FINAL REPORT

# Development of Information on Intermodal Safety Issues in Illinois

## Project VB-H2, FY 98

Report No. ITRC FR 98-4

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**Illinois Transportation Research Center**
**Illinois Department of Transportation**

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The objective of this study is to identify safety and efficiency issues related to the intermodal truck movements in the Chicago area. The literature was comprehensively reviewed and all possible sources of information were identified, so that a clear and objective assessment of what is the status of the intermodal industry in Chicago can be provided, as well as the problems they face and the problems they are creating. It was not possible to get complete access to all databases, or conclusively answer questions, such as "Are intermodal trucks less safe than the non-intermodal trucks?" However, the reasons for that were identified and recommendation for remedying this shortcoming were provided. The requirements to this study were exceeded by investigating sources of potential information not considered before (AVL, yard gate information) as well as the development of innovative tools that can help engineer and planners to objectively evaluate future improvements on the street network. In addition, the global view was taken of looking at the problem at the system level. Truck drivers were surveyed in a cost effective way and obtained both insights and objective data. Also, in the course of this research, communication was established with all involved stakeholders (trucking companies, drivers, ITA, CATS, rail companies, the police) who helped the team understand the problems better from their perspectives. The findings of this research are outlined with emphasis on the implementable recommendations.


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# Executive Summary

Intermodal movement of goods, with particular reference to rail-truck transfers, is a growing segment of the freight industry. This is especially true in the metropolitan Chicago area, through which 60% of the nation's rail traffic travels. Today there is extensive "rubber-tire transfer" between the 27 major intermodal rail yards and a number of smaller intermodal facilities in the Chicago area with an estimated 5 million lifts, resulting in more than 14,200 daily intermodal truck movements.

The Illinois Department of Transportation (IDOT) and other local and state governments are increasingly confronted with issues concerning increasing traffic congestion, inadequate roadway design, and public safety factors caused by the truck traffic. On the other hand, the freight industry is seeking to improve productivity by having easy access and direct routes between the intermodal facilities and the interstate highway system. Legislation permitting longer and wider trucks has changed the performance characteristics of today's semi-trailer trucks and twin-trailer combination trucks; in addition, containerization has resulted in increased utilization of commercial trucks in freight transfer, resulting in more containerized truck movements. This has contributed to the increased volumes on the nation's railroads but also in increased drayage activity at major rail yards for cross-town movements or delivering to a final destination. Many local arterials and intersections in Chicago now operate with large trucks maneuvering outside of their designated lane of travel because of inadequate turning radii, and crashes occur under overpasses or bridges due to inadequate clearance.

The objective of this study was to identify safety and efficiency issues related to intermodal trucks. Specifically, the objective was to determine if there is adequate data available to assess safety issues related to intermodal container freight movements. Based on these data, to identify the relevant safety issues associated with increased freight transfer utilizing intermodal container trucks in the metropolitan Chicago area and to recommend potential engineering, planning, or law enforcement measures to address safety issues. To meet the above objectives, first the data availability was assessed, by investigating the following data acquisition options:

1. Surveys with truck drivers
2. Surveys with safety managers of trucking companies
3. Crash data from IDOT
4. Crash data from the City of Chicago
5. Network and traffic data from the Chicago Area Transportation Study (CATS)
6. Previous studies of intermodal operations in Chicago—specifically a study by Barton-Ashman

7. Safety and Fitness Electronic Records System (SAFER) and Office of Motor Carriers (OMC) data on violations and safety of trucking companies
8. Gate traffic data from Intermodal yards
9. Automated Vehicle Location Data from companies with equipped trucks.
10. Expert and other anecdotal information from people at CATS, Illinois Transportation Association, Trucking and Intermodal companies.

The survey with truck drivers was very informative, since this provided the opportunity to interact with the people that actually drive the streets and face the problems daily. They consistently identified a number of intersections with limited turning radius, viaducts with low clearance as well as other problematic points. Some of these locations were further investigated with site visits and with the data from the crash databases verifying their experience. In addition, drivers tend to follow quite consistent routes between yards and they seem to be familiar with the street network, although some of them indicated that access to real-time traffic information would be useful. In terms of more objective information, they had fairly short experience in driving (2-6 years), which is expected since intermodal jobs are often entry level jobs in this industry. Another interesting insight is that most of the trips were performed during the rush hour. Although, this may appear to be counter-intuitive, since this is the time period one experiences long delays and greater risk exposure, it can be explained by the fact that drivers and trucking companies are simply responding to the demand at the yard and the customers. If the cut-off time at the yard is 5:00 PM, they will try to be there no matter what the traffic conditions are. This clearly presents significant opportunities for improvements, if the rail companies collaborated. Initial discussions with experts in this industry, however, expressed pessimism, since the train schedules are also often determined by exogenous factors beyond the control of the railroads (e.g. the arrival of a ship at Long Beach, CA). Nevertheless, there is room for improvement and an option recommended later in this report. CATS and the Intermodal Advisory Task Force would be the ideal setting for this issue to be further discussed.

Another group of people with substantial expertise on safety issues related to freight movements are the safety managers (SM) of the trucking companies. This group appears to be under-represented in the decision making process. SM deal with every safety issue in the company, including traffic safety. They interview every driver involved in a crash, minor or major, DOT reportable or not. There was limited success in interviewing them, though this was mostly due to the fact that they are very busy and often engaged in assignments other than safety issues. Although companies and SM seem to be very sensitive to safety issues, more needs to be done to engage them in the decision making process, so that they can realize that their input can make a difference. The data trucking companies maintain are of substantially better quality, accuracy and detail than the ones maintained by the government. A procedure should be devised so that these data will be available to researchers. The crash databases maintained by the agencies tend to be fragmented, incomplete and old. No proactive policy can be developed based on them. It took a lot of effort to simply integrate databases for the Chicago area. Certain streets are state routes and data are maintained by IDOT, while for municipal streets the City maintains crash data. While the engineers and planners at IDOT and the City were very helpful with providing the researchers access to the data, institutional changes need to be made so that more accurate and timely data are available to researchers and practitioners.

The SAFER database maintained by the Office of Motor Carriers (OMC) was evaluated in this project. It contains information on virtually all carriers, including their crash and inspection experience. Serious discrepancies were found between the data obtained from the SM and the data reported in the SAFER database. The exclusion of non-DOT reportable crashes hinders the understanding of carrier safety problems. In addition, no exposure measures (such as vehicle miles traveled) are included in the SAFER database, further reducing its utility. The SAFER database was used to perform a simple hypothesis test IDOT was interested in: whether intermodal trucks are less safe than non-intermodal trucks. The results indicated that this hypothesis is true assuming that the biases due to the limitations of the SAFER database are the same between the two groups of trucks. Note, however, that intermodal trucks are exposed to much higher risks than the rest, because a substantial portion of their trip is on arterial and local streets. In addition, another even more important insight was that there is high variance in the safety experience of intermodal trucks. This suggests that there is also substantial room for improvement. In other words, if some companies are doing very well in terms of safety, there is no reason for other similar companies not to do equally well, since they are operating in the same environment. This reinforces the need for establishing communication among the safety managers of trucking companies and facilitating technology and practices transfer. Illinois Transportation Association has initiated a forum for safety managers to interact. It is recommended that further investment is made in this initiative and possibly formalizing the knowledge transfer.

Another rather anecdotal insight from the truck drivers' survey was that the drivers feel apprehensive about the way they are treated in the intermodal yards. They feel that their time is not valued and often times they feel pressured to drive equipment of questionable safety. The yard managers perform elaborate checks of the intermodal equipment when the drivers enter the yard, but not when they leave. Clearly, inspecting the equipment when they enter the yard is done to identify potential damages to the equipment that the drivers should pay for. However, in terms of safety it would be much more beneficial if the inspection was done when the trucks exit the yard, so that their safety condition can be assessed. Typically, the before inspection is left to the drivers. It appears that the drivers are very concerned about this practice, because a "walk-around" inspection is far from sufficient to assess all potential safety hazards. In addition, the drivers indicated that if they find problems and ask for change of equipment this would be a time consuming process. One can only imagine the dilemma an owner operator (who is paid by the trip) is faced with when he has to wait 2-3 hours for a change of trailer. Leaving the inspection of the intermodal equipment to the driver is a practice that entails risks and needs to be seriously re-examined. Finally, while trailers are inspected by FHWA once a year and they need to have an inspection sticker, it is not certain whether the containers are inspected, by whom and how often. Containers which may sit for days on the deck of a ship exposed to salty water and the elements, can enter the state by rail and typically leave by rail, effectively "evading" roadside inspections.

Previous studies did not provide this team with any additional meaningful information on safety or operational issues related to the intermodal industry in the Chicago area. A significant source of information on the demand side of intermodal operations is the gate information collected by yards. These data were requested from the yard managers that directed the team to the rail companies; the discussions with them were not successful, at the time this report was documented. Although, the type of information collected is known, it was not possible to get a useful set to further analyze. It is, however, only a matter of time before this information can be obtained. The rail companies are apparently concerned about data privacy issues. These concerns need to be addressed in future discussions so that this information is available to researchers. It can provide the complete demand set of intermodal truck traffic in the Chicago area, which is pivotal for monitoring and future improvements purposes. Another data set that could be potentially very useful is the Automated Vehicle Location Data many trucking companies collect. In the report a procedure is outlined that can help establish an online monitoring system that will provide trucking companies, rail companies and the government with useful feedback on the condition of the freight network. Shifting patterns over time can be identified and corrected before they get out of hand and cause significant safety and efficiency problems. This obviously requires more research, but it could potentially provide the framework for an automatic monitoring system of the intermodal activity in the Chicago Area. Since traffic congestion information will also be generated that will be of a great interest to the City and State traffic management centers and possibly the general public; effort has to be made to coordinate with these agencies for a possible future research.

After the data were collected and analysis was performed, the safety conditions were investigated at certain intersections, such as 47th and Kedzie and Western Avenue and 47th. In addition, site visits were performed to certain yards and briefly the conditions outside the yards were assessed. The outcomes of this task were as follows:

[i] Conditions on certain intersection can be improved even with fairly inexpensive signalization and simple delineation enhancements.

[ii] Most of the problems at intersections are caused by right turning trucks, due to inadequate geometry of the intersections.

[iii] More problems exist at intersections between yards, rather that outside yards.

The connectors from yards to the National Highway System have sufficiently improved the accessibility to the yards, but there are numerous locations inside the city where multiple routes between various yards cross each other. Some of these intersections (such as the ones mentioned above) are operating at capacity and are potential hazards to safety. Trucks attempting to turn right routinely use lanes from the opposing stream and conflict with vehicles trying to make a left turn from the direction in which the trucks are turning.

Given that one of the objectives of this study is to identify possible improvements in geometry and control of roadways that will improve the safety and efficiency of intermodal trucks, the issue of which intersections should be improved was addressed. Certain locations are obvious problem points and warrant improvements; these locations have been in the past identified by inspection and improvements have been suggested or implemented (see the CATS report on Proposed intermodal connectors to the National Highway System for Northeastern Illinois). These improvements are typically connectors from the yards to the national highway system and they are obvious solutions, since terminal yards are the main production and attraction points. It is much harder, however, to identify and improve locations inside the city, where in fact the problems are even more severe, as many street segments and intersections between yards are the main facilities through which trucks move between yards. For example, it is rather obvious to make improvements outside BNSF's Corwith yard, but much harder to identify (and possibly justify) making improvements at the intersections of Western and 47th or on Kedzie and 47th intersections used by trucks moving between Corwith, 47th yard, Landers or 63rd yard. A list of problematic locations were identified by truck drivers and safety managers, that include mostly intersections with insufficient turning radii, low viaducts and congested sections and intersections. It is not clear, however, what will happen if these facilities were improved. Specifically, if an intersection is improved to accommodate a 53-foot container truck (such as 47th and Western), the following may happen:

(i) Trucks that were not using this particular intersection because of its insufficient geometry may now use it. This could in turn result in: (a) increased truck traffic at this location resulting in excessive volumes and possible higher crash rates, (b) trucks that diverted to this facility may actually drive longer routes, so that they can use this improved facility resulting in net increase in vehicle-miles traveled.

(ii) Once this bottleneck is removed, another one may appear downstream of this location, where conditions may get even worse due to the increased volumes leading to more safety and operational problems.

(iii) Passenger vehicles may be discouraged to use this particular location due to the increase truck traffic and use other less suitable roadways, including residential streets, which could create a different set of safety and congestion problems elsewhere.

(iv) Finally, conditions may actually be improved in alternative, "unsuspected" facilities, where trucks were diverted from.

There is a need for quantitative tools that will help engineers and planners to identify a set of improvements that will result in system-wide benefits. There are no such tools commercially available, but there are research models available that could be used for these applications. Northwestern University is currently investigating the option of modifying such tools to address this need. However, until such a tool is developed, suggested intersection improvement outlined in Chapter 3 should be used with caution as it is not clear what the impact of those improvements will be.

No database or model can replace the collective knowledge of people involved in the intermodal business. Personnel from CATS, ITA, trucking companies and IDOT provided valuable insights on the intermodal industry practices and operations for this report. This knowledge needs to be shared and forums such as the Intermodal Advisory Task Force organized by CATS as well as the various committees by ITA should be further encouraged and strengthened.

# 1-Introduction

## 1.1-PROBLEM STATEMENT

The freight industry provides transportation for all types of products from raw materials to finished merchandise in the course of meeting essential goods movement requirements. Intermodal movement of goods, with particular reference to rail-truck transfers, is a growing segment of the freight industry. This is especially true in the metropolitan Chicago area, through which 60% of the nation's rail traffic travels. Today there is extensive "rubber-tire transfer" between the 27 major intermodal rail yards and a number of smaller intermodal facilities in the Chicago area with an estimated 5 million lifts, resulting in more than 14,200 daily intermodal truck movements. Even conservative forecasts project that this volume will grow to almost 20 million lifts by the year 2020, quadrupling the truck movements among the intermodal rail yards (10).

The Illinois Department of Transportation (IDOT) and other local and state governments are increasingly confronted with issues concerning increasing traffic congestion, inadequate roadway design, and public safety factors caused by the truck traffic. On the other hand, the freight industry is seeking to improve productivity by having easy access and direct routes between the intermodal facilities and the interstate highway system. Legislation permitting longer and wider trucks has changed the performance characteristics of today's semi-trailer trucks and twin-trailer combination trucks. In addition, containerization has resulted in increased utilization of commercial trucks in freight transfer, resulting in more containerized truck movements. The efficiency of containerized shipments has increased water to rail, water to truck and truck to rail transfers. The system can now handle less-than-railcar-loads faster and safer. This has contributed to the increased volumes on the nation's railroads but also in increased drayage activity at major rail yards for transshipping or delivering to a final destination. Many local arterials and intersections now operate with large trucks maneuvering outside of their designated lane of travel because of inadequate turning radii, and crashes occur under overpasses or bridges due to inadequate clearance. For the most part, local regulations are not directed at any special class of trucks, but pertain to all large trucks, ignoring special characteristics of container trucks.

While the operational and safety characteristics of semi-trailer trucks and twin-trailer combination trucks have been extensively studied, those of container trucks are not well understood. It is not clear if containerization poses different safety problems from standard large trucks. Some distinct features of containers that might contribute to potential safety problems are: equipment mismatch, e.g., a 57' container mounted on a 53' chassis; unbalanced weight distribution inside the container (containers originating overseas are subjected to at least 5-6 lifts at various intermodal facilities before they reach their final destination that can shift the contents of the container); violation of U.S. weight limits that can present safety hazards for bridges, etc.

The volume distribution of intermodal container trucks on the local street system of metropolitan Chicago is not well known. The Illinois Department of Transportation has identified a need to develop information regarding these and other unique safety concerns associated with the trend of increasing intermodal freight operations in the metropolitan Chicago area. In developing this information, the impacts on productivity, highway design, traffic operations and pavement condition should be considered, especially if this information leads to any type of movement restrictions and route restrictions.

## 1.2-RESEARCH OBJECTIVES

The objectives of this study are:

1. To determine if there is adequate data available (and if not whether they can be obtained and at what cost) to assess safety issues related to intermodal container freight movements.
2. To identify the relevant safety issues associated with increased freight transfer utilizing intermodal container trucks in the metropolitan Chicago area.
3. To recommend potential engineering, planning, or law enforcement measures to address safety issues.

## 1.3-OVERVIEW OF THE RESEARCH PERFORMED

The Data Collection part of this study was particularly extensive and informative. It revealed the kind of data that is available, the kind of data needed, as well as the data collection effort required. There are various databases available, at the federal, state, municipal or private level. Some of the data are difficult to obtain and devoted substantial effort trying to get them.

First, a survey of truck drivers was designed in conjunction with the Technical Review Panel. This survey was performed and its findings are reported in Section 3.1 of this report. In a separate questionnaire safety managers of the intermodal trucking companies were surveyed. Their input was more at the management level, and therefore provided insights that were not obtained by the truck driver survey. This survey is discussed in Section 3.2.

Data also were obtained from public sources. The Chicago Police Department and IDOT databases provided similar insights and are discussed in Sections 3.3 to 3.6. The Network and Traffic data from the CATS helped in the mathematical modeling part of the study discussed in Section 7. In addition, information maintained by the Office of Motor Carriers of the Federal Highway Administration was used, regarding the safety statistics of trucking companies (SAFER Database). These data were used for testing a hypothesis regarding the safety experience of intermodal trucking companies versus the non-intermodal freight carriers; this is discussed in Section 5. Finally, the information given by the Barton Aschman Study to the City of Chicago was reviewed, and is discussed in Section 2.3.2.

Other more experimental sets of data were explored. The Automated Vehicle Location (AVL) system, discussed in Section 3.7, could potentially provide with continuous position information of a statistically significant sample of trucks operating in the Chicago Metropolitan Area. The potential for this system is promising for monitoring purposes as well as for developing tools that can identify systematically potential infrastructure improvements, as discussed in Section 7. Another set of data that could potentially useful is data collected by the rail yards: the entrance and exit gate logs. These logs would allow estimation of a truck trip table at regular time periods, which in turn would be invaluable for monitoring shifts truck traffic patterns as well as identifying needs for infrastructure improvements.

Valuable information was also obtained from various individuals, from private trucking companies, the Illinois Transportation Association and CATS. A series of analyses were performed on the data obtained:

1. The information received from truck drivers and safety managers was analyzed to draw certain conclusions as well as to identify future data needs. A list of problematic sections and intersection was constructed based on the drivers' and safety managers' responses. Most of the sections and intersections are located in the south side of Chicago, which is the area with the greatest concentration of intermodal yards. This analysis is discussed in Section 4, and some technical recommendations to alleviate the problem of narrow intersections is given.
2. Available data sources were identified. Their possible use, and recommendations on the way future data should be obtained in order to proactively identify problems and react to them. Indeed, by the analysis of the available data, missing information was identified, its potential value to safety and efficiency issues related to the freight industry in Chicago was understood.
3. The hypothesis of whether intermodal trucks are less safe than the non-intermodal trucks was tested. The tests are not conclusive due to the quality of the data on which they were based; the hypotheses and the methodology adopted are discussed in Chapter 5.

4. The possibility of building a mathematical model is investigated. The model is supposed to be able to help planners and engineers systematically identify problematic sections and intersections in the Chicago street network, through which many intermodal trucks travel.

# 2-Literature Review

The literature reviewed for this study can be classified in three categories: (i) trucking legislation history (ii) intermodal freight industry (iii) published journal articles on intermodal freight industry and safety. The first section provides a history of the trucking legislation history, which puts in perspective the intermodal trucks safety issues addressed by the legislation. The second section provides an overview of the intermodal industry and the resulting problems in the Chicago area. The third section overviews the scientific literature on intermodal and safety problems, published in transportation journals.

## 2.1-Trucking Legislation History

In 1982, the Surface Transportation Assistance Act (STAA) [22] invoked several changes in the trucking industry. The STAA enacted regulations allowing for wider, longer trailers and combination trailers. Succeeding federal and state laws supported the STAA changes, clarified provisions on access issues, and called for regulations to standardize truck weight limits. The following is a summary of the regulations set by STAA:

- The STAA required all states to permit the operation of wider trailers, longer single trailers, twin trailers, and establishment of the 80,000 pound gross vehicle weight benchmark.
- The maximum permissible trailer widths were increased by six inches to 102 inches (8 1/2 feet).
- The maximum allowable single trailer length was increased from 45 feet to 53 feet. Twin trailers of up to 28 feet each were also permitted.
- The STAA expanded the federal role in regulating commercial vehicle size by preempting state regulations.
- The STAA authorized the official creation of an inter-jurisdictional truck-routing system, called the National Network, to accommodate and serve commercial vehicles. States and local jurisdictions must allow operation of large trucks on these roads. The National Network includes the Interstate highway system, most of the Federal Aid Primary (FAP) highway system, and other major highways. Many states challenged the enactment of the Surface Transportation Assistance Act of 1982. For example, attempts were made to prohibit the use of twin trailers, wide trucks, or require special permits for operating large trucks. However, STAA regulations have been upheld in court with only one temporary exception permitted for a freeway with a high crash rate.

In 1994, The Tandem Truck Safety Act (TTSA) clarified and revised certain provisions of the STAA on access issues to the National Network for STAA trucks. Also, the TTSA amended the STAA provisions regarding vehicle widths. Specifically, TTSA sets the following:

- Permitted 102-inch wide vehicles to operate on the entire National Network. This amended the STAA regulation requiring vehicles of 102 inches in width to operate only on segments of the National Network with 12-foot lanes.
- Allowed states to request exemptions to the large truck network if all adjacent states were consulted and approved.

In 1987, The Surface Transportation and Uniform Relocation Assistance Act (STURAA) superseded the Surface Transportation Assistance Act of 1982. Among the many provisions contained in the STURAA were the following:

- A request for the Transportation Research Board (TRB) of the National Research Council to study several proposals affecting various segments of the trucking industry. The principal recommendations of the TRB committee concerned truck weights. The areas of primary concern included standardization of truck weight limits, elimination of grandfather claims for vehicles that exceed the federal weight limits, special state permit programs for trucks exceeding the federal gross weight limit of 80,000 pounds, and a recommendation for increased truck weight enforcement. A proposal was made for a new federal bridge formula that would permit increased vehicle weights.
- STURAA created a policy defining "reasonable access" for the longer, wider commercial trucks. States responded by upgrading many miles of roadway to STAA standards to provide reasonable access between the National Network and trucking terminals and other related facilities for food, fuel, repair, and rest.

In 1991, The Intermodal Surface Transportation Efficiency Act (ISTEA) superseded the STURAA highway funding authorization bill. ISTEA primarily addresses transportation issues outside of truck routing. One specific point of this bill limited the use of triple trailer combinations beyond states that already allowed their use. It is important to note that national standards for truck size and weight established under the previous federal transportation authorization bills are fully endorsed under the ISTEA legislation. In addition, ISTEA has promoted intermodalism resulting in substantial drayage activity in intermodal facilities across the nation.

The laws in most states regarding the trucking industry are primarily tied to the federal mandates. Many cities, especially larger cities, use some form of truck ordinance. In many states, cities have the authority to restrict truck access on any public street within the corporate limits of the city. However, local governments are obliged to accept all federal and state highways as designated truck routes under federal and state transportation laws that authorize large truck access. Common elements of the city truck-routing ordinances include truck-route signs and markings, parking restrictions on trucks, restrictions on truck size and weight, and enforcement and associated penalties for deviations from the truck route. Also, most ordinances exempt emergency vehicles, municipal vehicles, and vehicles operated by a public utility company to provide maintenance service. Other exemptions apply to vehicles traveling to a truck terminal, place of repair, garage, place of performing a service, or to a point for loading or unloading over the shortest practical route to or from the nearest truck route.

## 2.2-Intermodal Freight Studies

### 2.2.1-TRANSPORTATION RESEARCH BOARD SPECIAL REPORT 223

While the operational and safety characteristics of semi-trailer trucks and twin-trailer combination trucks have been extensively studied, those of container trucks are not well understood. It is not clear if containerization changes the safety characteristics of standard large trucks. Some distinct features of containers that might contribute to potential safety problems are:

- equipment mismatch, e.g., when a 57 foot container is mounted on a 53 foot chassis;
- unbalanced weight distribution inside the container (containers originating overseas may be subjected to multiple lifts at various intermodal facilities before reaching their final destination, and these movements can shift the contents of the container);
- violation of U.S. weight limits that can present safety hazards for bridges and road surface.

Few resources exist for truck-routing guidelines or standards. In general, cities faced with traffic problems involving trucks have responded by developing their own ordinances to address issues involving truck movements [3]. These local laws are limited to the arterial streets within their jurisdiction. Federal and state legislation applies to the state maintained highways. Four major sources were reviewed and provided much of the background information for this proposal: The Transportation Research Board Special Report 223: *Providing Access for Large Trucks (1)* that identifies procedures for appropriate access to large trucks; The Barton-Aschman study in Chicago on updating the intermodal yard survey; Various reports on intermodal freight operations [14, 15, 16, 17, 18]; and the CATS reports on the proposed intermodal connectors to the National Highway System for Northeastern Illinois [21] as well as papers by G. Rawlings [10, 11, 12]. The Barton Aschman report as well as the papers on intermodal operations are reviewed in more detail next.

### 2.2.2-BARTON ASCHMAN STUDY IN CHICAGO

The study "Chicago Master Plan Update, Intermodal Yard Survey", prepared by Barton-Aschman Associates, Inc. (BA) in October 1996 was reviewed. The study updated a previous study on the Commercial Vehicle Industry in the City written in 1986, by the Chicago Area Transportation Study (CATS). The purpose of the CATS study was to create a truck trip table for the City, identifying the attraction of different land-uses by grid-square by land use (employment, residential, commercial, industry). The CATS study did not, however, sufficiently recognize the intermodal facilities around the City as trip generators and attractors. Therefore, there was a need for the BA survey to update the trip table and specify truck trip rates for the existing facilities.

The purpose of the BA survey aimed to obtain the following data:

- Information about each intermodal site (including size, number of employees, number of lifts per day)
- Information about a sample of trucks and the trips made by those trucks arriving at the intermodal sites
- A manual classification count of all the trucks entering the site during the 12-hour survey period (single unit, piggyback, etc.).

Ultimately, the trucks are classified according to an array of different scales:

- Distribution of trucks by type
- Trucking company home base location
- Weight and type of cargo
- Origin and destination kind of place (truck terminal, intermodal facility, business) and location
- Proportion and description of the drayage trips.

The locations are given according to a three-zone system: City of Chicago, the six-county area (Cook, Kane, Du-Page, Lake, Will, McHenry), and outside the six counties. This system allowed the BA survey to have a very quick overview of the origin/destination of the truck interviewed. Indeed, the purpose of the BA survey was to get new entries in a trip *generation* grid, not a route description. The latter information seems to be actually easier to get by interviewing the drivers and get the drivers logs from companies that specialize on intermodal operations. The BA data also provides the detailed addresses of the different intermodal facility locations.

The BA data were gathered by surveyors standing at the front gates of intermodal sites, intercepting trucks going in. The interview typically lasted less than two minutes. Some truckers only had time to answer the first questions, and only their first answers were collected and reported. Therefore, the sample size for the last questions (destination, route taken, and frequency of the same trip) is much smaller than the reported sample size of 2213. Furthermore, the 12-hour survey time extends from 6am to 6pm. Therefore, it did not take into account all the trains (and the trucks) that entered the yard after 6pm. In addition, it did not take into account the daily variation of traffic. The collection day is not reported, although the day is important because different patterns exist every day of the week. The time of the year has also a huge influence, as shipments tend to be seasonal for certain commodities (e.g. certain shipments tend to increase around Christmas, according to various carriers contacted for this study).

The daily rates for each site were determined by multiplying the value from the 12 hours by 2. This is clearly questionable at best and statistically inaccurate at worst.

The interview distribution by site according to the annual lifts per site, as given in the "Proposed Intermodal Connectors to the National Highway System for Northeastern Illinois, Version 2", from CATS, March, 1996 is given in Table 1.

Table 1. Interview Distribution by Site

| Site name | # of intervews | Percent of total | Annual lifts (k) | Percent of total |
|---|---|---|---|---|
| BNSF Corwith | 290 | 13.1% | 664 | 18.7% |
| BNSF Hodgkins | 153 | 6.9% | 250 | 7.1% |
| BNSF Cicero | 295 | 13.3% | 430 | 12.1% |
| UP Global one | 169 | 7.6% | 350 | 9.9% |
| UP Global two | 254 | 11.5% | 225 | 6.4% |
| UP Yard Center | 119 | 5.4% | 256 | 7.2% |
| NS Landers | 294 | 13.3% | 264 | 7.5% |
| CSX | 244 | 11.0% | 600 | 16.9% |
| Markham | 126 | 5.7% | 103 | 2.9% |
| O'Hare South Cargo | 95 | 4.3% | N/A | |
| Conrail | 174 | 7.9% | 400 | 11.3% |

To conclude, the Barton-Aschman survey was an attempt to develop trip generation characteristics for the intermodal industry in Chicago and its use.

### 2.2.3 INTERMODAL FREIGHT REPORTS RELATED TO THE CHICAGO AREA INDUSTRY

J. Casey, head of the Intermodal Council of American Trucking Associations stated in Traffic World (1994) "Every intermodal drayman has the responsibility of doing a walk-around inspection of a trailer before he pulls a load" [17, 24]. Casey also stated that "some intermodal equipment is not in as good a shape as we would like." John McQuaid, president of the Intermodal Association of North America added that "The inspection issue continues to be a challenge to the industry."[17]

Clarke, *et. al.* (1996) pointed that while national truck Vehicle Miles Traveled (VMT) is expected to decrease due the increase in intermodal activities, on the local level the effect is reversed. Undoubtedly, such increase in truck volume at the local level will have impacts on the local count of crashes.

Thuermer (1994) cites statistics indicating that since rail is the safest way to transport hazardous materials, most major chemical companies including Dow Chemical, Nalco Chemical, and Du Pont de Nemours are now shifting from truck transport to intermodal transport. Nalco ships mostly from the Chicago and Gulf areas to the West Coast. The trucking industry also reflects the same changes. For example, J.B. Hunt Transport has shifted more long distance trailers from the highway to rail intermodal (18).

A report by the U.S. General Accounting Office (1992) emphasized the role played by Chicago in the Nationwide intermodal web and described the impact on highways, because intermodal yards are located "on former switching yards close to city centers". The report estimates that "nearly half of all intermodal rail shipments either originate, terminate, or connect in Chicago", generating at least 3 millions truck trips in 1991 (8000+ per day), including over 200,000 drayage trip between terminals (19).

## 2.3-Selected Annotated Literature Review

1. Sparkman D., "Draymen Call for Safety Rules: Want Piggyback equipment to be roadworthy" In: *Transport Topics*, November 1997, p53
   The article is about intermodal truckers who are calling for federal government legislation to make sure that intermodal equipment is safe to travel on public highway. It is pointed out that draymen have complained for long time that sometimes they are hired to haul equipment that is damaged, missing components such as lights, or unsafe condition such as poor tire condition, faulty brakes, loose nuts. Another concern is the no-inspection practice common among intermodal yard managers, before a driver picks up the equipment. Drivers also have little time to inspect the equipment thoroughly at the busy rail yard or port facility; if the safety defect is not immediately obvious, generally it will be ignored. Finally, even if a defect is found, the driver rarely insists on fixing it, because he might have to wait at the terminal, or might lose a haul. However, the trucker should refuse unsafe equipment, because once on the road, it

is his full responsibility.

2. Clarke B. D., Chatterjee A., Rutner M. S. , and Sink L. H., "Intermodal Freight Transportation and Highway Safety" In: *Transportation Quarterly*, Vol50, No.2, Spring 1996, p 97-110

   This study presented potential implications of intermodal transportation on highway safety. Specifically, it identified intermodal highway safety issues, forecast growth in intermodal traffic, estimated equivalent truck miles of travel for intermodal shipments, determined truck crash rates as a function of travel, and computed truck crash impact for intermodal shipments. The study pointed out that while national truck VMT is expected to decrease due the increase in intermodal activities, on the local level the effect is reverse. Undoubtedly, such increase in truck volume at the local level will have some impacts on the local count of crashes. The specific safety issues identified by this study are:

   *Lack of Easy Access to Interstate Highway-* Long or circuitous access routes in urban areas potentially increase the risk of crash.

   *Intermodal Equipment Maintenance-* A number of interviews reveal that intermodal equipment being moved on the highway is often poorly maintained.

   *Weight Limit Violation-* The study found that shippers often tend to load intermodal equipment beyond the legal highway limit. This practice contributes to a faster wear and tear of intermodal equipment, as well as roadway damage.

   *Drayage Poor Safety Record* - Although no quantitative data has been established, interviews of different parties involved in the intermodal activities shows that the drayage industry over-all had a poorer safety record than did the trucking industry as a whole.

3. Burke J., "Tragedy Raises Intermodal Inspection Questions" In: *Traffic World*, November 21, 1994, p 12

   On Election Day of 1994, six children of a Chicago minister ranging from age 6-13 years, died after the van in which they were riding burned on I-94. The crash was the result of a mud guard that fell off an intermodal trailer belonging to Transamerica.

4. Thuermer K., "Built for Safety: Safety and Service Drives Intermodal Shipments of Hazardous Materials" In: *Intermodal Shipping*, July 1994, p32-35

   This article indicates that since rail is the safest way to transport hazardous materials, most major chemical companies including Dow Chemical, Nalco Chemical, and Du Pont de Nemours are now switching from truck transport to intermodal transport. Nalco ships mostly from the Chicago and Gulf areas to the West Coast. The trucking industry also reflect the same changes, for example J.B. Hunt Transport has shifted more long distance trailers from the highway to rail intermodal.

Due to the increase in intermodal hazardous material transport, manufacturers are continuously developing safer containers that are easier and safer to transport. One example would be the universal "BulkTainer" developed by Union Pacific, which is capable of handling anything from food to petroleum products to chemicals. The "BulkTainer" is sturdy, and allows easy moving from lowboy trailer to flatcar and back to lowboy trailer. The success of the "BulkTainer" promotes the developments of other similar concepts, such as the "Eurotainer", which is a mini version of the "BulkTainer".

5. Frank Wilner, "Whose Equipment Is It?" in Traffic World, September 6 1999

   This report estimates to 45% the part of intermodal equipment on the highway today that has unsafe brakes, suspensions running and brake lights and tires, according to the American Trucking Association (ATA). The reason advanced is that the responsibility, being shared by everybody in the industry, is not taken care of; "When everybody is responsible, nobody is responsible". The ATA is trying to force the Federal Highway Administration (FHWA) to implement a public-funded safety plan that would help a better inspection policy of the container, at all stages of an intermodal trip. The railroads and steamship companies, however, would prefer a privately funded solution, and solve their problems on their yards on their own.

   The Intermodal Association of North America (IANA), representing primarily the interests of railroads and steamship companies, would like a federal response to the safety problem on highways, namely more roadside inspections. But the ATA claims that the responsibility of a container that has sat in a terminal several days or weeks, under the rain, snow, or on the seafront, should not be held solely by the party that moves the container on the highway, but by the party that actually damaged the container. The IANA claims that pick-up controls by the truckers should be sufficient to transfer the responsibility back to them, but the ATA says such a solution is impossible, because truckers need to pick up the load to get paid. Said the former president of the National Private Truck Council: "if the trucker doesn't accept the load, another often is right behind him who will".

   Some tension is actually building up today because of this permanent rejection of responsibilities, and some slow-downs at yards have been reported. This matter is therefore growing very important and needs to be looked into very carefully.

6. David Sparkman, "Union Pacific Service Failures Hurt Shippers, Intermodal" in *Transport Topics*, September 15 1997.

   This article shows the terrible impact that a small failure in such a big system as the intermodal grid can have. It explains how, due to crippled infrastructure in Houston, Union Pacific encountered serious delays in the summer of 1997. The whole shipping line was broken, and all parties were forced to wait for the loads and reschedule their plans.

The article showed the great fragility of the chain that is the intermodal business, and the additional pressure that is put on the trucking industry.

## 2.4 Conclusions

The above reviewed studies indicate that there are common concerns and issues related to safety of intermodal operations:

1. *Poor inspection practices and no clear statement of responsibilities.* It is not clear to the drivers what and how to inspect intermodal equipment. Practices differ among companies and yards. While the driver is responsible for the equipment, no clear procedures are established on how s/he should perform this task.
2. *Poor intermodal equipment maintenance-* A number of interviews revealed that intermodal equipment being moved on the highway is often poorly maintained. Drivers complained that they often have to haul equipment that is damaged, missing or with broken components such as brake lights, worn out tires, faulty brakes, loose nuts and damaged pins.
3. *Lack of inspections of the equipment by intermodal yard manager before it is picked up by the driver.* There is no incentive for the yard to perform such an inspection now. While a driver can refuse a load, it is highly unlikely s/he will do so, when there is pressure to meet deadlines.
4. *Lack of access roads to the national highway system.* Long or circuitous access routes in urban areas increases VMT, exposure, and potentially increase risk of crash since often part of the trip will be on streets that are not designed for trucks.
5. *Weight limit violation.* Shippers often tend to load intermodal equipment beyond the legal highway limit. This practice contributes to increased wear and tear of intermodal equipment, as well as roadway damage.
6. *The perception is that intermodal vehicles have poor safety record.* While this seems to be the perception in the literature, it has not been clearly established. Our own study could not support this conclusion.

# 3-Data Collection

The data collection part of this study involves the following:

- Surveys with truck drivers
- Surveys with safety managers of trucking companies
- Crash data from IDOT
- Crash data from the City of Chicago
- Network and traffic data from the Chicago Area Transportation Study (CATS)
- Previous studies of intermodal operations in Chicago—specifically a study by Barton-Ashman, Inc.
- SAFER and OMC data on violations and safety of trucking companies
- Gate traffic data from intermodal yards
- Automated Vehicle Location Data from companies with equipped trucks.
- Expert and other anecdotal information from people at CATS, Illinois Transportation Association, trucking and intermodal companies.

Some of the above described data were not collected given the limited timeframe and resource of this study. However, the sources and types of data are all identified, as well as the potential utility to improving the safety and efficiency of intermodal operations.

The data collection efforts as well as the insights gained from them are described (See 3.1). The synthesis of the data obtained and their integration to monitoring and modeling applications is discussed.

## 3.1-DESIGN AND PERFORMANCE OF TRUCK DRIVERS' SURVEYS

The people who know best the street network and its limitations are the truck drivers themselves. A truck driver survey was developed, in conjunction with the project Technical Review Panel (TRP) to obtain the following information:

1. *Routing information.* Questions were designed to identify roadways and intersections where major flows between intermodal facilities and other major origin destinations intersect, and to develop temporal departure and arrival information. In general, this information was not available from any other source identified.
2. *Problematic Points.* Drivers were asked to identify locations the drivers felt were of safety or efficiency concern. In addition, obstacles to truck operation, such as low-clearance viaducts and intersections of limited geometry were identified.

3. *Driver Population Information.* Demographics on driving experience, age and crash experience were obtained.
4. *Anecdotal Information.* Often valuable information on a complex system such as the freight system cannot be easily quantified to a level that it can be analyzed statistically or otherwise. However, it could be essential to obtain insights into the operation of the system and the complex interaction among the various players.

A questionnaire was developed and approved by the Technical Review Panel (TRP) to survey local trucking firms involved in rubber-tire transfer. Through CATS and the Transportation Center at Northwestern University major trucking companies (300+ trucks) and a number of minor ones were contacted to obtain their view on the best way to obtain data from truck drivers. The data were to be collected by students. Three procedures were explored:

1. students positioned outside selected yards, interviewing drivers that drive in and out of the yards,
2. students sitting with dispatchers from the companies, talking to the drivers over the radio,
3. students at the company offices when the drivers come in to pick up paychecks, or load assignment and interviewing them in the company offices.

It was decided after discussions with the TRP that the best way was approach 3, because it involved personal contact with the drivers, it would cover in a single survey many origin-destination (OD) pairs and routes that are not related to a particular yard. In addition, it would not expose students to the elements or other possibly uncomfortable or hazardous conditions. Two major companies were chosen to be the subjects of the survey. These two companies worked with all the intermodal terminals, and were thought to be representative of all trucking companies. It should be noted, however, that this may have introduced biases related to the operation of these companies and the driver pool they hire.

A survey was designed and after communication with the TRP, it was refined and approved. The surveys were conducted by 13 students over a period of three months. More than one hundred drivers were interviewed. Each driver was asked to provide information about one or more recent trips he or she performed. Useful information was obtained for approximately 200 trips. An example of a questionnaire is included in Appendix 2.1. A table that compiles all data obtained is included in Appendix 2.2. The results are discussed below.

