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Development and Application of a Commodity-Carrying Truck Flow Tool:

CMAP Freight Infrastructure Recommendations Analysis

Authors:

Monique S. Urban, Cambridge Systematics

Dan Tempesta, Cambridge Systematics

Tom Murtha, Chicago Metropolitan Agency for Planning

c/o

Cambridge Systematics
115 S. LaSalle St., Suite 2200
Chicago, IL 60603
Phone: (312) 346-9907
Fax: (312) 346-9908

Chicago Metropolitan Agency for Planning (CMAP)
233 S. Wacker Dr., Suite 800
Chicago IL 60606
Phone: (312) 386-8790

Abstract

In 2009, the Chicago Metropolitan Agency for Planning (CMAP) and its consultant, Cambridge Systematics, embarked on an effort to develop freight-related recommendations for its *GO TO 2040* Plan. This effort generated capital recommendations as well as policy and operations recommendations.

Highway infrastructure recommendations were evaluated by analyzing origin-destination flows of commodity-carrying trucks. This paper describes the development and application of an original sketch planning tool that was developed for this analysis. The sketch planning tool estimates the growth in commodity-carrying truck volumes throughout the region between years 2007 and 2040. The development and application of this sketch planning tool include the following steps:

1. Truck flow data for the greater Chicago region were obtained from IHS-Global Insight for years 2007 and 2040;

2. The truck flow data were disaggregated from the county level to a finer zone system using socio-economic data;

3. The CMAP and IHS-Global Insight model networks were joined to create a unified network for the entire area, and important network attributes were updated for a daily assignment of commodity-carrying trucks;

4. A daily assignment was developed that was sensitive to passenger car congestion, tolls, and arterial delays;

5. The base and future year truck flows were assigned to the network; and

6. The estimated truck volumes in conjunction with congestion measures were used to evaluate the truck infrastructure projects.

Using these procedures, the recommended highway projects were evaluated in a systematic fashion. This paper describes each step and the results in greater detail.

1.0 Overview

As part of the Chicago Metropolitan Agency for Planning (CMAP) *GO TO 2040* Plan development, CMAP and Cambridge Systematics undertook a comprehensive, high-level study of future needs of freight transportation in the Chicago region. Two main goals of the study were to develop a set of policy, operations, and infrastructure recommendations and to identify which recommendations would be recommended as freight improvements to be included in the *GO TO 2040* plan. This paper focuses on highway infrastructure recommendations, and it documents the multi-stage evaluation process that was used to assess these recommendations. In this process, truck trip tables that are derived from survey data are assigned to a model network to generate heavy truck volumes. The heavy truck volumes that are generated and the forecast growth of these volumes are analyzed to evaluate the highway project recommendations.

The objective of this discussion is to document the analysis of commodity-carrying truck flows in the CMAP planning region that was conducted for the *GO TO 2040* Regional Freight Planning Recommendations study. A sketch planning tool was developed to estimate the growth in truck flows throughout the CMAP region between years 2007 and 2040. Truck flows are based on TRANSEARCH data. The development and application of this sketch planning tool are the second and third steps of the TRANSEARCH data analysis:

- First, CMAP obtained TRANSEARCH commodity flow data for truck tonnage and value from IHS-Global Insight for years 2007 and 2040;
- Second, a sketch planning tool was developed for evaluating growth in TRANSEARCH truck volumes at the facility level for roadways throughout the CMAP region; and
- Third, the sketch planning tool was used to demonstrate the need for projects that involve truck-related facility improvements. These projects were generated during the infrastructure recommendations planning process.

This discussion focuses on the second and third steps, which involve developing and applying the forecast analysis tool. First, the development of the tool is described. Second, the reasonableness of the analysis results are examined. Third, the recommended highway infrastructure projects are evaluated using the sketch planning tool. This evaluation was designed to assess the recommended highway projects in a systematic fashion.

2.0 Development of the Future Truck Flows Analysis Tool

2.1 Description of the Tool

The sketch planning analysis tool is designed to provide a general view of future truck flows on the CMAP regional highway system. The tool is best described as a sketch planning tool that assigns TRANSEARCH truck trips to the CMAP regional highway network. Travel demand modeling software is used as a framework for the analysis tool. While the selected software package contains all of the functionalities that are required in four-step travel demand modeling, its basic functionalities are also compatible with sketch-level planning analysis. For the future truck flows analysis, the software framework was used to convert truck trips into highway volumes, which are then analyzed quantitatively.

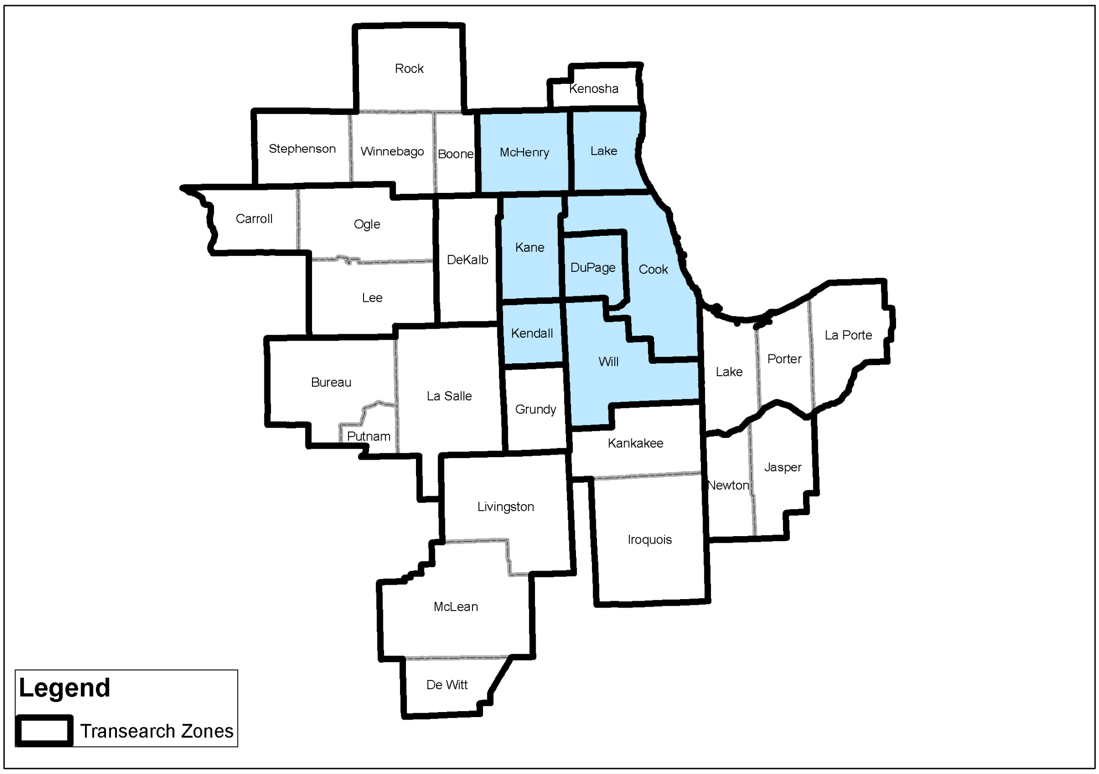
The analysis tool was developed by creating a truck trip table, a highway network, and an assignment procedure for assigning the truck trips. The tool generates an estimate of truck volumes on roadways throughout the highway network for years 2007 and 2040 as well as the growth in volume between the two years. Ultimately, the percentage growth will be used in conjunction with the base-year multi-unit (MU) truck count to derive a forecast volume for infrastructure project locations.

2.2 TRANSEARCH Truck Trips

TRANSEARCH truck trip tables were obtained by CMAP from Global Insight. The finest level of detail available from Global Insight in this dataset is the county, and the broadest is the Bureau of Economic Analysis (BEA) region. The CMAP dataset is based on truck trips that travel through the 1995 Chicago BEA region, or that begin and/or end in the region. The Chicago BEA region contains a total of 30 counties.

