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ROUTE SWITCHING BEHAVIOR AMONG AUSTIN COMMUTERS

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ROUTE SWITCHING BEHAVIOR AMONG AUSTIN COMMUTERS

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Abstract

ROUTE SWITCHING BEHAVIOR AMONG AUSTIN COMMUTERS

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IH-35 is a major north-south interstate highway across the State of Texas. It is an important business corridor, conveniently connecting four large Texas cities, Austin, Dallas, Fort Worth, and San Antonio, as well as facilitating trade between Mexico and the United States.

During construction of the SH-71/IH-35 Interchange, the Austin District of the Texas Department of Transportation (TxDOT) has had to close the main lanes of IH-35 and re-route traffic. Three main lane closures happened during three weekends in 2011. During those closures, a parallel route, the SH-130 toll road, was made free to travelers. TxDOT provided both pre-trip and en-route information about the closure. They used radio, TV, portable message sign (PMS), and dynamic message signs (DMS) to inform commuters about the closure. To inform travelers passing through Austin about the closure and the existing alternative (SH-130 was toll free), they even collaborated with Dallas and San Antonio TxDOT district personnel.

However, usage of SH130 was less than anticipated, and there was significant traffic queuing on IH-35. In this study, we tried to document the quantity of traffic that used the alternative path during the IH-35 closure and explore options for relieving delays on IH-35 during future closures.

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Chapter 1: Introduction

As the aging transportation infrastructure increasingly requires repair and renewal, construction activities and numbers of related work zones on urban freeways have grown significantly. Although very rare, full freeway closures are sometimes implemented to expedite project completion and thereby reduce the cumulative impact of construction on travelers. If a full freeway closure is necessary, one way to improve the management of traffic and reduce user costs is the use of traffic diversion strategies. An effective diversion plan makes drivers become aware of likely work zone delays and available alternate routes increasing the chances that they will choose alternate routes. However, diversion plans do not provide a means of controlling the quantity of traffic choosing alternate routes and are sometimes employed without proper consideration of the potential effect of the diverted traffic on the alternate route. To develop more efficient and effective strategies, careful analysis of diversion strategies is needed.

This thesis presents a work zone study (construction on the SH-71/IH-35 interchange) quantifying driver diversion and impacts during several IH-35 full freeway closures in Feb-May 2011. Because all traffic was detoured, closures were limited to weekends. IH-35 is a major north-south interstate highway that crosses Texas connecting Mexico with central United States. It is an important business corridor, conveniently connecting four large Texas cities, Austin, Dallas, Fort Worth, and San Antonio, as well as, facilitating trade between Mexico and the United States. Three main lane closures happened during three weekends in 2011. During those closures, a parallel route, the SH-130 toll road, was made free to travelers. TxDOT provided both pre-trip and en-route information about the closure. They used radio, TV, portable message sign (PMS), and dynamic message signs (DMS) to inform commuters about the closure. To inform travelers passing through Austin about the closure and the best alternative freeway route (SH130 was toll free), they even collaborated with Dallas and San Antonio TxDOT district personnel.

The purpose of this thesis was to investigate driver route switching behavior during IH-35 closure and explore options for relieving delays on IH-35 during future closures. However, usage of SH-130 was less than anticipated, and there was significant traffic queuing on IH-35 at the work zone. The analysis was based on integrating data from all available sources. In order to compare conditions of a non-closure weekend to the closure weekend, five recent months were considered.

This thesis is organized as follows: in the next chapter, related earlier research efforts are discussed. Chapter 3 presents MUTCD regulations for control traffic at work zones. In chapter 4, the traffic control plans for this closure are explained. Chapter 5 describes data collection and analysis to characterize traffic before and during the closure. Chapter 6 provides conclusions and discussion for future work.

CHAPTER 2: BACKGROUND

The objective of this literature review is to summarize available information about work zone traffic control concepts with emphasis on traveler diversion. The literature review includes aspects of work zone safety, capacity, speed reduction, driver behavior, changeable message signs, and lessons learned from full highway closure experiences by FHWA.

The most problematic work zones occur on roads that are already fully loaded with traffic. The impact of work zones on mobility and safety makes success of the traffic control plan vital. To properly manage traffic flow in a way that improves road safety and decreases congestion, accurate estimation of work zone capacity is critical [Weng, Jinxian, 2012]. Capacity reduction is the most significant factor that influences traffic delays. Several studies [Dudek and Richards, 1982; Rouphail and Tiwari, 1985; Krammes and Lopez, 1994] found that capacity at freeway work zones was mainly affected by: location (lane closure configuration and on-ramp/off-ramp proximity), traffic control plan (work zone duration, work time, lane narrowing, physical barriers, additional warning signs, and reduced speed limit), percentage of heavy vehicles in the traffic stream, and road grade. Even though various models [Krammes and Lopez, 1994; Dixon et al, 1996; Kim et al, 2001; Benekohal et. al, 2004; Ping et al, 2006; Sarasua et al, 2006; Al-Kaisy et al, 2003] and guidelines [HCM, 2010] have been offered to estimate work zone capacity, none of them incorporate all the important influencing factors. A decision tree based work zone capacity model designed by Weng and Meng (2012) [646] is an attempt to incorporate all the important influencing factors for work zone capacity estimation. This model could provide better estimation accuracy than other models, However, the decision tree structure is generally very unstable. To solve the instability of the decision tree base method, J. Weng, et al. (2012) developed the ensemble tree, which is a good alternative to estimate work zone capacity because of high estimation accuracy and stability. The authors assert that their model should be accepted in the HCM freeway facilities chapter.

There have been few studies of disequilibria and the adjustment process due to work zone traffic diversions. In practice, most work zone traffic impact studies either use the existing daily travel demand pattern or modify demand by arbitrarily assuming a diversion rate [Lee et al, 2005; Chu et al, 2005]. Some psychometric studies analyzed the diversion behavior of travelers in the presence of temporal road capacity reductions and traveler information systems [Khattak et al, 1993; Khattak et al, 1994; Peeta et al, 2000; e.g.,], but these studies did not substantiate their models with actual data.

Work zones pose a risk to the road users in terms of safety. The frequent involvement of heavy trucks in work zone crashes makes them a major work zone safety concern. Studies have found that the percentage of crashes involving trucks is much higher in work zones [AASHTO, 1987; Pigman et al, 1990; Schrock et al 2004]. Numerous studies have been conducted to enhance work zone safety and traffic control. Highway work zones use temporary traffic control (TTC) devices to provide continuous safe and efficient traffic flows during road work. Helmuth (2002) shows that the misapplication of TTC devices, and portable changeable message Signs (PCMS) commonly causes confusion and anxiety in drivers [AASHTO, 1987].

Provision of advance information to travelers regarding alternative routes, and temporary facilities are ways to reduce congestion during roadway construction. Accurate and timely reporting of traffic information is a valuable factor for managing a work zone. Advance notice to the public via resources such as radio, television, newspapers, changeable message signs, and traveler information systems can encourage drivers to use alternate routes or travel at off-peak times [MassHighway Chapter 17, 2006].

Changeable message signs (CMSs) are playing increasingly important roles in attempts to improve highway safety, operations, and use of existing facilities. CMSs are traffic control devices used for traffic warning, regulation, routing and management, and are intended to affect the behavior of drivers by providing real-time traffic-related information.

PCMSs can be used to notify drivers of future changes in traffic conditions in the work zone. However, generic messages can cause PCMSs to lose effectiveness with the motorists. Previous studies of driver understanding of traffic control devices through several work zones on high-speed roadways in Texas suggest that other misapplications of PCMSs in work zones often contribute to driver confusion and anxiety about their appropriate travel paths [Dudek, 2004]. To be effective, a PCMS must communicate a meaningful message that motorists can read and comprehend within a very short time period. Proper PCMS message design and use requires application of both human factors and traffic engineering principles. Guidelines on how to design and use PCMS have been developed through extensive research and field validation [Dudek, 1979; Dudek, 1997; Dudek, 2004; Dudek et al, 1978; Dudek et al, 2000; Ullman et al 2005]. Unfortunately, personnel who are expected to operate the PCMS come from a variety of educational backgrounds and types of experience. Those personnel who are given PCMS responsibilities (or inherit them by default) in the field often do not have adequate levels of training in PCMS message design and application [Halloin, 1996].

The Manual on Uniform Traffic Control Devices (MUTCD) provides a number of basic guidelines about PCMSs that are to be followed in sections 2A.07, 2E.21, and 6F.55 [MUTCD, 2003]. The Portable Changeable Message Sign Handbook is a 2003

FHWA document prepared to supplement the MUTCD and provide additional guidance regarding PCMS use [PCMS Handbook, 2003]

Developing a management strategy for work zone operation is highly dependent on the duration, time of day, and type of construction. Full Road Closure is often considered by transportation agencies as an effective way to balance the conflicting needs of mobility and safety in the work-zone. By definition, full road closure is "the removal or suspension of traffic operations either directionally or bi-directionally from a segment of roadway for the purpose of construction activities." (FHWA, 2003). Short-term full freeway closure is a work zone strategy that is receiving more consideration by state DOTs because it can often reduce project duration and cost. These positive effects usually lead to increased public acceptance, and potentially reduce both short- and long-term user costs [FHWA report, 2004]. While there is a wealth of literature on work zone safety, capacity, speed reduction, driver behavior, and changeable message signs, less has been written on traffic operations associated with full freeway closure.

Some case studies have been published by the Federal Highway Administration (FHWA) that provide information about essential planning measures and the benefit and impacts of full freeway closure [FHWA report, 2003]. The cost and duration of construction in most cases was reduced (for instances cities of Columbus, OH, Detroit, MI, and Portland OR). Tables 2-1 and 2-2 provide major characteristics of these closures. There are six long-term full closure projects and five weekend full closure projects presented in the tables. Most projects which used the weekend full closure method involved only re-paving or other roadway repair activities. While longer periods of full road closure usually involved reconstruction projects such as road widening and bridge repair, in the TH- 36 project, full closure reduced the construction duration from close to two years to 7 months (4 months of full closure and 3 months of partial and intermittent closures) [MnDOT report, 2006].

Although the ADT on the construction projects covers a wide range, from 30,000 to 240,000, most projects involved roads at, or close, to capacity. As seen in the table, eight of eleven projects are Interstate freeways and carry over 60,000 vehicles per day. Most of projects reported more than a 60 percent reduction of construction duration. The significant reduction of duration could mitigate the traffic impacts and save user costs.

The Washington State DOT [Dunston et al, 1998] studied full highway closure more extensively during the I-405 full weekend closure. They considered different criteria like travel time and purpose of trip. Their results showed that a large number of drivers did not cancel their trip because of the closure. Alternate routes are critical in utilizing the full benefits from full closure. Availability of alternate routes helps carry diverted traffic and reduce the congestion in the corridor. Most projects, except the I-405 project, had proposed detours that were parallel to the segment under construction using high-grade roadways such as freeways or major highways. Some cases cited that the projected congestion impacts typically were overestimated because the actual demand during construction was less than expected. Some studies assumed that diverted traffic would follow the proposed detours during the construction but they found that many drivers found other routes. Effinger J., et al. (2011) presented a case study on quantifying driver diversion and its impacts during the I-43/I-894 full freeway closure event in October 2010 in Milwaukee. Authors quantified that better understanding of traffic behavior is possible during a full freeway closure in an urban area [Effinger et al, 2011].

The most recent full closure happened on Interstate 5 near downtown Sacramento, California. The project construction plan for I-5 was to periodically close one direction near downtown Sacramento during a two month construction process, which decreased the construction time from the planned 190 days with a regular partial closure to the actual 35 days with full closure. They also significantly reduced the travel demand on I-5 near the closure section, due to a major freeway detour route for through traffic, and the abundance of local arterial routes to serve as alternative paths [Zhang et al, 2012].

	Seattle, Washington, I-405	Louisville, Kentucky I-65	Kennewick, Washington, SR 395	Wilmington, Delaware, I-95	Portland, Oregon, I-84
Facility Type	Interstate	Interstate	Arterial	Interstate	Interstate
ADT		130,000	30,000	100,000	180,000
Closure Duration	2 weekends	2 weekends	1 weekend	7 months	2 weekends
Land Miles	2	6	3 intersections	24.4	33
Cost		$4.1M	$0.5-1M	$23.5M	$5 M
Traffic Model	No	No	No	Yes	Yes
Project Date	1997	2000	2000	2000	2002

Table 2-1: Characteristics of Full Closure Sites by Location

	Detroit, Michigan , M-10	Columbus , Ohio, I-670	North St. Paul, Minnesota, TH 36	Tennessee DOT, I-40	Maine DOT, I-295	California, I-405
Facility Type	State Highway	Interstate	Trunck Highway	Interstate	Interstate	Interstate
ADT	97,000	62,000	39,000	-	-	240,000
Closure Duration	2 months	18months	4 months	13 months	3months NB, 15months SB	53 hours
Land Miles	7.6	8	2	-	24	10 NB, 4 SB
Cost	$12.5M	$36.7M	$27M		$35.3 M	
Traffic Model	No	Yes	No	Yes	-	-
ProjectDate	2002	2003	2007	2008	2008	2011

Table 2-1: Characteristics of Full Closure Sites by Location, Continued

Summary

A summary of available information on different aspects of work zone traffic control concepts with emphasis on lessons learned from full highway closure experiences was presented in this chapter. Considering the frequently limited diversion planning, this thesis will focus on evaluation of the route switching behavior of travelers during the IH-35 full closure in Austin, Texas. The next chapter will describe specific sections of the Manual on Uniform Traffic Control Devices related to detour and diversion plans that are required to have safe work zone and continuous traffic flow.

Chapter 3: MUTCD principles to control traffic at work zones

The manual on uniform traffic control devices (MUTCD) defines the minimum required nationwide standards to install and maintain traffic control devices. The MUTCD is the reference for the state and local transportation planners and traffic engineers who design roads and locate the traffic control devices.

By MUTCD definition, a work zone is an area of highway that has construction, maintenance, or utility work activities. To have continuous traffic flow at a work zone, proper traffic control plans can play a vital role. One chapter, Part 6, of MUTCD is devoted to temporary traffic control (TTC) elements. This chapter describes how to use different traffic control plans to assist road users through a work zone or an incident area. As a minimum, TTC plans should be designed to accommodate the MUTCD's TTC basic principles to navigate drivers safely while reasonably protecting workers. The level of detail in a TTC plan depends on the level of complexity of the situation; the needs of each TTC zone are a function of many variables, such as location of work, highway type, traffic volume, vehicle mix, and geometrics. The main purpose of the TTC in work zones is to maintain safety for workers and travelers while minimizing traveler costs.

Components of Temporary Traffic Control Zones

According to the MUTCD, there are four areas in most TTC zones: advance warning area (which tells drivers what to expect ahead), transition area (which moves traffic out of its normal path by merging lanes or detour plans), activity area (where work takes place), and termination area (which allows traffic to return to normal operations). A work zone begins with an advance warning area, which gives information about upcoming work to road users. Warning signs should be located ½ mile or more ahead of the work zone. The MUTCD introduces tables for distances, but at the same time it recommends adjustment according to field conditions and engineering judgment. The next part of a work zone is the transition area. The transition area is a road segment where road users are diverted from their normal path by merging lanes. The length of this section depends highly on speed and type of road. The activity area is where the construction takes place. The last part of a TTC zone is the termination area where road users merge/de-merge to their normal driving path(s).

Detour and Diversion definitions and related control devices

There are different regulations for rural/urban, highways/freeways, and level/type of work zone. During the SH71/IH35 interchange construction, traffic detour – a short-term rerouting of traffic from one road onto an alternative path to avoid a TTC zone—was a major part of TTC plans (MUTCD section 6C.09). The interchange construction detour plans followed MUTCD protocol by providing clear, easily understood signage about the alternative path: free use of toll road SH-130. Road users, however, preferred to stay on IH-35 rather than take SH-130, so three complete closures were analyzed to discover how to encourage more drivers to follow traffic plans. No activity or termination areas existed during the interchange construction because of complete closure.

Detour signage and regulations

The ROAD CLOSED sign shall not be implemented where through traffic flow exists in the TTC zone. In urban zones, word message signs that contain the name of the crossroads can specify the distance as XX MILES AHEAD (as shown in Figure 3-1).

