The Mid-City Freightway Study. By Monique S. Urban, Dan Tempesta, and Kimon Proussaloglou, Cambridge Systematics; Richard Hazlett, Chicago Department of Transportation. Paper presented at the Transport Chicago conference, June 5, 2009.

Abstract

The objective of this paper is to provide an overview of traffic forecasting for the proposed "Mid-City Freightway", a two-lane, grade-separated roadway for the exclusive use of commercial vehicles. The Full Build freightway would function as a beltway that would permit vehicles to travel circumferentially around the central area of the city.

Forecasts of the expected demand on the facility were made for a variety of alignments and toll levels and the impact of changes in truck volumes on other corridors in the region was evaluated. The project team upgraded the existing CMAP regional truck model using commodity flow data to reflect freight and truck movements to, from, and through Chicago. Truck traffic counts from around the region and new counts along the Mid-City Freightway corridor were used as inputs into an ODME procedure to refine the truck trip table. Values of time for truck travel in the region were used to better reflect the tradeoffs between toll costs and travel time savings.

A Full Build alternative and three shorter alignment alternatives were tested as a tollway. The key results are:

- Total truck traffic on the Mid-City Freightway is expected to vary by the length of the proposed facility, ranging from 10,100 daily trucks per direction for the shortest alignment to up to 12,400 trucks per direction in the Full Build alternative.
- Truck volumes on key interstates in the region would be affected by the introduction of the freightway. A decrease by as much as 35 percent is expected for traffic on alternoute routes, while truck traffic on expressways leading to the freightway was expected to increase by as much as 24 percent in the Full Build.
- Different design speeds had an important impact on the utilization of the freightway. Under a Full Build scenario, a slower design speed of 45 mph (vs. 55 mph) would decrease the freightway utilization by about 20 percent.
- Finally, different toll rate assumptions also had an important impact on the estimated use of the freightway with the toll-free facility expected to attract volumes up to 11 percent higher than the volumes projected with double the I-PASS toll rate.

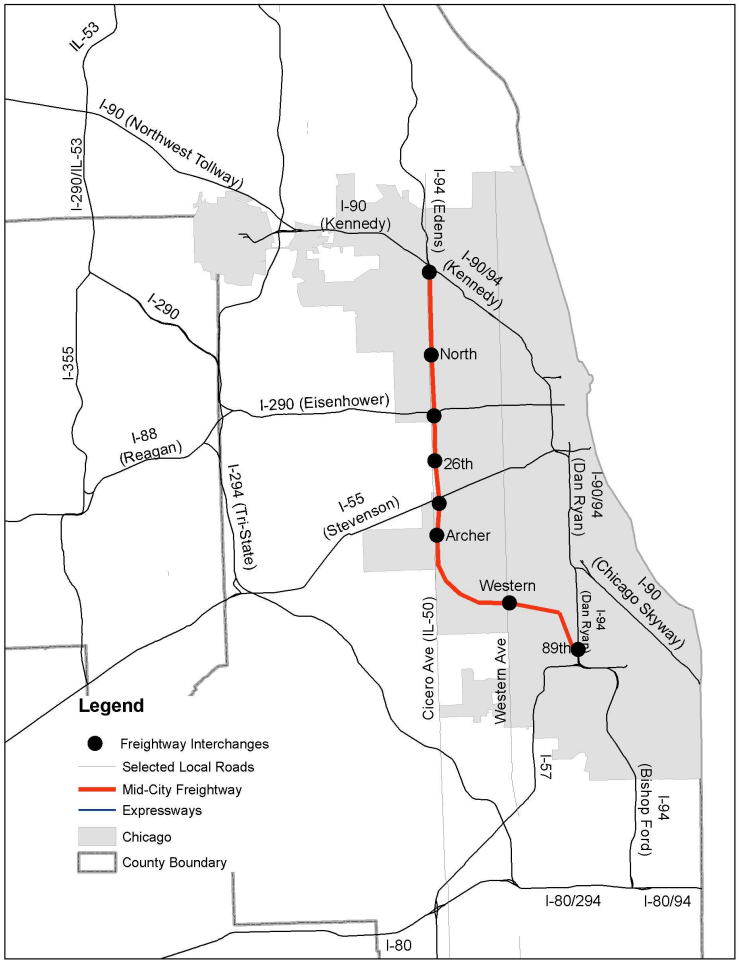
1.0 Introduction

The name "Mid-City Freightway" designates a proposed grade-separated roadway, with one lane in each direction, for the exclusive use of commercial vehicles, including both trucks and scheduled buses. The freightway is one of five alternatives under study by the Chicago Department of Transportation for the Mid-City Transitway corridor. The other four

alternatives are the focus of another study and include Commuter Rail, Light Rail, Heavy Rail, and Busway.

The full-build freightway consists of a north-south and an east-west alignment. The north-south portion would be located on a Belt Railroad of Chicago (BRC) and a Union Pacific (UP) right-of-way that run parallel to and one-fourth mile west of Cicero Avenue between the junction of the Kennedy and Edens Expressway on the northern end and Midway Airport on the southern end. South of Midway Airport, the alignment turns to the east and is located in BRC right-of-way just south of 74th Street. Just east of Halsted Street, the alignment turns southeast and terminates at the Dan Ryan Expressway in the vicinity of 87th Street (see Figure 1). A separate study is evaluating the feasibility and cost of building the freightway with this alignment.

Figure 1 Proposed Freightway Alignment and Area Expressways



The objectives of the Mid-City Freightway study were to:

- Determine the expected demand on the proposed Mid-City Freightway for a variety of alignments and tolls;
- Examine the demand impacts and revenue potential of charging a toll for use of the freightway; and
- Evaluate the impact on truck volumes on other roadways in the region, with emphasis on the impact on Chicago's expressway system.

1.1 Overview of the Analysis Approach

The proposed freightway provides a facility that will affect travel movements in its immediate vicinity and across the Chicago metropolitan region:

- The corridor will provide improved truck mobility and access for freight-oriented businesses in areas with existing industrial development. This suggests the need to include sufficient detail on access to adjacent land uses.
- The corridor will provide better connections to other designated industrial corridors in the city and will help separate longer-haul freight movements from mixed-flow traffic, improving overall traffic conditions and safety. This suggests that long-haul truck flows must be well characterized in the model.
- The corridor also may provide enhanced connections to nearby intermodal facilities. This suggests that the trip generation and origin-destination (O-D) patterns of these facilities with respect to the corridor must be included.

A collaborative approach among the Chicago Area Transportation Study (CATS)[1], CDOT, and CS was used to develop an improved truck model for the corridor. Inputs also were provided by the Illinois State Toll Highway Authority (ISTHA) and Wilbur Smith Associates (WSA) on appropriate values of time for tolls. The Metropolis 2020 base and future year truck trip tables also were examined as part of this project. We reviewed the CATS model and Metropolis models, flow data, and traffic counts and arrived at an updated freight model for the region as follows:

- The 2005 and 2030 CATS models were used as a base to obtain overall passenger car flows in the region. Other components of the CATS model that were used following some adjustments included the network and volume-delay functions.
- The CATS truck trip table was updated using commodity flow data on movements of freight to, from, and through the Chicago metropolitan area. Truck traffic counts from around the region and along the corridor in which the freightway would be located

1 The Chicago Metropolitan Agency for Planning (CMAP) was established in 2006 by merging the Chicago Area Transportation Study (CATS) and the Northeastern Illinois Planning Commission (NIPC) planning agencies.

were used to update the truck trip table and validate the model to meet the analysis objectives, focusing especially on areas around the Mid-City Freightway corridor.