Trip data for the seven-county CMAP region were provided to CMAP at the county level. For the outer counties of the BEA area, trip data were either provided for individual counties or for groups of counties. For example, data for Grundy, DeKalb, and Kenosha Counties were provided for each of these counties individually. The remaining outer counties were grouped together into seven additional areas, or zones. As a result, for the Chicago BEA region, truck trip origins and destinations are represented by a total of 17 "TRANSEARCH Zones" (Figure 1).

Figure 1. The 30-County Chicago BEA (1995) Represented by 17 "TRANSEARCH Zones"

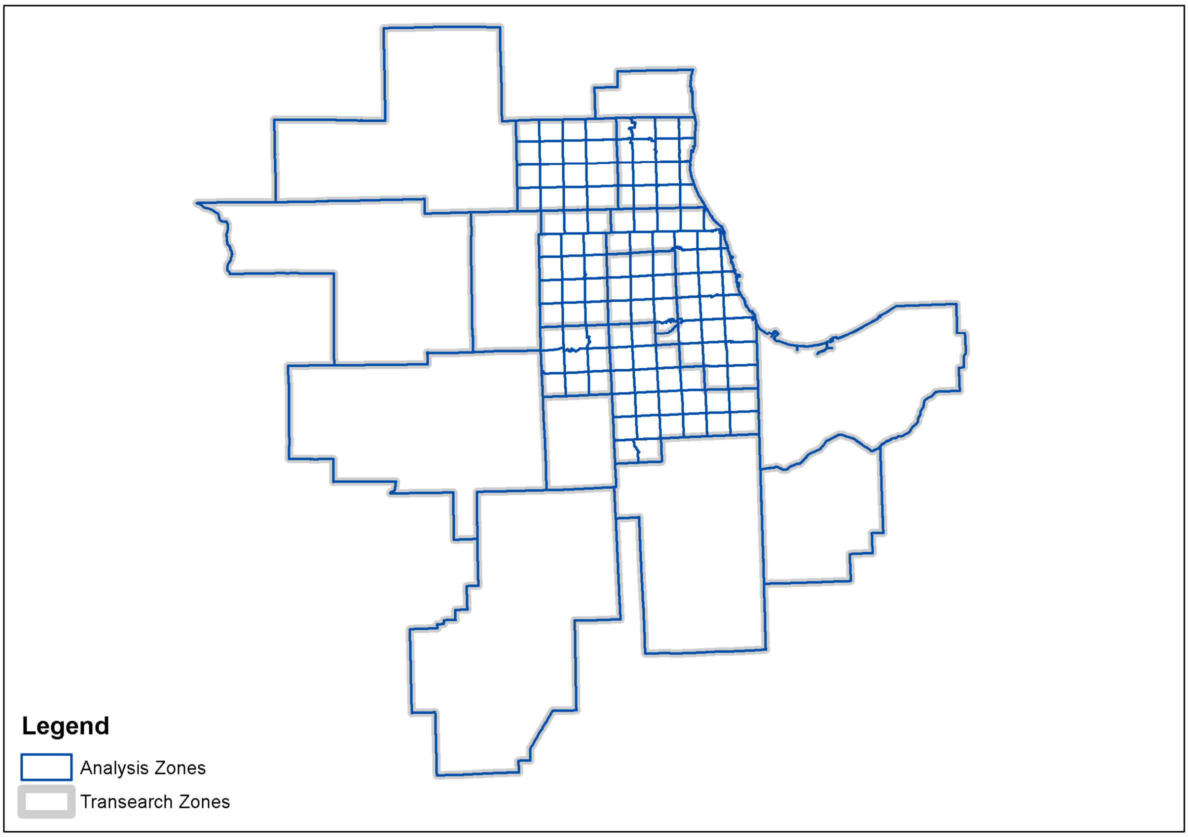


2.3 Preparation of the Truck Trip Table

2.3.1 Zone system development

For the seven-county CMAP region, a greater level of detail than the county was desired for analysis purposes. A finer zone system consisting of about 200 zones for the seven-county CMAP area (Figure 2) was developed for the analysis tool. These zones correspond roughly to townships in the region, which are typically 36 sq. mi., or 6 miles by 6 miles square. These zones are larger than CMAP traffic analysis zones (TAZs) but are much smaller than a county. Using a zone system of this size allows the tool to generate truck volumes on important arterial roadways such as Cicero Avenue. Outside of the seven-county area, the boundaries of the "TRANSEARCH Zones" that were provided by Global Insight were maintained for the analysis, as this area is outside the focus of the study.

Figure 2. Zone System Used in the Future Truck Flows Analysis



2.3.2 Truck trip disaggregation

Truck trips that begin or end in the seven-county area were disaggregated from the county to the analysis zone level shown in Figure 2. The trips were apportioned to each zone based on socio-economic data.

A linear regression analysis was conducted in order to decide which socio-economic factors would be used to apportion the trips among the zones. The raw truck production and attraction data for the seven counties in the CMAP area were regressed against socio-economic totals[1] at the county level. A number of socio-economic factors were considered: households, jobs, manufacturing employment, TCUW (transportation, communications, utilities, and warehousing) employment, sales volume reported by freight-related businesses, and number of employees in freight-related businesses.

[1] All socio-economic data were provided by CMAP.

The linear regression results showed that at the production end[2], manufacturing employment is a strong explanatory variable in determining the number of truck trips that are produced. Additional regressions that used other employment categories and freight sales volume were conducted, but the results from these regressions did not provide a better set of explanatory variables. As a result, truck trip productions were disaggregated based on the proportion of manufacturing employment in each zone compared to total manufacturing employment in the county for year 2007.

The linear regression results demonstrated that at the attraction or consumption end[3], the number of households is a strong explanatory variable in determining the number of truck trips that are attracted to a county. Ideally, an employment variable would be included in the regression as well; however, at the county level, households and employment are heavily correlated, which led to a negative coefficient for the employment variable. Therefore, the number of households alone is used to disaggregate truck trip attractions from the county level to each zone in the county.

2.3.3 Converting annual to daily trucks

A factor of 1/304 was used to convert annual truck trips to daily truck trips. This factor is based on the assumption that commodity-carrying trucks are in operation primarily on weekdays plus one weekend day (52 weeks/year x 6 working days/week) and that they do not operate for any of the eight major holidays per year.

2.4 Network Development

The network development combined data from the CMAP model network and the Global Insight TRANSEARCH routing network. Figure 3 shows the network that was developed for the sketch planning tool assignment. The CMAP model network was used for the seven-county CMAP area. The highway network that was provided by Global Insight was used for the outer area.