Figure 3-1: Example of road regulatory signs (R11-3a, MUTCD)

Another type of TTC device used in a temporary traffic plan is a warning sign, which notifies users of obstructions or restrictions in the roadway. Standards state that TTC warning signs used for incident management situations may have a black legend and border on a fluorescent pink background. Warning sings should be located where highway circumstances permit on the road before a work zone or any detour. Sign distances from the TTC zone vary depending on roadway type, condition, and posted speed. Where more than one series of advance warning signs is implemented, the nearest sign to the TTC zone should be placed a minimum of 100 feet in advance for low-speed urban streets and 1000 feet or more for freeways and expressways. The first advance warning sign should be the ROAD WORK AHEAD followed by different types of required advance warning signs (Figure 3-2). On advance warning signs, the word AHEAD can be used instead of a specific distance as an alternative. The ROAD WORK NEXT XX MILES (Figure 3-3) sign is an example of one that uses specific distances, which should be placed at least 2 miles or more ahead of a TTC zone (MUTCD, 2009).

Figure 3-2: Advance warning sign (W20-1, Figure 6F-4 MUTCD)

Figure 3-3: An example of ROAD WORK NEXT XX MILES sign (G20-1, Figure 6F-4 MUTCD)

Where the main road is shut down completely, the ROAD CLOSED sign should be placed in advance and shall have the legend ROAD CLOSED, XX FEET, XX MILES, or AHEAD. However, if just one lane of a multi-lane roadway is closed, then the Lane Ends (Figure 3-4) sign may be used to inform road users about the traffic diversion plan. In the case of freeway main lane closures, an adequately labeled detour plan is required. For each detour plan a new traffic control plan is needed. To have an effective TTC plan, A NEW TRAFFIC PATTERN AHEAD (Figure 3-5) sign should be placed in the future work zone two weeks prior to construction activity.

Figure 3-4: Example of Lane(s) Closed sign (W20-5, Figure 6F-4 MUTCD)

Figure 3-5: A NEW TRAFFIC PATTERN sign (W23-2, Figure 6F-4 MUTCD)

The DETOUR sign (Figure 3-6) should be placed ahead of the detour section on the road with the legend DETOUR, XX FEET, XXMILES, or AHEAD. At the site of closure, the Detour Arrow sign should be mounted right below the ROAD CLOSED sign with a legend or street name sign containing detour information.

Figure 3-6: Detour sign (W20-2, Figure 6F-4 MUTCD)

Portable changeable message sign regulations

Portable changeable message signs (PCMS) provide road users with required warning and information about unexpected situations. Most design and application provisions for portable changeable message signs are the same as changeable message signs. One of the wide varieties of applications of portable changeable message signs is road user management and diversion on high traffic volume urban freeways. The most powerful capability of portable changeable message signs is they can convey complex messages, show real time information about conditions ahead, and assist road users to make decisions with a variety of options by providing information. A road user should be able to read the sign from a distance of ½ mile under both day and night conditions. Some limitations to designing portable changeable message signs are: three lines of eight characters, minimum of 18 inches for the letter height (shorter letter size could be used on low speed facilities), no more than two phases and each phase should be able to be understood regardless of the other, and message should be centered within each line. There should be at least two seconds to display each phase and the total time should not be more than eight seconds. The message should be as brief as possible and should contain the problem, distance to the problem, and the recommended action that might be taken by drivers. When multiple portable changeable message signs are placed along a road, they should be on the same side of roadway and the distance between them should at least 1000 feet on freeways and expressways.

Work operation duration is not the only major factor to determine the number and types of devices required in TTC zones but it has a key roll in determining TTC plan costs.

Typical Application: Double Lane Closure on a Freeway

Designing a TTC plan for a freeway or expressway is usually more complex because of special conditions of high-speed, high traffic volume, and access controls. Therefore, more detailed TTC procedures should be implemented to minimize turbulence and delay in the vehicular traffic stream. These situations usually need more conspicuous devices than specified for urban streets or typical rural highways. More conditions should be considered where construction must be restricted during nighttime. Consequently, use of warning lights, illumination of work spaces, and advance warning systems are necessary.

Figure 3-7 presents a typical lane closure application suggested by the MUTCD for a two-lane closure on a freeway. Because every possible situation is not addressed by MUTCD, the information illustrated in this figure can generally be adapted to a wide range of conditions. In many cases, an appropriate TTC plan is developed by combining features from various typical applications. The procedures illustrated in the figure represent minimum requirements for the two lanes closure situation. Other devices may be added to enhance the devices and device spacing may be adjusted to provide additional reaction time. Furthermore, flashing warning lights and flags could be used to attain attention to the first warning signs. When a freeway lane is closed an arrow board shall be placed. The regulations for sign spacing are explained in the previous section.

Summary

The minimum required regulations (by MUTCD) related to detour and diversion plans are presented in this chapter. The temporary traffic control (TTC) plans used for IH-35/SH-71 construction are presented in the next chapter. The TTC plans have been designed to comply with the MUTCD to make sure they satisfy the minimum requirements.

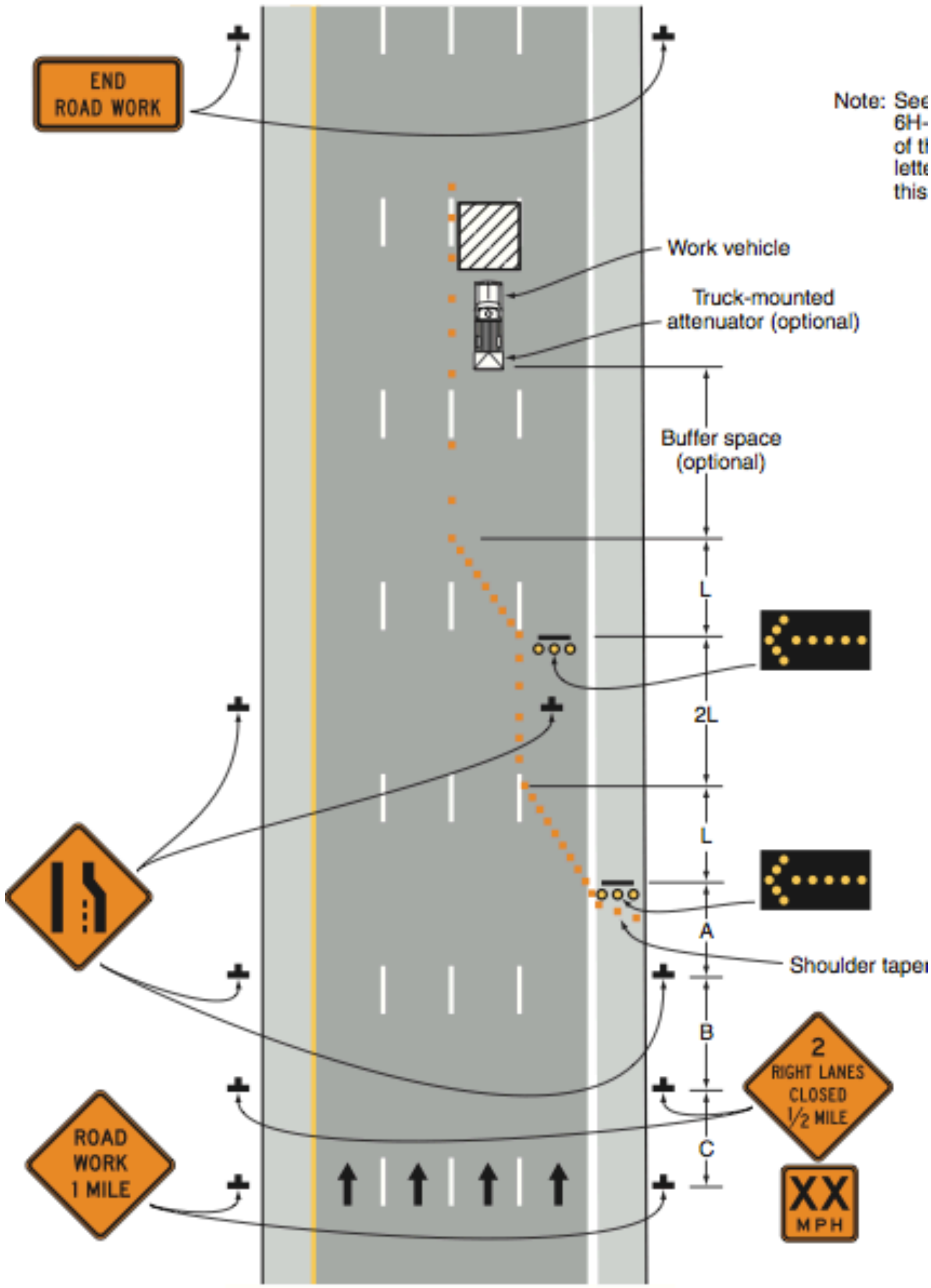


Figure 3-7: Typical Application: Double Lane Closure on a Freeway

Chapter 4: Traffic Control Plans and MUTCD Guideline Implementation

During the SH-71/IH-35 interchange construction, two diversion plans were designed to control the traffic: local detour and network diversion. The local detour plans were designed to detour the proportion of traffic not diverted but remaining on IH-35. The network diversion plans, which are the main interest of this project, diverted traffic to a free alternative road (SH-130 toll road) to reduce traffic congestion at the construction zone.

Detour plan details during IH-35 closures

Local detour plans for IH-35 users at the construction area were developed in three stages: southbound (SB) main lane closure, both northbound and southbound main lane closure, and northbound (NB) main lane closure. These different plans were used based on time of day and construction needs. During the first stage, the local detour traffic plan included closure only for IH-35 SB main lane traffic (figure 4-1). Through traffic on IH-35 was diverted onto two frontage road lanes. Eastbound (EB) and westbound (WB) frontage road traffic was reduced to one lane at the SH-71/IH-35 intersection. To reduce the delay time, NB and SB signals were continuous green (therefore WB and EB signals were continuous red) at the Ben White and Woodward intersections. The second stage detour plan included closure of both north and south-bound IH-35 main lanes (figure 4-2). In third stage, the southbound lanes return to a normal traffic plan (figure 4-3). The next traffic management concern is the proper signage of the road at the work zone to give travelers enough information about the detour plan, which is shown in figure 4-4.

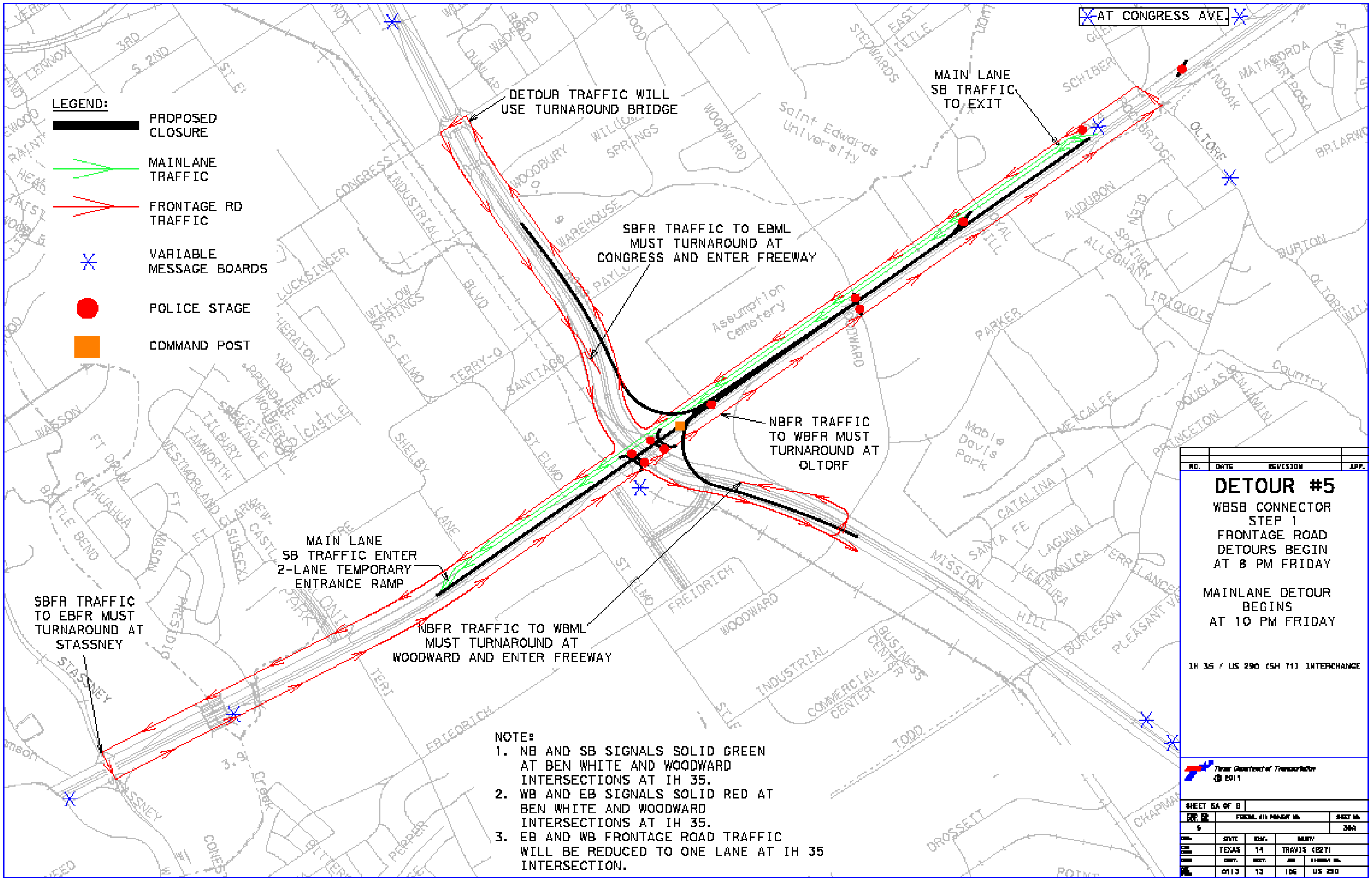


Figure 4-1: The local detour traffic plan that included closure only for IH-35 SB main lane traffic

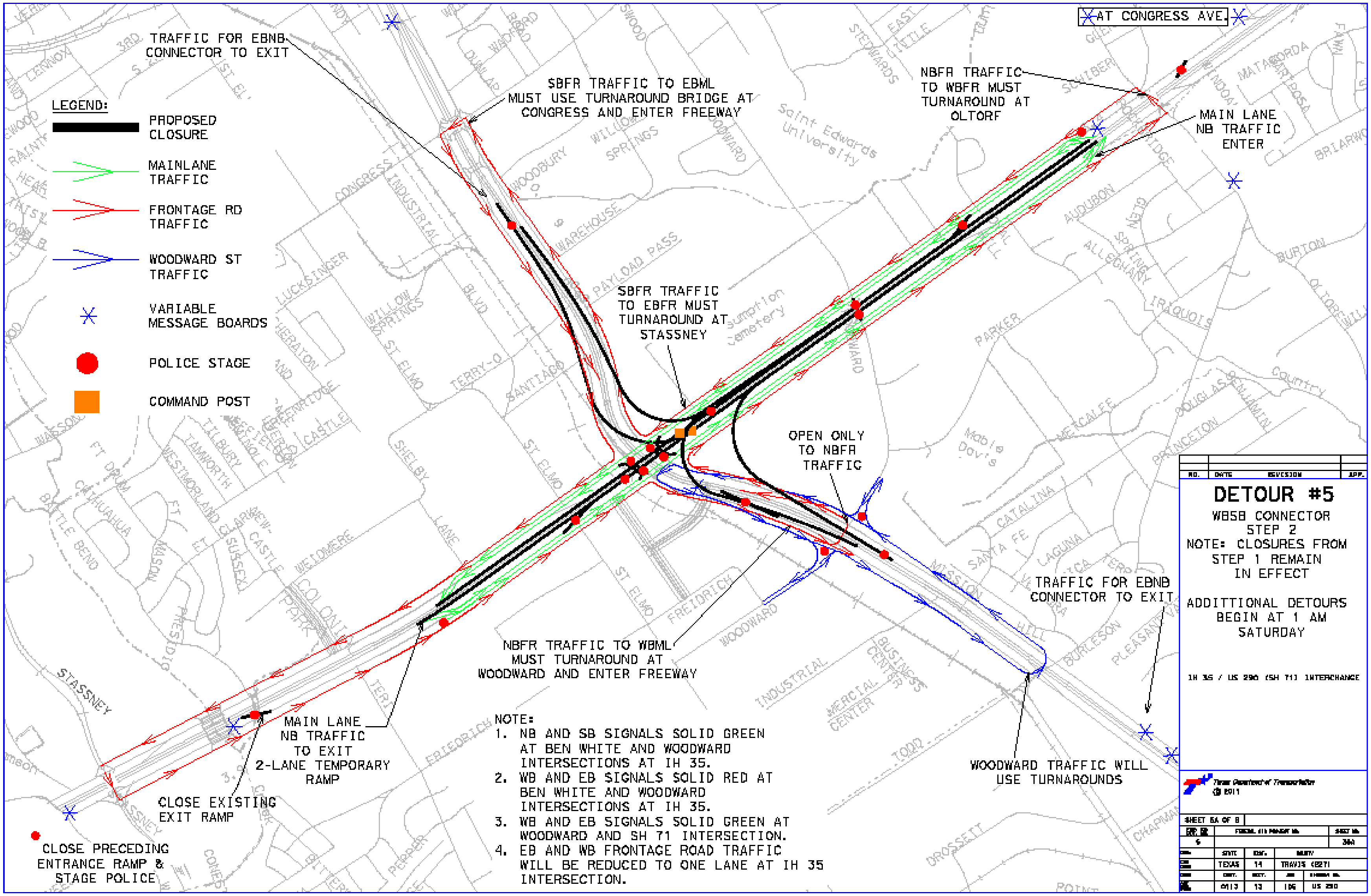


Figure 4-2: The local detour traffic plan that included closure for both NB and SB main lane traffic

