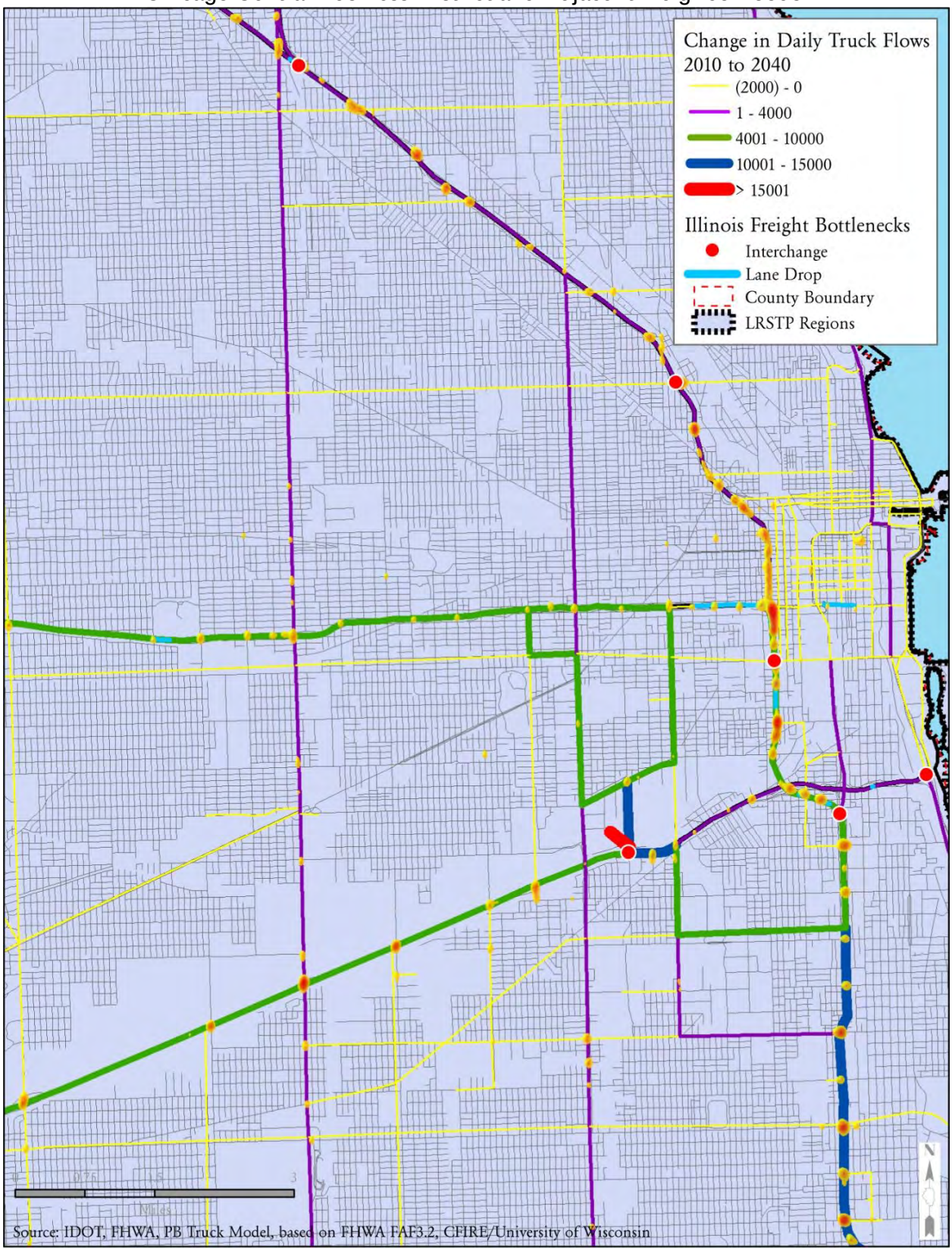
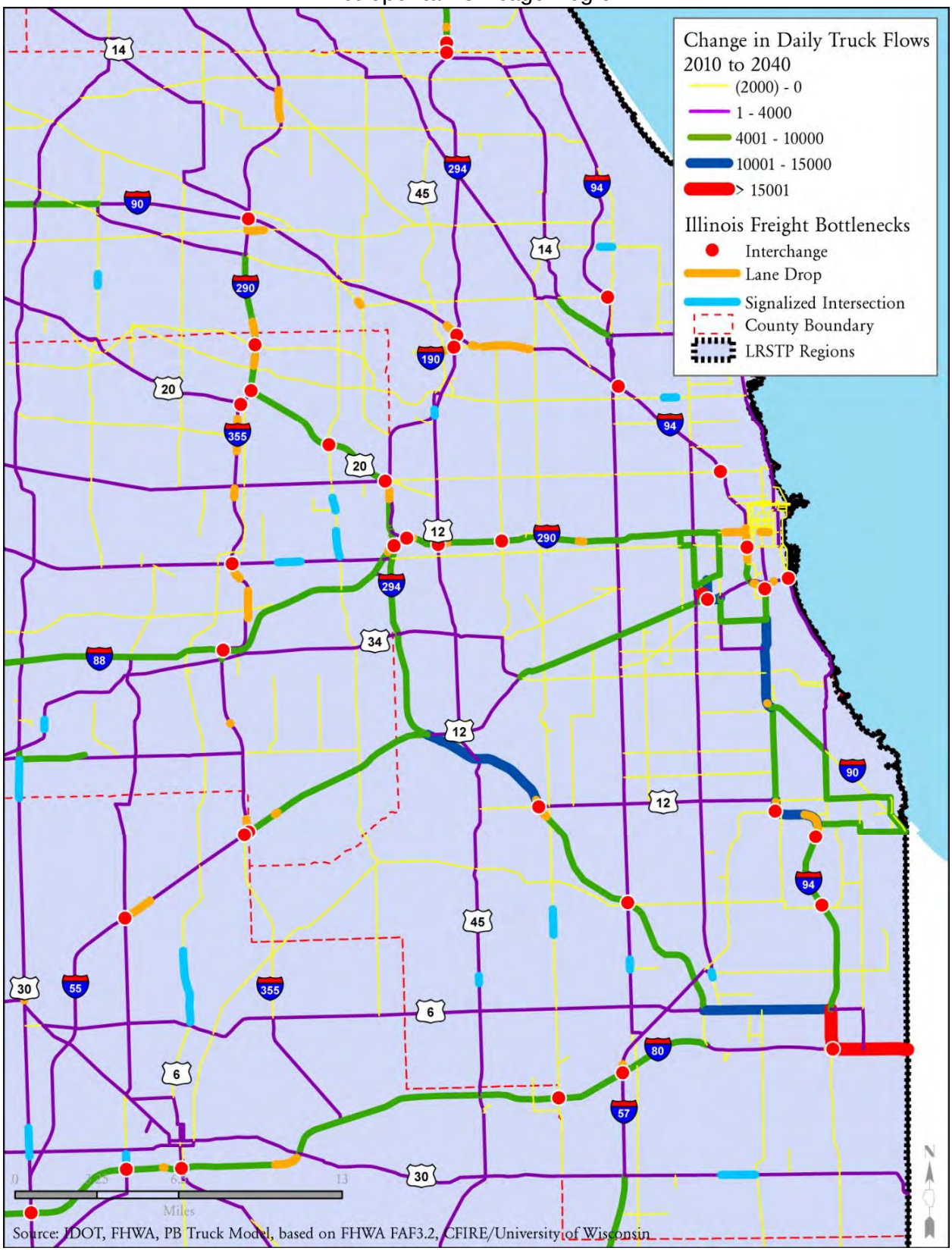


Figure 5.7: Projected Change in Daily Truck Flow and Existing Bottlenecks, Metropolitan Chicago Region



Of the top 20 freight-related bottlenecks within the Upper Midwest Region,[49] 11 are located in Illinois, including nine in Cook County and two in DuPage County. The Interchange of I-90/94 at North Avenue was identified as the most significant freight bottleneck in the entire region.[50] As shown in Figure 5.6, a 5.5 mile section of I-90/94 within Chicago between North Avenue and the I-55/I-90/I-94 feeder ramps includes six interchange or lane drop bottlenecks while carrying some of the highest truck volumes within the State. As truck volumes along these routes are expected to grow through 2040, the current recurring congestion issue will further degrade without capacity improvements or the identification of alternative parallel routes. IDOT has initiated a study of the Circle Interchange in 2012 to identify options for reducing congestion in this area.

The number of bottlenecks increases extending beyond downtown Chicago, as shown in Figure 5.7. As with I-90/94 in downtown Chicago, several routes include multiple bottlenecks within short distances, including I-355, I-290, I-294, I-80, I-90, I-64 and Illinois 83. All Illinois bottlenecks identified in the top 250 locations in the ten-state region were found in just four counties: Lake, Cook, DuPage, and Will.

Other significant bottleneck locations were apparent statewide as well. Outside of the four counties noted above, bottlenecks within the top 500 regionally were identified in seven other Illinois counties. These include three within Winnebago County (Rockford), two in Kankakee County, and one each in Sangamon, Jefferson, McLean, Kendall, and St. Clair Counties. The three in Winnebago County are noteworthy, as they exist within a ten mile section of Illinois 251, a major parallel route to I-90 and primary link to downtown Rockford.

Within the St. Louis region, an interchange and lane drop bottleneck was noted at the interchange of I-55/70 and I-64 in East St. Louis. While traffic volumes along this route are not as high as those found in Chicago and elsewhere statewide, this location is particularly important as it affects the primary link between East St. Louis and St. Louis (Poplar Street Bridge).

A review of statewide bottlenecks with respect to growth in Illinois-based truck flows against outbound and inbound tonnage is included in Figures 5.8 and 5.9, respectively. This illustrates the impact that existing bottlenecks may have on the growth of truck traffic that is directly related to Illinois commerce. Much of the growth and many of the bottlenecks are located within the Chicago metropolitan area. Other pinch points outside of the Chicago region that may have a more significant impact on Illinois-based truck traffic includes those along I-39, I-55, and I-57.

[49] The Upper Midwest Region is comprised of Iowa, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.
[50] Guo, idem.

Figure 5.8: Originating Tonnage Growth, Projected Truck Flow Growth and Bottlenecks

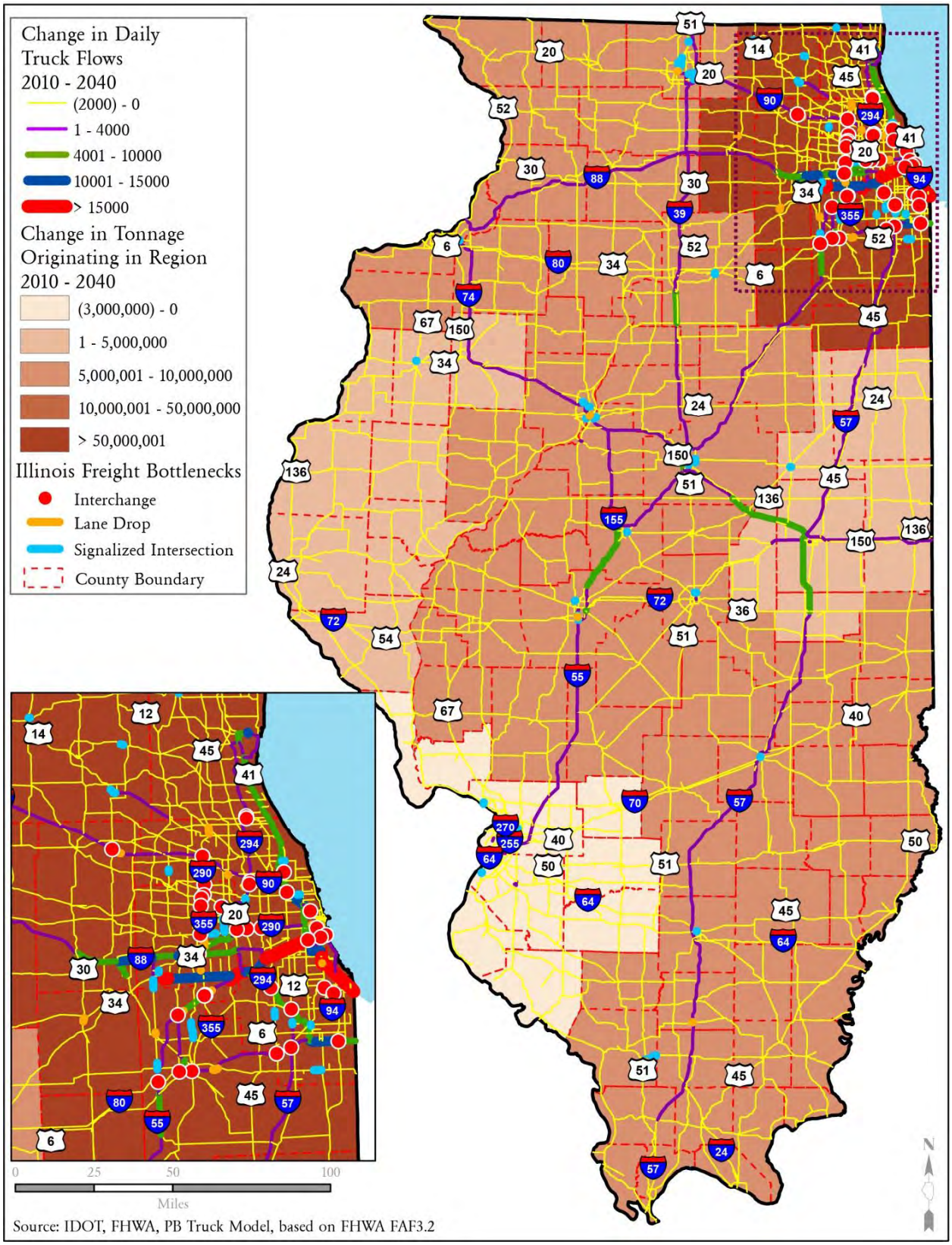
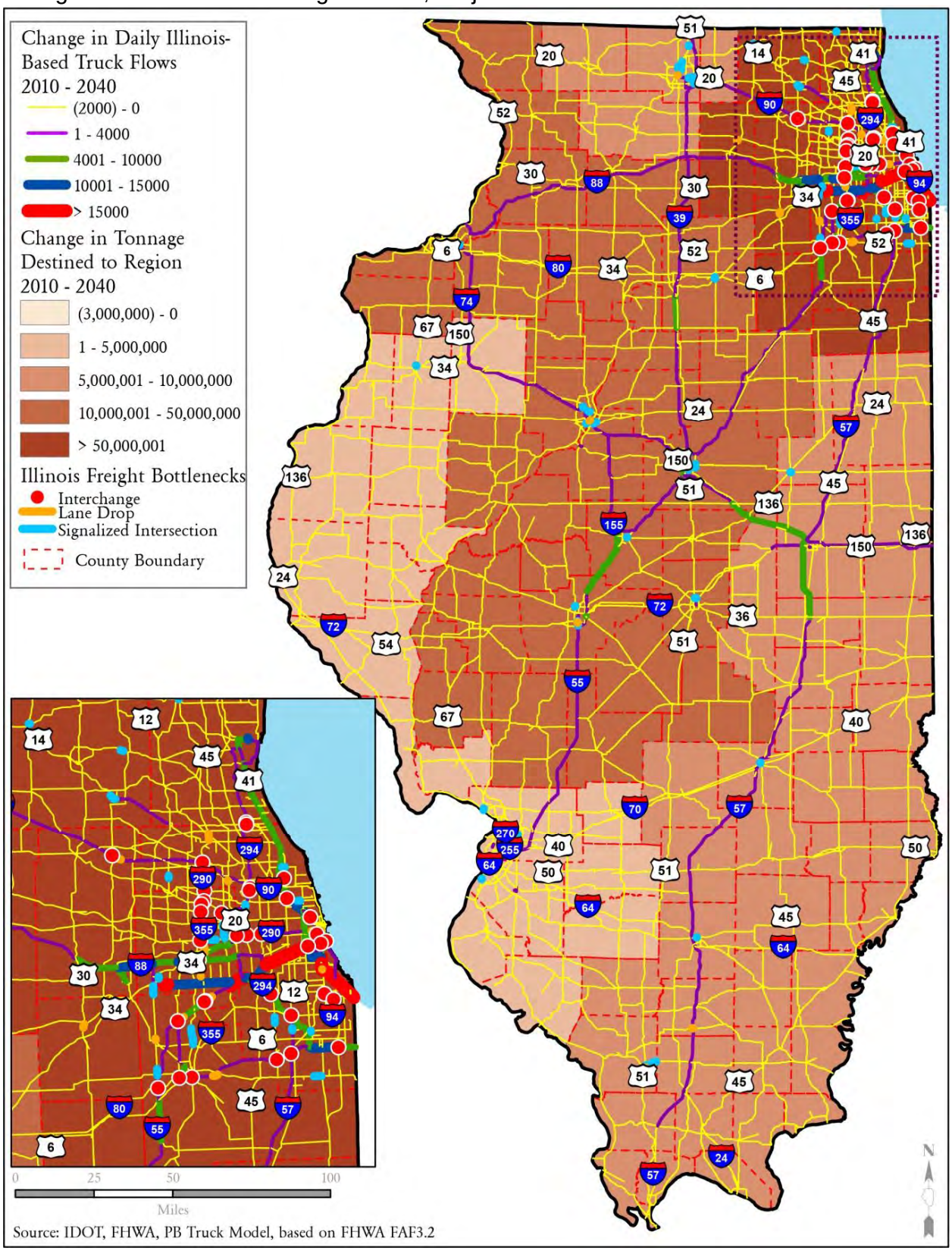


Figure 5.9: Destined Tonnage Growth, Projected Truck Flow Growth and Bottlenecks



Variability of travel speed is important as an indicator of the dependability of travel time, which is a leading risk factor for supply chain performance. A review of average travel speed data provided by the FHWA is illustrated in Figure 5.10, indicating the variability of average travel speeds among four travel periods: AM Peak, Midday Peak, PM Peak, and Night.[51] The FHWA data is available for several key roadways in Illinois: I-24, I-55, I-70, I-80 and I-90. The variability data indicates locations where travel speeds differ most significantly between the four periods, illustrating routes where truck traffic is most likely to benefit from off-peak travel. The darker shades of orange indicate those corridors where travel speeds are most variable, while those routes that are lightest have the most consistent travel speeds during the four periods.