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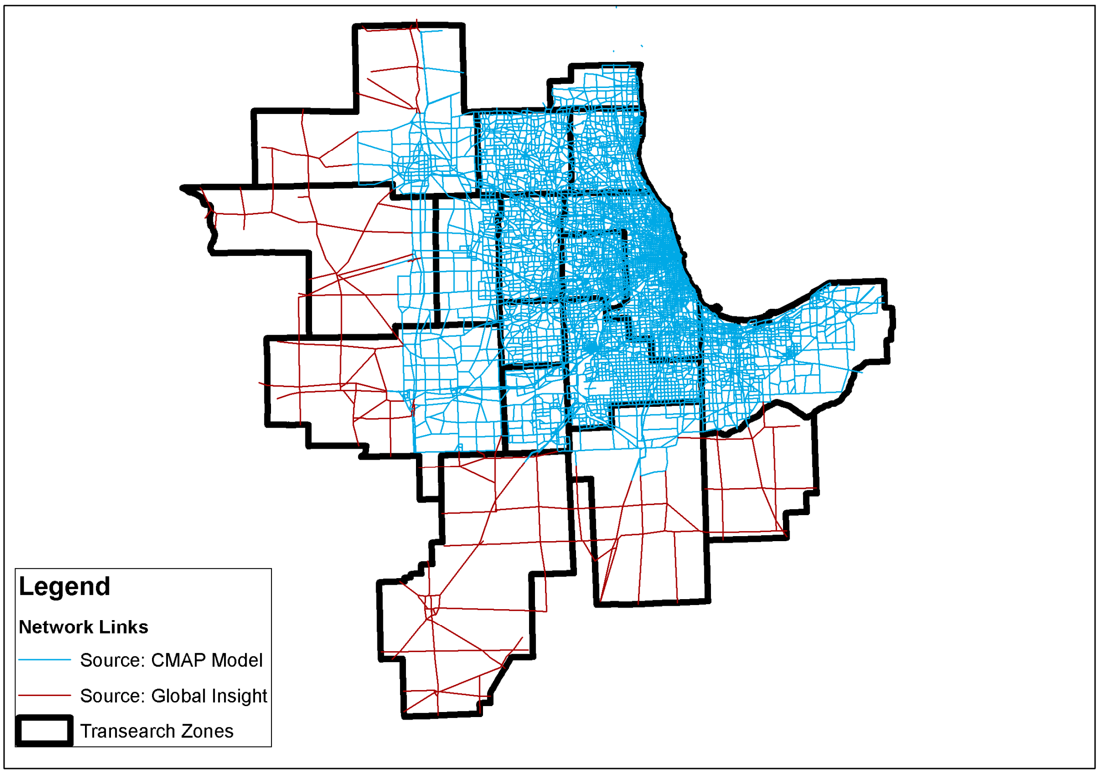
[2] This is considered the origin end in the TRANSEARCH database.
[3] This is considered the destination end in the TRANSEARCH database.

Figure 3. Analysis Network



Some basic adjustments were required to make the Global Insight TRANSEARCH network compatible with the CMAP network. For example, capacity and volume-delay functions were added or modified. Additionally, free-flow speeds from the CMAP and Global Insight networks were used to compute free-flow travel time for the assignment.

Additional adjustments were performed to equip the network with the information that is necessary for input into a daily truck trip assignment procedure. These adjustments include introduction of truck tolls and calculation of daily truck capacity.

2.4.1 Truck Tolls

Truck tolls were calculated by applying factors to the passenger vehicle tolls that are already coded in the existing CMAP network. Ideally, the truck toll that is coded represents the average daily toll that is actually paid by commodity-carrying trucks that pass through the toll plaza.

However, the exact percentage of commodity-carrying trucks by axle class at each toll location is unknown. Therefore, commodity-carrying trucks that utilize the toll roads are assumed to have five or more axles. This assumption is based on the TRANSEARCH dataset, which indicates that about 97 percent of commodity-carrying trucks have five or more axles (Table 1).

Table 1. Annual Tonnage and Corresponding Truck Loads by Vehicle Configuration

Config-uration	Description	Trailer Type	Axles	Truck Tons	% Truck Tons	Truck Loads	% Truck Loads
CS4	Combination	Semi-Trailer	4	27,275,767	3.7%	2,016,247	3.3%
CS5	Combination	Semi-Trailer	5	628,629,053	84.2%	51,541,147	84.9%
CS6	Combination	Semi-Trailer	6	58,207,751	7.8%	4,956,162	8.2%
CS7	Combination	Semi-Trailer	7	1,538,228	0.2%	79,549	0.1%
DS5	Double	Semi-Trailer	5	5,578,667	0.7%	334,426	0.6%
DS6	Double	Semi-Trailer	6	11,615,861	1.6%	1,010,731	1.7%
DS7	Double	Semi-Trailer	7	3,186,746	0.4%	187,924	0.3%
DS8	Double	Semi-Trailer	8	1,954,614	0.3%	105,316	0.2%
DS9+	Double	Semi-Trailer	9	5,246,558	0.7%	260,319	0.4%
TS7+	Triple	Semi-Trailer	7	2,964,546	0.4%	228,217	0.4%
All Trucks				746,197,790	100.0%	60,720,037	100.0%

Source: Global Insight and Cambridge Systematics

Additionally, the proportion of trucks by time-of-day is not available. This required some assumptions to be made about the average toll that is paid by truck drivers throughout the day. Toll data for year 2009 were obtained from the websites of each of the toll operators (Table 2). Since most commodity-carrying trucks have five axles, the tolls shown in Table 2 are used to determine the factors to apply to the existing passenger vehicle tolls to calculate the truck tolls. Factors that range from approximately 4 to 10 times passenger car tolls were estimated. The resulting truck toll values at mainline toll plazas range from about $4 on ISTHA and Indiana Toll Road facilities to up to $10 on the Chicago Skyway.

Table 2. Passenger Car and Heavy Commercial Vehicle Tolls[4] Comparison

Vehicle Characteristics				
Vehicle Type:	Passenger Car	Heavy Commercial Vehicle		
Axles:	2	5	6	7+
Toll Facility	**Mainline Tolls (2009)**			
Skyway	$3.00	$9.00-$12.60	$10.80-$15.20	$12.60-$17.70
IN Toll Road (entire 157 miles)	$4.65	$32.00	$37.50	$69.75
ISTHA (per plaza)	About $0.40-$0.50	About $2.00-$5.00		
Tolls coded in 2007 CMAP model (for autos at mainline plazas):				
Skyway	$2			
IN Toll Road	About $0.50 per mainline plaza			
ISTHA	About $0.50 per mainline plaza			

Sources: Websites for Chicago Skyway, Indiana Toll Road, and ISTHA (Accessed November, 2009) and the CMAP 2007 Model

[4] For facilities with toll variations by time-of-day, Table 2 displays the minimum and maximum values.

2.4.2 *Available Truck Capacity*

The amount of roadway capacity that is available to truck vehicles was derived. Capacity is an important input for the assignment procedure because it is used in determining how fast vehicles can travel in high volume conditions. For this analysis, hourly capacity was multiplied by 14 to derive daily total capacity. Next, auto and light truck volumes (which include B-plate trucks and light trucks) from the CMAP model were effectively subtracted from the total capacity to derive the amount of remaining capacity that is available to truck traffic.

The available truck capacity was further refined in two ways. First, for most roads, it was assumed that at least 10 percent of the daily computed capacity of each roadway is available for trucks. If the remaining capacity was less than 10 percent of the original capacity, the capacity was set to 10 percent. Second, for severely congested freeways or tollways, daily truck capacity was reduced to better represent the extreme congestion found on these roads. Available truck capacity was calculated as five percent of total capacity in cases where the CMAP model volume-to-capacity (v/c) ratio was between 1.1 and 1.2, and as one percent of total capacity where the CMAP model v/c ratio was greater than 1.2.

2.5 Truck Trip Assignment

The truck trip table and network were then used as inputs into the sketch planning tool. A daily assignment procedure was used to assign truck trips to the network. The assignment used the following parameters:

- Standard BPR functions with alpha = 0.15 and beta= 4 were used;
- Additional generalized cost was added to paths that use toll roads by converting each toll value to a generalized cost (in minutes) based on a value-of-time of $90/hour; and
- Between 15 and 30 seconds of red light delay per mile was introduced to arterials and expressways. These delays were introduced in order to generate more realistic travel patterns for the relatively long-distance truck trips in the TRANSEARCH dataset. Without this delay component, the tool generated a handful of unrealistic paths that spurred the abandonment of freeways for less congested arterials[5]. The delay component was introduced as a generalized cost that is equal to 0.5 times the link length (for arterials) or 0.25 times the link length (for expressways). These formulas generate 30 seconds of additional travel time for every mile of arterial street that is traversed on a given path and 15 seconds for every mile of expressway. This component of the tool had the desired effect of generating more realistic travel paths.

[5] This type of path deviation occurred fairly readily with automobile trips, but much less so with commodity-carrying truck trips.