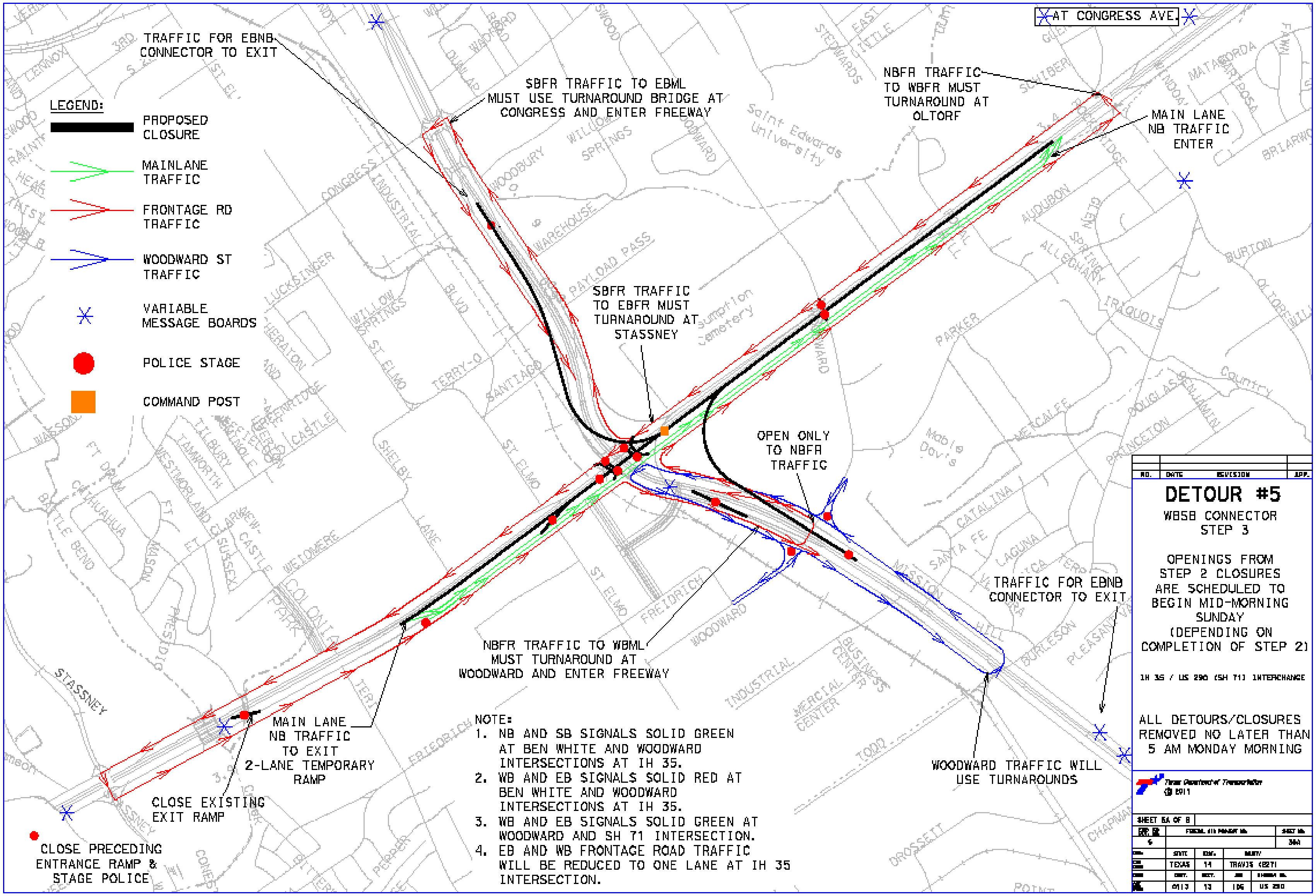


Figure 4-3: The local detour traffic plan that included closure only for IH-35 NB main lane traffic

Diversion plan details during IH-35 closures

TxDOT provided both pre-trip and en-route information about the closure hoping to reduce traffic demand during the construction. To inform travelers passing through Austin about closure and the existing alternative (SH130 was toll free), they used radio, TV, portable message sign (PMS), and dynamic message signs (DMS). They even collaborated with Dallas and San Antonio TxDOT district personnel.

Portable message signs (PMS) and dynamic message signs (DMS) are a main part of designing diversion traffic plans. The criteria that should be considered in the planning stage are: number of message signs, type (content) of message, size of letters, number of phases, time between each post (which is dependent on speed), when to notify drivers about a future closure, location of first sign, and the distance between PMS's.

In this traffic control plan, a message giving information about the time and location of the closure was posted three days before the beginning of each closure. On the northbound side, two DMS signs were placed at locations 23 miles and 8 miles from the construction area. To satisfy MUTCD requirements, two PCMS's were placed, one on southbound IH-35 before the SH-45SE exit and the other one on eastbound SH-45 before the IH-35 exit. Because the construction location was south of the city, the only freeway to freeway path to SH-130 for southbound IH-35 traffic was SH-45 but several non-freeway paths connect IH-35 to SH-130. Therefore, fewer message signs were required for northbound IH-35 traffic compared to southbound.

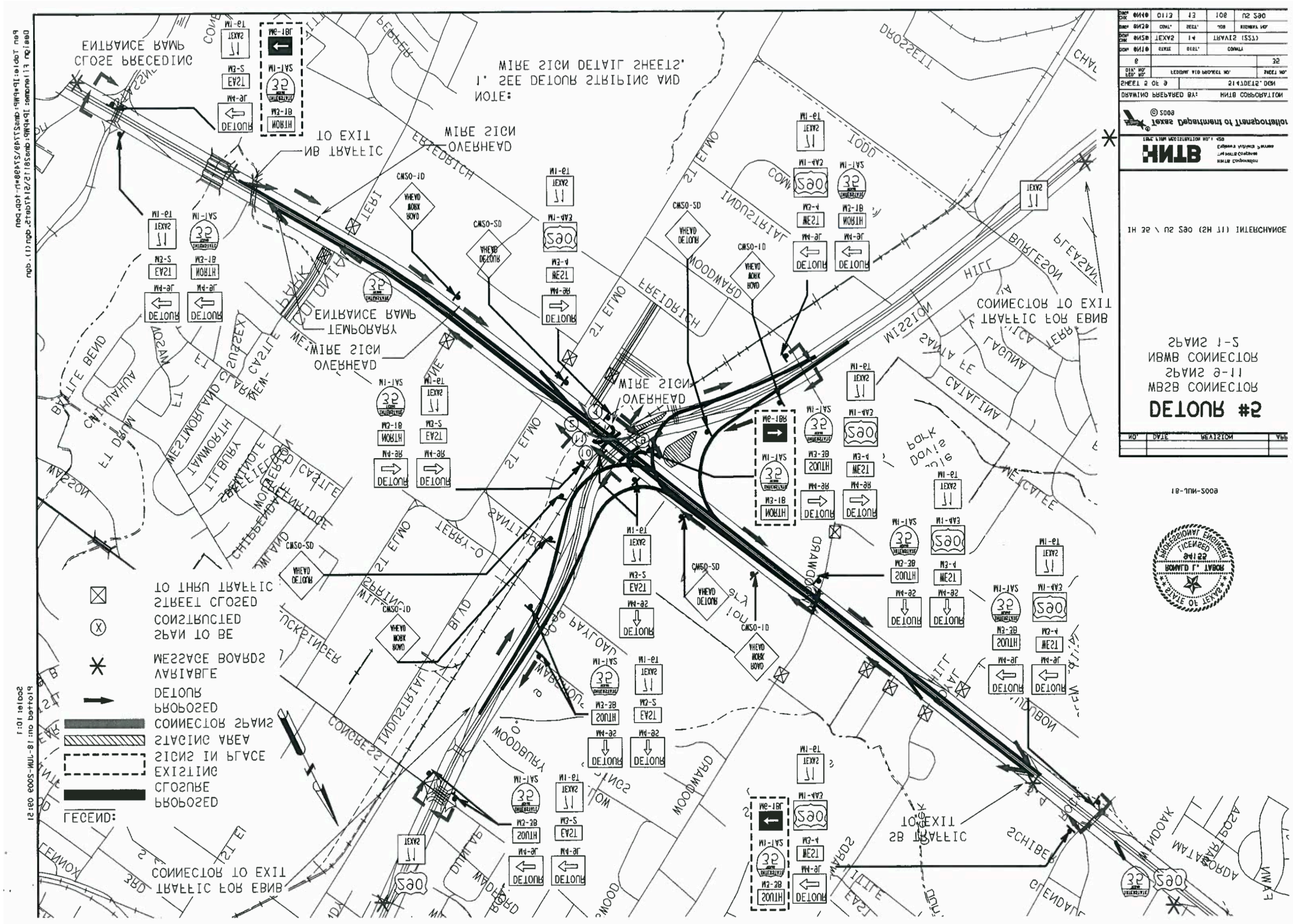


Figure 4-4: signage of the road at the work zone

Based on the location of the construction (south of the City), there were more options for the southbound commuters to choose an alternative detour route. The fixed DMS signs used for the southbound direction were located at distances of 16, 13, 12, 11, and 8 miles from the closure. All these signs were located south of the SH-130 exit on IH-35 southbound. Two PCMS signs were placed at distances of 30 and 17 miles north of the construction zone. All major roads crossing IH-35 including SH-45, SH-183, and SH-71, were properly signed to inform travelers about the future construction. The TTC plan for this construction project described additional measures, but it is beyond the scope of this thesis to go through the remaining details.

At the commencement of this study, several data items relevant to developing the diversion plans were collected from a number of sources and these are presented in next chapter.

Conclusion

The TTC plans used for IH-35/SH-71 construction satisfy all of the minimum requirements suggested by the MUTCD. The types of signage and distances between them meet the minimum requirements of the MUTCD. The detailed traffic control plan shows: work and buffer zones, the location and type of barricades, length of taper and width of offset, and the types and sizes of channelizing devices used.

Chapter 5: Data collection and analysis

In this chapter, the available traffic count data will be described along with analysis designed to characterize IH-35 and SH 130 traffic before and during the IH-35 work zone closures. While IH-35 data was limited to counts provided by permanent counting stations, SH 130 data included hourly toll transactions at the series of toll stations along the length of the facility. These data were used to estimate the success of the diversion plan, presented in the previous sections.

Data collection

To analyze how traffic patterns changed during the IH-35 weekend closures, it is a prerequisite to establish what a typical weekend pattern really is. However, traffic count data on IH-35 was available only for two locations in the vicinity of the closures, but not precisely where counts were needed. The available data on IH-35 were the hourly traffic volumes for permanent count stations located 0.3 miles south of FM1626, south of Austin and near San Marcos 0.9 miles south of FM 2001.

SH-130 hourly traffic transaction counts were the second available data source. We had access to one-year directional hourly traffic data from all toll stations along SH-130, which were classified by axles (from Jun 2010 to May 2011). To predict typical hourly traffic on SH-130, we used the most recent five-months data (Jan-May 2011), which included traffic counts during the closure dates. Because all the closures were encompassed by the time frame late evening on Friday until midnight Sunday, we analyzed this period of time. The days and times of the three main lane closures on IH-35 due to construction of flyovers at the IH35/Ben White Boulevard interchange are shown in Table 5-1.

	North bound		South bound	
	Date/start	Date/end	Date/start	Date/end
1st Closure	2/12/11 2AM	2/13/11 6PM	2/11/11 9PM	2/13/11 6PM
2nd Closure	2/26/11 6AM	2/27/11 6AM	2/25/11 10PM	2/27/11 6AM
3rd Closure	5/20/11 10PM	5/22/11 9PM	5/21/11 8PM	5/22/11 9PM

Table 5-1: Dates and Times of IH35 closures

The transaction data on SH-130 is directional data, defined by segments corresponding to toll collection stations. The data related to each station ID is the cumulative number of transactions on main lanes and exit ramps located in the same segment. It is divided into five segments, as shown in Table 5-2 (with graphical demonstration in Figure 5-1).

Station ID	Segment location
305	Between IH-35 and US79
306	Between US79 and US290
307	Between US290 and SH71
308	Between SH71 and US183
SH45	Between US183 and IH-35

Table 5-2: SH-130 segment/station descriptions

Figure 5-1: SH-130 segment/station illustration Comparison of Average Hourly Traffic for Closure Durations

To analyze how traffic patterns changed during the closures, we compared hourly traffic on typical weekends with hourly traffic during each closure. However, traffic count data on IH-35 was available only for two locations in the vicinity of but not precisely where counts were needed. Therefore, we gathered SH-130 transaction data for a five-month period (Jan-May 2011), which includes traffic counts during the closure dates.

TXDOT provided prior notice to travelers about the closures hoping to reduce numbers of unnecessary trips and stimulate path changes during the closure. We compared the traffic data for each closure with typical traffic at the same time of day and week to find how successful they were at achieving their goal. To do so, we needed to predict the typical hourly traffic counts.

We tested a null hypothesis (H0) that the closure had no impact on IH-35 traffic volumes as monitored by the permanent count stations in South Austin and San Marcos. The actual tables of hourly traffic data are presented in Appendix A. To test the significance, we set a risk level, or "alpha level," at .01. This means that one time out of a hundred one would find a statistical difference between the means even if there was none (i.e., by "chance"). Therefore, if the t-value is significant, we can reject the H0, which means that compared to typical traffic demands for similar times and days drivers did reduce trip making during closures. Table 1 shows the effect of IH-35 lane closures on traffic flow. "Yes" indicates significantly less traffic on IH-35 during closures compared to a typical weekend, and "No" indicates that no significant difference was observed. The analysis shows that South Austin was affected by the IH-35 closure, but San Marcos was not. Traffic data collected at the south Austin detector indicates that traffic flow decreased during closures on both north and south bound lanes (Table 5-3). Clearly, TxDOT was successful in encouraging drivers to avoid some unnecessary trips.

	Detector location	
	South Austin	San Marcos
North bound	Yes	No
South bound	Yes	Yes

Table 5-3: Did IH-35 average hourly traffic volume change during closures?

To see the how successful the diversion plan was in the Austin area, we ran tests on SH-130 data (the only available data). Tables 5-4 and 5-5 show the directional average hourly traffic during each closure for each segment. Data for the first and second closures are not available in segment SH-45.

North Bound Average hourly traffic during closures	Type of Vehicle	Stations					
		SH130					SH45
		305	306	307	308	Ave	SH45
2/11/2011 Closure	Car	349	847	597	463	564	-
2/25/2011 Closure		326	886	627	479	579	-
5/20/2011 Closure		318	864	561	398	535	377
2/11/2011 Closure	Truck	58	69	70	68	66	-
2/25/2011 Closure		86	102	101	99	97	-
5/20/2011 Closure		43	53	51	48	49	51

Table 5-4: Northbound SH-130 average hourly volumes by segment during closures.