Figure 5.10 indicates that outside of Chicago, travel speeds on major routes are largely consistent throughout the four periods. However, within the vicinity of Chicago, several routes show significant differences between peak and non-peak periods. Although I-55, I-80, and I-90 all reflect this difference, it is important to note that while these routes do show some improvement between peak and non-peak periods, they are still among the most congested routes within the State.

5.2.1 Heavy Truck Movements

MAP-21 has mandated a national Truck Size and Weight Study which will ultimately drive Federal and potentially Illinois policy regarding future rulemaking related to the heavest freight traffic. In 2010, Illinois approved an increase in the default maximum gross vehicle weight (GVW) allowed on State roadways to 80,000 pounds, in line with Federal regulations and bordering states. Heavier loads are allowed on the State highway network through special permitting, which will reflect the GVW, commodity being transported, distance traveled, roadways traversed, and type of truck.

With respect to specific commodities, MAP-21 places a special reference to routes traversed by the heaviest payloads. Thus, a review of truck volumes for commodity groups CG 07 (Coal) and CG 09 (Refined Petroleum Products) are included in Figures 5.11 and 5.12, respectively. These commodities were selected based on top payload weights highlighted in FHWA data and industry experience in freight movement.

Coal (CG 07) truck flows were reviewed with respect to traffic tonnage and the location of active mines within Illinois. The highest coal flows exist within the southern and central regions of the State, which is to be expected given the location of active mines within Illinois. Refined Petroleum truck flows were reviewed with respect to traffic tonnage and were centered almost exclusively within the Chicago region, which is to be expected given the number of oil depots and level of fuel demand in that area.

Coal and petroleum flows were reviewed with respect to existing structurally deficient (SD) bridges within the State. Given the significant payload of individual trucks carrying coal or petroleum, weight restrictions on SD bridges can signficantly alter the routing of trips carrying these goods. As shown in Figure 5.11, several routes carrying high volumes of coal include numerous SD bridges. These include bridges on I-57, Illinois 1, and Illinois 130.

[51] The FHWA works with the ATRI to catalog average travel speeds along the most heavily traveled Interstate highways nationwide. This data is available for download via the FPMweb Tool. www.freightperformance.org. Accessed September 4, 2012.

Figure 5.10: Travel Speed Variability

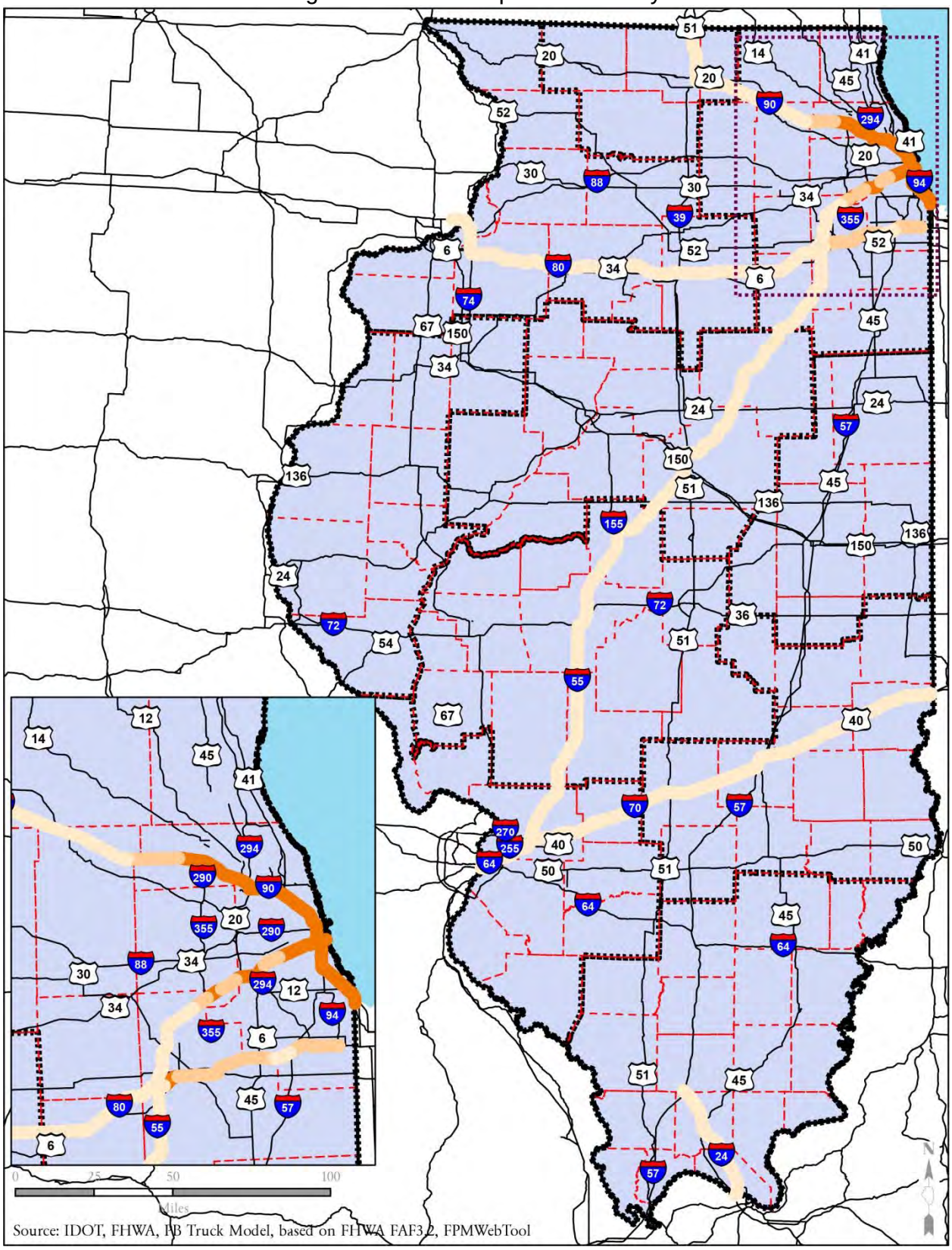


Figure 5.11: 2010 Coal (CG 07) Truck Flows, Outbound Tonnage and Structurally Deficient Bridges

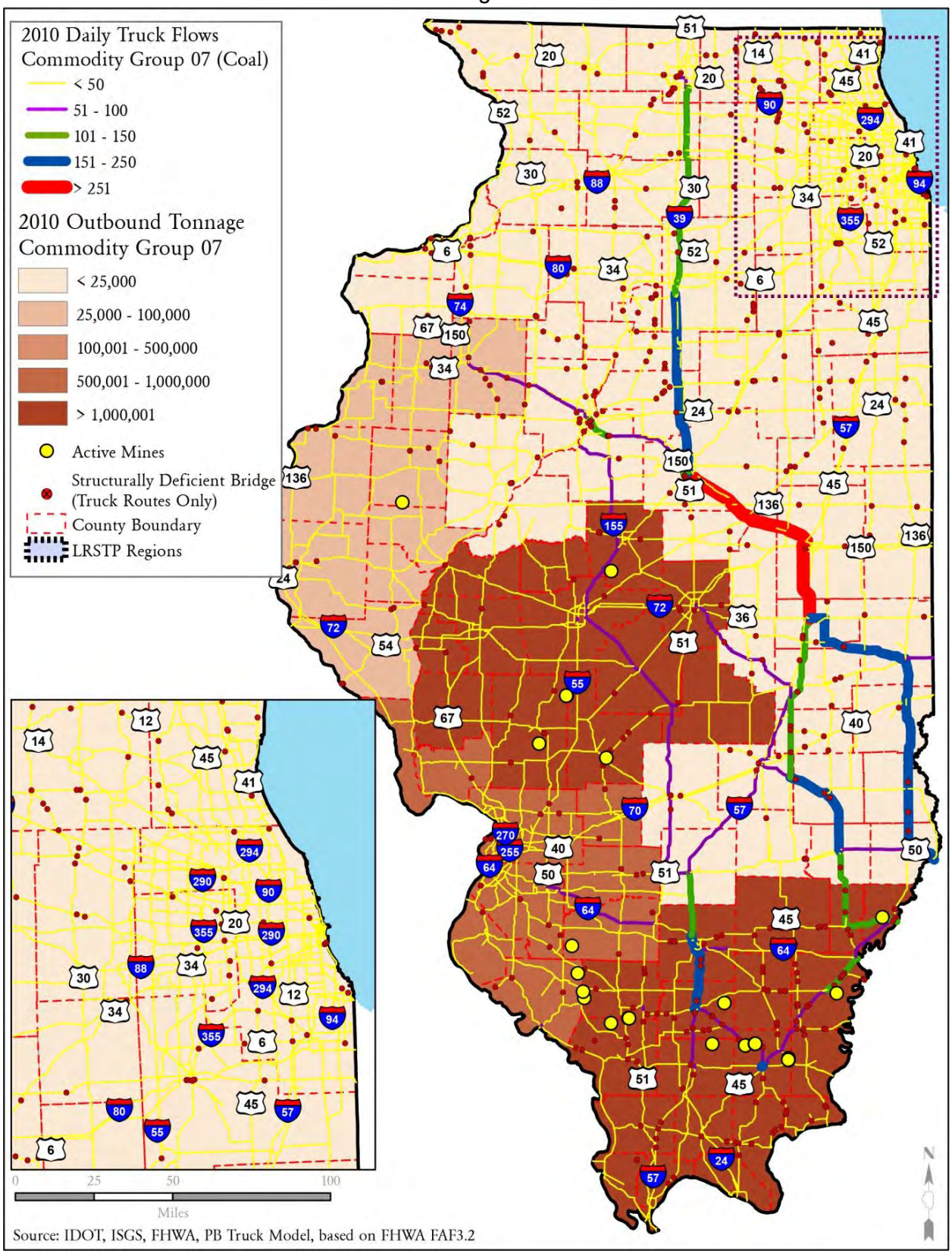
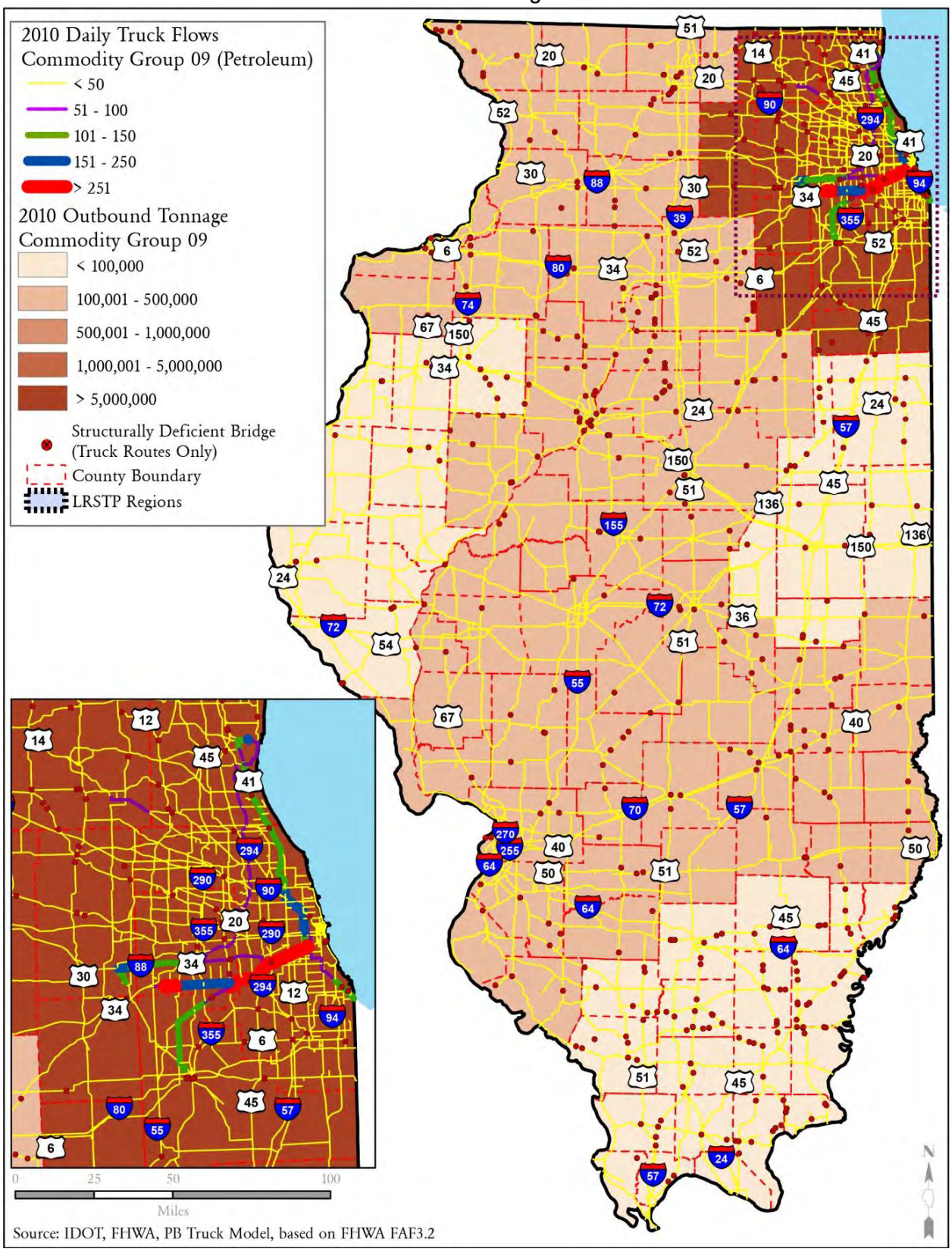


Figure 5.12: 2010 Petroleum (CG 09) Truck Flows, Outbound Tonnage and Structurally Deficient Bridges



Similarly, as illustrated in Figure 5.12, key routes carrying petroleum in the Chicago region are impacted by SD bridges, inclulding I-90 and US 41. The prioritization of investments in the repair and replacement of these stuctures should include a more detailed review of the effect that these structures have on the movement of heavy goods. Further, as the number of active downstate coal mines increases in the future and they require connection to railheads, waterways, and customers, a focus on the effect that the related freight traffic will have on the surrounding roadway network will be necessary.