### 3.1.1- Interpretation Of Results

The first thing considered was the driver population characteristics. The most relevant variable is the number of years of experience. As shown in the Figure 1, drivers tend to stay in this business for a relatively short period of time, before moving to other areas of the industry; this is partly because the intermodal business is generally an entry position for the general freight industry.

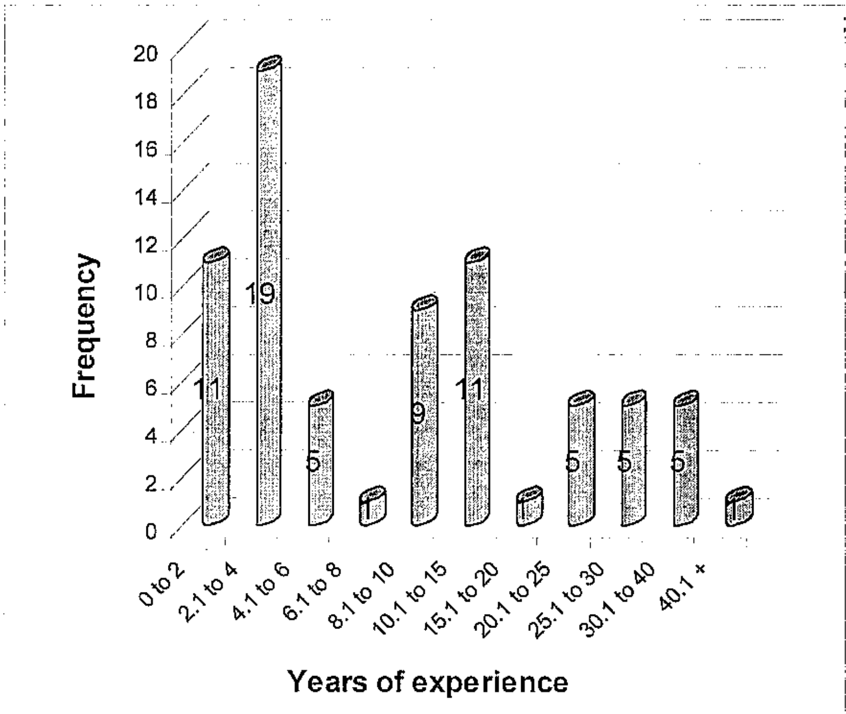


**Figure 1**. Drivers' years of experience

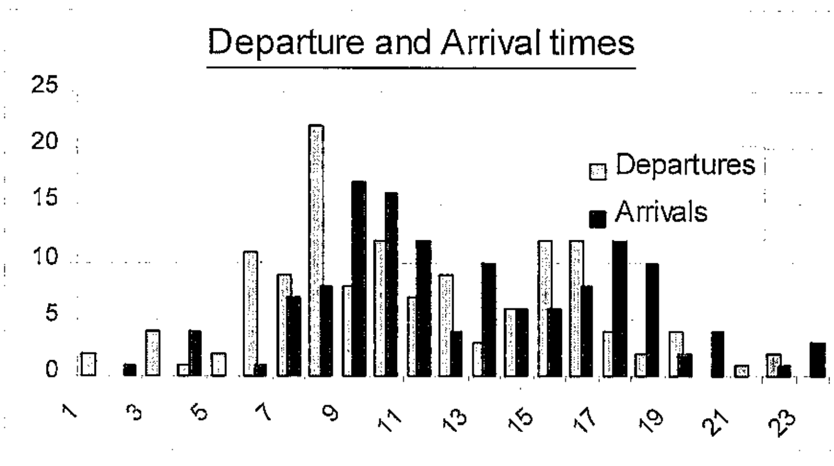


**Figure 2. Departure and Arrival times of the sampled trips**

In Figure 2, the departure and arrival times are plotted as a function of the time of the day. The figures on the horizontal axis are the hours of travel, in 24-hour format. For example, 22 trips departed between 8:00am and 8:59am, and 7 trips arrived during the same time interval. Two patterns are apparent. First, a large number of trucks depart in the morning rush hour to pick up or drop off containers. The curve linking the top points of the bars for the arrivals curve has the same general shape as the departures curve translated to the right two or three hours. This could show that the trucks spend on average two or three hours in the morning traffic, and then go back to the base. The same pattern was observed in the late afternoon rush hour.

While this could not be justified in terms of efficiency, it is due to the fact that drivers and trucking companies typically react to the train arrival patterns and cut-off times. This clearly presents opportunities for improvements if there was a coordinated effort between and rail and trucking companies. While it would barely impact the rail operations, it can substantially benefit the trucking operations as well as congestion and passenger traffic. While it is hard to quantify the benefits of a temporal shift in train schedules, it is well known from traffic engineering that even a small reduction of traffic volume at very congested conditions may result in substantial improvements to traffic flow and as a result to safety issues.

The duration of the trips in the morning and afternoon peak hours is given by the following graph. It illustrates the travel time, on the horizontal axis, as a function of the time of the day.

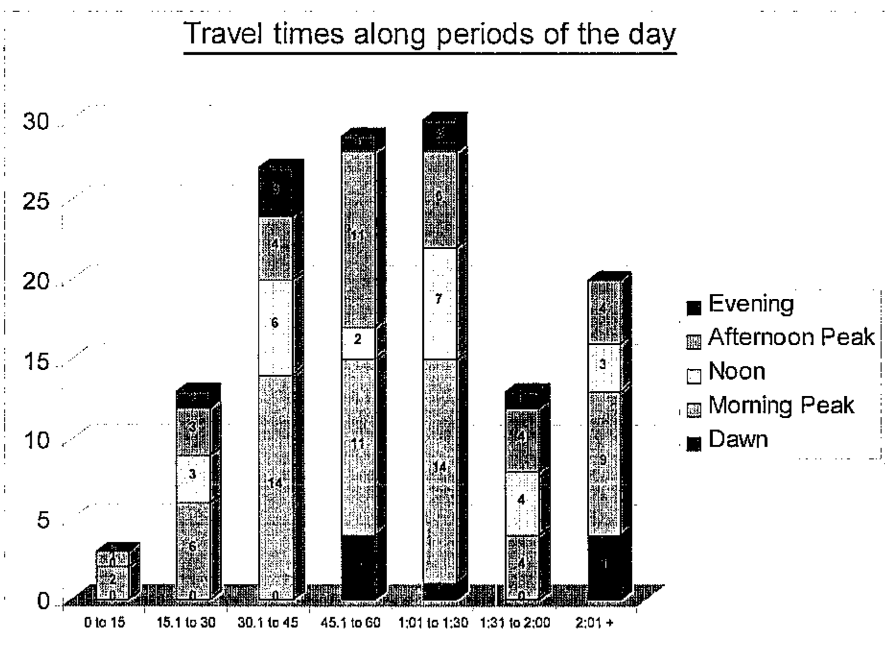


Figure 3: Travel times

It is apparent that the average travel time is about one hour during the morning peak hour, and also during the afternoon peak hour; the longer trips are more likely to take place during the morning peak.

Table 2 summarizes the type of containers moved: the majority of containers are 40 to 48 ft.

Table 2: Type of container moved

| Dimension (ft) | Percentage (%) |
|---|---|
| 20 | 2.27 |
| 40 | 29.55 |
| 44 | 11.36 |
| 45 | 27.27 |
| 48 | 22.73 |
| 53 | 6.82 |

Another aspect of the information provided by the truck drivers, is the route that they use to go around the city. A number of heavily used corridors were identified, especially in the South Side of the City. Indeed, yards are clustered in this area around a small number of significant links, and the traffic tends to follow rigorous patterns. The following picture is a detail from the map of the City of Chicago, in Appendix 1.

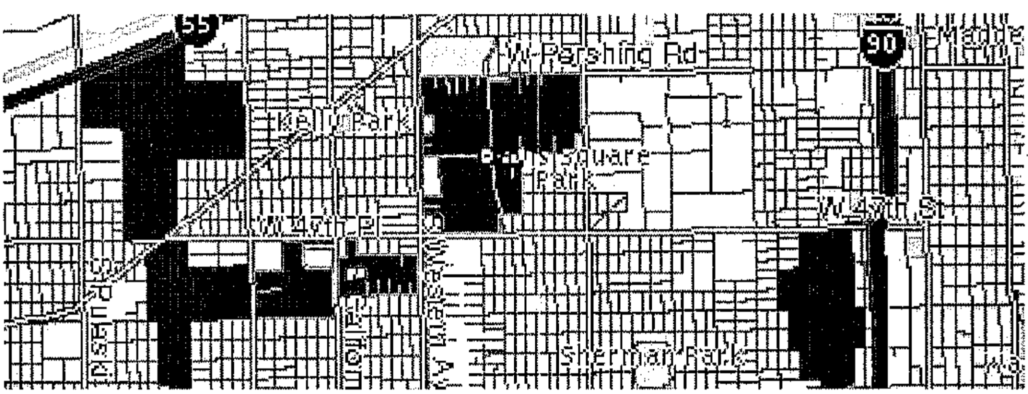


Figure 4: Schematic of the area with the highest concentration of intermodal truck movements

The darker areas are zones where some intermodal activity is taking place.

A trip can be typically classified according to one of the following:
1. Cross-town (drayage)
2. Local delivery
3. Regional

Evaluation of the data (it was also supported by the operations managers at the trucking companies) indicated that these trips are equally likely to occur, i.e., the split is 1/3-1/3-1/3.

In the first case, considering the large concentration of yards in the area in Figure 4, the likelihood that the destination is in the same area is quite high. Some of the most used facilities are the following:

ARTERIALS

E-W: 47th Str. from I-94 to Harlem, 51st Str. From I-94 to Western, 79th from Western to Harlem, parts of Pershing, 56th, 31st, 26th and Cermak.

N-S: Western and Kedzie from 79th to Stevenson Expressway (I-55), Harlem from 71st to Stevenson Expressway (I-55), Cicero from 79th to Ogden, parts of Halsted, Ashland and Pulaski.

Diagonals: Archer, Ogden and 171at Willow Springs.

FREEWAYS

Stevenson Expressway (I-55) from I-294 to Dan Ryan Expressway (I-90/94), Dan Ryan Expressway (I-90/94) (south of the junction with I-55) and to the point where they split to I-94 and I-57 to I-80 as well as parts of Eisenhower Expressway (I-290), Kennedy Expressway (I-90/94).

Table 3 summarizes the roadways used and the percentage of time each roadway appeared in the sample. The trips can be classified in two major categories: those that used a freeway and those that stayed on the arterial streets. The majority of the trips used part of freeway segment, in which case access to freeway seems to be an important concern. For example, in order to access Dan Ryan Expressway (I-90/94), a truck has to take one of the larger avenues going north: Pulaski, Kedzie, California or Western, or an east-west street, such as 47th Street. The result of this situation is a large amount of traffic on those links, creating an array of problems at intersections or portions of the roadways.

With the help of the surveys, a series of problematic points on the South Side network were identified and are outlined in Tables 4 through 7.

**Table 3:** Usage of roadways

| Roadway | Percentage times it appeared in the sample routes (%) |
|---|---|
| Stevenson Expressway (I-55) | 8.13 |
| Eisenhower Expressway (I-290) | 5.26 |
| I-294 | 3.83 |
| I-80 | 4.31 |
| Edens Expressway (I-94) | 1.44 |
| 45/20/12 St.Route | 4.51 |
| 79th Str. | 5.74 |
| 47th Str. | 5.50 |
| 26th | 4.98 |
| Harlem Av. | 4.78 |
| 59th Rd. | 4.77 |
| Western Av. | 2.87 |
| Kedzie Av. | 2.86 |
| Cicero Av. | 1.91 |
| 171 Rd. | 1.66 |
| Archer | Less than 1.00 |
| 98th Str. | Less than 1.00 |
| Pershing Rd. | Less than 1.00 |
| Pulaski Rd. | Less than 1.00 |
| 103rd Str. | Less than 1.00 |
| 67th Str. | Less than 1.00 |
| California Av. | Less than 1.00 |

Table 4: Problematic roadways

| Roadway | Problem |
|---|---|
| $79^{th}$, $25^{th}$ , 171 Rd. | Signals are not properly coordinated |
| $25^{th}$ , $47^{th}$ | Potholes/pavement in bad condition/heavy congestion |
| Harlem, California | No Delineation at places |
| All freeways | Congestion |
| Southbound Dan Ryan Expressway (I-90/94) at $63^{rd}$ | Sudden lane drop with little warning |
| $83^{rd}$, Western Av. | Congestion |
| Stevenson Expressway (I-55) to Dan Ryan Expressway (I-90/94) ramp | Curve shape for prevailing speeds |
| Stevenson Expressway (I-55) to California Exit Ramp | Bumpy ramp, insufficient geometry |
| Western | Low viaducts and in addition poor signage (left lane is not allowed for trucks but there is no sign/right lane full of potholes) |
| Cicero around Midway Airport | Poor signage and delineation (probably due to construction) |
| Stevenson Expressway (I-55) between I-94 and I-294 | Too many on- off-ramps that disturb the traffic stream on the rightmost lanes that trucks drive. |
| Manheim and $1^{st}$ Avenue | Weight limitations |

Table 5: Problematic intersections

| Intersection | Problem |
|---|---|
| Western and 47th | Insufficient turning Radius |
| Western and 35th | Insufficient turning Radius |
| 79th and Pulaski | Insufficient turning Radius |
| 41st and Pulaski | too long red light and vertical alignment |
| 47th and Stewart (Conrail) | Narrow turns, poor visibility |
| Stevenson Expressway (I-55) and California | Timing plans, Insufficient turning Radius |
| Ohio and Orleans | Insufficient turning Radius |
| Orleans and Grand | Insufficient turning Radius |
| 47th and Kedzie | Insufficient turning Radius |
| 26th and Cicero | Insufficient turning Radius |
| 16th and Cicero | Insufficient turning Radius |
| 26th and Pulaski | Insufficient turning Radius |
| Western and 111th | fire hydrant |
| 26th and Archer | Insufficient turning Radius |
| 43rd and Ashland | Insufficient turning Radius |
| Canal and Archer | Insufficient turning Radius |
| 31st and California | Central island blocks left turn |
| State and 63rd | Due to long delays entering the yard, drivers have to wait under the viaduct and are ticketed repeatedly (and unfairly) by the police who know the problem |

Table 6: Low Clearance viaducts

| Low clearance viaducts |
|---|
| 35th, 36th, 37th and California |
| 37th and Halsted |
| 49th and Kedzie |
| Ogden and Central Park |
| $47^{th}$-$48^{th}$ and Kedzie |
| 59th and Ashland |
| 47th and Archer |
| 36th and Laramie |
| Kimball and Lawrence |
| 59th and Halsted |
| 51st and Kedzie |
| Ogden and Rockwell |
| 14th and Western |
| 35th and Western |
| 79th and Western |
| 31st and Western |
| 51st and Western |
| 71st and Western |
| 49th and Ashland |
| Edens Expressway (I-94) exit ramp at Irving Park |
| Cermak Rd. between Kedzie and Ogden |

Table 7: Other Problematic Points

| Other | Problem |
|---|---|
| Suburban communities | low electrical wires |
| Belmont | narrow due to parking on the sides |
| 1st avenue | weight limitation (16) |
| Mannheim | weight limitation (16) |
| Damen off I55 | road surface |

This list helps identify the problematic locations for further study. Other problems include low electrical wires, trees that are not trimmed, some weight restrictions, scales on the streets and non-existing delineation and markings at various places. Another concern the drivers expressed was the behavior of passenger vehicles around trucks. Passenger vehicles do not seem to understand the difficulties a truck has to maneuver, speed-up and stop. This was supported by truck drivers' comments on their safety experience. Most of the crashes reported by the drivers appeared to be between trucks and passenger vehicles. Two common types of crashes include:

- Crashes with passenger vehicles that cut in front of trucks and then quickly slow down trying to make an exit or a turn.
- Crashes when passenger cars attempt to take a right turn at the same time a truck is trying to make this turn. Similar crashes were reported with passenger cars that drive for a while in the blind spot of a truck driver at the time the driver changes lanes.

Truck drivers also stated that even under unfavorable conditions most crashes are preventable; however, when the geometry is insufficient, the weather unfavorable and one of the involved drivers is fatigued or intoxicated crashes are more likely to happen. Finally in Table 8 the ratings the drivers gave for the various yards are summarized.

Table 8: Rating of intermodal yards

| Yards | Problems | Rating 10:Excellent 1:Poor |
|---|---|---|
| Conrail (now CSX) 63rd | waiting time, dispatchers don't answer phone/unhelpful employees, roadways inside the yard poorly maintained, capacity problems inside the yard that spill over to the adjacent streets. | 2 |
| Conrail (now NS) 47th | waiting time (1-3 hrs delay), problematic service, slow inspections. Spotters not responsive to drivers' requests, especially when the equipment is bad | 4 |
| UP 26th | Long waiting time | 4 |
| BN Ogden, BN Santa Fe | Problematic and old equipment, Yard in poor condition | 5 |
| CSX Bedford Park | Crowded, few equipment | 5 |
| NS Landers | OK service and reasonable waiting time | 5 |
| UP Global One | OK, occasional delays | 8 |
| UP Global Two | OK, occasional delays | 8 |
| Bensonville Yard | Best rated | 10 |

## 3.2-SAFETY MANAGERS SURVEY

The trucking companies are concerned about safety issues and they understand that the impact of a fatal crash could be catastrophic for the company. This is the reason that most major trucking companies have a safety manager (SM) in their staff. The role of the SM is to make sure that the background of each driver is satisfactory, and to monitor the safety records of all drivers and the company as a whole. Even minor crashes, *not reportable to DOT*, are being investigated by safety managers. They interview the driver, understand the circumstances of the crash, and report it both to their management and to the insurance company. The safety managers are responsible for making sure that newly hired drivers have an acceptable safety record and they are responsible for developing and running all safety programs inside the company. Such programs, as well as the instructions to drivers in case they are involved in a crash vary: For example, in certain companies drivers get free disposable cameras that they must use anytime they have a crash, to keep record of what happens. The pictures are used for both legal purposes as well as for the safety manager to understand the circumstances of the crash. The drivers then have to fill out forms with the SM and be interviewed. The interest of the companies to monitor very accurately their drivers' safety behavior is evident: besides being good corporate citizens, safety affects the bottom line of the company. Clearly, they lose money when their trucks are involved in crashes, so they want to make sure they know exactly the circumstances and contributing factors.

Although, it was not part of the deliverables for the project, safety directors survey form was developed in conjunction with the project TRP, to be sent to 30 safety directors. This form has been thoroughly discussed with one Safety Manager (a blank copy of the survey is in Appendix 3). The response rate was very low: out of the 30 surveys mailed out, only 3 were received back and 2 were completed over the phone. The reason is that SMs are overburden with many responsibilities and have little time to respond to such requests. Still, however, the responses received and the interactions that took place with the safety managers have enhanced the basic understanding of the industry and the role of the safety managers in the company structure. Next, the structure of the survey is discussed and some of the findings qualitatively, since there is no large enough sample to produce descriptive statistics.

The survey first requests basic information about the safety manager. Experience and company's interests in safety are examined. Certain statistics are requested about the company, such as total number of miles, number of crashes and total number of trucks. The causes for crashes are examined, asking the director to assign weight to each contributing cause. Statistics on the location and time of the crashes was requested (the term "accidents" is used in the surveys rather than "crashes" because this is the terminology used by safety managers).

The second part of the survey tries to get insights (subjective information) from the safety managers. The goal of the survey is to get their views regarding things that happen on the road, whether intermodal trucks have more crashes than others, and if yes, why. Finally, the managers were asked to spend a fictional budget on road improvements they could advise. Numbering priorities would have been a possibility, but if they were allowed to spend budgets, the amounts they come up with will be a good indication on how important they judge each improvement is.

Their role is often multiple. They take care of human resources as well as paycheck, social consultants, and finally safety managers. The percentage of their time spent solely on safety management is highly variable. Their job only becomes safety related only when a crash occurs, or when an inspection by IDOT is scheduled.

Safety training is usually in the form of meetings from time to time (4 times a year) that talk about the general safety issues encountered. Some training to specific tasks is also provided in those instances.

The size of the companies returning surveys varies from 75 to 195 trucks. Around 80% of the trips are cross-town or local deliveries with 20% regional. Very few crashes happen that are DOT-reportable (which makes more sensitive the use of a general database, as described in the *Recommendations* part of this report). Most of them are either property damage-only crashes, or take place on private property, such as intermodal yards, and are not even reported to the police. The number of crashes where the company's driver was at fault is between 40 and 80% (according to the police reports).

It is interesting to consider the determining factors of the crashes. The safety managers, seem to think that street geometry contributes to more than half the crashes occurred. This, with the truck drivers' survey and the researchers' experience in the field, is yet another indication that street geometry plays an important role in crashes involving intermodal trucks. This trend is only expected to increase as more and more 53-foot containers are manufactured.

The intermodal equipment is the second most determining factor given by the safety managers. Indeed, the containers are never inspected and are not followed during the shipment. On the boat, the contents may shift and cause imbalances in the weight distribution. Rust on containers is also often visible, which could pose problems since rusty pieces are more likely to fall off containers, but as explained above, the drivers usually must take the shipment.

## 3.3-COMMERCIAL AND GENERAL CRASH DATA FROM IDOT

The Illinois Crash Records were obtained from IDOT. Charts were developed from the data and are included in Appendix 4. Specifically, the crash profiles are developed for various street segments that are heavily traveled by trucks according to the surveys. The format of this database and its limitations are important. The database contains only crashes that are DOT-reportable. That means a crash that involves death, bodily injury or property damage over $500, as stated in the following extract of the Illinois Rules of the Road[1]:

> *Regardless of fault, a crash report must be filed by the driver of a vehicle if the crash involves death, bodily injury or property damage over $500. To report a crash:*
>
> - *Notify the police. Many towns and cities require a report if a crash occurs within their limits. Therefore, if an officer is not at the scene of the crash, a report must be made at the nearest police station as soon as possible. If in a rural area, the county sheriff or Illinois State Police must be notified. If the driver is unable to make the report and there is a passenger, the passenger must make the report.*
> - *A report also must be made to the Illinois Department of Transportation. This confidential report must be sent no later than 10 days after the crash. The form can be obtained from a police officer or automobile insurance agency.*

Using the IDOT crash data, crash profiles were plotted for the following roadways:
Ashland Avenue, California Avenue, Cicero Avenue, Halsted Street., Kedzie Avenue, Pulaski Avenue, and Western Avenue.

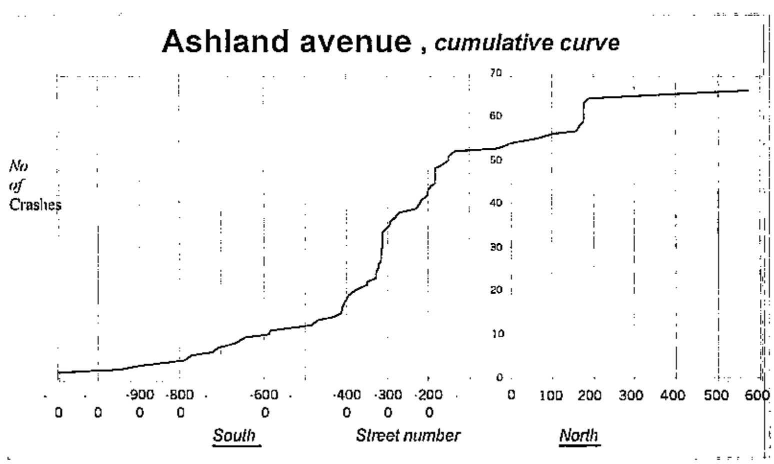


Figure 5: Cumulative crash curve, Ashland Avenue (source 1995 IDOT crash records)

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*1 http://www.sos.state.il.us/publications/rr/rules_of_the_road.html*

An example is depicted in Figure 5 for Ashland Avenue, while the others are included in Appendix 4. Note that the curves have not been adjusted for Average Daily Traffic, therefore curves for different roadways may not be comparable; this curves simply provides the "safety profile" along an arterial. It is not surprising that most of the crashes took place at intersections, rather than sections. The curves indicate the increase in the number of crashes along the roadway, indicated by the street numbers. This number is the number of commercial crashes for the year 1995. This analysis allowed better identification of the problem points along the main truck-traveled arterials, confirming the results from the truck drivers' surveys. Additional curves were drawn to allow visual identification of problematic locations (Figure 6).

The peaks in the curves indicate a location where crashes happen more often, with a higher concentration along the roadway. Some of the peaks are not easily visible, so a secondary curve is provided that indicates the "crash concentration" (in crashes per street number).

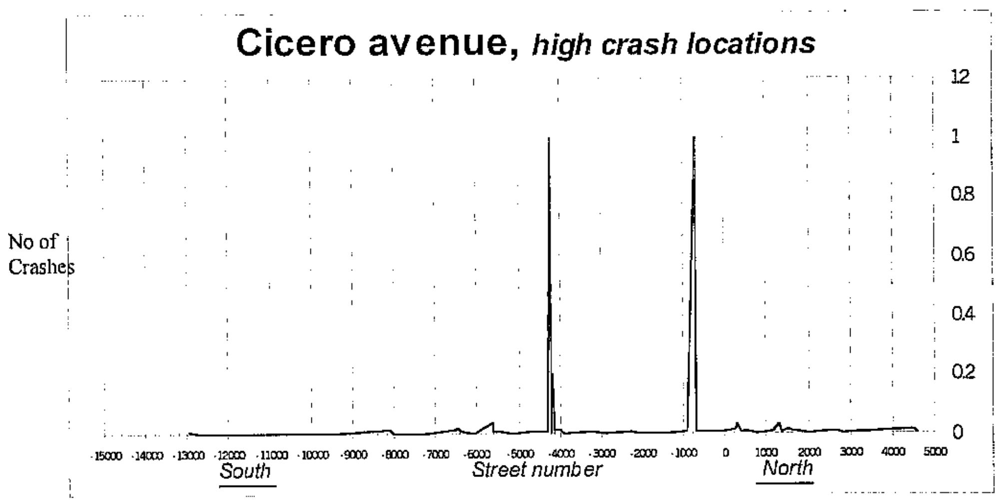


Figure 6: High crash locations, Cicero (source 1995 IDOT crash records)

Based on the 1995 data, the following intersections appeared to be particularly hazardous in the south side of the City:

| | |
|---|---|
| Ashland and: | 31st |
| | 18th |
| California and: | 47th |
| | 41st |
| | 34th |
| Cicero and: | 21st |
| | 29th |
| | 42nd |

| | |
|---|---|
| Halsted and: | 29th |
| | 39th |
| | 49th |
| Kedzie and: | 38th |
| | 39th |
| | 47th |
| Pulaski and: | 40th |
| | 44th |
| | 47th |
| Western and: | 16th |
| | 34th |
| | 67th |

Some of these intersections had already been cited by the truck drivers and/or the safety managers, and the crash data confirmed that information. The intersections were either in high traffic areas (the curves do not take into account the ADT at an intersection compared to the number of crashes at this intersection. Furthermore, the database does not differentiate between a commercial truck doing a local delivery and an intermodal truck, moving a container across town.

## 3.4-TRUCKS VERSUS PASSENGER VEHICLES CRASH EXPERIENCE

Another database was examined that lists all the crashes that have occurred in 1995 on Illinois State Routes. This database is therefore only useful for Cicero Avenue (State Route 50).
However, it allows seeing if there is a discrepancy in the number of crashes for "general" vehicles, versus commercial vehicles.

The milepost for 47th street is 23.00 miles. A large increase can be observed in the number of truck crashes, but no significant increase in the number of car crashes.
This is an indication that the intersection between Cicero and 47th tends to be problematic for trucks but somehow not for passenger vehicles. The geometry and traffic control features of this intersection will be examined in Section 4.2 to identify contributing factors.

## 3.5-POLICE DEPARTMENT DATA, GIVEN BY THE CITY OF CHICAGO

Printouts of crash records were obtained from the City of Chicago, with the help of TRP. Unfortunately, the data were provided in a hard copy printout, which limits our ability to perform analysis on many intersections. The data available was a list of all the crashes involving trucks since 1993 classified by:

- District of occurrence (25 police districts in the city, as shown in Appendix 5).
- Date and address.
- Vehicles involved.
- Crash type (fatality/injury and property damage only).

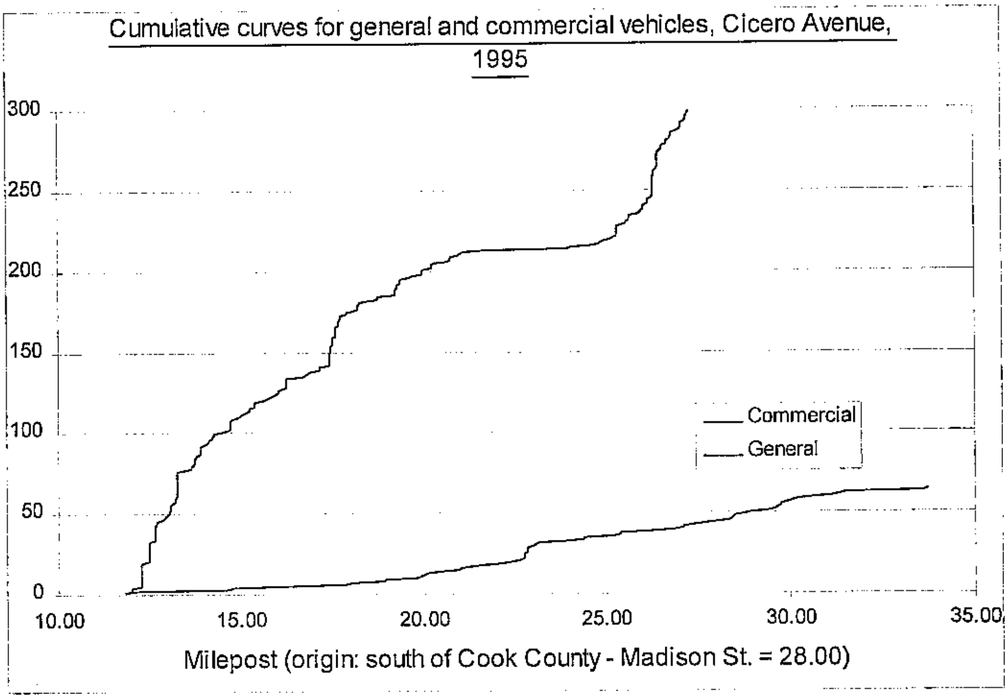


**Figure 7: Commercial and General Cumulative Crash Curves, Cicero Av. (source 1995 IDOT crash records)**

Furthermore, the City is divided into 5 areas, two of which contain a majority of the intermodal yards in Chicago. The total number of crashes for each area was computed for each year since 1993 and the effect of the intermodal industry growth over the past few years was examined. Table 9 shows the number of crashes over the years 1993-1999 for each one of the areas.

**Table 9: Number of Crashes Per Year Per Area (source Chicago DOT crash records)**

| Year | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
|---|---|---|---|---|---|---|---|
| Area | | | | | | | |
| 1 | 705 | 1574 | 1495 | 1361 | 1503 | 1354 | 1461 |
| 2 | 301 | 710 | 625 | 592 | 700 | 651 | 677 |
| 3 | 199 | 449 | 375 | 427 | 469 | 461 | 495 |
| 4 | 496 | 1076 | 955 | 952 | 1007 | 1074 | 1178 |
| 5 | 467 | 1131 | 907 | 855 | 882 | 919 | 936 |

Obviously, the year 1993 has not been taken into account totally, for the number of crashes is much lower than the following years. When the percentage of increase or decrease from year n to year n+1 is computed, the following table is developed:

Table 10: Change Rate in Number of Crashes Per Year Per Area (source Chicago DOT crash records)

| Change rate from previous year | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
| Area | | | | | | | |
| 1 | - | 123% | -5% | -9% | 10% | -10% | 8% |
| 2 | - | 136% | -12% | -5% | 18% | -7% | 4% |
| 3 | - | 126% | -16% | 14% | 10% | -2% | 7% |
| 4 | - | 117% | -11% | 0% | 6% | 7% | 10% |
| 5 | - | 142% | -20% | -6% | 3% | 4% | 2% |

Finally, the curves of the number of crashes per area versus the year are plotted in Figure 8:

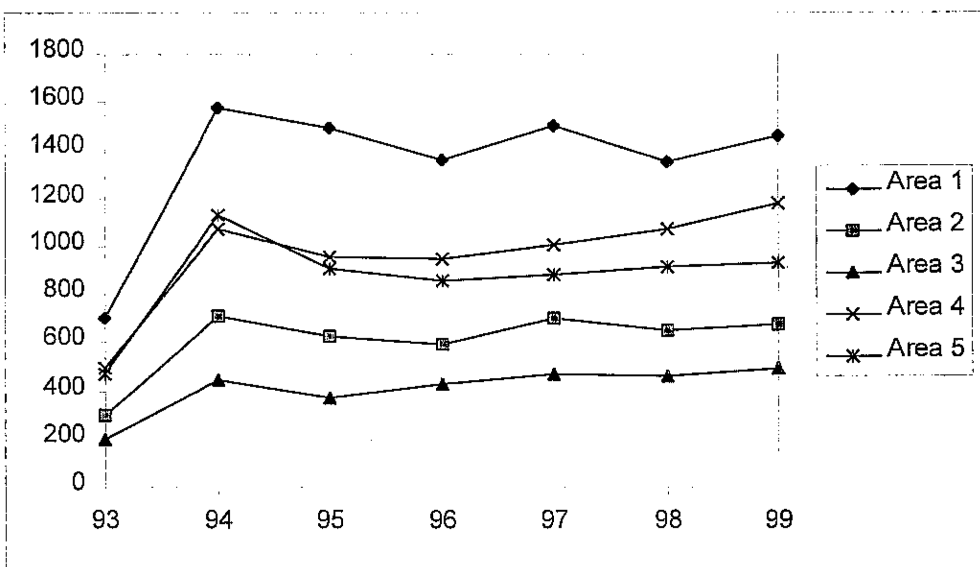


Figure 8: Number of Crashes Per Area by Year (source Chicago DOT crash records)

The areas where the majority of the yards are located, as mentioned above, are areas 1—between Dan Ryan Expressway (I-90/94) and Stevenson Expressway (I-55)—and 4—north of Stevenson Expressway (I-55).

Note that the number of crashes is almost the same (except for the peak from 1993 to 1994), slightly varying around their mean value for areas 1, 2, 3 and 5. However, there seems to be a gradual and steady increase for area 4 (from less than 1000 in 1995 to 1200 in 1999).

To obtain a better idea about the link between intermodal business and increase in number of crashes, the number of lifts[2] performed in the yards of each relevant area were computed:

| | |
|---|---|
| Area 4 | 2289400 |
| Area 1 | 449400 |

Those figures show a substantially higher (5.1 times) number of lifts performed in area 4 than in area 1, and yet the highest number of crashes occurred in area 1.

One possible explanation is that the accounted crashes ignore crashes in the suburbs. However, a movement initiated in Cicero could have an impact on roadway safety in Chicago, since most of the traffic out of Cicero is destined or originated in Chicago. Therefore, another table is constructed, showing the number of lifts in each approximate area:

| | |
|---|---|
| Area 4 | 2979100 |
| Area 1 | 869700 |

The difference between the two areas is now approximately 3.5 times higher in area 4. Finally, taking into account that area 4 is twice as large as area 1, if the number of lifts per area unit is compared (in square miles), the factor is reduced to 1.6.

The data indicate that the number of crashes has been steadily increasing in area 4, but not in area 1, even though area 1 is the largest "concentration of lifts". Furthermore, the increase in the number of lifts per area from 1993 to 1994 is larger in area 4 (18%) than in area 1 (no increase).

No definitive conclusions can be drawn based on the data above. Clearly, if the annual number of lifts per yard for the past 5 years was available, a link could have been established between the number of crashes that happen around those yards to the increase in intermodal business. This would allow drawing graphs centered on the yards, for each year, and see if any patterns develop. Unfortunately, obtaining data for each yard was not possible at this stage, as they are all managed by a different railroad company. Attempts to obtain such data from the Corwith yard, owned by BNSF (logs from the gates) was not possible due to time constraints and privacy concerns raised by the railroads.

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[2] *Approximate numbers for year 1998, taken from the CATS report "Proposed Intermodal Connectors to the National Highway System for Northeastern Illinois", Version 3, June 1999.*

## 3.6-POLICE DEPARTMENT RECORDS

Data were also obtained from the Chicago Police Department. This database provides detailed information on each crash that has occurred within the city limits.

This database was analyzed similarly to the IDOT crash database. Cumulative curves were drawn along some intermodal-intensive (according to the truck drivers surveys) streets, separately for cars and for trucks. The most significant graph for a street is probably the one on 47th street. As shown below, the peaks for each city block intersection is shown. The curve for the cars also shown peaks, but they are less distinguishable. This can be explained by the fact that trucks cannot take smaller streets and are limited to major arterials. Peaks exist at 3200W (Kedzie), 2800W (California) and 1600W (Ashland).

On the minor streets, the graphs are more difficult to interpret, because the vertical scale is larger. More crashes take place on avenues than on boulevards, on which trucks are not allowed. If Figure 7 is considered (Cicero Av.), two significant peaks in terms of number of truck crashes can be observed: One is around 79th street (milepost 27) and the other at 57th street (milepost 18).

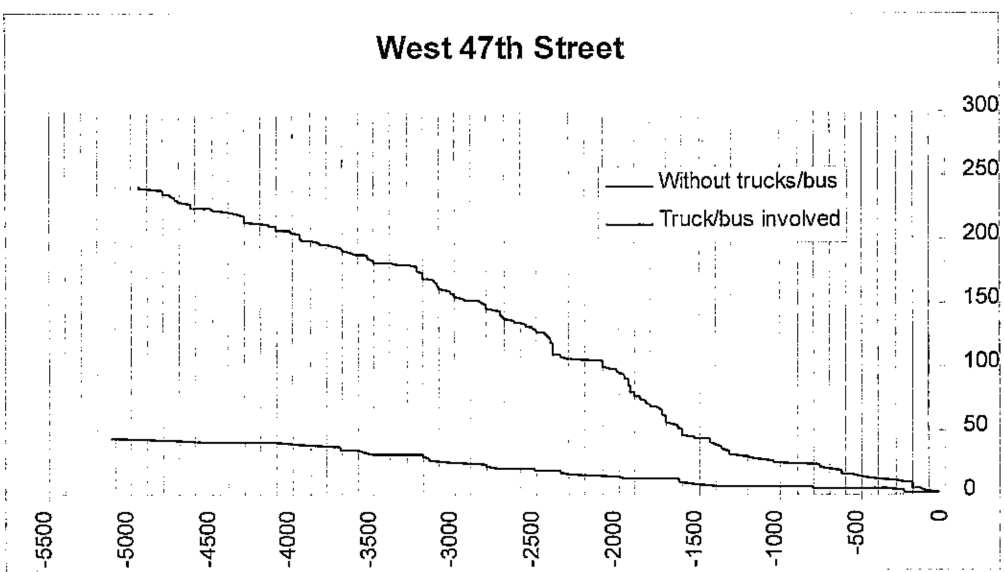



Figure 9: Cumulative crash curves, 47th street

They are significant, yet the truck drivers have not cited them as problematic intersections. A possible explanation may be that these intersections attract a high number of non-intermodal trucks: Cicero and 79th is right in front of a large shopping center–Ford City–and attracts a substantial number of distribution and other non-intermodal truck traffic that contributes to the high number of truck crashes. The situation may be slightly different at 57th street, which is right in front of Midway Airport's terminal. A large volume of construction trucks as well as other large vehicles that can be classified as trucks use this intersection. Midway airport does not support significant cargo operations and the companies interviewed do not operate at this airport. However, the general slope of the truck crash curve is quite steep on Cicero, suggesting a consistent safety hazard on the avenue, possibly due to its central position in the intermodal yards' area.

Once again, the data would be of much greater use, if the trucks were classified in terms of intermodal/non-intermodal. This would have allowed to better identify intermodal truck related problematic locations, and also if those locations are different than the locations where non-intermodal trucks create problems. Based on the current reporting system of vehicle crashes there is no classification between intermodal and non-intermodal trucks. One suggestion is to make a fairly simple change in the police report indicating whether the truck is carrying a container or not.