South Bound Average hourly traffic during closures	Type of Vehicle	Stations					
		SH130					SH45
		305	306	307	308	Ave	SH45
2/11/2011 Closure	Car	286	789	489	350	479	-
2/25/2011 Closure		235	706	448	315	426	-
5/20/2011 Closure		305	793	459	314	468	268
2/11/2011 Closure	Truck	54	71	70	66	65	-
2/25/2011 Closure		40	57	54	51	50	-
5/20/2011 Closure		46	51	48	46	48	44

Table 5-5: Southbound SH-130 average hourly volumes by segment during closures.

Tables 5-6 and 5-7 show "typical" weekend average hourly traffic for the closure times. Typical conditions were based upon approximately 5 months of transaction data.

North Bound Average hourly traffic for typical weekend	Type of Vehicle	Stations					
		SH130					SH45
		305	306	307	308	Ave	SH45
First Closure	Car	207	526	305	182	305	-
Second Closure		305	709	430	276	449	-
Third Closure		234	600	343	208	348	166
First Closure	Truck	17	22	19	17	9	-
Second Closure		51	57	53	51	14	-
Third Closure		25	31	27	25	11	9

Table 5-6: Typical northbound hourly transaction on SH-130 for closure days/times.

South Bound Average hourly traffic for typical weekend	Type of Vehicle	Stations					
		SH130					SH45
		305	306	307	308	Ave	SH45
First Closure	Car	199	494	261	159	277	-
Second Closure		245	599	317	195	342	-
Third Closure		286	645	361	240	394	230
First Closure	Truck	26	30	26	25	9	-
Second Closure		36	40	36	34	11	-
Third Closure		50	55	50	49	13	11

Table 5-7: Typical southbound hourly transaction on SH-130 for closure days/times.

These tables show that the northbound traffic is slightly heavier than southbound traffic on both typical weekends and during closures. The volumes are generally larger during closure times than under typical conditions. Using this information, we performed a test to determine the statistical significance of the differences between typical and closure traffic volumes on SH-130 based upon average hourly volumes.

For this test, the null hypothesis (H0) is that closures did not have any impact on driver route choices and that drivers did not use the toll road as an alternative, even if it was free. To test the significance, we used the same risk/alpha level as before: 0.01. This means that one time out of a hundred one would find a statistically significant difference between the means even if there was none (i.e., by "chance"). So if the t-value is significant we can reject the H0, which means more drivers were using the free toll road during closures compared to a typical weekend. In other words, TxDOT successfully diverted a proportion of IH-35 traffic to SH-130 during the closure. In the following table, “Yes” present that traffic is significantly higher during weekend closures on SH-130, while “No” indicates that the difference is not significant. As indicated in Tables 8 and 9, a significant increase in traffic flows in both directions for all stations was observed. Although this give the evidence of diversion, one cannot quantitively state how much diversion is because more detailed data on IH-35 is needed to conduct the that analysis that can help answer the question. Unfortunately, such detailed IH-35 traffic data is not available.

North Bound [99% confidence level]	Type of Vehicle	Stations					
		SH130					SH45
		305	306	307	308	Ave	SH45
First Closure	Car	Yes	Yes	Yes	Yes	Yes	
Second Closure		Yes	Yes	Yes	Yes	Yes	
Third Closure		Yes	Yes	Yes	Yes	Yes	Yes
First Closure	Truck	Yes	Yes	Yes	Yes	Yes	
Second Closure		Yes	Yes	Yes	Yes	Yes	
Third Closure		Yes	Yes	Yes	Yes	Yes	Yes

Table 5-8: Were northbound SH-130 transaction volume increases statistically significant during IH35 closures?

South Bound [99% confidence level]	Type of Vehicle	Stations					
		SH130					SH45
		305	306	307	308	Ave	SH45
First Closure	Car	Yes	Yes	Yes	Yes	Yes	
Second Closure		Yes	Yes	Yes	Yes	Yes	
Third Closure		Yes	Yes	Yes	Yes	Yes	Yes
First Closure	Truck	Yes	Yes	Yes	Yes	Yes	
Second Closure		Yes	Yes	Yes	Yes	Yes	
Third Closure		Yes	Yes	Yes	Yes	Yes	Yes

Table 5-9: Were southbound SH-130 transaction volume increases statistically significant during IH35 closures?

Estimation of entry/exit locations for SH-130 traffic during closures

Furthermore, from the toll road average hourly transaction data, one can obtain a net difference in transaction volume between successive stations allowing estimation of net changes in SH-130 traffic volumes that can be interpreted as an estimate of entry/exit volumes.

In Table 5-10, the North Bound Net Difference table, the car column contains a heading "307-308" that identifies the net difference in transactions between SH-130 stations 308 and 307. The positive 134 indicates 134 more car transactions occurred at the more northerly 307 than 308 or the transaction volume increased by 134 cars between station 308 and station 307. US183 is the primary highway with connection to SH-130 between 307 and 308. The net difference shown for "306-307" identifies an increase of 249 cars through this section in which SH-71 and US-290 are the major connecting highways. Similarly, the "-497" under the "305-306" heading shows a net loss of 497 cars connecting to SH-45 north or US-79 from SH-130 (see Figure 5-2).

North Bound	Type of Vehicle	Net difference in transaction between stations (Δ)			
		308-SH45	307-308	306-307	305-306
2/11/2011 Closure	Car	-	134	249	-497
2/25/2011 Closure		-	148	259	-559
5/20/2011 Closure		21	163	303	-546
2/11/2011 Closure	Truck	-	2	-2	-10
2/25/2011 Closure		-	2	0	-15
5/20/2011 Closure		-3	2	2	-10

Table 5-10: Net changes in northbound SH-130 traffic transactions among successive toll stations during closures.

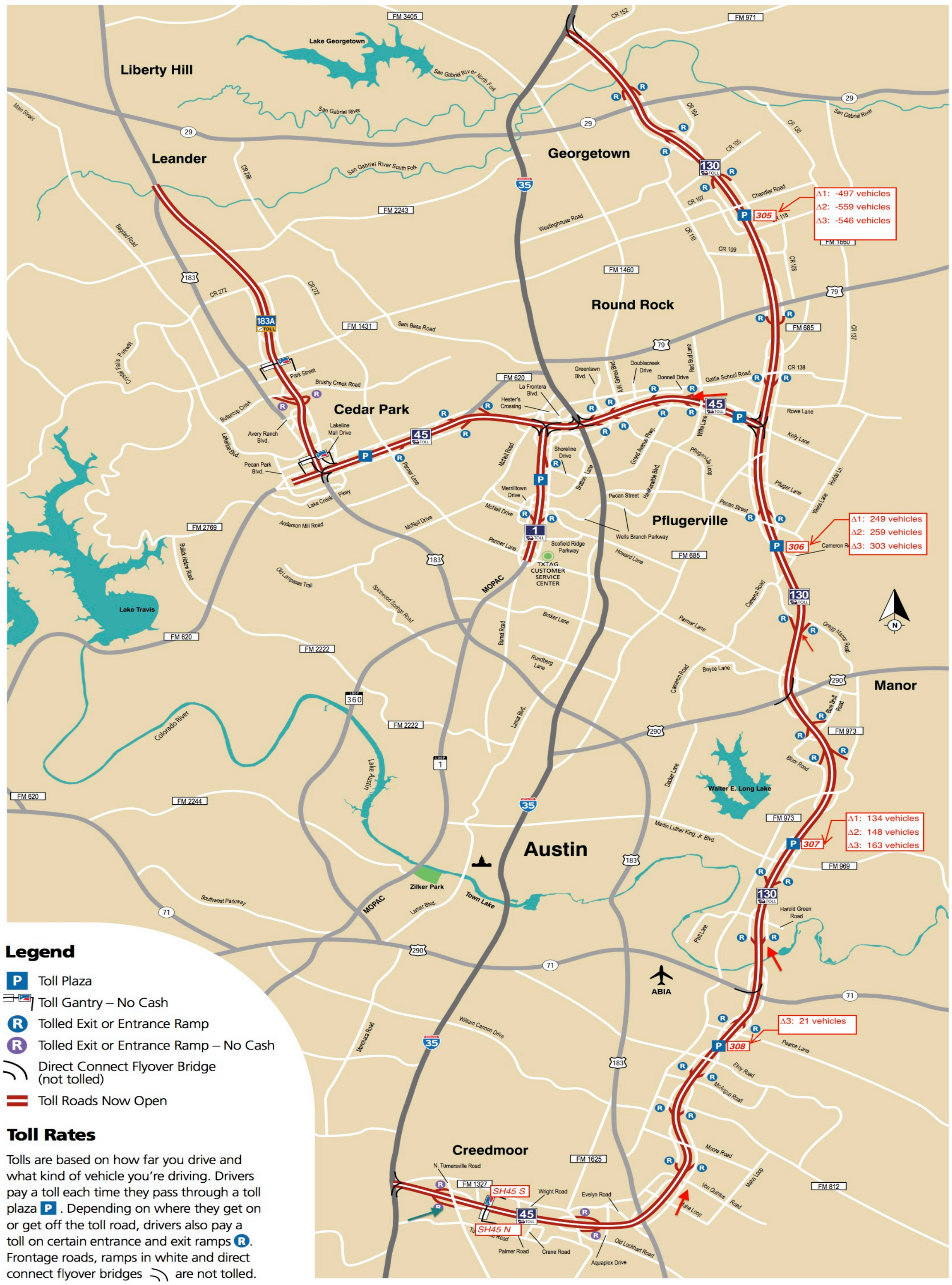


Figure 5-2: Net changes in northbound SH-130 traffic transactions during closures.

In Table 5-11, the South Bound Net Difference table, the same rationale is used showing the largest net gain in the most northerly section "306-305" and net losses of -300 and -139 in the following two more southerly sections (for the 2/11/2011 closure). Since SH-45 and US-79 are the primary connecting highways in the most northern section, these highways are primary feeders while US-290 and SH-71 in the next section and US-183 in the following section provide exit connections to Austin destinations (see Figure 5-3).

South Bound	Type of Vehicle	Net difference in transaction between stations (Δ)			
		306-305	307-306	308-307	SH45-308
2/11/2011 Closure	Car	502	-300	-139	-
2/25/2011 Closure		471	-259	-132	-
5/20/2011 Closure		488	-334	-144	-46
2/11/2011 Closure	Truck	16	-1	-4	-
2/25/2011 Closure		17	-3	-3	-
5/20/2011 Closure		5	-3	-2	-2

Table 5-11: Net changes in southbound SH 130 traffic transactions among successive toll stations during closures.

Using the segment transaction net differences, one can roughly calculate that 80 percent of north bound traffic that entered SH-130 from feeder highways south of the most northern segment exited SH-130 in the most northern segment and 90 percent of south bound traffic that entered from feeder highways north of the most southern segment exited SH 130 in the most southern segment. That is, about 20 percent of the northbound traffic that entered from feeder highways traveled through to points north of Austin and about 10 percent of the southbound feeder highway traffic was likewise through traffic.

Regarding estimation of traffic that was northbound on IH-35 and chose to divert to SH-130, the first available northbound transaction station is 308 located north of the

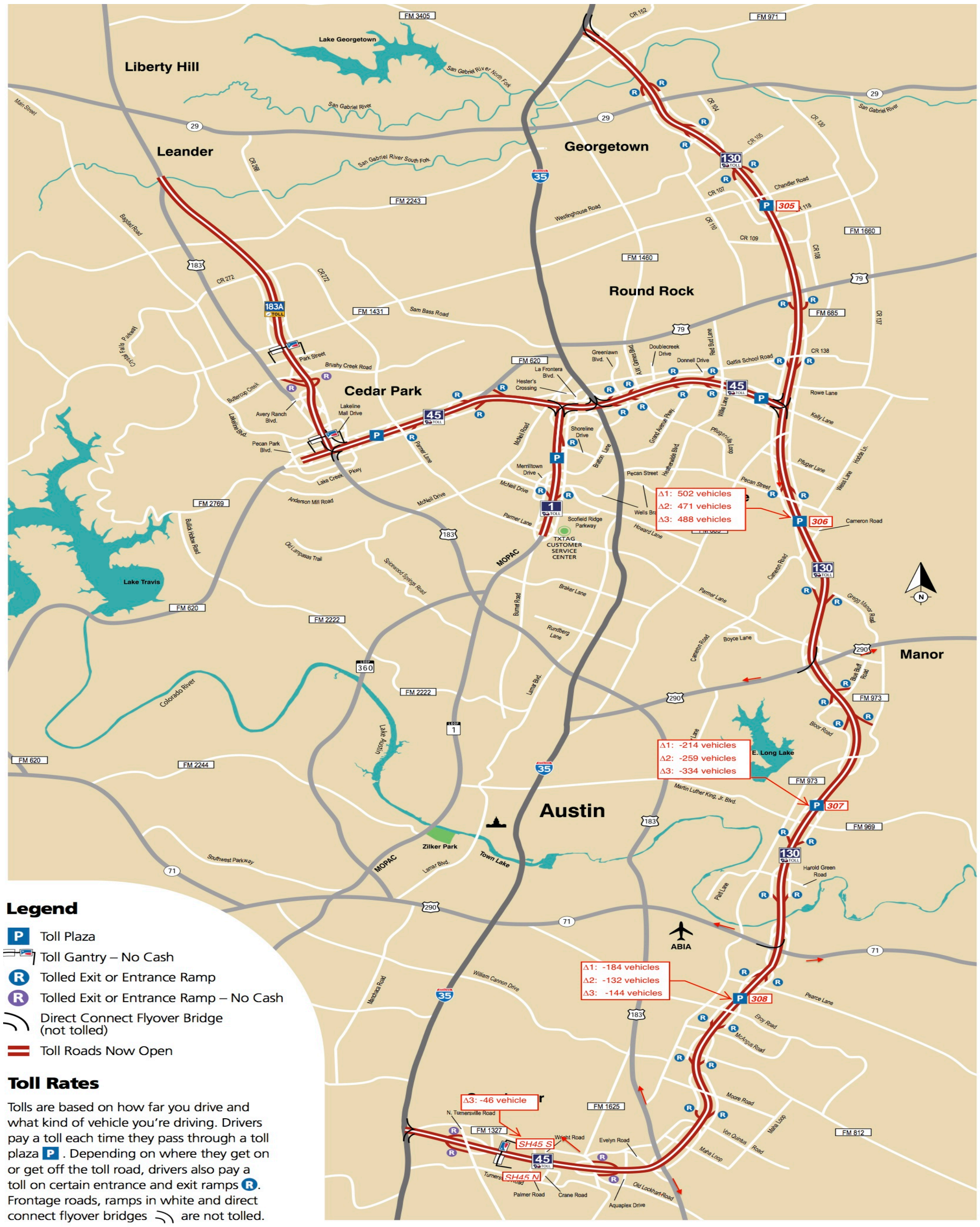


Figure 5-3: Net changes in southbound SH-130 traffic transactions during closures.

IH-35 and SH-130 interchange. Between the interchange and the toll station are a number of feeder highways including US-183 and FM 812, so one must logically assume that a non-zero fraction of the transactions at station 308 are vehicles that entered from the feeder facilities instead of from IH-35. However, the maximum volume that could have come from IH-35 is the total volume of station 308, with an averaged of 446 transactions per hour across the three closures. The average number of transactions processed at the northern most toll station, station 305, averaged 331 per hour across the three closures. As an extreme but unlikely estimate of the fraction of traffic that originated on IH-35 and traveled through to points north of Austin, 331/446 or 74 percent could possibly have traveled through to points north of Austin or 26 percent were destined for Austin. For the southbound direction, toll station 305 provides the first counts after the SH130-IH35 interchange and this volume averaged 275 per hour across the three closures. At the southern end of SH 130, toll station 308 averaged 326 per hour across the three closures or roughly 118 percent of the first southbound counts at station 305. Using the previously described logic, then all of the possible southbound traffic was destined for points south of Austin.

Comparisons for different times of day during the closures

The previous analysis was based upon average hourly volumes across the closure times, but volumes and patterns vary significantly among the times of day during which the IH-35 closures were active. If one considered every hour of the day to be a distinctive case the result would be specific but rather difficult to understand. To simplify the analysis, the 24 hours of the day were combined into 3 time slices or groups as shown in Table 5-12.