3.0 Quality Control Checks

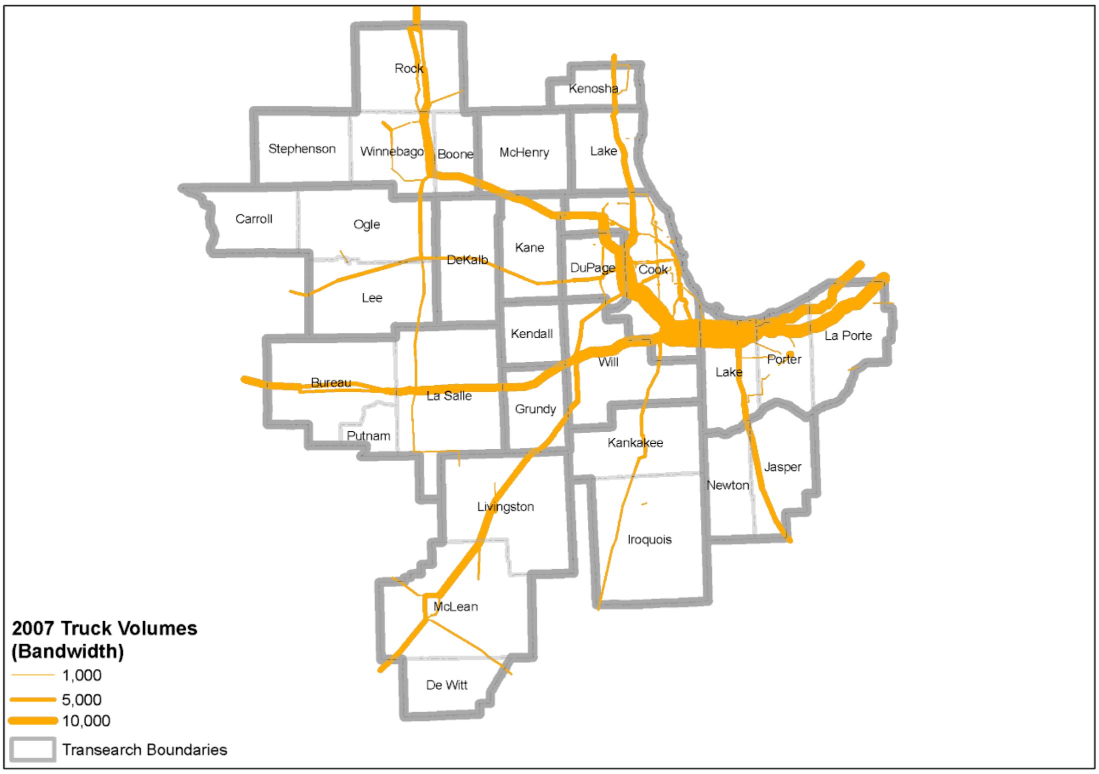
After running the application, the resulting truck volume assignments were examined for reasonableness. The truck flows analysis tool is a high-level, sketch planning tool. As such, it is not subject to the same validation procedures and targets that are used in traditional four-step model development. Nevertheless, some of the tools that are used in traditional model validation are useful to perform basic quality control checks to ensure that the tool is behaving reasonably well. These tools include:

- A high-level examination of regional commodity-carrying truck volume trends;
- A more detailed review of modeled truck volumes on interstate facilities;
- A high-level review of the volumes that are generated on local roadways by the tool; and
- Examining the future-year forecast volume to ensure that growth patterns are reasonable.

3.1 Regional Trends

Commodity-carrying trucks in the Chicago region are predicted to travel mostly on interstate highways and to a lesser degree on principal arterials. Indeed, this is reflected in the assignment results shown in Figure 4, which shows the relative magnitude of assigned truck volumes throughout roadways in the region. As this graphic illustrates, the interstate system carries significant volumes of commodity trucks. Roadways with less than 1,000 assigned daily trucks are not shown.

Figure 4. Bandwidth Plot of 2007 Modeled Truck Volumes



Note: Volumes < 1,000 daily trucks are not pictured
Source: Sketch Planning Tool by Cambridge Systematics

The pattern of commodity-carrying trucks in the region is expected to exhibit higher volumes in the east-west direction. One reason for this pattern is that the Chicago region is a logical gateway for pass-through trips that are traveling between the Northwest/Upper Midwest and Northeast U.S. In addition, the Chicago region also serves as an origin or destination of goods that travel to or from these two areas. As a result, these pass-through trips generate a level of truck traffic in the east-west direction that is greater than the truck volumes that are generated by trip exchanges between the Chicago region and the Southeast, Central Midwest, and Southwest U.S.

The analysis tool results show substantial numbers of trucks in the east-west I-80/94 connection and the east-northwest connection from I-80/94 to I-90/94, which serve as gateways between the Northwest/Upper Midwest and the Northeast regions.

3.2 Freeway and Tollway Review

For the year 2007 assignment (Figure 4), the modeled truck volume was compared to the Multi-Unit[6] (MU) truck volume at various locations around the region. The source of the observed MU volumes is count data from the Illinois Department of Transportation. This basic, high-level quality control check illustrated that the tool is producing truck volumes that reaffirm the trends that are observed on the roadways.

For example, two checks of interstate travel are:

- According to the sketch planning tool, I-80/94 has a substantial number of commodity-carrying trucks (Figure 4). This highway, which carries very high MU volumes, services through trips as well as trips that are produced in or attracted to the northeastern U.S. Therefore, the analysis tool is generating very reasonable results at this location.

- In contrast to I-80/94, the analysis tool estimates that I-290 near downtown Chicago carries relatively few commodity-carrying trucks. In reality, this facility is heavily congested, but passenger cars comprise most of the traffic on this road. The analysis tool estimates in the heavily congested I-290 corridor are reasonable because I-290 at this location is not a logical route for the relatively long-distance truck trips that comprise most of the TRANSEARCH dataset, such as through trips[7], which can utilize interstates that have much less congestion such as I-294.

- Other locations, such as I-39, I-88, and I-355 were evaluated in a similar fashion and were found to be reasonable.

3.3 Trends on Non-Interstate Facilities

In addition to checking the overall trends and interstate volumes, the estimated truck flows on the local network were examined. It was confirmed that the analysis tool is generating reasonable results on local streets. For example, the modeled commodity-carrying trucks are more prevalent on principal arterials such as Western Avenue and Cicero Avenue than on local neighborhood streets.

3.4 Future-Year Forecast

After evaluating the year 2007 truck trip patterns, the analysis tool was used to evaluate the forecast 2040 truck trips. The 2040 application was identical to the 2007 year except for the trip

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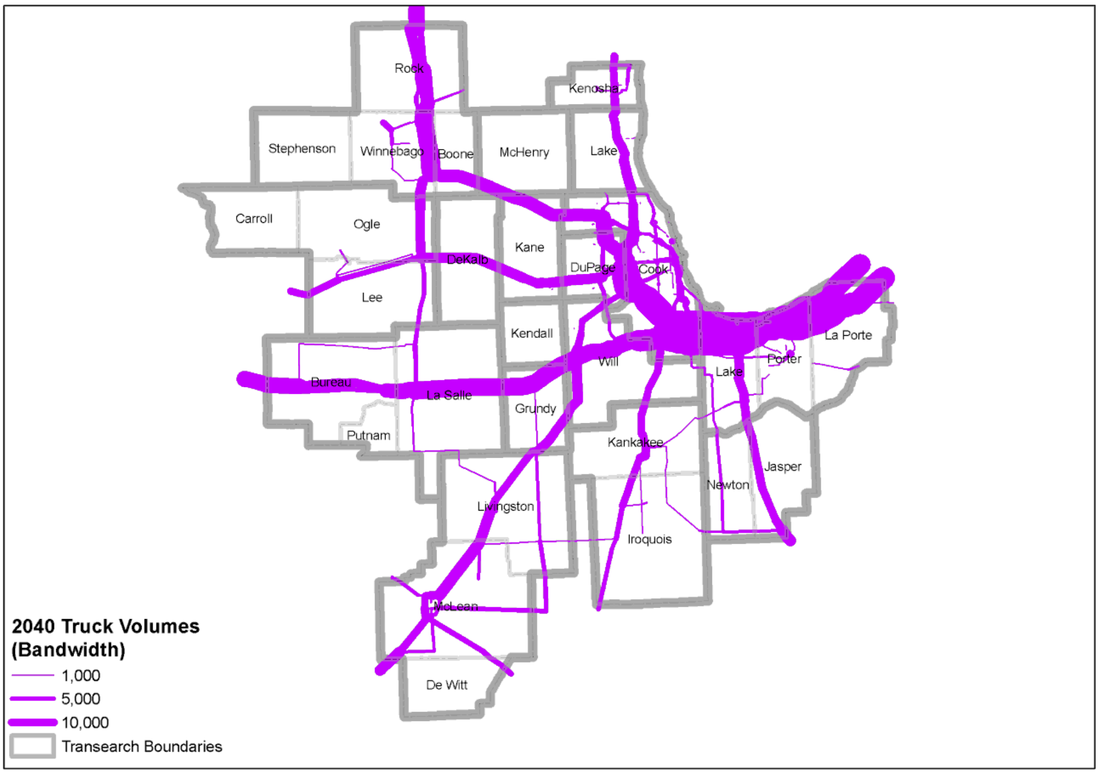
[6] Most commodity-carrying trucks in the Global Insight dataset have at least five axles, which typically means that they are multi-unit trucks.