## 3.7-ASSESSMENT OF POSSIBLE USE OF AVL DATA FOR MONITORING OF INTERMODAL FREIGHT FLOWS

Data were obtained from a major intermodal company that owns 37 trucks equipped with AVL devices. Those devices send radio signals to an antenna that polls the location information of every truck at regular time interval (Figure 10).

If the polling time interval is short enough, the data could be used to trace the route of the trucks, thus getting an extensive route information on route patterns, delay points and other problematic locations. Simply to explore the value of data this technology can provide, AVL data were collected for two days, with time intervals of 15 minutes. This is the smallest interval (according to the current settings of the system) the system could poll the trucks and it may be a limitation in the future, although it is expected that the technology can be easily improved to increase the frequency of polling for this particular AVL device (possibly down to 1 minute). The data are stored in a database file, readable from Excel, and includes the following information: truck ID, time of day, and address in alphanumerical format.

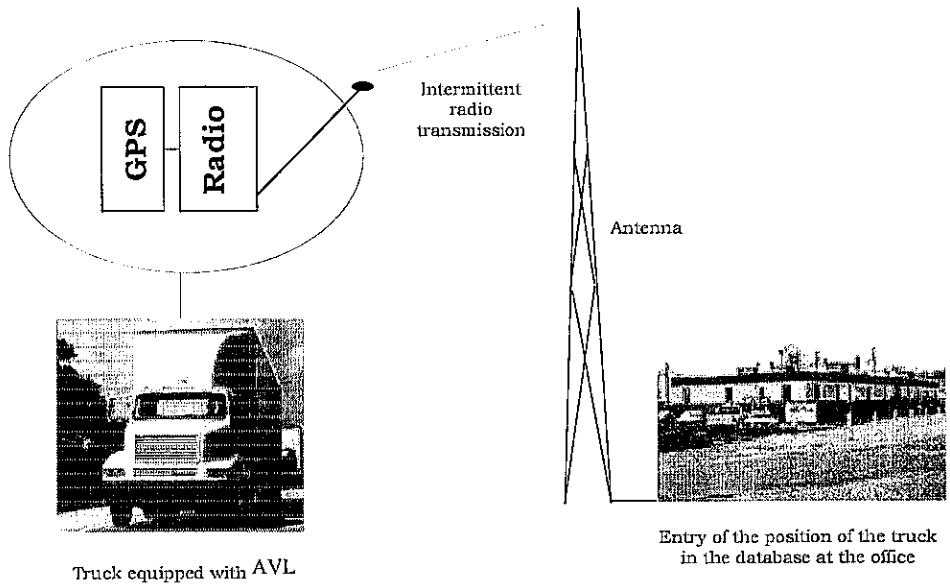



Figure 10: Schematic of an AVL system

The points were traced on a series of maps of Chicago, at which the trucks were located at different time intervals; based on that the route followed by trucks from one point to another was traced. The research teams' familiarity with the south side of Chicago helped trace the routes, although sometimes, consecutive points were too far away to be a possible truck movement. This is an indication that there are errors in the data transmission or coding, which, however, can be corrected. Most of the routes, however, are reasonable and agree with the routes the drivers indicated they follow for the same origin-destination pairs. Data were collected for two consecutive days, with 15-minute time intervals, and for 37 equipped trucks. Many data were not used because the trucks were not traveling at that time. In addition, some data related to trips outside the Chicago metropolitan area were discarded.

The remaining part of the collected data allowed tracing some significant routes around the city, from intermodal yards to other sites (terminal or customer locations). The sample size is obviously limited and cannot be used at this stage for analysis purposes, but provides an indication of available data sources that can significantly help government agencies understand the freight movements in the Chicago area.

Next, as a recommendation, the general steps that need to be followed to be able to establish an online monitoring system based on the AVL data are outlined:

- Protect the privacy of the participating tucking company, by eliminating all identifiers specific to the company. Assign a randomly generated number to the truck monitored (similar to the TRANSMIT standards).
- Obtain the x-y coordinates them more accurately on a line coordinates.
- If possible, increase the frequency of polling (the best being probably 1 minute); 5 minutes seems to be readily available from our discussions with TeleTrac (one of commercial vendors of this system).
- Enter the routes into a GIS format, so that the routes are automatically stored in a database. Some algorithmic development may be needed to infer connections between data points located farther apart.
- Eliminate unreasonable routes.
- Have the program output the busiest routes and intersections and extract congestion information. Produce a list of problematic points. Verify (using the same GIS software) if the routes followed are the shortest routes.
- Obtain data from as many as possible trucking companies (and therefore, different locations throughout the city) to get a better coverage and eliminate company specific biases.
- Communicate information on problematic points and possibly better routes to the participating companies on a time-of-day basis.
- Communicate the problematic points (intersection, viaducts) to the City, IDOT, CATS for possible improvements.
- If long delays are experienced outside/inside yards, communicate the information to railroads.

The above procedure can help establish an online monitoring system that will provide trucking companies, rail companies and the government with useful feedback on the condition of the freight network. Shifting patterns over time can be identified and corrected before they get out of hand and cause significant safety and efficiency problems. This obviously requires more research, but it is believed that it could potentially provide the framework for an automatic monitoring system of the intermodal activity in the Chicago Area. Since traffic congestion information will also be generated that is of a great interest to the City and State traffic management centers and possibly the general public, effort has to be made to coordinate with these agencies for a possible future research.

# 4-Safety and Operational Analysis on Selected Routes

## 4.1-EXAMPLE EVALUATION AND OPTIMIZATION OF THE SIGNALIZED INTERSECTION OF 47TH AND KEDZIE

Northwestern students performed detailed safety and operational analysis of various intersections identified by the truck drivers in the fall of 1998. Next, the analysis performed by one group of students on the intersection of 47th and Kedzie is included as an example of analysis that needs to be performed for all problematic locations.

First, a representation of the intersection was drawn, indicating the geometry details, the surrounding businesses, and the observed volumes per turning movement.

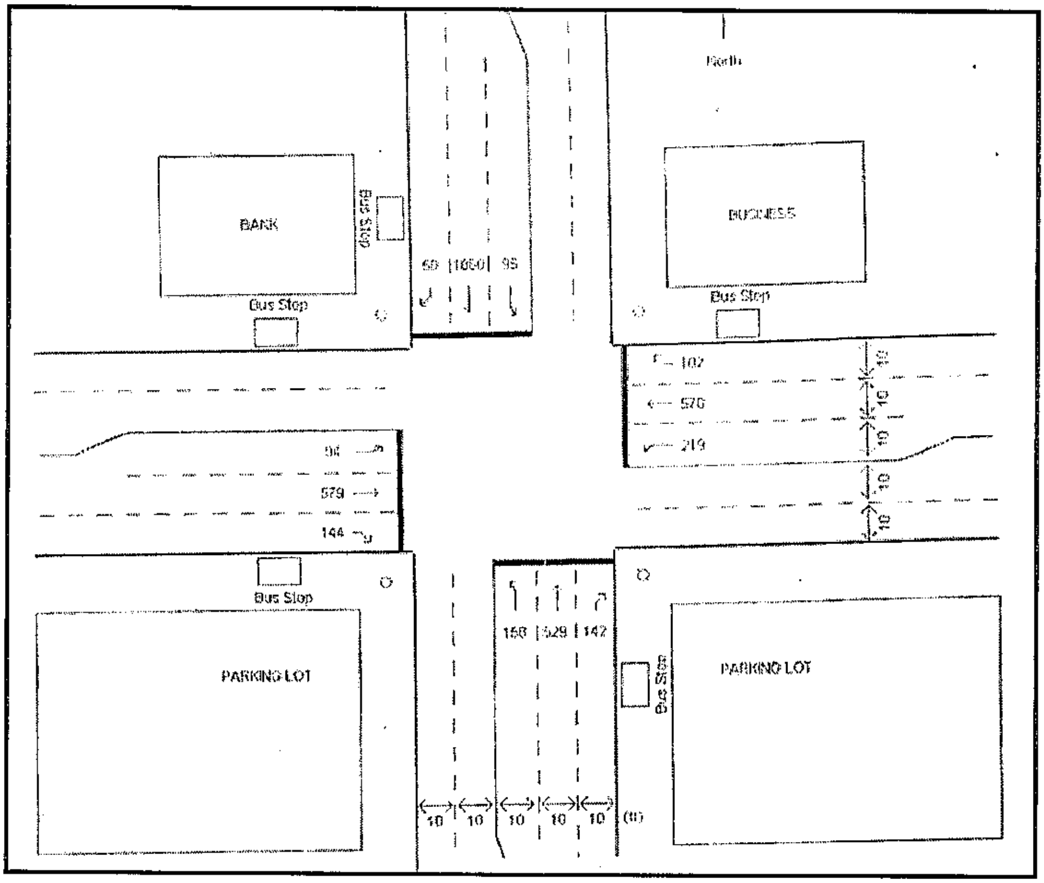



Figure 11: Intersection of 47th and Kedzie Av. (not to scale)

Then the phasing and timing plans of the traffic control devices were collected. All the times are in seconds. The data collection included the counting of the traffic volumes for each approach, and the computation of the Peak Hour Factor (PHF) for each approach. The following tables show the data collected.

Table 11: Current timing and phasing (seconds)

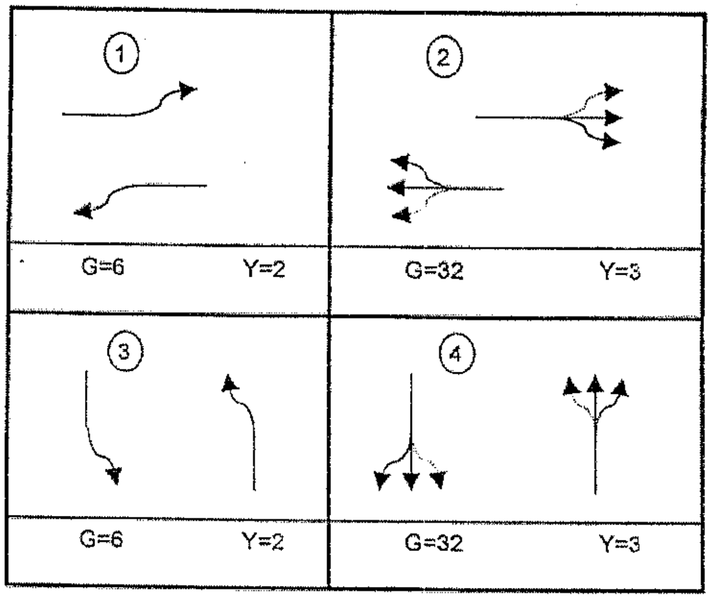



Table 12: Peak hour volumes

| Northbound | Volume Count | % Auto | % HV | PHF | Adjusted Volume |
|---|---|---|---|---|---|
| Thru | 529.0 | 94.6 | 5.4 | 0.97 | 548 (61%) |
| Right | 141.5 | 89.8 | 10.2 | 0.83 | 170 (19%) |
| Left | 158.0 | 80.4 | 19.6 | 0.88 | 180 (20%) |
| Southbound | | | | | |
| Thru | 1080.0 | 97.4 | 2.6 | 0.80 | 1344 (86%) |
| Right | 49.5 | 100.0 | 0.0 | 0.69 | 72 (5%) |
| Left | 94.5 | 92.6 | 7.4 | 0.69 | 136 (9%) |
| Eastbound | | | | | |
| Thru | 549.0 | 93.4 | 6.6 | 0.95 | 580 (67%) |
| Right | 144.0 | 92.0 | 8.0 | 0.80 | 180 (21%) |
| Left | 94.0 | 97.3 | 2.7 | 0.87 | 108 (12%) |
| Westbound | | | | | |
| Thru | 578.0 | 89.2 | 10.8 | 0.93 | 620 (62%) |
| Right | 102.0 | 90.6 | 9.4 | 0.77 | 132 (13%) |
| Left | 218.5 | 95.2 | 4.8 | 0.88 | 248 (25%) |

The intersection was analyzed using two pieces of software: a signal evaluation tool that used to verify whether the timing plan with the current phasing was appropriate. A signal optimization tool was used to produce the best possible timing plan for the prevailing traffic and geometric conditions.

The phasing was found satisfactory for the existing conditions. However, the optimal timing plan and the current one show strong discrepancys.

Table 13: Optimal Phase lengths under current conditions

| MOVEMENTS | TIMING FROM *SOAP* | | TIMING COLLECTED | |
|---|---|---|---|---|
| | GREEN | YELLOW | GREEN | YELLOW |
| NB/SB LEFT | 6.5 | 2 | 5 | 2 |
| NB/SB THRU | 25 | 3 | 32 | 3 |
| EB/WB LEFT | 10.5 | 2 | 5 | 2 |
| EB/WB THRU | 15 | 3 | 32 | 3 |

Table 14: Average delays (sec/veh)

| | Webster's | HCS | Netsim* |
|---|---|---|---|
| *Northbound* | | | |
| thru | 22.7 | 18.8 | |
| right | 21 | 18.8 | |
| left | 41.5 | ### | |
| **average** | **26.1** | **>18.8** | **28.8** |
| *Southbound* | | | |
| thru | 25.7 | ### | |
| right | 20.6 | ### | |
| left | 41.4 | 176.5 | |
| **average** | **26.9** | **<176.5** | **85.7** |
| *Eastbound* | | | |
| thru | 22.8 | 19.6 | |
| right | 21 | 19.6 | |
| left | 41 | 66.9 | |
| **average** | **24.6** | **25.3** | **23.8** |
| *Westbound* | | | |
| thru | 23 | 19.7 | |
| right | 20.8 | 19.7 | |
| left | 41.6 | ### | |
| **average** | **27.4** | **>19.7** | **25.5** |

The current timing plan is not appropriate for the prevailing traffic conditions of this intersection. The east-bound/west-bound through approach is provided with sufficient green time. This could be due to the changing traffic patterns: the current plan might have been adequate a few years ago, but conditions have changed since then.

Table 14 shows the delay one could expect to experience at this kind of intersection, using the Webster's Equation, the Highway Capacity Software (HCS), and a traffic simulator (NETSIM). The results from HCS should be disregarded, because that particular piece of software is not adequate for calculating delays on approaches that are heavily unbalanced. However, it can be seen that the average delays for this approach are quite high, even for the Southbound approach. A 25-second average delay entails a level of service (LOS) D (on a scale from A to F). The LOS is a measure of effectiveness that relates to the volume-over-capacity ratio. The volume-over-capacity ratiofor the SB approach during the peak hour is close to one (LOS F) and the slightest disturbance in the flow of vehicles creates instability that could result in failure of the intersection (vehicles would have to wait for more than one cycle to cross the intersection). Any right turning truck causes such disturbances. Drivers that have to wait longer than one cycle to traverse the intersection tend to be impatient and take risks they would not normally take, such as cutting in front of a truck, or trying to "sneak" between a right turning truck and the curb. These conditions result often in sideswipe and rear-end collisions.

This analysis demonstrates the type of analysis need to be performed at the intersections identified by the drivers. As it can be seen, fairly inexpensive signalization improvements could result in substantial benefits for the trucks and the traveling public.

## 4.2-EXAMPLE ANALYSIS OF THE INTERSECTION AT 47$^{TH}$ AND WESTERN

As explained above, a number of problematic intersections have been identified from the analysis of crash data and the drivers' survey. All these intersection need to be further analyzed to understand the underlying contributing factors to crashes, as well as for identifying countermeasures. In here, only one intersection, that of 47$^{th}$ and Western, was selected for further analysis since there were no resources to repeat it for all intersections. All diagrams and tables are included, for convenience, in Appendix 6.

The analysis of the intersection begins with a condition diagram. It shows the configuration of the intersection, with adjacent stores, parking lots, and bus stops. It is a diamond intersection (two very closely spaced intersections). Western Avenue branches in this part of the city in an Avenue (west branch) and a Boulevard (east branch). The traffic signals and the timing plans are also included as part of the condition diagram. This diagram can be found in Appendix 6.1.

The timing plan is indicated in Appendix 6.2, and the peak-hour volumes at this site are shown in Appendix 6.3. This information indicates how well the traffic signals accommodate the intersection's traffic.

The collision diagrams are also shown in Appendix 6. They are drawn with the information that was made available by the Chicago DOT data. This document was a list of all the crashes that occurred on this particular intersection in 1995, each crash being identified by type of vehicles involved, type of collision and road surface. The Chicago Police Department as discussed earlier in this report later gave this information in a computer file format. A page of the document has been included in Appendix 6.4.

From the volume classification, it can seen that there is a very large number of trucks going through this intersection on 47$^{th}$ street, which agrees with the data collected from the truck drivers.

By examining the collision diagrams, three patterns of crashes are observed:

- Most crashes involving trucks on EB 47$^{th}$ are sideswipes. This is usually due to an inappropriate lane change. It appears that trucks tend to change lane in that area, and, in doing so, they collide with cars. Due to the narrow turning radius the trucks use part of the left lane in their effort to make a right turn.
- A large number of rear-end collisions, concerning cars on Western Avenue north-bound and trucks on 47$^{th}$ west-bound were observed. These type of crashes typically occur when the traffic signals are not well set (lack of all red, or too short yellow interval, resulting in "*dilemma zone*" problems–situations were the driver does not have sufficient time to go through the intersection or stop before it reaches the intersection stop line), the speed is too high, or various inadequate sight distance problems occur.
- Finally, there were a large number of angle collisions between cars on 47$^{th}$ WB and cars on Western NB. This again may be attributed to a short yellow interval, high prevailing speed or limited sight distance.

The contributing factors for the last two observations may be:

1. The yellow interval is not long enough resulting in a "*dilemma zone*", during which drivers cannot either go through the intersection or stop. By the time they make their decision, they are either too far within the intersection and run the light, possibly causing an angle collision, or they have to brake very abruptly, possibly causing a rear end collision.
2. Although the speed limit is 35 mph on this segment of Western Avenue (normal for this type of roadway), it was observed that the prevailing

speed is much higher than that (although no formal speed study was performed).

The first observation has to do with roadway geometry. Indeed, it seems trucks have to change lane, and go from the right lane to the left lane on 47th EB, in order to be able to make the right turn on Western without encroaching into the opposing stream's left turning lane from Western NB to 47th WB.

Recommendations concerning the turning radii of streets for long trucks are provided in: "*A Policy on Geometric Design of Highways and Streets*", 1994, AASHTO. According to this manual, and as seen in the figures in the Appendix, there are two ways to solve this particular problem. The turning radius of the right turn from 47th EB to Western SB and from Western SB to 47th WB could be increased. This is feasible since there is a sufficient right of way on the median between Western Av. and Western Boulevard (though no formal engineering study has been performed at this stage). In addition, simpler measures, such moving the stop line for left turning vehicles further upstream on both Western Av. and 47th can significantly reduce conflicts for right turning trucks.

Summary of recommendations for this intersection:

1. The timing plan should be revised, and the yellow/all red time be increased.
2. The speed on Western NB should be monitored and enforced.
3. The stop lines for left turning vehicles can be moved further upstream.
4. The turning radius should be improved from 47th EB to Western SB and from Western SB to 47th WB.

# 5-Hypothesis testing

The main objective of this research is to identify safety issues caused by the growing intermodal industry in Chicago. This research has provided this research team with a good understanding of the dynamics of truck traffic in the urban network of South Chicago, the crash experience, and possible contributing factors. However, the crash databases do not distinguish between intermodal and other trucks, limiting the options to perform meaningful hypotheses tests on whether intermodal trucks are less or more safe than other trucks.

Given this shortcoming of the existing databases, two ways of obtaining this information were explored:

(i) In coordination with CATS planners and other experts a set of intersections were identified that are heavily used by intermodal trucks and another set of similar in volume and geometry intersections that are used by mostly non-intermodal trucks. Then the hypothesis of whether the crash history between the two sets of intersections are the same was tested. Clearly, given the small number of intersections and the qualitative nature of the information, this result should be used with caution.

(ii) From the SAFER database maintained by the OMC, two sets of trucking companies were identified: one set with companies that are specilizing in intermodal operations and the other set with non-intermodal companies. The hypothesis of whether the crash experience for the two sets is the same of different was tested. Again, these results should be used cautiously because the safety managers' survey indicated that many of the crashes are not DOT reportable and are not included in the SAFER database. In addition, the intermodal trucks tend to travel more on local and arterial streets than the non-intermodal trucks, thus being exposed more to local traffic.

## 5.1-HYPOTHESIS TESTING WITH THE CRASH DATA

One way to analyze the effect of intermodal trucks versus non-intermodal trucks was a simple hypothesis testing involving intersections used by intermodal trucks as opposed to similar ones that are not. With the help of Mr. Gerald Rawlings and Mr. Arthur Nicholas, from CATS, a list of intersections were identified that are heavily used by non-intermodal trucks. The list to intersections was limited to those on which crash data existed from the Chicago DOT database. Specifically, the following intersections were considered:

- $55^{th}$ and Central
- $63^{rd}$ and Central

- 63rd and Cicero
- 43rd and Ashland
- Pershing and Ashland
- 47th and Laramie

The Chicago DOT data were then used to compute the number of crashes that occurred at those intersections for a given year.

The crash counts are as follows: (in 1996, within one block of the intersection)

| | Only cars | Involving trucks/buses |
|---|---|---|
| • 55th and Central | 7 | 0 |
| • 63rd and Central | 9 | 3 |
| • 63rd and Cicero | 35 | 2 |
| • 43rd and Ashland | 13 | 5 |

Next, based on the IDOT data information was obtained on the geometric attributes of the selected intersections. This provided a basis for comparison with the set of intersections used by intermodal trucks. The number of crashes that took place on similar intersections with intermodal traffic was also computed and analysis was performed.

The approach adopted is summarized as follows:

| *Action* | *Database used* |
|---|---|
| 1. Find a set of intersections used primarily by "classic" trucks | |
| 2. Count the number of crashes that took place in those intersections | Chicago Police Department |
| 3. Get the characteristics of the intersection (ADT's, geometry) | IDOT/ CATS (used as a Geographic Information System map) |
| 4. Find other intersections with similar characteristics, and that are used by intermodal trucks (from the surveys) | IDOT/ CATS (used as a Geographic Information System map) |
| 5. Count the number of crashes that occurred in those "intermodal" intersections | Chicago Police Department |
| 6. Compare | |

The characteristics of the four analyzed intersections are as follows:

| 55th and Central | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Central | 55th | central | 55th |
| LNS | 4 | 4 | 4 | 2 |
| LNS_WTH | 10 | 12 | 11 | 12 |
| AADT | 25400 | 16300 | 25400 | 16300 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 25 | 30 | 25 | 30 |
| ID | 6616 | 6896 | 6617 | 6895 |

| 43rd and Ashland | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Ashland | 43rd | Ashland | 43rd |
| LNS | 4 | 4 | 4 | 2 |
| LNS_WTH | 12 | 11 | 12 | 12 |
| AADT | 20800 | 9500 | 20800 | 7300 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 30 | 25 | 35 | 25 |
| ID | 14313 | 10333 | 14314 | 10332 |

| 63rd and Cicero | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Cicero | 63rd | Cicero | 63rd |
| LNS | 6 | 4 | 6 | 4 |
| LNS_WTH | 11 | 11 | 12 | 11 |
| AADT | 52000 | 20300 | 52000 | 20300 |
| HCV (MU_VOL) | 3600(2000) | 0 | 3600(2000) | 0 |
| SP_LIM | 35 | 30 | 35 | 30 |
| ID | 6263 | 10508 | 6264 | 10507 |

| 63rd and central | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Central | 63rd | central | 63rd |
| LNS | 4 | 4 | 2 | 2 |
| LNS_WTH | 11 | 11 | 12 | 12 |
| AADT | 25400 | 18300 | 25400 | 16600 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 25 | 30 | 25 | 30 |
| ID | 6617 | 10506 | 6618 | 10505 |

(1, 2, 3 and 4 are the links north, east, south and west, respectively of the intersection.)

The intersections with intermodal traffic are listed next. Note that intersections such as $26^{th}$ and Archer were discarded, because of its special geometry. The results are as follows:

| 79th and Pulaski | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Pulaski | 79th | Pulaski | 79th |
| LNS | 4 | 6 | 4 | 6 |
| LNS_WTH | 12 | 11 | 12 | 11 |
| AADT | 29300 | 22400 | 27300 | 33300 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 35 | 30 | 35 | 30 |
| ID | 6652 | 10708 | 6654 | 10707 |

| 47th and Kedzie | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Kedzie | 47th | Kedzie | 47th |
| LNS | 2 | 2 | 2 | 2 |
| LNS_WTH | 12 | 12 | 12 | 12 |
| AADT | 21200 | 17900 | 21200 | 17900 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 25 | 35 | 25 | 30 |
| ID | 1785 | 10362 | 13785 | 10361 |

| 26th and Pulaski | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Pulaski | 26th | Pulaski | 26th |
| LNS | 2 | 2 | 2 | 2 |
| LNS_WTH | 12 | 12 | 12 | 12 |
| AADT | 15700 | 13000 | 15700 | 13000 |
| HCV (MU_VOL) | 0 | 0 | 0 | 0 |
| SP_LIM | 30 | 25 | 30 | 25 |
| ID | 13620 | 10170 | 13620 | 10170 |

| 16th and Cicero | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Cicero | 16th | Cicero | 16th |
| LNS | 4 | 2 | 4 | 2 |
| LNS_WTH | 12 | 12 | 12 | 12 |
| AADT | 35800 | 7800 | 35800 | 10000 |
| HCV | 3400 (2100) | 0 | 3400(2100) | 6 |
| SP_LIM | 30 | 25 | 30 | 25 |
| ID | 6229 | 10010 | 6229 | 10010 |

| Orleans and grand | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Orleans | Grand | Orleans | Grand |
| LNS | 2 | 4 | 2 | 4 |
| LNS_WTH | 12 | 11 | 12 | 11 |
| AADT | 19600 | 9700 | 19600 | 9700 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 30 | 30 | 30 | 30 |
| ID | 14693 | 7157 | 14694 | 7158 |

| 31st and California | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | California | 31st | California | 31st |
| LNS | 2 | 2 | 2 | 2 |
| LNS_WTH | 12 | 12 | 12 | 12 |
| AADT | 13300 | 17600 | 14700 | 19000 |
| HCV (MU_VOL) | 0 | 0 | 0 | 0 |
| SP_LIM | 20 | 25 | 25 | 30 |
| ID | | | | |

| 111th and Western | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ROAD_NAME | Western | 111th | Western | 111th |
| LNS | 4 | 4 | 4 | 2 |
| LNS_WTH | 12 | 12 | 12 | 12 |
| AADT | 21100 | 24700 | 21100 | 25400 |
| HCV | 0 | 0 | 0 | 0 |
| SP_LIM | 30 | 30 | 30 | 30 |
| ID | 6767 | 11027 | 6768 | 11026 |

Next, pairs of intersections with similar characteristics were selected. All these intersections have various geometric and traffic characteristics. Therefore, summary characteristics for each one of them were developed, in order to choose pairs that are likely to behave similarly in terms of crashes.

Looking at the ADT per lane, and the ratio of this value between the four different approaches of an intersection, the following groups of similar intersections were identified:

| | |
|---|---|
| 63rd and Cicero | Orleans and Grand<br>16th and Cicero<br>26th and Pulaski |
| 43rd and Ashland | 79th and Pulaski (the ADT/#lanes is 1.5 greater on all approaches for 79th and Pulaski) |

The number of crashes occurred on these "intermodal" intersections were compared to the number of crashes on the "non-intermodal" intersections.

| | Only cars | Involving trucks/buses |
|---|---|---|
| To compare to 63rd and Cicero: | | |
| • Orleans and Grand | 14 | 2 |
| • 16th and Cicero | *no data (in Cicero, IL)* | |
| • 26th and Pulaski | 28 | 1 |
| • 63rd and Cicero | 35 | 2 |
| To compare to 43rd and Ahsland: | | |
| • 79th and Pulaski | 21 | 6 |
| • 43rd and Ashland | 13 | 5 |

As can be seen, this set of intersections is inconclusive. Indeed, there is no trend developing: there are discrepancies within the same group of intersections as well as between groups. Given the sample size and the quality of the data this approach is not likely to produce meaningful comparisons. This type of analysis is also very sensitive, with such small number of crashes, to that very number of crashes. The crash data for this analysis was from the Chicago Police Department Database. This database has a number of columns, three of which are of particular interest for our study. The first one states the street number, the second one the street name, and the third one, a possible avenue intersected by the street. The grid-like plan of Chicago makes finding an address fairly easy, and enables identifying intersections from street numbers. This is not true in this database. For example, 4000W 47$^{th}$ street does not appear to be an intersection with Pulaski, or 3260W 47$^{th}$ street appears to be an intersection with Kedzie (Kedzie is normally 3200W), while several 3200W 47$^{th}$ street addresses are not marked as intersections with Kedzie. This makes the task of finding the number of crashes difficult, error prone and highly sensitive to what is considered an intersection versus a section crash. The intersections above classified to intermodal or non-intermodal based on input from experts. There were no resources to verify or question their judgment; more work needs to be done, however, in this area.

## 5.2-HYPOTHESIS TESTING WITH THE SAFER DATABASE

SAFER (Safety and Fitness Electronic Records System) was deployed in 1997, as an Intelligent Transportation System (ITS) component (funded by ISTEA). In the past, the Office of Motor Carriers (OMC) of the FHWA provided, under the Freedom of Information Act, safety statistics on motor carriers by phone of letter. SAFER provides the same information over the Web, and allows the users to obtain for any given company the number of power units, the number of drivers, roadside inspection data, and crash data. Considering the weakness of our approach described in Section 5.1, a simple hypothesis test was performed on the SAFER database.

From the membership list of the Intermodal Association of Chicago, a series of trucking companies that specialize in intermodal business were selected. Then the database was queried for each one of them and the number of units, percentage of roadside inspections that resulted in equipment Out Of Service (OOS), and the number of crashes (fatal, injury or property damage) was inferred. A number of large non-intermodal companies were also selected and similar analysis was performed. Table 15 lists comparatively the findings of the search.

Table 15. Comparison of crash rates

| | Power units (total) | (Crashes/Unit)*100 [std dev.] | % of OOS inspections [std dev.] |
|---|---|---|---|
| Non-Intermodal | 25,003 | 5.3[3.6] | 16.1[4.6] |
| Intermodal | 4,411 | 11.1[9.2] | 29.3[11.6] |

The total number of units for the intermodal companies is smaller than the non-intermodal ones. Intermodal companies tend to be smaller in size than non-intermodal truckload (TL) and less-than truckload (LTL) companies. Twenty-six companies are represented for the intermodal part and eighteen for the non-intermodal business. Another point worth noting is that the SAFER database does not provide total mileage for the companies, so no adjustments for exposure could be made. While, crashes per unit are used, while a more precise measure would be number of crashes per 100 million Vehicle Miles Driven. However, since VMT is a difficult number to estimate, using crashes per unit is a reasonable measure to use.

The differences between intermodal and non-intermodal trucks are significant. The number of crashes per unit for intermodal trucks is more than double that for non-intermodal trucks. Despite the inaccuracy of the data used, the gap is a definite indicator of significant differences in crash experience. Furthermore, the large value of the standard deviation for this measure indicates that there is a wide range of values, depending upon the company that is operating the truck. This also means that there is a substantial potential for improvements, since certain intermodal companies are doing much better than others. The smaller value of standard deviation for the non-intermodal trucks may also be due to the larger sample size, but there is a definitely narrower range of values. Another measure of safety risk is the percentage of roadside inspections that ended up with equipment Out-Of-Service (OOS). Here again, the percentage for intermodal trucks is almost twice as much as the one for the non-intermodal trucks. The standard deviations are low, indicating a consistent set of values. This measure indicates the condition of the equipment alone, while the crash measure also allows insights into the behavioral part of the trip. This is also of some concern, because it may indicate that intermodal equipment is not as well maintained as non-intermodal equipment. This confirms cases documented in the literature that intermodal equipment is a contributing factor in safety problems.

## 5.3 CONCLUSIONS

Analysis is often based upon expert knowledge (from CATS, the truck drivers, trucking companies, the police) of where the intermodal trucks are, and what is their impact on roadway safety. There is no database to the best of our knowledge that classifies trucks into intermodal or not, and as stated before, the police reports do not include specific entries for intermodal trucks. Given the above limitations, it is cleat that the analysis performed in this section is probably the only way to obtain some insights on the differences in safety experience between intermodal and non-intermodal trucks.

To summarize, the results point in two directions: First, an average intermodal truck appears to have been involved in more crashes than a non-intermodal truck. Second, the standard deviation of those crashes is much higher, which indicates that there is a lot of room for improvement, since certain intermodal companies are doing much better even than many non-intermodal companies. This necessitates additional research to understand what makes one company "safer" than another one and how experience can be transferred from one company to another.

# 6-Overview of Selected Intermodal Facilities

## 6.1-INFORMATION ON SELECTED YARDS

A good source of information on intermodal facilities is the CATS report titled "Proposed Intermodal Connectors to the National Highway System for Northeastern Illinois", Version 3, June 1999. The following information is partly extracted from the aforementioned report, while additional data were collected during a visit at the sites. The yard number corresponds to the number on the map with the intermodal yards in Chicago (Appendix 1). Schematics of the yards are included in Appendix 7. This part of the research was performed in response to Task D of the proposal:

> *"Perform visual observations and assessment to identify potential traffic safety issues at a minimum of six intermodal facilities. Observations shall be made over a minimum period of one week at each site, scheduled to assess potential safety issues related to daily and hourly traffic variations."*

LOCATION: Corwith Yard
OPERATOR: BURLINGTON NORTHERN/SANTA FE (BNSF)
Statistics (1998): Lifts: 720,400
TEUs: 1,368,000
Truck Volumes: 1039 each way/daily
Corwith yard handles more TEU volume, annually, than any location in the country, with the exception of three major tidewater ports. Periodic expansion consists of remodeling parts (such as 19 acres made into a JB Hunt terminal); and adding contiguous acreage (such as the 17 acres purchased at the corner of Kedzie and 39$^{th}$). Capacity is so constrained, especially for grounded loads, that the BNSF has contracted with the Canadian National Railway for the use of the Railport yard on 43$^{rd}$ street as an "outlier"; BNSF is operating the Railport acreage as an integral part of Corwith. BSNF employs a small coterie of drayage operators to reposition serviceable empties from Corwith to Railport, which adds to the amount of truck movements.

The main entrance to the yard is on Kedzie Av. and 41$^{st}$ Str. A smaller gate on 47$^{th}$ is reserved for JB Hunt. On the order of 600 trucks ddaily each direction use Corwith via Kedzie. The exit from Stevenson Expressway (I-55) Kedzie has an eastbound on-ramp and a westbound off-ramp. Westbound access to I-55 and eastbound Stevenson Expressway (I-55) is accomplished using the ramps at California, 0.5 miles east of Kedzie. While the level of traffic on Kedzie is fairly high, the traffic in the vicinity of the yard appears to be reasonable. The entrance to yard has a satisfactory geometry (turning radius and sight distance), and the traffic signals appropriately located and operated. Major problems, however, are caused by this traffic at the intersection of Kedzie and 47th which is used from trucks destined south, southeast and southwest of the yard. Truck drivers also stated that 47th is used as an alternate to Stevenson Expressway (I-55) during peak hours for accessing Dan Ryan Expressway (I-90/94) and Stevenson Expressway (I-55) Westbound as well as the 47th yard and Railport.

A schematic of the yard is included in Appendix 7.

Photographs from the yard appear in the next section of this Chapter.

LOCATION: 47th Street Yard (formerly Conrail, until June 1st 1999)
OPERATOR: Norfolk Southern(NS)
Statistics (1998): Lifts: 450,000
TEUs: 855,000
Truck Volumes: 649 each way/daily

The access to the yard is from 51st street and an exit at 47th street. There is no traffic light now at the entrance, which causes some problems with trucks moving WB on 51st and attempting to turn left to the gate of the yard. In addition, the geometry of 51st under the viaducts in the vicinity of the entrance, limits the visibility of the oncoming traffic, which raises safety concerns.

Figure 12. Activity outside NS 47th street yard

The safety records from obtained from the City does not appear, however, to present major safety concerns. No other major problems were observed. CATS indicated that a major re-engineering effort is planned by Metra that owns tracks that bisect 47th street and NS that owns an adjacent property, which could be integrated with the existing facility. The photographs below provide a view of 51st street just under the tracks outside the gate of the yard. In the second photograph, a truck exiting the yard attempts to make a left turn, westbound 51st Street.

LOCATION: GLOBAL I YARD
OPERATOR: UNION PACIFIC RAILROAD
Statistics (1998): Lifts: 350,000
TEUs: 700,000
Truck Volumes: 505 each way/daily

Entrance to the yard is from Western Avenue and exit to Ashland via 15th street. 15th street has adequate geometry to accommodate the truck traffic, though the pavement is in a very poor condition (see Photograph below). Ashland Avenue is high volume arterial but with sufficient geometry to accommodate the traffic from the yard. Ashland Avenue provides access to both Eisenhower Expressway (I-290) and Stevenson Expressway (I-55) with sufficient geometry and viaduct clearance. The photograph provides a view of the exit gate on 15th Street.

Figure 13. GLOBAL I exit gate on 15th Street

LOCATION: RAILPORT YARD
OPERATOR: CANADIAN NATIONAL(CN)/BURLINGTON NORTHERN/SANTA FE (BNSF)
Statistics (1998): Lifts: N/A
TEUs: 95,000
Truck Volumes: 260 each way/daily

The entrance/exit gate of the yard is located on 43rd street. No lifts are performed at this yard but the rail connection is in place, which means the facility is still viable as intermodal facility. It is mostly used to reposition servicable empties from Corwith. The traffic was fairly light during the site visit and no problems were observed. 43rd is a low traffic street with adequate geometry. The pavement is in fairly poor condition. The traffic to the yard though does not seem to create or experience problems around the gate, it encounters problems on Western and 47th as well as on Ashland Avenue. The photograph below provides a view of the gate traffic on 43rd Street.

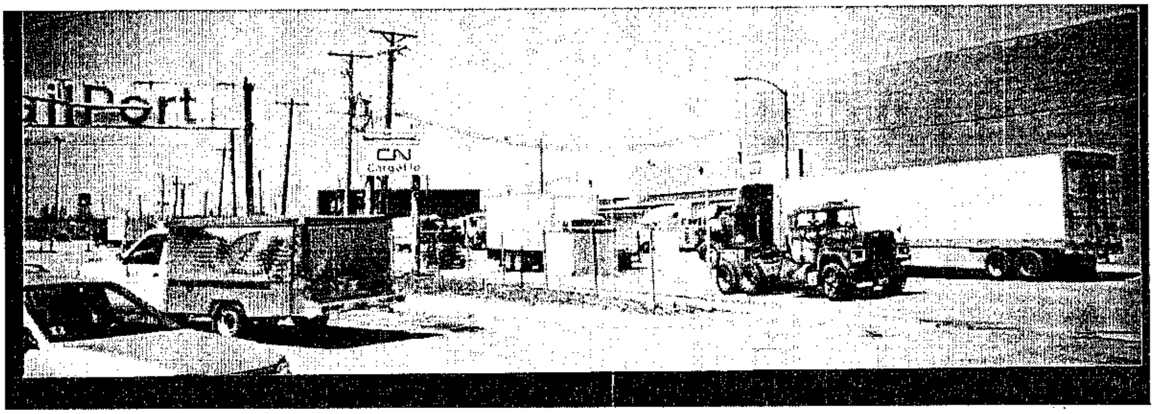


Figure 14. Activity at the gate of Railport

LOCATION: 63rd STREET YARD
OPERATOR: CSXI until June 2002 then NORFOLK SOUTHERN
Statistics (1998): Lifts: 450,000
TEUs: 855,000
Truck Volumes: 650 each way/daily

The entrance/exit to the yard is located on 63rd street , while a second access gate is located on 59th. The main access to Dan Ryan Expressway (I-90/I-94) is via 63rd street. While the geometry and traffic on 63rd do not appear to be problematic, long lines were observed queuing up in front of the gate on 63rd. These lines occasionally spill back to the freeway, which raises safety concerns. The photograph below provides a view of the line of trucks queued outside the gate on 63rd Street.

LOCATION: 59th STREET YARD
OPERATOR: CSX INTERMODAL
Statistics (1998): Lifts: 165,000
TEUs: 297,000
Truck Volumes: 238 each way/daily

The present volume is about 4 trains a day with a capacity up to 7. The entrance is on 59th Street. A proposed connector to Western will certainly impove access to the National Highway System, though no serious problems appear around the gate. The access to Dan Ryan Expressway (I-90/94) does not appear to have major problems either.