5.2.2 Industry Exposure to Bottlenecks

While coal and petroleum shipments are especially affected by the potential for load restricted structures, bottlenecks affect all commodities depending on the most common travel patterns for each group. Figures 5.13 through Figure 5.20 illustrate 2010 daily truck flows and annual tonnage for a selection of commodities. Some of them are relatively heavy loading and relate to important Illinois industries: Grain (CG 01) for the agricultural sector, and Stone/Gravel (CG 06) for construction. Others are significant for their value of goods and potential for re-shored industry: Machinery and Parts (CG 15), which also includes some transportation equipment, and Electric, Scientific, and Medical Equipment (CG 18), which encompasses electronics. Each commodity group has specific common travel patterns and exposure to existing bottlenecks, as illustrated by the 2010 daily truck flows and tonnage map for each. A review of the stress that existing bottlenecks may have on future movements for each of these commodity groups is included as well.

While grain truck traffic (Figure 5.13) is spread throughout the State highway network, it is generally highest within Central Illinois. This forces truck traffic carrying grain to traverse bottlenecks in or near major urban centers Peoria, Bloomington, Springfield, and Effingham. Growth patterns (Figure 5.14) exhibit similar patterns within Central Illinois, with an increase in trips in the Chicago region as well. Overall tonnage growth is predominantly focused on the central and northwestern regions of the State, but is evident statewide.

Stone and gravel truck traffic (Figure 5.15) has significantly different travel patterns, with stone/gravel traffic predominantly found within the Chicago region, forcing these vehicles to use highly congested roadways with numerous existing bottlenecks. Future travel flow and tonnage growth in stone and gravel (Figure 5.16) illustrates a continued reliance on the Chicago region, with the heaviest growth along routes already in use today.

The most common travel patterns for trucks carrying machinery and parts (Figure 5.17) shows flows that are mostly focused on the Chicago region, with heavy north-south flows along I-55 and I-57 and a heavy east-west flow along I-88. Therefore, these commodites are affected not only by the significant number of bottlenecks in the Chicago region, but those along the two primary north-south routes within the State and the most direct link between Chicago and the Quad Cities region as well. As with stone and gravel traffic, growth of machinery and parts truck traffic (Figure 5.18) is anticipated to occur along primary routes already in use today. The bulk of the growth in tonnage is focused on the Chicago region, with smaller amounts within East St. Louis and the central portion of the State.

Electric, scientific, and medical equipment truck traffic (Figure 5.19) shows similar flows to those carrying machinery and parts within the Chicago region, but is focused on connections between Chicago and St. Louis and Chicago and the Quad Cities region. Growth in electric, scientific, and

medical equipment truck traffic (Figure 5.20) is concentrated primarily within the Chicago region, unsurprising as the bulk of tonnage growth is focused there as well. A smaller amount of growth in this commodity is apparent within East St. Louis, while the rest of the State expects to see negligible increases in volume. For both the machinery and electronics commodity groups, it is possible that re-shoring businesses will seek locations with less transportation disruption risk and potentially lower wage rates than would be found in metropolitan Chicago, and so run counter to the forecast. Alternately, the labor skills and supplier base in that region should be attractive, implying that efforts to reduce disruption exposure could pay off.

Figure 5.13: 2010 Grain (CG 01) Truck Flows and Total Truck Tonnage

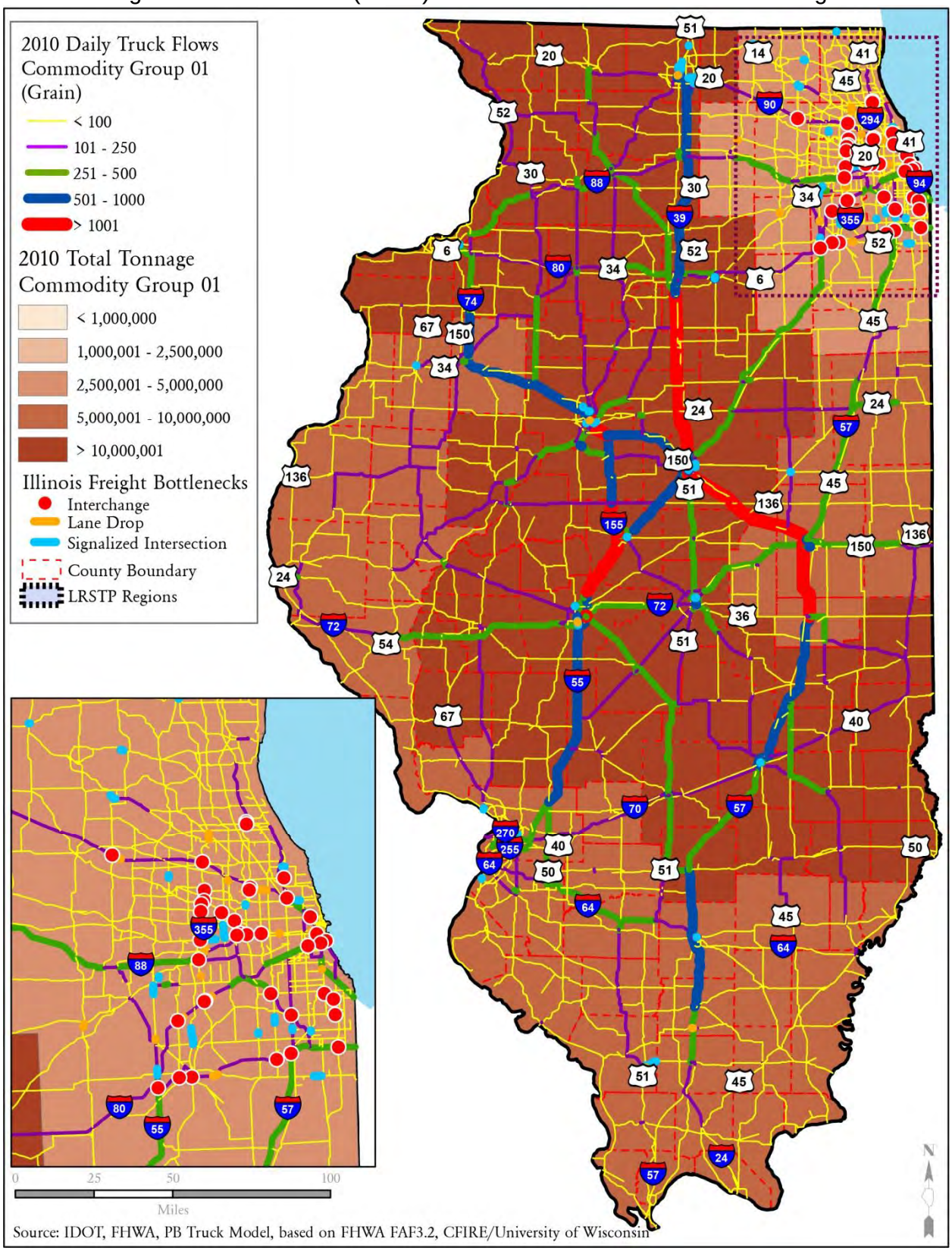


Figure 5.14: Change in Truck Flows and Total Truck Tonnage, Grain (CG 01)