[7] Although the commodity-carrying trucks that feature heavily in the Global Insight dataset are not as likely to use I-290 as other interstates, the I-290 corridor is in close proximity to several intermodal facilities and other major truck generators. This makes this corridor strategically important from an accessibility standpoint.

tables that were used. The same network[8], tolls, and assignment procedure were used for each year.

The results were checked for reasonableness by examining the 2040 volume patterns and comparing them to the year 2007. The patterns were similar to the patterns exhibited by the 2007 results. Growth between the two analysis years was also reviewed to ensure that it too was reasonable. Both the future trip patterns and the growth rates were concluded to be reasonable.

Figure 5. Bandwidth Plot of 2040 Modeled Truck Volumes



Note: Volumes < 1,000 daily trucks are not pictured
Source: Sketch Planning Tool by Cambridge Systematics

3.5 Summary

The quality control checks demonstrated that the sketch planning tool generates reasonable estimates of heavy truck traffic. Therefore, the heavy truck traffic flows that are generated by the sketch planning tool will be used to evaluate whether the TRANSEARCH data are

[8] The future year network was under development at the time of this study.

supportive of the highway infrastructure recommendations. The following sections describe the application of the sketch planning tool for the analysis.

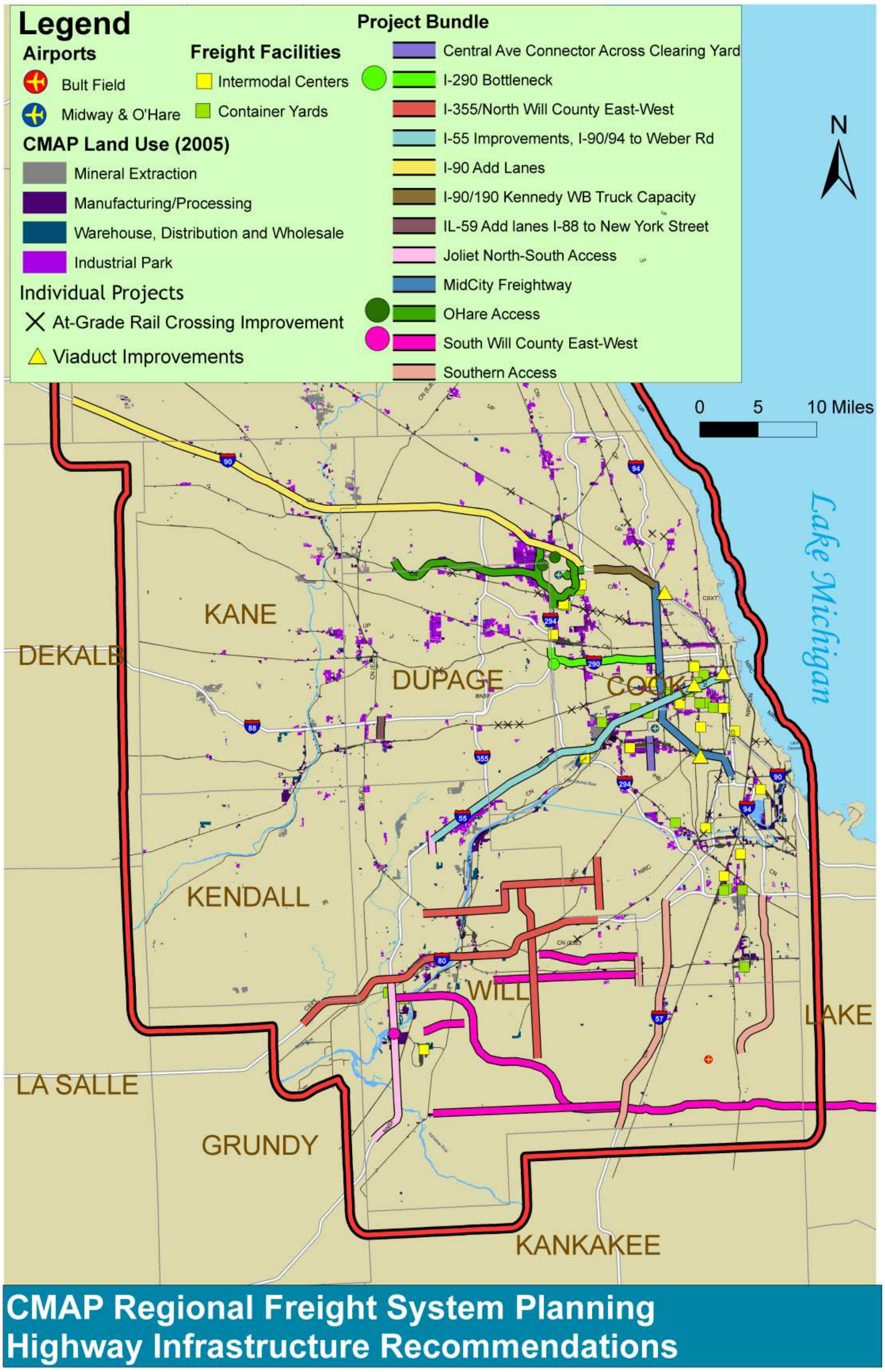
4.0 Application and Results

4.1 Project Recommendations

The infrastructure project recommendations are shown in Figure 6. The highway infrastructure project recommendations are analyzed according to "project bundles". Each project bundle consists of projects that are located in the same general geographic area. Some projects were analyzed individually. These "individual projects" include improvements to existing facilities such as I-55 or new facilities such as the Mid-City Freightway. The projects will be described in detail in the infrastructure recommendations section of the Final Report.

Figure 6 also shows major freight-related facilities and corresponding land use. The relationship between the location of these freight facilities, the adjacent land uses, and the project recommendations show that the highway infrastructure recommendations may play an important role in serving the future transportation needs of freight-related businesses.

Figure 6. Highway Infrastructure Recommendations



4.2 Application Methodology

The truck volume forecasts that were generated by the sketch planning tool were used to analyze freeways, tollways and arterial roadways. Since the freight flow data include national flows in addition to trips that are generated in the CMAP region, the highest volumes and more reliable flows occur on the freeways and tollways. Therefore, for **freeway and tollway** improvements, the truck volume growth that was generated by the sketch planning tool was applied directly to Multi-Unit truck counts from the base year in order to estimate future year truck volumes:

Future-Year MU Truck Volume =

Base Year MU Count * Percentage Growth

A modified approach was used for evaluating improvements on arterials. For **arterial streets**, the total percentage growth in truck VMT on arterial streets was calculated for each analysis zone. This method was used to overcome the limitations of the sketch planning tool at the local street level, where the tool produces estimates that are not as robust as the estimates at the interstate highway level. To overcome these limitations, the tool-generated volumes were used to calculate total base and future year commodity truck VMT at the zonal level. The zonal VMT data were used to calculate percentage growth in commodity-carrying trucks at the zonal level for the analysis of arterial roadways within the zone.