- A new toll component was introduced into the CATS model to take into account the impact of tolls and travel time savings on the route choice decisions of truck drivers.
- The 2005 truck model was validated using recent truck traffic counts available from Illinois DOT, the Chicago DOT, and counts collected as part of this project in areas around the Mid-City Freightway corridor.
- The 2030 alternative evaluations were made by projecting the updated 2005 truck trip table to year 2030 conditions.
- The alternatives that were studied differed in terms of the length of the proposed alignment, the tolls charged to use the proposed freightway, and the design speed of the facility. The estimated volumes on the freightway and changes in volumes on expressways in the region were examined in our analysis.

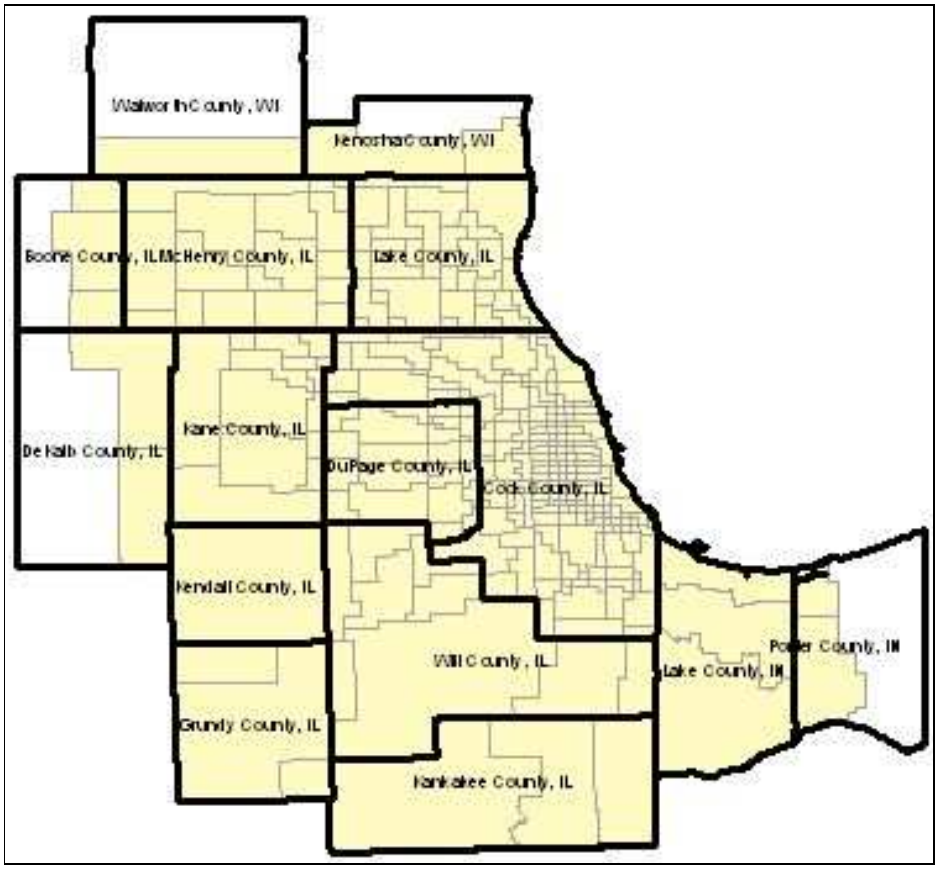
1.2 Update of the Truck Model

The refinement of the existing freight model focuses on the development of a truck trip table that is built using commodity flows and truck traffic data, a zone system that is more detailed than the existing freight zone system in the CATS model, the explicit modeling of tolls, and the application of the model for 2030.

One objective for this study was to develop a new ***2005 truck trip table*** that is based on observed commodity flows and differentiates between the long- and short-haul/local truck traffic in the region. The approach used in this project is rooted in commodity flows that are destined to, or flow through, the Chicago metropolitan area. Commodity flow data were used to account for long-haul/ "through" movements compared to short-haul/local truck traffic.

- Commodity flow data were converted to truck flows using a more detailed zone system of 262 zones (Figure 2).
- Truck traffic counts and the seed trip table were subjected to an ODME procedure to produce an updated truck trip table.
- New truck traffic count data that were collected along the Mid-City Freightway corridor were used to validate the model primarily at a corridor-specific level and secondarily at a regional level.

Figure 2 Updated Freight Model Traffic Analysis Zone System



The second objective was to develop ***a zone system*** that was more detailed than the original 150-zone system used in the CATS freight model. The 262-zone system that was developed is based on aggregations of the detailed system of 1,790 analysis zones and external stations maintained by CATS for its passenger model (see Figure 2). The resulting truck trip table was developed at the 262-zone level of detail and contains greater detail along the proposed Mid-City Freightway corridor.

The third objective was to explicitly account for the ***impact of tolls*** on base and future year truck traffic in the region and on the proposed Mid-City Freightway. The interest in dedicated truck lanes in various parts of the country reflects the belief that the productivity benefits that truck lanes provide to shippers and carriers would make them willing to pay tolls to use the facilities.

The CATS model treats tolls by accounting for the delay that all vehicle classes face at toll booths by using a specialized volume-delay function at toll booth points. This procedure was maintained outside of the corridor for consistency with the CATS model.

In addition, the impact of tolls was introduced by using a generalized cost for trucks operating on area tollways and on the proposed freightway. Truck drivers' value of time is used to mimic an elasticity curve for truckers' willingness to pay tolls. The generalized cost for each link was calculated by taking into account the level of tolls and combining it with the implicit

values of time found in the existing literature and used in practice in studies in the Chicago region. These values of time reflect the willingness of truck drivers to pay a toll in order to enjoy the travel-time savings of using an uncongested tollway facility.

The fourth objective was to obtain a ***2030 truck trip table***. This future year trip table was developed by growing the updated truck trip table for the region. We reviewed the growth factors used in the Metropolis 2020 model, the growth factors implied by the CATS model, and the growth factors used in the Freight Analysis Framework studies. In our analyses we have relied on the more conservative growth factors derived from the CATS model.

2.0 An Updated Truck Model for the Mid-City Freightway

2.1 Overview of the Truck Modeling Process

The updated truck model used in testing the Mid-City corridor alternatives is based on the existing CATS model. The updated truck model uses the CATS EMME/2 assignment routine to assign an updated truck trip table to the Chicago area highway network.

