



CIVIL ENGINEERING STUDIES
Illinois Center for Transportation Series No. 08-025
UIIU-ENG-2008-2013
ISSN: 0197-9191

REGIONAL WAREHOUSE TRIP PRODUCTION ANALYSIS: CHICAGO METRO AREA, SEPTEMBER 2008

Prepared By

Jon B. DeVries
Sofia V. Dermisi
Roosevelt University

Research Report ICT-08-025

A report of the findings of
ICT-R27-15
Regional Warehouse Trip Production Analysis: Chicago Metro Area

Illinois Center for Transportation

October 2008

1. Report No. FHWA-ICT-08-025	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle REGIONAL WAREHOUSE TRIP PRODUCTION ANALYSIS, Chicago Metro Area, September, 2008		5. Report Date October 2008	
		6. Performing Organization Code	
7. Author(s) Jon B. DeVries and Sofia V. Dermisi		8. Performing Organization Report No. ICT-08-025 UILU-ENG-2008-2013	
9. Performing Organization Name and Address Marshall Bennett Institute of Real Estate Walter E. Heller College of Business Administration Roosevelt University, GB 810 430 S. Michigan Avenue, Chicago IL 60605		10. Work Unit (TRAIS)	
		11. Contract or Grant No.	
		13. Type of Report and Period Covered	
12. Sponsoring Agency Name and Address Illinois Department of Transportation Bureau of Material and Physical Research 126 East Ash Street Springfield, IL 62704		14. Sponsoring Agency Code	
15. Supplementary Notes			
<p>16. Abstract This research report provides primary research data and analysis on heavy truck trip generation and characteristics from regional distribution centers (RDC) and similar facilities in an effort to facilitate future public policy making regarding roadway transportation needs as well as land-use and economic development decisions. The report also provides secondary data and information on intermodal freight transportation - its growth and its economic impacts – to provide a regional, national, and international context for the research.</p> <p>The primary data was obtained from a field survey of 12 distribution centers of various scales (7 of them regional) in Northeast Illinois. The 12 facilities and their supervisory personnel were visited by the research team and analyzed in depth for their general business characteristics (e.g. type of goods, number of employees, hours of operation etc.), property characteristics (e.g. location, facility size, ceiling height) and their truck trip productions (e.g. number of arrivals-departures, geographic distribution of inbound-outbound movement, volume per quarter etc.).</p> <p>The findings of this research project in reference to the 12 facilities indicate the uniqueness and significant complexity of the distribution centers. There is clear evidence of an increase in size (sq. ft & ceiling) and automation (racking systems) of the newer facilities as well as 24-hour operations. The comparison of daily heavy truck movement shows significant arrival concentration between 8am-10am and 8pm-6am. In contrast the heaviest departure activity is between 4-6pm. The majority of originating freight is from the Midwest with the outbound distributions also being allocated regionally then nationally and internationally (minimal allocation). Another result was the increased volume concentration in the third quarter of each year between July and September.</p> <p>The above results along with the significant expansions of RDC facilities in the last few years indicate the additional need for studying the locations of the various facilities and the heavy truck traffic volume they generate. The results should also be useful in determining the economics benefits/costs and impacts of these facilities for purposes of making infrastructure investment, economic incentive, and land use decisions.</p>			
17. Key Words Heavy Truck movements, Intermodal, Regional Distribution		18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 27	22. Price

ACKNOWLEDGEMENTS AND DISCLAIMER

Marshall Bennett Institute of Real Estate would like to gratefully acknowledge the following people for facilitating interviews and site tours:

- Christopher R. Bultinck, Director of Portfolio Leasing, Northern Builders, Inc.
- Lloyd E. Berry, Second Vice President; Colliers, Bennett & Kahnweiler, Real Estate Management Services
- Ben Bischmann, Manager; Colliers, Bennett & Kahnweiler, Real Estate Management Services

The Institute would also like to thank the following people for their support on this study:

- Claire Bozic, Chicago Metropolitan Agency for Planning (CMAP), for advice on the survey instrument's design
- Roseann O'Laughlin, CMAP, for feedback and critiques
- Charles Abraham, Illinois Department of Transportation (IDOT)-DPIT, for study review, coordination, and input
- Gerald Rawling, for counsel on the study process, field interview assistance, insights on global logistics, and advice on data format

A list of the twelve facilities surveyed is shown in Table 2. We thank all of the professionals associated with these facilities for generously providing time, operating data, personal insights, and tours of their facilities.

This publication is based on the results of ICT-R27-15, Regional Warehouse Trip Production Research Analysis. ICT-R27-15 was conducted in cooperation with the Illinois Center for Transportation; the Illinois Department of Transportation (IDOT), Division of Highways; and the U.S. Department of Transportation, Federal Highway Administration. Members of the Technical Review Panel are the following:

- Chuck Abraham (Chair), IDOT
- Chuck Cadlek, IDOT
- Claire Bozic, CMAP

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EXECUTIVE SUMMARY

This research report provides primary research data and analysis on heavy truck trip generation and characteristics from regional distribution centers (RDC) and similar facilities in an effort to facilitate future public policy-making regarding roadway transportation needs as well as land-use and economic development decisions. The report also provides secondary data and information on intermodal freight transportation - its growth and its economic impacts – to provide a regional, national, and international context for the research.

The primary data was obtained from a field survey of 12 distribution centers of various scales (7 of them regional) in Northeast Illinois. The 12 facilities and their supervisory personnel were visited by the research team and analyzed in depth for their general business characteristics (e.g. type of goods, number of employees, hours of operation etc.), property characteristics (e.g. location, facility size, ceiling height), and their truck trip productions (e.g. number of arrivals-departures, geographic distribution of inbound-outbound movement, volume per quarter etc.).

The findings of this research project in reference to the 12 facilities indicate the uniqueness and significant complexity of the distribution centers. There is clear evidence of an increase in size (sq. ft & ceiling) and automation (racking systems) of the newer facilities as well as 24-hour operations. The comparison of daily heavy truck movement shows significant arrival concentration between 8am-10am and 8pm-6am. In contrast, the heaviest departure activity is between 4-6pm. The majority of originating freight is from the Midwest with the outbound distributions also being allocated regionally then nationally and internationally (minimal allocation). Another result was the increased volume concentration in the third quarter of each year between July and September.

The above results along with the significant expansions of RDC facilities in the last few years indicate the additional need for studying the locations of the various facilities and the heavy truck traffic volume they generate. The results should also be useful in determining the economic benefits/costs and impacts of these facilities for purposes of making infrastructure investment, economic incentive, and land use decisions.

CONTENTS

ACKNOWLEDGEMENTS AND DISCLAIMER.....	i
EXECUTIVE SUMMARY	ii
CHAPTER 1 STUDY CONTEXT OVERVIEW	1
CHAPTER 2 STUDY PARTIES AND PURPOSE	2
CHAPTER 3 SUPPLY CHAIN CONTEXT	4
3.1. INTERMODALISM'S GLOBAL CONTEXT	4
3.2. NATIONAL CONTEXT	6
3.3. SUPER-REGIONAL CONTEXT	7
3.4. REGIONAL CONTEXT	8
CHAPTER 4 STUDY PROCESS, FINDINGS, AND CONCLUSIONS	11
4.1. STUDY JUSTIFICATION.....	11
4.2. STUDY METHODOLOGY	11
4.3. INTERVIEW SITES	11
4.4. BUSINESS CHARACTERISTICS	12
4.5. BUILDING CHARACTERISTICS.....	13
4.6. HEAVY TRUCK TOTAL ARRIVALS AND DEPARTURES	14
4.7. NUMBER OF HEAVY TRUCK ARRIVALS BY TIME PERIOD	15
4.8. NUMBER OF HEAVY TRUCK DEPARTURES BY TIME PERIOD.....	16
4.9. LAND USE DISTRIBUTION OF FREIGHT TRUCK DESTINATIONS	16
4.10. GEOGRAPHIC DISTRIBUTION OF OUTBOUND FREIGHT TRUCKS.....	19
4.11. GEOGRAPHIC DISTRIBUTION OF INBOUND FREIGHT TRUCKS.....	20
4.12. PERCENT OF GROSS VOLUME PER QUARTER	22
4.13. AREA (SQ. FT.) AND HEAVY TRUCK RATIOS PER EMPLOYEE	23
CHAPTER 5 REPORT FINDINGS, OBSERVATIONS, AND RECOMMENDATIONS	24
REFERENCES.....	25
APPENDIX - SURVEY INSTRUMENT AS ADMINISTERED	26

CHAPTER 1 STUDY CONTEXT OVERVIEW

Although it can hardly be called “new” anymore and researchers have widely written about it at all geographic levels, from global to local, intermodalism still elicits a wiggly, red line in Microsoft Word. This is proof, if it was needed, that intermodalism is still more of a specialist than mainstream discipline.