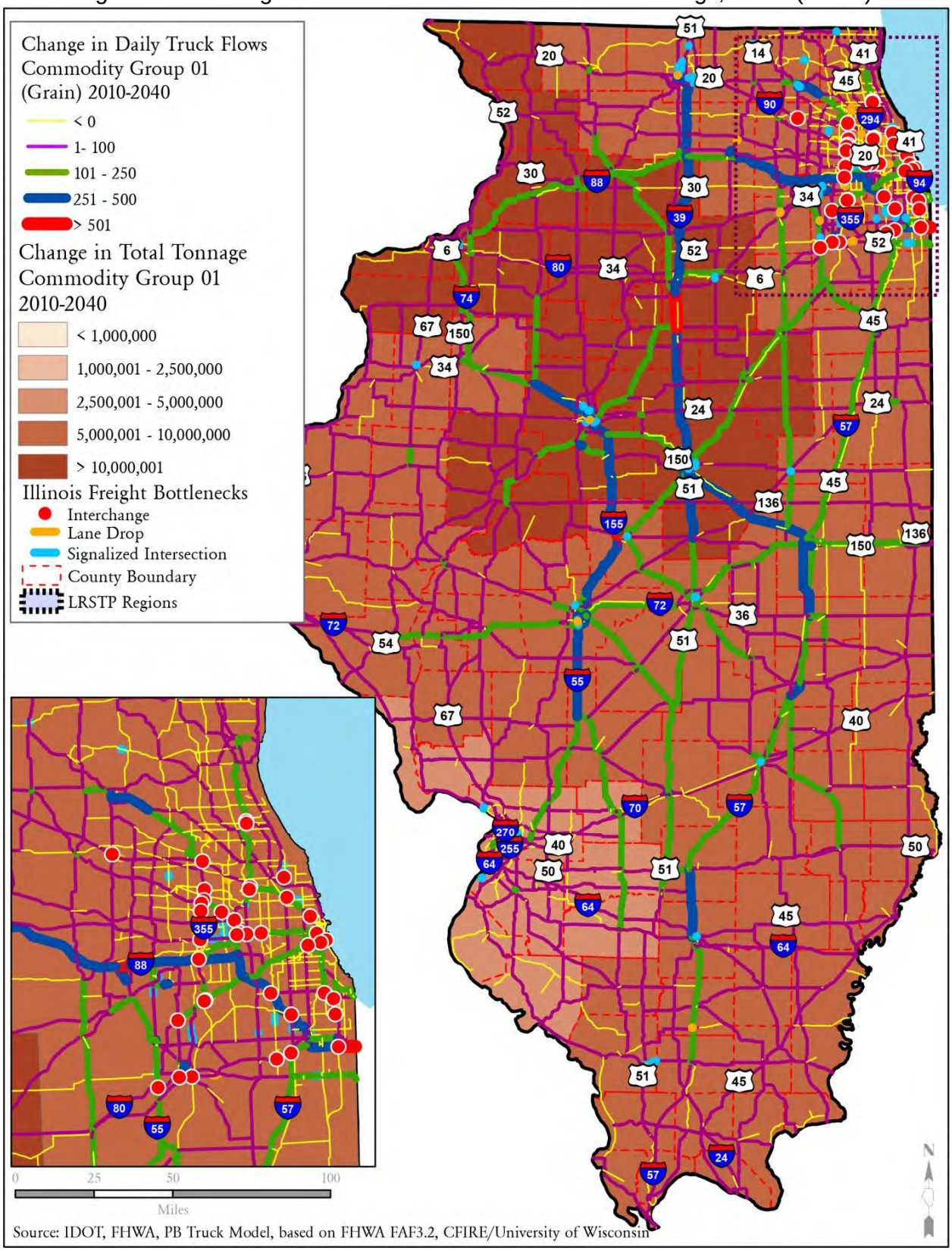


Figure 5.15: 2010 Stone/Gravel (CG 06) Truck Flows, Outbound Tonnage

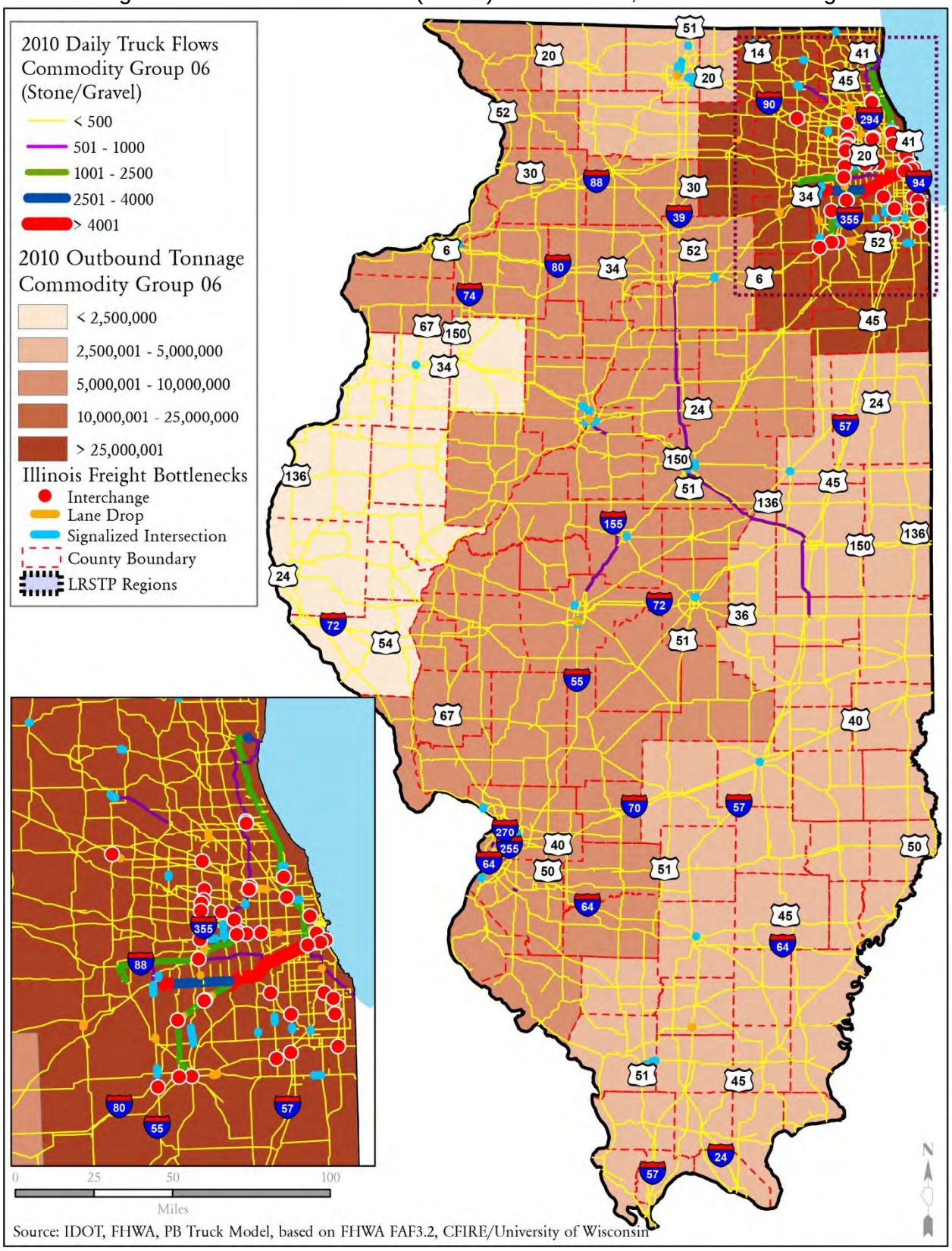


Figure 5.16: Change in Stone/Gravel (CG 06) Truck Flows, Outbound Tonnage

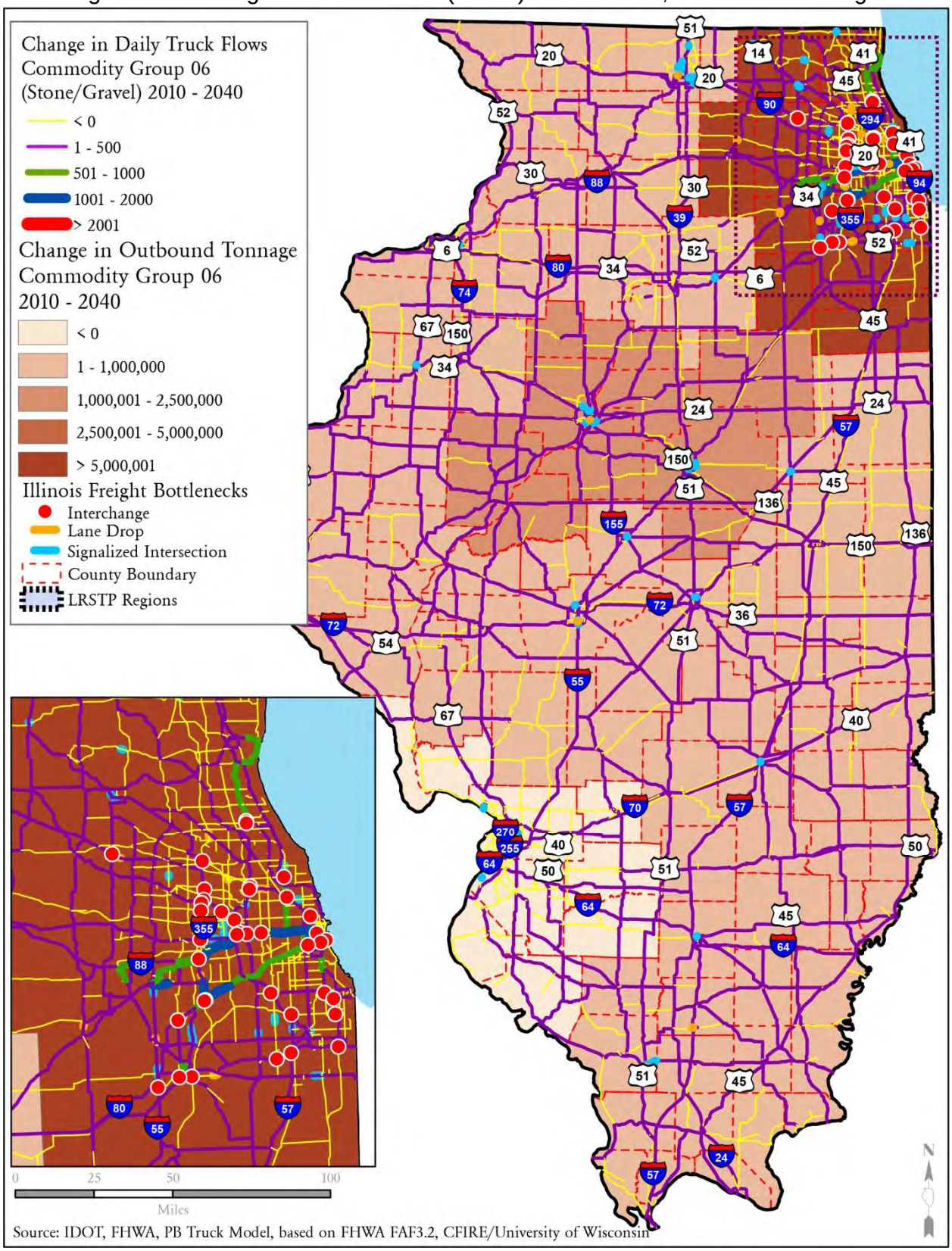


Figure 5.17: 2010 Machinery (CG 15) Truck Flows, Outbound Tonnage

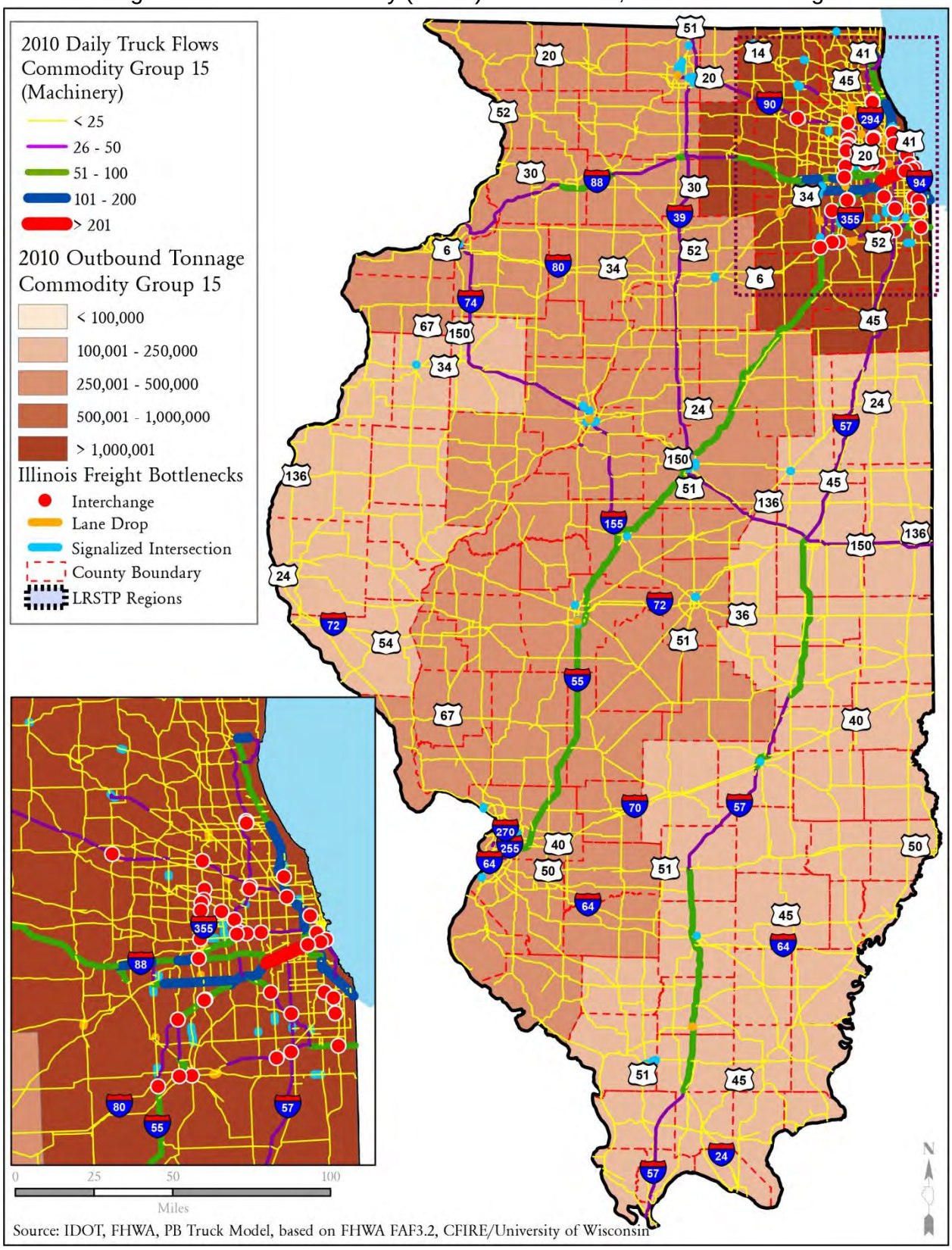


Figure 5.18: Change in Machinery (CG 15) Truck Flows, Outbound Tonnage

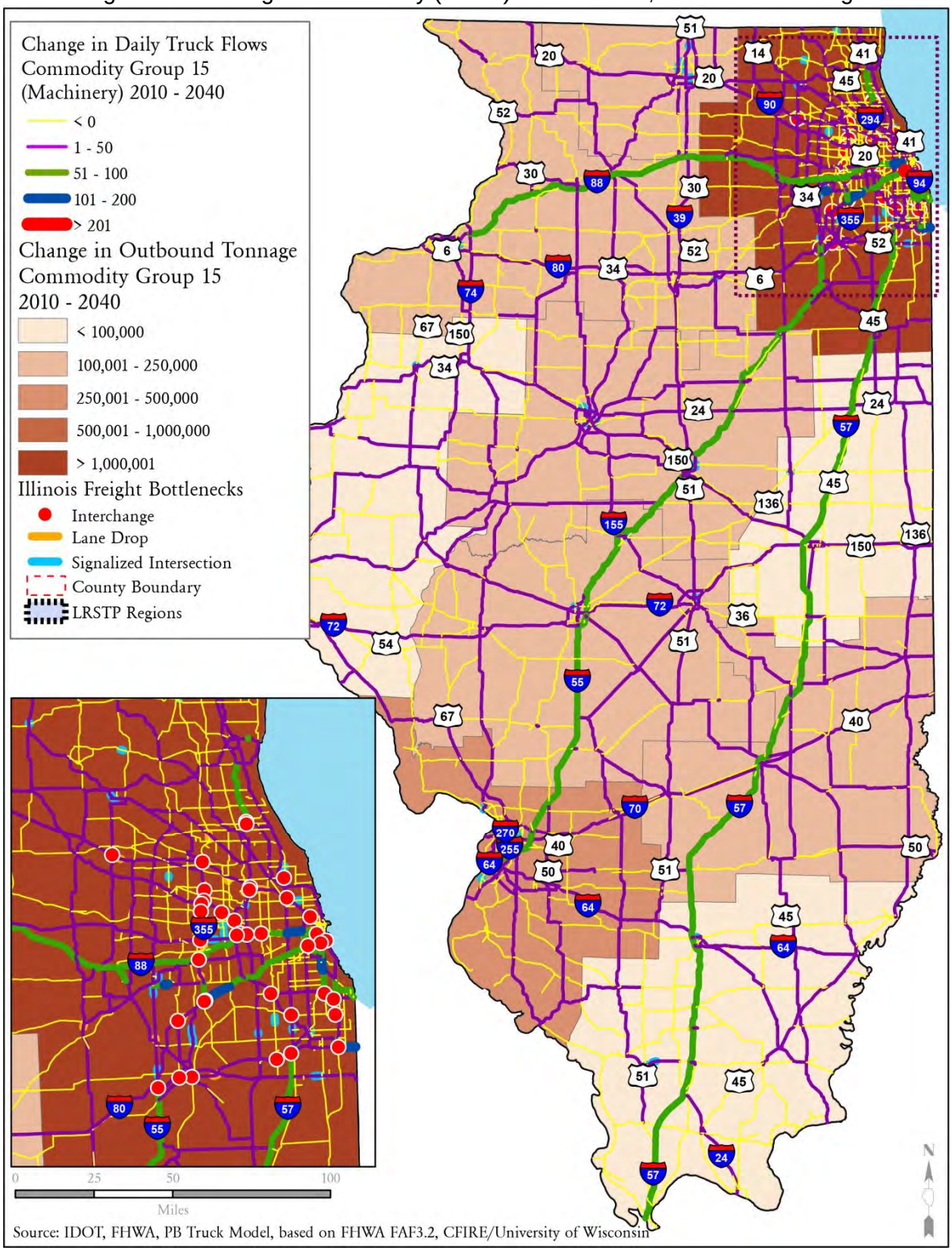


Figure 5.19: 2010 Electronics (CG 18) Truck Flows, Outbound Tonnage

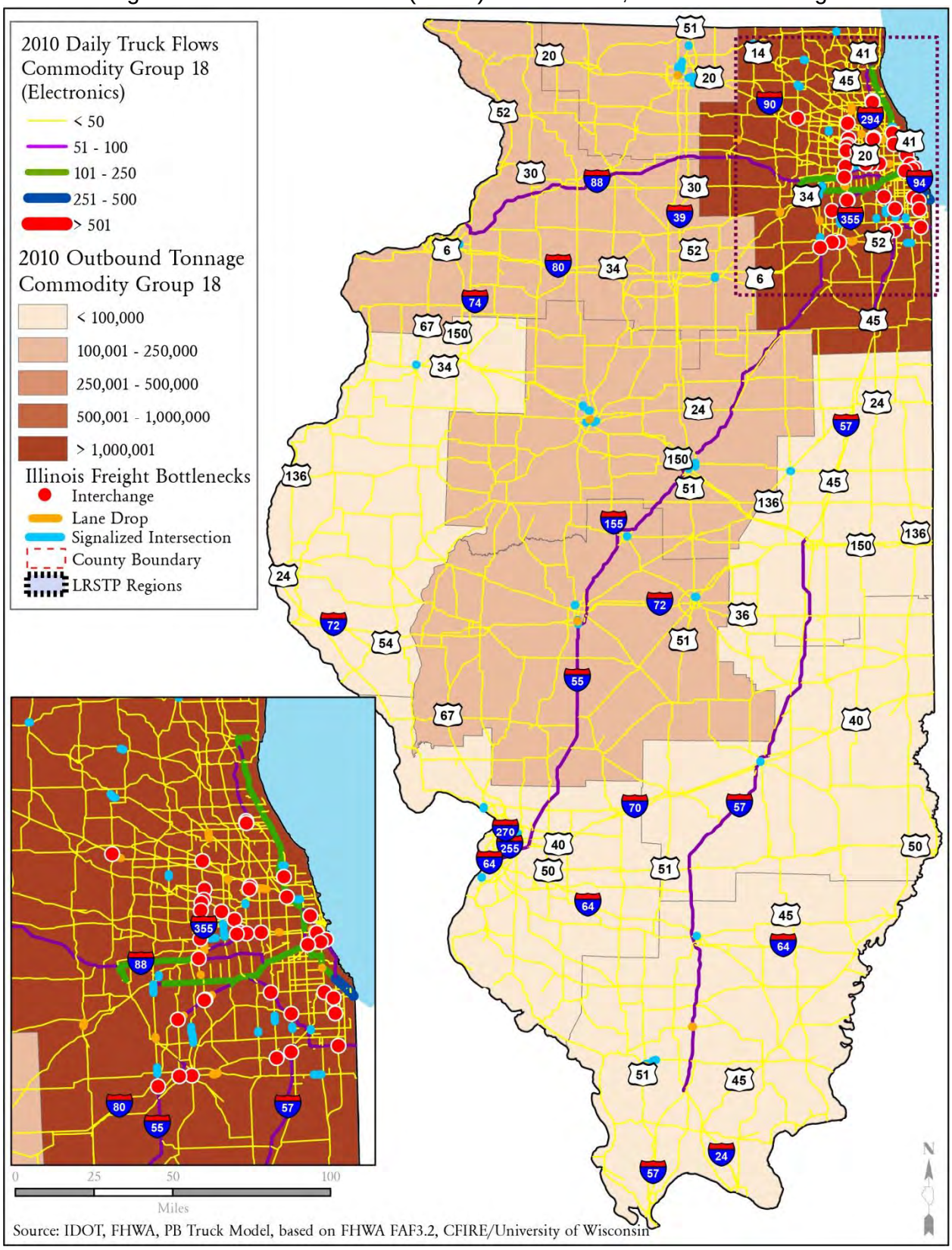
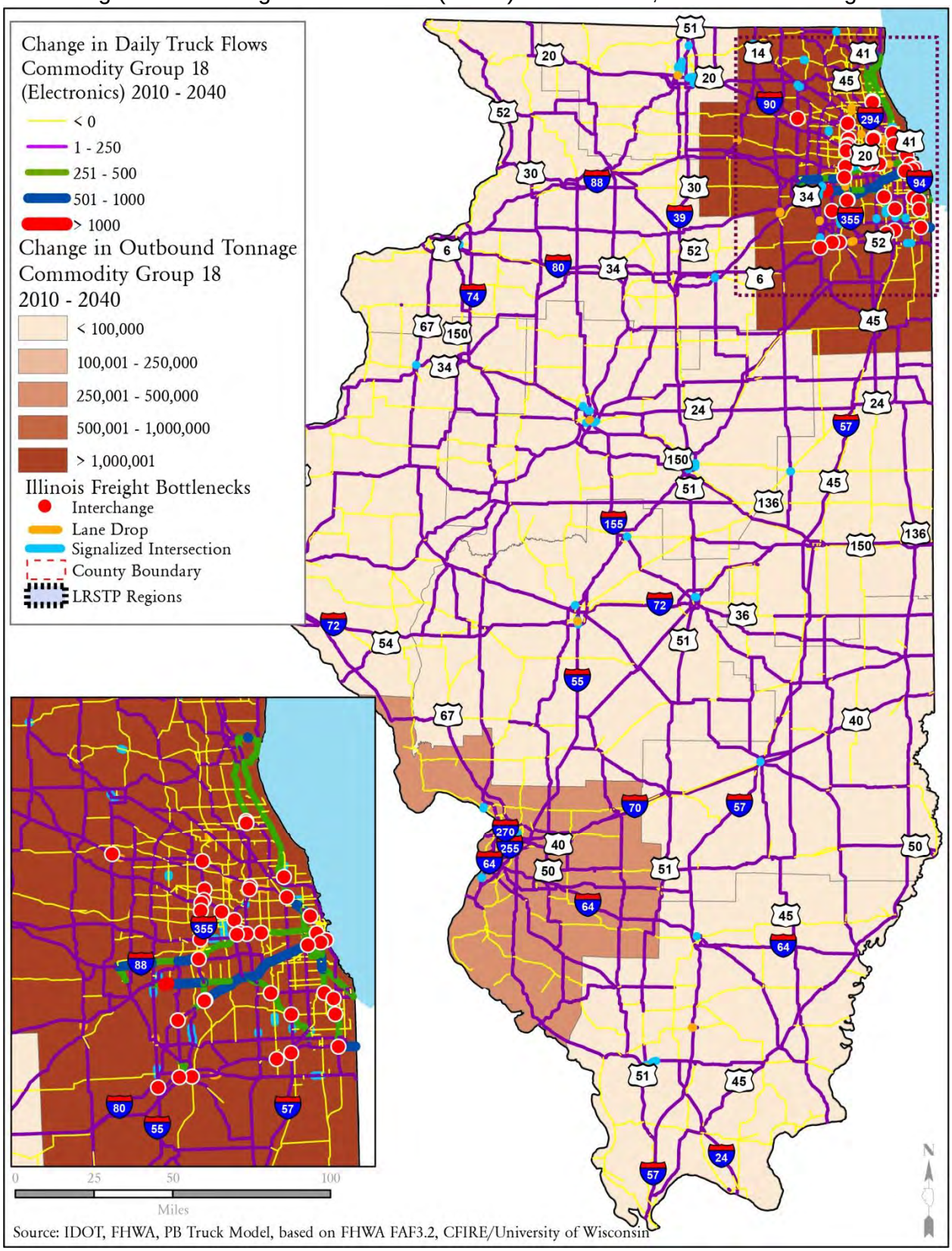