Early discussions with the planning staff at CATS determined that while the CATS truck trip table may be suitable for regional planning, a more detailed truck trip table would be required to test the various freightway alternatives in more detail. Discussions with CATS and CDOT staff led to the decision to use the non-truck portions of the CATS model "as is". The updated truck model trip table was developed in multiple steps:

- The first component is the commodity-carrying truck portion of the trip table. Chicago is not only a large producer and consumer of commodities, but also a major transshipment point with a large amount of goods shipped through the region. As a result, the proposed Mid-City Freightway is anticipated to carry a considerable number of commodity-carrying trucks. Commodity-carrying trucks have different characteristics that other trucks, as their trips tend to be long-haul trips. A better understanding of the commodity flows in the region is essential for properly representing the flows of truck traffic in the vicinity of the corridor. TRANSEARCH data, purchased from Global Insight, is used to obtain the commodity flows.
- The second major component of the updated trip table is the total truck trip table, which was estimated using an ODME process. This process uses a seed trip table, a zone system, and a highway network that includes truck traffic count data. The traffic counts are used to adjust the seed truck trip table data to better reflect current truck traffic conditions.
- The final truck trip table consists of both the commodity truck trip table that was built from the commodity flow data and the total truck table that was built from the ODME process. The commodity-based truck trip table was subtracted from the ODME trip table to determine the number of non-commodity-carrying trucks. In cases where the number of commodity-carrying trucks was greater than the total trucks predicted by the ODME, the number of non-commodity-carrying trucks was set to zero.

2.2 Updating the Total Truck Trip Table

An origin-destination matrix estimation (ODME) process was used to update the total truck trip table. The process was run using the TransCAD modeling software package. Running the process in a different software package required that the network, CATS truck trip table, and zone system has to be converted from EMME/2 formats to TransCAD formats. After the input data sources were converted, an automated process was set up to run the ODME multiple times. This process consisted of the following steps:

- Building the network;
- Running the ODME process;
- Assigning the resulting truck table to the network; and
- Calculating summary statistics.

The seed table used to run the ODME process consisted of the CATS medium and heavy duty truck trip table aggregated to the updated zone system. The count data referred to single- and multiple-unit trucks, which related most closely with the medium and heavy duty truck definitions used by CATS.

To check the performance of the total truck trip table, the table is assigned to the highway network and a set of summary statistics is produced[2]. Overall, the assignment of the updated truck trip table produces very satisfactory results for facilities with higher volumes, replicates truck traffic on expressways very well, and accounts for the north-south travel patterns in and around the Mid-City corridor very well.

The updated truck model was validated using recent truck traffic counts and was applied to each alternative to evaluate patterns of truck traffic movements in the region and the projected utilization of the Mid-City Freightway under different alignment and toll scenarios.

2.3 Forecast of the Updated Truck Trip Table

Unlike traditional passenger travel demand models, the forecast of the updated truck trip table is based on growth factoring.

CDOT and Cambridge Systematics agreed to use the growth in truck trips as implied by the CATS model. According to CATS, there is a 21 percent increase in truck trips between years 2005 and 2030. Compared to other sources, this a conservative estimate of truck trip growth. This represents an average annual growth of less than 1.0 percent.

The one exception to this is for E-E trips. The CATS model predicts negative growth in E-E trips due to the calibration procedure and the limited number of E-E trips in the CATS model. However, other sources indicate that E-E truck traffic will grow substantially in future years. Therefore, a modified approach has been used to develop the E-E portion of the 2030 truck trip

[2] These validation statistics are not shown here but are included in the full Chicago DOT report.

table: The average E-I and I-E growth factor as predicted by CATS is being used for all E-E trips. The growth factor of 34 percent is still conservative compared to other estimates and reflects a positive rate of growth compared to the CATS model.

3.0 Forecasts of Truck Demand on the Mid-City Freightway

This section discusses and summarizes the results of the travel demand forecasts for the proposed Mid-City Freightway. The alternatives are described in some detail followed by the modeling results for each alternative.

3.1 Overview of Alternatives

The Belt Railway of Chicago and Union Pacific right-of-way between Jefferson Park and 89th Street/Dan Ryan was selected as a base alignment for this study. This Full Build alternative is based on an existing right-of-way that currently is not used and has the advantage of:

- Access to key expressways in the region;
- Vicinity to a number of intermodal facilities; and
- Access to industrial and commercial areas.

Variations in the freightway alignment were considered to reflect, in part, a range of potential issues with the implementation of the Full Build alternative. Such issues include potential conflicts with the CREATE project in the southern leg of the freightway alignment, sensitivity to potential community concerns in various segments of the corridor, and geometric design issues for segments of the southern leg of the freightway alignment. The basic characteristics of all alternatives examined include the following key assumptions:

- An expressway facility with limited access is assumed for the proposed freightway.
- A design speed of 55 mph is assumed with a resulting free-flow speed of 65 mph.
- Both single- and multiple-unit trucks are permitted on the facility.
- One 12-foot lane of traffic is assumed in each direction with shoulders along the full alignment without a concrete median.
- The value of time[3] assumed for single-unit trucks is $35 per hour and the value of time assumed for multiple-unit trucks is $60 per hour.

[3] Conservative values of time for single-unit and multi-unit trucks were developed by examining values that are used in other studies. For example, the Illinois Tollway Authority uses a value of time of $33/hour for trucks. The USDOT's 2004 Conditions and Performance Report indicates that other studies generally use values of time that are as high as $193.80. The median value used in these studies is $40 and the mean is $51.80. The value of reliability, which accounts for the cost of unexpected delay, ranges from 50 to 250 percent higher.

- The standard CATS networks are used along with the volume-delay functions used in the CATS model. The proposed freightway uses a volume-delay function that corresponds to the expressway facilities in the CATS model since an electronic toll collection scheme is envisioned that will not cause delays at the toll booths.
- Assumptions regarding tolling are as follows:
    - The freightway would utilize a form of open-road tolling to reduce delays at toll booth locations. No cash tolls would be permitted. Therefore, the calculated toll rates are based on the new I-PASS rates for trucks that currently are in force.
    - The Mid-City Freightway model uses two classes of single- and multiple-unit trucks and did not differentiate between peak and off-peak toll strategies.
    - The equivalent base toll rate for single-unit trucks of $0.12 per mile was calculated as a weighted average of the tollway rates. The equivalent base toll rate for multiple-unit trucks was calculated at $0.25 per mile based again on the new Illinois Tollway rates for trucks of this type.

The project team analyzed, summarized, and interpreted the results for each alternative. The CATS base year and 2030 networks were used for the analysis of each alternative and the impacts on roadway facilities around the region.

3.2 Definition of Alternatives

The alternatives that were examined in this study varied in terms of the length of the Mid-City Freightway facility under study, the frequency and location of access points to the freightway, toll scenarios that varied the tolls charged to freightway users, and design speed scenarios in which the operating speed on the freightway was varied.

The five basic variants that were studied for year 2030 include the following:

- Alternative 1 is the Full Build alternative between Jefferson Park and 89th Street/Dan Ryan without tolls.
- Alternative 2 is the Full Build alternative with tolls that are double the rate of current I-PASS truck tolls.
- Alternative 3 uses a shorter alignment between the Kennedy/Edens expressway junction to Archer Avenue and the same toll structure.
- Alternative 4 uses an alignment from North Avenue to Archer Avenue and the same toll structure.
- Alternative 5 examines the alignment between North Avenue and 89th Street/Dan Ryan with the same toll structure.

The sensitivity test scenarios include the following:

- The Full-Build 2030 version of the model (with double IPASS tolls) that uses a design speed of 45 mph instead of the design speed of 55 mph was tested to determine how longer travel times on the freightway affect its attractiveness.
- The Full-Build 2030 version of the model was also used to test the sensitivity of truck drivers to tolling. The different toll values that were tested include:
    - Alternative 1 (with no tolls imposed);
    - The standard I-PASS toll rate;
    - Double the I-PASS toll rate; and
    - A quadruple I-PASS toll rate.