Intermodalism, logistics, or supply chain management is the movement of goods or products by two or more of the transportation system’s components. A typical movement in the global economy involves moving products from an offshore source by truck or train to a foreign port, ocean passage to the United States, and distribution via truck or train to one or more warehouses before reaching end users such as processors or retailers.

Intermodalism has explosively grown in Northeastern Illinois over the last 15 years although the public still does not fully appreciate the contributions that the intermodal business’ movers and shakers have made to the regional and average household economies. The availability of affordable goods and products is inescapably linked to an efficient and economical supply chain. Without a full appreciation of this fact, the media sometimes reports on many of these movers and shakers unfavorably and the public often views them negatively (Chicago Sun Times, 2007; Tramel, 2008). Since trucks and trains need to move these goods and products to reach store shelves, researchers and planners need to understand and quantify these movers and shakers’ modus operandi so that public sector discourse, planning, and public policy are informed.

As the supply chain’s fixed and mobile pieces get larger and denser (e.g. a larger flow of goods and products, more and longer trains, larger warehousing properties, and new logistics parks), intermodalism’s impact becomes more pervasive and concentrated and creates needs for more infrastructure improvements and more desirable logistics jobs. It is precisely an increase in warehousing, especially regional distribution center (RDC)-scale warehousing, in Northeastern Illinois that prompted this research.

CHAPTER 2 STUDY PARTIES AND PURPOSE

The Chicago Metropolitan Agency for Planning (CMAP) and the Illinois Department of Transportation (IDOT) therefore sought this study of warehouse operations in order to obtain and analyze truck trip production and attraction data and examine warehouse features to inform discourse, planning, and policy making, particularly in the public sector. The Marshall Bennett Institute of Real Estate (MBIRE) at Roosevelt University was charged with obtaining current and comprehensive original data on the issue of heavy truck traffic and characteristics of that traffic at regional warehouse and similar facilities in the Chicago metropolitan region.

In particular, the research team obtained the following data through field visits to regional distribution centers and similar facilities, and from key stakeholder interviews and analysis of the resulting data in the context of current and emerging distribution sector trends:

- Trip production and attraction from regional warehouse facilities
- A profile of truck type
- Origin-destination data on same
- Type of cargo and/or businesses
- Building and employment characteristics
- Additional logistics data obtainable from owners and/or operators

This data and analysis is organized in a series of tables with accompanying text to accomplish several things:

- To improve the accuracy of inputs to regional transportation modeling.
- To lay the ground work for similar studies related to intermodal growth.
- To provide input to possible revisions in land use categories.
- To inform public decisions related to the intermodal and distribution sector.

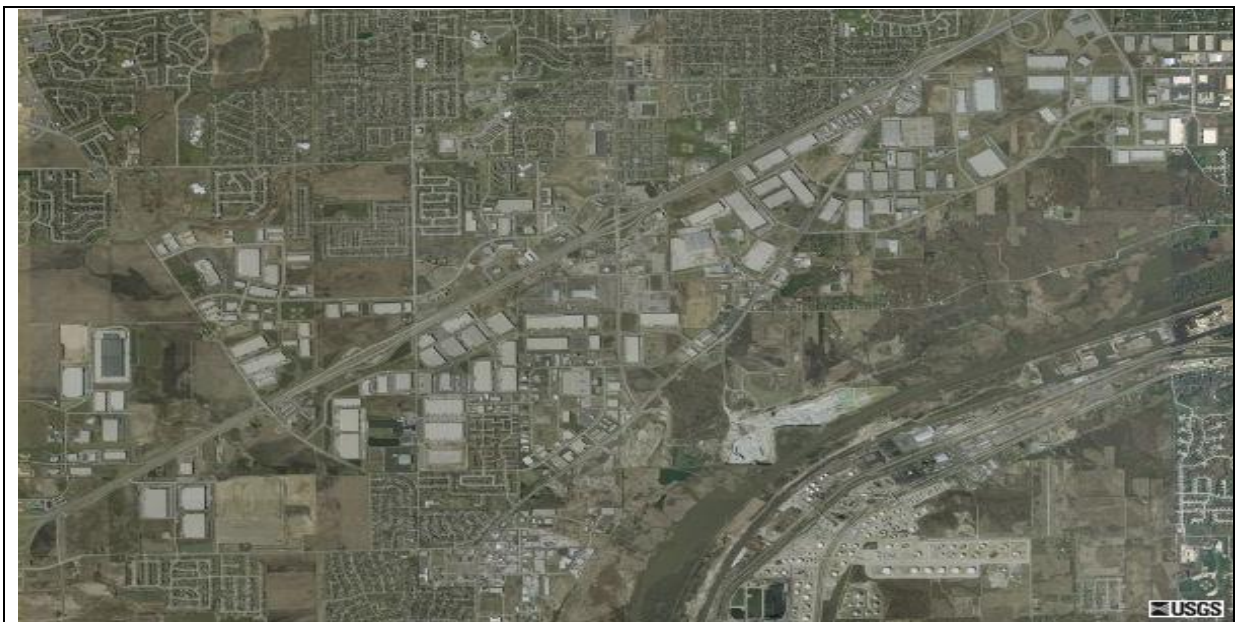
The research team began this analysis in the spring of 2007 and conducted the interviews and tours at 12 research distribution centers and similar facilities from June to September of 2007. The team completed the subsequent analysis and report preparation in July of 2008. All errors and omissions in the data and analysis are strictly the responsibility of the authors and therefore not of the collaborating warehouse facility owners and operators. Once again, the research team thanks them for their complete and candid cooperation and assistance.

The research team also wants to thank IDOT for providing the financial resources for the study and CMAP and IDOT-DPIT for providing counsel, management, and review assistance.

Figures 1 and 2 provide an impression of the scale of Northeastern Illinois' warehousing activity.



Figure 1. Aerial view of LPC - warehouses are observable in top right of image, including the DSC warehouse which was surveyed (Will County, 2008).



Source: Google - Earth

Figure 2. Interstate 55 (I-55) is the thick diagonal line that almost bisects this image and the thick, curved line near the lower right corner is the Des Plaines River. Bolingbrook lies north of I-55 and Romeoville lies south of I-55 and north of the Des Plaines River. From left to right along I-55 are the following: Remington Lake Business Center (north of I-55), Crossroads Business Park (south), Corporate Crossings (south), and the International Center (south).

CHAPTER 3 SUPPLY CHAIN CONTEXT

3.1. INTERMODALISM'S GLOBAL CONTEXT

Regardless of whether the public understands the supply chain and fully appreciates its contribution to the average household economy, public discourse now regularly features the concept of global economy. The public now broadly understands that very large quantities of goods are imported from around the world, even though many of them may not fully understand that these goods are inside the large numbers of containers (or “boxes”) they see every day in passing trains or behind passing trucks. However, if the research team asked several members of the public, “What’s in the box?” referring specifically to inbound boxes (or imports), some of them may say something like the following:

- Bathroom tiles from Mexico or Argentina
- Glassware from Poland, Spain, or Turkey
- Clothes from the Indian Subcontinent
- Athletic shoes from Indonesia
- Auto parts from Europe and Korea
- Beer, wine, spirits, and ethnic foods from everywhere
- Fruit in season from the Southern Hemisphere
- Anything and everything from China

These and other imports will likely be warehoused at some point in their journey.

If the research team then asked the same question about exports, some of these people may also say the following:

- Specialty and generic grains
- Machines, applied electronics (machine controls), and advanced machine tools
- Auto and machine parts
- Scrap paper, plastics, and metals
- Agricultural products and grain
- Beer, wine, and spirits

E. Hunter Harrison, the Canadian National Railway’s President and Chief Executive Officer, underscored intermodalism’s importance and pervasiveness when he wrote in an open letter to the Surface Transportation Board, “whether it’s a box of cereal, a new vehicle, or a high definition television, most products travel a long way before we see them.”

Intermodalism’s importance and pervasiveness has been growing with increasing global trade, which has been growing faster than the world’s gross domestic product’s (GDP) growth rate since 1990. This gap has become especially pronounced since 2002. Figure 3 shows these growth rates.