Group	Time of day
Time 1 (midnight to early morning)	2300-0600
Time 2 (morning and late evening)	0700-0900, 1900-2200
Time 3 (mid-day through PM peak)	1000-1800

Table 5-12: Time of day groups.

The reason to choose this grouping is that traffic volume patterns during weekends are different from week days. By looking at the data and performing multiple range tests, we determined that "rush hours" on weekends start later in the morning than weekdays and continue until early evening.

Time group 1 covers hours of the day with least traffic transactions. The second time group includes hours with higher traffic but peak hours are not included in this category. The third Time group has the highest analytical priority because it has the highest numbers of transactions. The following table shows average hourly transactions with more detail (divided by each group for each closure). As we were expecting, the third group has the largest numbers of transactions.

To be able to see the changes during the closure compared to typical conditions, typical hourly traffic volumes were developed for the three generalized time frames. These are shown in the Tables 5-13 and 5-14 as "Typical North Bound" and "Typical South Bound" transaction volumes for each of the four toll stations.

Typical North bound		Type of Vehicle	Stations					
			SH130					SH45
			305	306	307	308	Ave	SH45
NB	Time 1	Car	45	154	86	38	81	25
NB	Time 2		191	533	292	159	294	120
NB	Time 3		411	1045	581	352	597	281
NB	Time 1	Truck	3	5	4	3	4	3
NB	Time 2		10	16	11	8	11	8
NB	Time 3		18	29	22	18	22	16

Table 5-13: Typical hourly north bound transaction volumes for the chosen three time groups.

Typical South bound		Type of Vehicle	Stations					
			SH130					SH45
			305	306	307	308	Ave	SH45
SB	Time 1	Car	46	132	76	33	72	20
SB	Time 2		201	571	274	152	299	116
SB	Time 3		397	1080	547	332	589	272
SB	Time 1	Truck	3	5	4	3	4	2
SB	Time 2		9	16	11	9	11	8
SB	Time 3		18	29	21	17	21	15

Table 5-14: Typical hourly south bound transaction volumes for the chosen three time groups.

Transaction volumes for each of the toll stations for each time group are presented in Tables 5-15 and 5-16 for northbound and southbound SH-130 respectively.

North Bound		Type of Vehicle	Stations					
			SH130					SH45
			305	306	307	308	Ave	SH45
1 Closure	Time 1	Car	52	169	112	78	103	
	Time 2		276	718	486	370	462	
	Time 3		620	1440	1034	812	977	
2 Closure	Time 1		62	214	145	97	130	
	Time 2		316	890	636	487	582	
	Time 3		569	1479	1048	811	977	
3 Closure	Time 1		63	207	144	75	122	68
	Time 2		275	785	503	355	479	336
	Time 3		577	1505	974	715	943	681
1 Closure	Time 1	Truck	27	30	31	29	29	
	Time 2		58	65	66	65	63	
	Time 3		82	101	103	100	96	
2 Closure	Time 1		28	32	31	30	30	
	Time 2		93	109	108	104	104	
	Time 3		134	158	158	156	151	
3 Closure	Time 1		18	22	21	19	20	21
	Time 2		44	54	52	51	50	55
	Time 3		65	80	76	73	73	76

Table 5-15: Northbound SH-130 hourly transaction counts during time groups and closures.

South Bound		Type of Vehicle	Stations					
			SH130					SH45
			305	306	307	308	Ave	SH45
1 Closure	Time 1	Car	59	173	112	70	104	
	Time 2		257	740	458	317	443	
	Time 3		521	1403	865	638	857	
2 Closure	Time 1		58	168	117	66	102	38
	Time 2		275	855	538	389	514	
	Time 3		494	1471	919	666	888	
3 Closure	Time 1		55	167	105	59	96	
	Time 2		265	747	405	275	423	244
	Time 3		562	1390	821	577	837	484
1 Closure	Time 1	Truck	30	38	37	36	35	
	Time 2		50	63	61	58	58	
	Time 3		81	107	108	101	99	
2 Closure	Time 1		21	30	27	26	26	29
	Time 2		44	62	55	53	53	
	Time 3		68	97	98	91	88	
3 Closure	Time 1		16	18	17	17	17	17
	Time 2		45	50	46	43	46	43
	Time 3		74	83	77	74	77	69

Table 5-16: Southbound SH-130 hourly transaction counts during time groups and closures.

By comparing these tables, one can see the number of trucks using SH-130 during closures increased by more than three times the typical volumes. Car transactions also increased significantly during all time groups for the closure conditions.

Table 5-17 and 5-18 show results of analytical tests comparing closure traffic transactions with typical weekend transactions. In the table, "Yes" indicates a statistically significant difference between closure and typical transactions while "No" indicates the closure and typical transactions were not significantly different. As one can see in the tables, most stations during closures had significantly increased traffic flows in both directions. Only time group 1 failed to consistently show increased volumes for cars. However, because time group 1 is midnight until 0600 hours traffic demand is much less during this time anyway.

South Bound [99% confidence level]		Type of Vehicle	Stations					
			SH130					SH45
			305	306	307	308	Ave	SH45
1 Closure	Time 1	Car	No	No	No	Yes	No	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
2 Closure	Time 1		No	No	No	No	No	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
3 Closure	Time 1		Yes	No	No	No	No	No
	Time 2		Yes	Yes	Yes	Yes	Yes	Yes
	Time 3		Yes	Yes	Yes	Yes	Yes	Yes
1 Closure	Time 1	Truck	Yes	Yes	Yes	Yes	Yes	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
2 Closure	Time 1		Yes	Yes	Yes	Yes	Yes	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
3 Closure	Time 1		Yes	Yes	Yes	Yes	Yes	Yes
	Time 2		Yes	Yes	Yes	Yes	Yes	Yes
	Time 3		Yes	Yes	Yes	Yes	Yes	Yes

Table 5-17: Were southbound SH-130 increases in transaction counts by time of day statistically significant during IH-35 closure?

North Bound [99% confidence level]		Type of Vehicle	Stations					
			SH130					SH45
			305	306	307	308	Ave	SH45
1 Closure	Time 1	Car	No	No	No	Yes	No	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
2 Closure	Time 1		No	Yes	No	No	Yes	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
3 Closure	Time 1		Yes	Yes	Yes	Yes	Yes	Yes
	Time 2		Yes	Yes	Yes	Yes	Yes	Yes
	Time 3		Yes	Yes	Yes	Yes	Yes	Yes
1 Closure	Time 1	Truck	Yes	Yes	Yes	Yes	Yes	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
2 Closure	Time 1		Yes	Yes	Yes	Yes	Yes	-
	Time 2		Yes	Yes	Yes	Yes	Yes	-
	Time 3		Yes	Yes	Yes	Yes	Yes	-
3 Closure	Time 1		Yes	Yes	Yes	Yes	Yes	Yes
	Time 2		Yes	Yes	Yes	Yes	Yes	Yes
	Time 3		Yes	Yes	Yes	Yes	Yes	Yes

Table 5-18: Were northbound SH-130 increases in transaction counts by time of day statistically significant during IH-35 closures?

Previously, net changes in transaction counts at SH-130 toll stations during closures of IH-35 were presented as averages across all closure hours. Tables 5-19 and 5-20 present these data for each of the three time of day groups.

North Bound Closure		Type of Vehicle	Net difference in transaction between stations (Δ)			
			308-SH45	307-308	306-307	305-306
1 Closure	Time 1	Car		34	57	-118
	Time 2			116	232	-443
	Time 3			221	407	-820
2 Closure	Time 1			48	69	-152
	Time 2			149	254	-574
	Time 3			237	431	-909
3 Closure	Time 1		7	69	63	-144
	Time 2		20	148	282	-510
	Time 3		34	259	531	-928
1 Closure	Time 1	Truck		2	-1	-3
	Time 2			0	-1	-7
	Time 3			3	-2	-19
2 Closure	Time 1			1	1	-4
	Time 2			3	1	-17
	Time 3			3	0	-24
3 Closure	Time 1		-2	2	1	-4
	Time 2		-4	1	2	-10
	Time 3		-3	3	4	-14

Table 5-19: Net changes in northbound SH-130 traffic transactions among successive toll stations during closures for the three time-of-day groups.

South Bound Closure		Type of Vehicle	Net difference in transaction between stations (Δ)			
			306-305	307-306	308-307	SH45-308
1 Closure	Time 1	Car	114	-61	-43	
	Time 2		483	-282	-141	
	Time 3		882	-537	-227	
2 Closure	Time 1		110	-51	-51	
	Time 2		580	-317	-149	
	Time 3		977	-553	-253	
3 Closure	Time 1		112	-62	-46	-10
	Time 2		482	-341	-130	-31
	Time 3		828	-569	-244	-92
1 Closure	Time 1	Truck	8	-1	-1	
	Time 2		14	-2	-3	
	Time 3		26	0	-7	
2 Closure	Time 1		10	-3	-1	
	Time 2		18	-7	-2	
	Time 3		30	0	-7	
3 Closure	Time 1		1	-1	0	0
	Time 2		4	-4	-3	0
	Time 3		9	-6	-3	-6

Table 5-20: Net changes in southbound SH-130 traffic transactions among successive toll stations during closures for the three time-of-day groups.

Net differences between toll stations for typical non-closure conditions during the three time-of-day groups are presented in Tables 5-21 and 5-22.

Typical North bound		Type of Vehicle	Net difference in transaction between stations (Δ)			
			308-SH45	307-308	306-307	305-306
NB	Time 1	Car	13	48	68	-110
NB	Time 2		38	133	242	-343
NB	Time 3		71	229	465	-635
NB	Time 1	Truck	0	1	1	-2
NB	Time 2		0	3	4	-6
NB	Time 3		2	5	7	-12

Table 5-21: Net changes in northbound SH-130 traffic transactions among successive toll stations for typical non-closure conditions for the three time-of-day groups.

Typical South bound		Type of Vehicle	Net difference in transaction between stations (Δ)			
			306-305	307-306	308-307	SH45-308
SB	Time 1	Car	87	-57	-43	-12
SB	Time 2		370	-297	-122	-36
SB	Time 3		683	-533	-214	-61
SB	Time 1	Truck	2	-2	-1	-1
SB	Time 2		7	-5	-3	-1
SB	Time 3		11	-8	-5	-2

Table 5-22: Net changes in southbound SH-130 traffic transactions among successive toll stations for typical non-closure conditions for the three time-of-day groups.

These tables indicate that although patterns of entering and exiting traffic are similar across the three time periods, numbers of transactions or volumes are much greater during day time hours, that is Time 3 (1000 through 1800 hours). Tables 5-21 and 5-22 seem to identify clear patterns of traffic entering and exiting SH-130. That is, in the northbound direction there are net increases in traffic volume through all stations until the northern most station 305 where the net decrease is approximately equal to the sum of the net gains across the previous stations. This indicates a very large fraction of the SH-

130 northbound traffic is destined for points in Austin rather than points north of Austin. In the southbound direction only the section between stations 305 and 306 shows a net traffic volume increase with the three more southern sections showing net volume decreases. Like the northbound direction, this seems to indicate that a very large fraction of the southbound traffic is destined for points in Austin rather than locations south of Austin.

Figures 5-4 and 5-5 present numbers of transactions for the four toll stations along SH-130 for the daytime conditions (1000 to 1800 hours) for the northbound and southbound directions respectively. The Figures ten illustrate the same concepts stated in the previous paragraph, that is northbound volumes reach a maximum at station 306 located just south of the SH-45 and US-79 exits. Stations 308 and 305 at the south and north ends of SH-130 have the smallest traffic volumes again, showing that the "through" traffic is a small fraction. Southbound volumes reach a maximum at station 306 just the south of SH-45 and US-79 entrances and decrease to the smallest level at station 308 the most southerly transaction station.

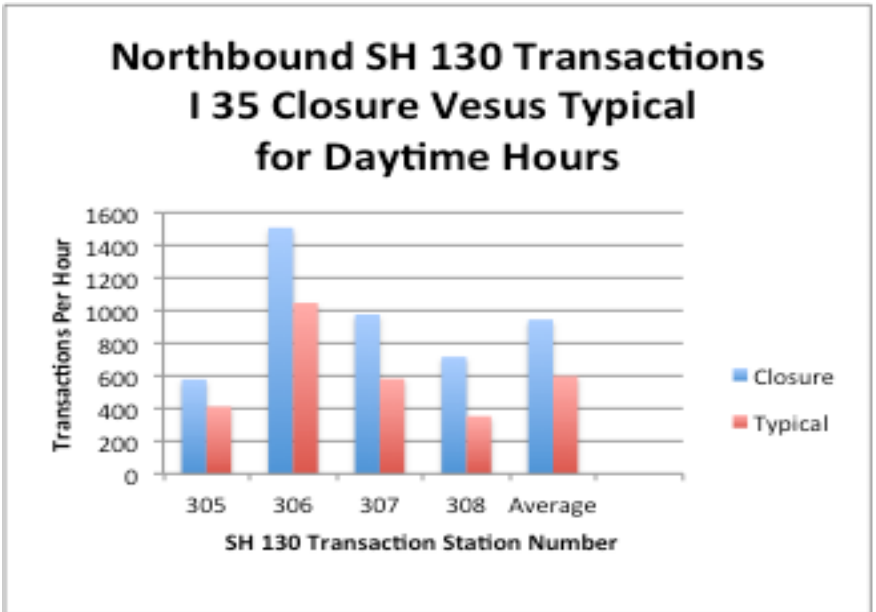


Figure 5-4: Northbound SH 130 transactions by toll station during daytime hours [Station 308 is most southerly, 305 is most northerly].

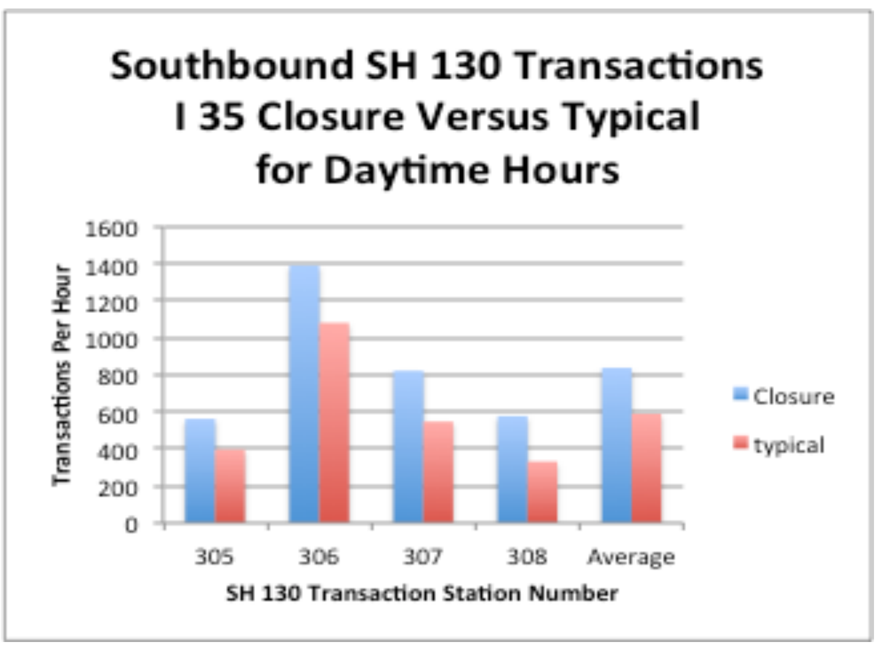


Figure 5-5: Southbound SH 130 transactions by toll station during daytime hours [Station 305 is most northerly, 305 is most southerly].

Conclusion

Based on the analysis, TxDOT was successful in diverting certain amount of traffic to SH-130 as an alternative road during IH-35 closures. But regardless of the effort, a significant amount of traffic stayed on IH-35 and the diversion was not adequate to prevent unusually significant traffic congestion on IH-35 during the closures.

Chapter 6: Conclusion and Suggestions

During the IH-35 main lane closures, the increase in SH-130 traffic volumes clearly indicates diversion from IH-35. However, the volumes diverted from an IH-35 path were small in both the northbound and southbound directions. For northbound, the SH-130 toll transaction station closest to SH-35 showed over twice the typical traffic volume during the closures; however, this increase was only about 350 car transactions per hour. In other words, even if all of the 350 vehicles per hour was diverted from IH-35, it would still represent a very small fraction of one freeway lane. As for southbound, the station nearest to the beginning of SH-130 showed a maximum increase of about 165 vehicles per hour.