3.3 No-Build Alternatives

The year 2005 base year conditions alternative reflects the current estimates of truck flows in the region. The truck trip table for this alternative was developed using the commodity flow data discussed in Section 2.0 and provides a base for comparisons with the estimates under the 2030 conditions. Figure 3 shows the base 2005 truck volumes at each of the roadway segments of interest to facilitate comparisons across alternatives.

The No-Build 2030 scenario represents the future year 2030 conditions in the region using the conservative growth assumptions for truck traffic that are used in the CATS model. This alternative reflects the Existing and Committed projects included in the future-year CATS network for the region. The 2030 trip table for automobile and B-plate truck traffic is obtained from the CATS model. The 2030 trip table for other truck traffic is obtained directly from the commodity flow data as discussed previously and the assigned truck traffic flows are summarized in Figure 4.

Figure 3 One-Way Daily Truck Volumes for 2005 Base Year

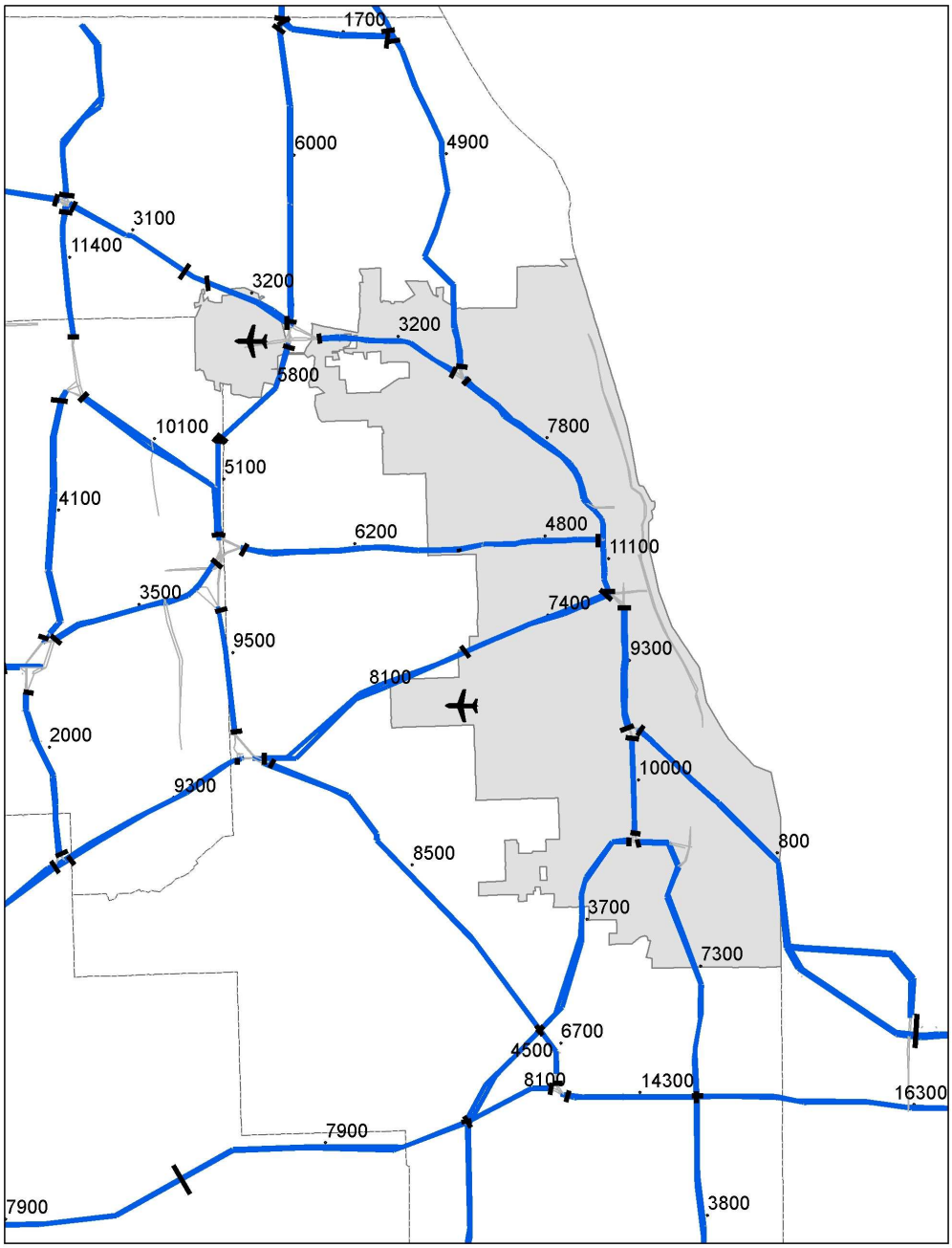
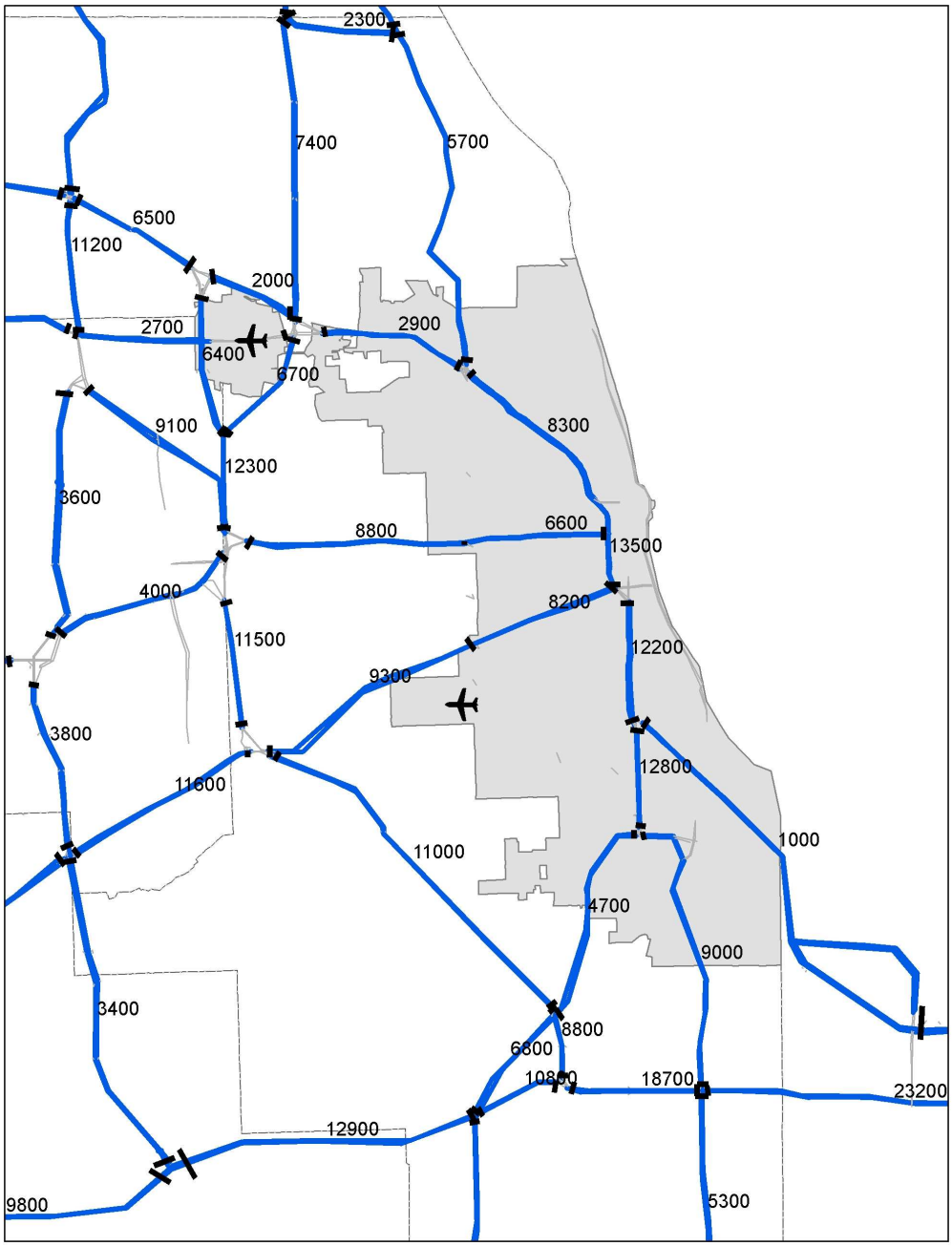