Figure 5.20: Change in Electronics (CG 18) Truck Flows, Outbound Tonnage



5.3 Air Quality

Air quality and the federal guidelines that monitor it are important issues when addressing freight mobility. Air quality is affected by freight vehicles: airplanes, trucks, trains and water vessels (barges, ships). Currently, Illinois has two regions designated as ozone nonattainment areas: Chicago-Gary-Lake County (Illinois and Indiana) and St. Louis (Illinois and Missouri).[52]

A review of 2010 and 2040 truck volumes within these areas indicates anticipated growth in freight traffic, which may impact overall air quality in the region. This is further illustrated in the review of anticipated growth in freight tonnage originating or destined to regions throughout Illinois, as illustrated in Figures 5.21 and 5.22, respectively. Air, rail and water volume traffic are not included in these projections.

Within the metropolitan Chicago nonattainment area, significant growth is anticipated in tonnage originating from and destined to the region. Anticipated growth within the metropolitan area is that 72.9 percent of the growth in originating statewide tonnage and 67.4 percent of growth in tonnage destined to Illinois will occur in the metropolitan Chicago region. No other region in Illinois is expected to experience more than five percent of statewide originating tonnage growth or seven percent of growth in tonnage destined to an individual region. Given the importance of the Chicago region in the national logistics chain, the level of growth in both volume and tonnage in this region is not surprising.

The trends within the East St. Louis region (as a subset of the larger metropolitan St. Louis area) are significantly different from Chicago, with originating freight tonnage projecting to decline between 2010 and 2040. Freight tonnage destined to the East St. Louis region is expected to increase, but at significantly smaller levels than most of Illinois.

A review of growth in external truck trips is included in Figure 5.23 and reflects the impact of non-Illinois based trips within the two nonattainment zones. The increase in these trips is highest along several major routes within the nonattainment zones, including I-80, I-90, and I-294 within the Chicago region, and I-64 and I-55/70 within St. Louis. A review of overall VMT within the State for internal, external, and inbound/outbound trips is included in Table 5.1[53] further illustrating the growth in external trips through 2040, which will increase at a higher rate than internal or inbound/outbound trips.

Table 5.1: Statewide VMT, 2010-2040

	Internal		Inbound / Outbound			
	Miles (000's)	Percent	Miles (000's)	Percent	Miles(000's)	Percent
2010	3,282,628	15.4%	6,392,757	30.0%	11,603,188	54.5%
2040	4,507,391	12.8%	10,593,496	30.1%	20,091,132	57.1%
2040 - 2010	1,224,763	8.8%	4,200,739	30.2%	8,487,944	61.0%

[52] A nonattainment area is one "that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant." The two 8-Hour Ozone nonattainment areas within Illinois are classified as "moderate" indicating an Ozone measurement between 0.086 and 0.100 parts per million. Source: EPA Green Book Designations. www.epa.gov/oar/oaqps/greenbk/define.html. Accessed August 27, 2012.

[53] These VMT numbers refer to the VMT that is traveled on the modeled network. Since the statewide network is a subset of the overall network, the absolute numbers are likely to underestimate true VMT.

Figure 5.21: Projected Change in Truck Volume and Outbound Tonnage

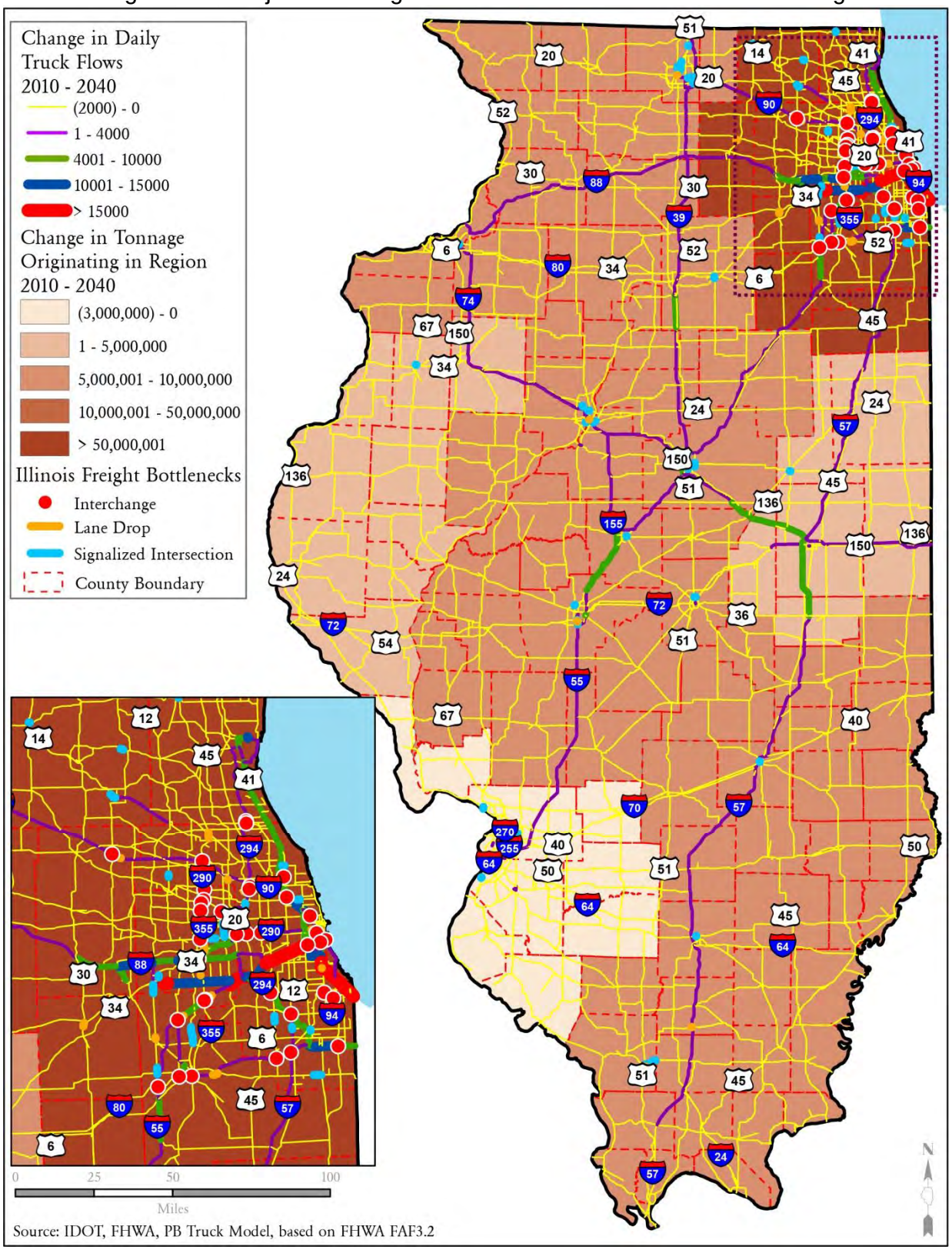


Figure 5.22: Projected Change in Truck Volume and Inbound Tonnage

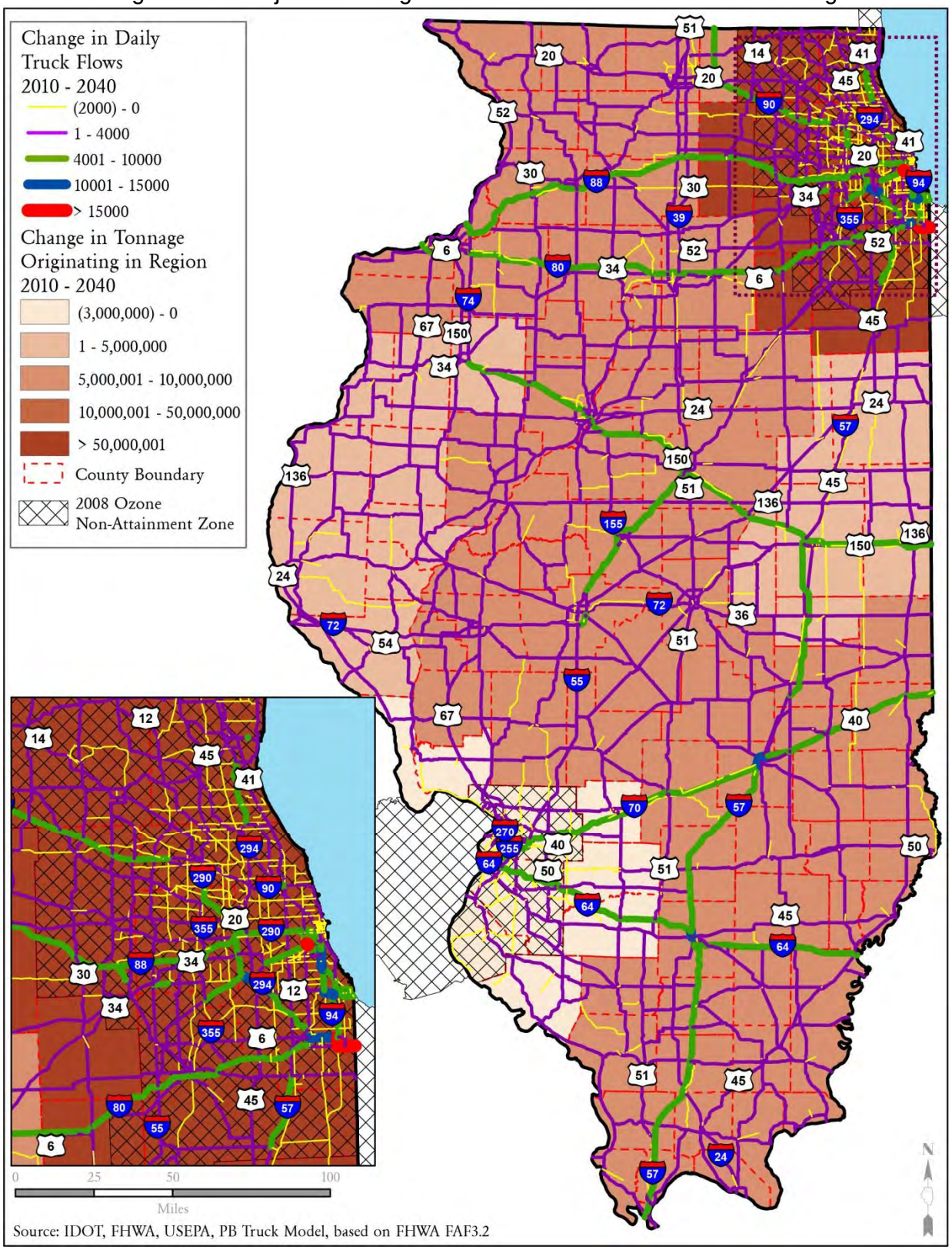
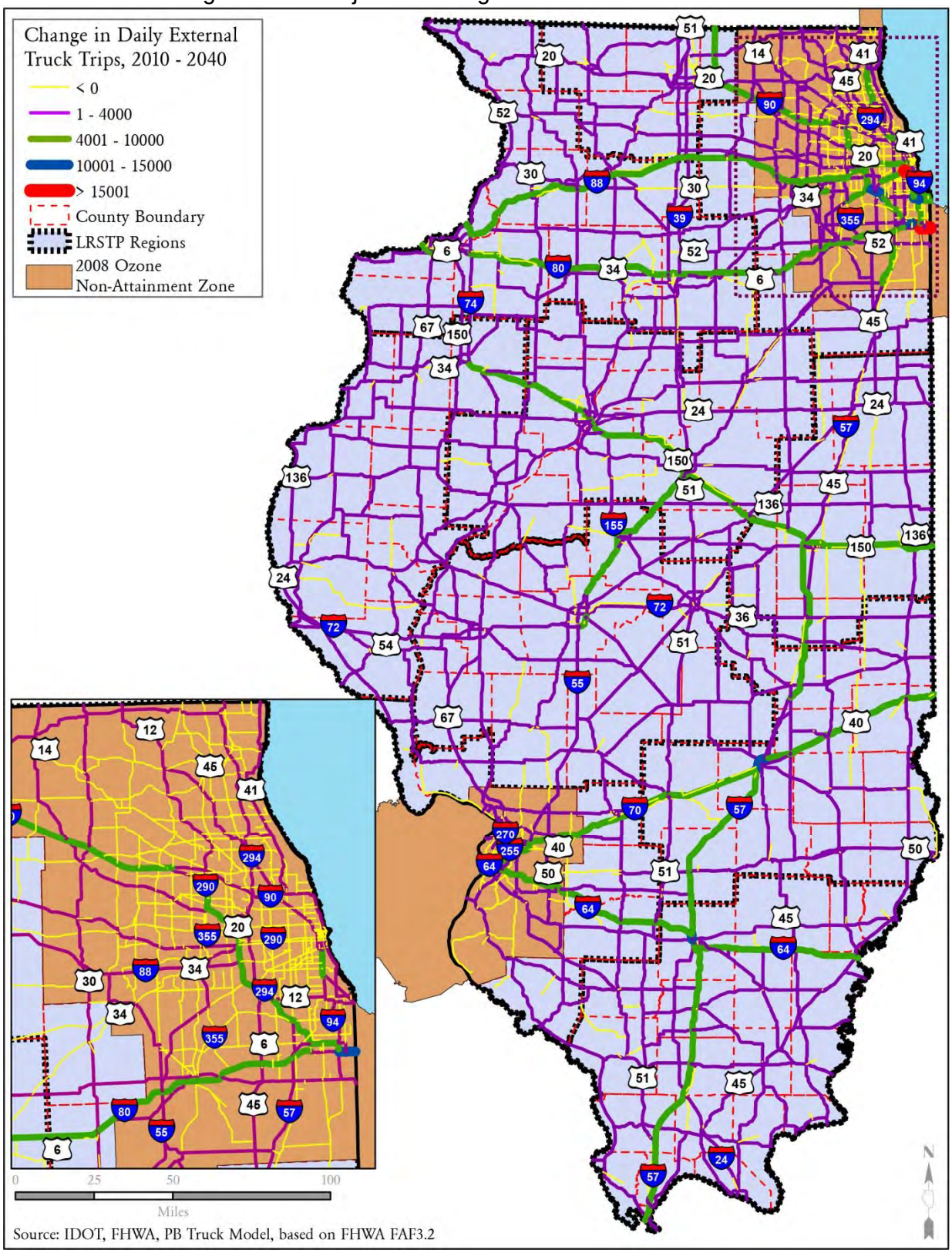


Figure 5.23: Projected Change in External Truck Volume



Trips that are through-state are not generating much direct positive economic impact for Illinois industry, suggesting that strategies to shift them to other roadways outside of the nonattainment zones could be desirable. Conversely, the position of Illinois and Chicago particularly as freight hubs depends on through trips, so that without them much of the logistics strength of the State – from which all industry benefits – would be lost. This suggests that strategies to mitigate the emissions from through freight may be preferable, and methods to encourage the use of "green" technologies, including the use of alternative fuels, might be one strategy.