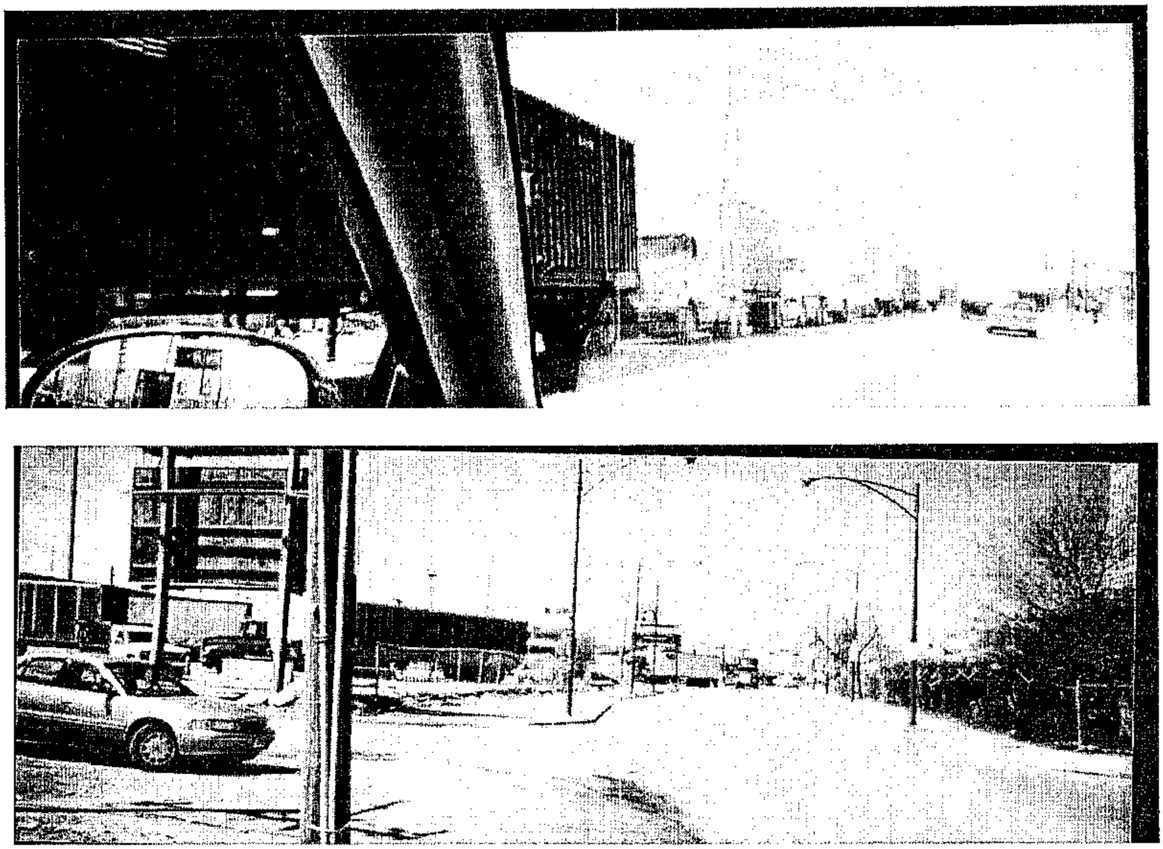


Figure 15. Lines of trucks outside the 63rd street yard

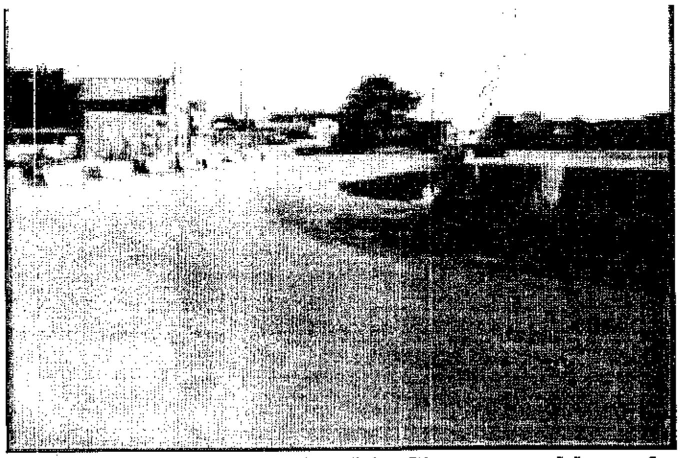
## 6.2-TRANSCRIPT OF A VIDEOTAPE OF CERTAIN LOCATIONS OF INTEREST

As it can be inferred from the previous section, not many problems appear to exist outside the yards but quite a few problems on sections and intersections in the city, between yards. On various occasions, it was observed that the yard gates are not the bottlenecks we expected them to be. If there was a problem, as it may happen at peak hours at certain yards, the improvements would usually be much easier to perform on the yards' property than on arterial streets. If there is a problem outside a yard's gate, the best way to solve it would be to build longer ramps on the yard's property, a decision that can be made by the rail company, since the property belongs to them.

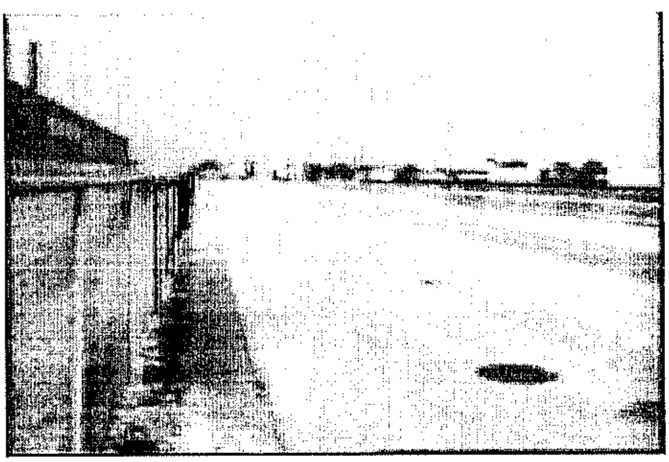
However, the problem of congestion at intersections is much more widespread and complicated to solve. On a drayage trip, a truck will leave a yard, go across town through busy streets, and deliver the container to another yard. In the case of Chicago, the majority of drayage trips go through the South Side, as identified by the survey of truck drivers, the safety managers survey, the Police and IDOT data, and visual observations.


First, trucks get into the entrance ramp on Cicero Avenue, southbound

The ramp is large enough to accommodate any type of truck, such as this 53 footer

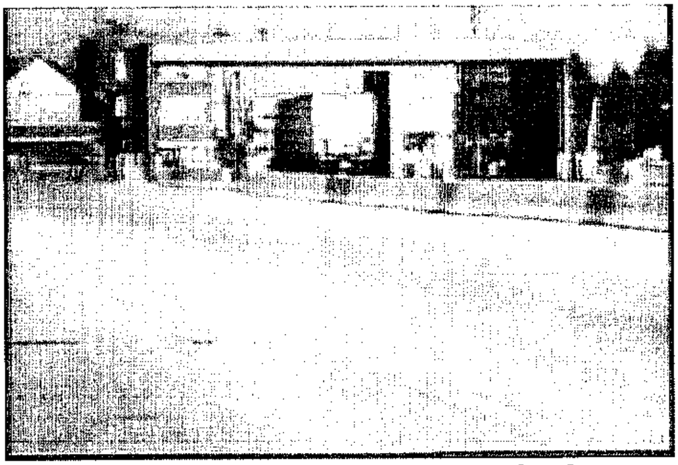


They can also enter by this Cicero northbound ramp

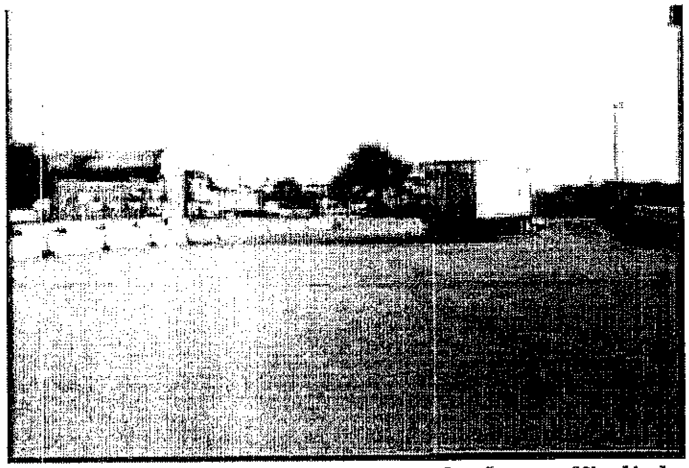


They then go through that long (about a quarter of a mile) road towards the primary entrance gates

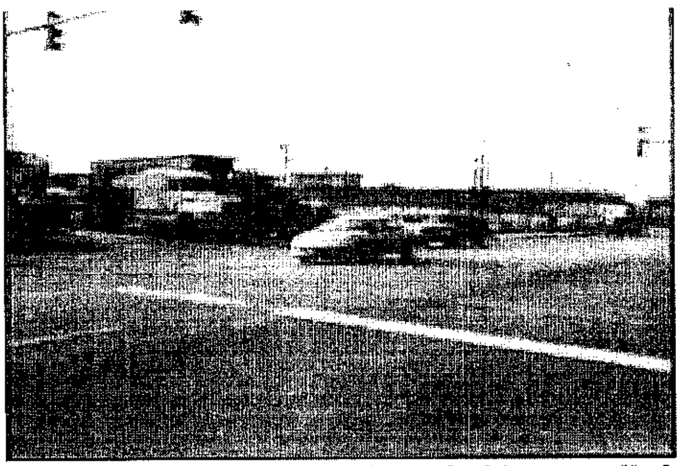
They check in at those gates and proceed further into the yard to check at the second entrance gate, where cargo is assigned



*When trucks leave the facility, they take the same long road towards the check out gates*



*They take that exit ramp towards the traffic light at the limit of the property*

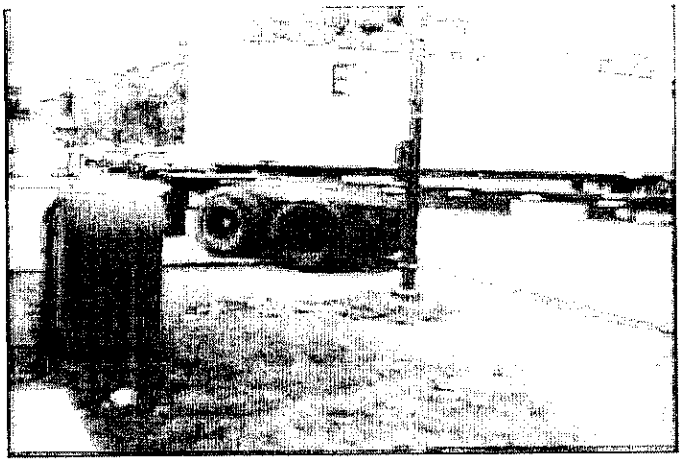


*And they leave on Cicero through this controlled intersection*

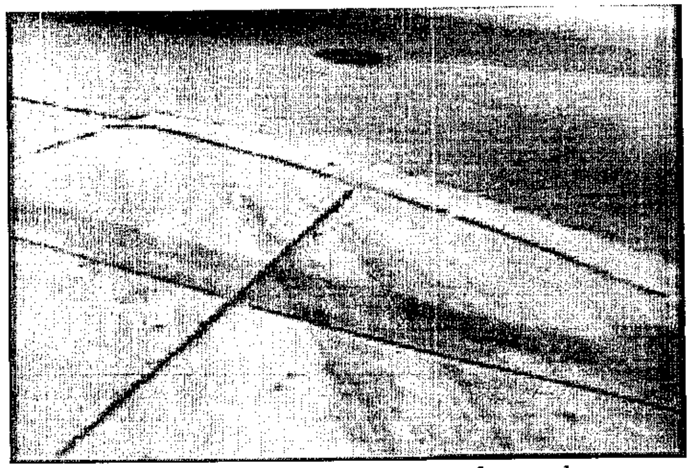
*The disruption of the car traffic is minimal*

Figure 16. Pictures from Corwith BNSF Terminal

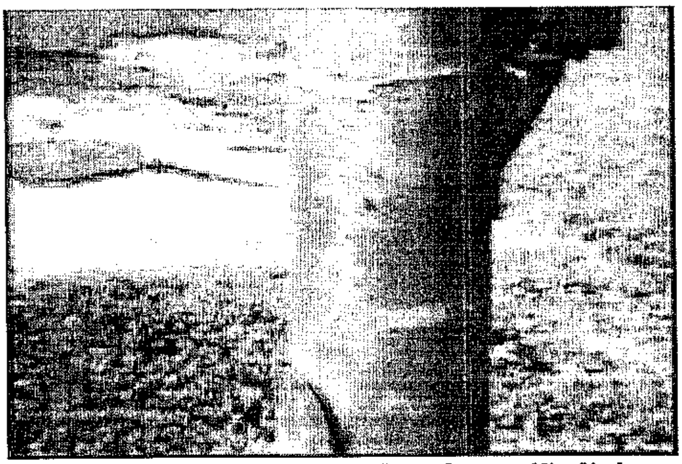
Most right turns in that area are too narrow to accommodate 53 footers, and the situation is bound to get worse, for the length of the trailers might increase, as well as the truck traffic itself. In addition, areas around yards are usually not very populated, whereas intersections inside the city are often residential and business streets, with often a high pedestrian traffic. The tape shot outside Corwith and at 47th and Western illustrates this discrepancy between yards and urban intersections. The still frames presented here are extracted from the video. The quality of the images is the best achievable, but the details are obviously better viewable on the video itself.



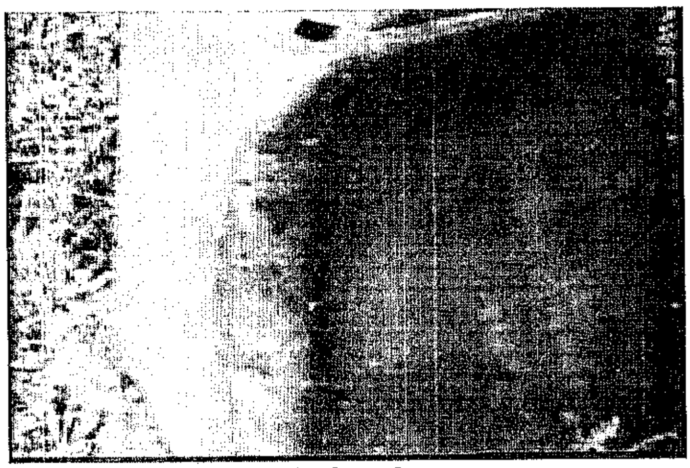
*Narrow right turns result in pedestrian safety hazards, as trucks drive over the curb*



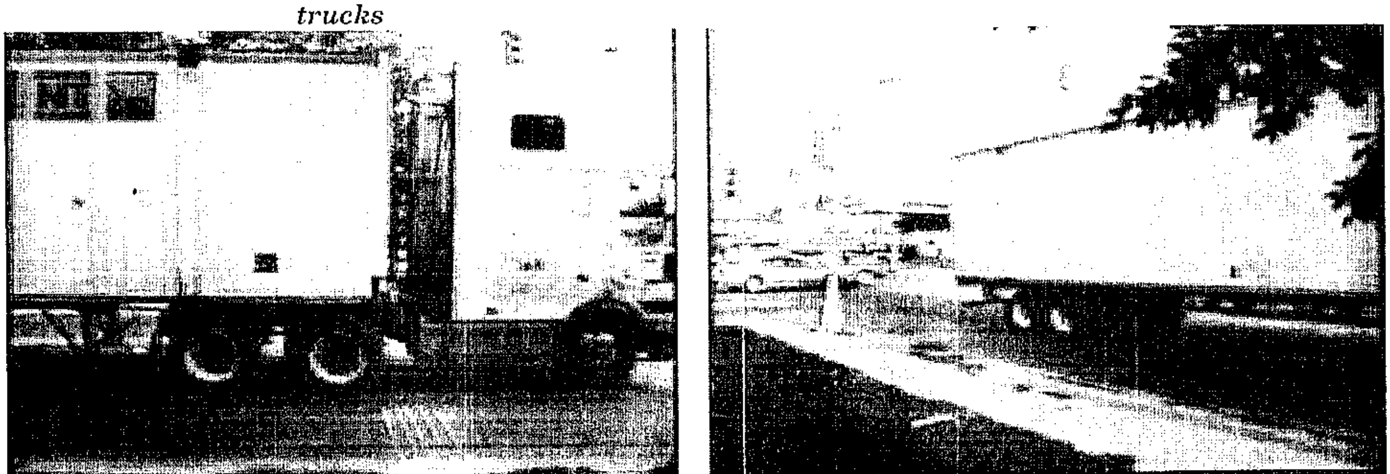
*This trace shows how far onto the curb some trucks go*



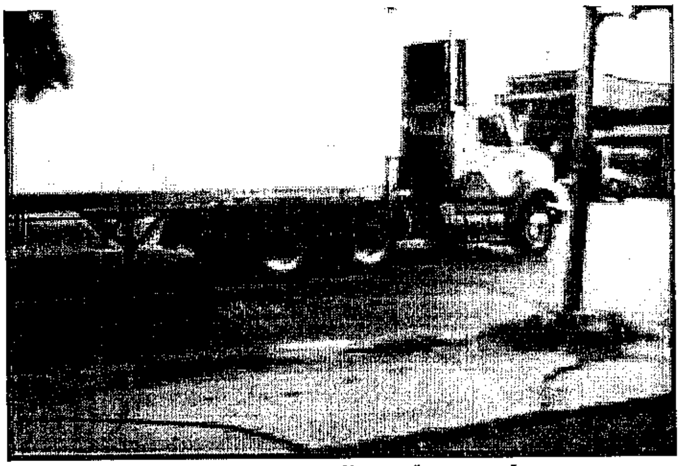
*Another consequence is that the traffic light poles are severely scratched by the bodies of the trucks*



*Scratched and torn...*

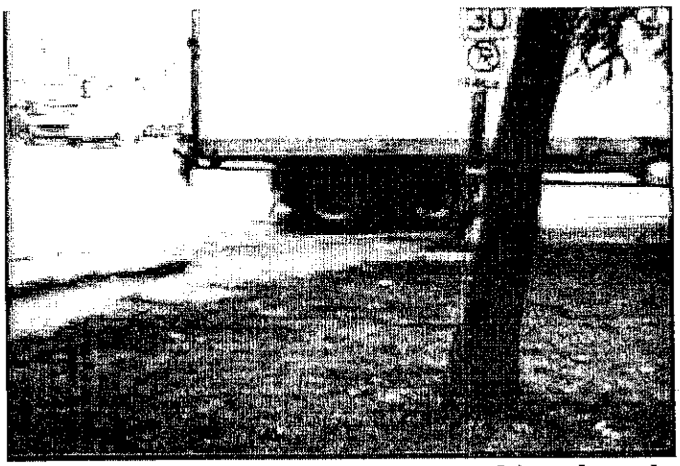


*Western has a parkway in the middle, and the space between Western Avenue and Western Boulevard is just enough to accommodate this 53 footer. This creates great rear side collision risks, for cars behind the truck don't necessarily see the truck is blocked at the second lights*



*A right turn sequence: first the truck goes onto the left lane (loss of capacity on the link)*

*It starts the turn, and sometimes sideswipes a car that would sneak in*



*And finally finishes the turn, scratching the pole*

*Another aspect is the hazard created by the left turning bay: The car here will have to back up*

*Indeed, if it remained there...*

*...it would be crushed! This creates a long delay in the turn, and sometimes a collision*

Figure 17. Pictures from Intersection of $47^{th}$ Street and Western Avenue

*Insights gained from the site visits and observations*

Cortwith was selected for videotaping, a yard operated by BNSF (see Section 6.1). This yard went through renovations recently and clearly, the geometric configuration of the driveways in and out the yard are properly designed.

This video simply demonstrates that the situation outside a yard could be "remedied" much easier than somewhere inside the City. A yard is typically a fairly large property, and room can always be made to accommodate for long entrance driveways. Besides, there an entiry (the yard management) that can advocate and undertake improvements if conditions deteriorate. This is not the case at intersections inside the city. On the streets, in general, the situation is more complicated: The entities that would bear the cost for any possible improvement (IDOT or Chicago DOT) need to go through a much more complicated justification process to implement the improvements. In addition, there is no sufficient right-of-way in most cases. The possibilities for improvement are much more limited than on an intermodal yard.

Further, the possibility for improvement of the intersection of 47th street on Western Avenue was considered; such improvements are easier to make because of the empty space between Western Avenue and Western Boulevard. However, certain obstructions hard to remove are located close to the intersection, as well as the sidewalks, which are narrow and they cannot be further reduced. Improving the geometry of such an intersection may mean tearing down buildings or other solutions very hard to implement.

# 7-Mathematical Model

One of the objectives of this study is to identify possible improvements in geometry and control of roadways that will improve the safety and efficiency of intermodal trucks. Certain locations are obvious problematic points and warrant improvements; these locations have been in the past identified by inspection and improvements have been suggested or implemented (21). These improvements are typically connectors from the yards to the national highway system and they are obvious solutions, since terminal yards are the main production and attraction points. It is much harder, however, to identify and improve locations inside the city, where in fact the problems are even more severe, as many street segments and intersections between yards are the main facilities through which trucks move between yards. For example, it is rather obvious to make improvements outside BNSF's Corwith yard, but much harder to identify (and possibly justify) making improvements at the intersections of Western and 47th or on Kedzie and 47th intersections used by trucks moving between Corwith, 47th yard, Landers or 63rd yard. In Sections 3.1 and 3.2, a list of problematic locations were identified by truck drivers and safety managers, that include mostly intersections with insufficient turning radii, low viaducts and congested sections and intersections. It is not clear, however, what will happen if these facilities were improved. Specifically, if an intersection is improved to accommodate a 53-foot container truck (such as 47th and Western), the following may happen:

i. Trucks that were not using this particular intersection because of its insufficient geometry may now use it. This could in turn result in: (a) increased truck traffic at this location resulting in excessive volumes and possible higher crash rates, (b) trucks that diverted to this facility may actually drive longer routes, resulting in net increase in vehicle-miles traveled.

ii. Once this bottleneck is removed, another one may appear downstream of this location, where conditions may get even worse due to the increased volumes leading to more safety and operational problems.

iii. Passenger vehicles may be discouraged to use this particular location due to the increase truck traffic and use other less suitable roadways, including residential streets, which could create a different set of safety and congestion problems elsewhere.

iv. Finally, conditions may actually be improved in alternative, "unsuspected" facilities, which trucks were diverted from.

There is a need for quantitative tools that will help engineers and planners to identify a set of improvements that will result in system-wide benefits. There are no such tools commercially available, but there are research models available that could be used for these applications. In the last decade, with the evolution of ITS, FHWA has been funding a series of research efforts aiming to produce such tools. Northwestern University has access to these tools and it has the necessary expertise to customize them for this particular application and make them available to the various agencies.

The possibility of using an approach developed by Northwestern University, University of Texas and others, to model the truck traffic activities in the Chicago area and develop infrastructure improvement policies was investigated. The model consists of a traffic simulator (ROUTESIM) and optimization routing algorithms bundled into a system known as a Dynamic Traffic Assignment Model. This tool is able to model the routing behavior of trucks and passenger vehicles and the impact of changes in the infrastructure and demand (both trucks and passenger vehicles) on the overall system performance. This model was recently coded in a software package (called VISTA) that includes some basic graphic user interfaces and reporting capabilities. The Chicago network (especially the south part of the city) can be coded and mapped as well as the demand and infrastructure data on the network. This software will be useful to CATS planners, City of Chicago and IDOT Engineers in investigating "what-if" scenarios and as a decision aid tool for developing infrastructure improvement policies.

There are numerous challenges associated with such an undertaking:
1. Data requirements.
2. Modeling and algorithmic changes so that a network as large as Chicago's can be modeled with the necessary accuracy (and run in a reasonable time).
3. User friendly interfaces for operation, data input, and reporting.
4. Personnel training so that the model can be usable in the future.

While this research is large scale and beyond the scope of this study to be fully completed, the first step was taken of an incremental approach that is currently continuing with a seed grant from the Infrastructure Technology Institute, (and matched by University of Illinois at Chicago), to do the following:

1. Investigate the challenges and develop the exact functional requirements for the ultimate model.
2. Build a prototype with some functionality and data requirements to demonstrate the potential benefits of such a model.

The main challenges are mapping the infrastructure and demand. The CATS databases will be used to model the main network attributes and demand. This data may not include detailed representation of intersection geometry and signalization, but it does include the network topology, lane information and demand data, so that some functionality can be demonstrated.

The other challenges include algorithmic difficulties associated with modeling intersection movement delays in the routing choice of the drivers, capturing the behavior of both trucks and passenger vehicles and finally in integrating these components in a model that can run in a reasonable time. These difficulties can also be addressed by the ongoing project funded by ITI.

The structure of the mathematical model that will be used as an evaluation tool is outlined in Figure 12.

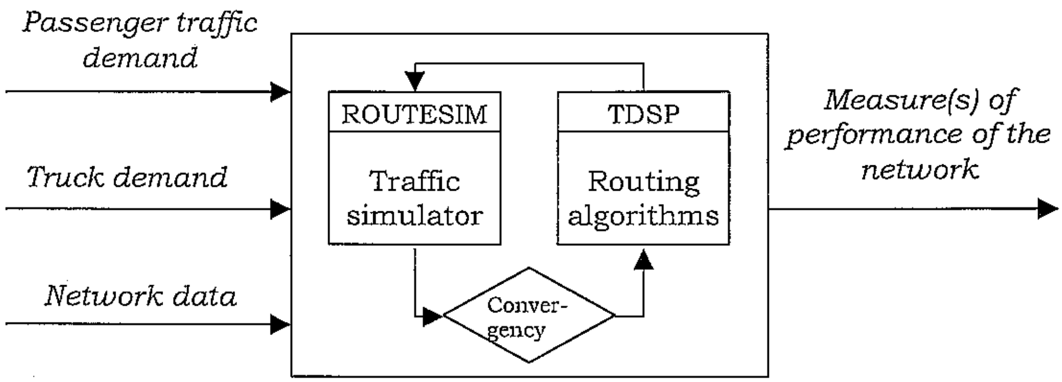



**Figure 18: Structure of the Multi-User Simulator**

In Figure 18 the input data include traffic demand, truck demand and network infrastructure data. Based on these inputs the routing algorithms compute the routing preferences of the drivers that, in turn, are fed into the simulator. The simulator computes the delays at the roadways and intersections and feeds them back to the routing algorithm for verification. If the routes change from the previous iteration another run is performed. The model converges when all drivers use their best path between their desired origin/destination. The model outputs system-wide as well as intersection-specific measures of performance. This allows testing several design scenarios and choosing the best one.

# 8 Conclusions and Recommendations

The objective of this study was to identify safety and efficiency issues related to the intermodal truck movements in the Chicago area. This objective was met and exceeded in some regards, while fell short in others. The literature was comprehensively reviewed and all possible sources of information were identified, so that a clear and objective assessment of what is the status of the intermodal industry in Chicago can be provided, as well as the problems they face and the problems they are creating. It was not possible to get complete access to all databases, or conclusively answer questions, such as "Are intermodal trucks less safe than the non-intermodal trucks." However, the reasons for that were identified and recommendations for remedying this shortcoming were provided. The requirements of this study were exceeded by investigating sources of potential information not considered before (AVL, yard gate information) as well as the development of innovative tools that can help engineers and planners to objectively evaluate future improvements on the street network. In addition, the global view was taken of looking at the problem at the system level. truck drivers were surveyed in a cost effective way and obtained both insights and objective data. Also, in the course of this research communication was established with all involved stakeholders (trucking companies, drivers, ITA, CATS, rail companies, the police) who helped the team understand the problem better from their perspectives. In this section, the findings of this research are again outlined with emphasis on the implementable recommendations.

*Regulatory Measures and Possible Implications*

Some of the safety problems could be resolved by implementing restrictions and regulations that will limit the movements of the trucks to certain facilities. The implications of such measures, however, would be questionable at best. If the City decides to restrict trucks from certain routes, the positive impact could be reduction of truck related crash to those routes. If it is assumed, however, that the demand stays the same, these trucks will most probably use other routes to get to their destination. Any restriction is bound to increase the vehicle miles traveled, because trucks will have to use alternate routes, obviously longer than the previous ones. This, in turn, will create more problems elsewhere. In addition, any restrictions and regulations will most likely impact the demand side of the problem. The intermodal industry is an extremely competitive business: any increase to the cost of moving a container from one yard to the next will be passed to the shippers who in turn may decide to use other routes to ship their goods (not through Chicago). This could have serious economic implications for the area.

However, there are safety improvements that can also facilitate productivity, such as improving sections and intersections and making them favorable to the truck drivers. In other words, instead of restricting access to a certain street, one could make another street more desirable to drive therefore having drivers switch there, because it will be more efficient for them. Identifying, however, where to restrict and where to improve on a street network of the size of Chicago is very complicated and quantitative tools are needed to help engineers play with "what-if" scenarios and evaluate impacts of solutions before they implement them.

One area that should to be considered for regulation and enforcement is the inspection of intermodal equipment BEFORE it exits the yard. The walk-around inspection performed by drivers is not sufficient (as indicated by the drivers themselves). If the cargo inside the container has been displaced (in the various lifts), it is possible that it has shifted the gravity center to the side of the trailer creating potentially a safety hazard. Effective procedures should designed so that intermodal equipment are inspected by qualified personnel that can perform on-site check-over and repairs as well as take the responsibility for the condition of the equipment, before they are delivered to the drivers.

### *Planning, Institutional and Engineering*

This study was a one-time snapshot study. It revealed some of the problems related to this industry *now* based mostly on data collected 0-3 years ago. This is the wrong approach to solving this type of problems, since it only reacts to something that happened in the past. What is needed is a monitoring mechanism that allows agencies (and companies) to proactively respond to these problems. Fortunately, the technology and capabilities are there: yard gate information can be monitored on a regular basis to identify the total demand at the various yards. The AVL data can provide routes and shifting patterns, as well as congestion information. Crash data can be continuously obtained to provide safety information at the various facilities. This is all the information one needs to evaluate the conditions and make decisions on countermeasures. Unfortunately, there are numerous institutional issues that need to be overcome before this could be implemented. The rail and trucking companies need to have guaranties that the information provided would be protected. The local and state government need to update the way crashes are collected and reported, as well resolve institutional and jurisdictional issues inside their organizations. Certainly, simple changes to the crash report should be done so that one can tell if a truck involved in a crash is intermodal or not.

Coordination with the rail companies can help identify train schedules (arrivals and cut-off times) that will not induce truck traffic on the streets during the peak hour, without being financially harmful for the railroads. The Intermodal Advisory Task Force organized by CATS would be the ideal forum for discussing an initiative like this.

The Safety Managers committee at ITA needs to be enhanced. Companies need to encourage their safety managers to participate and the government needs to include them in the decision making process. It was found that the safety managers are one of the most knowledgeable groups of professionals on safety issues related to intermodal operations. Technology and experience needs to be transferred among companies. This study indicated that there is high variance on crash experience and safety practices among companies, which means that some of them are doing very well, while others very poorly. This gap needs to close, moving the average towards safer practices.

The crash databases maintained by the agencies tend to be fragmented, incomplete and fairly old. No proactive policy can be developed based on them. A fair amount of time was spent simply integrating databases for the Chicago area. Certain streets are state routes and data are maintained by IDOT, while for municipal streets the City maintains crash data. While the engineers and planners at IDOT and the City were very helpful with providing access to the data, institutional changes need to be made so that more accurate and timely data are available to researchers and practitioners in the future.

The SAFER database maintained by the Office of Motor Carriers (OMC) is a very useful resource but needs to be updated more often, as well as include information on exposure (e.g. vehicle miles traveled) and the non-DOT reportable crashes.

A list of problematic locations was identified by truck drivers and safety managers that include mostly intersections with insufficient turning radii, low viaducts and congested sections and intersections. As repeatedly stated in this report, it is not clear what will happen if these facilities were improved. There is a need for quantitative tools that will help engineers and planners to identify a set of improvements that will result in system-wide benefits. There are no such tools commercially available, but there are research models available that could be used for these applications. Some of the simple signalization and delineation projects could be done inexpensively. An engineering firm needs to be contracted to comprehensively perform engineering studies at all these sections and intersections and make suggestions for improvements at the particular locations. The impact of any combination of these improvements on the overall system needs to be performed, though, before any isolated improvement is implemented.

Finally, all stakeholders need to included and engaged in any improvements or changes in the systems. As it was noted before, no database or model can replace the collective knowledge people involved in the intermodal business have in this area. People from CATS, ITA, rail companies, trucking companies intermodal equipment companies, City and IDOT need to be interacting on a regular basis and information needs to be exchanged. Forums such as the Intermodal Advisory Task Force organized by CATS as well as the various committees by ITA should be further encouraged and strengthened.

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# 10-Appendices

APPENDIX 1-MAP OF CHICAGO'S INTERMODAL FACILITIES
APPENDIX 2-TRUCK DRIVER'S SURVEY
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- 6.6-CRASHES INVOLVING TRUCKS
- 6.7-AASHTO GEOMETRIC RECOMMENDATIONS
- 6.8-AASHTO GEOMETRIC RECOMMENDATIONS (CTD.)
- 6.9-RECOMMENDED MODIFICATIONS

APPENDIX 7-SCHEMATICS OF SELECTED YARDS
APPENDIX 8-EXAMPLE OF AVL DATA

# Appendix 1-Map of Chicago's intermodal facilities

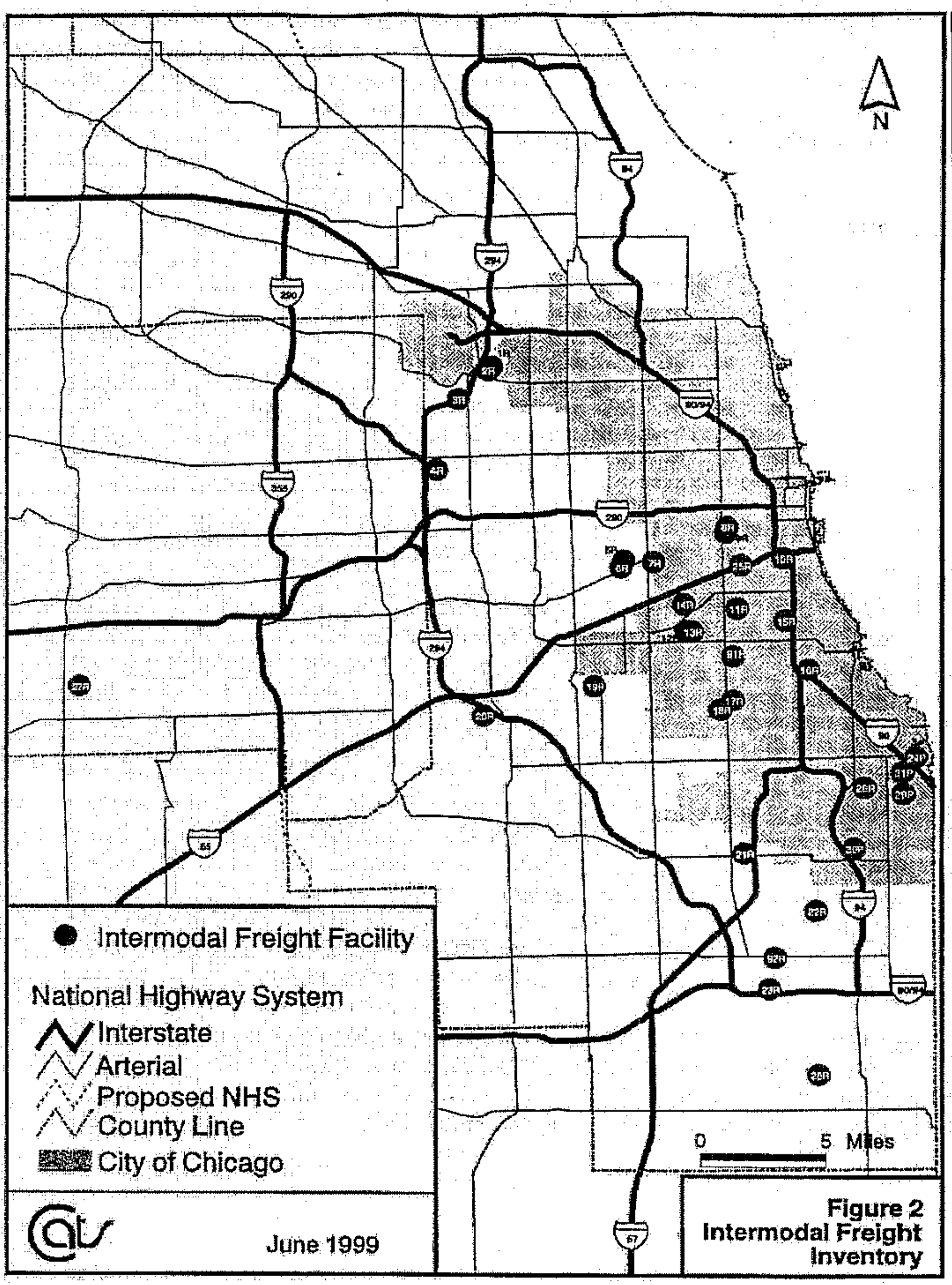



**Figure 2 Intermodal Freight Inventory**

| | |
|---|---|
| 1R | Schiller Park East |
| 2R | Schiller Park West |
| 3R | Bensenville |
| 4R | Global Two |
| 5R | Cicero 26th St. |
| 6R | Cicero Ogden |
| 7R | Cicero/CCP |
| 8R | Global One |
| 9R | Western Ave. |
| 10R | 26th St. Yard |
| 11R | Railport |
| 12R | Bulk Lumber |
| 13R | Bulk Paper |
| 14R | Corwith |
| 15R | 47th St. Yard |
| 16R | 63rd St. Yard |
| 17R | Forest Hill |
| 18R | Landers |
| 19R | Bedford Park |
| 20R | Willow Springs |
| 21R | Iowa Interstate |
| 22R | Yard Center |
| 23R | Moyers International |
| 24P | Federal Marine |
| 25R | IMX |
| 26R | Triple Crown Terminal |
| 27R | Auto-Transload |
| 28R | Auto-Transload |
| 29P | Water Terminal Cluster 1 |
| 30P | Water Terminal Cluster 2 |
| 31P | Water Terminal Cluster 3 |
| 91R | CSXI 59th Street |
| 92R | CN Gateway |

# Appendix 2-Truck Drivers Survey

## SURVEY

Development of Information on Intermodal Safety Issues in Illinois

(This study is conducted by Northwestern University to help the intermodal trucking industry in **improving efficiency and safety.** The identity of the drivers involved in this survey will be kept **anonymous**)

1. Origin? ______________________ Address: ______________________
   Destination? ______________________ Address: ______________________
   Departure Time ______________________ Arrival Time ______________________

2. Cross town Local Delivery Regional

3. Which route did you take? (Please give detailed direction along the route)

______________________________________________
______________________________________________
______________________________________________
______________________________________________

4. What are the most problematic points on your current route, reason, and suggested improvement?

| Location | Reason | Suggested Improvement |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

5. Is there another route you want to pick as your 1st choice, but there are some restrictions (regulations, low vertical clearance, small turning radius, school zone ect.) that prevent you from doing it?
   No, my first route is the best *Go to question 8*
   Yes, there is another route that I would like to pick as my 1st choice

*Please give detailed direction along this route*

______________________________________________
______________________________________________
______________________________________________

6. What are the restrictions that prevent you from picking the route in question 5 as your 1st choice? And your suggested improvement?

| Location, and type of restriction | Suggested Improvement |
|---|---|
| | |
| | |
| | |
| | |
| | |

7. Rate the intermodal equipments used in this trip (0=inoperable, 10=exellent) ______________
   Reasons ______________________________________________

8. Type of intermodal equipments, and dimensions? ______________________

9. How was the service at the yard (0=Bad, 10=exellent) ______________________
   Explain ______________________________________________