4.3 Results

4.3.1 Growth on Interstates

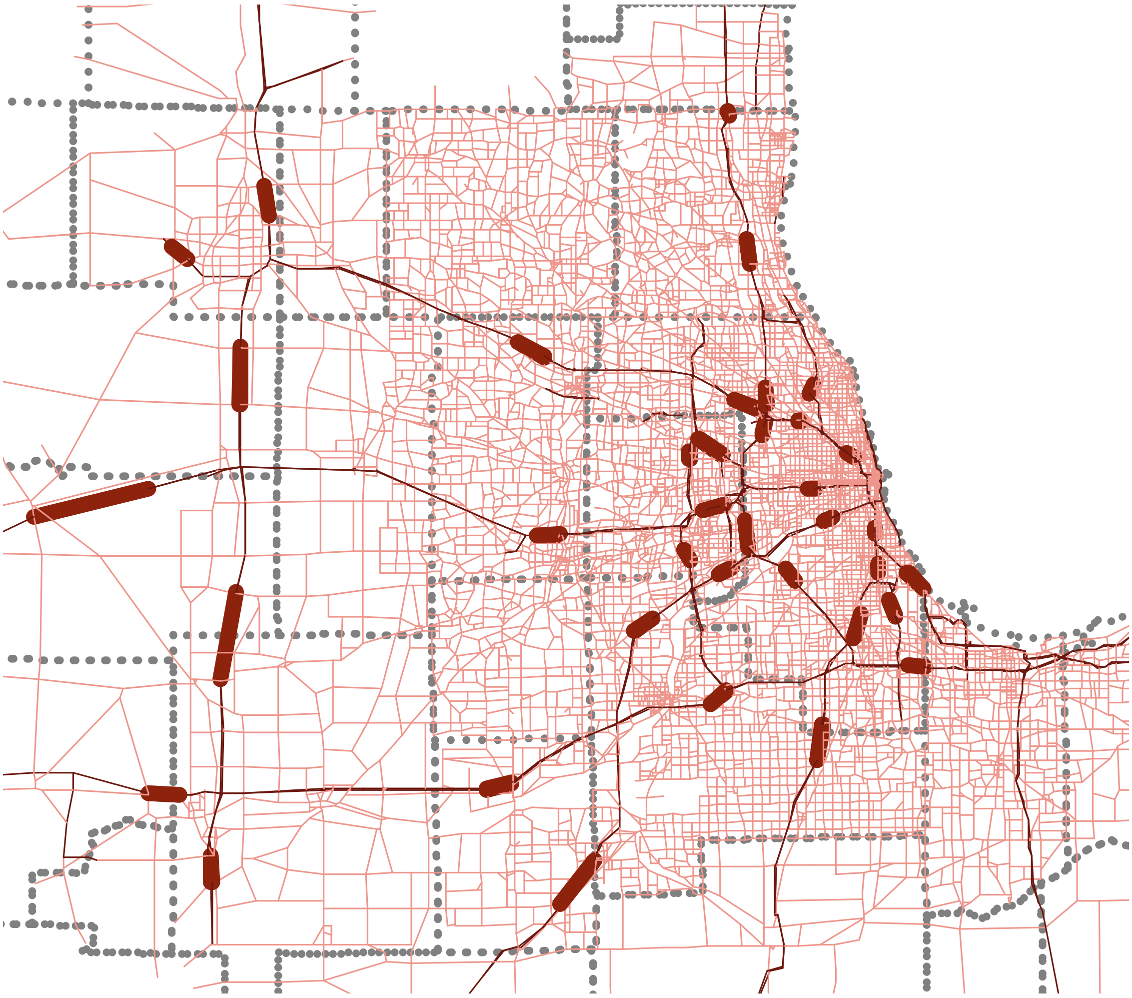
To establish the degree to which the estimated future freight flows are supportive of the interstate recommendations, each interstate recommendation was analyzed in a systematic fashion along three dimensions:

- Observed Multi-Unit (MU) trucks;
- Estimated growth in commodity-carrying trucks; and
- Calculated MU truck volume forecast.

The MU truck volume forecast was derived by multiplying the base year MU traffic count value by the estimated percentage growth. These three values were obtained for several points along each proposed improvement corridor, averaged for each corridor, and used for corridor level analysis.

The MU, growth, and future MU values from 36 regionally significant locations were compiled to establish a framework to use in comparing truck flows on the project interstates with truck flows on key facilities throughout the CMAP region. The data values for these 36 locations are shown in Figure 7 and listed in Table 3. The ranges of values that represent the top third, middle third, and lowest third percentiles for each category (MU, percentage growth, and forecast MU) were compiled from the 36 locations to rank each of the proposed interstate improvements. The top, middle and lowest third percentiles are listed in Table 4.

Figure 7. Regionally Significant Count Locations



Sources: Sketch Planning Tool and IDOT MU Count Data

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Table 3. Base Year Daily MU Count, Percentage Growth from Analysis Tool, and Forecast MU Volume for 36 Regionally Significant Locations

Count Location	MU Truck Traffic Count	% Growth, 2007-2040	MU Truck Forecast Volume
I290 at IL-83	13,000	50%	19,476
I290 Cook	7,400	22%	9,047
I294 95th St	15,700	36%	21,356
I294 at O'Hare	13,600	47%	19,948
I294 Dempster	10,500	52%	15,942
I294 Ogden Ave	19,600	50%	29,438
I355 75th St	8,100	152%	20,425
I355 North Ave	6,200	91%	11,871
I39 LaSalle	5,800	40%	8,092
I39 Lee	7,200	77%	12,750
I39 Ogle	8,300	121%	18,359
I39-90 Winnebago	12,300	97%	24,249
I55 Cicero	12,500	34%	16,698
I55 Grundy	5,700	78%	10,143
I55 North of Joliet	15,000	66%	24,969
I57 130th St	3,500	85%	6,492
I57 Will	7,900	131%	18,245
I80 Bureau	8,500	92%	16,302
I80 East of Joliet	15,300	53%	23,479
I80 Grundy	11,000	101%	22,077
I80-94 Indiana	36,000	58%	57,040
I88 at IL-83	21,500	53%	32,827
I88 Kane	4,400	134%	10,298
I88 Lee	2,600	40%	3,649
I90 Kane	6,100	72%	10,470
I90 Kennedy at Harlem	3,600	90%	6,839
I90 Kennedy West of I290	7,500	74%	13,040
I90 Skyway	4,200	73%	7,250
I90-94 Dan Ryan 47th St	20,700	83%	37,860
I90-94 Dan Ryan 83rd St	16,500	42%	23,445
I90-94 Kennedy	9,000	87%	16,810
I94 130th St	14,300	44%	20,545
I94 Dempster	6,900	64%	11,337
I94 Kenosha	9,500	66%	15,750
I94 Lake Forest	11,000	63%	17,890
U20 Winnebago	1,600	15%	1,841

Table 4. Percentile Ranges of Base Year MU Count, Percentage Growth from Analysis Tool, and Calculated Forecast MU Volume

Value	MU Truck Traffic Count	% Growth, 2007-2040	MU Truck Forecast Volume
Average	10,107	76%	17,378
Lower Third, Range	0-7,300	0-52%	0-12,000
Middle Third, Range	7,301-12,400	53-80%	12,001-20,000
Top Third, Range	12,401+	81% and up	20,001+

Table 5 lists the average MU, percentage growth, and forecast MU volume values for each interstate in the project recommendations list. The interstates are evaluated by comparing these three values to the percentile ranges shown in Table 4. A point system was developed to calculate a score for each interstate improvement. Values that are in the top third percentile were awarded two points, values in the middle third one point, and values in the lowest third zero points. The points for each project were added up to calculate the total score for each improvement. The maximum possible score is six and the minimum is zero. Higher values indicate greater support for the project.