A large fraction, or more specifically more than half of the traffic on SH-130 northbound and southbound appears to be destined for locations in Austin rather than locations north or south of the Austin area.

Considering these two facts together, one can logically speculate that the volumes of traffic diverted from IH-35 paths were small for several reasons:

- If most IH-35 travelers were destined for Austin they would unlikely consider the SH-130 path, as it would cause them to travel "out of their way" to reach their destination.
- Travelers may have been unfamiliar with the many connections between SH-130 and their Austin destinations.
- IH 35 travelers likely did not perceive the level of congestion that would develop on that freeway as the result of the main lane closures.

To ameliorate the lack of diversion from IH-35 to SH-130 the following suggestions are provided for future diversion efforts:

- Provide comparative travel times for IH-35 and SH-130 through forecasts or through real-time information delivery means, including changeable message signs (CMS), highway advisory radio, Television and other traffic condition outlets.
- Provide information through CMS's, TV, and newspapers regarding the ease of connection from SH-130 to Austin destinations. For travelers who are not familiar with alternative paths (like SH-130) graphical signage showing schematic maps could be provided along the path leading to diversion routes.

Appendix A

Here the complete hourly traffic data are presented for both IH-35 and SH-130. The first column of each table represents the day of the week and hour in the day as follows:

D6	Friday
D7	Saturday
D1	Sunday

H0	12:00 AM-1:00 AM	H12	12:00 PM-1:00 PM
H1	1:00 AM-2:00 AM	H13	1:00 PM-2:00 PM
H2	2:00 AM-3:00 AM	H14	2:00 PM-3:00 PM
H3	3:00 AM-4:00 AM	H15	3:00 PM-4:00 PM
H4	4:00 AM-5:00 AM	H16	4:00 PM-5:00 PM
H5	5:00 AM-6:00 AM	H17	5:00 PM-6:00 PM
H6	6:00 AM-7:00 AM	H18	6:00 PM-7:00 PM
H7	7:00 AM-8:00 AM	H19	7:00 PM-8:00 PM
H8	8:00 AM-9:00 AM	H20	8:00 PM-9:00 PM
H9	9:00 AM-10:00 AM	H21	9:00 PM-10:00 PM
H10	10:00 AM-11:00 AM	H22	10:00 PM-11:00 PM
H11	11:00 AM-12:00 PM	H23	11:00 PM-12:00 AM

- IH-35 average hourly traffic during closures

Average hourly traffic during closures IH-35	North Bound			South bound		
	NB-South Austin	NB-San Marcos	Ave	SB-South Austin	SB-San Marcos	Ave
D1H0	763	784	773	949	964	957
D1H1	493	533	513	649	612	631
D1H2	344	363	354	766	688	727
D1H3	279	292	286	605	601	603
D1H4	261	286	273	369	364	367
D1H5	439	438	439	358	376	367
D1H6	623	652	637	579	603	591
D1H7	855	919	887	934	979	957
D1H8	1263	1458	1361	1267	1277	1272
D1H9	1845	2012	1929	1696	1827	1761
D1H10	2527	2796	2661	2354	2439	2397
D1H11	2801	3112	2957	2785	2997	2891
D1H12	3202	3487	3345	3202	3479	3341
D1H13	3267	3710	3488	3419	3709	3564
D1H14	3307	3715	3511	3494	3718	3606
D1H15	3275	3821	3548	3586	3800	3693
D1H16	3320	3872	3596	3552	3824	3688
D1H17	3403	3795	3599	3221	3573	3397
D1H18	3181	3590	3385	3112	3482	3297
D1H19	2657	2880	2768	2766	3037	2902
D1H20	2202	2375	2289	2274	2417	2345
D1H21	1764	1836	1800	1905	1940	1923
D6H20	2735	2723	2729	2887	2884	2885
D6H21	2129	2128	2128	2608	2535	2572
D6H22	1608	1621	1615	2088	2095	2092
D6H23	1214	1197	1206	1432	1477	1455
D7H0	768	738	753	1117	1118	1117
D7H1	497	481	489	780	772	776
D7H2	391	396	394	816	769	793
D7H3	351	351	351	600	605	602
D7H4	398	449	423	478	485	481
D7H5	744	802	773	653	643	648
D7H6	1202	1276	1239	1208	1258	1233

D7H7	1674	1900	1787	1745	1894	1820
D7H8	2181	2410	2295	2124	2379	2252
D7H9	2390	2665	2528	2511	2806	2659
D7H10	2717	3130	2923	2937	3267	3102
D7H11	3062	3545	3303	3191	3606	3398
D7H12	3176	3603	3390	3419	3807	3613
D7H13	3110	3545	3328	3474	3788	3631
D7H14	3111	3658	3385	3418	3772	3595
D7H15	3107	3714	3411	3505	3805	3655
D7H16	3213	3798	3506	3353	3631	3492
D7H17	3293	3946	3620	3332	3595	3464
D7H18	3059	3536	3298	3073	3329	3201
D7H19	2637	2943	2790	2662	2843	2753
D7H20	2197	2575	2386	2267	2415	2341
D7H21	2103	2311	2207	2015	2122	2069
D7H22	1739	1909	1824	1690	1732	1711
D7H23	1315	1363	1339	1243	1287	1265

- IH-35 average hourly typical traffic

Typical Average hourly traffic IH-35	North Bound			South bound		
	NB-South Austin	NB-San Marcos	Ave	SB-South Austin	SB-San Marcos	Ave
D1H0	915	869	892	1029	1005	1017
D1H1	546	526	536	745	695	720
D1H2	374	360	367	822	736	779
D1H3	309	284	297	595	568	581
D1H4	298	296	297	384	378	381
D1H5	494	471	482	372	359	366
D1H6	666	653	659	592	589	590
D1H7	887	890	889	861	833	847
D1H8	1357	1405	1381	1265	1211	1238
D1H9	2076	2075	2076	1887	1883	1885
D1H10	2787	2798	2792	2594	2640	2617
D1H11	3229	3280	3255	3151	3239	3195
D1H12	3552	3508	3530	3600	3653	3626
D1H13	3682	3718	3700	3822	3811	3817
D1H14	3679	3754	3716	3855	3856	3855
D1H15	3682	3826	3754	3692	3721	3706
D1H16	3845	3962	3904	3805	3826	3816
D1H17	3752	3770	3761	3559	3627	3593
D1H18	3514	3515	3514	3313	3370	3342
D1H19	2972	3065	3019	2836	2914	2875
D1H20	2587	2549	2568	2411	2459	2435
D1H21	2100	2097	2098	2033	2081	2057
D6H20	2596	2500	2548	3958	2819	3388
D6H21	2183	2111	2147	3720	2507	3114
D6H22	1690	1651	1671	3396	2044	2720
D6H23	1235	1174	1204	2811	1521	2166
D7H0	825	786	805	1130	1077	1103
D7H1	544	504	524	835	818	826
D7H2	437	409	423	816	823	820
D7H3	404	383	394	620	604	612
D7H4	436	439	437	492	472	482
D7H5	791	753	772	656	622	639
D7H6	1301	1258	1279	1164	1105	1135

D7H7	1856	1769	1813	1683	1638	1661
D7H8	2536	2419	2477	2190	2198	2194
D7H9	2922	2817	2870	2725	2761	2743
D7H10	3233	3160	3196	3264	3337	3301
D7H11	3661	3599	3630	3672	3742	3707
D7H12	3845	3698	3771	3838	3831	3834
D7H13	3860	3794	3827	3922	3926	3924
D7H14	3761	3703	3732	3987	3968	3978
D7H15	3779	3754	3766	4039	3976	4007
D7H16	3718	3694	3706	3923	3846	3884
D7H17	3762	3705	3733	3724	3637	3680
D7H18	3641	3499	3570	3385	3277	3331
D7H19	3080	3057	3068	2905	2817	2861
D7H20	2630	2601	2616	2590	3216	2903
D7H21	2346	2331	2338	2334	2778	2556
D7H22	2012	1934	1973	2031	2399	2215
D7H23	1489	1382	1435	1571	1847	1709

- SH-130 average hourly traffic transactions during closures
  - First closure (2/11/11)
    - Northbound

North Bound Closure	SH130								SH45	
	Car				Truck				Car	Truck
2/11/11	305	306	307	308	305	306	307	308	SH45N	SH45N
D7H2	23	109	41	28	20	23	32	39	-	-
D7H3	27	74	34	17	37	40	34	28	-	-
D7H4	24	67	39	19	35	35	48	44	-	-
D7H5	53	86	105	83	40	47	38	45	-	-
D7H6	144	309	250	183	48	62	65	44	-	-
D7H7	220	502	379	289	57	63	72	72	-	-
D7H8	316	694	479	374	76	104	94	86	-	-
D7H9	412	897	638	474	85	82	78	82	-	-
D7H10	516	1030	723	583	69	94	103	92	-	-
D7H11	554	1166	823	655	102	118	138	120	-	-
D7H12	545	1299	882	650	95	102	114	105	-	-
D7H13	527	1392	898	655	96	133	126	128	-	-
D7H14	570	1435	1019	774	96	115	128	130	-	-
D7H15	653	1630	1120	862	94	126	132	131	-	-
D7H16	609	1597	1152	873	104	113	108	119	-	-
D7H17	592	1690	1238	998	80	113	107	100	-	-
D7H18	587	1568	1130	865	79	93	98	93	-	-
D7H19	432	1222	850	645	81	78	90	88	-	-
D7H20	330	948	651	491	67	73	76	70	-	-
D7H21	237	809	550	428	53	62	63	60	-	-
D7H22	213	822	424	318	43	48	44	49	-	-
D7H23	129	540	360	255	47	33	35	29	-	-
D1H0	81	319	186	130	30	39	35	31	-	-
D1H1	37	193	105	67	20	19	23	21	-	-
D1H2	29	149	73	45	15	17	18	18	-	-
D1H3	14	83	42	23	16	11	13	12	-	-
D1H4	13	63	31	30	16	20	22	24	-	-
D1H5	38	75	79	58	18	20	10	12	-	-
D1H6	61	135	114	81	15	25	29	25	-	-
D1H7	120	287	197	134	33	35	31	33	-	-

D1H8	157	390	272	208	33	46	54	60	-	-
D1H9	318	610	423	338	50	55	56	54	-	-
D1H10	443	887	654	527	70	85	94	88	-	-
D1H11	535	1060	848	704	72	65	54	58	-	-
D1H12	620	1320	949	777	64	86	91	84	-	-
D1H13	722	1551	1050	853	79	91	87	91	-	-
D1H14	737	1610	1225	973	70	83	76	73	-	-
D1H15	807	1773	1257	985	74	104	109	102	-	-
D1H16	794	1755	1330	1073	76	83	74	75	-	-
D1H17	732	1719	1272	1004	77	108	110	103	-	-
Mean	349	847	597	463	58	69	70	68	-	-

- Southbound

South Bound Closure	**SH130**								**SH45**	
	Car				**Truck**				**Car**	**Truck**
2/11/11	305	306	307	308	305	306	307	308	SH45S	SH45S
D6H21	290	576	393	260	43	45	46	47	-	-
D6H22	207	443	358	233	65	78	73	70	-	-
D6H23	124	254	188	128	47	65	71	69	-	-
D7H0	76	131	81	70	51	61	60	60	-	-
D7H1	27	78	48	44	48	49	52	57	-	-
D7H2	26	61	52	33	40	50	46	44	-	-
D7H3	28	71	41	19	23	39	38	38	-	-
D7H4	42	129	70	31	34	39	46	42	-	-
D7H5	74	271	175	98	45	55	41	37	-	-
D7H6	160	596	375	221	38	54	53	49	-	-
D7H7	237	889	539	360	57	83	74	70	-	-
D7H8	335	1157	673	478	63	96	89	67	-	-
D7H9	404	1303	732	525	77	104	89	88	-	-
D7H10	514	1522	894	666	91	100	119	92	-	-
D7H11	548	1482	952	754	84	113	126	124	-	-
D7H12	563	1553	985	753	97	124	126	122	-	-
D7H13	513	1476	940	731	60	109	120	115	-	-
D7H14	515	1483	969	696	98	128	126	105	-	-
D7H15	547	1411	878	690	74	104	126	122	-	-
D7H16	571	1373	868	659	85	103	88	85	-	-
D7H17	496	1410	850	568	53	82	84	87	-	-
D7H18	397	1280	694	532	66	91	88	74	-	-
D7H19	302	909	525	387	74	78	74	72	-	-
D7H20	315	661	467	343	42	64	70	68	-	-
D7H21	245	602	401	288	17	31	40	47	-	-
D7H22	112	396	324	224	25	25	25	28	-	-
D7H23	107	232	158	140	26	31	25	22	-	-

D1H0	56	158	121	98	12	16	26	23	-	-
D1H1	29	95	84	51	16	20	19	20	-	-
D1H2	14	87	50	32	9	12	17	19	-	-
D1H3	26	56	31	16	21	26	18	14	-	-
D1H4	25	72	59	26	22	23	24	26	-	-
D1H5	46	164	99	35	24	27	24	21	-	-
D1H6	84	317	166	73	21	35	33	30	-	-
D1H7	160	431	272	183	48	44	33	30	-	-
D1H8	178	648	361	225	46	54	65	60	-	-
D1H9	301	863	454	300	39	57	56	50	-	-
D1H10	335	1033	551	362	47	63	62	58	-	-
D1H11	386	1207	695	448	65	82	83	80	-	-
D1H12	472	1284	782	596	75	112	104	105	-	-
D1H13	516	1424	869	608	105	102	98	87	-	-
D1H14	550	1495	951	676	95	144	135	134	-	-
D1H15	622	1537	993	745	80	113	120	121	-	-
D1H16	664	1452	917	692	89	114	99	93	-	-
D1H17	644	1421	919	672	115	139	125	114	-	-
Mean	286	789	489	350	54	71	70	66	-	-

- Second closure (2/26/11)
  - Northbound

North Bound Closure	SH130								SH45	
	Car				Truck				Car	Truck
2/26/11	305	306	307	308	305	306	307	308	SH45N	SH45N
D7H6	153	286	248	185	30	50	53	55	-	-
D7H7	242	616	472	383	69	88	86	78	-	-
D7H8	396	864	639	533	96	136	146	147	-	-
D7H9	426	901	658	529	124	156	148	155	-	-
D7H10	536	1105	799	642	130	158	158	162	-	-
D7H11	586	1340	971	767	139	169	168	160	-	-
D7H12	612	1525	1037	782	131	164	185	200	-	-
D7H13	564	1455	1017	780	148	176	164	147	-	-
D7H14	560	1406	1006	818	146	166	174	162	-	-
D7H15	546	1583	1125	865	149	146	142	143	-	-
D7H16	617	1690	1142	859	124	145	163	157	-	-
D7H17	569	1626	1206	921	128	161	136	135	-	-
D7H18	533	1578	1128	867	109	134	133	134	-	-
D7H19	430	1232	905	628	126	142	149	135	-	-
D7H20	281	1070	703	534	100	106	86	85	-	-
D7H21	261	867	598	459	72	74	75	73	-	-
D7H22	174	681	478	346	61	62	65	58	-	-
D7H23	109	461	330	245	56	56	54	55	-	-
D1H0	74	334	214	146	37	47	45	40	-	-
D1H1	37	222	133	74	30	27	27	29	-	-
D1H2	31	140	82	45	23	28	31	25	-	-
D1H3	22	112	48	27	28	23	19	19	-	-
D1H4	21	62	33	20	9	13	11	14	-	-
D1H5	50	97	75	35	10	9	7	4	-	-
Mean	326	886	627	479	86	102	101	99	-	-