A key trend in reducing vehicle emissions is the promotion of alternative fuel use by the trucking industry. Compressed and Liquid Natural Gas (CNG and LNG) are the primary alternative fuels being considered to replace diesel, due to cost and reduction in greenhouse and carbon emissions. Unfortunately, one of the main roadblocks preventing the logistics industry from increasing usage of CNG/LNG fueled vehicles is that the availability of these fuels is not widespread or consistent. Figures 5.24 and 5.25 illustrate locations where LNG and CNG are available in Illinois, respectively.

While CNG stations are present throughout the Chicago region, there are few stations outside of the metropolitan region. CNG is available on a somewhat limited basis within the St. Louis region as well, but like Chicago, few stations are located outside of the St. Louis area. As CNG is more likely to be used for shorter-haul trips, there are few current opportunities to take advantage of this fuel source outside of Chicago or St. Louis. While LNG is better suited for longer haul trips, the availability of LNG is limited to three stations within Illinois, significantly limiting the logistics industry from committing resources to converting to this fuel type.[54] Further, the lack of LNG facilities along the heaviest traveled routes in Chicago limits the ability of through-state freight traffic to use LNG, thereby reducing particulate emissions within the nonattainment zone.

[54] "Fuel Efficiency and Alternative Fuels" - *Stifel Nicolaus*, July 2012.

Figure 5.24: 2010 Daily Truck Flows and Compressed Natural Gas (CNG) Stations

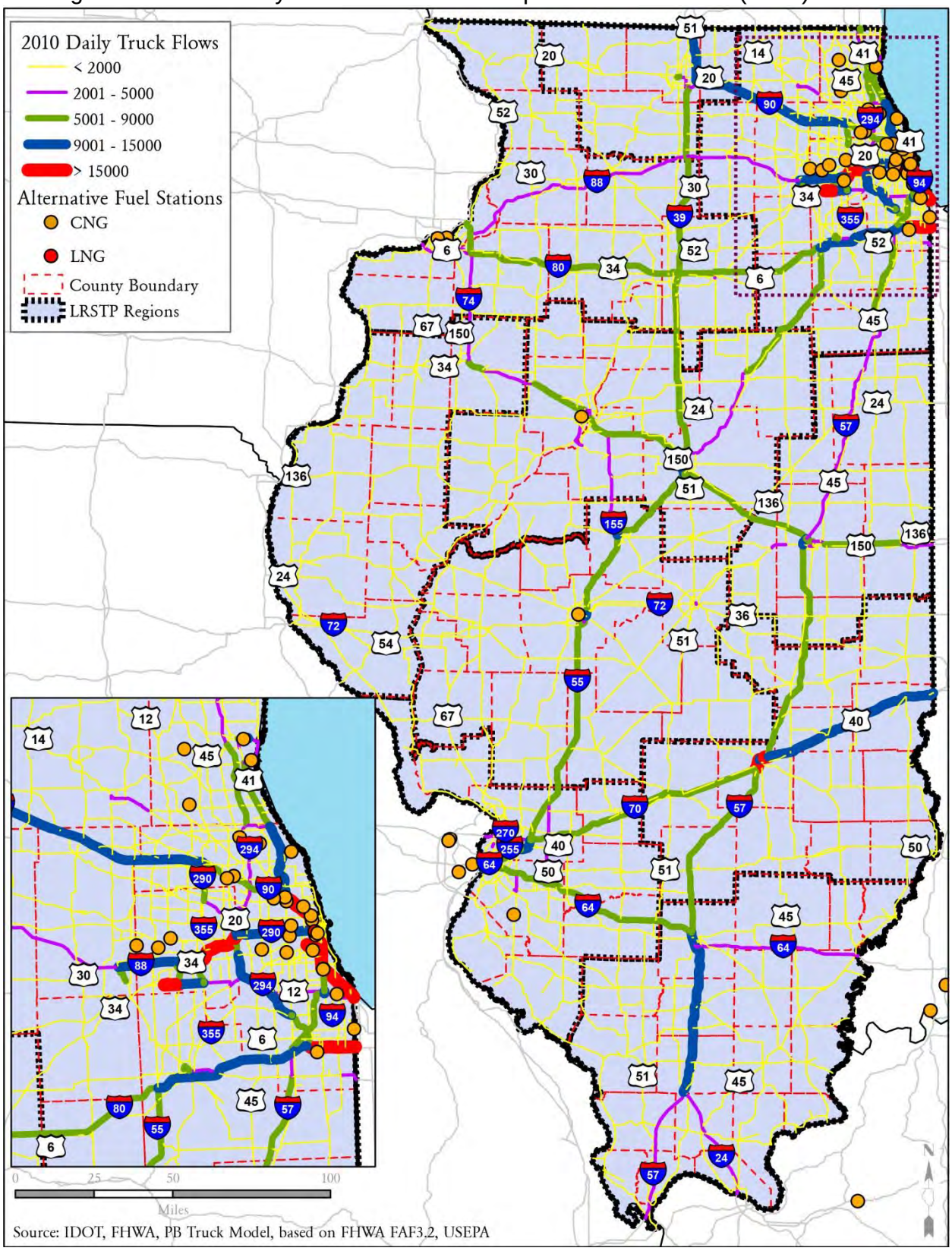
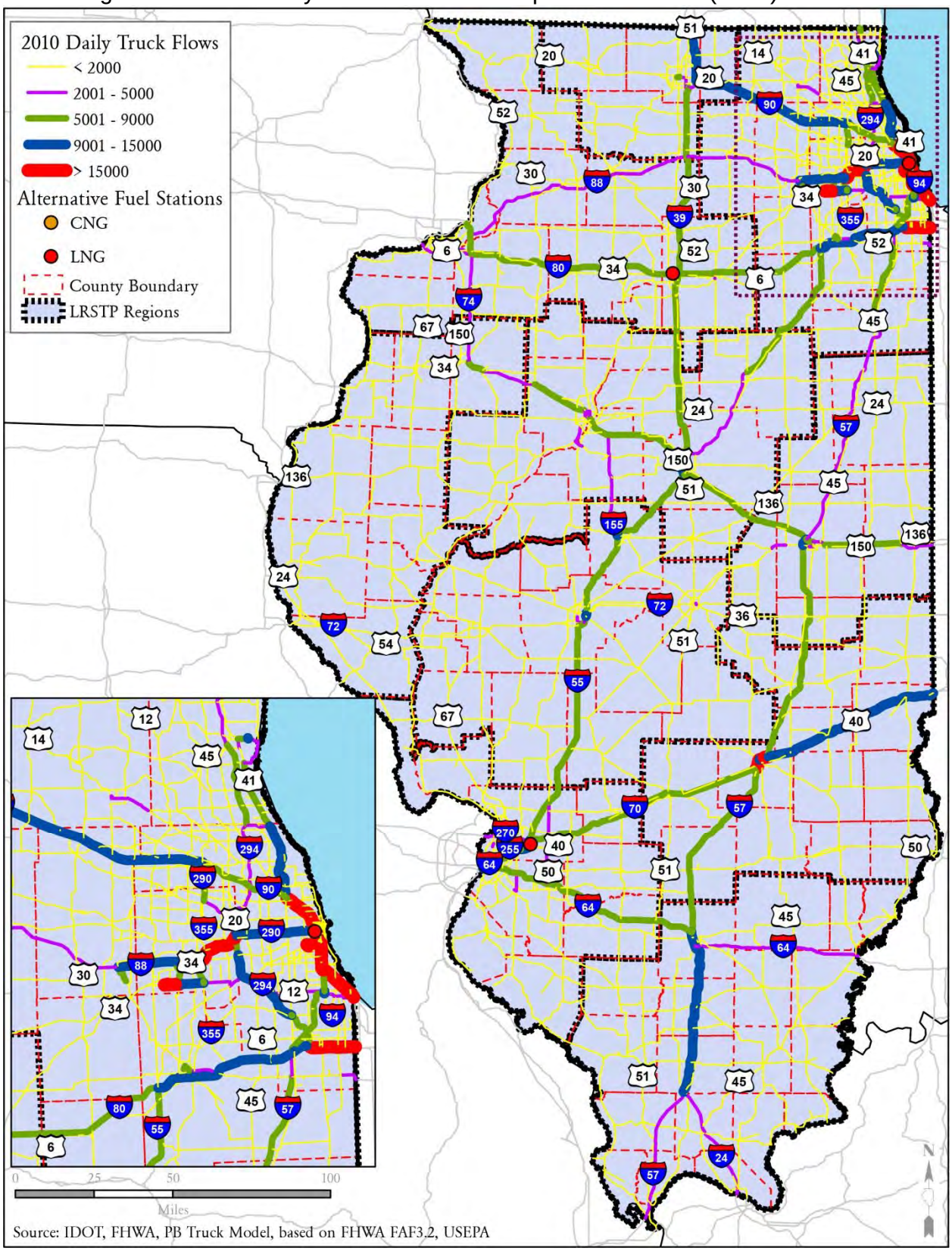


Figure 5.25: 2010 Daily Truck Flows and Liquid Natural Gas (LNG) Stations



5.4 Strategies

The future of freight in Illinois is in flux. While the Chicago hub will continue to be a key national center for freight transportation, new freight patterns can be expected to develop over the next 20 to 30 years that will impact the Illinois economy and its national position in freight movement.

The changes that are expected will be dynamic and not always predictable. Clearly, projected growth in the freight logistics industry in Illinois will continue to affect and be affected by congestion along the State's highway network. Critical measures for determining future statewide infrastructure investments include understanding how key industries move freight along that network, reviewing locations where recurring (congestion, bottlenecks) and non-recurring (crashes) delay exists, and investigations of the root cause(s) of the recurring or non-recurring delay.

5.4.1 Strategy: Implement Freight Performance Measures

Key datasets are available to illustrate many of the challenges that the goods movement industry faces on a daily basis. The metropolitan Chicago region is especially taxed by the finite capacity of the roadway network, the presence of high crash locations, bottlenecks, and the inefficiencies that come with those challenges. Given the historic and future importance of Chicago in the national logistics chain, there is little likelihood that these problems will disappear without a significant level of infrastructure investment directed towards freight-focused performance improvements.

Moreover, there is no guarantee of the future importance of any area, and the sharpened sensitivity to risk in modern supply chains implies that freight-focused improvements will be necessary to assure the prosperity the State that its businesses and citizens desire. To guide such improvements, performance measures can be developed based on the existing relevant datasets illustrated in the previous sections, using specified elements to prioritize locations and/or projects based on a desired goal. The information from this Freight Mobility Plan will aid in the determination of specific freight performance measures.

5.4.1.1 Safety Performance

Safety focused measures may include an analysis of crash reduction based on specific types of improvements (geometry, capacity, access, etc.) statewide or regionally. Given the availability of historic statewide crash data, this measure could be applied before and after an improvement is implemented to determine the success of a specific type of improvement. Such an analysis would serve as a guide to apply similar improvements at other locations within the State that suffer similar crash incidence.

5.4.1.2 Service Reliability

Reliability measures are more complex. The bottleneck data utilized is clearly valuable, yet not routinely collected. FHWA data on travel speed variability is available, but limited in scope. While comparable data is increasingly available from commercial vendors, the most straightforward approach might be to combine the known bottlenecks and significant freight routes identified in this report, and then apply existing freight traffic monitoring techniques to track performance at those critical locations. Analysis of geometrics affecting bottlenecks could be combined with growth projections contained in this report to identify points of future concern, and add them to the tracking locations as well.

5.4.1.3 Air Quality

Air quality measurements are regularly collected, most notably for nonattainment areas like those in the Chicago and St. Louis regions. To minimize the impact of future freight growth on these areas and the rest of the State, strategies can be developed so that impacts from this growth are minimized. For example, the number and spacing of LNG fueling locations on major through freight routes would be a potential measure.

5.4.2 Strategy: Enhance Knowledge of Industry Transportation Needs

Understanding how individual industries are impacted by the challenges outlined within this report is critical. Each industry group has specific travel patterns based on producers and consumers, and relies on the existing infrastructure to transport goods. While some industry groups are not beholden to specific areas of the State – or world – and can shift operations in or out based on performance, others (mining, petroleum) cannot simply shift to alternative locations where the transportation network may better serve their needs. Therefore, necessary resources must be committed to ensure that key industries can be attracted or retained, and continue to be productive within the State. Public-private coordination should be encouraged to ensure efficient freight system operation and to ensure freight transportation remains a key industry in Illinois that supports the economic health and development of the State.

5.4.3 Strategy: Expand Multimodal Planning

At this critical juncture of an evolving freight transportation environment, it is essential that IDOT expands its presence in planning and position Illinois' freight industry to meet the challenges set forth in this report. Key to this effort will be expanding interaction with air, rail, barge and trucking carriers as well as developing working relationships with logistics and intermodal terminal operators. Expanded multimodal freight planning will need to occur at the State and local level, as well as expanded coordination with neighboring states and other major economic regions where Illinois freight moves. Establishment of a State Freight Advisory Committee as federal MAP-21 legislation recommends is a practical step toward accomplishing this.

Changes like the capacity of the Panama Canal and new rail intermodal investments and services are already interacting to affect freight delivery patterns and systems. New technologies, markets and innovative freight delivery systems will create a competitive freight environment that demands an expanded interaction between government and freight carriers, intermodal transfer facility operators and logistics firms to assure strategic planning responses that avoid risky investments. The threats and opportunities of shifting and dynamic global markets dictate that a strong and trusted partnership be developed alongside the State's many freight service providers and transportation users to best understand both the certainty of the strengths of the Illinois transportation system as well as the fragility of freight demand.

To capitalize on future opportunities, public-private coordination and initiatives will be a foundation for meeting the needs of the future. The utilization of performance measures to guide freight initiatives and reduce supply chain risk offers one avenue to establish this, by providing common motivation based on shared benefits to users and the State's economy.

6.0 Summary

The Freight Mobility Plan, which includes the State Rail Plan, provides an understanding of Illinois' multimodal freight system. Freight transportation is one of Illinois' key industries. Our State is the third largest in the nation in freight tonnage, third in trucking volume and third in rail. Illinois is second in rail intermodal traffic, and its total tonnage by all modes is the highest for states that are not located on a seacoast.

Illinois is the linchpin of the American rail freight network, served by all seven of its Class I railroads. Illinois stands at the juncture of the Ohio and Mississippi river systems, and via the Illinois River connects them to the Great Lakes and the Atlantic Ocean. Chicago's O'Hare International Airport is an important air hub in the world, offering belly space in passenger aircraft to carry cargo all over the globe. Rockford's airport houses a dedicated air cargo hub for the largest freight company in the world.

Intermodal service is a principal advantage that Illinois brings to supply chain businesses; this advantage helps drive the State's economy. Businesses are dependent on an integrated system of freight transportation and Illinois' transportation network and freight services provide a full range of options. Freight hubs are essential to Illinois' position in the business logistics system. Originally because of its waterways, and then because industry and modal networks developed on similar patterns, Illinois is a national freight crossroads, bearing goods traffic from all directions. The virtue of a transportation hub is that it consolidates fragmented activity to achieve volume economies. Once this is done, the number of markets that can be connected efficiently and the quality of the service to them rises dramatically. Through traffic is one key element for a successful hub. Businesses surrounding the hub have far better freight options and performance than would otherwise be possible because of the through traffic. This greater freight service also attracts businesses, as well as aiding them to compete.

Facilitated by its status as a huge metropolitan market, Chicago became one of the three main centers of inland distribution for the United States because of its excellent and robust transportation network. These factors have helped make Illinois and Illinois industry integral to global systems of trade, despite being in the interior of the continent.