Figure 4 One-Way Daily Truck Volumes for 2030 No-Build Alternative



The representation of truck flows in the 2005 and 2030 No-Build conditions is shown in Figures 3 and 4. A comparative examination of these flows highlights the expected growth of truck traffic in the entire region. Some of the more interesting patterns of change between 2005 and 2030 include:

- A major projected increase in the Tri-State Tollway truck traffic between the proposed western O'Hare Bypass and I-290;

- A forecasted increase in truck traffic along the entire length of the Eisenhower expressway;
- The pattern of growth is less clear in roadways leading to and located west of O'Hare airport. The additional roadway facilities that are expected to serve that part of the Chicago region results in a redistribution of traffic patterns in the vicinity of O'Hare airport as shown in Figure 4; and
- Projected increases in truck traffic at the southern portion of the study area, including truck traffic to Indiana and also traffic on the Dan Ryan, I-57, and I-94 Bishop Ford expressways.

3.4 Full Build Alternatives

3.4.1 Full Build – No Tolls (Alternative 1)

The first alternative examined for the Mid-City Freightway (Alternative 1) represents the 2030 Full Build alignment for the freightway between Jefferson Park and 89th Street/Dan Ryan. This alternative assumes that no tolls are charged to use the freightway. This Full Build alignment links together key expressways in the region and also provides access to key arterials along its entire length.

The expressways that are linked together with the Full Build alignment include the Kennedy/Edens, Eisenhower, Stevenson, and Dan Ryan expressways, providing alternative routes for both short- and long-distance trips for trucks operating in and around the Chicago region. A comparison of Alternative 1 with the No-Build 2030 conditions is shown in Figure 5. Differences in projected truck flows are shown, with positive flows suggesting a projected increase in truck traffic relative to the No-Build 2030 conditions. The pattern of truck traffic differences can be summarized as follows (Figure 5):

- The freightway is expected to draw between 8,500 and 13,700 trucks per day;
- The highest truck volume is expected between the interchanges with the Eisenhower expressway to the north and the Stevenson Expressway to the south;
- The segments with the lowest projected volumes are at the northern end of the freightway between Kennedy/Edens and North Avenue with over 8,000 daily trucks and at the southern portion of the freightway between Western Avenue and 89th Street/Dan Ryan;
- The truck traffic drawn to the Mid-City Freightway is expected to increase truck traffic on several key roadways that have an interchange with the freightway (Figure 5):

  i. Truck traffic west of the freightway is expected to grow both on the Eisenhower expressway and the Stevenson expressway as east-west truck traffic accesses the interchanges with the Mid-City Freightway.

  ii. Truck traffic south of the freightway also is expected to grow particularly on the I-94 Bishop Ford expressway at the southern end of the freightway.

iii. Truck traffic also is expected to increase to a lesser extent on the Edens expressway at the northern end of the Mid-City Freightway.

- The utilization of roadway facilities that are either parallel to or currently serve traffic that could best be accommodated by the Mid-City Freightway is expected to decrease (Figure 5):

i. The most significant decrease is expected for the Kennedy expressway and the Dan Ryan expressway closer to the urban core. Trucks that currently face congestion on these facilities are most likely to shift to the proposed Mid-City Freightway.

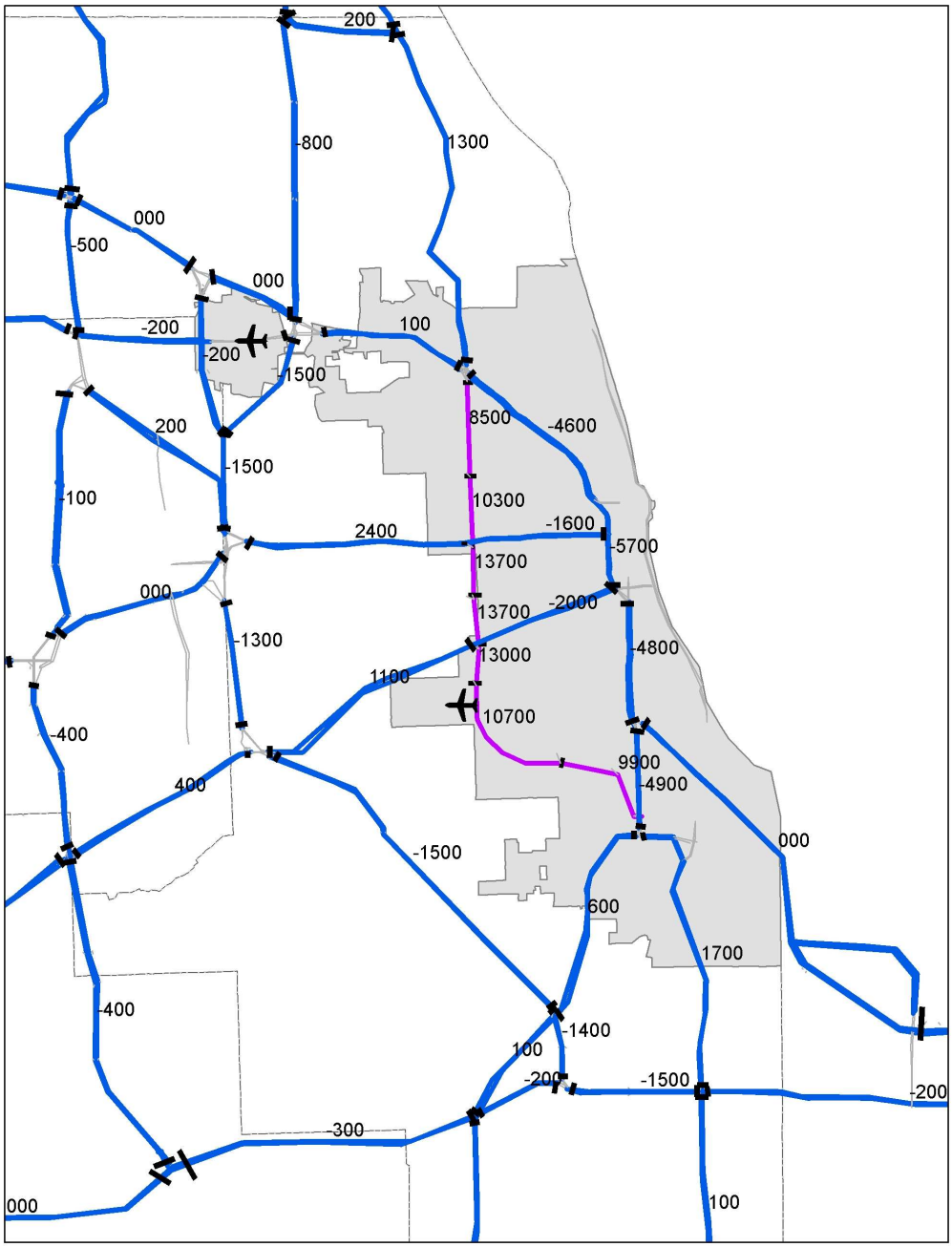
ii. Truck traffic on both the Eisenhower and Stevenson expressways east of the Mid-City Freightway is expected to decrease.