- Southbound

South Bound Closure	SH130								SH45	
	Car				Truck				Car	Truck
2/26/11	305	306	307	308	305	306	307	308	SH45S	SH45S
D6H22	199	404	272	164	42	43	41	35	144	31
D6H23	111	232	165	111	37	49	41	44	87	43
D7H0	57	128	82	48	21	36	43	40	40	37
D7H1	31	76	55	37	30	38	35	37	20	39
D7H2	25	43	27	23	18	29	23	23	20	28
D7H3	19	55	36	11	10	21	13	14	15	17
D7H4	45	137	92	34	13	20	15	17	19	11
D7H5	68	262	167	74	49	74	41	35	63	29
D7H6	134	636	422	238	50	69	76	65	-	-
D7H7	254	1037	608	421	49	87	77	64	-	-
D7H8	322	1276	713	506	57	85	68	65	-	-
D7H9	414	1385	838	559	71	107	85	84	-	-
D7H10	455	1500	939	651	70	117	103	87	-	-
D7H11	510	1596	993	702	85	112	119	110	-	-
D7H12	537	1656	1012	708	76	98	116	113	-	-
D7H13	528	1621	964	683	63	102	92	81	-	-
D7H14	499	1422	949	725	64	90	92	80	-	-
D7H15	487	1416	865	637	75	110	105	106	-	-
D7H16	527	1403	855	639	55	99	98	89	-	-
D7H17	485	1400	926	665	64	79	77	70	-	-
D7H18	421	1228	766	586	56	70	77	81	-	-
D7H19	354	927	612	511	49	61	56	60	-	-
D7H20	238	712	468	375	35	45	50	58	-	-
D7H21	232	639	453	339	16	29	32	34	-	-
D7H22	190	459	341	237	30	37	32	26	-	-
D7H23	119	257	233	159	20	28	28	33	-	-
D1H0	74	166	97	81	15	21	23	21	-	-
D1H1	33	97	63	54	8	10	10	12	-	-
D1H2	30	77	57	35	4	8	13	12	-	-
D1H3	38	63	41	16	15	17	13	13	-	-
D1H4	38	106	85	29	6	16	9	10	-	-
D1H5	51	191	134	34	14	19	24	18	-	-
Mean	235	706	448	315	40	57	54	51	51	29

- Third closure (5/21/11)
  - Northbound

North Bound Closure	SH130								SH45	
	Car				Truck				Car	Truck
5/21/11	305	306	307	308	305	306	307	308	SH45N	SH45N
D6H22	164	517	278	153	27	39	29	36	154	33
D6H23	142	468	345	129	31	36	31	27	106	27
D7H0	106	372	221	64	13	16	14	11	59	15
D7H1	43	176	116	32	14	12	16	11	27	13
D7H2	30	136	59	14	11	19	10	9	18	9
D7H3	15	52	25	15	9	12	8	9	12	12
D7H4	21	46	43	24	13	15	16	14	29	13
D7H5	73	142	112	67	15	20	21	20	49	22
D7H6	124	266	225	152	28	38	34	30	193	47
D7H7	231	620	434	312	28	43	53	52	315	59
D7H8	322	805	485	353	69	81	79	69	360	74
D7H9	374	959	629	433	65	80	67	64	409	68
D7H10	459	1059	762	563	48	67	67	67	546	77
D7H11	518	1338	821	589	73	98	92	83	601	83
D7H12	553	1506	828	584	84	95	84	76	570	83
D7H13	478	1455	835	592	65	100	107	104	576	112
D7H14	493	1537	991	669	96	103	77	78	691	88
D7H15	542	1678	1122	759	64	83	88	83	668	78
D7H16	545	1703	1070	766	71	96	90	81	746	94
D7H17	492	1551	933	717	81	83	73	77	730	76
D7H18	434	1438	884	639	46	58	58	61	614	86
D7H19	350	1184	716	515	54	72	78	86	482	106
D7H20	303	1125	648	434	73	79	68	67	442	71
D7H21	258	924	619	441	63	79	74	64	402	57
D7H22	234	723	493	353	33	26	28	37	310	49
D7H23	150	550	382	240	36	49	47	37	211	33
D1H0	77	336	268	155	27	27	33	31	125	33
D1H1	42	201	124	83	16	24	21	18	59	23
D1H2	32	141	63	46	17	15	17	17	33	15
D1H3	18	73	37	29	10	15	17	17	15	18
D1H4	19	58	47	25	17	20	15	18	23	18
D1H5	42	81	85	38	22	21	19	15	42	14
D1H6	68	215	146	89	12	10	13	13	89	20
D1H7	119	339	217	139	20	27	27	26	116	26

D1H8	178	343	291	215	31	38	41	45	213	44
D1H9	318	612	419	321	40	48	52	42	296	54
D1H10	455	1047	738	541	50	53	61	56	506	59
D1H11	581	1323	881	637	58	74	76	81	646	76
D1H12	621	1524	993	777	57	65	56	48	735	52
D1H13	676	1684	1077	813	51	75	61	60	819	65
D1H14	731	1664	1225	921	70	87	87	86	898	79
D1H15	826	1785	1219	930	72	86	77	79	855	91
D1H16	758	1685	1167	945	74	91	92	74	852	61
D1H17	712	1745	1131	798	63	72	62	60	695	68
D1H18	504	1365	851	627	49	46	60	57	512	40
D1H19	413	1189	768	554	28	44	40	37	515	45
D1H20	305	864	541	397	40	48	39	34	349	29
Mean	318	864	561	398	43	53	51	48	377	51

- Southbound

South Bound Closure	SH130								SH45	
	Car				Truck				Car	Truck
5/21/11	305	306	307	308	305	306	307	308	SH45S	SH45S
D7H20	311	729	411	263	42	40	35	30	256	39
D7H21	233	689	400	278	30	47	37	41	233	38
D7H22	158	587	293	216	32	28	32	28	177	35
D7H23	104	327	223	157	17	23	26	27	142	29
D1H0	56	170	117	101	14	16	17	14	83	12
D1H1	50	103	66	42	16	16	15	18	38	17
D1H2	34	75	42	23	10	12	14	11	17	15
D1H3	26	56	37	21	18	18	14	14	17	12
D1H4	38	101	65	19	21	19	21	23	11	23
D1H5	50	167	97	23	13	21	16	13	17	14
D1H6	80	336	189	84	21	16	12	14	69	14
D1H7	135	541	282	165	37	51	48	41	145	35
D1H8	207	773	398	248	47	38	28	32	222	36
D1H9	330	1050	488	323	42	56	55	48	258	41
D1H10	354	1198	593	399	41	56	45	41	350	35
D1H11	467	1284	722	500	58	68	61	54	419	59
D1H12	526	1250	750	505	100	101	91	80	492	64
D1H13	614	1448	864	611	65	81	69	70	527	93
D1H14	570	1464	854	604	68	66	80	78	504	71
D1H15	696	1634	1013	714	87	94	97	86	635	85
D1H16	647	1554	926	681	61	79	70	79	601	79
D1H17	668	1508	941	628	108	117	98	88	556	81
D1H18	513	1166	726	548	76	82	82	93	274	51
D1H19	410	926	531	406	77	79	81	75	387	72
D1H20	336	677	438	301	55	57	50	50	273	47
Mean	305	793	459	314	46	51	48	46	268	44

- SH-130 average hourly traffic transactions during typical weekend
  - Northbound

Ave typical trans. For North bound		SH130								SH45	
		Car				Truck				Car	Truck
Time	Week day	305	306	307	308	305	306	307	308	SH45N	SH45N
D6H21	Fri.	186	630	319	146	14	19	13	10	117	9
D6H22	Fri.	138	508	270	105	10	13	9	7	82	6
D6H23	Fri	92	375	209	72	5	9	6	5	52	4
D7H0	Sat	60	247	126	45	3	5	5	3	30	2
D7H1	Sat	29	138	62	25	3	5	4	3	16	2
D7H2	Sat	21	107	42	18	3	5	3	2	10	1
D7H3	Sat	16	64	28	13	3	4	4	3	8	2
D7H4	Sat	22	52	34	17	3	5	4	3	9	4
D7H5	Sat	50	88	83	40	5	9	7	5	23	5
D7H6	Sat	101	199	145	74	10	19	16	10	59	10
D7H7	Sat	167	360	213	119	13	24	18	11	90	16
D7H8	Sat	225	484	268	160	16	27	21	14	122	16
D7H9	Sat	293	615	345	219	18	32	24	16	184	15
D7H10	Sat	348	784	412	261	20	32	25	18	217	15
D7H11	Sat	392	931	506	301	24	37	29	20	245	19
D7H12	Sat	405	1042	528	310	22	36	27	20	257	19
D7H13	Sat	400	1070	555	333	22	35	26	19	278	18
D7H14	Sat	406	1133	590	340	20	35	27	21	277	19
D7H15	Sat	405	1144	614	371	18	31	25	22	299	20
D7H16	Sat	410	1180	614	374	19	30	23	18	301	18
D7H17	Sat	385	1136	597	361	18	28	21	17	286	17
D7H18	Sat	351	1054	538	302	15	25	19	14	234	12
D7H19	Sat	252	818	423	236	12	20	15	11	180	10
D7H20	Sat	199	648	350	192	9	13	10	8	143	7
D7H21	Sat	164	562	295	163	6	10	7	6	126	5
D7H22	Sat	129	488	256	131	4	8	5	4	96	4
D7H23	Sat	90	354	194	99	2	5	3	3	63	3

D1H0	Sun	59	235	123	64	2	4	2	2	38	2
D1H1	Sun	32	152	69	36	1	3	2	2	22	2
D1H2	Sun	23	123	48	20	1	3	2	1	12	1
D1H3	Sun	16	75	31	15	1	1	1	1	9	1
D1H4	Sun	17	54	30	13	1	2	1	1	9	1
D1H5	Sun	31	74	66	23	1	2	1	1	12	1
D1H6	Sun	56	135	94	38	3	4	2	2	25	2
D1H7	Sun	85	199	113	55	4	6	4	3	41	3
D1H8	Sun	132	271	158	88	6	8	6	4	69	4
D1H9	Sun	215	429	246	144	8	11	7	6	116	6
D1H10	Sun	292	595	345	212	10	15	12	9	176	8
D1H11	Sun	349	779	477	290	11	20	15	13	237	11
D1H12	Sun	425	970	553	335	15	25	20	17	272	14
D1H13	Sun	449	1066	617	395	16	28	21	18	320	15
D1H14	Sun	484	1174	704	432	19	31	24	21	344	16
D1H15	Sun	511	1236	748	462	20	31	25	20	369	15
D1H16	Sun	520	1267	740	463	19	31	24	20	357	18
D1H17	Sun	468	1208	704	432	18	30	23	20	326	16
D1H18	Sun	392	1046	611	354	15	26	17	14	255	9
D1H19	Sun	287	841	473	267	12	17	11	10	189	8
D1H20	Sun	199	614	353	197	7	11	8	6	133	5
Mean		225	599	332	191	11	17	13	10	149	9

Southbound

Ave typical trans. For South bound		SH130								SH45	
		Car				Truck				Car	Truck
Time	Week day	305	306	307	308	305	306	307	308	SH45S	SH45S
D6H21	Fri.	196	457	254	144	8	13	12	10	110	9
D6H22	Fri.	153	385	219	120	8	11	10	9	84	7
D6H23	Fri	97	210	139	73	6	8	8	7	51	6
D7H0	Sat	60	126	74	43	5	6	5	5	28	4
D7H1	Sat	34	77	45	27	4	6	5	4	16	3
D7H2	Sat	23	53	33	18	3	4	5	3	11	3
D7H3	Sat	22	59	35	15	2	5	3	2	8	1
D7H4	Sat	31	106	65	18	4	7	4	2	11	2
D7H5	Sat	51	209	113	34	5	10	7	4	18	3
D7H6	Sat	51	209	113	34	5	10	7	4	18	3
D7H7	Sat	166	640	269	122	13	30	18	12	88	11
D7H8	Sat	248	871	341	179	17	34	22	13	133	13
D7H9	Sat	305	1018	444	241	19	37	27	17	192	14
D7H10	Sat	364	1140	524	306	20	38	29	20	242	14
D7H11	Sat	389	1164	552	340	22	37	29	20	279	16
D7H12	Sat	404	1202	574	348	22	37	32	23	295	20
D7H13	Sat	416	1221	598	367	22	38	30	22	303	20
D7H14	Sat	416	1187	617	377	21	38	29	21	303	17
D7H15	Sat	402	1103	596	361	20	34	26	19	293	16
D7H16	Sat	425	1086	586	361	17	27	23	18	291	18
D7H17	Sat	357	1013	536	328	15	24	18	15	266	15
D7H18	Sat	311	906	446	278	12	19	15	13	230	12
D7H19	Sat	239	665	348	217	9	14	11	10	168	11
D7H20	Sat	193	513	261	155	7	10	9	7	118	7
D7H21	Sat	170	433	227	129	5	9	7	6	91	5
D7H22	Sat	131	346	179	103	4	5	3	3	75	3
D7H23	Sat	97	227	123	74	3	4	3	2	49	2
D1H0	Sun	60	143	79	49	3	3	2	1	34	2
D1H1	Sun	34	92	49	31	2	2	2	1	20	1

D1H2	Sun	22	55	37	23	1	2	2	1	12	1
D1H3	Sun	19	52	31	15	1	2	2	1	9	1
D1H4	Sun	30	99	58	14	2	3	1	1	8	1
D1H5	Sun	38	164	92	20	2	3	2	2	11	1
D1H6	Sun	61	238	122	35	3	6	3	2	23	1
D1H7	Sun	120	349	144	52	4	8	5	3	38	2
D1H8	Sun	142	498	201	87	6	11	6	5	62	3
D1H9	Sun	250	726	299	143	8	14	9	6	104	5
D1H10	Sun	275	906	395	204	11	19	12	10	157	5
D1H11	Sun	344	970	452	252	15	24	16	11	200	9
D1H12	Sun	395	1059	499	296	19	27	16	14	241	11
D1H13	Sun	427	1137	556	332	20	27	17	14	267	12
D1H14	Sun	453	1147	596	356	20	30	19	17	287	14
D1H15	Sun	470	1155	622	389	20	28	20	17	320	15
D1H16	Sun	492	1147	628	396	19	29	20	17	324	17
D1H17	Sun	438	1052	589	374	18	27	19	17	320	15
D1H18	Sun	365	846	476	320	15	21	16	14	276	13
D1H19	Sun	289	624	377	256	12	16	12	11	214	10
D1H20	Sun	209	462	269	179	10	13	10	9	148	8
Mean		223	616	310	180	11	17	13	10	143	8

- Net differences in transactions among successive SH-130 toll stations during closures
    - First closure
        - Northbound

North Bound Closure	Net difference in transaction between stations (Δ)							
	Car				Truck			
2/11/11	308-SH45	307-308	306-307	305-306	308-SH45	307-308	306-307	305-306
D7H2	-	13	68	-86	-	-7	-9	-3
D7H3	-	17	40	-47	-	6	6	-3
D7H4	-	20	28	-43	-	4	-13	0
D7H5	-	22	-19	-33	-	-7	9	-7
D7H6	-	67	59	-165	-	21	-3	-14
D7H7	-	90	123	-282	-	0	-9	-6
D7H8	-	105	215	-378	-	8	10	-28
D7H9	-	164	259	-485	-	-4	4	3
D7H10	-	140	307	-514	-	11	-9	-25
D7H11	-	168	343	-612	-	18	-20	-16
D7H12	-	232	417	-754	-	9	-12	-7
D7H13	-	243	494	-865	-	-2	7	-37
D7H14	-	245	416	-865	-	-2	-13	-19
D7H15	-	258	510	-977	-	1	-6	-32
D7H16	-	279	445	-988	-	-11	5	-9
D7H17	-	240	452	-1098	-	7	6	-33
D7H18	-	265	438	-981	-	5	-5	-14
D7H19	-	205	372	-790	-	2	-12	3
D7H20	-	160	297	-618	-	6	-3	-6
D7H21	-	122	259	-572	-	3	-1	-9
D7H22	-	106	398	-609	-	-5	4	-5
D7H23	-	105	180	-411	-	6	-2	14
D1H0	-	56	133	-238	-	4	4	-9
D1H1	-	38	88	-156	-	2	-4	1
D1H2	-	28	76	-120	-	0	-1	-2
D1H3	-	19	41	-69	-	1	-2	5
D1H4	-	1	32	-50	-	-2	-2	-4
D1H5	-	21	-4	-37	-	-2	10	-2
D1H6	-	33	21	-74	-	4	-4	-10
D1H7	-	63	90	-167	-	-2	4	-2

D1H8	-	64	118	-233	-	-6	-8	-13
D1H9	-	85	187	-292	-	2	-1	-5
D1H10	-	127	233	-444	-	6	-9	-15
D1H11	-	144	212	-525	-	-4	11	7
D1H12	-	172	371	-700	-	7	-5	-22
D1H13	-	197	501	-829	-	-4	4	-12
D1H14	-	252	385	-873	-	3	7	-13
D1H15	-	272	516	-966	-	7	-5	-30
D1H16	-	257	425	-961	-	-1	9	-7
D1H17	-	268	447	-987	-	7	-2	-31
Mean		134	249	-497	-	2	-2	-10