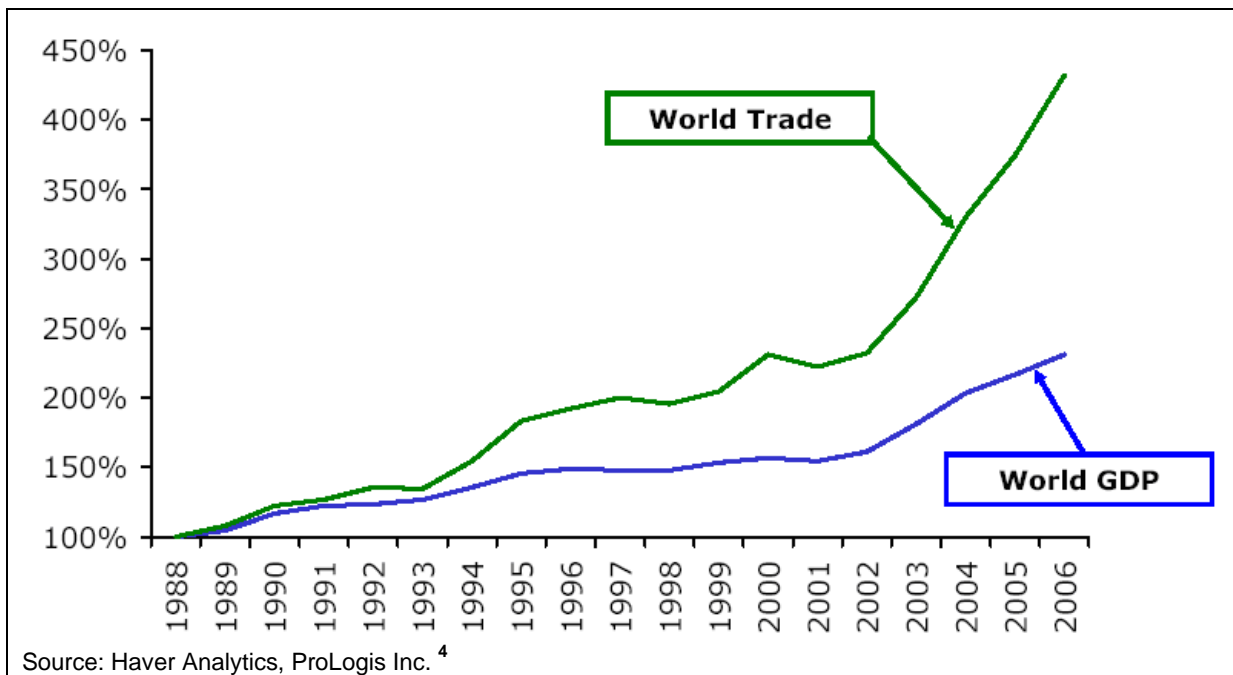


Figure 3. Growth in world trade and world GDP, 1988 – 2006 (Schwartz, 2008).

The growth in world trade has outstripped world GDP for many reasons, but two outstanding factors are: 1) the globalization of manufacturing; and 2) significant improvements in transportation technology. The globalization of manufacturing has particularly impacted the Midwestern United States because of this sector's previous strength and dominance in this region, especially related to automobile parts and vehicle production. As has been well documented elsewhere, much of that production has shifted overseas, and more recently, to the Southeastern United States. Manufactured goods now arrive in Chicago from international production centers and goods are leaving the Midwest through Chicago via intermodal trains.

Improvements in transportation technology have been less noticed – typically, the analytical emphasis has been on improvements in global communication. The strong increases in trade in the early 1990's and the early part of this century have coincided with the introduction of major new logistics tools including:

- The shift to containers by ocean carriers and rail carriers
- Double stack trains in the U.S. starting in the 1990's
- Global logistics management and tracking systems
- A new generation of "super" container ships
- New efficient harbor facilities in the U.S. and other countries

NAFTA has also led to significant increases in intermodal traffic between Chicago and Canada and Chicago and Mexico. Railroad mergers that have resulted in single carrier service between Chicago and these countries' markets have increased this trend.

The gap between world trade and world GDP is expected to increase in the future. The amount of containerized imports from the Pacific Rim to the U.S., for example, is forecasted to increase 69.4% from 382 million twenty-foot equivalent units (TEUs) (2006) to 647 million TEUs by 2015.

The emergence of the Pacific Rim economies – particularly China, South Korea, and others, has heavily driven global trade growth. Future global growth is also anticipated to increase significantly from Brazil, Russia and India. The improvement of railroad routes between Chicago and the Atlantic ports with “day-lighting” of tunnels and other vertical impediments to enable double stack trains and expansion of track capacity on the Norfolk Southern and CSX has also impacted intermodal traffic growth in the Chicago area. These routes will serve increasing global trade from the European Union, Russia, and Latin America – particularly Brazil.

3.2. NATIONAL CONTEXT

The National Association of Regional Councils has estimated that the U.S. freight industry annually moves approximately \$6 trillion worth of products on a national transportation infrastructure valued at approximately \$1.75 trillion (NARC, 2005). Transportation planners and analysts broadly agree that this freight transportation activity will increase 80% in the next 15-20 years, if not actually double (Hilkevitch, 2007). More than 13 million people directly or indirectly work in these transportation-related businesses.

This current and projected freight activity, however, suffers or will suffer further under Northeastern Illinois’ severe congestion, unless steps are taken to mitigate it. The Chicago-Northeastern Illinois-Northwestern Indiana region is third in gross delays after Los Angeles and New York (Texas Transportation Institute, 2007). These delays cost the region \$4 billion annually. A resource paper by Gerald Rawling estimates that an “average” truck operating in this region may incur as much as \$3,700 annually in congestion-related costs (2007).

Figures 4 and 5 on the following page depict the national spread of capacity limitations. This spread’s breadth and intensity are clearly noticeable on Lake Michigan’s west coast.

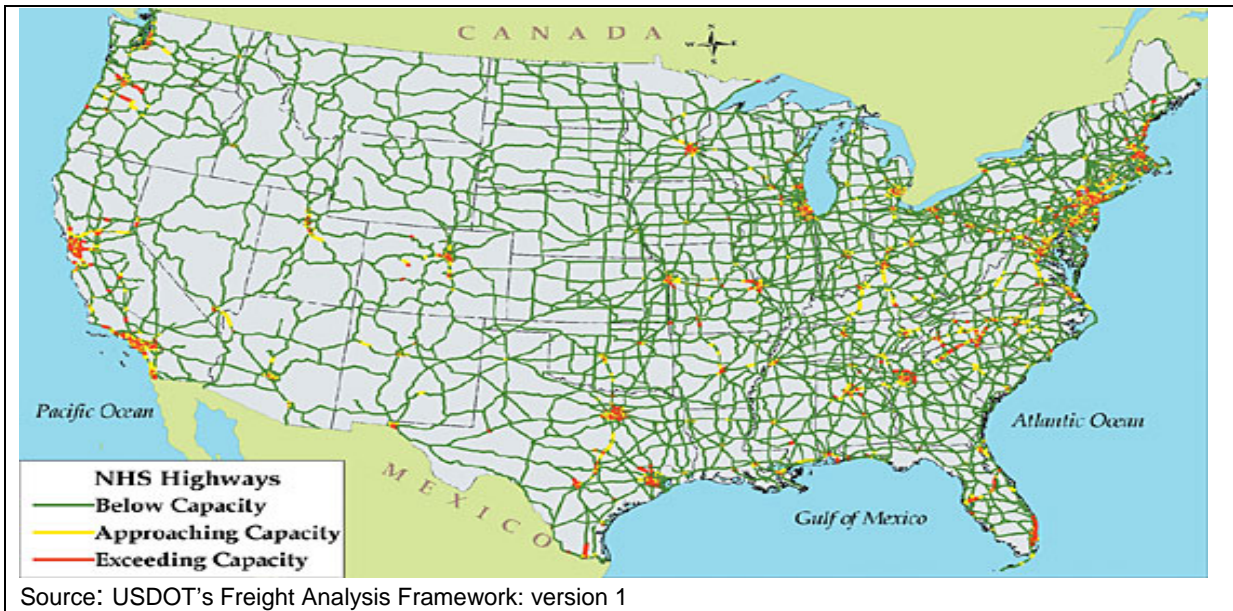


Figure 4. NHS Congestion - 1998 [Base] Condition (USDOT).