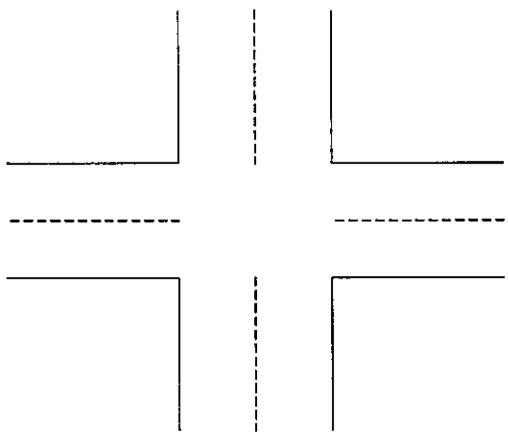
## Miscellaneous

1. In general, for this type of operation, list 3 or more improvements to make your trip more efficient, and safe?

| Location | Suggested Improvement |
| --- | --- |
| | |
| | |
| | |
| | |
| | |
| | |

2. Have you ever been involved in an accident before while doing this type of operation?
   No
   Yes

| Location of accident | Explain (If possible, sketch the accident situation) |
| --- | --- |
| | |
| | |
| | |
| | |



3. What type of traffic information would you like to receive to facilitate your trips? (if any)

4. What is your major concern in this job? (Please Explain)

5. Owner Operator    Company Employee

6. How long have you been a commercial driver? ____________________

# 2.2-TABLES SUMMARIZING THE DATA OBTAINED FROM THE SURVEYS

| R | Survey numbe | Origin Name | Origin Y | Origin Serv | Origin Address | Destination Name | Destination Y | Destination Serv | Destination Address | Time informations Depart. | Arrival | Ttime | Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7 | IC Harvey | 30 | 5 | Harvey, IL | | | | West Bend, WI | | | | |
| 2 | 7 | IC Harvey | 30 | 5 | Harvey, IL | Sooline | 2 | | Bensenville, IL | | | | |
| 3 | 7 | IC Harvey | 30 | 5 | Harvey, IL | Railport | 9 | | 2075W 43rd (and Western) | | | | |
| 4 | 31 | Auto-transload | 26 | 8 | Aurora, IL | | | | New Berlin, WI | | | | |
| 5 | 31 | Corwith | 10 | 10 | 41st and Kedzie | Toyota | | 10 | Crest and Roosevelt | | | | |
| 6 | 31 | BN Ogden | 5B | 4 | 5600W Ogden | 63rd st yard | 13 | 4 | 63rd and State | 19:00 | 19:45 | 0:45 | E |
| 7 | 32 | BN Ogden | 5B | 10 | 5600W Ogden | 63rd st yard | 13 | 10 | 63rd and State | 21:00 | 23:00 | 2:00 | E |
| 8 | 32 | BN Ogden | 5B | 10 | 5600W Ogden | Bedford Park | 16 | 10 | 71st and Harlem | 19:00 | 20:00 | 1:00 | E |
| 9 | 32 | IMX | 25 | 0 | Damen and I-55 | CSX | | 8 | 59th and Western | 1:00 | 2:00 | 1:00 | D |
| 10 | 37 | Corwith | 10 | 3 | 41st and Kedzie | Sooline | 2 | 8 | Bensenville, IL | 8:00 | 9:30 | 1:30 | M |
| 11 | 37 | Sooline | 2 | 8 | Bensenville, IL | Recon | | 2 | La Grange, IL | 9:30 | 10:30 | 1:00 | M |
| 12 | 40 | Cushing | 200 | | Cicero and I-55 | Triple Crown | 26 | 8.5 | Lake Calumet | 6:15 | 6:50 | 0:35 | M |
| 13 | 40 | Triple Crown | 26 | | Lake Calumet | Montgomery | | | Orchard rd, Aurora,IL | 7:30 | 9:15 | 1:45 | M |
| 14 | 62 | Central States | 100 | | Ridgeland and 31st | | | | 1840N Clybourn | 5:45 | 7:00 | 1:15 | M |
| 15 | 62 | Landers | 15 | 10 | 79th and Western | | | | Woodridge,IL | 9:15 | 10:00 | 0:45 | M |
| 16 | 63 | Corwith | 10 | 10 | 42nd and Kedzie | Central States | 100 | | Ridgeland and 31st | 15:45 | 16:30 | 0:45 | A |
| 17 | 63 | Landers | 15 | 10 | 79th and Western | Corwith | 10 | 10 | 42nd and Kedzie | 15:00 | 15:30 | 0:30 | A |
| 18 | 63 | 26th /UP | 8 | 10 | Canal and 26th | Corwith | 10 | 10 | 42nd and Kedzie | 14:30 | 15:15 | 0:45 | N |
| 19 | 64 | Central States | 100 | | Ridgeland and 31st | Bedford Park | 16 | 4 | 71st and Harlem | 7:00 | 8:00 | 1:00 | M |
| 20 | 64 | Bedford Park | 16 | 4 | 71st and Harlem | Industrial Park | | | West Chicago (North/rte 59) | 11:00 | 14:00 | 3:00 | N |
| 21 | 64 | Airport | | 10 | O'Hare | CS Logistics | | 10 | Thorndale and 83rd | 6:00 | 6:10 | 0:10 | M |
| 22 | 66 | Central States | 100 | | Ridgeland and 31st | | | | Indiana | 6:00 | 9:00 | 3:00 | M |
| 23 | 96 | BN Western | 7B | 10 | 1551 S Western | Central States | 100 | | Ridgeland and 31st | 16:00 | 17:00 | 1:00 | A |
| 24 | 96 | Strombecker | | | Lake and Cicero | Global One | 7A | 5 | 1425 S Western | 2:30 | 3:30 | 1:00 | A |
| 25 | 99 | Central States | 100 | | Ridgeland and 31st | Penske rental | | | 101st and harlem | 6:00 | 6:45 | 0:45 | M |
| 26 | 100 | IMX Yard | 25 | 3 | 3000 S Damen | | | | Bristol, IN | 10:15 | 18:00 | 7:45 | N |
| 27 | 26 | Corwith | 10 | | 42nd and Kedzie | 63rd st yard | 13 | 0 | 63rd and State | 21:30 | 22:00 | 0:30 | E |
| 28 | 26 | Corwith | 10 | 10 | 42nd and Kedzie | Bedford Park | 16 | | 71st and Harlem | 12:00 | 12:45 | 0:45 | N |
| 29 | 26 | Corwith | 10 | 10 | 42nd and Kedzie | Toyota | | | Crest and Roosevelt | 2:30 | 3:30 | 1:00 | D |
| 30 | 67 | Cicero/BN CEC | 5A | 3 | 26th and Cicero | Markham | 21 | 4 | Harvey,IL | 8:00 | 9:00 | 1:00 | M |
| 31 | 67 | Corwith | 10 | | 42nd and Kedzie | | | | West Chicago | 6:00 | 7:30 | 1:30 | M |
| 32 | 71 | Corwith | 10 | 3 | 42nd and Kedzie | | | | Ogden and Keeler | 7:30 | 8:45 | 1:15 | M |
| 33 | 122 | Global Two | 4 | 9 | North Lake, IL | Panasonic | | | Elgin, IL | | | 0:00 | |
| 34 | 122 | Cicero/BN CEC | 5A | 5 | 26th and Cicero | 47th st yard | 11 | | 47th and Princeton | 8:45 | 9:30 | 0:45 | M |
| 35 | 136 | Corwith | 10 | 8 | 42nd and Kedzie | Sooline | 2 | 8 | Bensenville, IL | 7:30 | 10:00 | 2:30 | M |
| 36 | 115 | Corwith | 10 | 8 | 42nd and Kedzie | | | | Dolton, IL | 7:30 | 13:00 | 5:30 | M |
| 37 | 115 | | | | Dolton, IL | Bedford Park | 16 | 8 | 71st and Harlem | 13:15 | 14:30 | 1:15 | N |
| 38 | 11 | Central States | 100 | 8 | Ridgeland and 26th | Springfield | | 8 | Illinois | 4:00 | | | D |
| 39 | 11 | Central States | 100 | 8 | Ridgeland and 26th | Wisconsin | | | Wisconsin | 4:00 | | | D |
| 40 | 11 | Central States | 100 | 7 | Ridgeland and 26th | Dolton | | 8 | 147th and Halsted | 12:00 | 14:00 | 2:00 | N |
| 41 | 13 | Central States | 100 | 8 | Ridgeland and 26th | Western | | 8 | 18th and Western | 15:25 | 16:20 | 0:55 | A |
| 42 | 13 | 47th St. Yard | 11 | 5 | 361W. 47th | Euromarket | | | Naperville, IL | 11:20 | 12:20 | 1:00 | N |
| 43 | 13 | NTS | | | 79th and Western | 26th St./UP | 8 | 9 | 26th and Canal | 8:40 | 8:55 | 0:15 | M |
| 44 | 89 | Bedford Park | 16 | 8 | 7000 W. 71st | Kention | | | Illinois | 7:00 | 9:00 | 2:00 | M |
| 45 | 89 | Bedford Park | 16 | 8 | 7000 W. 71st | W. Chicago | | | Carolina St. | 18:00 | 19:30 | 1:30 | E |
| 46 | 87 | Central States | 100 | 9 | Cicero and I-55 | | | | 142nd and Cottage | 14:00 | 15:00 | 1:00 | A |
| 47 | 87 | | | | 111th and Cicero | Hamilton Base | | | 18th and Western | 7:00 | 8:05 | 1:05 | M |
| 48 | 116 | | | 4 | 26th | Cushing | 200 | 8 | Cicero and I-55 | 16:45 | 17:20 | 0:35 | A |
| 49 | 116 | Cicero/BN Ogde | 5B | 0 | 5600W Ogden | 63rd St. Yard | 13 | 0 | 63rd and Indiana | 22:00 | 22:45 | 0:45 | E |
| 50 | 124 | Cushing | 200 | 10 | Cicero and I-55 | Centralia | | | Missouri | 12:00 | 17:30 | 5:30 | A |
| 51 | 124 | Wisconsin | | | Wisconsin | Ripon | | | | 4:30 | 7:30 | 3:00 | D |
| 52 | 124 | Bedford Park | 16 | 2 | 7000 W. 71st | | | | 71st and Harlem | 15:00 | 16:30 | 1:30 | A |
| 53 | 135 | DeKalb | | | Illinois | Cushing | 200 | 10 | Cicero and I-55 | 17:00 | 19:00 | 2:00 | A |
| 54 | 135 | | | | 39th and Kedzie | Rochelle | | | Illinois | 10:00 | 11:50 | 1:50 | N |
| 55 | 135 | | | | 39th and Kedzie | West Chicago | | | Illinois | 6:30 | 7:30 | 1:00 | M |
| 56 | 22 | | | | 35th and Ashland | Cushing | 200 | 1 | Cicero and I-55 | 8:00 | 17:45 | 9:45 | M |
| 57 | 22 | | | | Kedzie | | | | Languid | 14:30 | 16:30 | 2:00 | A |
| 58 | 34 | Cicero/BN Ogde | 5B | 0 | 5600 W. Ogden | Corwith | 10 | 0 | 3526 W. 43rd | 15:00 | 16:30 | 1:30 | A |
| 59 | 34 | Cicero/BN Ogde | 5B | 0 | 5600 W. Ogden | Bedford Park | 16 | 8 | 7000 W. 71st | | | | |
| 60 | 23 | Cushing | 200 | 4 | Cicero and I-55 | 63rd St. Yard | 13 | 4 | 63rd and Indiana | 6:00 | 7:00 | 1:00 | D |
| 61 | 23 | 63rd st. yard | 13 | 8 | 63rd and Indiana | ICC | | | 167th and Halsted | 7:20 | 8:00 | 0:40 | M |
| 62 | 23 | ICC | | 7 | 167th and Halsted | Sooline | | | Bensenville, IL | 9:00 | 10:20 | 1:20 | M |
| 63 | 29 | Sooline | | | Bensenville, IL | Corwith | 10 | 3 | 3526 W. 43rd | 14:00 | 17:30 | 3:30 | A |
| 64 | 29 | Cicero/BN Ogde | 5B | 3 | 5600 W. Ogden | Landers | 15 | 3 | 75th and Western | 9:00 | 10:20 | 1:20 | M |
| 65 | 29 | 63rd st. yard | 13 | 8 | 63rd and Indiana | Willow Springs | | | Lagrange and Santa Fe, IL | 12:00 | 12:30 | 0:30 | N |
| 66 | 18 | Toyota | | | Roosevelt and Crest | Cicero/BN Ogde | 5B | 5 | 5600 W. Ogden | 15:15 | 15:30 | 0:15 | A |
| 67 | 18 | Bedford Park | 16 | 2 | 7000 W. 71st | Landers | 15 | 8 | 75th and Western | 11:00 | 11:45 | 0:45 | N |
| 68 | 8 | Ogozpee | | 5 | 39th and I-80 | Corwith | 10 | 5 | 3526 W. 43rd | 7:00 | 15:00 | 8:00 | N |
| 69 | 20 | Corwith | 10 | 7 | 3526 W. 43rd | Toyota | | 10 | Roosevelt and Crest | | | | |
| 70 | 20 | Corwith | 10 | 6 | 3526 W. 43rd | CF | | 9 | 76th and Harlem | 10:00 | 10:20 | 0:20 | N |
| 71 | 20 | Willowspring | 17 | 8 | 7600 Santa Fe Dr. | 63rd St. Yard | 13 | 3 | 63rd and Indiana | 13:00 | 13:40 | 0:40 | N |

Departure time:
12 AM-5AM:Dawn (D)
5AM-10AM:Morning peak (M)
10AM-3PM:Noon (N)
3PM-7PM:Afternoon peak (A)
7PM-12AM:Evening (E)

| Route taken | | | | | | | | | | | | | Problematic points Intersection | | ? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Link 1 | Link 2 | Link 3 | Link 4 | Link 5 | Link 6 | Link 7 | Link 8 | Link 9 | Link 10 | Link 11 | Link 12 | Link 13 | | | |
| I-294 | | | | | | | | | | | | | | | |
| I-294 | north to | Rte-19 | | | | | | | | | | | | | |
| 159th | east to | I-94 | north to | 47th | west to | Western | | | | | | | toll booths | | c |
| I-88 | east to | I-294 | north to | end | | | | | | | | | | | |
| Kedzie | north to | I-55 | west to | I-294 | west to | I-88 | | | | | | | | | |
| Cicero | south to | I-55 | east to | I-94 | south to | 63rd | east to | State | | | | | | | |
| 26th | east to | Pulaski | south to | I-55 | east to | I-94 | south to | 63rd | east to | State | | | 26th | Pulaski | n |
| Ogden | west to | Harlem | south to | 71st | | | | | | | | | | | |
| Damen | south to | Archer | west to | Western | south to | 59th | | | | | | | | | |
| Kedzie | north to | I-55 | west to | I-294 | north to | North | east to | Mannheim | north to | Lawrence | | | | | |
| Lawrence | west to | Mannheim | south to | North | west to | I-294 | | | | | | | | | |
| I-55 | east to | I-94 | south to | 103rd | | | | | | | | | | | |
| I-94 | south to | I-294 | west to | I-88 | west to | Aurora, IL | | | | | | | I-88 | | w |
| 26th | east to | Cicero | north to | I-290 | east to | I-94 | north to | Division | east to | Halsted | north to | Clybourn | I-94 | Division | cl |
| 79th | west to | I-55 | west to | Joliet | | | | | | | | | | Joliet | π |
| Kedzie | north to | I-55 | west to | Cicero | north to | 26th | west to | Ridgeland | | | | | | | |
| 79th | east to | Western | north to | 47th | west to | Kedzie | | | | | | | 47th | Kedzie | n |
| Canal | north to | Archer | west to | Western | | | | | | | | | Archer | Canal | n |
| Ogden | west to | Harlem | south to | 67th | | | | | | | | | | | |
| Harlem | south to | 79th | west to | I-294 | north to | I-88 | | | | | | | | | |
| Manheim | south to | Irving park | west to | end | | | | | | | | | | | |
| Ridgeland | north to | 26th | east to | Cicero | south to | I-55 | east to | I-90 | | | | | 103rd | | r |
| Western | south to | 31st | west to | Cicero | north to | 26th | west to | Ridgeland | | | | | | | |
| Lake | east to | Kostner | south to | I-290 | east to | Western | south to | 14th | | | | | | | |
| Ridgeland | south to | Ogden | west to | Harlem | south to | 101st | | | | | | | 95th | Harlem | w |
| Ashland | south to | Pershing | east to | Racine | south to | 47th | east to | I-90 | | | | | | | |
| I-94 | north to | I-55 | west to | end | | | | | | | | | I-55 | | r |
| Western | north to | 39th | west to | California | north to | I-55 | west to | Harlem | south to | 71st | | | | California | r |
| Kedzie | north to | I-55 | west to | I-355 | north to | I-88 | west to | RTE-53 | | | | | | | |
| 26th | east to | Cicero | north to | I-55 | east to | I-94 | south to | end | | | | | I-55 | | w |
| I-55 | south to | I-355 | north to | I-88 | west to | Rte-59 | end | | | | | | I-355 | | w |
| I-55 | west to | Cicero | north to | Ogden | east to | Keeler | | | | | | | | | |
| I-290 | north to | Rte-53 | north to | I-90 | west to | end | | | | | | | Rte-53 | | w |
| Cicero | south to | I-55 | east to | I-94 | south to | 47th | | | | | | | | | |
| I-55 | south to | Cicero | north to | I-290 | north to | Manheim | west to | Franklin | | | | | | | |
| 47th | east to | I-94 | west to | 147th | west to | end | | | | | | | I-94 | | w |
| 147th | west to | I-294 | north to | 95th | west to | Harlem | north to | 79th | east to | end | | | I-294 | | c |
| Ogden | west to | Harlem | south to | I-55 | | | | | | | | | I-94 | | c |
| Ogden | west to | I-294 | south to | I-90 | | | | | | | | | | | |
| 36th | east to | Cicero | south to | I-90 | west to | Sibley | west to | Halsted | | | | | | | |
| Ogden | west to | Western | south to | | | | | | | | | | 36th | Ogden | cl |
| I-90 | south to | I-290 | west to | I-88 | west to | Rte-59 | south to | | | | | | | | |
| Western | north to | 47th | east to | Halsted | north to | 26th | east to | Canal | | | | | | | |
| Harlem | south to | 95th | west to | I-294 | south to | | | | | | | | 163rd toll constructio | | w |
| Harlem | south to | I-290 | west to | | | | | | | | | | | | |
| Ogden | north to | 26th | east to | Harlem | south to | I-55 | north to | I-94 | south to | 142nd | | | | | |
| 111th | east to | Western | north to | 18th | | | | | | | | | | | |
| 26th | east to | Cicero | north to | Cushing | | | | | | | | | 47th | Kedzie | n |
| Ogden | west to | Cicero | south to | I-55 | north to | I-90 | south to | 63rd | | | | | CR 63rd | | bn |
| I-55 | north to | I-94 | south to | I-57 | south to | Rte-161 | west to | Rte-51 | south to | | | | Western | 51st | cl |
| I-55 | north to | I-90 | south to | Rte-23 | west to | Ripon | | | | | | | | | |
| Harlem | north to | I-55 | north to | I-90 | south to | 63rd | | | | | | | | | |
| Bays Rd. | north to | I-88 | east to | I-355 | south to | I-55 | north to | Cicero | north to | Cushing | | | | | |
| Kedzie | north to | I-55 | south to | I-355 | north to | I-88 | west to | Rte-251 | north to | Rochelle | | | | | |
| Kedzie | north to | I-55 | south to | I-355 | north to | I-88 | west to | rte-59 | north to | Joliet Rd | north to | roosevelt | | | |
| Western | south to | 47th | west to | 159 | south to | Languid | | | | | | | I-55 | | c |
| I-55 | north to | I-290 | west to | 5th Ave. | north to | Lawrence | west to | | | | | | | | |
| Cicero | south to | 31st | east to | Kedzie | | | | | | | | | | | |
| Ashland | south to | I-55 | south to | Harlem | | | | | | | | | | | |
| Cicero | south to | I-55 | north to | I-90 | south to | 63rd | east to | State | | | | | 63rd | state | w |
| 63rd | east to | I-90 | south to | 159th | west to | Halsted | south to | | | | | | I-90 | 103rd | c |
| 167th | east to | Halsted | south to | I-294 | north to | I-290 | west to | George St | north to | Rand | east to | Manheim | | | |
| Franklin | south to | Mannheim | east to | I-290 | east to | 1st Ave. | south to | I-55 | north to | Kedzie | south to | 43rd | Manheim | 1st | c |
| Cicero | south to | 79th | east to | Western | | | | | | | | | Cicero | | c |
| 63rd | east to | I-90 | north to | I-55 | south to | willow sp. | north to | Santa Fe | | | | | | | |
| I-55 | south to | I-355 | north to | I-88 | east to | Rte-59 | north to | Roosevelt | east to | | | | 63rd | state | c |
| Harlem | south to | 79th | east to | Western | south to | 76th | | | | | | | | | |
| I-55 | south to | I-80 | west to | 39th | north to | | | | | | | | | | |
| I-55 | south to | I-355 | south to | I-88 | west to | Rte-59 | south to | Joliet St. | south to | Roosevelt | | | | | |
| 43rd | west to | Ashland | south to | I-55 | west to | Harlem | south to | 76th | | | | | | | |
| I-55 | north to | I-94 | east to | 63rd | | | | | | | | | | | |

**Code for cause:**
- n->narrow turn
- c->congestion
- r->bad road condition
- w->work zone
- rr->rough railroad crossing
- cl->clearance
- bn->bad neighborhood

Route preferred

| Li | | | Link 4 | Link 5 | Link 6 | Link 7 | Link 8 | Link 9 | Link 10 | Link 11 | Link 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kedzie | north to | I-55 | west to | Mannheim | north to | Lawrence | | | | | |
| Western | south to | Ogden | west to | 26th | west to | Ridgeland | | | | | |
| 47th | north to | Archer | west to | Harlem | south to | 71st | | | | | |
| Cicero | south to | 47th | | | | | | | | | |
| I-55 | south to | I-294 | north to | I-290 | west to | York rd | west to | Grand | Golf | Franklin | |
| Ridgeland | north to | 26th | west to | Cicero | south to | I-55 | north to | I-90 | east to | 142nd | |
| 43rd | west to | Western | north to | 35th | east to | California | south to | I-55 | south to | Harlem | |
| 57th | south to | 147 | east to | Dixie | south to | 159 | east to | ICC | | | |
| Manheim | south to | I-290 | Cicero | | | | | | | | |

Problematic points

| Intersection | | Cause |
|---|---|---|
| 35th | California | cl |
| 1st ave | | w |
| 37th | California | cl |
| 35th | California | cl |
| 36th | California | cl |
| 47th to 51 | Kedzie | cl |
| 59th | Ashland | cl |
| 79th | Western | cl |
| 47th to 51 | Ashland | cl |
| | Mannheim | w |
| 37th | California | cl |
| | Elston st | ns |
| 35th | Western | cl |
| 14th | Western | cl |
| 59th | Halstead | cl |
| 83rd | Thorndale | rs |
| 111th | Western | n |
| I-294 | California | rs |
| Archer | Canal | n |
| I-294 | Kedzie | rs |
| I-94 | Division | cl |
| 127th | Cicero | c |
| on this rou | 4 or 5 | cl |
| Ogden | Rockwell | cl |
| 26th N | Pulaski | n |
| I-55 | Damen | r |
| 35th | California | cl |
| | Archer | ns |
| 79th | Western | cl |
| I-55 | | r |
| 36th | California | cl |
| 37th | Halsted | cl |
| 47th | | c |
| I-294 | tolls | |
| I-94 | I-55 | c |
| I-294 | I-55 | rs |
| I-90 | Ohio | n |
| Orleans | Ohio | n |
| Orleans | Grand | n |
| Harlem | 85th | n |
| I-94 | I-90 | rs |
| I-90 | I-94 | c |
| 43rd | Ashland | ns |
| 59th | Ashland | s |
| 47th | Archer | s |
| Archer | 26th | n |
| ogden | 67th | ns |
| I-290 | | c |
| BN ogden yard doesn't answer p | | |
| 47th | Western | n |
| 35th | Western | cl |
| 63rd | State | bn |
| BN ogden yard doesn't answer p | | |
| Western | 31st | cl |

Concerns about the job:
c->other cars
s->safety, in general
m->money
t->traffic
ms->meeting schedule

| S | General improvements that could be made | | | | | | Owner:O Employee:E | Exp (yrs) | Accident? | Major concerns | In th | uipment pe | Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | #1 | #2 | #3 | #4 | #5 | #6 | | | | | | | |
| EC | | | | | | | E | 25 o | | | | ailer | |
| EC | | | | | | | E | 25 o | | | | ailer | |
| EC | | | | | | | E | 25 o | | | | ailer | |
| EC | | | | | | | E | 22 | s | m | | 45 Trailer | 6 |
| EC | | | | | | | E | 22 | s | m | | 53 Contain. | 9 |
| EC | | | | | | | E | 22 | s | m | | 48 Contain. | 6 |
| EC | | | | | | | E | 2.5 | | | | 40 Contain. | 10 |
| EC | | | | | | | E | 2.5 | | | | 45 Contain. | 7 |
| EC | | | | | | | E | 2.5 | | | | 45 Trailer | 0 |
| EC | California | sl | Kedzie | sl | | | O | 10 cc | | | | 40 Contain. | 8.5 |
| EC | | | | | | | O | 10 cc | | | | 40 Contain. | 8 |
| EC | | | | | | | E | 10 | | | d | | |
| EC | | | | | | | E | 10 | | | | 53 Trailer | 8 |
| EC | | | | | | | O | 40 n | | | | 40 Contain. | 10 |
| EC | | | | | | | O | 40 n | | | | 45 Trailer | 5 |
| EC | | | | | | | O | 21 | | | | 48 Contain. | 10 |
| EC | | | | | | | O | 21 | | | | 48 Trailer | 10 |
| EC | | | | | | | O | 21 | | | | 48 Trailer | 10 |
| EC | | | | | | | E | 30 | | | | 53 Contain. | 10 |
| EC | | | | | | | E | 30 | | | | 53 Contain. | 10 |
| EC | | | | | | | E | 30 | | | | 53 Trailer | 10 |
| EC | | | | | | | E | 47 | | | | 48 Contain. | 10 |
| EC | | | | | | | O | 9 | | | | 40 Contain. | 10 |
| EC | | | | | | | O | 9 | | | | 40 Contain. | 5 |
| EC | | | | | | | E | 5 | | | | 20 Semi | 8 |
| EC | | | | | | | O | 4 | | | | 48 Contain. | 2 |
| SS | | | | | | | O | 11 | | | | 45 Trailer | 8 |
| SS | | | | | | | O | 11 | | | | 40 Contain. | 9 |
| SS | | | | | | | O | 11 | | | | 53 Van | 10 |
| SS | | | | | | | O | 4 | | | | 53 Trailer | 9 |
| SS | | | | | | | O | 4 | | | | | |
| SS | | | | | | | O | 40 | | | | 48 Contain. | |
| SS | | | | | | | E | 12 | | | | 48 Contain. | 5 |
| SS | | | | | | | E | 12 | t | c | | 20 Contain. | 7 |
| SS | | | | | | | O | 9 | s | | | 53 Trailer | 8 |
| SS | | | | | | | O | 23 | s | c | | 48 Contain. | 6 |
| SS | | | | | | | O | 23 | s | c | | 45 Trailer | 8 |
| JB | | | | | | | O | 14 o | t | | t | 40 Contain. | 8 |
| JB | | | | | | | O | 14 o | t | | t | 40 Contain. | 8 |
| JB | | | | | | | O | 14 o | t | | t | 48 Contain. | 7 |
| JB | | | | | | | E | 15 | t | m | t | 40 Trailer | 8 |
| JB | | | | | | | E | 15 | t | m | t | 40 Trailer | 7 |
| JB | | | | | | | E | 15 | t | m | t | 40 Contain. | 8 |
| JB | | | | | | | E | 27 | c | | | | |
| JB | | | | | | | E | 27 | c | | t | 40 Contain. | 7 |
| JB | | | | | | | O | 33 | | | | 48 Trailer | 9 |
| JB | | | | | | | O | 33 | | | | | |
| NM | | | | | | | O | 6 | | | t | 40 Contain. | 8 |
| NM | | | | | | | O | 6 | | | t | 45 Contain. | 8 |
| NM | | | | | | | O | 3 o | s | | t | 48 Contain. | 9 |
| NM | | | | | | | O | 3 o | s | | t | 48 Contain. | 9 |
| NM | | | | | | | O | 3 o | s | | t | 48 Contain. | 9 |
| NM | | | | | | | O | 3 | s | | t,w | 48 Trailer | 9 |
| NM | | | | | | | O | 3 | s | | t,w | 53 Trailer | 9 |
| NM | | | | | | | O | 3 | s | | t,w | 53 Trailer | 9 |
| NM | | | | | | | O | 2 | s | m | | | |
| NM | | | | | | | O | 2 | s | | | | |
| DD | | | | | | | O | 12 | | | | 45 Trailer | 5 |
| DD | | | | | | | O | 12 | | | | 40 Container | 8 |
| AR | | | | | | | O | 2 | | | | Container | 8 |
| AR | | | | | | | O | 2 | | | | | |
| AR | | | | | | | O | 2 o | | | | 53 trailer | 9 |
| AR | | | | | | | O | 2 cc | s | | | 40 trailer | 7 |
| AR | | | | | | | O | 2 cc | s | | | 20 trailer | 7 |
| AR | | | | | | | O | 2 cc | s | | | 48 trailer | 7 |
| DD | | | | | | | O | 2 l | | | | 53 Container | 8 |
| DD | | | | | | | O | 2 l | | | | 48 Container | 7 |
| DD | | | | | | | E | 30 re | t | | w | 45 Container | 10 |
| DD | | | | | | | O | 3 l | | | | 53 Container | 8 |
| DD | | | | | | | O | 3 l | | | | 48 trailer | 8 |
| DD | | | | | | | O | 3 l | | | | 28 Van | 7 |

| R | Survey numbe | Origin Name | Y | Serv | Address | Destination Name | Y | Serv | Address | Depart. | Arrival | Ttime | Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 202 | Yard Center | 20 | 10 | Sibley and Indiana | Bedford Park | 16 | 10 | 7000 W. 71st | | | | |
| 101 | 68 | 47th St. Yard | 11 | 6 | 361 W. 47th St. | 26th. St./UP | 8 | 7 | 436 W. 25th Pl | | | | M |
| 102 | 68 | Cicero/BN Ogde | 5B | 8 | 5600 W. Ogden | 63rd St. Yard | 13 | 5 | 63rd and Indiana | | | | |
| 103 | 24 | Cicero/BN Ogde | 5B | 7 | 5600 W. Ogden | 63rd St. Yard | 13 | 2 | 63rd and Indiana | | | | |
| 104 | 24 | Bedford Park | 16 | 0 | 7000 W. 71st | 26th. St./UP | 8 | 0 | 436 W. 25th Pl | | | | M |
| 105 | 24 | Corwith | 10 | 0 | 3526 W. 43rd | 47Th St. Yard | 11 | 0 | 361 W. 47th St. | | | 0:20 | |
| 106 | 19 | Landers | 15 | 5 | 75th and Western | Bollingbrook | | 5 | Pace St. and 2nd | | | 1:30 | |
| 107 | 19 | Corwith | 10 | 9 | 3526 W. 43rd | Toyota | | 9 | Roosevelt and Crest | | | 1:00 | M |
| 108 | 19 | Corwith | 10 | 9 | 3526 W. 43rd | Mitsubishi | | 9 | 74th and Mitsubishi | 13:00 | 15:00 | 2:00 | N |
| 109 | 203 | Cushing | 200 | 6 | Cicero and I-55 | Syracuse | | 6 | Indiana | 7:30 | 10:30 | 3:00 | M |
| 110 | 203 | Cushing | 200 | 8 | Cicero and I-55 | Yard Center | 20 | 8 | Sibley and Indiana | 7:30 | 8:40 | 1:10 | M |
| 111 | 203 | Cushing | 200 | 8 | Cicero and I-55 | Landers | 15 | 8 | 75th and Western | 7:30 | 8:10 | 0:40 | M |
| 112 | 30 | Corwith | 10 | 4 | 3526 W. 43rd | Toyota | | | Roosevelt and Crest | | | 0:00 | |
| 113 | 114 | Cicero/BN Ogde | 5B | 1 | 5600 W. Ogden | Landers | 15 | 8 | 75th and Western | 14:45 | 15:30 | 0:45 | N |
| 114 | 114 | Corwith | 10 | 8 | 3526 W. 43rd | Bedford Park | 16 | 9 | 7000 W. 71st | 19:00 | 19:45 | 0:45 | E |
| 115 | 117 | Corwith | 10 | 5 | 3526 W. 43rd | Schiller Park W | 1B | 5 | 4423 N. 25th | 11:00 | 12:15 | 1:15 | N |
| 116 | 117 | Railport | 9 | 4 | Ashland and 43rd | | | 7 | 73rd and Pulaski | 10:00 | 10:35 | 0:35 | M |
| 117 | 137 | Cicero/BN Ogde | 5B | 5 | 5600 W. Ogden | Bulkmail | | | Bollingbrook | 7:00 | 8:15 | 1:15 | M |
| 118 | 137 | IC Harvey | 30 | 6 | Harvey, IL | Sooline | 2 | 8 | Bensenville, IL | 15:00 | 16:30 | 1:30 | A |
| 119 | 137 | | | | Bollingbrook | IC Harvey | 30 | 6 | Harvey, IL | 14:00 | 15:00 | 1:00 | A |
| 120 | 61 | Rte-83 | | | Elkgrove village | Global Two | 4 | 3 | I-294 and North | 15:30 | 16:30 | 1:00 | A |
| 121 | 61 | Landers | 15 | 9 | 75th and Western | | | | Rosemont, IL | | | 0:00 | M |
| 122 | 57 | Willowspring | 17 | 5 | 67th and I-55 | Landers | 15 | 5 | 75th and Western | 2:30 | 4:00 | 1:30 | D |
| 123 | 57 | | | | Aurora, IL | Pepsi | | | I-94 and 51st | 7:00 | 8:00 | 1:00 | M |
| 124 | 35 | IMX | 25 | 9 | 3000 S. Damen | Syracuse | | | Indiana | 6:00 | 9:15 | 3:15 | M |
| 125 | 60 | Cicero/BN Ogde | 5B | 5 | 5600 W. Ogden | Bollingbrook | | | Naperville, IL | 14:40 | 16:00 | 1:20 | A |
| 126 | 60 | Railport | 9 | | Ashland and 43rd | | | | Schaumburg, IL | 10:00 | 11:00 | 1:00 | N |
| 127 | 113 | Sooline | 2 | 2 | Bensenville, IL | Bulkmail | | | Bollingbrook | 15:00 | 15:45 | 0:45 | A |
| 128 | 113 | IC Harvey | 30 | | Harvey, IL | Sooline | 2 | | Bensenville, IL | 10:30 | 11:20 | 0:50 | M |
| 129 | 106 | Sooline | 2 | | Bensenville, IL | Motorola | | | Harvard, IL | 15:30 | 17:30 | 2:00 | A |
| 130 | 106 | Sooline | 2 | | Bensenville, IL | | | | Buffalo Grove, IL | 9:30 | 10:30 | 1:00 | M |
| 131 | 73 | IMX | 25 | 10 | 3000 S. Damen | Bedford Park | 16 | 9 | 7000 W. 71st | 15:30 | 16:30 | 1:00 | A |
| 132 | 73 | IC Harvey | 30 | | Harvey, IL | 47Th St. Yard | 11 | 5 | 361 W. 47th St. | 10:00 | 10:45 | 0:45 | M |
| 133 | 73 | Cicero/BN Ogde | 5B | 8 | 5600 W. Ogden | IC Harvey | 30 | | Harvey, IL | 8:15 | 9:30 | 1:15 | M |
| 134 | 120 | Corwith | 10 | 8 | 3526 W. 43rd | Toyota | | | Roosevelt and Crest | 8:00 | 9:20 | 1:20 | M |
| 135 | 120 | Cicero/BN Ogde | 5B | 2 | 5600 W. Ogden | Railport | 9 | | Ashland and 43rd | 6:00 | 6:30 | 0:30 | M |
| 136 | 74 | Cicero/BN Ogde | 5B | 5 | 5600 W. Ogden | 47Th St. Yard | 11 | 5 | 361 W. 47th St. | 10:00 | 10:45 | 0:45 | M |
| 137 | 74 | 63rd st. yard | 13 | 8 | 63rd and Indiana | Bedford Park | 16 | | 361 W. 47th St. | 12:00 | 13:15 | 1:15 | N |
| 138 | 69 | Cicero/BN Ogde | 5B | 3 | 5600 W. Ogden | 47Th St. Yard | 11 | 3 | 361 W. 47th St. | 16:00 | 17:00 | 1:00 | A |
| 139 | 125 | Sooline | 2 | 9 | Bensenville, IL | Corwith | 10 | | 3526 W. 43rd | 15:00 | 16:30 | 1:30 | A |
| 140 | 125 | Sooline | 2 | 8 | Bensenville, IL | Cicero/BN Ogde | 5B | 7 | 5600 W. Ogden | 11:25 | 12:50 | 1:25 | N |
| 141 | 76 | Central States | 100 | 5 | Ridgeland and 26th | | | | Michigan | 14:00 | | | A |
| 142 | 76 | Central States | 100 | 5 | Ridgeland and 26th | | | | Indiana | 18:30 | 22:30 | 4:00 | A |
| 143 | 79 | Central States | 100 | 5 | Ridgeland and 26th | Sooline | 2 | | Bensenville, IL | 8:00 | 9:00 | 1:00 | M |
| 144 | 102 | Central States | 100 | 8 | Ridgeland and 26th | | | | Wisconsin | 0:00 | 4:00 | 4:00 | D |
| 145 | 1 | Cicero/BN Ogde | 5B | 6 | 5600 W. Ogden | Belmont av | | | Franklin Park, IL | 15:15 | 17:45 | 2:30 | A |
| 146 | 1 | Bedford Park | 16 | 6 | 7000 W. 71st | Panasonic | | | Elgin, IL | 5:30 | 6:30 | 1:00 | D |
| 147 | 1 | Cicero/BN Ogde | 5B | 6 | 5600 W. Ogden | 47Th St. Yard | 11 | 5 | 361 W. 47th St. | 8:00 | 8:40 | 0:40 | M |
| 148 | 12 | | | | Des Plaines, IL | Triple Crown | 26 | | 2040 W. 103rd | 11:30 | 13:00 | 1:30 | N |
| 149 | 12 | Central States | 100 | | Ridgeland and 26th | Mop Pack | | | Calumet city, IL | 17:30 | 19:00 | 1:30 | E |
| 150 | 14 | Central States | 100 | | Ridgeland and 26th | | | | Aurora, IL | 7:50 | 8:30 | 0:40 | M |
| 151 | 14 | Landers | 15 | 10 | 75th and Western | IMX | 25 | 8 | 3000 S. Damen | 15:30 | 16:00 | 0:30 | A |
| 152 | 75 | Western ave/BN | 7B | 8 | 1551 S.Western | | | | 1840 N. Clybourn | 6:00 | 7:50 | 1:50 | M |
| 153 | 75 | Landers | 15 | 1 | 75th and Western | | | | Naperville, IL | 9:30 | 12:45 | 3:15 | M |
| 154 | 98 | Sooline | 2 | 10 | Bensenville, IL | STRA Lease Yard | | | I-55 and Central | 15:30 | 17:10 | 1:40 | A |
| 155 | 98 | STRA Lease Yard | | | I-55 and Central | | | | Des Plaines, IL | 8:30 | 9:45 | 1:15 | M |
| 156 | 98 | Corwith | 10 | 5 | 3526 W. 43rd | | | | Naperville, IL | 8:00 | 9:45 | 1:45 | M |
| 157 | 91 | 47Th St. Yard | 11 | 7 | 361 W. 47th St. | CN Lumber | 9A | 7 | 3500 W. 51st | 8:00 | 8:30 | 0:30 | M |
| 158 | 91 | CN Lumber | 9A | 7 | 3500 W. 51st | Bedford Park | 16 | 8 | 361 W. 47th St. | 9:15 | 9:45 | 0:30 | M |
| 159 | 91 | Bedford Park | 16 | 8 | 361 W. 47th St. | 47Th St. Yard | 11 | 6 | 361 W. 47th St. | 10:30 | 11:15 | 0:45 | M |
| 160 | 145 | Corwith | 10 | 6 | 3526 W. 43rd | | | | St Charles, IL | 12:25 | 13:30 | 1:05 | N |
| 161 | 145 | | | | West Chicago, IL | Global One | 7A | 3 | 1425 S. Western | 14:20 | 15:15 | 0:55 | A |
| 162 | 145 | Western ave/BN | 7B | 8 | 1551 S.Western | Central States | 100 | | Ridgeland and 26th | 16:50 | 17:15 | 0:25 | A |
| 163 | 146 | 47Th St. Yard | 11 | 9 | 361 W. 47th St. | Corwith | 10 | 6 | 3526 W. 43rd | 10:00 | 10:30 | 0:30 | M |
| 164 | 146 | Corwith | 10 | 6 | 3526 W. 43rd | 47Th St. Yard | 11 | 7 | 361 W. 47th St. | 12:00 | 12:45 | 0:45 | N |
| 165 | 146 | 47Th St. Yard | 11 | 9 | 361 W. 47th St. | Central States | 100 | | Ridgeland and 26th | 14:00 | 15:00 | 1:00 | A |