Section 2 presents a description of existing and projected 2040 Illinois freight traffic by mode, industrial commodity, and geography. Total Illinois freight tonnage is expected to increase by 34 percent between 2010 and 2040 growing to 1.7 billion tons annually. The major Illinois freight traffic findings are summarized below.

- *Illinois freight is a substantial user of all modes.* The 1.3 billion tons of freight based in Illinois is five-eighths truck, two-eighths rail, and one-eighth water. Air is small, but significant in value, and is a crucial backstop for supply chain logistics. Modal transfers are important, encompassing not only pick-up and delivery services by truck for rail, water, and air shipping, but also rail relays to water. By 2040, Illinois-based freight will grow by one-third to 1.7 billion tons, with air freight doubling and growing far the fastest, but trucks absorbing four-fifths of the traffic added in the State. This projected 42 percent increase in truck freight tonnage in Illinois has long-term implications for maintaining and enhancing truck routes in the State. The multi-modal and

inter-modal character of the Illinois freight system and the powerful position as a hub that it confers are strengths that must be preserved, while the pressures of growth on this system must be effectively managed.

- *Commodities are concentrated.* Four groups of mainly bulk products account for half the Illinois-based volume by weight: petroleum products, coal, livestock and feed, and stone and minerals. By product value, five commodities account for 40 percent of the volume: machinery, electronics, pharmaceuticals, motor vehicles and parts, and a mixed class of chiefly manufactured products. The bulk shipping relies on truck, rail, and water in that order; the high value shipping relies on truck and air. The significance is that different parts of the modal system serve different industries, and assurance of transportation performance for a relative handful of industries will support a large portion of activity. These different modal freight markets must be monitored to better understand future industry needs.

- *Directional patterns are approximately 30 percent outbound, 30 percent inbound, and 40 percent intrastate, with somewhat more tonnage outbound than in.* However, patterns are very different by mode. Intrastate volume is almost entirely trucked, while interstate volumes are modally diverse and often imbalanced. Interstate truck tonnage is roughly equal between outbound and inbound flows, yet rail has 40 percent more tonnage inbound than out and air has 50 percent more. For water, the situation is reversed. Six times more waterborne tonnage is outbound than inbound, with over 80 percent of the traffic on the Mississippi, Illinois, and Ohio Rivers and the rest on the Great Lakes. The implication is that in-state and interstate activity require distinct forms of support, and that system demands in some cases are weighted heavily by direction. The Illinois freight traffic by direction (inbound, outbound, or intrastate) must be monitored to better understand modal needs.

- *Volume by trading partner (excluding in-state tonnage) is 82 percent domestic and 18 percent foreign, and over one-third is regional trade with neighboring states.* However, foreign trade does not always take second place: there is more freight to and from Canada than the U.S. Northeast, and more with Eastern Asia than the U.S. Pacific (although Asian shipping typically moves via the Pacific Coast). The heaviest imports are from Canada, the heaviest exports to Asia, and Canadian tonnage overall is six times bigger than that traded with Mexico. By 2040, the picture changes. Foreign trade climbs to 24 percent of the traffic and captures almost half the growth, with new import tonnage somewhat ahead of new export. Canada and Eastern Asia become bigger than three out of six areas of the U.S., and only regional traffic adds more tonnage. Canada remains larger than Mexico, but by three and a half times instead of six. The meaning of these patterns is that Illinois is a regional, national, and international freight center, the international component rising, and all of these dimensions will require monitoring and support to retain and expand upon our global freight traffic position.

- *Differences in the use of the roadway network matter to investment decisions, and Illinois roads are used differently in two key ways: first by through trucks versus trucks carrying Illinois-based freight, and second by sectors of industry.* The east-west highways I-70 and I-80 are prominent routes for through freight, but for Illinois traffic I-88 and the north/south routes I-55 and I-57 are more important. Industries mainly serving interstate or in-state markets (for example, machinery versus petroleum products) diverge in the corridors they depend on, and those active in Central Illinois make particular use of I-74, I-155, and I-39. Greater Chicago is a high volume zone for top industries, making its

local and radial routes as well as the I-90/94 corridor along the lake important almost across the board. An extensive network of secondary routes appears less significant by individual segment yet in total reaches much of the industry around the State, underscoring the fact that effective freight service must be door-to-door. The implications of these points are that management and investment in transportation performance to support Illinois industry will not focus on the same roadways facing external demand, the focus will vary with the industry supported and its location in the State, and secondary roadways cannot be overlooked.

Section 3 describes potential market trends that could affect freight movement in Illinois. These potentially significant trends include trends in bulk commodities; expansion of the Panama Canal; near-shoring, on-shoring, and supply chain risks; change is distribution and retail; and freight carriage change. These potential market trends are summarized below.

- *Bulk Commodity Trends for Coal and Grain*

  Coal Trends: Illinois' coal output is concentrated in ten counties along or near the Mississippi and Wabash Rivers in Southern Illinois, with other significant coal reserves that could be developed. If Illinois coal production is increased over the next decade or longer for shipment to neighboring states for consumption by utilities, or for export down the Mississippi River, then the capacity of connecting highway, truck, rail and barge services may need to be improved to handle this volume. This would also be the case for new coal mining, exploiting the lower cost of extraction in locations that have not previously handled such traffic.

  Grain Trends: Total U.S. corn production is forecast to increase 24 percent by 2021, and corn exports by 32 percent according to the USDA. Total U.S. soybean production is projected to grow a more modest 8 percent by 2021, and soybean exports only 6 percent. Assuming production and export growth in line with projections for the U.S. as a whole, then Illinois could experience significant growth in corn shipments, both domestic and exports, and minor growth in soybeans. Water and rail represent the largest outbound freight tonnage modes for cereal grains and would requiring improved capacity and connections.

- *Panama Canal Expansion could affect three types of Illinois freight traffic: containerized cargo, and exports of coal and grain*. Illinois and the City of Chicago have been the crossroads and exchange point of the Class I railroads for moving containerized goods from West Coast ports to Ohio and points east. If the expansion of the Panama Canal tips some cargo to the East Coast this will tend to incrementally lessen the volume of rail traffic moving through the State from the west and reduce pressure on Chicago exchanges of containers. Growth at the CSX Northwest Ohio freight hub depends in part on routing rail traffic around Chicago, and its success could tend to minimize container volumes being shifted to East Coast ports.

  – *Coal:* The United States is a marginal supplier in world coal trade, and it is not expected that Illinois coal exports will significantly increase because of lower transportation costs resulting from the Panama Canal expansion. This is especially unlikely because a) any growth in coal exports is likely to be concentrated in metallurgical rather than steam coal; and b) the use of larger ships through the Canal will also lower transportation costs for competitive coal producing countries such as Colombia. If there is potential for increased coal exports to Asia, it may be in metallurgical coal flowing through Illinois coal terminals on the Mississippi River, where there would be minimal impacts on Illinois transportation.

– *Grain:* The Corps anticipates that U.S. grain exports will not increase significantly due to the Panama Canal expansion, but that the *routing* of grain exports could be more focused on use of the Mississippi River and other inland waterways. The implications are that grain exports originating from states to the west of Illinois could increase shipments to grain handling terminals for export on the Mississippi River and other inland waterways, rather than by rail through the West Coast. Like coal moving through Illinois, these grain shipments would not be expected to have a significant impact on Illinois transportation. Neither would there be expected impacts for grain produced in Illinois, where shipment down the Mississippi River is already the norm.

- *On-shoring:* Seven manufacturing industries appear likely to return production to the United States from Asia primarily due to narrowing wage differentials and higher transportation costs. The seven range from machinery, electronics, and transportation goods to fabricated metals products, plastics and furniture. These industries account for 36 percent of the value of goods shipped outbound from Illinois today, and half of its top ten outbound commodities ranked by value. There is no guarantee that "on-shoring" will be a boon to Illinois, yet the magnitude of its existing activity in these industries implies a strong base of skills and suppliers, and Illinois' powerful transportation system offers attractive time to market over a large area. Supporting and strengthening those factors could be a path to growth for the State, including for exports to the developed world. Trucks are the dominant freight mode for manufacturing in the State, so trends in these manufacturing areas should be closely monitored. In addition, the State should use its strong manufacturing base and freight system to attract more than its fair share of these growing industries.

- *Supply Chain Risk:* The long-term trend in manufacturing and distribution is to supply systems that are highly responsive to local market conditions with little inventory exposure. Reliance on minimal inventory and the use of the transportation system as warehouse has created acute sensitivity to disruption risks in the transportation system and surrounding environment. For Illinois, this means that its advantages of location and transportation alternatives aid its economic prospects, and are supported by natural factors like a lower incidence of destructive weather events. However, system factors like reduction of transportation risk from deteriorated infrastructure or bottleneck-induced delivery failures will also play a role in supply chain decisions. Management of risks as they affect supply chain performance thus will be an appropriate tool of economic stewardship for the State. The State must continue to invest in maintaining its transportation infrastructure and to reduce bottlenecks.

- *Change in Distribution:* Rising fuel costs, carbon footprint management, and the need to improve market responsiveness are causing redesign of supply chain networks and utilization of larger numbers of distribution centers placed closer to end markets. For Illinois, this can mean a) national distribution from Chicago will be less important than regional distribution; b) facilities may be viable closer to urban centers and so impose less truck VMT; c) network redesign will offer an economic opportunity to be captured with strong transportation system performance and appropriate facilities and policies. This need for strong transportation system performance will require continued performance monitoring, and effective freight infrastructure investments and policies.

- *Change in Retail:* Competition between brick-and-mortar stores and on-line retailers has induced new strategies that combine storefront convenience with large web selections, along with offers of fast home delivery. Distribution centers (DCs) will be positioned at shorter distances to fulfill the service promise, home delivery should grow even more rapidly, and freight transportation performance will be fundamental to the entire business model. In Illinois, DC location and land use management would benefit from improved alignment with delivery service requirements, and reduction of delivery risks from freight bottlenecks and infrastructure condition would help the new retail systems reach more of the State's consumers. This will required increased coordination with industry, as well as continued focus on the freight transportation system performance.
  - *Big Box:* Big box retailers are now moving into central business districts where they have traditionally not operated, using new store designs better suited to the environment. Urban costs of living are apt to benefit from the highly competitive cost structures these stores bring, which to a significant degree are founded on their global logistics systems, and the reliable levels of logistics performance they have been able to achieve in locations less challenging than downtown centers. For Illinois, it will be important to recognize that the realization of cost of living benefits will be connected to this logistics performance, both inside the cities and in the networks that feed them.

- *Freight Carriage:* Significant trends affecting freight carriers are natural gas fuels, the truck driver shortage, and rail intermodal growth.
  - *Natural Gas:* Freight vehicles fueled by natural gas (NG) have been active in cites for some time. They now seem poised to transition from niche to mainstream, primarily because of the much lower cost of the fuel, which recently was about half the cost of diesel. For Illinois, three advantages are available from the encouragement of NG conversion and expansion of the fueling network: first as a support to the supply chain costs of Illinois industry, second for attraction of new businesses to the State, and third as an increasingly pragmatic route to air quality improvement. However, some method of taxing NG should be explored if it serves a diesel substitute, in order to maintain investment in the State's freight transportation system.
  - *Driver Shortage and Intermodal Growth:* A shortage of truck drivers has plagued the freight industry for many years and has reduced its productivity. The problem is getting worse due to a rapidly aging workforce, safety regulations that also tighten the effective supply, and wages. As economic growth strengthens, freight rates could rise and driver wages along with them. One potential solution to driver supply is substitution of rail intermodal for over-the-road trucking, and the industry has seen continuing growth in domestic intermodal and the shortening of distances at which it competes. This will be a private sector decision based largely on cost. This potential trend will require monitoring to support necessary connections.

Section 4 summarizes selected findings from prior studies of freight transportation in the State. Improvements to the efficiency and cost effectiveness of freight operation in Illinois and the greater region have been proposed and studied in various formats. This section summarizes these reports and notes recurring issues and trends present at the statewide level.

- Much of Illinois' freight movement takes place in the Chicago metropolitan area, a region with commodity flow volumes that would rank it among the most active ports worldwide, had these goods traveled by ocean carrier rather than truck or rail. The metropolitan St. Louis and Peoria areas are also important freight centers, along the Mississippi and Illinois Rivers. Accordingly, it is not surprising that Chicago, the Illinois portions of metropolitan St. Louis, and the Peoria metropolitan area are the focus of research for many of these studies. However, as these main nodes are the primary locations of modal conflict and operational bottlenecks, addressing inefficiencies in these key regions can deliver improvement to businesses and consumers statewide.

- The greatest problem addressed in many of the studies is roadway congestion, cited as a driving factor in the degradation of efficient freight movement operations within Illinois and the surrounding region. FHWA data support these assessments: for truck trips longer than 500 miles, Chicago and northwest Indiana occupy seven of the top 25 truck freight bottlenecks in the United States, as ranked by annual hours of vehicle delay. Congestion costs are not only experienced by shippers and passed on to consumers via high total landed costs for consumables, but also transmitted to local drivers in dense urban areas that find themselves losing increasing amounts of time waiting behind at-grade rail crossings.

- While most of these impacts are concentrated in Chicago, the Illinois portion of the St. Louis metropolitan area and the Peoria metropolitan area are forecasted to demonstrate degraded levels of service in the next 15 years, which could substantially hinder the flow of inputs and finished goods in the region. Several means of addressing congestion being considered in these studies include preservation of rail assets for a future in which the mode is more time-competitive to a congested roadway system, a system of dedicated truck lanes in selected interstate highway corridors, intersection grade separation and redesign, and increased investment in intelligent transportation systems (ITS) and transportation management centers (TMCs).

- Another means of improving the efficiency of the freight movement network, and hence bolstering the economic competitiveness of the region, are intermodal ports and transfer stations suggested in several studies. The impact of these facilities upon load consolidation and separation of local and long haul loads should be demonstrable in the form of decreased roadway congestion, and sustained use of a rail asset that diverts loads from oversubscribed roadways.

- Several key portions of the studies reviewed planning efforts by IDOT and regional MPOs to mitigate conflict between residential and commercial activities and freight movement and associated industrial activities. This has taken the form of localities studying locations of conflict between truck and private automobile congestion, passenger and freight train congestion, relocation of freight-driven impacts away from dense urban cores, and the systemic preservation of industrial and freight related assets.

- The studies also focus upon the means of implementation for designing, building, financing, and operating public freight-supporting facilities. Corridor length improvements such as dedicated truck lanes and other large investments may involve memoranda of understanding or more formal interstate compacts. At a more local scale, risks may be mitigated and funding secured

through public-private partnership. Finally, the role of competing and overlapping jurisdictions is mentioned in several summaries of inland port investment plans, as regionally (rather than geographically) defined port districts face different economies of agglomeration than coastal ports with captive hinterlands.

Section 5 addresses performance and strategy, describing safety, reliability, and air quality issues in the context of freight commodity traffic patterns and growth, and presenting potential ways forward for the State to preserve and enhance it key freight system. The freight industry in Illinois relies heavily on the State's robust highway network to move goods within, into, out of and through the State. While a significant portion of the State's highway freight activity occurs within or through the greater metropolitan Chicago region, the State also serves significant highway freight traffic near urban centers in Peoria and Springfield, as well as national traffic associated with St. Louis, Indianapolis, and Louisville. This mix of highway freight traffic is illustrated in the numerous datasets reviewed to determine where the most significant safety, reliability, or emissions-related deficiencies currently exist or may exist in the future.

This section includes a review of existing and future truck volumes with respect to safety, system reliability, and air quality. These sections are followed by a set of strategies aimed at mitigating identified safety, reliability, or air quality issues, as well as strategies that will raise performance, encourage industry, and proactively measure and minimize future impacts to the freight network.

Highway freight-focused safety analyses indicate locations where truck crash clusters and/or rollover locations may impact the goods movement industry, either directly via a crash risk or indirectly via nonrecurring congestion associated with crash incidents. Given the level of truck volumes in the Chicago region, it is not surprising that the highest levels of truck crash incidence are found along major truck routes in and around the city. Continuing attention is warranted in areas of known concern, and in locations where rising volumes could create new pressures.