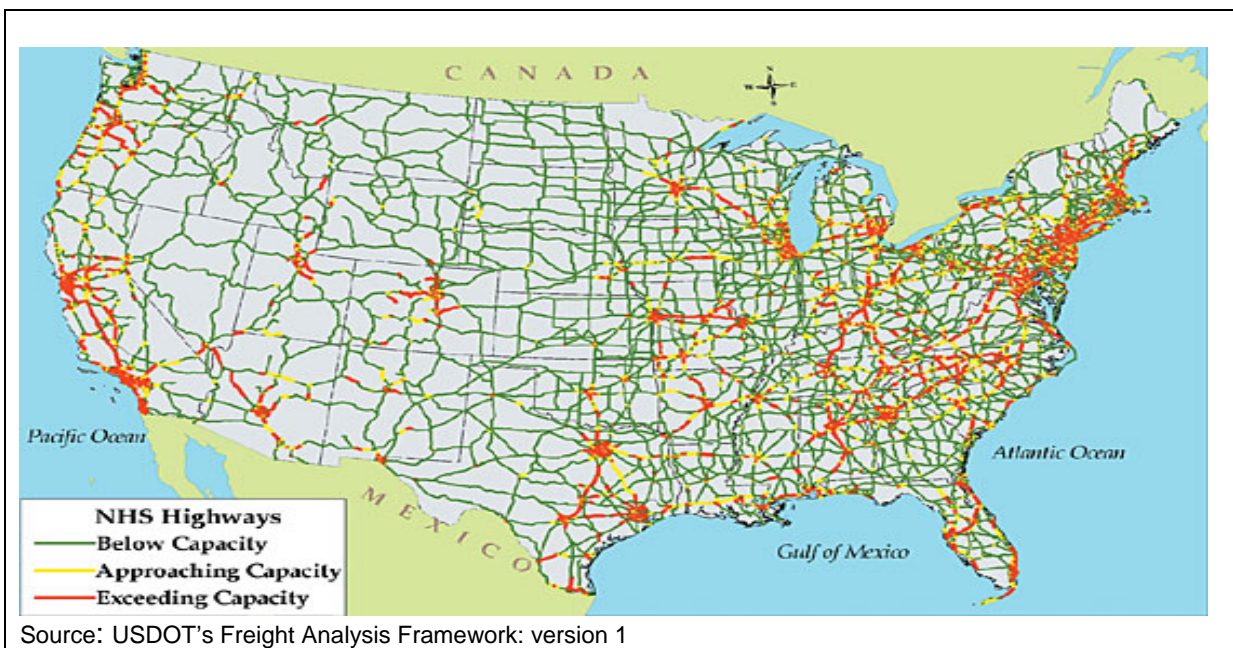


Figure 5. NHS Congestion – 2020 [Forecast] Condition (USDOT).

3.3. SUPER-REGIONAL CONTEXT

Eight American states and the province of Ontario are within a one-day truck trip from Northeastern Illinois. These eight American states have approximately 59 million people or approximately 20% of the American population while the province of Ontario has over 12 million people or approximately 39% of Canada's population. This is illustrated in Figure 6.

Within a two-day truck trip, this market increases to 23 states and the provinces of Saskatchewan, Manitoba, Ontario, and Quebec. These 23 American states have approximately 123.5 million people or approximately 42% of the American population while the four Canadian provinces have approximately 21.8 million people or approximately 69%

of the Canadian population. This can be considered the demand side of Northeastern Illinois' supply and demand equation.

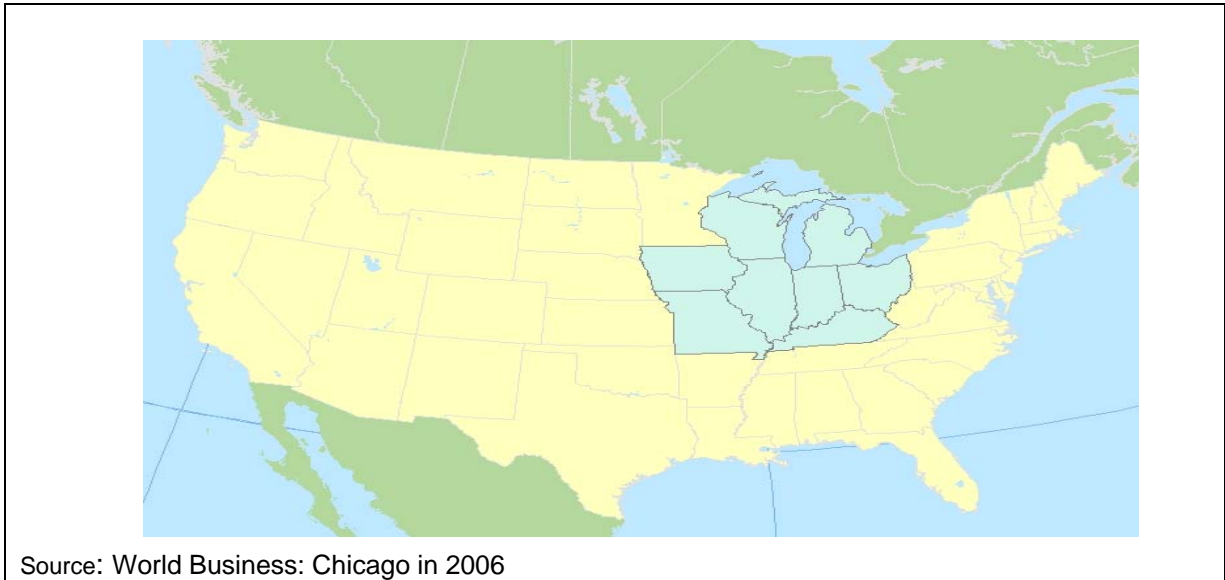


Figure 6. One-day truck travel accessible from Northeast Illinois.

3.4. REGIONAL CONTEXT

The supply side of this equation is Northeastern Illinois, where a combination of historic, geographic, and institutional factors have given Northeastern Illinois an asset base eminently suited to logistics in general. It has also made Northeastern Illinois the “epicenter in the nation for rail traffic” (Cain, 2008).

In 1997, the former Chicago Area Transportation Study used 1996 Illinois Department of Employment Security data to calculate the value of freight-related activity to the regional economy (Gerald, 1997). It also forecast its value in 2020. Using interpolation, the research team estimates that Northeastern Illinois' freight industry employed 134,800 people who collectively earned \$5.22 billion in gross pay in 2006. This pay had a multiplier effect of \$15.88 billion on the regional economy.

Northeastern Illinois' nineteen active intermodal yards performed approximately 6.3 million lifts in 1995 (Gerald 2006). As used here, lifts refer to lifting trailers or containers onto or off of trains. Each of these lifts translates into one or more truck movements, which depend on whether these trailers or containers go directly from the railheads to end users. The *Weekly Railfax Car Loading Report*, which summarizes North American rail freight traffic by commodity/business unit and by major railroad, says recent data suggests that this growth may have nationally declined one or two percentage points. However, Northeastern Illinois may not mirror this decline because of existing, multiple initiatives to grow this region's freight industry (see Table 1). It is also worthy to note that Northeastern Illinois has seven logistic developments (two underway and five proposed) plus two geopolitical units being studied for their suitability.

Given their positive economic benefits, intermodal rail properties or “logistics projects” have somewhat assumed a “holy grail” status, although some communities have begun to reject them. Table 1 lists logistics parks in use, development, or proposals that are located in the southern or southwestern parts of Northern Illinois. If Logistics Park, Chicago (LPC) in Elwood is regarded as a pioneer or modern industrial park template, the

proposed follow-on developments listed in this table will likely involve more than 10,000 owned or optioned acres.

Table 1. Logistics Parks and Developments in Northern Illinois

<u>Name</u>	<u>Location</u>	<u>Status</u>	<u>Forecasted Activity Level</u>
Logistics Park, Chicago	Will County (Elwood)	In Operation	17 Million sq. ft. at Completion
RidgePort Logistics Center	Will County	2,000 Acres (Proposed)	20 Million sq. ft. at Completion
CenterPoint Properties (CIC North)*	Will County (South of Joliet)	3,850 Acres (Proposed)	Not Yet Announced
CenterPoint Properties (CIC Elwood)	Will County (Elwood)	2,500 Acres (Proposed)	Not Yet Announced
CenterPoint Properties (Crete)	Will County (Crete)	1,000 Acres (Proposed)	Not Yet Announced
ProLogis Park (Arsenal)	Will County (Wilmington)	775 Acres (Proposed)	10 Million Square Feet at Completion
Rochelle (I-39 Corridor)	Ogle County (Rochelle)	365 Acres (Proposed)	5 Million Square Feet at Completion
U.S. 34 Logistics Center	West on U.S. 34 from Chicago to Monmouth	Study in Process	
I-80 East Logistics Center	I-80 from Joliet to the Indiana State Line	In Discussion	

Note: Although there is not a formal logistics park associated with or attached to the Rochelle Intermodal yard, there are several developments within a short distance.