Departure time:
12 AM-5AM:Dawn (D)
5AM-10AM:Morning peak (M)
10AM-3PM:Noon (N)
3PM-7PM:Afternoon peak (A)
7PM-12AM:Evening (E)

| Route taken | | | | | | | | | | | | | Problematic points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Intersection | | ? |
| Link 1 | Link 2 | Link 3 | Link 4 | Link 5 | Link 6 | Link 7 | Link 8 | Link 9 | Link 10 | Link 11 | Link 12 | Link 13 | | | |
| Indiana | south to | Rte-6 | west to | I-294 | north to | Harlem | north to | 79th | | | | | | | |
| 51st | east to | I-94 | north to | Archer | west to | Canal | north to | | | | | | Halsted | | n |
| Ogden | east to | Cicero | south to | I-55 | north to | I-94 | south to | 63rd | west to | | | | 63rd | state | c |
| I-55 | north to | I-90 | south to | 63rd | west to | | | | | | | | | | |
| I-55 | north to | Canal | north to | | | | | | | | | | | | |
| Kedzie | south to | 47th | west to | | | | | | | | | | | | |
| I-55 | south to | I-355 | north to | I-88 | north to | Pace | east to | 2nd | | | | | | | |
| I-55 | south to | I-355 | north to | I-88 | west to | Rte-59 | north to | Joliet St. | west to | Roosevelt | | | | | |
| I-55 | south to | I-74 | north to | Mitsubishi | | | | | | | | | | | |
| I-55 | north to | I-94 | east to | I-80 | west to | 15th | | | | | | | | | |
| I-55 | north to | I-94 | east to | 159th | west to | Central | | | | | | | | | |
| Cicero | south to | 79th | east to | Western | north to | 75th | | | | | | | | | |
| Kedzie | north to | I-55 | west to | I-355 | north to | I-88 | west to | Rte-59 | | | | | | | |
| Ogden | east to | Cicero | south to | 79th | east to | Western | | | | | | | | | |
| Ashland | north to | I-55 | west to | Harlem | south to | 71st | | | | | | | 43rd | Ashland | n |
| Pulaski | north to | I-55 | west to | I-294 | north to | Manheim | north to | Lawrence | | | | | | | |
| Ashland | north to | I-55 | west to | Pulaski | south to | 73rd | | | | | | | | | |
| Ogden | east to | Cicero | south to | I-55 | west to | Rte-53 | | | | | | | | | |
| Rte-6 | west to | I-294 | north to | I-290 | north to | Wolf rd | east to | Franklin | | | | | | | |
| I-55 | east to | I-294 | south to | 159th | | | | | | | | | | | |
| Rte-83 | north to | Higgins | west to | I-290 | south to | Lake | | | | | | | | | |
| 79th | west to | Cicero | north to | I-290 | west to | I-294 | north to | Rosemont | | | | | | | |
| Rte-20 | south to | 79th | east to | Western | | | | | | | | | 79th | Western | c |
| I-88 | east to | I-355 | north to | I-55 | east to | I-94 | | | | | | | 79th | Sawyer | c |
| I-55 | east to | I-94 | south to | Indiana | | | | | | | | | | | |
| Ogden | west to | Harlem | south to | I-55 | west to | Bollingbrook | | | | | | | 53rd | Newberry | n |
| 47th | east to | I-90 | north to | I-290 | west to | Schaumburg | | | | | | | I-90 | I-294 | c |
| Mannheim | south to | North | east to | 1st ave | south to | Roosevelt | | | | | | | | | |
| 159th | west to | I-294 | north to | Mannheim | | | | | | | | | | | |
| Thorndale | west to | Rte-53 | north to | I-90 | west to | Rte-23 | | | | | | | 83rd | Thorndale | c |
| Thorndale | west to | Rte-53 | north to | Lake Cook rd | | | | | | | | | | | |
| Archer | east to | Ashland | north to | I-55 | west to | Harlem | south to | 71st | | | | | | | |
| I-57 | north to | I-94 | north to | 47th | | | | | | | | | | | |
| Cicero | south to | I-55 | east to | I-94 | south to | I-57 | | | | | | | | | |
| Kedzie | north to | I-55 | west to | I-355 | north to | I-88 | west to | end | | | | | 26th | Archer | n |
| Ogden | east to | Cicero | south to | I-55 | east to | I-94 | south to | 63rd | | | | | | | |
| Cicero | south to | I-55 | east to | I-94 | south to | 47th | | | | | | | I-94 | | c |
| I-94 | north to | I-55 | west to | Harlem | south to | 71st | east to | end | | | | | | | |
| Ogden | east to | Cicero | south to | I-55 | east to | I-94 | south to | 47th | | | | | | | |
| Mannheim | south to | I-290 | east to | Cicero | south to | I-55 | east to | Kedzie | south to | 41st | | | | | |
| Mannheim | south to | I-290 | east to | Cicero | north to | Ogden | | | | | | | | | |
| Ridgeland | south to | Ogden | east to | Cicero | south to | I-55 | east to | I-90 | | | | | | | |
| Ridgeland | south to | Ogden | east to | Cicero | south to | I-55 | east to | I-90 | | | | | | | |
| Ridgeland | south to | Cermak | east to | 1st ave | north to | I-290 | west to | Rte-83 | | | | | | | |
| Ridgeland | south to | Cermak | east to | 1st ave | north to | I-290 | | | | | | | | | |
| 26th | east to | Cicero | south to | I-55 | west to | Rte-171 | north to | Belmont | | | | | | | |
| 79th | west to | Harlem | north to | I-55 | west to | I-294 | north to | I-290 | north to | end | | | | | |
| 26th | east to | Cicero | south to | I-55 | west to | I-94 | south to | 47th | | | | | | | |
| I-294 | south to | I-90 | south to | 103rd | | | | | | | | | | | |
| 26th | west to | Harlem | south to | I-55 | west to | I-294 | south to | I-94 | north to | 159th | | | | | |
| 22nd | west to | Harlem | north to | I-290 | west to | I-88 | west to | Rte-59 | | | | | | | |
| Western | north to | Archer | east to | Canal | | | | | | | | | | | |
| Western | north to | I-290 | east to | I-90 | north to | Division | east to | Halsted | north to | Clybourn | | | | | |
| 79th | west to | Rte-45 | north to | Ogden | west to | end | | | | | | | | | |
| I-294 | north to | Rte-19 | east to | 25th ave | south to | I-290 | east to | 1st ave | south to | I-55 | east to | end | | | |
| I-55 | west to | Harlem | north to | I-290 | west to | Manheim | north to | end | | | | | | | |
| Pulaski | north to | I-55 | west to | Cicero | north to | I-290 | west to | I-88 | west to | end | | | | | |
| 47th | west to | Kedzie | south to | 51st | | | | | | | | | 47th | Kedzie | c |
| Kedzie | south to | 79th | | | | | | | | | | | | | |
| 79th | west to | Harlem | north to | I-55 | east to | I-90 | south to | 47th | | | | | | | |
| Kedzie | north to | I-55 | west to | I-355 | north to | I-88 | west to | end | | | | | | | |
| Rte-59 | south to | I-88 | east to | I-355 | south to | I-55 | west to | Western | north to | end | | | | | |
| Western | north to | Ogden | west to | 26th | east to | Ridgeland | | | | | | | | | |
| 47th | west to | Kedzie | north to | 43rd | | | | | | | | | | | |
| 43rd | east to | Kedzie | south to | I-55 | east to | I-90 | south to | 47th | | | | | 43rd | Kedzie | c |
| 47th | east to | I-90 | north to | I-55 | west to | Central | south to | end | | | | | | | |

**Code for cause:**
n->narrow turn
c->congestion
r->bad road condition
w->work zone
rr->rough railroad crossing
cl->clearance
bn->bad neighborhood

| Route preferred | | | | | | | | | | | | Problematic points | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li[nk 1] | | | Link 4 | Link 5 | Link 6 | Link 7 | Link 8 | Link 9 | Link 10 | Link 11 | Link 12 | Intersection | | Cause |
| | | | | | | | | | | | | Cermak | Kedzie | cl |
| | | | | | | | | | | | | 35th | California | cl |
| | | | | | | | | | | | | I-55 | Pulaski | n |
| | | | | | | | | | | | | I-294 | I-94 | rs |
| Ogden | east to | Cicero | south to | I-55 | east to | California | south to | 35th | east to | Western | south | 35th | Campbell | cl |
| | | | | | | | | | | | | 43rd | Damen | cl |
| | | | | | | | | | | | | 48th | Kedzie | cl |
| | | | | | | | | | | | | 79th | Western | cl |
| | | | | | | | | | | | | 79th | Western | cl |
| | | | | | | | | | | | | 47th | Western | n |
| Archer | west to | Harlem | south to | 71st | | | | | | | | 43rd | Ashland | n |
| Cicero | south to | 79th | east to | Western | south to | 119th | east to | I-57 | south to | end | | | | |
| Cicero | north to | Roosevelt | west to | end | (numerous lights) | | | | | | | | | |
| | | | | | | | | | | | | 47th | Kedzie | n |
| | | | | | | | | | | | | 47th | Kedzie | n |
| | | | | | | | | | | | | Archer | Canal | n |
| | | | | | | | | | | | | 79th | Kedzie | n |
| | | | | | | | | | | | | 47th | Kedzie | n |
| | | | | | | | | | | | | 43rd | Ashland | n |

Concerns about the job;
c->other cars
s->safety, in general
m->money
t->traffic
ms->meeting schedule

| S | General Improvements that could be made #1 | #2 | #3 | #4 | #5 | #6 | Owner:O Employee: | Exp (yrs) | Accident? | Major concerns | | In th | uipment pe | Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA | | | | | | | E | 4 | | | | t | ntainer | 10 |
| KS | | | | | | | O | 3 | | w | si | | iler | 8 |
| KS | | | | | | | O | 3 | | w | si | | iler | 8 |
| KS | | | | | | | O | 36 | | | | | 42 trailer | 10 |
| KS | | | | | | | O | 36 | | | | | 42 trailer | 10 |
| KS | | | | | | | O | 36 | | | | | 42 trailer | 10 |
| KS | | | | | | | O | 3 | | | | | 48 trailer | 10 |
| KS | | | | | | | O | 3 | | | | | 53 trailer | 10 |
| KS | | | | | | | O | 3 | | | | | 48 trailer | 8 |
| KS | | | | | | | E | 5 | | | | t | 40 trailer | 9 |
| KS | | | | | | | E | 5 | | | | t | 48 trailer | 8 |
| KS | | | | | | | E | 5 | | | | t | 20 trailer | 8 |
| BN | | | | | | | O | 26 | | c | | | | |
| BN | | | | | | | O | 4 | | c | | d | | |
| BN | | | | | | | O | 4 | | c | | d | | |
| BN | | | | | | | O | 4 | | c | | | | |
| BN | | | | | | | O | 4 | | | | | | |
| BN | | | | | | | O | 4 | | c | | t | | |
| BN | | | | | | | O | 4 | | c | | t | | |
| BN | | | | | | | O | 4 | | c | | t | | |
| BN | | | | | | | E | 10 | | c | | d | | |
| BN | | | | | | | E | 10 | | c | | d | | |
| BN | | | | | | | E | 2 | | c | | t,w | | |
| BN | | | | | | | E | 2 | | c | | t,w | | |
| BN | | | | | | | E | 10 | | c | | t,w | | |
| JW | | | | | | | E | 12 | | c | | | | |
| JW | | | | | | | E | 12 | | c | | | | |
| JW | | | | | | | O | 1 | | c | | d | 48 trailer | 2 |
| JW | | | | | | | O | 1 | | c | | d | trailer | |
| JW | | | | | | | E | 8 | | c | | | | |
| JW | | | | | | | E | 8 | | c | | | | |
| NH | | | | | | | O | 3 | | | | | | |
| NH | | | | | | | O | 3 | | | | | 45 trailer | 5 |
| NH | | | | | | | O | 3 | | | | | 53 trailer | 9 |
| NH | | | | | | | O | 13 | | | | | 48 container | 8 |
| NH | | | | | | | O | 13 | | | | | 45 trailer | 8 |
| NH | | | | | | | O | 1 | | c | | d,t,w | 53 trailer | 7 |
| NH | | | | | | | O | 1 | | c | | d,t,w | 48 container | 8 |
| NH | | | | | | | O | 5 | | | | | 45 trailer | 8 |
| NH | | | | | | | O | 4 | | | | | 40 trailer | 6 |
| NH | | | | | | | O | 4 | | | | | 40 container | 6 |
| CV | | | | | | | O | 11 | | | | d | | |
| CV | | | | | | | O | 11 | | | | d | | |
| CV | | | | | | | E | 4 | | | | | | |
| CV | | | | | | | O | 10 | | c | | | | |
| MV | | | | | | | O | 1 | | | | | 45 trailer | 6 |
| MV | | | | | | | O | 1 | | | | | 45 trailer | 6 |
| MV | | | | | | | O | 1 | | | | | 45 trailer | 6 |
| MV | | | | | | | E | 4 | | m | | d | 45 | |
| MV | | | | | | | E | 4 | | m | | d | 48 | 9 |
| MV | | | | | | | O | 30 | | c | | t | 40 | 8 |
| MV | | | | | | | O | 30 | | c | | t | 45 | 8 |
| MV | | | | | | | O | 20 | | m | | t | 40 | 10 |
| MV | | | | | | | O | 20 | | m | | t | 40 container | 7 |
| MV | | | | | | | O | 3 | | m | | t | 40 container | 8 |
| MV | | | | | | | O | 3 | | m | | t | 40 | 9 |
| MV | | | | | | | O | 3 | | m | | t | 40 | 9 |
| MV | | | | | | | O | 15 | | m | c | t,w | 48 trailer | 7 |
| MV | | | | | | | O | 15 | | m | c | t,w | 48 | 6 |
| MV | | | | | | | O | 15 | | m | c | t,w | 48 | 7 |
| MV | | | | | | | O | 9 | | s | | d | 48 | 8 |
| MV | | | | | | | O | 9 | | s | | d | 45 trailer | 3 |
| MV | | | | | | | O | 9 | | s | | d | 40 trailer | 3 |
| MV | | | | | | | O | 9 | | s | m | | 45 | 9 |
| MV | | | | | | | O | 9 | | s | m | d | 45 | 9 |
| MV | | | | | | | O | 9 | | s | m | d | 44 | 8 |

# Appendix 3-Safety Managers' Survey

# SURVEY OF SAFETY MANAGERS
## For the Project:
## Development of Information on Intermodal Safety Issues in Illinois, Sponsored by IDOT and performed by Northwestern University

Important Note: ***The information you will provide us in this survey will be aggregated with information obtained from other companies and will be strictly used for research purposes. The name of the company will not appear anywhere in the resulting documents. The number on the left is simply from tracking the responses. Upon request, the findings of this research will be shared with you.***

*Your responses to the questions are essential in helping us develop meaningful recommendations to IDOT and the City of Chicago. Our Objective is to eventually help all involved entities to have a better understanding of the safety related issues and develop countermeasures to save lives and reduce your safety problems.*

IN ALL QUESTIONS PLEASE PROVIDE, IF POSSIBLE, STATISTICS FOR THE LAST CALENDAR YEAR (JANUARY 1, 1998 TO DECEMBER 31, 1998) IF YOU ARE UNABLE TO DO THAT PLEASE SPECIFY YOUR TIME FRAME.

### Part A: Information about You:

**1. How long have you been in your current position as Safety Manager?**
**_____Yrs_____Mths**

2. In general, how long have you worked as a Safety Manager?:_____Yrs___Mths

3. Besides the Safety Manager's responsibilities, do you have any other responsibilities in your firm?: Yes_____ No ______

If Yes, please specify the other main responsibilities:_________________

Percentage of your time spent on Safety Management? _______%

4. Does your company currently have any regular safety programs, such as
(i) Incentives to drivers (i.e., safest driver award)? Yes_____ No_____
If Yes, do they provide monetary incentives? Yes_____ No_____
(ii) Other programs (please specify):______________________________
________________________________________________
________________________________________________

6. Do you use the DAC system for obtaining background information on new driver applicants? Yes_____ No, we use another system (specify)________________________

## Part B: Company Safety Statistics

B1: Overall Statistics: Please fill up as many entries as possible on the table below (comment on the questions that you cannot answer):
PLEASE PROVIDE STATISTICS FOR THE LAST CALENDAR YEAR (JAN 1, 1998 TO DEC 31,1998)

| | *Owner Operators* | *Company Trucks* | *Comments* |
|---|---|---|---|
| *Total No of Trucks your company operates* | | | |
| ***Total Miles Traveled*** | | | |
| *Total Miles of Crosstown/Local Delivery Trips* | | | |
| *Total Miles of Regional Trips* | | | |
| *Total DOT reportable Accidents/ Incidents* | | | |
| *Total non-DOT reportable Accidents/ Incidents* | | | |
| *Total Accidents/ Incidents inside yards or other private property* | | | |
| *No of Accidents where your driver was at fault.* | | | |

**B2:** Contributing Factors: In the next table, we are collecting data on the potential contributing factors of the accidents/incidents. Please include ALL accidents/incidents (DOT and non-DOT reportable).
PLEASE PROVIDE STATISTICS FOR THE LAST CALENDAR YEAR (JAN 1, 1998 TO DEC 31,1998)

| *Number of accidents/ incidents:* | Owner Operators | Company Trucks | Comments |
|---|---|---|---|
| *Due to the Street Geometry* | | | |
| *Due to Weather Conditions (rain, ice, storm)* | | | |
| *Due to Intermodal Equipment (brakes, broken pins, etc.)* | | | |
| *Due to Your Driver's Error* | | | |
| *Due to Other Driver's Error* | | | |

**B3: Location Statistics: Please include ALL accidents/incidents (DOT and non-DOT reportable).**
PLEASE PROVIDE STATISTICS FOR THE LAST CALENDAR YEAR (JAN 1, 1998 TO DEC 31,1998)

| *Number of accidents/ incidents:* | Owner Operators | Company Trucks | Comments |
|---|---|---|---|
| *At a Construction Zone* | | | |
| *In the Chicago Metropolitan Area (6 County Area)* | | | |
| *At Intersections* | | | |
| *On Freeways* | | | |
| *On Freeway on-ramps/ off-ramps and acceleration lanes* | | | |
| *Inside Intermodal Yards* | | | |
| *Inside Other Private property* | | | |
| *No of Accidents/ Incidents by Time of Day* | | | |
| *6AM-10 AM* | | | |
| *10 AM-3:00 PM* | | | |
| *3:00 PM- 6:00 PM* | | | |
| *6:00 PM-midnight* | | | |
| *Midnight-6:00 AM* | | | |

**B4: Driver Statistics: Please include ALL accidents/incidents (DOT and non-DOT reportable).**

PLEASE PROVIDE STATISTICS FOR THE LAST CALENDAR YEAR (JAN 1, 1998 TO DEC 31,1998)

| | Owner Operators | Company Trucks | Comments |
|---|---|---|---|
| | | | |
| *No of Total Moving Violations (Tickets) Issued to Your Drivers* | | | |
| *No of Inspections* | | | |
| *No of Out of Service* | | | |
| *No of Out of Service due to Intermodal Equipment NOT OWNED by the Company* | | | |

**B5: Driver Statistics: Please include ALL accidents/incidents (DOT and non-DOT reportable). Some of these questions may seem sensitive, but again we would like to re-iterate that it is purely for research purposes.**

PLEASE PROVIDE STATISTICS FOR THE LAST CALENDAR YEAR (JAN 1, 1998 TO DEC 31,1998)

| | Owner Operators | Company Trucks | Comments |
|---|---|---|---|
| *No of Non-US Born Drivers* | | | |
| *No of Accidents/Incidents that Non-US Born Accidents/Incidents were involved* | | | |
| *No of Hours Behind the Wheel at the time of the crash* | | | |
| *Less than 4 hours* | | | |
| *4-6 hours* | | | |
| *6-8 hours* | | | |
| **MORE THAN 8 HOURS** | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

## Part B: Your opinion

**I. In your opinion what percentage of preventable accidents/incidents you are familiar are due to:**

1. Inadequate street geometry. Specifically:
   3.i Too small right turn radius ___%
   3.ii Lack of left turning bay ___%
   3.iii Insufficient left turning green period ___%
   3.vi Too narrow lane width ___%
   3.v Obstruction very close to the pavement ___%
   3.vi Other geometry problems (please specify) and percentages:
   ____________________%
   ____________________%
   ____________________%
2. Congestion on the freeway ___%
3. Congestion on the arterials ___%
4. Congestion outside or inside the yards ___%
5. Inadequate signing on the streets ___%
6. Poor pavement conditions (potholes, soft shoulders) ___%
7. Construction zones ___%
8. Improper traffic signal timing ___%

9. Truck Driver fatigue ___%
10. Truck Driver's inexperience/improper training ___%
11. Your truck driver was speeding: ___%
12. Truck Driver's age ___%
13. The other driver was speeding: ___%
14. Other drivers' inability to drive around trucks ___%
15. Improper maneuvering of the truck ___%
16. Improper maneuvering of the other drivers ___%

17. Poorly maintained intermodal equipment ___%
18. Poorly maintained trucks ___%
19. Other Reasons: Please specify
    ____________________%
    ____________________%
    ____________________%
    ____________________%
    ____________________%

II. From your experience so far, would you say that:

1. Intermodal trucks are involved in more crashes than other trucks?
   Yes____ No____ (If Yes please explain:______________
   ______________________________________________
   ______________________________________________
   ______________________________________________)
2. Fewer crashes happen on freeways (vs. local streets)?
   Yes____ No____ (Why? Please explain:_____________
   ______________________________________________
   ______________________________________________
   ______________________________________________)
3. The older the truck driver is, the more crashes s/he has?
   Yes____ No____
4. The longer the driver drives the fewer accidents he has?
   Yes____No____
5. Foreign drivers tend to be involved in more accidents than US born drivers?
   Yes____No____ (If yes, please explain:______________
   ______________________________________________
   ______________________________________________
   ______________________________________________)
6. Company drivers have fewer crashes than owner operators?
   Yes____No____ (If yes please explain:______________
   ______________________________________________
   ______________________________________________
   ______________________________________________)
7. More crashes happen in local deliveries or drayage trips than regional trips?
   Yes____No____ (Please explain :______________
   ______________________________________________
   ______________________________________________
   ______________________________________________)

## Part C: Your recommendations

If you had unlimited budget (say $100 Million) and no (political) constraints to make improvements to reduce the number of crashes, how would you invest your money:

1. On improving Intersections/Sections/Viaducts: Please specify locations and tell us how much money you will spend on them (the $ dollar amount is just an indicator, you don't need to know construction costs):

1.1 Location 1:____________________________________Money
$___
Improvement__________________________________________
__

1.2 Location 2:____________________________________Money
$___
Improvement__________________________________________
__

1.3 Location 3:____________________________________Money
$___
Improvement__________________________________________
__

1.4 Location 4:____________________________________Money
$___
Improvement__________________________________________
__

1.5 Location 5:____________________________________Money
$___
Improvement__________________________________________
__

1.6 Location 6:____________________________________Money
$___
Improvement__________________________________________
__

1.7 Location 7:____________________________________Money
$___
Improvement__________________________________________
__

1.8 Location 8:____________________________________Money
$___
Improvement__________________________________________
__

1.9 Location 9:____________________________________Money
$___
Improvement__________________________________________
__

2. On improving Freeways/Interchanges/Ramps: Please specify locations and tell us how much money you will spend on them:
2.1 Location 1:____________________________________Money
$___
Improvement__________________________________________
__

2.2 Location 2:______________________________Money
$___
Improvement___________________________________
__
2.3 Location 3:______________________________Money
$___
Improvement___________________________________
__
2.4 Location 4:______________________________Money
$___
Improvement___________________________________
__
2.5 Location 5:______________________________Money
$___
Improvement___________________________________
__
2.6 Location 6:______________________________Money
$___
Improvement___________________________________
__
2.7 Location 7:______________________________Money
$___
Improvement___________________________________
__
2.8 Location 8:______________________________Money
$___
Improvement___________________________________
__
2.9 Location 9:______________________________Money
$___
Improvement___________________________________
__

3. On educating the other drivers on how to drive around trucks
Please specify the program you would do:
3.1 Develop a TV campaign: ____________________ Money
$___
3.2 Require drivers to take truck related safety exams during their BMV drivers license exam
______________________ Money $___
3.3 Develop high school programs ________________ Money
$___

3.4 Lobby the legislation for stricter laws against motorist driving unsafely around trucks ______________________________ Money $___

3.5 Other (please specify) ________________________________ Money $___

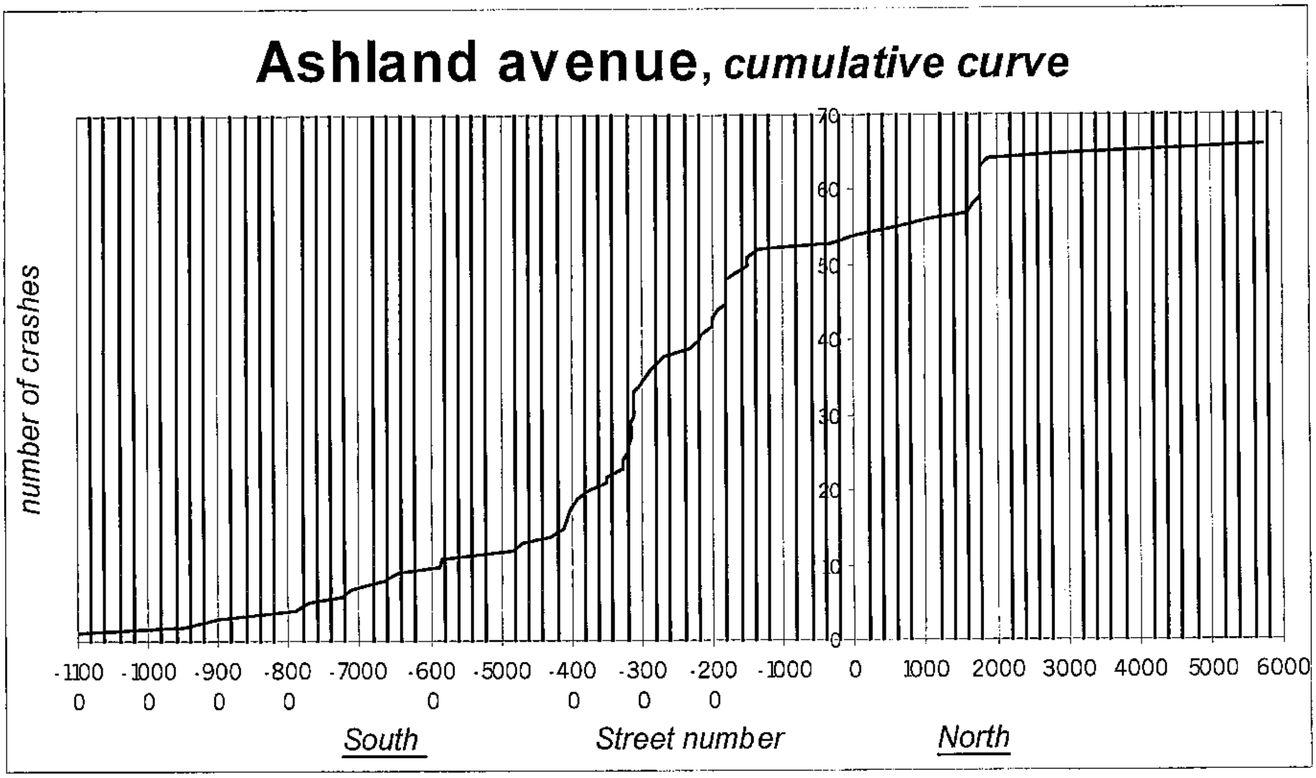
3.6 Other (please specify) ________________________________ Money $___

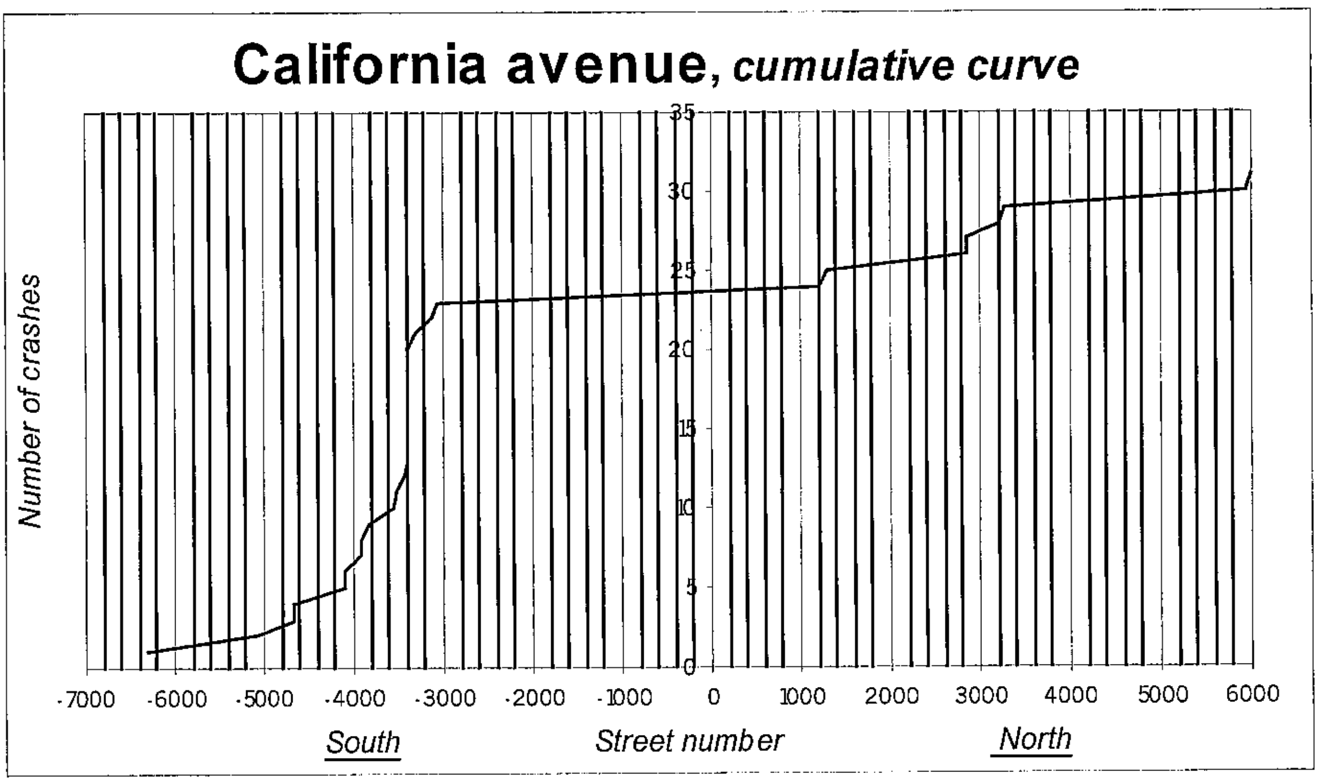
3.7 Other (please specify) ________________________________ Money $___

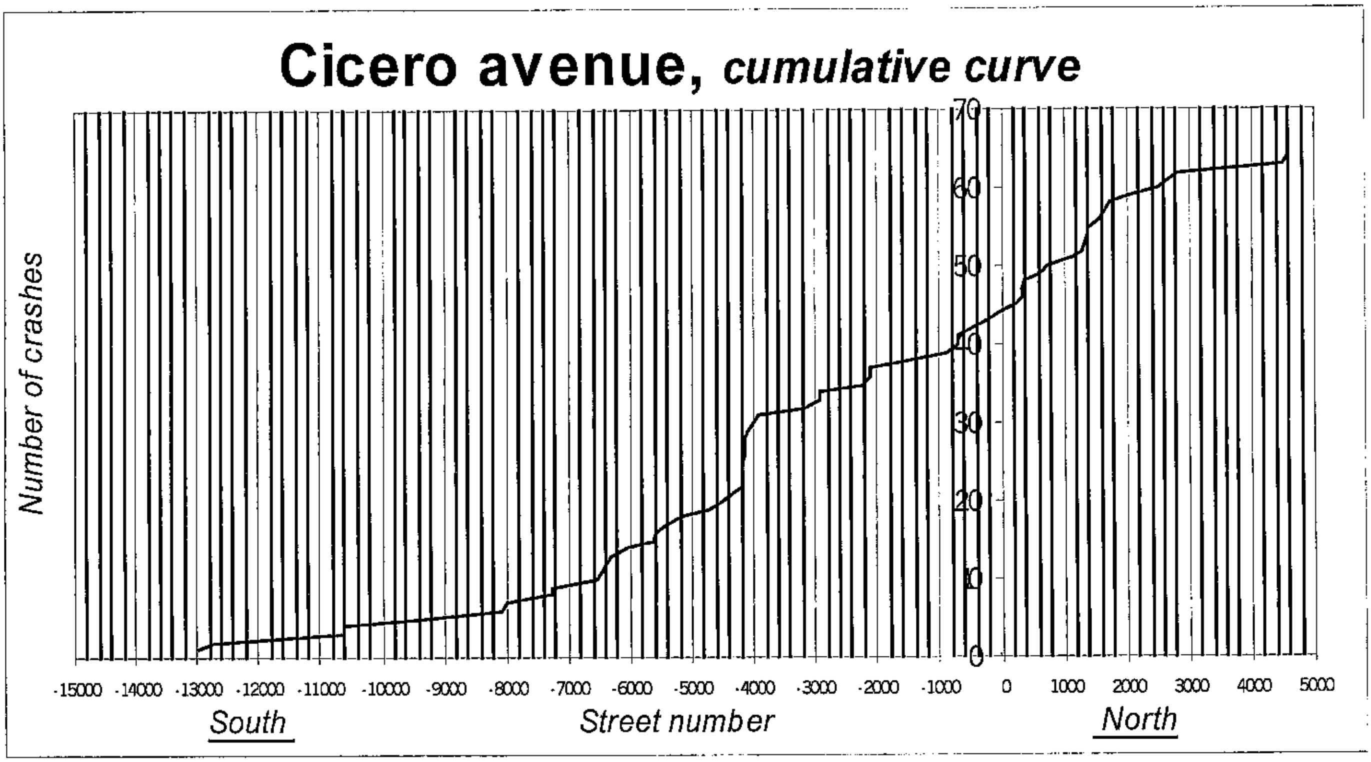
4. On educating your company drivers
   Please specify the program you would do:
   4.1 Program 1 ____________________________________________________
   ____________________________________________________ Money $___
   4.2 Program 2 ____________________________________________________
   ____________________________________________________ Money $___
   4.3 Program 3 ____________________________________________________
   ____________________________________________________ Money $___
   4.4 Program 4 ____________________________________________________
   ____________________________________________________ Money $___
   4.5 Program 5 ____________________________________________________
   ____________________________________________________ Money $___

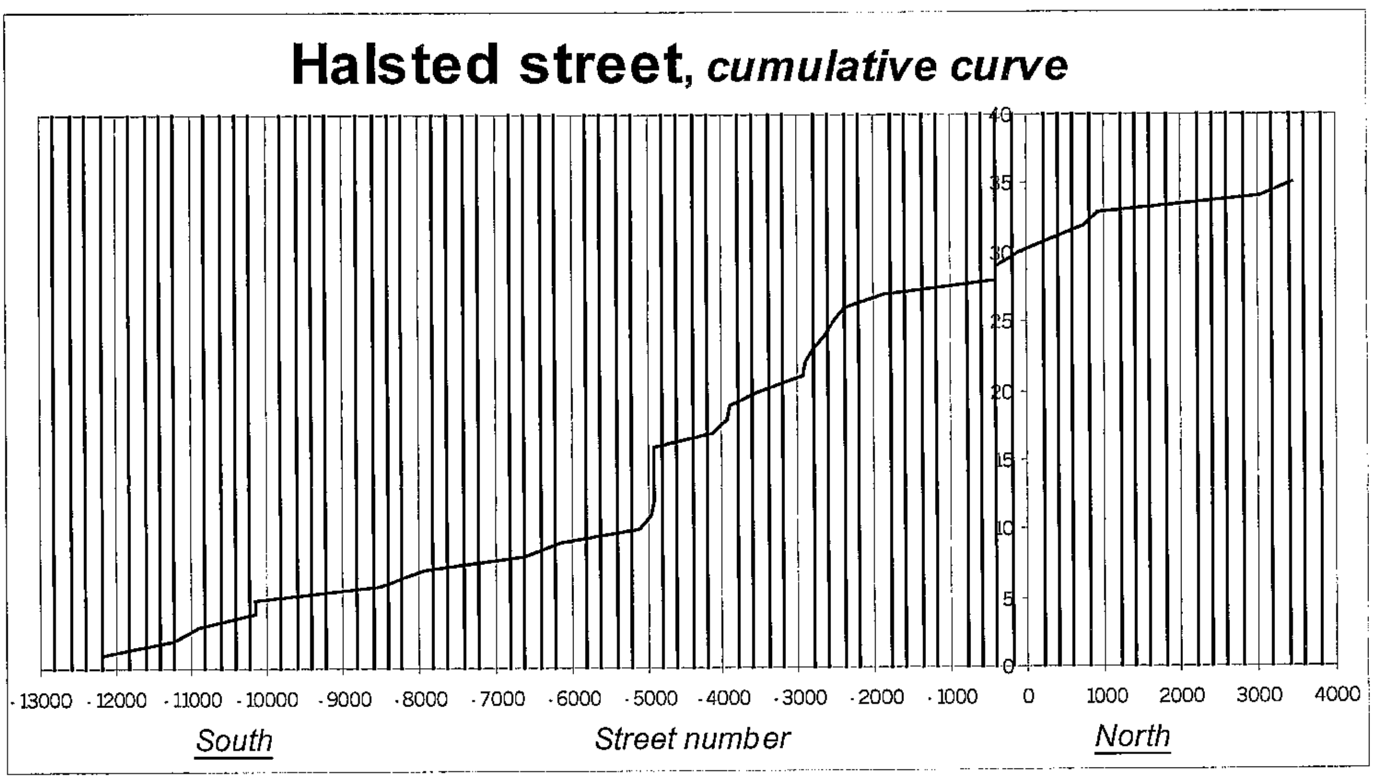
# Appendix 4-Cumulative Crash Curves From IDOT Database