The service reliability section provides insight on the impact that increased freight volumes may have on the statewide freight network, most notably at locations where existing or future congestion levels are highest or at locations where bottlenecks are readily apparent. This features a review of volumes for commodities most critical to Illinois or most sensitive to changes in the transportation network. This includes the identification of locations where structurally deficient bridges could restrict the movement of the heaviest freight loads. Investment and management in roadways important to critical industry and subject to performance risk is a key way to heighten their competitiveness, capitalize on growth opportunities, and build the economy of the State.

Air quality can be affected by freight in areas where congestion is highest, as evident in the two non-attainment areas in Illinois. Projected increases in truck volumes in these areas and the potential for those increases to be offset by improvements in green technologies, including alternative fuels like compressed or liquefied natural gas are reviewed. Because the viability of natural gas as a freight fuel appears to be gaining, possibly offering economic as well as environmental advantages, support for expansion should be considered.

Three overarching strategies will help the State prepare for the future, capitalize on its strengths and opportunities, expand on the global stage, respond to new federal MAP-21 legislation, and build prosperity for its businesses and citizens:

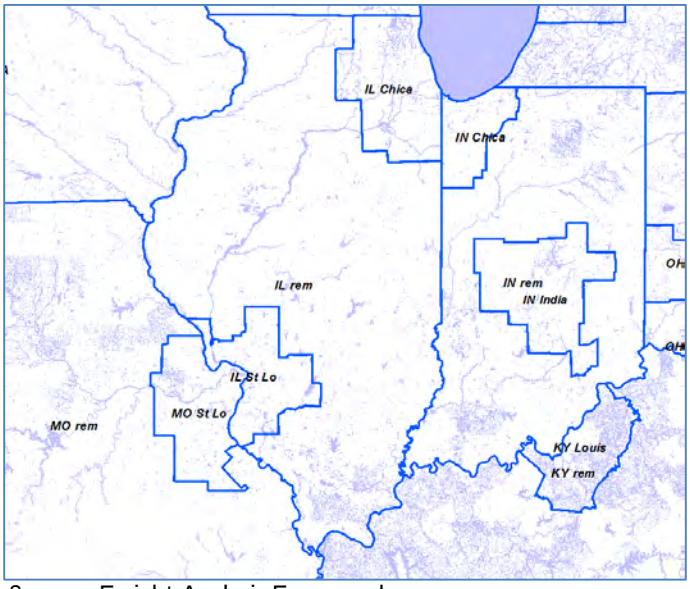
- First, implement freight performance measures, so that the quality of performance can be known and enriched, and ultimately employed as a competitive advantage. The information from this Freight Mobility Plan will aid in the determination of specific freight performance measures.
- Second, enhance knowledge of industry transportation needs, so that responsive policies and investments can be implemented in the long term interest of the Illinois economy and jobs. Public-private coordination should be encouraged to ensure efficient freight system operation.
- Third, expand freight multimodal planning, in order to enjoy the benefits of every mode, improve their connection, and sustain the State's position as the primary freight hub of the United States. This will need to occur at the State and local level, as well as expanded coordination with neighboring States and other major economic regions where Illinois freight moves.

IDOT will also provide future updates to this Freight Mobility Plan as final federal guidance becomes available.

Appendix: Truck Model Documentation

To capture the complete picture of truck traffic in Illinois, a model has been developed that covers trucks trips across the entire continental U.S. Truck trips are generated based on commodity flow data provided by the FAF. At the time of the model development, the most recent version available was FAF 3.2, which has been used consistently in this analysis. Figure A.1 shows the size of the FAF zones in and around Illinois.

Figure A.1: Geography of FAF Zones in Illinois

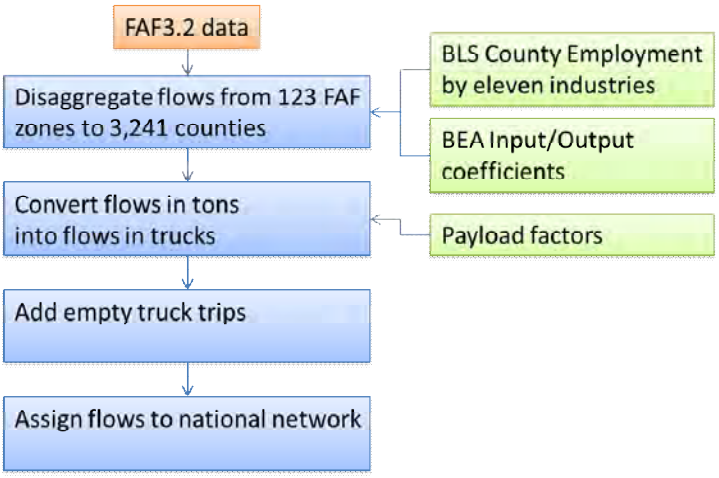


Source: Freight Analysis Framework

The resolution of the FAF data with 123 zones within the U.S. is too coarse to analyze freight flows in Illinois. The three zones within Illinois do not provide sufficient spatial detail, and some other states, such as neighboring Iowa, are covered by a single FAF zone only. Assigning truck flows from and to these states to a single point (centroid) would lead to highly unrealistic truck travel patterns. Therefore, a method has been developed to disaggregate freight flows from 123 FAF zones to 3,241 U.S. counties.

An overview of the truck model design is shown in Figure A.2. First, the FAF data are disaggregated to counties across the entire U.S. using 11 employment types and input/output coefficients (also called make/use coefficients). Then, commodity flows in tons are converted into truck trips using average payload factors. Empty truck trips are added, and the total truck trips are assigned to a national highway network.

Figure A.2: Truck Model Flowchart

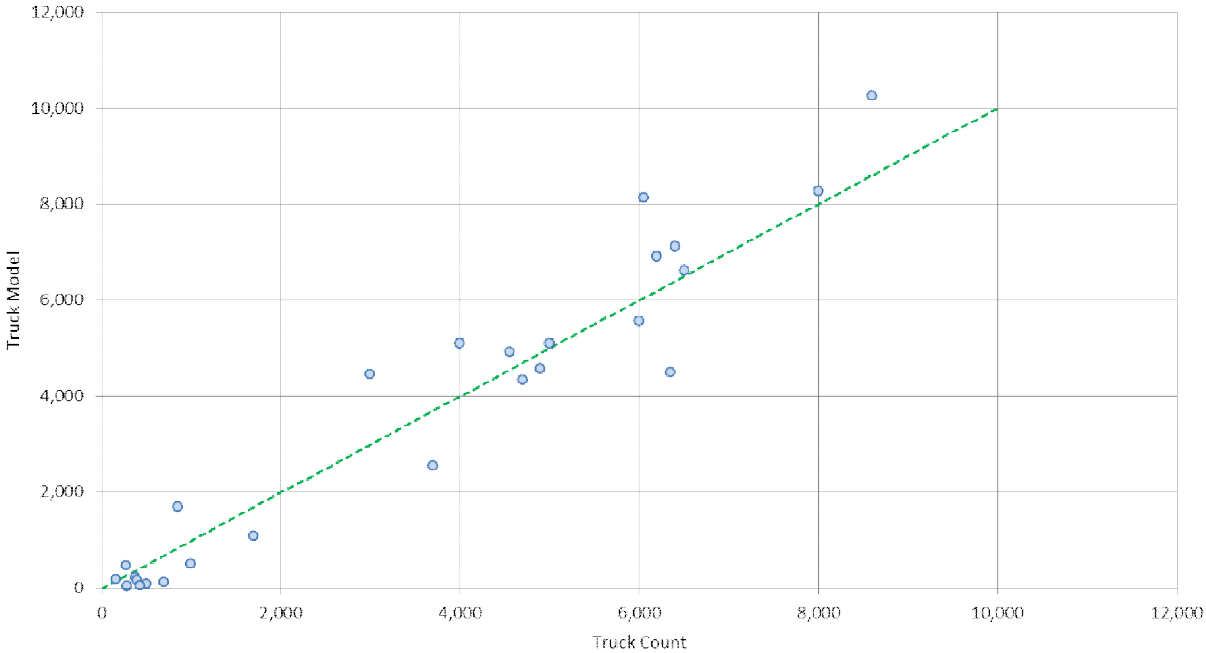


The assigned truck volumes have been validated against truck traffic counts. Figure A.3 shows the validation of the model output against traffic counts. Overall, the modeled volumes are two percent larger than the count volumes. An R2 of 0.934 shows a close correlation, and the root mean square error of 858 or 25 percent shows a close match between model results and count data. Truck flows are then assigned to a U.S.-wide network covering the continuous 48 states. Figure A.4 shows the assignment of truck flows across the U.S.

Lastly, the FAF dataset provides commodities at the two-digit SCTG level. To focus on commodities and groups of commodities that are most relevant to Illinois, the 43 SCTG commodities provided by FAF were aggregated to 20 commodity groups for this study. Table A.1 shows the aggregated commodities.

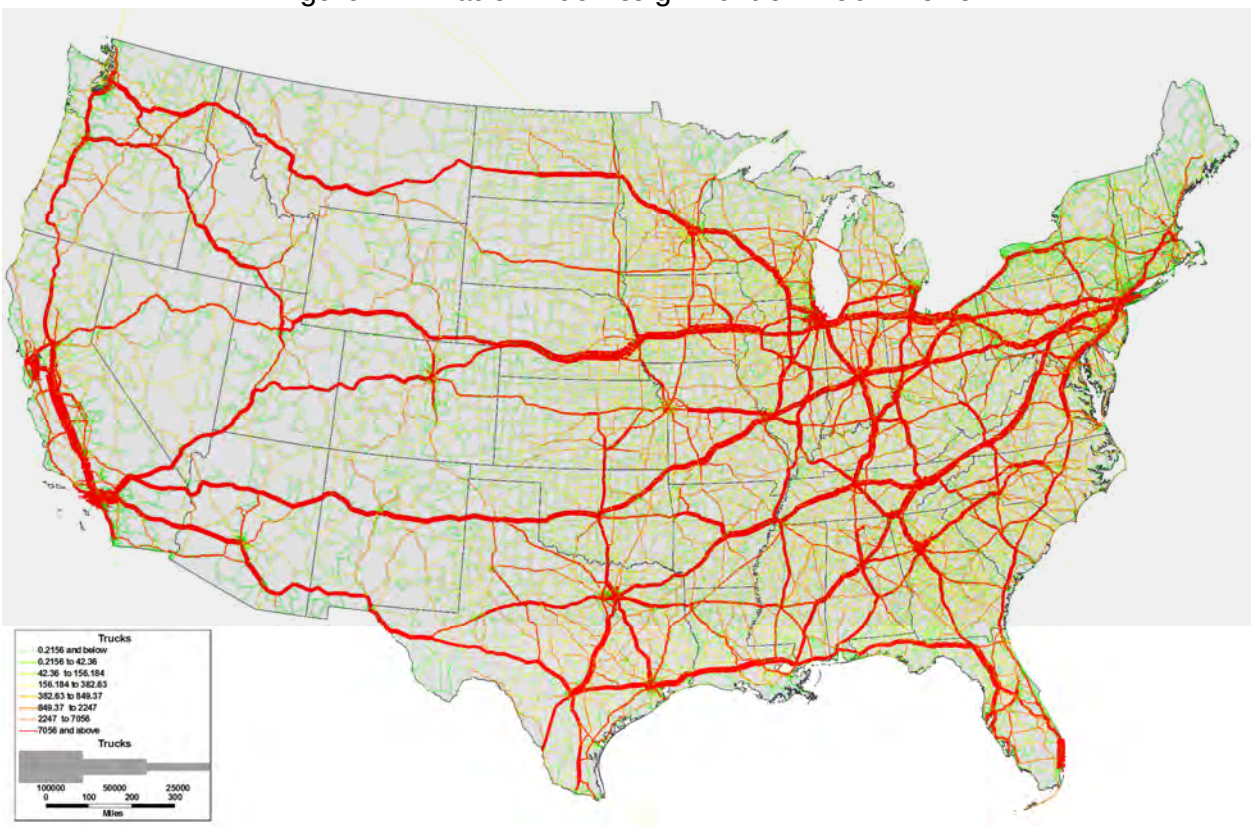
This aggregation process considered four aspects. Important commodities for Illinois were kept as a single commodity group, only commodities that are carried by the same (or similar) truck types were aggregated, it was attempted to aggregate commodities that have comparable payload factors, and finally, commodities with larger flow volumes across the U.S. were kept separate.

FigureA.3: Base Year Truck Model Validation



Source: Freight Analysis Framework, Parsons Brinckerhoff

Figure A.4: Nationwide Assignment of Truck Flows



Source: Freight Analysis Framework, Parsons Brinckerhoff

Table A.1: Grouping of SCTG Commodities

Commodity Group	SCTG	Truck Type	Payload	U.S. Truck Tons	Avg. Payload
1: Cereal Grains	02 Cereal grains	Bulk for food, medium	27,945	1,207,263	27,945
2: Live Animals, Animal Feed	01 Live animals/fish	Livestock	24,492	106,275	23,449
	04 Animal feed		22,967	229,774	
3: Other Agricultural Products	03 Other ag products	Bulk for food, heavy	22,140	364,487	22,140
4: Meat or Seafood	05 Meat/seafood	Reefer	30,691	108,171	30,691
5: Prepared Food, Tobacco, or Alcohol	06 Milled grain products	Van, light	11,831	122,235	22,694
	07 Other foodstuffs	Van, heavy	25,926	487,249	
	08 Alcoholic beverages		20,573	121,747	
	09 Tobacco products		25,168	4,496	
6: Stone, Ore, or Mineral Products	10 Building stone	Flatbed with lift	25,429	55,466	31,106
	11 Natural sands	Bulk	29,501	527,822	
	12 Gravel		30,840	1,939,431	
	13 Nonmetallic minerals		29,101	289,045	
	12 Metallic ores		39,464	39,123	
	25 Logs	Logging truck	35,073	506,984	
	31 Nonmetal min products		31,044	1,311,295	
7: Coal	15 Coal	Bulk	43,866	267,722	43,866
8: Petroleum or Asphalt Products (Except Gasoline)	16 Crude petroleum	Tank, heavy	28,007	4,613	20,808
	18 Fuel oils		23,442	369,735	
	19 Coal-n.e.c.		18,608	457,693	
9: Gasoline	17 Gasoline	Tank, medium	48,686	589,187	48,686
10: Fertilizers or Chemicals	20 Basic chemicals	Van for chemicals	29,391	246,626	25,349
	22 Fertilizers		19,833	158,979	
	23 Chemical products		24,432	130,671	
11: Manufactured Products or Durable Goods	30 Textiles, leather	Van for non-food	20,608	57,305	17,112
	39 Furniture		14,103	45,251	
	40 Misc mfg products		16,462	98,613	
12: Paper, Pulp, or Allied Products	27 Newsprint/newspaper	Van for consumer goods,	33,046	115,872	30,023
	28 Paper articles	non-food, medium	26,282	93,613	
13: Printed Products	29 Printed products	Van	11,024	49,646	-
14: Metal Products (Primary and Fabricated)	32 Base metals	Flatbed, medium	24,458	335,388	20,923
	33 Articles-base metal		14,395	181,619	
15: Machinery or Parts	34 Machinery	Flatbed, heavy	6,064	171,184	7,002
	37 Transport Equipment	Automobile, medium	34,282	5,888	
16: Motor Vehicles	36 Motorized Vehicles	Automobile, heavy	15,690	154,291	15,690
17: Lumber or Miscellaneous Rubber Products	24 Plastics, rubber	Van for non-consumption	19,324	159,913	18,751
	26 Wood products	products, medium	18,494	355,706	
18: Electrical, Scientific, or Medical Equipment	21 Pharmaceuticals	Van for consumer goods,	10,260	16,572	12,855
	35 Electronics	non-food, heavy	13,821	64,199	
	38 Precision Instruments	Van for non-consumption products, heavy	9,024	4,958	
19: Waste or Scrap	41 Waste, scrap	Trash truck	29,113	1,249,162	29,113
20: Mixed or Unknown Freight	43 Mixed freight	Unknown	11,826	334,651	11,826