Figure 7 shows an existing modern logistics park. It consists of a variety of regional distribution centers that collectively contain products ranging from housewares to pharmaceuticals. Each of the depicted warehouses contains approximately 1.5-3.0 million square feet. The size and variety of these warehouses reflects a revolution in “domestic” logistics practice that has been underway for many years driven by the technology changes in distribution referenced above as well as these other factors:

- The growth of discount retailing and “big box” stores supporting high volume movement of goods.
- The emergence of stacking and loading systems that enable higher ceiling and larger floor plate warehouses that now often serve multiple users.
- The combination of international railroad connections and regional interstate road systems converging in the Chicago area.

In 1996, the former Chicago Area Transportation Study extensively analyzed truck activity in Northeastern Illinois (Nicholas, 1997). It showed that large, commercial vehicles consume an average of 27.7% of available interstate capacity and an average of 15.7% of other marked route capacity in the region. The full range of consumed capacity spanned 4% to 51% on interstates and from 4% to 63.5% on other marked roads.

All of this activity has contributed to the region’s existing congestion, which ranked second in the country for total traffic congestion, according to the Texas Transportation Institute’s 2007 Urban Mobility Report. People in this region were collectively delayed 203 million hours or 46 hours per person in 2005, which is up 74% and 39% respectively since

1995. Each of these people therefore wasted 32 gallons of gas waiting in congestion and spent \$906.00 a year in congestion costs.



Source: Google Earth

Figure 7. Warehouse cluster, Romeoville.

CHAPTER 4 STUDY PROCESS, FINDINGS, AND CONCLUSIONS

4.1. STUDY JUSTIFICATION

The growth of intermodal traffic (rail and road) described in the “Context” section above as well as related issues of economic development and congestion led to this study being undertaken. The Chicago Metropolitan Agency for Planning and the Illinois Department of Transportation wanted more information about where gridlock and congestion is occurring in Northeastern Illinois. The Chicago Metropolitan Agency for Planning also wanted to have present and future truck activity data for its regional planning tool. This tool relies on truck trip tables, which help its traffic demand modelers assign truck trips to the available present or forecasted transportation networks.

4.2. STUDY METHODOLOGY

When initiating this study, the research team met with Chicago Metropolitan Agency for Planning staff to determine how they use truck activity data for their regional travel demand model. They also discussed how to best draft a survey that would take into account the staff’s requirements for this model’s input.

After drafting the survey and receiving the staff’s concurrence, the research team began to arrange formal interviews, which required a level of corporate involvement and approval. It was this approval that created the greatest obstacle since a request “sent up” the corporate hierarchy was often never approved or denied outright, thus leaving the research team in limbo. However, the research team was able to informally conduct their interviews in two person teams and followed up these interviews with walks through the warehouses, if possible. The interviewers resolved any ambiguities through post-interview questions.

Tables 2-12, which follow, provide the results of the field interview process and resulting data analysis. The interview sites were selected to provide a cross section or mix as follows:

- City of Chicago and suburban locations
- Consumer and shopper goods
- Goods and professional services
- New generation RDC facilities and established users
- Range in facility size

4.3. INTERVIEW SITES

Table 2 lists the interview sites by company name and provides an overview of the salient site characteristics.

Table 2: Interview Sites, Regional Warehouse Trip Production Survey, 2007

Company Name	Abbreviated Name	Location	Type of Goods	Size in Sq. Ft. (In Use)	Year Built/ Last Rebuilt
Overseas Orient Container Lines	OOCL	New Lenox	Electronics	282,000	2006
Hickory Farms		Joliet	Specialty Foods	205,000	2007
Donnelley		Bolingbrook	Paper/Mail	660,000	2005
Michaels		New Lenox	Art Goods	700,000	2003
Kimberley-Clark	KC	Romeoville	Toiletries	805,912	2006
HUDD		Joliet	Freight Consolidation	852,500	2006
DSC Logistics	DSC	Elwood	Foods/Dry Goods	1,022,554	2004
DHL		Des Plaines	Mail/Express Delivery	136,000	Unknown
LTD Industries	LTD	Naperville	Mail Order	260,000	Unknown
Coca-Cola		Chicago	Beverages	198,000	2006
Ferguson		Chicago	Plumbing Supply	140,000	2006
5-Star		Chicago	Laundry	36,580	1999

The research team then catalogued these responses, built a database/spreadsheet, resolved any discrepancies between the two interviewers' reports, and analyzed the data, including prepared tables, charts, and GIS maps as appropriate.

4.4. BUSINESS CHARACTERISTICS

The research team interviewed executives at twelve sites in Northeastern Illinois and toured their facilities. The characteristics of businesses in these facilities can be summarized as follows and are shown in Table 3:

- Three are located in the city (Coca-Cola, Ferguson, and 5-Star) and nine are in the suburbs.
- The three city businesses are all located on recycled in-fill, former industrial sites with incentive support from the City of Chicago. The businesses chose these sites to be close to their city-based customers.
- Seven of the nine suburban firms are located in multi-building industrial parks, located at the epicenter of new distribution center development in the I-55 and I-80 corridors.
- Two of the businesses are involved in mail/package delivery (DHL and Donnelly), one in mail order fulfillment, two in food and beverage, one in wholesale building products, four in dry goods/retail goods, one in services, and one in both food and dry goods.
- The number of employees per facility ranges from 42 at Overseas Orient Container Lines to 400 each at Hickory Farms and DHL. Average employment for the 12 facilities listed in Table 3 is 214 employees per facility although peak employment at Hickory Farms and DHL is seasonal.

- Ten of the facilities operate 24 hours per day (although Overseas Orient Container Lines has temporarily cut back to daytime), one is daytime only, and one is daytime plus evening delivery hours.

Table 3. Business Characteristics by Respondent

Facility Type	Name	Type of Goods/Business	On-Site Employees	Operating Hours
Regional Distribution Center	Overseas Orient Container Lines	Electronics	42	8:00 a.m.-4:30 p.m.
	Hickory Farms	Specialty Foods	400	24 Hours
	Donnelley	Paper/Mail	150	24 Hours
	Michaels	Art Goods	225	24 Hours
	Kimberly-Clark	Diapers	150	24 Hours
	HUDD	Freight Consolidation	87	24 Hours
	DSC Logistics	Foods/Dry Goods	192	24 Hours
Package/Mail Delivery	DHL	Mail/Delivery Services	400	24 Hours
	LTD Industries	Mail Order	320	6:00 a.m.-2:30 p.m.
Local Delivery	Coca-Cola	Beverages	300	24 Hours
	Ferguson	Plumbing	47	5:00 a.m.-1:30 a.m.
	5-Star	Laundry	250	24 Hours
Average			214	

4.5. BUILDING CHARACTERISTICS

The surveyed businesses' building characteristics can be summarized as follows and are shown in Table 4:

- Seven of these facilities are regional distribution centers.
- Seven of these facilities are stand-alone single-user buildings; three share a common wall in multi-bay buildings; and two are in sub-divided multi-tenant buildings.
- The regional distribution centers are the largest facilities. DSC Logistics has over one million square feet, Kimberly Clark has 805,912 sq. ft., and Michaels has 700,000 square feet.
- The buildings in the City of Chicago are the smallest with Five Star at 36,000 sq. ft. and Coca-Cola at 198,000 sq. ft.
- The average size for the 12 facilities is 403,629 sq. ft.
- The surveyed buildings are very efficient and fully utilized with over 98% of the usable square feet occupied.
- The survey focused on the larger, new facilities being built to best capture the intermodal industry's latest trends. Nine of the twelve facilities were built in the last five years.
- Newer buildings are getting both larger in square footage and taller in ceiling height.
- The two oldest buildings in the survey (Five Star and DHL) are typical of industrial buildings built in the 1980s and 1990s. Both have 24-26 foot ceilings.
- All nine of the newest buildings have ceiling heights between 30-40 feet.
- The regional distribution centers have rack systems with varying degrees of automation that can be varied according to the type of goods.
- The degree of the facility's utilization is indicated by utilized ceiling height and occupied square feet.

- The type of product a facility handles affects its ceiling height utilization. Lighter goods, such as paper goods; plastic goods; and giftware tend to “cube out” before they “weight out” on the rack systems.
- Heavier products, such as food and beverages and any liquid-intensive items tend to “weight out” before they “cube out.”
- As will be profiled below, the lighter products can also create higher levels of movement, because they also “cube out” in the trucks before they “weight out.”