iii. A smaller decrease also is expected on most segments of the Tri-State Tollway in part because a shorter and more direct route is offered by the Mid-City Freightway.

iv. An even smaller decrease is expected on outer-ring roadway facilities such as the I-355 and truck traffic to/from Indiana on I-80.

These patterns are very reasonable and they reflect the role of the Mid-City Freightway in drawing truck traffic from roadway facilities that currently are congested and serve the same O-D markets. At the same time, traffic on the Mid-City Freightway also is expected to cause an increase in traffic on roadway facilities that act as feeders to the Mid-City Freightway.

Figure 5 One-Way Daily Truck Flows: Alternative 1 Versus 2030 No-Build



3.4.2 Build Alternatives With Tolls

The build alternatives that include tolling on the freightway are discussed in this section. These alternatives vary by alignment, operating speed, and toll value. Table 1 shows the daily one-way truck flows in each of the alignment alternatives with tolls for the selected network segments.

Introduction of Tolls: Alternative 2

Alternative 2 is the same Full Build alignment as Alternative 1 but it assumes that trucks are charged a toll that is double the rate of current I-PASS truck tolls. Overall, the impact of the tolls on the Mid-City Freightway and the impact on truck traffic on Chicago area roadway facilities follows an expected pattern as shown in Figure 6.

Traffic is expected to drop on each individual freightway segment as a result of the introduction of tolls. However, the projected drop in traffic is more significant along the segments of the freightway that are north of 26th Street. This may reflect in part the pattern of current truck movements in the Chicago region and in part the availability of more options for trucks to use exiting facilities near the northern portion of the freightway.

The Mid-City Freightway also is projected to shift truck traffic from other Chicago area roadways following the same general pattern described for Alternative 1 (Table 1). Compared to the 2030 No-Build, truck traffic is expected to increase on routes that act as feeders to the freightway such as the Eisenhower and Stevenson expressways west of the Mid-City Freightway, and the I -94 Bishop Ford expressway while truck traffic is expected to drop on the Tri-State and to a lesser extent on outer-ring roadways such as I-355.

Alignment Adjustments: Alternatives 3-5

This section focuses on the impact of three different alignments on the utilization of the freightway. The same assumptions are used for the overall alignment of the Mid-City Freightway, the double I-PASS toll structure, and the freightway level of service. However, each alterative differs in terms of the freightway length and the connectivity that it provides to Chicago area expressways and tollways.

The truncated versions of the freightway have a significant impact both on the utilization of the freightway itself and on the shifting of truck traffic to/from roadways in the vicinity of the corridor. The impacts for each alternative alignment are summarized in the remainder of this section.

Table 1 One-Way Truck Volumes with Double I-PASS Tolls
One-Way Daily Truck Traffic by Roadway Segment

Roadway Section	2030 No Build	Alternatives 2 Full Build	3 Kennedy to Archer	4 North to Archer	5 North to Dan Ryan/89th
MID-CITY FREIGHTWAY SEGMENTS					
Kennedy/Edens to North Avenue		6,171	5,850		
North Avenue to Eisenhower		8,224	7,916	5,281	5,133
Eisenhower to 26th Street		12,260	10,205	9,448	11,295
26th Street to Stevenson		12,405	10,608	10.060	11,646
Stevenson to Archer Avenue		11,291	6,277	5,777	10,795
Archer Avenue to Western Avenue		8,535			8,407
Western Avenue to 89th/Dan Ryan		7,718			7,551
SELECTED EXPRESSWAY SEGMENTS					
Kennedy West of I-94	2,911	3,077	3,218	2,802	2,696
Kennedy East of I-94	8,324	5,424	6,129	6,845	6,734
Dan Ryan: I-290 to I-55	13,482	9,023	10,886	10,787	9,983
Dan Ryan: I-55 to I-90	12,184	8,899	11,722	11,982	9,530
Dan Ryan: I-90 to I-57	12,807	9,388	12,443	12,679	10,023
I-94 Bishop Ford	8,989	10,376	9,032	9,011	10,605
Stevenson East of Freightway	8,239	6,026	6,704	6,736	6,088
Stevenson West of Freightway	9,336	10,332	10,162	9,704	10,007
Eisenhower East of Freightway	6,577	5,181	6,887	6,876	5,347
Eisenhower West of Freightway	8,844	10,980	9,839	9,971	11,539

Kennedy to Archer (Alternative 3)

Alternative 3 uses a shorter alignment between the Kennedy/Edens expressway junction and Archer Avenue. This alignment represents the "northern portion" of the freightway and provides access to key expressways, including the Kennedy/Edens, Eisenhower, and Stevenson facilitating long-distance truck travel in the region. However, it does not extend the linkage to the Dan Ryan expressway to the south.

Compared to the Full-Build alternative, there is a significant and uniform drop in freightway traffic with up to 2,000 fewer daily truck trips on each segment from the Kennedy/Edens junction all the way to the Stevenson Expressway (Table 1). The drop is even more significant in the Stevenson to Archer segment which drops by almost 5,000 daily truck trips. Compared to the 2030 No-Build, the shifts in truck traffic flows in the region as a result of this alternative include:

- The projected decrease in truck traffic on the Kennedy is still important (a reduction of 2,200 daily trucks).
- Reductions in truck traffic closer to the downtown area are much smaller than in Alternative 2 (2,600 fewer trucks compared to a reduction of 4,500 trucks in Alternative 2).
- Increase in truck traffic projected for the Eisenhower also is much smaller (an increase of 1,000 trucks instead of 2,100 trucks per day in Alternative 2).

Finally, there is practically no change in truck traffic on the roadways south of the downtown area compared to 2030 No-Build conditions. Under Alternative 2, there were major reductions in the Dan Ryan truck traffic and important increases in truck traffic on the I-94/Bishop Ford segment that was feeding into the southern leg of the freightway. The lack of change in this alternative reflects the truncation of the freightway at Archer Avenue and the resulting lack of a linkage to the Dan Ryan expressway and points beyond.