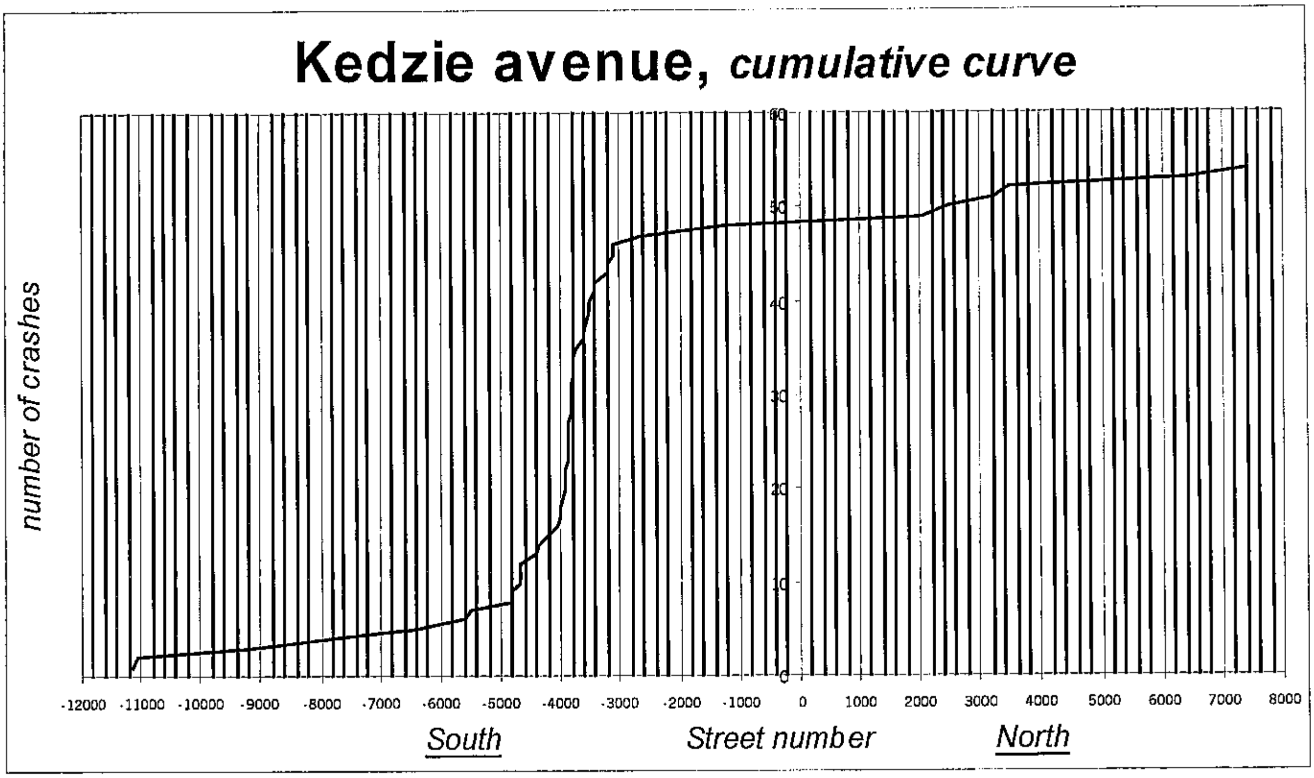
4-CUMULATIVE CRASH CURVES FROM IDOT DATABASE

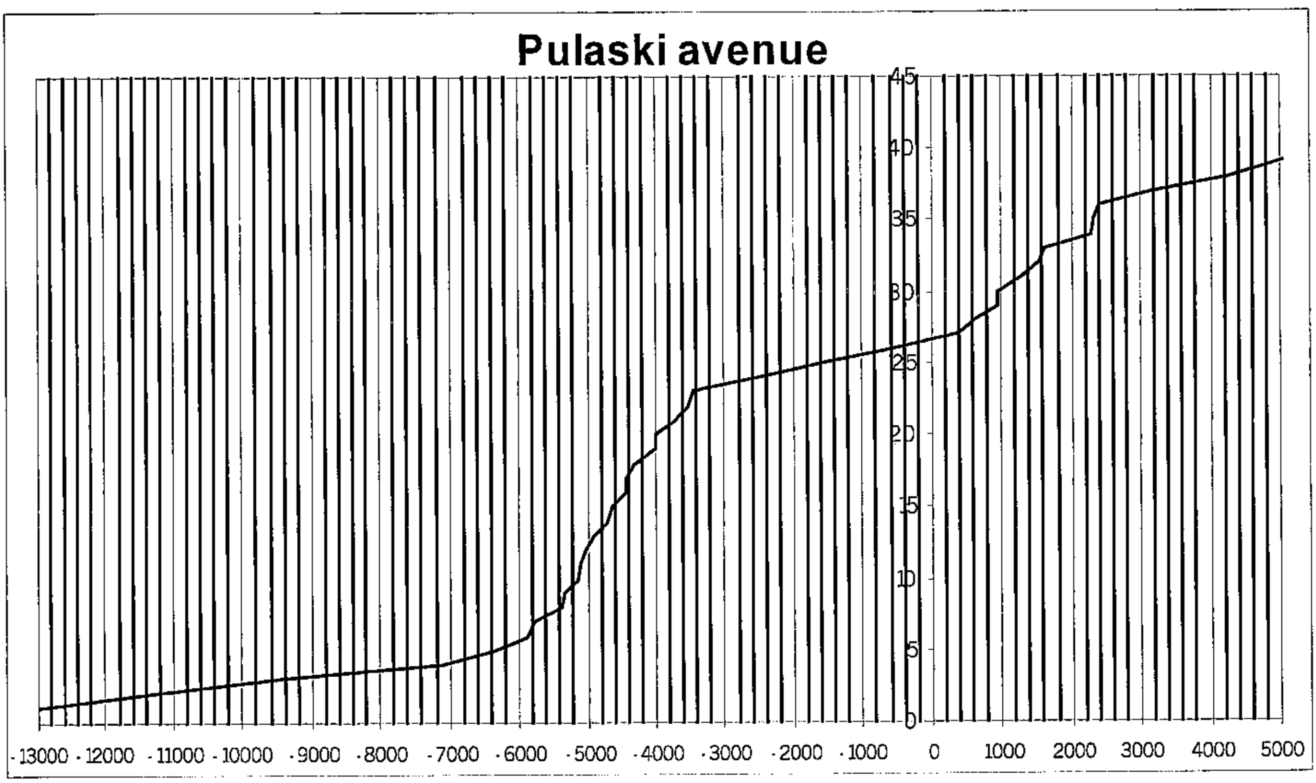


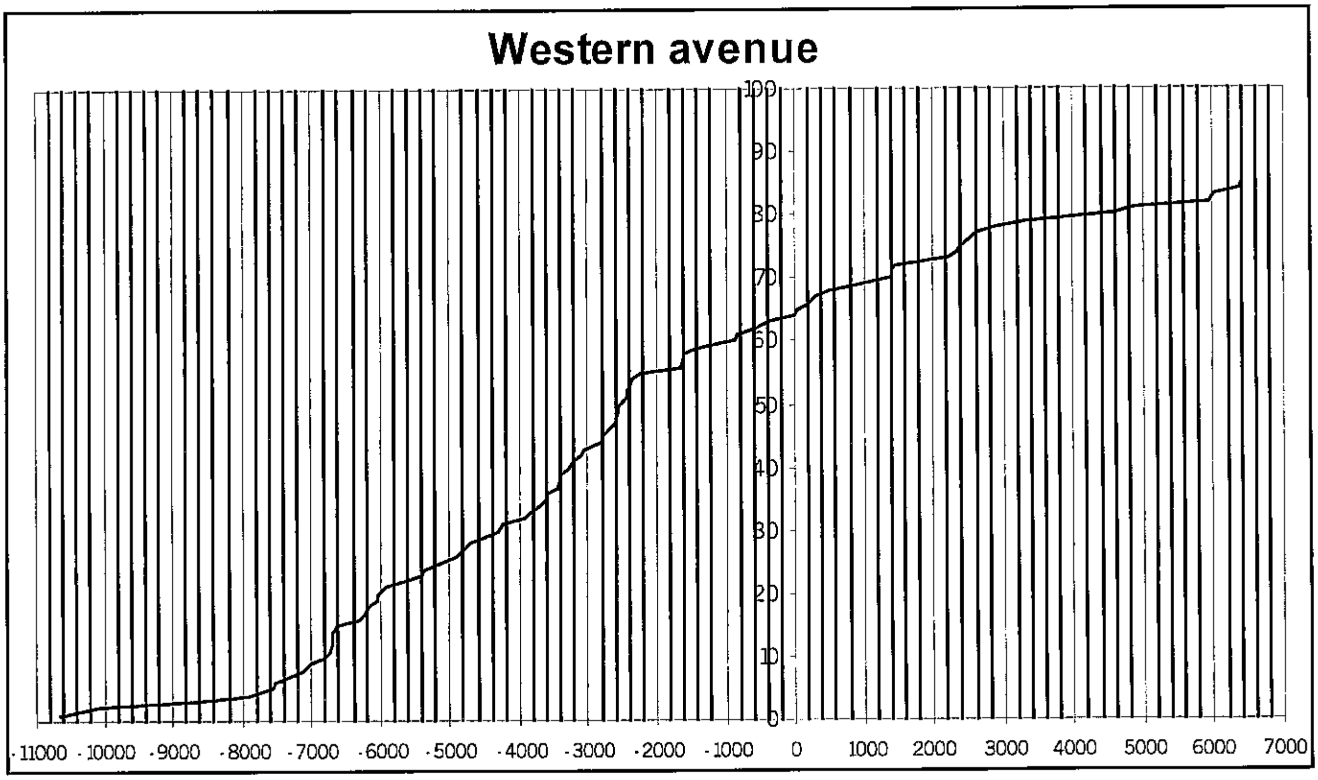




Cicero avenue, cumulative curve
Number of crashes
70
60
50
40
30
20
10
0
-15000 -14000 -13000 -12000 -11000 -10000 -9000 -8000 -7000 -6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000 5000
South
Street number
North


Halsted street, cumulative curve
40
35
30
25
20
15
10
5
0
-13000 -12000 -11000 -10000 -9000 -8000 -7000 -6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000
South
Street number
North


Kedzie avenue, cumulative curve
number of crashes
South
Street number
North
-12000 -11000 -10000 -9000 -8000 -7000 -6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000 5000 6000 7000 8000

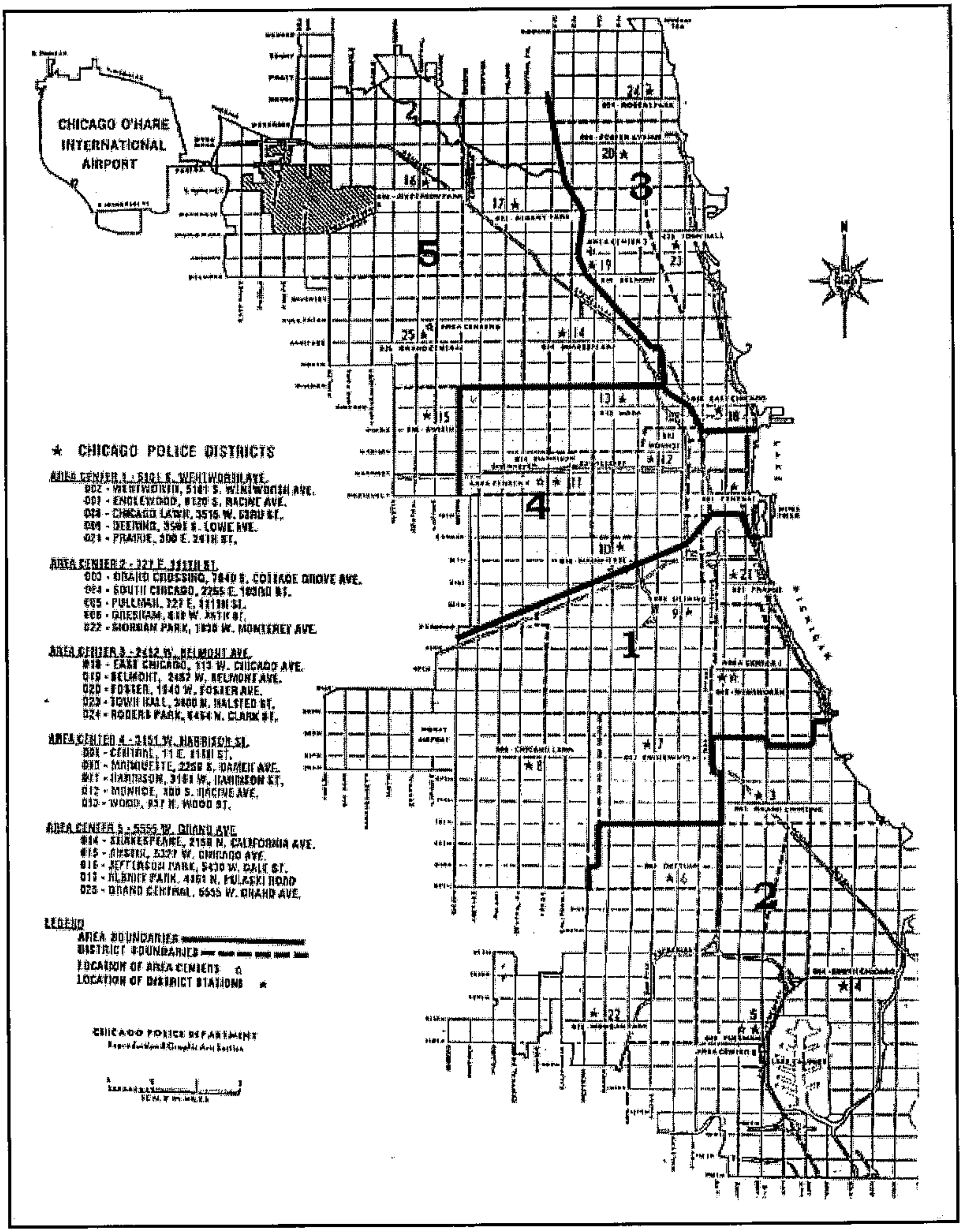

Pulaski avenue
45
40
35
30
25
20
15
10
5
0
-13000 -12000 -11000 -10000 -9000 -8000 -7000 -6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000 5000


Western avenue
100
90
80
70
60
50
40
30
20
10
0
-11000 -10000 -9000 -8000 -7000 -6000 -5000 -4000 -3000 -2000 -1000 0 1000 2000 3000 4000 5000 6000 7000

# Appendix 5-Chicago Police Department. Data

# 5-CHICAGO P.D. DATA

## 5.1-MAP OF DISTRICTS



# 5.2-EXAMPLE OF DATA SHEET

REPORT SPECIAL
SYSTEM CODE 039 TRAFFIC ACCIDENT

CITY OF CHICAGO DEPARTMENT OF POLICE 25

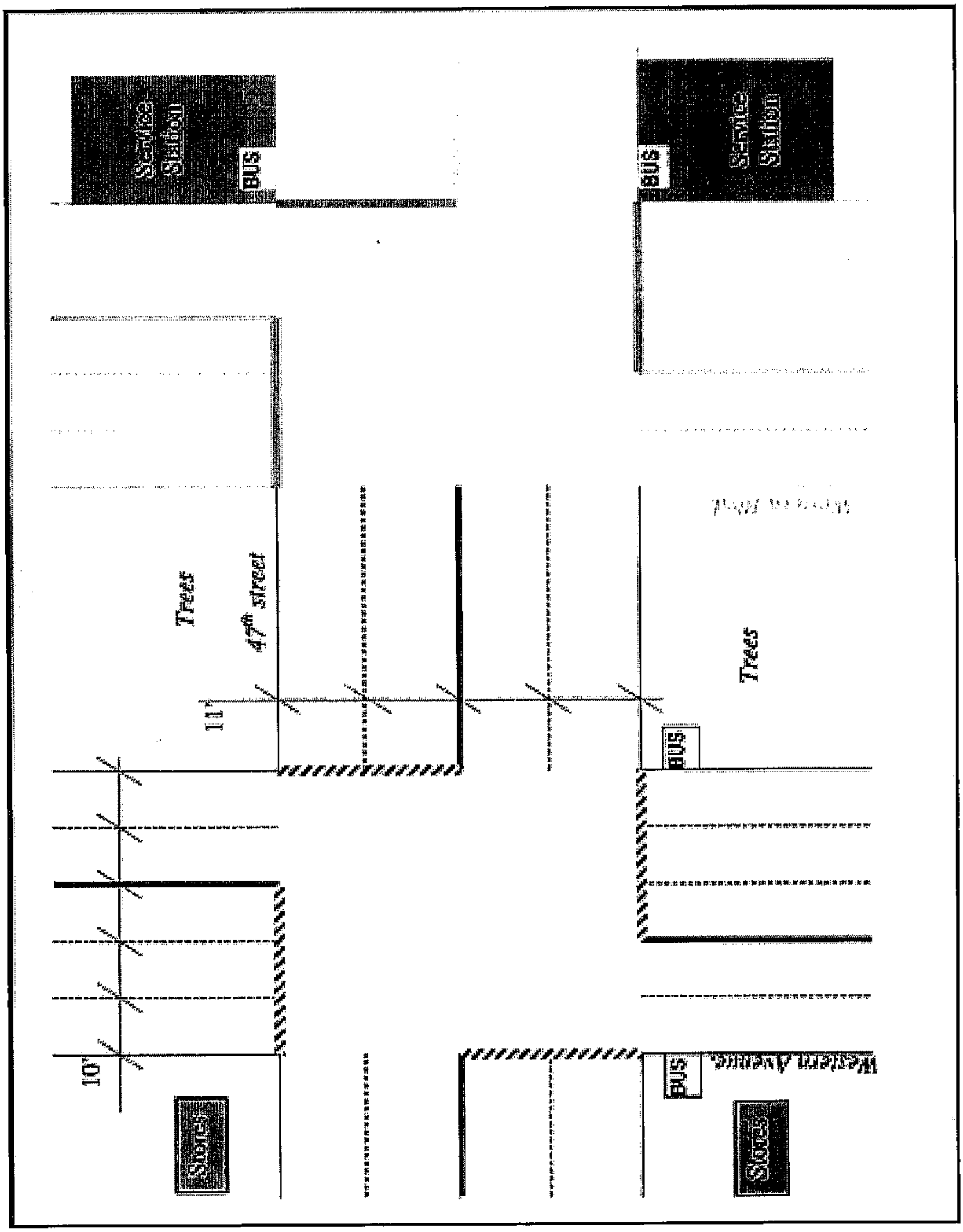
TRAFFIC ACCIDENTS FOR TRACTOR WITH SEMI-TRAILER 09:36 TUESDAY, JULY 27, 1999
PERIOD BETWEEN 01 JAN 1993 TO PRESENT

TY=93 DISTRICT=09
(CONTINUED)

| DISTRICT | CRASHDATE | TIME | ADDR | INTERSECTION ROAD FEATURE | VECHT1 | VECHT2 | ACC_TYPE |
|---|---|---|---|---|---|---|---|
| 09 | 23NOV93 | 1415 | 04750 S ASHLAND AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 23NOV93 | 1410 | 02158 S WESTERN AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 24NOV93 | 1205 | 02800 W 55 ST | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 26NOV93 | 0500 | 00130 N WESTERN AV | | PASSENGER | TRACTOR WITH SEMI-TRAILER | A |
| 09 | 30NOV93 | 0345 | 02450 W 51 ST | | | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 30NOV93 | 0800 | 04300 S PACKERS AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 01DEC93 | 0824 | 01818 W PERSHING RD | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 01DEC93 | 1210 | 02420 S HALSTED | | PASSENGER | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 02DEC93 | 0210 | 04805 S ASHLAND AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | B |
| 09 | 02DEC93 | 0400 | 02504 W 35 ST | | PASSENGER | TRACTOR WITH SEMI-TRAILER | A |
| 09 | 03DEC93 | 0330 | 03858 S WESTERN AV | | TRACTOR WITH SEMI-TRAILER | UNKNOWN | B |
| 09 | 03DEC93 | 1030 | 05101 S HALSTED ST | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 03DEC93 | 0400 | 02035 W 47 ST | | TRACTOR WITH SEMI-TRAILER | UNKNOWN | A |
| 09 | 03DEC93 | 0750 | 04700 S WESTERN AV | | PASSENGER | TRACTOR WITH SEMI-TRAILER | A |
| 09 | 06DEC93 | 0313 | 00330 W 55 ST | | TRACTOR WITH SEMI-TRAILER | UNKNOWN | B |
| 09 | 06DEC93 | 0225 | 02000 W 51 ST | | TRUCK - SINGLE UNIT | TRACTOR WITH SEMI-TRAILER | A |
| 09 | 06DEC93 | 0500 | 04600 S PACKERS AV | | TRACTOR WITH SEMI-TRAILER | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 07DEC93 | 0455 | 05400 S WESTERN AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 07DEC93 | 0115 | 02843 S HILLOCK AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 07DEC93 | 0525 | 04300 S RACINE AV | | TRACTOR WITH SEMI-TRAILER | PICKUP | A |
| 09 | 07DEC93 | 0515 | 03028 S WENTWORTH AV | | PASSENGER | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 08DEC93 | 0745 | 04659 S WESTERN AV | | TRACTOR WITH SEMI-TRAILER | VAN/MINI-VAN | A |
| 09 | 08DEC93 | 0220 | 04200 S HALSTED ST | | TRACTOR WITH SEMI-TRAILER | PASSENGER | B |
| 09 | 08DEC93 | 0703 | 04605 S ASHLAND AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 09DEC93 | 0900 | 01658 W PERSHING RD | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 10DEC93 | 1130 | 03200 S DAMEN AV | | TRACTOR WITH SEMI-TRAILER | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 10DEC93 | 1130 | 03200 S DAMEN AV | | TRACTOR WITH SEMI-TRAILER | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 10DEC93 | 0945 | 03358 S DAMEN AV | 34 & DAMEN | TRACTOR WITH SEMI-TRAILER | UNKNOWN | A |
| 09 | 11DEC93 | 0945 | 03501 S LOWE AV | | PICKUP | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 11DEC93 | 0930 | 01557 W 47 ST | | TRACTOR WITH SEMI-TRAILER | UNKNOWN | B |
| 09 | 14DEC93 | 0745 | 00733 W ROOT | EMERALD | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 14DEC93 | 0600 | 00832 W PERSHING RD | | | TRACTOR WITH SEMI-TRAILER | B |
| 09 | 14DEC93 | 1010 | 00920 W PERSHING RD | | TRACTOR WITH SEMI-TRAILER | TRACTOR WITH SEMI-TRAILER | A |
| 09 | 15DEC93 | 0700 | 03200 S DAMEN AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 15DEC93 | 0200 | 03100 S ASHLAND AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | B |
| 09 | 15DEC93 | 0610 | 03901 S ASHLAND AV | | TRACTOR WITH SEMI-TRAILER | UNKNOWN | A |
| 09 | 15DEC93 | 0630 | 04300 S WENTWORTH AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 15DEC93 | 0310 | 03810 S KEDZIE AV | | TRACTOR WITH SEMI-TRAILER | PASSENGER | B |
| 09 | 16DEC93 | 1100 | 00840 W 45 ST | | TRACTOR WITH SEMI-TRAILER | PASSENGER | A |
| 09 | 17DEC93 | 0910 | 04640 S HALSTED ST | | TRACTOR WITH SEMI-TRAILER | BUS OVER 15 PASS | A |
| 09 | 17DEC93 | 1245 | 03700 S ASHLAND AV | | VAN/MINI-VAN | TRACTOR WITH SEMI-TRAILER | B |

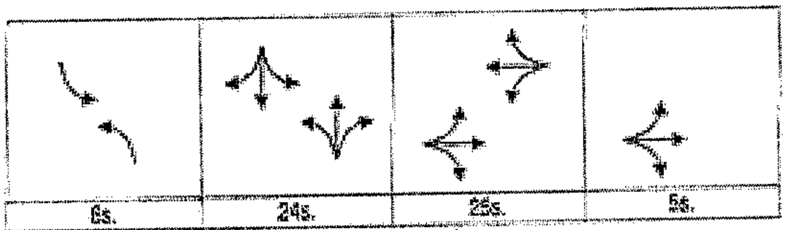
# Appendix 6-Analysis of the Intersection at 47$^{th}$ Street and Western Avenue

## 6.1-47TH STREET AND WESTERN AVENUE - GENERAL VIEW



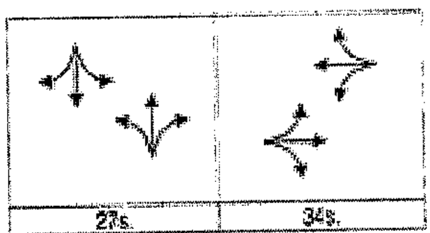
## 6.2-TIMING PLAN AND PHASING

47th street and Western avenue:



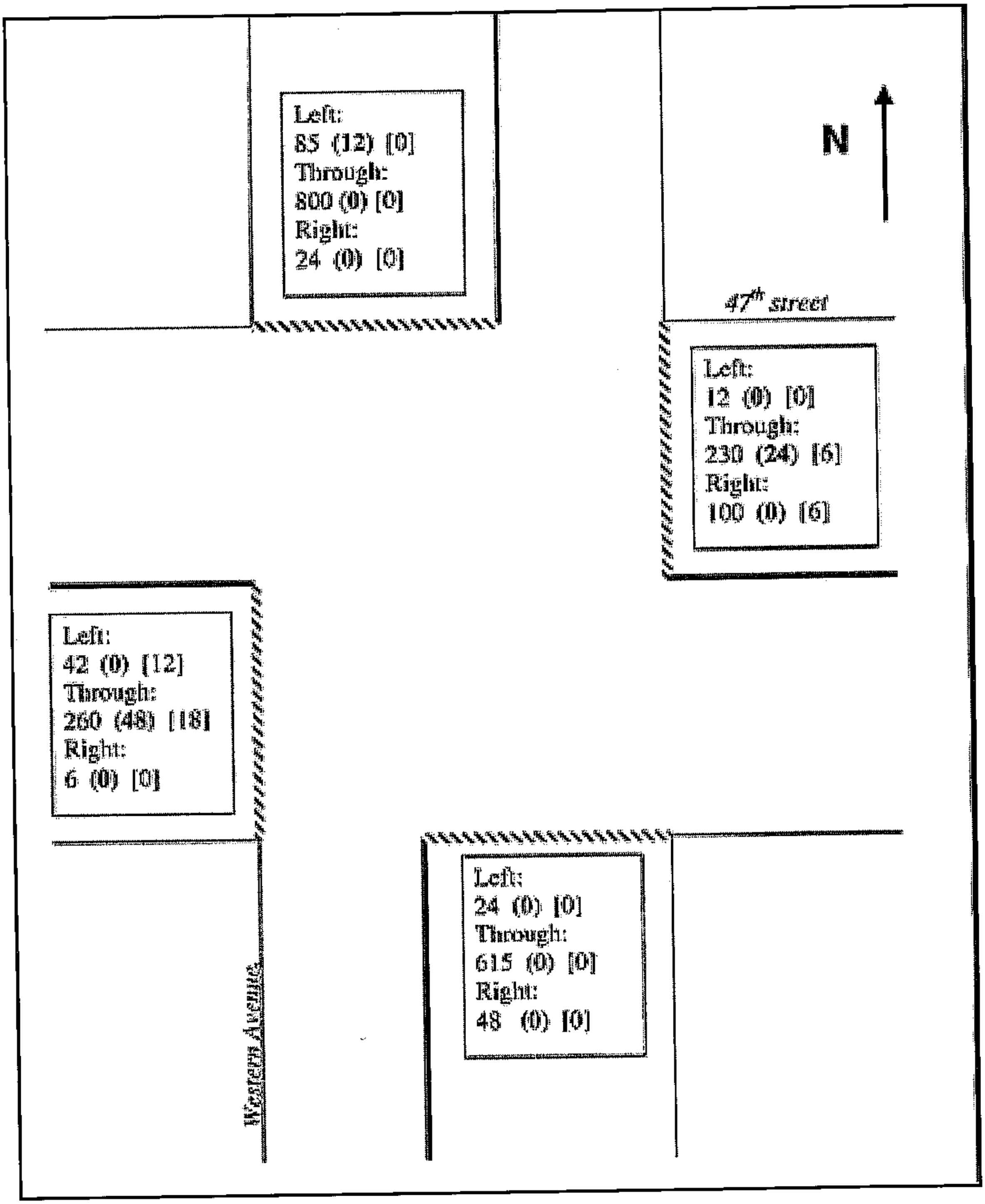

all red: 2seconds

26th street and California avenue




all red: 2 seconds

## 6.3-ESTIMATE HOURLY TRAFFIC FOR CARS, (TRUCKS), [BUSES]

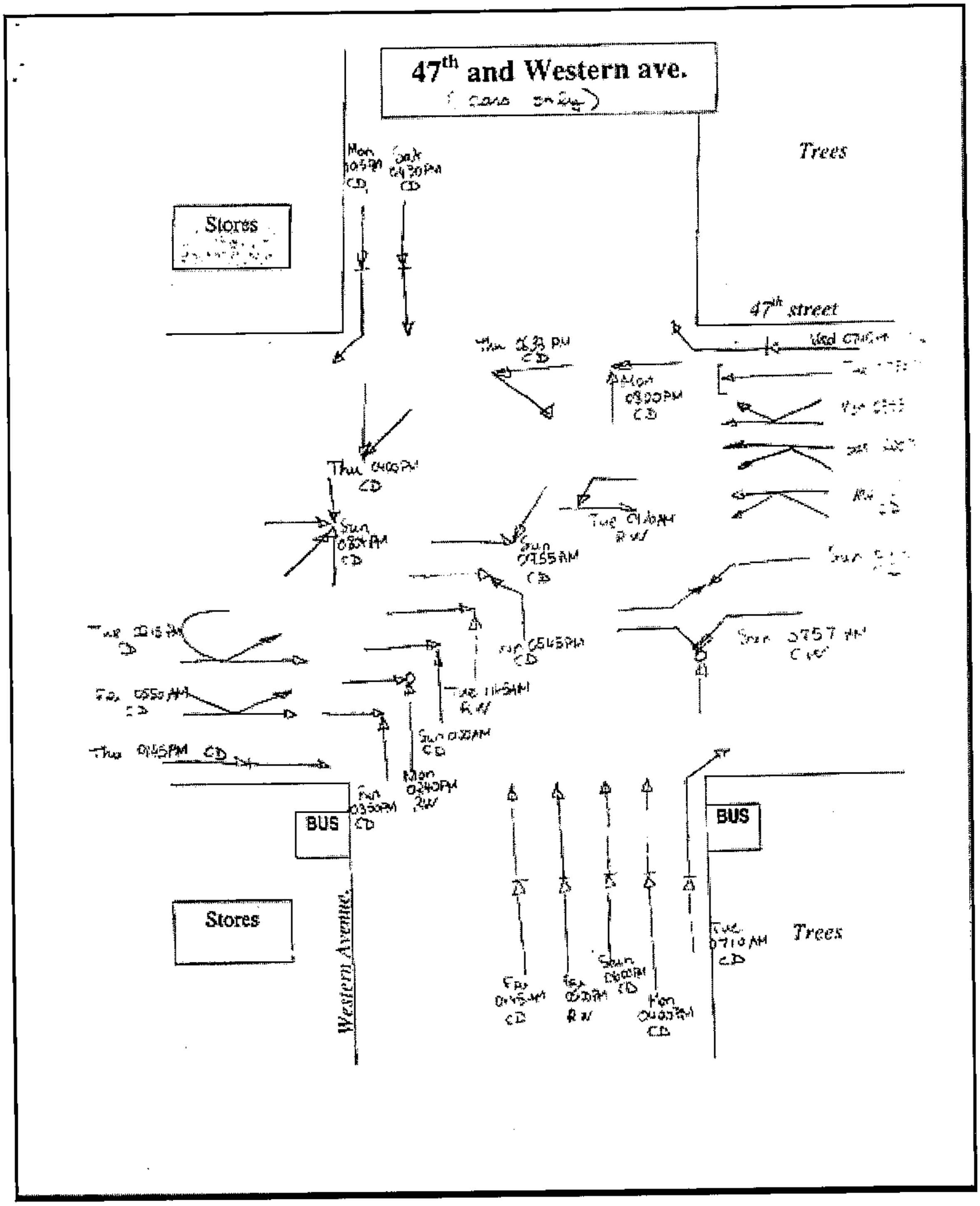


# 6.4-DETAILLED CRASH DATA FOR 47TH AND WESTERN

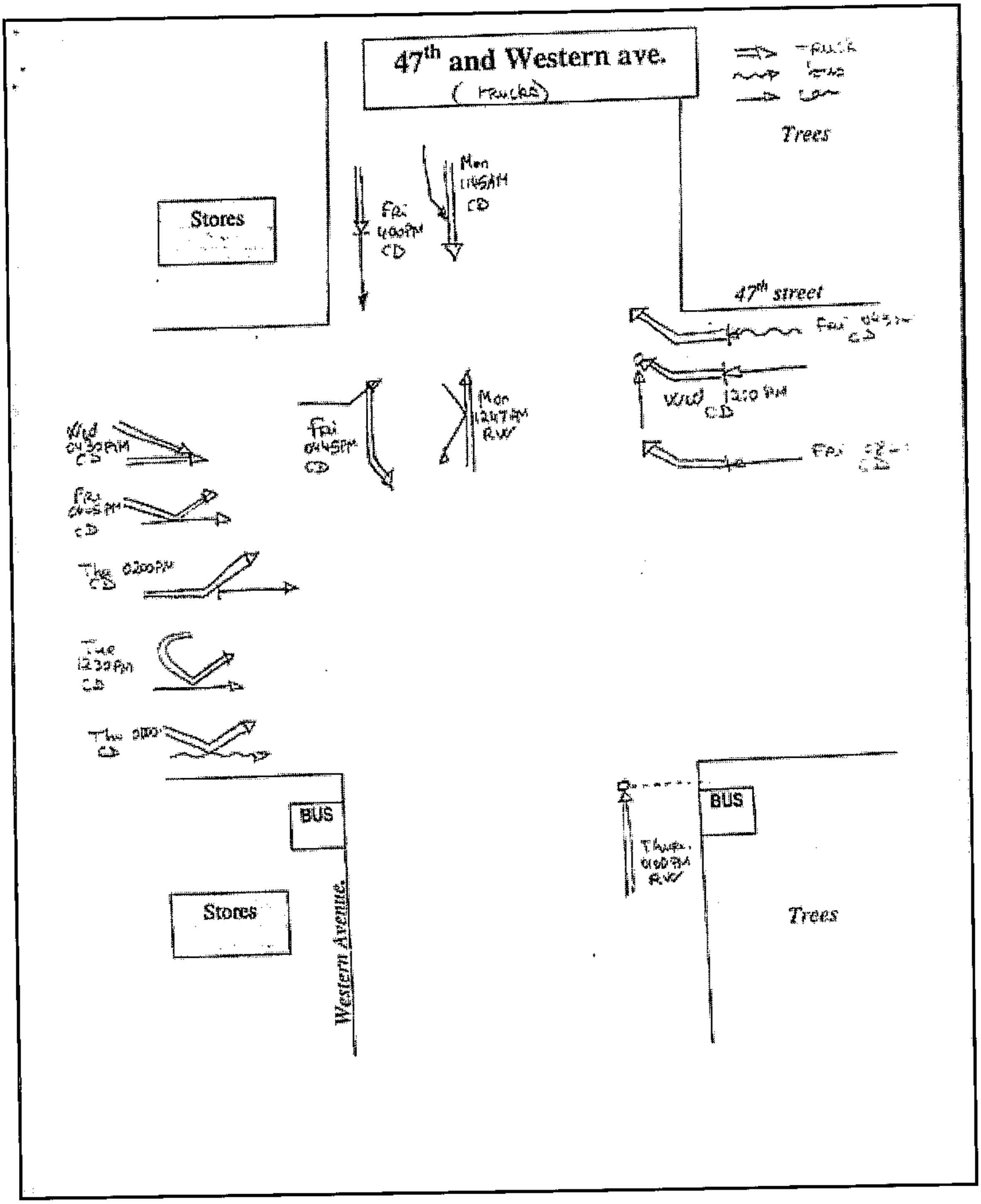
PROGRAM: PH030069 CHICAGO SAFETY INFORMATION SYSTEM - LOCATION PROFILE CRASH REPORT PAGE NO 1
DATE: 08/23/99 LOCATION: AT 25 ST AND CALIFORNIA AV - PERIOD: 01/01/1998 TO 12/31/1998 TIME 21:30:4

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DATE | 01-01-1998 | 01-05-1998 | 01-08-1998 | 01-13-1998 | 01-18-1998 | 01-22-1998 | 01-23-1998 | 01-23-1998 |
| DAY | THURSDAY | MONDAY | THURSDAY | TUESDAY | SUNDAY | THURSDAY | FRIDAY | FRIDAY |
| TIME | 0710 HOURS | 0415 HOURS | 1045 HOURS | 0535 HOURS | 0352 HOURS | 0801 HOURS | 0710 HOURS | 0730 HOURS |
| RD NUMBER | C001831 | C010209 | C018165 | C027815 | C035514 | C042808 | C049924 | C050036 |
| STREET | 25 ST | 25 ST | 25 ST | 25 ST | 25 ST | 25 ST | 25 ST | 25 ST |
| ADDRESS | W 2800 INTRSCTN | W 2800 INTRSCTN | W 2800 INTRSCTN | W 2800 MIDBLOCK | W 2800 INTRSCTN | W 2800 INTRSCTN | W 2800 INTRSCTN | W 2800 INTRSCTN |
| KILLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| INJURED | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| PRECIP EVENT | VEH IN TRAFFIC | VEH IN TRAFFIC | | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC |
| MANNER COLL | ONE/MORE TURNING | ONE/MORE TURNING | FIXED OBJECT | SIDESWIPE-SAME D | ONE/MORE TURNING | ANGLE COLLISION | ONE/MORE TURNING | ANGLE COLLISION |
| LOCATION | INTERSECTION | ON PAVEMENT | | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT |
| WEATHER | CLEAR | RAIN | SNOW | CLEAR | CLEAR | SNOW | CLEAR | CLEAR |
| ROAD SURFACE | SNOW/SLUSH | WET | DRY | DRY | DRY | SNOW/SLUSH | WET | WET |
| LIGHT | DAYLIGHT | DAYLIGHT | DAYLIGHT | DRKNS-LIGHTED RD | DAYLIGHT | DRKNS-LIGHTED RD | DRKNS-LIGHTED RD | DRKNS-LIGHTED RD |
| UNIT | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ACTION | TURNING RIGHT | SLOW/STOP-LF TRN | OTHER | TURNING LEFT | STRAIGHT AHEAD | TURNING RIGHT | STRAIGHT AHEAD | STRAIGHT AHEAD |
| DIRECTION | NORTHWEST | EAST | | WEST | EAST | NORTH | EAST | SOUTH |
| TYPE | TRACTOR W/SEMI | PASSENGER CAR | OTHER | PASSENGER CAR | PASSENGER CAR | PASSENGER CAR | PICKUP | PICKUP |
| CONDITION | NORMAL | NORMAL | OTHER/UNKNOWN | OTHER/UNKNOWN | NORMAL | NORMAL | NORMAL | OTHER/UNKNOWN |
| DRVR ACTION | NONE | | | | FAILED TO YEILD | NONE | FAST FOR COND | DISREGARD SIGNAL |
| VEHICLE USE | AGRICULTURAL | PERSONAL | | PERSONAL | PERSONAL | PERSONAL | PERSONAL | |
| 1ST EVENT | VEH IN TRAFFIC | VEH IN TRAFFIC | | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC |
| LOCATION | INTERSECTION | ON PAVEMENT | | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT |
| MOST SEVERE | VEH IN TRAFFIC | VEH IN TRAFFIC | | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC |
| LOCATION | INTERSECTION | ON PAVEMENT | | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT |
| 1ST CONTACT | REAR RIGHT SIDE | RIGHT SIDE | | NONE | RIGHT SIDE | RIGHT SIDE | FRONT | FRONT |
| NO. KILLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NO. INJURED | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| UNIT | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| ACTION | SLOW/STOP-LF TRN | SLOW/STOP-LF TRN | SLOW/STOP-RT TRN | SLOW/STOP-LF TRN | STRAIGHT AHEAD | STRAIGHT AHEAD | TURNING LEFT | TURNING LEFT |
| DIRECTION | WEST | WEST | NORTH | WEST | WEST | SOUTH | WEST | WEST |
| TYPE | PASSENGER CAR | PICKUP | TRACTOR W/SEMI | PASSENGER CAR | VAN/MINI VAN | PASSENGER CAR | PASSENGER CAR | PASSENGER CAR |
| CONDITION | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL | NORMAL |
| DRVR ACTION | FAILED TO YEILD | | NONE | | NONE | NONE | FAILED TO YEILD | OTHER |
| VEHICLE USE | PERSONAL | PERSONAL | OTHER | PERSONAL | PERSONAL | PERSONAL | PERSONAL | PERSONAL |
| 1ST EVENT | VEH IN TRAFFIC | VEH IN TRAFFIC | | VEH IN TRAFFIC | | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC |
| LOCATION | INTERSECTION | ON PAVEMENT | | ON PAVEMENT | | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT |
| MOST SEVERE | VEH IN TRAFFIC | VEH IN TRAFFIC | | VEH IN TRAFFIC | | VEH IN TRAFFIC | VEH IN TRAFFIC | VEH IN TRAFFIC |
| LOCATION | INTERSECTION | ON PAVEMENT | | ON PAVEMENT | | ON PAVEMENT | ON PAVEMENT | ON PAVEMENT |
| 1ST CONTACT | FRONT RIGHT SIDE | FRONT | FRONT | FRONT | FRONT | FRONT | RIGHT SIDE | |
| NO. KILLED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NO. INJURED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT | | | | | | | | |
| ACTION | | | | | | | | |
| DIRECTION | | | | | | | | |
| TYPE | | | | | | | | |
| CONDITION | | | | | | | | |
| DRVR ACTION | | | | | | | | |
| VEHICLE USE | | | | | | | | |
| 1ST EVENT | | | | | | | | |
| LOCATION | | | | | | | | |
| MOST SEVERE | | | | | | | | |
| LOCATION | | | | | | | | |
| 1ST CONTACT | | | | | | | | |
| NO. KILLED | | | | | | | | |
| NO. INJURED | | | | | | | | |
| PED/BIKE | | | | | | | | |
| ACTION | | | | | | | | |
| KILLED | | | | | | | | |
| INJURED | | | | | | | | |
| CONDITION | | | | | | | | |

## 6.5-CRASHES NOT INVOLVING TRUCKS



## 6.6-CRASHES INVOLVING TRUCKS



# 6.7-AASHTO GEOMETRIC RECOMMENDATIONS

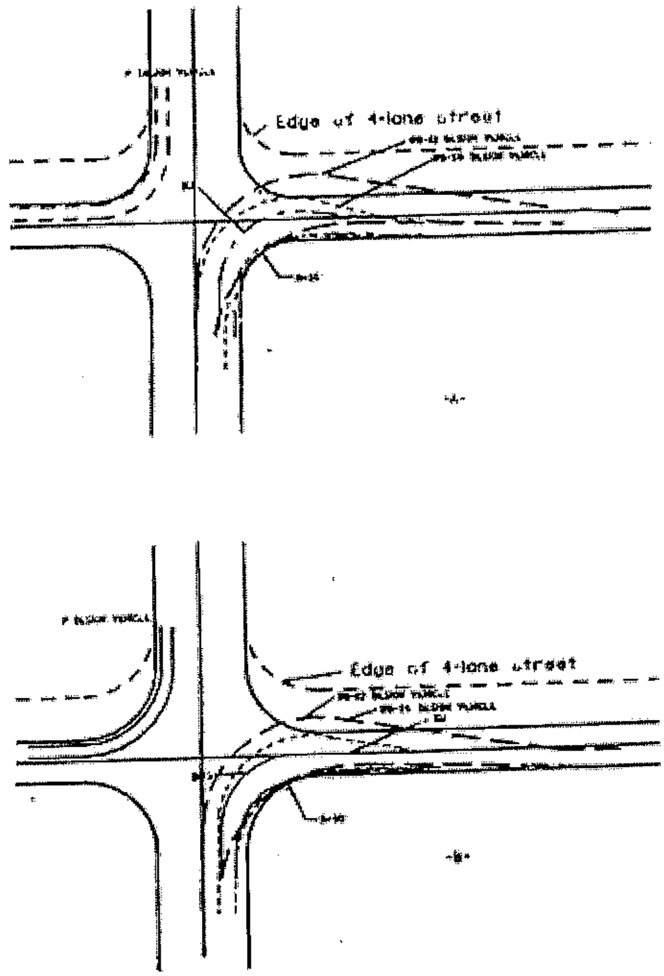
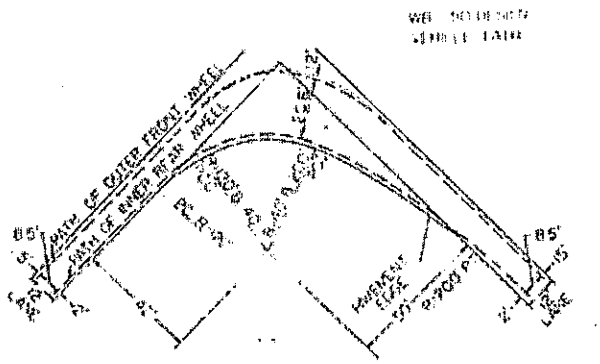
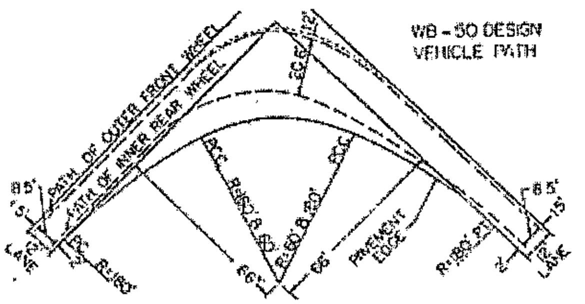



Figure IX-19. Effect of curb radii on turning paths of various design vehicles.