Table 4. Building Profile by Respondent

Facility Type	Name	Net Usable Square Feet	Occupied Square Feet	Year Built	Ceiling Height (ft.)	Utilized Ceiling Height (ft.)
Regional Distribution Center	Overseas Orient Container Lines	282,000	282,000	2006	36	25
	Hickory Farms	205,000	205,000	2007	30	25
	Donnelley	660,000	660,000	2005	30	20
	Michaels	700,000	700,000	2003	38	35
	Kimberley-Clark	805,912	805,912	2006	30	21
	HUDD	352,500	352,500	2006	32	No stacks
	DSC Logistics	1,022,554	1,022,554	2004	35	32
Package/Mail Delivery	DHL	136,000	136,000	Unknown	24	12
	LTD	260,000	260,000	Unknown	30	30
Local Delivery	Coca-Cola	198,000	198,000	2006	40	24
	Ferguson	185,000	140,000	2006	40	30
	5-Star	36,580	36,580	1999	26	26
Average		403,629	399,879	2005	32	23

4.6. HEAVY TRUCK TOTAL ARRIVALS AND DEPARTURES

The characteristics of heavy truck traffic into and out of the surveyed business facilities can be summarized as follows and are summarized in Table 5:

- This survey inquired about total truck activity, including building and package delivery services. Since the level of building and package delivery services was inconsequential compared to heavy truck/freight traffic, the detailed analyses of Tables 3-10 focus exclusively on heavy truck/freight activity.
- Most of the surveyed facilities maintain a 24-hour gate facility that counts all arrivals and departures by time. In several cases, facility operators provided data sheets for this study directly from gate counts.
- Arrivals and departures roughly balance in a 24-hour period for most operations. DHL and Donnelley, however, use various package, postal container, and vehicle combinations.
- The average total number of heavy trucks per 24 hour period was 129 trucks with the fewest being from LTD, which ships large numbers of small packages via UPS. DSC Logistics, which is a single logistics provider for several national clients, ships the most packages.

- The seven regional distribution centers each average 173 total trucks per 24-hour time period or 78% more than the other five facilities.

Table 5. Heavy Truck Arrivals and Departures, 24-Hour Period, By Respondent

Facility Type	Name	Total Arrivals	Total Departures	Total Trucks
Regional Distribution Center	Overseas Orient Container Lines	80	80	160
	Hickory Farms	20	20	40
	Donnelley	150	130	280
	Michaels	46	51	97
	Kimberly Clark	60	60	120
	HUDD	184	184	368
	DSC Logistics	165	165	330
Package/Mail Delivery	DHL	25	35	60
	LTD	10	10	20
Local Delivery	Coca-Cola	100	100	200
	Ferguson	20	20	40
	5-Star	12	12	24
Average				145

4.7. NUMBER OF HEAVY TRUCK ARRIVALS BY TIME PERIOD

Truck arrivals at each of the 12 facilities were documented by time period—two hour time periods from 6:00 a.m. to 8:00 p.m. and one time period from 8:00 p.m. to 6:00 a.m. Using this data, the research team came up with the following findings and conclusions (also shown in Table 6):

- The heaviest arrival period is 8:00 a.m. to 10:00 a.m. with 126 arrivals, excluding 40 trucks which arrive at Coca-Cola during the 12:00 a.m. to 2:00 p.m. time period.
- Coca-Cola and Ferguson have heavy arrivals in the noon to 2:00 p.m. time period. These arrivals are primarily local delivery trucks returning from morning deliveries after leaving between 8:00 p.m. and 6:00 a.m.
- Mid-day arrival activity is approximately 113 trucks for the 10:00 a.m. to noon and the noon to 2:00 p.m. periods. This activity then declines throughout the day—96 for 2:00 p.m. to 4:00 p.m.; 79 for 4:00 p.m. to 6:00 p.m., and 65 for 6:00 p.m. to 8:00 p.m. These figures exclude Coca-Cola.
- A major finding is the diurnal distribution of truck activity. The nighttime period of 8:00 p.m. to 6:00 a.m. has 116 truck arrivals or approximately 12 per period hour. This is reflective of the 24-hour nature of regional distribution centers.
- HUDD has an even distribution of 23 arrivals per hour since it is a transloading facility for WalMart. HUDD's activity entirely depends upon the varying arrival times of container trains primarily originating from West Coast ports.
- DSC Logistics is the largest regional distribution center. It has morning and evening arrival peaks, reflecting the Midwestern origin of many of its food products. It also has a steady arrival stream mid-day, reflecting its mix of food and dry good/shopper goods from other U.S. regions and intermodal ramps.

4.8. NUMBER OF HEAVY TRUCK DEPARTURES BY TIME PERIOD

Truck departures at each of the 12 facilities were documented by time period—two hour time periods from 6:00 a.m. to 8:00 p.m. and one overnight time period from 8:00 p.m. to 6:00 a.m. with the following findings and conclusions (also shown in Table 7):

- The heaviest daytime departure time is between 4:00 p.m. and 6:00 p.m. with 111 departures.
- The three morning periods between 6:00 a.m. and 12:00 p.m. average about 100 departures each.
- As with arrivals, there is a diurnal distribution of activity. The nighttime period of 8:00 p.m. to 6:00 a.m. has 175 departures (approximately 17 per hour or 34 per two hours)—reflecting the regional distribution centers' 24-hour operations.
- Coca-Cola and Ferguson have heavy departures before 6:00 a. m. because these departures are primarily local delivery trucks leaving for morning deliveries.
- The three largest regional distribution centers, Donnelly, Michaels, and DSC Logistics, have 20-30% of their departures at night between 8:00 p.m. and 6:00 a.m.

4.9. LAND USE DISTRIBUTION OF FREIGHT TRUCK DESTINATIONS

The research team asked interviewees at each of the twelve facilities to use seven possible land use types to categorize the destinations of freight trucks leaving their facilities. These categories mirror the major employment categories (NICS Codes) that could apply to the type of business being conducted at the destination locations. The findings and conclusions about the type of business and employment for the freight truck destinations are as follows and are also shown in Table 8:

- The predominant destination category was transportation, communications, utilities, and warehousing (TCUW) with ten of the twelve facilities reporting shipments to this category.
- The TCUW sector strength reflects the “supply chain” nature of many of the shipments. Many of these shipments are going from one type of warehouse to another or as shipments to package and less than load (LTL) freight carriers who will ship to the ultimate user.
- Four of the facilities have 60-100% of their departing freight going directly to retail locations.
- The intermodal ramp category (rail or air, but predominantly rail) was added to the previous five employment-land use categories to capture the specific and growing importance of containerized shipping, particularly to the regional distribution centers.
- HUDD is an example of a facility totally focused on intermodal shipping. All of its freight arrives from container trains for transshipment to other warehouses and with containers returning empty to the intermodal ramp.
- Two facilities (Donnelley and Coca-Cola) have some shipments to manufacturers, two facilities (Coca-Cola and Ferguson) have some shipments to governmental-institutional users, and one (Five-Star) has all of its shipments to “other,” which are principally hotels.

Table 6. Heavy Truck Arrivals by Time Period, By Respondent

Facility Type	Name	8 p.m.- 6 a.m	6 a.m.- 8 a.m.	8 a.m. - 10 a.m.	10 a.m.- 12 a.m.	12 a.m.- 2 p.m.	2 p.m.- 4 p.m.	4 p.m.- 6 p.m.	6 p.m.- 8 p.m.
Regional Distribution Center	Overseas Orient Container Lines			20	20	20	20		
	Hickory Farms		4	4	4	3	3		
	Donnelley	10	25	30	25	25	15	10	10
	Michaels	9	2	8	9	10	7		1
	Kimberley Clark	16	3	6	7	8	8	6	6
	HUDD	23	23	23	23	23	23	23	23
	DSC Logistics	30	26	16	20	10	18	30	15
Package/Mail Delivery	DHL	15	2	8					
	LTD		2	3	3	2			
Local Delivery	Coca-Cola	5	5	5	5	40	20	10	10
	Ferguson	2	2	1	1	12	2		
	5-Star	6	2	2	2				
Totals		116	96	126	119	153	116	79	65

Table 7. Heavy Truck Departures by Time Period, By Respondent

Facility Type	Name	8 p.m.- 6 a.m	6 a.m.- 8 a.m.	8 a.m. - 10 a.m.	10 a.m.- 12 a.m.	12 a.m.- 2 p.m.	2 p.m.- 4 p.m.	4 p.m.- 6 p.m.	6 p.m.- 8 p.m.
Regional Distribution Center	Overseas Orient Container Lines			20	20	20	10	10	
	Hickory Farms	5				10	3	4	5
	Donnelley	35	10	10	10	9	15	20	20
	Michaels	12	4	5	8	8	9	3	1
	Kimberley Clark	16	3	6	7	23	8	6	6
	HUDD	23	23	23	23	10	23	23	23
	DSC Logistics	30	26	16	20	2	18	30	15
Package/Mail Delivery	DHL		14	15	3	2	1		
	LTD		2	3	3	5			
Local Delivery	Coca-Cola	40	20	10	5	1	5	10	5
	Ferguson	14	1	1	1		1	1	
	5-Star						4	4	4
Totals		175	103	109	100	90	97	111	79