North to Archer (Alternative 4)

This alternative reflects the shortest alignment that was considered between North Avenue to the north and Archer Avenue to the south. This alignment does not provide access either to the Kennedy or the Dan Ryan expressways. The only significant expressway interchanges that remain for this proposed freightway alignment are with the Eisenhower and Stevenson expressways.

The pattern emerges is the reduced utilization of the freightway and even less shifting of traffic from existing facilities compared to Alternative 3. In Alternative 4, the freightway is truncated even further with no access to the Kennedy/Edens interchange. This alignment by design provides short alternative routes for mostly local truck traffic. As a result, the projected utilization for the Mid-City Freightway drops even further. The segments linking the Eisenhower with the Stevenson expressways have traffic flows of about 10,000 daily trucks while the segments north and south of these expressways carry 5,000 and 6,000 daily trucks (Table 1).

The shifting of truck traffic in the region compared to the 2030 No-Build conditions follows the expected patterns:

- No increase in the Edens expressway traffic since this alignment does not provide a link at the Kennedy/Edens interchange.
- No shifting of truck traffic at the Dan Ryan/Bishop Ford area since the alignment is truncated at Archer Avenue.
- A measurable increase in truck traffic west of the Mid-City on the Eisenhower and a smaller one on the Stevenson, reflecting the linkages provided by this freightway alignment.
- A measurable decrease on the Kennedy expressway especially closer to the downtown area (a drop of 2,500 daily truck trips).

North to Dan Ryan/89th (Alternative 5)

Finally, Alternative 5 examines another short alignment between North Avenue and Dan Ryan/89th Street. This alignment represents the "southern portion" of the freightway. Although it does not provide access to the Kennedy/Edens, it links together the Eisenhower, Stevenson, and Dan Ryan expressways providing an alternative for both short- and longer-distance truck travel in the region.

The middle core of this alignment between the Eisenhower expressway and Archer Avenue interchanges carries about 11,000 daily truck trips with 5,000 truck trips between the Eisenhower and North Avenue and about 8,000 truck trips between Archer Avenue and the Dan Ryan interchange (Table 1). The shifts in truck traffic flows in the region projected for this alternative compared to the 2030 No-Build include:

- An important decrease in truck traffic on the Kennedy especially closer to the downtown area (a reduction of 1,600 daily trucks) with a significant decrease extending south to the Dan Ryan expressway (2,800 fewer truck trips per day).
- A strong projected increase in truck traffic on the Eisenhower (an increase of up to 2,700) and a smaller increase on the Stevenson (700 additional daily trucks west of the Mid-City Freightway).
- Substantial decreases both on the Tri-State (up to 1,600 fewer daily truck trips) and to a lesser extent on the I-355 suggesting that this freightway alignment provides a more realistic alternative to long-distance truck travel in the region compared to Alternatives 3 and 4.

3.4.3 Sensitivity to Design Speed

Another sensitivity test was conducted to explore the impact of a slower design speed for the freightway. In all of the alternatives studied, the design speed was assumed to be 55 mph. This test examines the impact of a design speed of 45 mph. Such a decrease in the design speed would result in travel times that are approximately 20 percent longer on the freightway.

The results of this sensitivity run are summarized in Table 2. The projected utilization of the freightway at different sections drops by as little as 1,200 to as much as 2,000 daily trucks when compared with the Full Build alternative.

Table 3 summarizes the differences on other expressways in the region. between the two versions using the 55 mph and 45 mph design speed assumptions on the Full Build alternative. As expected, a lower design speed on the Mid-City Freightway reduces the amount of truck traffic it carries. As a result, it also increases the truck traffic carried by other expressways in the region.

At both the northern and southern ends of the freightway, the drop in truck traffic is around 20 percent. At the middle segments of the freightway, the percentage decrease in traffic is close to 13 percent. These changes in projected traffic suggest a rather high elasticity that reflects truck drivers' response to a decrease in travel time savings due to the lower design speed of 45 mph.

This finding is consistent with the high values of time that truck drivers place on travel time savings and the inherent travel time advantage that the freightway has compared to existing roadway facilities in the region that face increasing congestion.

Table 2 Truck Volumes for Design Speeds of 45 and 55 MPH
One-Way Daily Truck Traffic by Roadway Segment

Roadway Section	Full Build Speed 55 MPH	Full Build Speed 45 MPH	Percent Difference
MID-CITY FREIGHTWAY SEGMENTS			
Kennedy/Edens to North Avenue	6,171	4,951	-19.8%
North Avenue to Eisenhower	8,224	6,940	-15.6%
Eisenhower to 26th Street	12,260	10,731	-12.5%
26th Street to Stevenson	12,405	10,815	-12.8%
Stevenson to Archer Avenue	11,291	9,590	-15.1%
Archer Avenue to Western Avenue	8,535	6,569	-23.0%
Western Avenue to 89th/Dan Ryan	7,718	6,089	-21.1%

Table 3 Impact of Design Speed on Other Expressway Traffic
One-Way Daily Truck Traffic by Roadway Segment

Roadway Section	No Build	Full Build Speed 55 MPH	Full Build Speed 45 MPH	FB 55 mph versus No Build	FB 45 mph versus No Build
SELECTED EXPRESSWAY SEGMENTS					
Kennedy West of I-94	2,911	3,077	3,027	5.7%	4.0%
Kennedy East of I-94	8,324	5,424	6,221	-34.8%	-25.3%
Dan Ryan: I-290 to I-55	13,482	9,023	10,055	-33.1%	-25.4%
Dan Ryan: I-55 to I-90	12,184	8,899	9,585	-27.0%	-21.3%
Dan Ryan: I-90 to I-57	12,807	9,388	9,976	-26.7%	-22.1%
I-94 Bishop Ford	8,989	10,376	9,944	15.4%	10.6%

3.4.4 Sensitivity to Toll Value

Under the analyses discussed previously, Alternative 1 assumed that no tolls would be charged to freightway users while Alternative 2 assumed a toll that is roughly double the current I-PASS truck toll. In addition, two more sensitivity runs were conducted assuming a toll rate that is comparable to the current I-PASS tolls and a rate that corresponds to roughly four times the current level of the I-PASS truck tolls.

As expected, the projected utilization of the freightway is sensitive to the level of tolls charged. Figure 6 summarizes the response to the tolls charged for each segment of the proposed freightway under each of the four toll scenarios tested.