# 6.8-AASHTO GEOMETRIC RECOMMENDATIONS (CTD.)



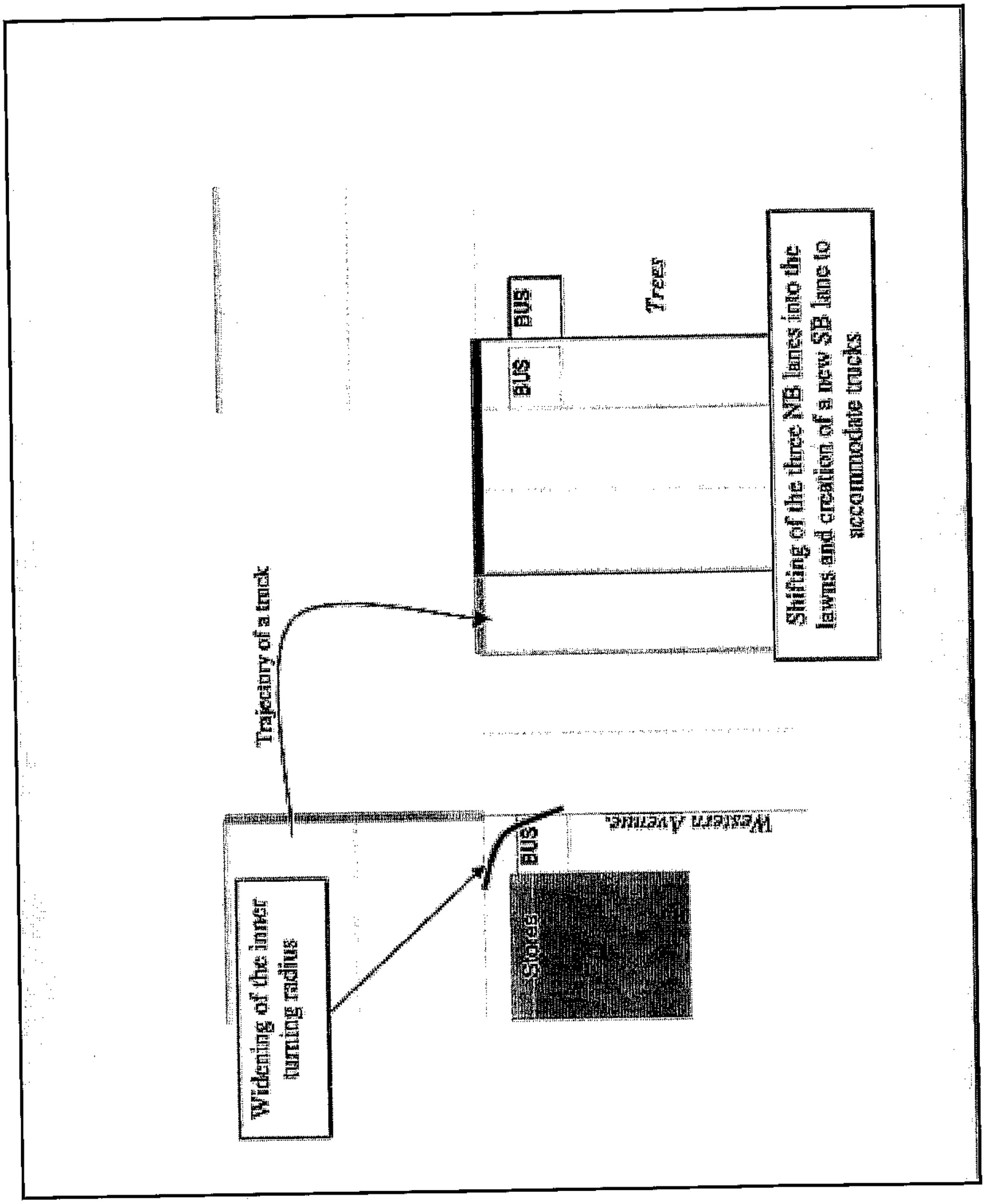

WB-50 SEMITRAILER COMBINATION
3 CENTERED COMPOUND CURVE,
120'-40'-200' RADII, OFFSET 2' AND 10'



WB-50 SEMITRAILER COMBINATION
3 CENTERED COMPOUND CURVE,
180'-60'-180', OFFSET 6'

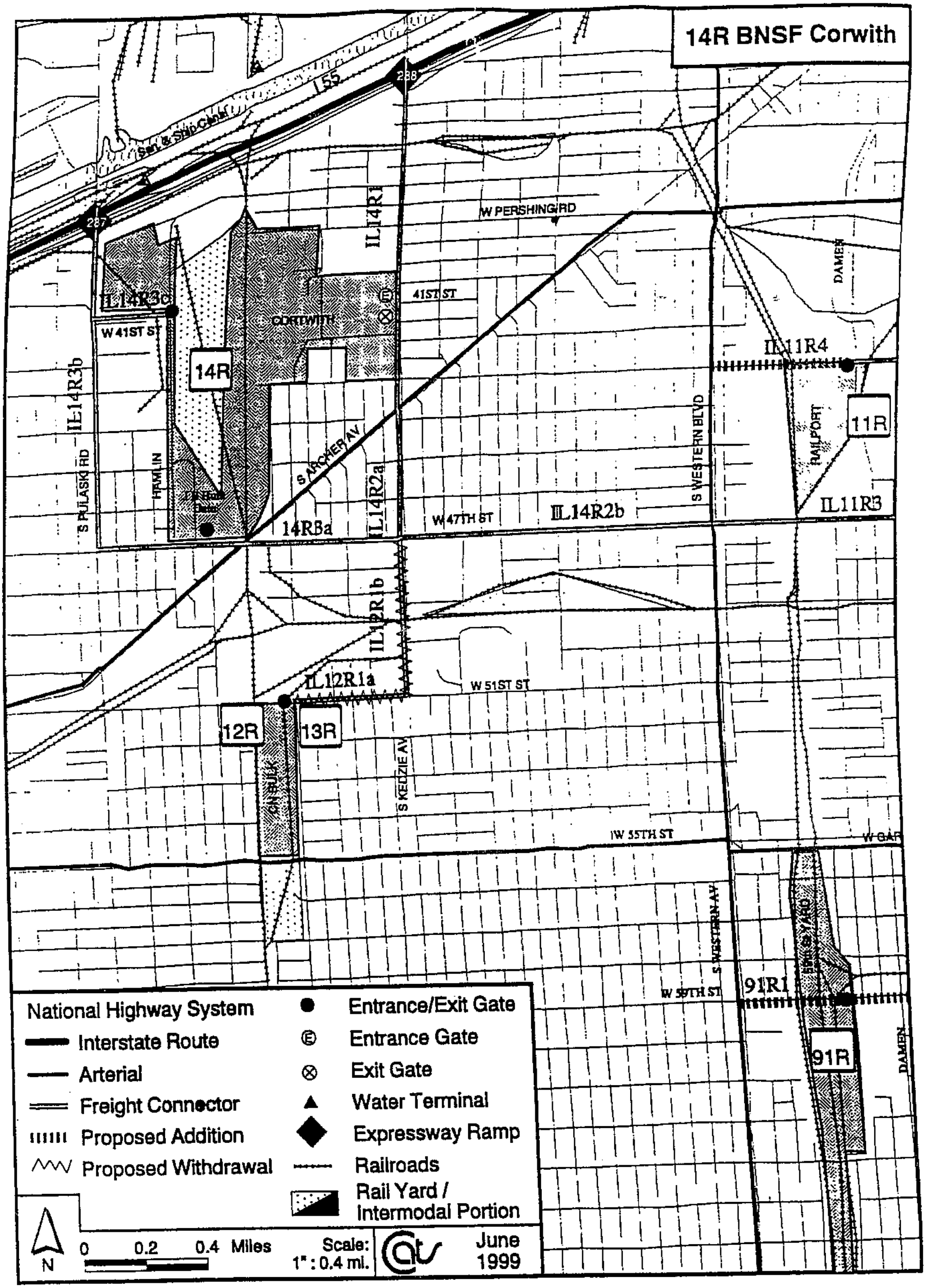
**Figure IX-14. Minimum designs for semitrailer combinations (WB 50 design vehicle path).**

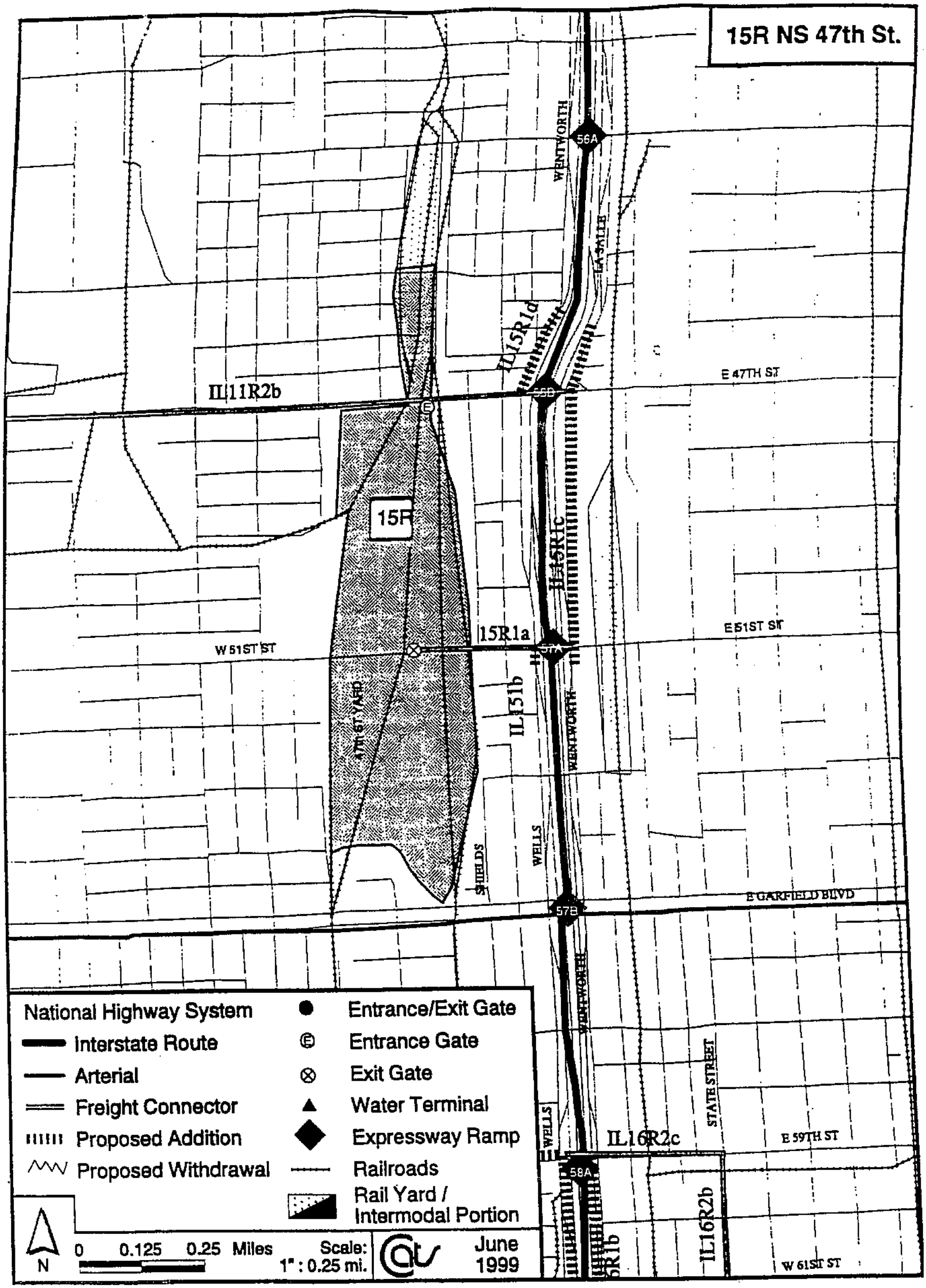
## 6.9-RECOMMENDED MODIFICATION

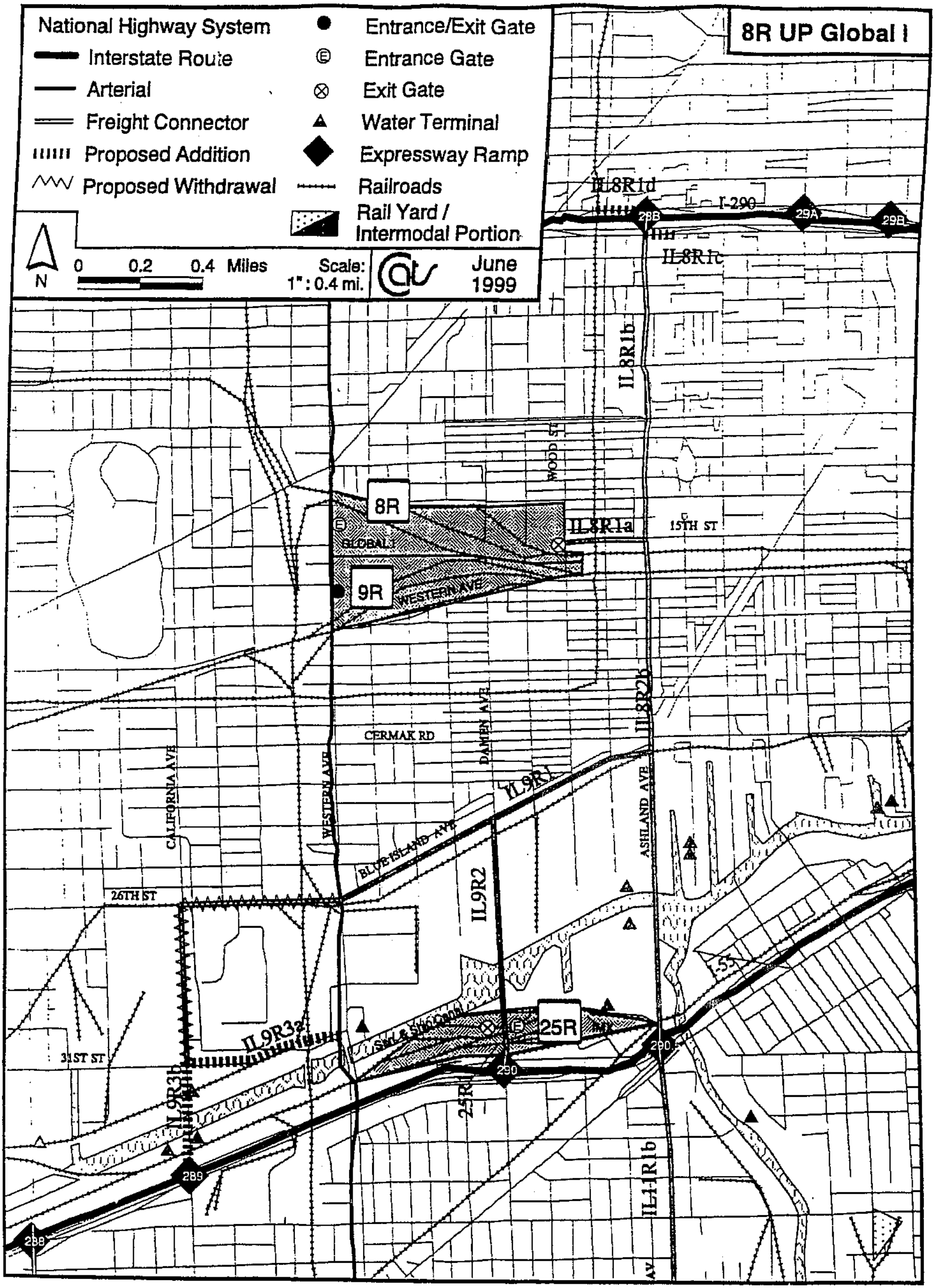


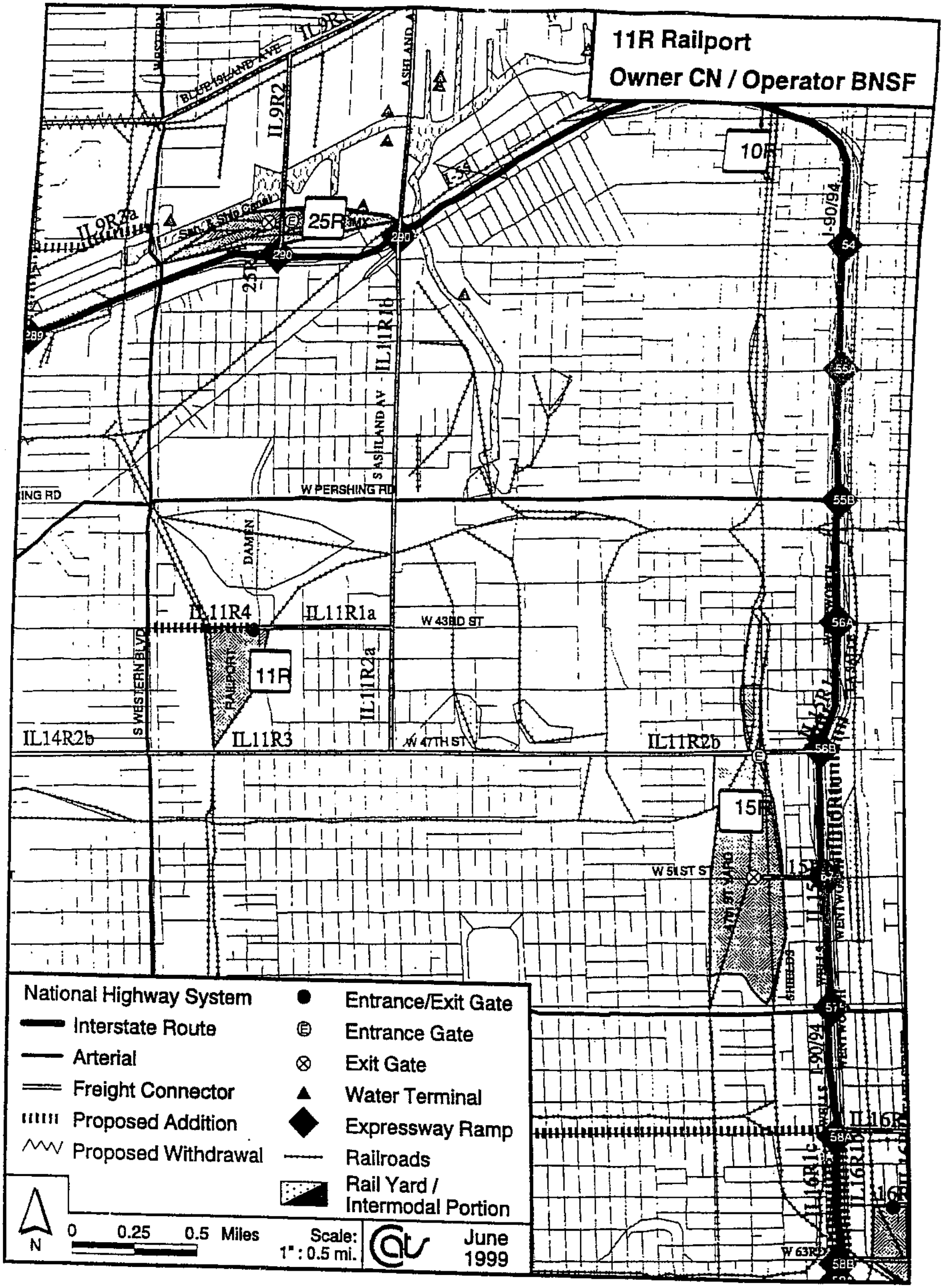
# Appendix 7-Schematics Of Selected Yards

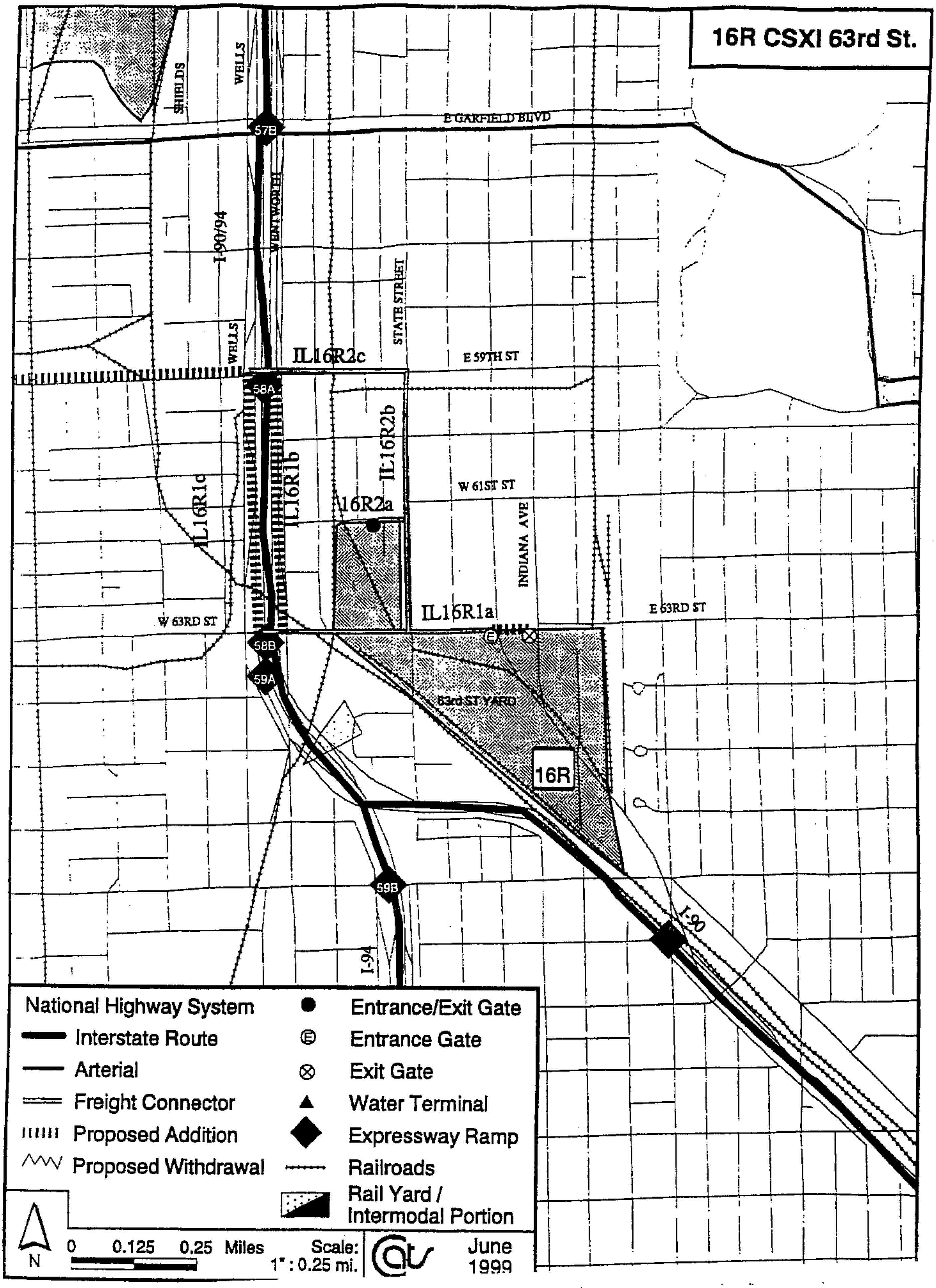
1. BNSF CORWITH YARD
2. NS 47th Street YARD
3. GLOBAL I
4. RAILPORT YARD
5. 63rd STREET YARD
6. 59th STREET YARD

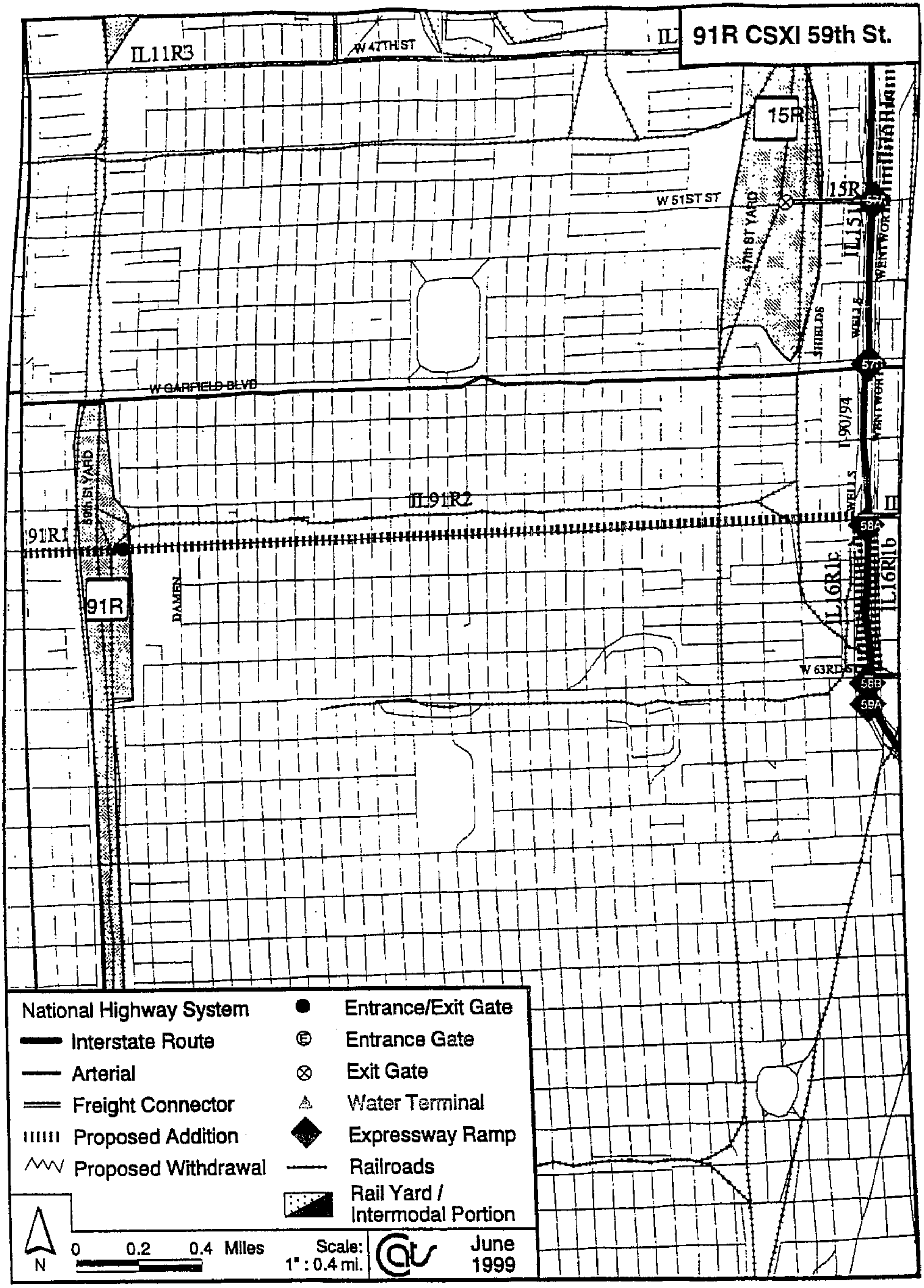

14R BNSF Corwith
I 55
Sanit & Ship Canal
W PERSHING RD
41ST ST
W 41ST ST
CORWITH
14R
IL14R3c
IL14R3b
IL14R1
IL14R2a
IL14R2b
14R3a
S PULASKI RD
HAMLIN
S ARCHER AV
W 47TH ST
IL14R1b
IL12R1a
W 51ST ST
12R
13R
CN BULK
S KEDZIE AV
W 55TH ST
S WESTERN BLVD
S WESTERN AV
IL11R4
11R
RAILPORT
IL11R3
DAMEN
W GAR
W 59TH ST
91R1
91R
59th St YARD
National Highway System
Interstate Route
Arterial
Freight Connector
Proposed Addition
Proposed Withdrawal
Entrance/Exit Gate
Entrance Gate
Exit Gate
Water Terminal
Expressway Ramp
Railroads
Rail Yard / Intermodal Portion
N
0 0.2 0.4 Miles
Scale: 1" : 0.4 mi.
June 1999


15R NS 47th St.
WENTWORTH
LA SALLE
IL15R1d
E 47TH ST
IL11R2b
15R
IL15R1c
15R1a
E 51ST ST
W 51ST ST
IL151b
47TH ST. YARD
SHIELDS
WELLS
E GARFIELD BLVD
STATE STREET
E 59TH ST
IL16R2c
IL16R2b
W 61ST ST
56A
57A
57B
58A
National Highway System
Interstate Route
Arterial
Freight Connector
Proposed Addition
Proposed Withdrawal
Entrance/Exit Gate
Entrance Gate
Exit Gate
Water Terminal
Expressway Ramp
Railroads
Rail Yard / Intermodal Portion
N
0 0.125 0.25 Miles
Scale: 1" : 0.25 mi.
June 1999


8R UP Global I
National Highway System
Interstate Route
Arterial
Freight Connector
Proposed Addition
Proposed Withdrawal
Entrance/Exit Gate
Entrance Gate
Exit Gate
Water Terminal
Expressway Ramp
Railroads
Rail Yard / Intermodal Portion
N
0 0.2 0.4 Miles
Scale: 1" : 0.4 mi.
June 1999
IL8R1d
I-290
28B
29A
29B
IL8R1c
IL8R1b
WOOD ST
8R
IL8R1a
15TH ST
GLOBAL I
9R
WESTERN AVE
IL8R2b
CERMAK RD
DAMEN AVE
IL9R1
CALIFORNIA AVE
WESTERN AVE
BLUE ISLAND AVE
ASHLAND AVE
IL9R2
26TH ST
I-55
IL9R3a
25R
290
31ST ST
IL9R3b
25R
289
IL11R1b
288
AV


11R Railport
Owner CN / Operator BNSF
National Highway System
Interstate Route
Arterial
Freight Connector
Proposed Addition
Proposed Withdrawal
Entrance/Exit Gate
Entrance Gate
Exit Gate
Water Terminal
Expressway Ramp
Railroads
Rail Yard / Intermodal Portion
N
0 0.25 0.5 Miles
Scale: 1" : 0.5 mi.
June 1999
W PERSHING RD
W 43RD ST
W 47TH ST
W 51ST ST
W 63RD
S WESTERN BLVD
S ASHLAND AV
DAMEN
BLUE ISLAND AVE
IL11R4
IL11R1a
IL11R1b
IL11R2a
IL11R2b
IL11R3
IL14R2b
IL9R2
IL9R2a
IL16R1c
IL16R1b
11R
10R
15R
25R
RAILPORT
I-90/94
WENTWORTH


16R CSXI 63rd St.
SHIELDS
WELLS
E GARFIELD BLVD
57B
I-90/94
WENTWORTH
STATE STREET
WELLS
IL16R2c
E 59TH ST
58A
IL16R2b
IL16R1b
IL16R1c
W 61ST ST
16R2a
INDIANA AVE
IL16R1a
E 63RD ST
W 63RD ST
58B
59A
63rd ST YARD
16R
59B
I-90
I-94
National Highway System
Interstate Route
Arterial
Freight Connector
Proposed Addition
Proposed Withdrawal
Entrance/Exit Gate
Entrance Gate
Exit Gate
Water Terminal
Expressway Ramp
Railroads
Rail Yard /
Intermodal Portion
N
0 0.125 0.25 Miles
Scale:
1" : 0.25 mi.
June
1999


91R CSXI 59th St.
IL11R3
W 47TH ST
15R
W 51ST ST
47th ST YARD
SHIELDS
W GARFIELD BLVD
I-90/94
IL91R2
91R1
59th St YARD
91R
DAMEN
IL16R1c
IL16R1b
W 63RD ST
58A
58B
59A
National Highway System
Interstate Route
Arterial
Freight Connector
Proposed Addition
Proposed Withdrawal
Entrance/Exit Gate
Entrance Gate
Exit Gate
Water Terminal
Expressway Ramp
Railroads
Rail Yard / Intermodal Portion
N
0 0.2 0.4 Miles
Scale: 1" : 0.4 mi.
June 1999

# 8-Example Of AVL Data

# 8-EXAMPLE OF AVL DATA

| | | | | |
|---|---|---|---|---|
| TC0005 | NS | | 2:45:04 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 3:00:07 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 3:15:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 3:30:07 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 3:45:05 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 4:00:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 4:15:05 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 4:30:07 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 4:45:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 5:00:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 5:15:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 5:30:07 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 5:45:05 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 6:00:07 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 6:15:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 6:30:07 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 6:45:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 7:00:08 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 7:15:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 7:30:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 7:45:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 8:00:05 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 8:15:09 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 55W | 8:30:08 | S CENTRAL AV btw W 48TH ST & W 47TH ST. |
| TC0005 | NS | 0 | 8:45:12 | I 55 btw S CENTRAL AV & S HARLEM AV. |
| TC0005 | NS | | 9:00:05 | W 47TH ST btw S CENTRAL AV & LONG AV |
| TC0005 | NS | 44SW | 9:15:05 | I 55 btw CLARENDON HILLS RD & LORRAINE DR. |
| TC0005 | NS | 55SW | 9:30:07 | I 55 btw RENWICK RD & LOCKPORT RD. |
| TC0005 | NS | 62S | 9:45:09 | I 55 btw BLODGET RD & RIVER RD. |
| TC0005 | NS | | 10:00:09 | Insufficient data -- Retry Location. |
| TC0005 | NS | | 10:15:12 | Insufficient data -- Retry Location. |
| TC0005 | NS | | 10:30:07 | Vehicle off or out of service area. |
| TC0005 | NS | | 10:45:09 | Vehicle off or out of service area. |
| TC0005 | NS | | 11:00:08 | Vehicle off or out of service area. |
| TC0005 | NS | | 11:15:06 | Vehicle off or out of service area. |
| TC0005 | NS | | 11:30:07 | Vehicle off or out of service area. |
| TC0005 | NS | | 11:45:09 | Vehicle off or out of service area. |
| TC0005 | NS | | 12:00:05 | Insufficient data -- Retry Location. |
| TC0005 | NS | | 12:15:10 | Insufficient data -- Retry Location. |
| TC0005 | NS | | 12:30:07 | I 55 btw ARSENAL RD & TOWNLINE RD. |
| TC0005 | NS | 42N | 12:45:08 | HARRIS DR btw FRONTAGE RD & FRONTAGE RD. |
| TC0005 | NS | 50NE | 13:00:09 | I 55 btw N FRONTAGE RD & I 355. |
| TC0005 | NS | 51NE | 13:15:05 | I 55 btw EDGEDALE & RIVER RD. |
| TC0005 | NS | 20NE | 13:30:09 | I 55 btw S CALIFORNIA AV & I 55. |
| TC0005 | NS | 0 | 13:45:12 | W 24TH PL btw S NORMAL AV & S CANAL ST. |
| TC0005 | NS | | 14:00:08 | Insufficient data -- Retry Location. |
| TC0005 | NS | | 14:15:07 | S ARCHER AV btw S LOCK ST & S GRADY CT |
| TC0005 | NS | | 14:30:07 | W 31ST PL btw S BENSON ST & S THROOP ST. |
| TC0005 | NS | | 14:45:08 | S LOOMIS ST btw S LYMAN ST & W FULLER ST. |
| TC0005 | NS | 10W | 15:00:09 | I 55 btw S CICERO AV & S PULASKI RD. |
| TC0005 | NS | 0 | 15:15:05 | W PERSHING RD at W PERSHING RD. |
| TC0005 | NS | | 15:30:08 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 15:45:06 | EDMER RD at S CICERO AV. |
| TC0005 | NS | 0 | 16:00:09 | 43RD ST btw GUNDERSON AV & ELMWOOD AV. |
| TC0005 | NS | | 16:15:08 | I 55 btw S HARLEM AV & S CENTRAL AV. |
| TC0005 | NS | 6NE | 16:30:09 | S CICERO AV btw W PERSHING RD & W 32ND ST |
| TC0005 | NS | | 16:45:09 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 17:00:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 17:15:06 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | 0 | 17:30:06 | W PERSHING RD at W PERSHING RD. |
| TC0005 | NS | | 17:45:08 | S CICERO AV btw W PERSHING RD & W 32ND ST. |
| TC0005 | NS | | 18:00:08 | S CICERO AV btw W PERSHING RD & W 32ND ST |