In addition, Table 5 shows the level of congestion in the base year that was determined using performance measures (see Final Report for detailed methodology). The selected performance measures relate to congestion. For each project, the scores were summed up and then factored to a scale of 10, where 10 indicates significant congestion for trucks.

For facilities that do not yet exist, data were not directly available. For these facilities, the three values were calculated for interstates in nearby corridors that serve the same direction of flow. In cases where there were two competing facilities, scores for each competing facility were calculated separately and then averaged to derive a score for the proposed new facility.

Table 5. Limited Access Highway Infrastructure Projects: Importance Ratings

Project		Future Year Freight System Support for Project: Top Third (2 pts.)	Middle Third (1 pt.)	Bottom Third (0 pts.)	Total Points (6 is maximum)	Base Year Congestion: Scale 1 to 10 (10 is worst)
I-90 Add Lanes					2	3
I-39 to I-294	MU			X		
	% Growth, 2007-2040		X			
	Forecasted Volume		X			
I-90/190 Truck Capacity					2	8.5
I-294 to Edens/I-94	MU			X		
	% Growth, 2007-2040	X				
	Forecasted Volume			X		
O'Hare Access: Growth on Competing Facilities					3.5	4.5
I-90 near Elgin-O'Hare Extensions	MU			X		
	% Growth, 2007-2040	X				
	Forecasted Volume		X			
I-290 between I-355 and I-294	MU	X				
	% Growth, 2007-2040			X		
	Forecasted Volume	X				
I-290 Bottleneck					1	7
I-294 to Cicero Ave	MU		X			
	% Growth, 2007-2040			X		
	Forecasted Volume			X		
I-355/North Will County East-West					5	3
I-80 from Grundy to LaGrange	MU	X				
	% Growth, 2007-2040		X			
	Forecasted Volume	X				
I-55 Improvements					4	8
Weber Rd to I-90/94	MU	X				
	% Growth, 2007-2040			X		
	Forecasted Volume	X				
Joliet North-South Access					4	6.5
I-55, I-80 to Coal City (North to South)	MU		X			
	% Growth, 2007-2040	X				
	Forecasted Volume		X			
Mid-City Freightway: Growth on Competing Facilities					4.5	7.5
I-294, I-90 to I-57	MU	X				
	% Growth, 2007-2040			X		
	Forecasted Volume	X				
Kennedy/Dan Ryan, Edens to 95th Street	MU	X				
	% Growth, 2007-2040		X			
	Forecasted Volume	X				

Table 5. Limited Access Highway Infrastructure Projects: Importance Ratings (continued)

Project		**Future Year Freight System Support for Project**				**Base Year Congestion: Scale 1 to 10 (10 is worst)**
		Top Third (2 pts.)	Middle Third (1 pt.)	Bottom Third (0 pts.)	Total Points (6 is maximum)	
South Will County East-West: Growth on Competing Facilities					5	4.5
I-80, I-57 to State Line	MU	X				
	% Growth, 2007-2040		X			
	Forecasted Volume	X				
Southern Access					3.5	2.5
IL-394, I-80/94 to IL-1	MU			X		
	% Growth, 2007-2040	X				
	Forecasted Volume		X			
I-57, I-80 to Wilmington-Peotone Road	MU		X			
	% Growth, 2007-2040	X				
	Forecasted Volume		X			

According to this analysis, the commodity flow data show the strongest support for the following improvements score between four and five points in the rating system:

- I-355/North Will County East-West,
- I-55 Improvements,
- Joliet North-South Access,
- Mid-City Freightway, and
- South Will County East-West.

Most of these improvements are located in the southern, southwestern, and southeastern parts of the CMAP region. The freeways and tollways in these areas tend to experience heavy commodity truck flows because they serve as major geographic gateways between the Chicago region and most of the remainder of the U.S. For example, the I-80 corridor serves as a gateway to the northeastern and northwestern U.S.

The data also show moderate support for the other interstate recommendations. The following interstate projects rank two to three points in the rating system:

- I-90 Add Lanes
- I-90/190 Truck Capacity
- O'Hare Access

- Southern Access

Although this analysis demonstrates only moderate support for these projects, they are regionally significant for commodity truck travel for other reasons. In particular, these improvements would help to facilitate the heavy through movements between I-80/94 and I-90/39 that are documented in Section 3. These improvements would also facilitate access to major freight generators in the O'Hare area. These and other reasons are described in more detail in the performance measures section of the Final Report.

Congestion in the base year is another level of support for many projects. In terms of base-year congestion, the projects that rank the highest are:

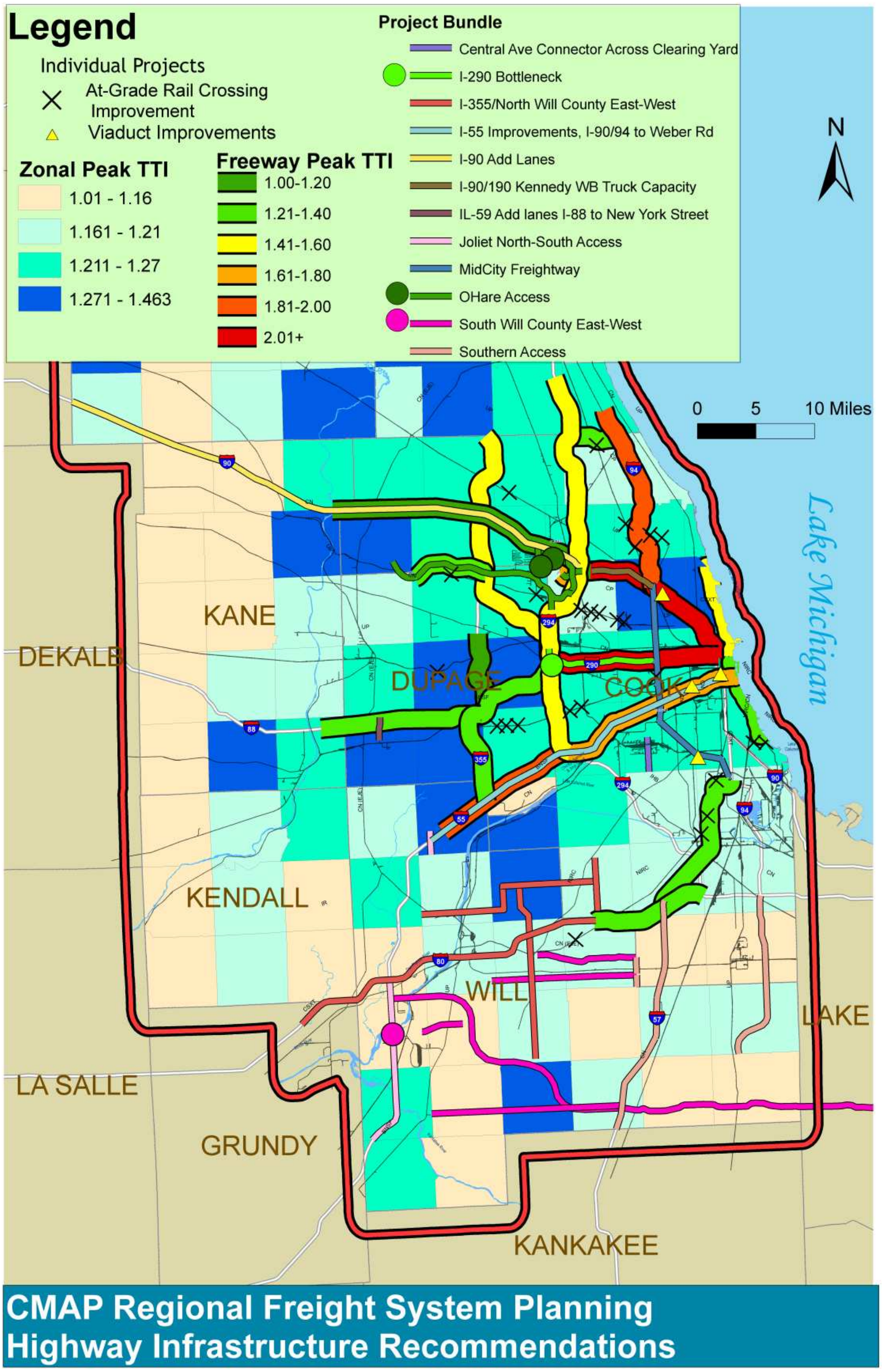
- I-90/190 Truck Capacity
- I-290 Bottleneck
- I-55 Improvements
- Mid-City Freightway

As described in earlier chapters, the level of congestion that trucks face is a significant component of the project development process. For example, key regional interstate such as I-90/190 and I-290 pose substantial mobility issues to trucks. As a result, these projects, which rank on the lower end in the future freight system ranking, rank very high on the congestion component. The congestion measures that were used for this evaluation are described in more detail in the performance measures section of the Final Report.