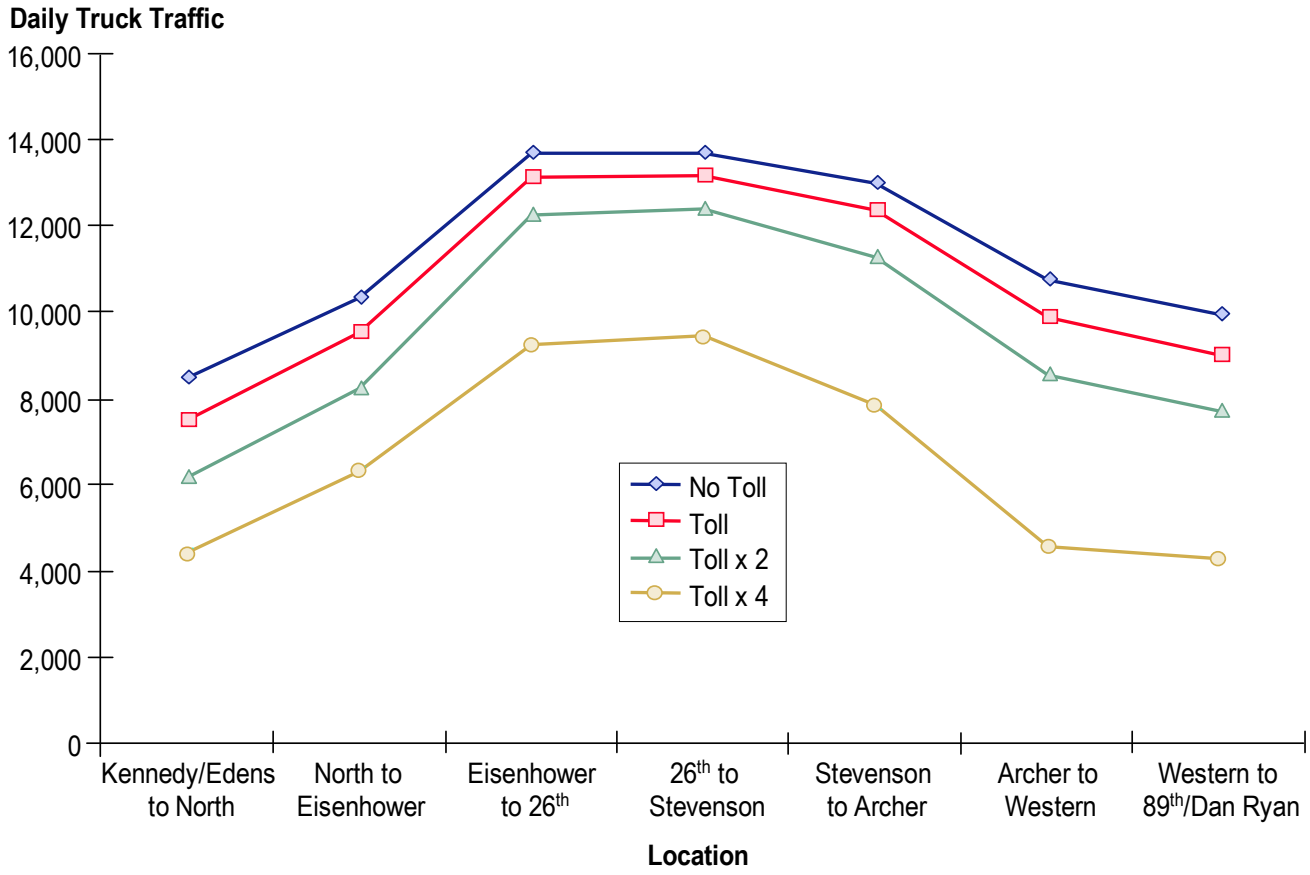
- The small differences in projected truck traffic between the "no toll" and the "current I-PASS toll" rate suggests that truck drivers would value the travel time savings offered by the new facility more than the cost reflected in the current toll rates.
- The implied elasticity to increasing the current truck tolls to twice the current I-PASS rates and to four times the current I-PASS rates also provides us with insights into truck drivers' tradeoffs between travel time savings and cost (Figure 6).

  i. The doubling of the rates from the current I-PASS rates suggest an elasticity that is lower than 0.15 for all but one of the segments of the freightway. This suggests that truck drivers are not very sensitive to tolls even at double the current I-PASS rates.

  ii. The further doubling of the I-PASS rates to four times the current toll rates suggests a higher elasticity to the increased rates. However, the elasticity still remains below 0.30 for all but two of the freightway segments.

These sensitivity runs highlight the tradeoffs between travel time savings and costs that truck drivers face. These results suggest that truck drivers would generally be willing to pay a higher premium for using the Mid-City Freightway for the benefit of enjoying travel time savings in their travel through the region.

Figure 6 Changes in Freightway Truck Traffic in Response to Changes in Truck Tolls


Daily Truck Traffic
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
No Toll
Toll
Toll x 2
Toll x 4
Kennedy/Edens to North
North to Eisenhower
Eisenhower to 26th
26th to Stevenson
Stevenson to Archer
Archer to Western
Western to 89th/Dan Ryan
Location

4.0 Summary

The key results from the Mid-City Freightway study reflect the expected shifts in freightway use and traffic on other expressways in the region. Forecasts were developed for different freightway alignments, design speeds and toll levels.

Total truck traffic on the Mid-City Freightway is expected to vary by the length of the proposed facility as follows:

- Truck volumes on segments of the 22-mile Full Build alternative for the year 2030 range from 6,100 in each direction between the Kennedy/Edens junction and North Avenue to 12,400 in each direction between 26th Street and the Stevenson Expressway (Table 1).
- Truck volumes are expected to decline with shorter alignment alternatives. The shortest alignment located between North Avenue and Archer Avenue, is forecast to have a maximum volume of 10,100 trucks in each direction.

The evaluation showed that truck volumes on key roadways in the region would be affected by the introduction of the freightway:

- The Full Build alternative is projected to significantly reduce truck volumes on the Kennedy Expressway leading into the Central Area and the Dan Ryan Expressway south of the Stevenson Junction.
- Truck volumes on the Stevenson and the Eisenhower Expressway east of the freightway also would decline substantially.
- Truck volumes on different segments of the Tri-State Tollway from I-90 to I-55 also would be reduced to a lesser degree.

The capacity freed by the reduction of trucks on the Kennedy and the Dan Ryan Expressway will be replaced, in part, by an increase in auto volumes. However, the forecasts show an overall decrease in traffic congestion as measured by auto-equivalent units. This result is expected because the freightway would add more capacity to the system, making the overall network less congested.

On certain expressways leading into the city that act as feeders to reach the freightway, truck volumes would increase. For example, truck volumes on the Eisenhower and Stevenson Expressways west of the freightway would increase.

The impact of different design speeds on the utilization of the freightway also was examined. Under a Full Build scenario, a slower design speed of 45 mph would decrease the freightway utilization by 12 to 15 percent at its highest loading point and by as much as about 20 percent at the northern end and 23 percent at the southern end of the freightway.

The different design speeds of the freightway also would have an impact on other area expressways that feed into or compete with the proposed freightway facility. Under both speeds, expressways connecting with the freightway at the northern and southern ends are expected to experience an increase in truck traffic. On the other hand, truck traffic on the portion of the Kennedy east of I-94 and the Dan Ryan expressway is expected to drop since the freightway will draw truck traffic from these facilities. The slower design speed will create the same diversion patterns but with less of an impact on these patterns since fewer trucks will be attracted to the slower freightway facility.

Different toll rate assumptions also had an important impact on the estimated use of the freightway. As expected, a toll-free facility would attract a higher volume of truck traffic while higher toll rates would discourage the use of the tollway. On the segment with highest truck utilization, the toll-free facility is expected to attract an 11 percent higher volume than the volume projected with double the I-PASS rate. With a toll rate equivalent to quadruple the I-PASS rate, truck traffic volumes at the highest load-point are projected to decline by as much as a third of the volumes in the toll-free facility .