Table 8. Land Use Distribution of Freight Trucks by Respondent

Facility Type	Name	Manufacturing	Retail	Residential	Utilities/ Warehouse Transportation	Government/ Institutional/ Educational	Intermodal Rail or Air	Other
Regional Distribution Center	Overseas Orient Container Lines		60%		5%		35%	
	Hickory Farms				100%			
	Donnelley	10%			60%		30%	
	Michaels		75%		25%			
	Kimberly Clark		100%					
	HUDD				50%		50%	
	DSC Logistics		5%		85%		5%	
Package/ Mail Delivery	DHL				70%		30%	
	LTD				100%			
Local Delivery	Coca-Cola	30%	60%		5%	5%		
	Ferguson		10%		20%	20%		
	5-Star							100%

4.10. GEOGRAPHIC DISTRIBUTION OF OUTBOUND FREIGHT TRUCKS

The origins and destinations of freight trucks utilizing these facilities have major implications for the location of future facilities and the provision of appropriate roadway infrastructure to serve them. Six destination categories and one category for intermodal ramp were used to identify the destinations of outbound freight trucks with the findings as follows (also shown in Table 9):

- All of the facilities, except HUDD, ship to destinations within the Chicago metropolitan area, ranging from 10% for Donnelley and Kimberly Clark to 100% for Coca-Cola.
- The largest shipment points, exempting the three city delivery facilities, are in the order of magnitude, Southern Illinois and the adjacent Midwestern states of Indiana, Wisconsin, and Iowa in that order.
- Four of the regional distribution centers have 10-35% of their shipments to other U.S. locations, typically to other regional distribution centers serving other regions.
- Five of the facilities also do outbound shipment using intermodal ramps to coastal or international destinations.

Table 9. Geographic Distribution of Outbound Freight Trucks by Respondent

Facility Type	Name	Chicago Metro	Wisconsin (or North)	Indiana (East or South)	Iowa (or West)	Southern Illinois (or South)	Other U.S.	Intermodal Ramp for International Locations
Regional Distribution Center	Overseas Orient Container Lines	15%	5%	5%	5%	5%	30%	35%
	Hickory Farms	25.5%	1%	31%	21.25%	21.25%		
	Donnelley	10%	5%	20%	25%	25%	10%	5%
	Michaels	12%	15%	31%	19%	23%		
	Kimberly Clark	10%	10%	40%	15%	20%	5%	
	HUDD		20%	10%	20%			50%
	DSC Logistics	30%	10%	5%	10%	5%	35%	5%
Package/Mail Delivery	DHL	40%	5%	30%	10%	15%		
	LTD	15%	5%	25%	15%	15%	20%	5%
Local Delivery	Coca-Cola	100%						
	Ferguson	75%	10%	10%		5%		
	5-Star	90%		10%				

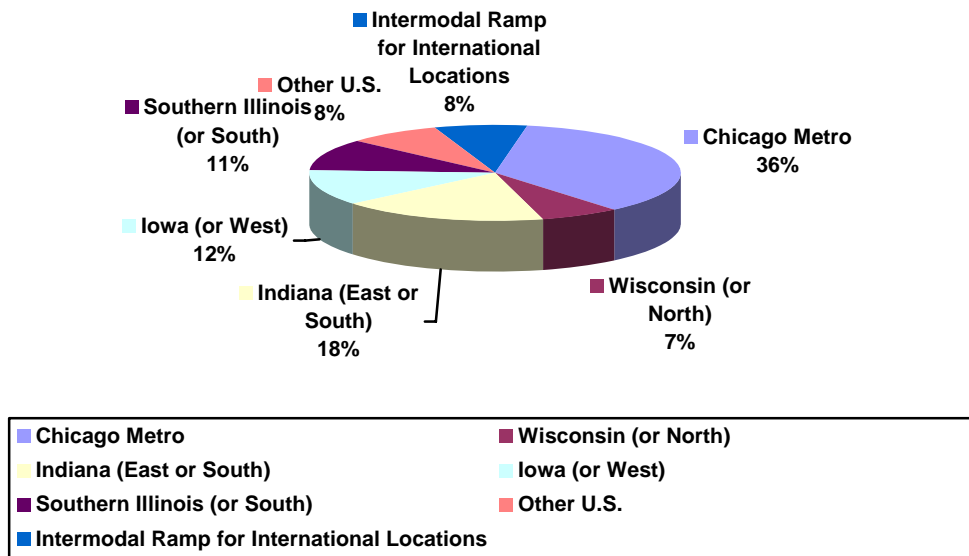


Figure 8. Geographic distribution of outbound freight trucks.

4.11. GEOGRAPHIC DISTRIBUTION OF INBOUND FREIGHT TRUCKS

The research team used three geographic categories (the Chicago metropolitan area, other Midwestern states, and other U.S. regions) plus intermodal ramps from international locations to identify the origin for freight arriving at these facilities. From this data, the team was able to make the following findings and conclusions:

- As with the destination data, the Midwestern states are a major source of originating freight for four of the regional distribution centers and five of the other facilities.
- Three of the regional distribution centers receive 80-100% of their freight from the intermodal ramps. Primarily imported goods arriving from West Coast ports.
- One regional distribution center, Michael's, receives as much from other U.S. regions (37%) as from other Midwestern states (35%) and intermodal ramps from international locations (17%).
- Except for local delivery and package shipment facilities, the Chicago metropolitan area is the origin for only 5%-20% of shipments.

Table 10. Geographic Distribution of Inbound Freight Trucks by Respondent

Facility Type	Name	Chicago Metro	Other Midwestern States	Other U.S. Regions	Intermodal Ramp From International Locations
Regional Distribution Centers	Overseas Orient Container Lines	20%			80%
	Hickory Farms	20%	70%	10%	
	Donnelley	20%	50%	25%	5%
	Michaels	11%	35%	37%	17%
	Kimberly Clark		80%	20%	
	HUDD				100%
	DSC Logistics	20%	45%	20%	15%
Package/Mail Delivery	DHL	55%	30%	15%	
	LTD	5%	5%	5%	85%
Local Delivery	Coca-Cola	90%	5%	5%	
	Ferguson		90%	10%	
	5-Star	100%			

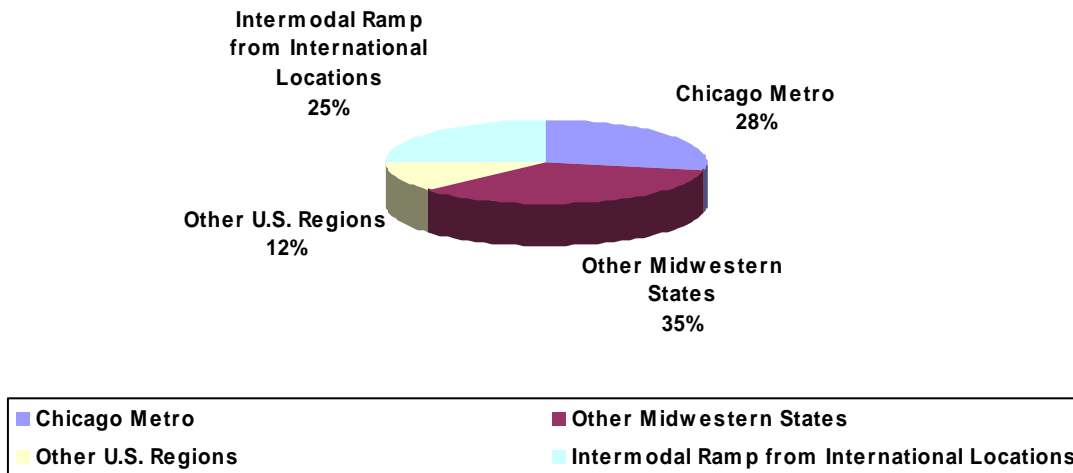


Figure 9. Geographic distribution of inbound freight trucks.