Levels of congestion are graphically shown along with the project recommendations in Figure 8. This figure shows congestion in terms of peak period Travel Time Index (TTI) on freeways and on arterials. The TTI was available for the AM and PM peak periods[9]. The data that are shown in the figure further illustrate the severity of congestion on the major regional interstates such as I-290, I-90, and I-55.

[9] For interstates, the higher of the two TTI value was used. For arterials, congestion at the link level was first weighted by VMT to compose a zonal average by time period, then the higher of the two values was used.

Figure 8. Highway Recommendations and Congestion on Interstates and Arterial Streets



4.3.2 Growth on Arterial Streets

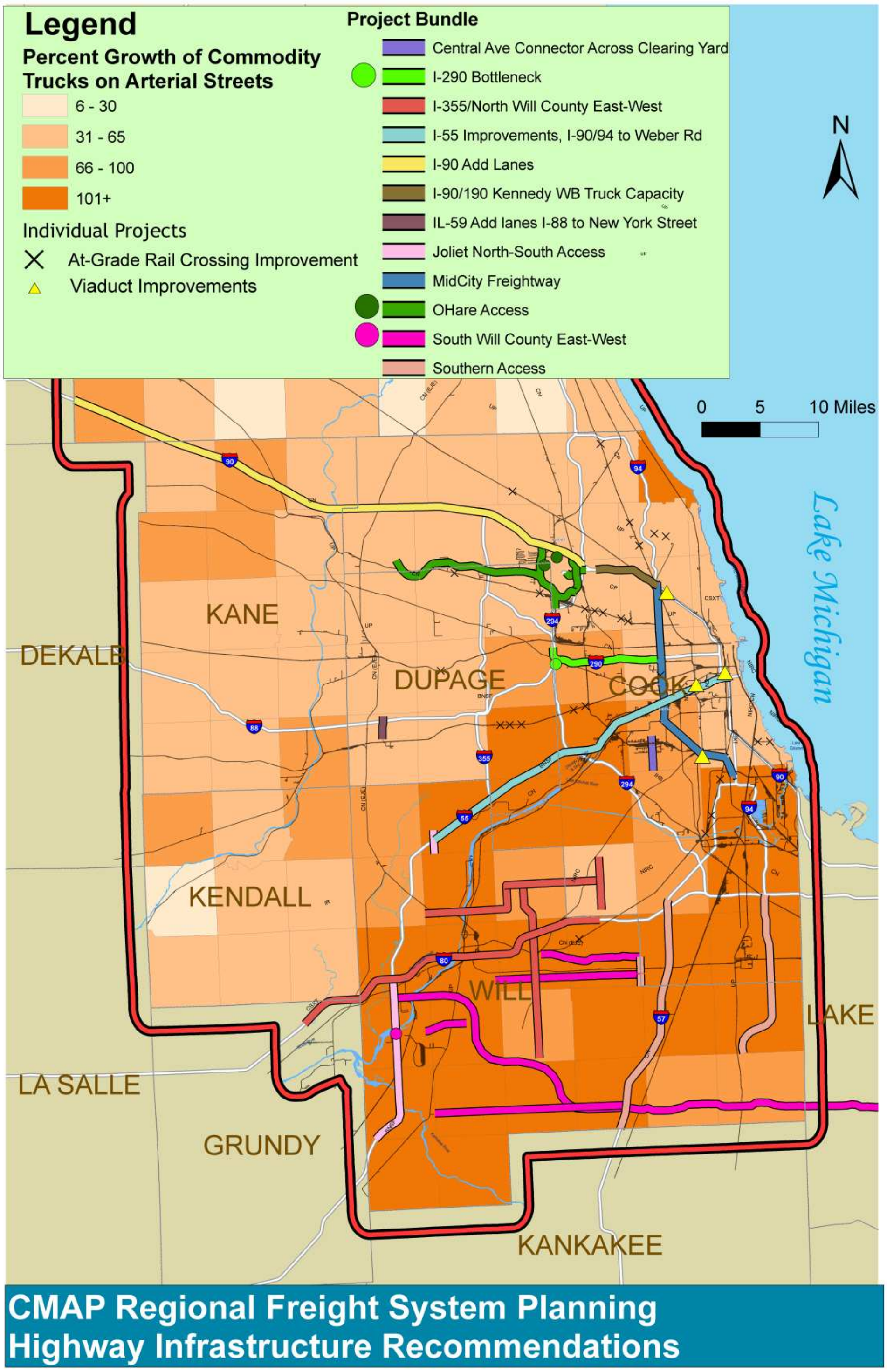
Figure 9 shows the forecasted percentage change of commodity-carrying truck VMT on arterial streets in each analysis zone. The average zonal growth of commodity-carrying truck VMT on arterial streets was about 65 percent between 2007 and 2040. The zones are color-graded to represent a comparison of the zonal growth with the average zonal growth. The two lighter shades represent below-average growth and the two darker shades represent above-average growth. According to the sketch planning tool, the largest percentage increases in arterial growth are expected to occur in the southern part of the CMAP region. This high-growth area includes Will, southern Cook, and southeastern DuPage Counties.

Most of the proposed infrastructure improvements, shown in Figure 9, are also located in the high-growth, southern CMAP area. This analysis suggests that the proposed infrastructure projects located in the southern area of the region tend to be aligned with the higher growth volumes predicted by the sketch planning tool.

The projects which are located in the lower-growth areas also are important for commodity-carrying trucks. For example, routes such as I-90, I-290 and the Mid-City Freightway help to facilitate truck movements throughout the region. Additionally, these routes provide important connections to key freight-related areas in the northern part of the region such as the O'Hare area.

As shown in Figure 8, many of these projects are located on roadways with high levels of congestion. For example, the arterial street networks in the vicinity of the I-290 / St. Charles interchange and the O'Hare Access improvements are very congested relative to other areas.

Figure 9. Highway Recommendations and Growth in Commodity-Carrying Trucks on Arterial Streets



5.0 Summary and Next Steps

This paper describes a high-level evaluation of recommended highway infrastructure projects that were proposed to be included in the CMAP *GO TO 2040* plan. The evaluation focuses on the highway network travel patterns of commodity-carrying trucks using a highway assignment sketch planning tool that was developed and customized for this purpose. In addition to commodity truck demand in base and future years, the existing congestion is used to form a comprehensive picture of the highway infrastructure available to commodity-carrying trucks. Using demand and congestion measures, the analysis confirms the importance of the proposed highway infrastructure recommendations.

CMAP continues to use the TRANSEARCH dataset to support other freight and economic analyses. For example, the agency plans to update the freight component of its regional travel demand model. One simple way to incorporate the TRANSEARCH dataset, which contains origin-destination tonnage flows , involves using the commodity truck trip tables basically "as is" in the current four-step modeling framework. The TRANSEARCH dataset provides rich information in terms of modes and commodities as well, therefore it can be used to support far more complex efforts such as modeling commodity movements and mode choices within an economic framework that utilizes an understanding of supply chains.