4.12. PERCENT OF GROSS VOLUME PER QUARTER

- The third quarter from July to September is the largest shipping quarter with high activity levels for all of these facilities.
- The three facilities most directly tied to retail sales (Hickory Farms, Michaels, and LTD) have their heaviest shipping in the fourth quarter from October to December with 40-60% of their annual shipments.
- DHL, which has most of its business tied to international document/package delivery, particularly to Europe, reflects the peak fall and winter business season.
- The first quarter from January to March has the lowest percentage of freight shipping.

Table 11. Percent of Gross Volume per Quarter by Respondent

Facility Type	Name	Jan.-March	April-June	July-Sept.	Oct.-Dec.
Regional Distribution Centers	Overseas Orient Container Lines	10%	20%	50%	20%
	Hickory Farms	5%	5%	30%	60%
	Donnelley	20%	15%	30%	35%
	Michaels	10%	10%	30%	50%
	Kimberly Clark	25%	25%	30%	20%
	HUDD	20%	20%	30%	30%
	DSC Logistics	20%	20%	35%	25%
Package/Mail Delivery	DHL	30%	20%	20%	30%
	LTD	15%	15%	30%	40%
Local Delivery	Coca-Cola	20%	30%	30%	20%
	Ferguson	20%	30%	30%	20%
	5-Star	20%	25%	35%	20%

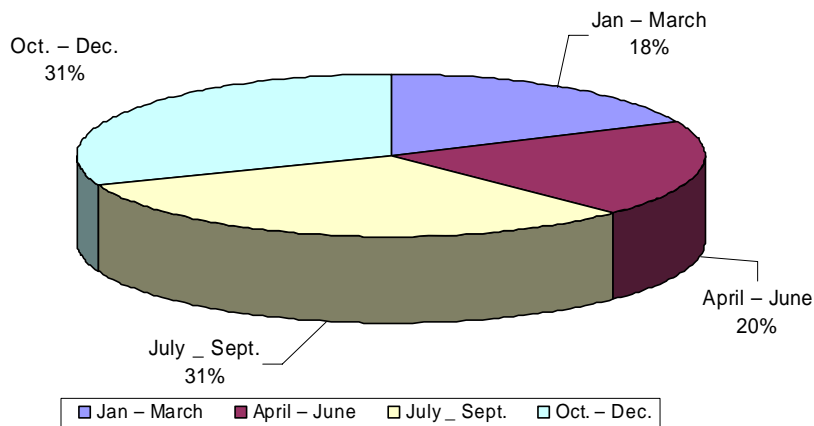


Figure 10. Gross volume per quarter.

4.13. AREA (SQ. FT.) AND HEAVY TRUCK RATIOS PER EMPLOYEE

- The average number of square footage per employee was 2,949, with regional distribution center ratios ranging from 4,000 to 6,000 sq. ft. per employee.
- The high square footage per employee for the regional distribution centers reflects the increasing size in floor area and height and computer based inventory and internal goods movement and rack systems.
- Two of the facilities (Hickory Farms and LTD) have ratios of 513 to 813 sq. ft. per employee, which is more similar to light manufacturers rather than regional distributors. This reflects these facilities' assembly and packaging operations.
- The average number of heavy trucks per employee per 24-hour day was 1.05, with regional distribution center ratios ranging from 1.72 to 3.81 trucks per employee for the largest facilities.
- The city delivery facilities are employment intensive and see only .1-.15 trucks per employee for Five Star and DHL and up to .67-.85 trucks per employee for Coca-Cola and Ferguson.

Table 12. Area (Sq. Ft.) and Heavy Truck Ratios per Employee, By Respondent and Average

Facility Type	Name	Net Usable Sq. Ft. per Employee	Heavy Trucks per Employee
Regional Distribution Centers	Overseas Orient Container Lines	6,714	3.81
	Hickory Farms	513	0.09
	Donnelley	4,400	1.87
	Michaels	3,111	0.43
	Kimberly Clark	5,373	0.80
	HUDD	4,052	2.11
	DSC Logistics	5,326	1.72
Package/Mail Delivery	DHL	340	0.15
	LTD	813	0.03
Local Delivery	Coca-Cola	660	0.67
	Ferguson	3,936	0.85
	5-Star	146	0.10
Average		2,949	1.05

CHAPTER 5 REPORT FINDINGS, OBSERVATIONS, AND RECOMMENDATIONS

- No sweeping generalizations can suitably describe the complexity of regional distribution centers; however, the analysis shows that there is significant heavy truck traffic required for their operation and the volume and characteristics of this traffic needs to be considered in transportation and land use planning.
- Use of size and space matters, but only in context because square footage (floor area) is only one measure. A warehouse with a ceiling height of 24 feet racked to 20 feet may have more cubic feet of goods capacity than a similarly sized warehouse with a 30 foot ceiling racked to 18 feet.
- Product type also matters. Paper goods, plastic goods, giftware (especially giftware with specialty packaging) “cube out” before they “weigh out” and will thereby cause a relatively high level of internal and external movement.
- Many warehouses that primarily receive foreign-made products by ocean shipping containers cross-dock them, mix and match their products, and resend them via domestic trailers and containers. This process generates a lot of empty containers.
- Warehouses that receive a significant share of products from domestic suppliers, on the other hand, can potentially unload products from an inbound trailer and load outbound product in the same trailer.
- The Federal Highway Administration’s Freight Analysis Framework cannot provide the local data that this report has provided. This data should therefore be regularly updated to determine how intermodalism affects Northeastern Illinois and its transportation needs.
- Seasonality is clearly a major issue in intermodalism. Several respondents emphasized that the surge begins in August in anticipation of Halloween and Thanksgiving and continues until it peaks in mid-November in anticipation of Christmas.
- Substantial distribution activity is scheduled outside of the traditional “peak” or “rush hour,” including overnight activity. Therefore, it may be wise to further study how public policy directives or regulations can positively or negatively affect private business decisions about distribution.
- The employment impacts of new RDC facilities can be estimated from the square feet per employee ratios of this analysis.
- There are also significant ratios indicated by the data between employment levels, trucks per employee, size of facilities and types of operations that can be useful in planning future distribution centers and related facilities.

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APPENDIX - SURVEY INSTRUMENT AS ADMINISTERED

REGIONAL WAREHOUSE TRUCK TRIP PRODUCTION QUESTIONNAIRE Illinois Department of Transportation/Marshall Bennett Institute of Real Estate

Date: _____ Interviewer: _____
 Person Interviewed/Title: _____

I. BUSINESS/BUILDING PROFILE (Co-Star /Interview)

1. Building ID/Name _____
2. NICS code(s): _____
3. Building Owner: _____
4. Building Address: _____
5. Type of Goods/Business/Description: _____
6. Single Tenant? Yes _____ or No _____ ; Who _____
7. If multi-tenant name other tenants: _____
8. Usable sq ft of the building? _____ Occupied sq ft? _____
9. Year built? _____
10. Ceiling height? _____ Utilized Ceiling Height: _____ ft. _____ %
11. Number of Loading Docks? _____
12. How many acres on the site? _____
13. How Many Employees On-Site? _____
14. Hours of operation? _____

II. TRUCKING/OPERATION PROFILE

1. Is there a gate count at this site/per 24 hours? _____
2. If not gate, how many trucks do you estimate in 24/hour period? _____
3. How many trucks visit by time period? (Per Table Below)

	Arrivals	Departures
8pm -6 am		
6 am - 8am		
8 am - 10 am		
10 am - 12 am		
12 am - 2pm		
2 pm - 4 pm		
4 pm - 6 pm		
6 pm - 8 pm		

4. How many inbound **Building Services** trucks per day? (i.e. garbage, linen, office supplies, food service). _____
5. How many inbound **Package Delivery** trucks per day? (i.e. FedEx, UPS, U.S. Postal, DHL, messenger) _____

III. MOVEMENT/ORIGIN-DESTINATION PROFILE

1. Where are freight trucks going by land use? (percentage)

- Manufacturing:
- Retail:
- Residential:
- Utilities/ Other Warehouse/Transportation (other than Rail intermodal or Air intermodal) / Communications:
- Government /Institutional/ Educational
- Inter-modal – Rail or Air
- Other

2. Where are freight trucks going by geography? (percentage)

- Chicago metro area
- Wisconsin (or North)
- Indiana (or South)
- Iowa (or West)
- Southern Illinois (or South)
- Other U.S.
- Intermodal Ramp (for International location)

3. Where are freight trucks arriving from by geography? (percentage)

- Chicago metro area
- Other Midwestern states
- Other U.S. regions
- Intermodal Ramp (from International location)

4. Number or Percent of gross volume per quarter?

Jan – March _____; April – June _____;
July – September _____; October – December _____

5. What additional comments would you like to make?

6. May we contact for you for additional information? _____