- Southbound

South Bound Closure	**Net difference in transaction between stations (Δ)**							
	Car				**Truck**			
2/11/11	306-305	307-306	308-307	SH45-308	306-305	307-306	308-307	SH45-308
D6H21	286	-183	-133	-	2	1	1	-
D6H22	236	-85	-125	-	13	-5	-3	-
D6H23	130	-66	-60	-	18	6	-2	-
D7H0	55	-50	-11	-	10	-1	0	-
D7H1	51	-30	-4	-	1	3	5	-
D7H2	35	-9	-19	-	10	-4	-2	-
D7H3	43	-30	-22	-	16	-1	0	-
D7H4	87	-59	-39	-	5	7	-4	-
D7H5	197	-96	-77	-	10	-14	-4	-
D7H6	436	-221	-154	-	16	-1	-4	-
D7H7	652	-350	-179	-	26	-9	-4	-
D7H8	822	-484	-195	-	33	-7	-22	-
D7H9	899	-571	-207	-	27	-15	-1	-
D7H10	1008	-628	-228	-	9	19	-27	-
D7H11	934	-530	-198	-	29	13	-2	-
D7H12	990	-568	-232	-	27	2	-4	-
D7H13	963	-536	-209	-	49	11	-5	-
D7H14	968	-514	-273	-	30	-2	-21	-
D7H15	864	-533	-188	-	30	22	-4	-
D7H16	802	-505	-209	-	18	-15	-3	-
D7H17	914	-560	-282	-	29	2	3	-
D7H18	883	-586	-162	-	25	-3	-14	-
D7H19	607	-384	-138	-	4	-4	-2	-
D7H20	346	-194	-124	-	22	6	-2	-
D7H21	357	-201	-113	-	14	9	7	-
D7H22	284	-72	-100	-	0	0	3	-
D7H23	125	-74	-18	-	5	-6	-3	-
D1H0	102	-37	-23	-	4	10	-3	-
D1H1	66	-11	-33	-	4	-1	1	-
D1H2	73	-37	-18	-	3	5	2	-
D1H3	30	-25	-15	-	5	-8	-4	-
D1H4	47	-13	-33	-	1	1	2	-
D1H5	118	-65	-64	-	3	-3	-3	-
D1H6	233	-151	-93	-	14	-2	-3	-
D1H7	271	-159	-89	-	-4	-11	-3	-
D1H8	470	-287	-136	-	8	11	-5	-
D1H9	562	-409	-154	-	18	-1	-6	-

D1H10	698	-482	-189	-	16	-1	-4	-
D1H11	821	-512	-247	-	17	1	-3	-
D1H12	812	-502	-186	-	37	-8	1	-
D1H13	908	-555	-261	-	-3	-4	-11	-
D1H14	945	-544	-275	-	49	-9	-1	-
D1H15	915	-544	-248	-	33	7	1	-
D1H16	788	-535	-225	-	25	-15	-6	-
D1H17	777	-502	-247	-	24	-14	-11	-
Mean	502	-300	-139	-	16	-1	-4	-

- Second closure
  - North Bound

North Bound Closure	Net difference in transaction between stations (Δ)							
	Car				Truck			
2/26/11	308-SH45	307-308	306-307	305-306	308-SH45	307-308	306-307	305-306
D7H6	-	63	38	-133	-	-2	-3	-20
D7H7	-	89	144	-374	-	8	2	-19
D7H8	-	106	225	-468	-	-1	-10	-40
D7H9	-	129	243	-475	-	-7	8	-32
D7H10	-	157	306	-569	-	-4	0	-28
D7H11	-	204	369	-754	-	8	1	-30
D7H12	-	255	488	-913	-	-15	-21	-33
D7H13	-	237	438	-891	-	17	12	-28
D7H14	-	188	400	-846	-	12	-8	-20
D7H15	-	260	458	-1037	-	-1	4	3
D7H16	-	283	548	-1073	-	6	-18	-21
D7H17	-	285	420	-1057	-	1	25	-33
D7H18	-	261	450	-1045	-	-1	1	-25
D7H19	-	277	327	-802	-	14	-7	-16
D7H20	-	169	367	-789	-	1	20	-6
D7H21	-	139	269	-606	-	2	-1	-2
D7H22	-	132	203	-507	-	7	-3	-1
D7H23	-	85	131	-352	-	-1	2	0
D1H0	-	68	120	-260	-	5	2	-10
D1H1	-	59	89	-185	-	-2	0	3
D1H2	-	37	58	-109	-	6	-3	-5
D1H3	-	21	64	-90	-	0	4	5
D1H4	-	13	29	-41	-	-3	2	-4
D1H5	-	40	22	-47	-	3	2	1
Mean	-	148	259	-559	-	2	0	-15

- Southbound

South Bound Closure	Net difference in transaction between stations (Δ)							
	Car				Truck			
2/26/11	306-305	307-306	308-307	SH45-308	306-305	307-306	308-307	SH45-308
D6H22	205	-132	-108	-26	1	-2	-6	-4
D6H23	121	-67	-54	-28	12	-8	3	-2
D7H0	71	-46	-34	-10	15	7	-3	-3
D7H1	45	-21	-18	-17	8	-3	2	1
D7H2	18	-16	-4	-4	11	-6	0	4
D7H3	36	-19	-25	1	11	-8	1	2
D7H4	92	-45	-58	-16	7	-5	2	-6
D7H5	194	-95	-93	-13	25	-33	-6	-6
D7H6	502	-214	-184	-	19	7	-11	-
D7H7	783	-429	-187	-	38	-10	-13	-
D7H8	954	-563	-207	-	28	-17	-3	-
D7H9	971	-547	-279	-	36	-22	-1	-
D7H10	1045	-561	-288	-	47	-14	-16	-
D7H11	1086	-603	-291	-	27	7	-9	-
D7H12	1119	-644	-304	-	22	18	-3	-
D7H13	1093	-657	-281	-	39	-10	-11	-
D7H14	923	-473	-224	-	26	2	-12	-
D7H15	929	-551	-228	-	35	-5	1	-
D7H16	876	-548	-216	-	44	-1	-9	-
D7H17	915	-474	-261	-	15	-2	-7	-
D7H18	807	-462	-180	-	14	7	4	-
D7H19	573	-315	-101	-	12	-5	4	-
D7H20	474	-244	-93	-	10	5	8	-
D7H21	407	-186	-114	-	13	3	2	-
D7H22	269	-118	-104	-	7	-5	-6	-
D7H23	138	-24	-74	-	8	0	5	-
D1H0	92	-69	-16	-	6	2	-2	-
D1H1	64	-34	-9	-	2	0	2	-
D1H2	47	-20	-22	-	4	5	-1	-
D1H3	25	-22	-25	-	2	-4	0	-
D1H4	68	-21	-56	-	10	-7	1	-
D1H5	140	-57	-100	-	5	5	-6	-
Mean	471	-259	-132	-	17	-3	-3	-

- Third closure
  - Northbound

North Bound Closure	Net difference in transaction between stations (Δ)							
	Car				Truck			
5/21/11	308-SH45	307-308	306-307	305-306	308-SH45	307-308	306-307	305-306
D6H22	-1	125	239	-353	3	-7	10	-12
D6H23	23	216	123	-326	0	4	5	-5
D7H0	5	157	151	-266	-4	3	2	-3
D7H1	5	84	60	-133	-2	5	-4	2
D7H2	-4	45	77	-106	0	1	9	-8
D7H3	3	10	27	-37	-3	-1	4	-3
D7H4	-5	19	3	-25	1	2	-1	-2
D7H5	18	45	30	-69	-2	1	-1	-5
D7H6	-41	73	41	-142	-17	4	4	-10
D7H7	-3	122	186	-389	-7	1	-10	-15
D7H8	-7	132	320	-483	-5	10	2	-12
D7H9	24	196	330	-585	-4	3	13	-15
D7H10	17	199	297	-600	-10	0	0	-19
D7H11	-12	232	517	-820	0	9	6	-25
D7H12	14	244	678	-953	-7	8	11	-11
D7H13	16	243	620	-977	-8	3	-7	-35
D7H14	-22	322	546	-1044	-10	-1	26	-7
D7H15	91	363	556	-1136	5	5	-5	-19
D7H16	20	304	633	-1158	-13	9	6	-25
D7H17	-13	216	618	-1059	1	-4	10	-2
D7H18	25	245	554	-1004	-25	-3	0	-12
D7H19	33	201	468	-834	-20	-8	-6	-18
D7H20	-8	214	477	-822	-4	1	11	-6
D7H21	39	178	305	-666	7	10	5	-16
D7H22	43	140	230	-489	-12	-9	-2	7
D7H23	29	142	168	-400	4	10	2	-13
D1H0	30	113	68	-259	-2	2	-6	0
D1H1	24	41	77	-159	-5	3	3	-8
D1H2	13	17	78	-109	2	0	-2	2
D1H3	14	8	36	-55	-1	0	-2	-5
D1H4	2	22	11	-39	0	-3	5	-3
D1H5	-4	47	-4	-39	1	4	2	1
D1H6	0	57	69	-147	-7	0	-3	2
D1H7	23	78	122	-220	0	1	0	-7
D1H8	2	76	52	-165	1	-4	-3	-7
D1H9	25	98	193	-294	-12	10	-4	-8

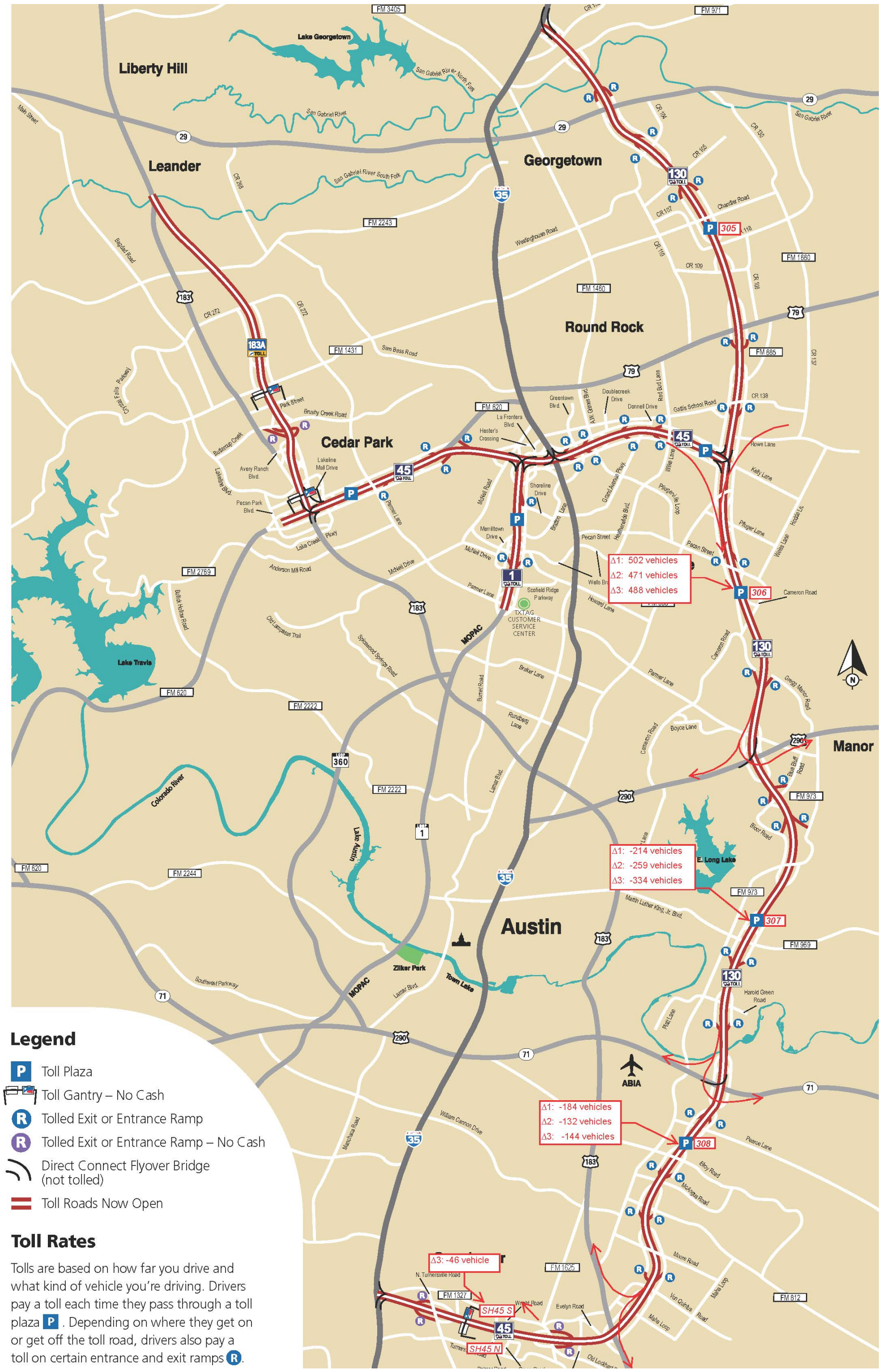
D1H10	35	197	309	-592	-3	5	-8	-3
D1H11	-9	244	442	-742	5	-5	-2	-16
D1H12	42	216	531	-903	-4	8	9	-8
D1H13	-6	264	607	-1008	-5	1	14	-24
D1H14	23	304	439	-933	7	1	0	-17
D1H15	75	289	566	-959	-12	-2	9	-14
D1H16	93	222	518	-927	13	18	-1	-17
D1H17	103	333	614	-1033	-8	2	10	-9
D1H18	115	224	514	-861	17	3	-14	3
D1H19	39	214	421	-776	-8	3	4	-16
D1H20	48	144	323	-559	5	5	9	-8
Mean	21	163	303	-546	-3	2	2	-10

- Southbound

South Bound Closure	Net difference in transaction between stations (Δ)							
	Car				Truck			
5/21/11	306-305	307-306	308-307	SH45-308	306-305	307-306	308-307	SH45-308
D7H20	418	-318	-148	-7	-2	-5	-5	9
D7H21	456	-289	-122	-45	17	-10	4	-3
D7H22	429	-294	-77	-39	-4	4	-4	7
D7H23	223	-104	-66	-15	6	3	1	2
D1H0	114	-53	-16	-18	2	1	-3	-2
D1H1	53	-37	-24	-4	0	-1	3	-1
D1H2	41	-33	-19	-6	2	2	-3	4
D1H3	30	-19	-16	-4	0	-4	0	-2
D1H4	63	-36	-46	-8	-2	2	2	0
D1H5	117	-70	-74	-6	8	-5	-3	1
D1H6	256	-147	-105	-15	-5	-4	2	0
D1H7	406	-259	-117	-20	14	-3	-7	-6
D1H8	566	-375	-150	-26	-9	-10	4	4
D1H9	720	-562	-165	-65	14	-1	-7	-7
D1H10	844	-605	-194	-49	15	-11	-4	-6
D1H11	817	-562	-222	-81	10	-7	-7	5
D1H12	724	-500	-245	-13	1	-10	-11	-16
D1H13	834	-584	-253	-84	16	-12	1	23
D1H14	894	-610	-250	-100	-2	14	-2	-7
D1H15	938	-621	-299	-79	7	3	-11	-1
D1H16	907	-628	-245	-80	18	-9	9	0
D1H17	840	-567	-313	-72	9	-19	-10	-7
D1H18	653	-440	-178	-274	6	0	11	-42
D1H19	516	-395	-125	-19	2	2	-6	-3
D1H20	341	-239	-137	-28	2	-7	0	-3
Mean	488	-334	-144	-46	5	-3	-2	-2

o Northbound closures,

o Southbound closures,


Liberty Hill
Leander
Georgetown
Round Rock
Cedar Park
Manor
Austin
Lake Georgetown
Lake Travis
Colorado River
Lake Austin
Zilker Park
Town Lake
E. Long Lake
ABIA
MOPAC
TXTAG CUSTOMER SERVICE CENTER
305
306
307
308
SH45 S
SH45 N
Δ1: 502 vehicles
Δ2: 471 vehicles
Δ3: 488 vehicles
Δ1: -214 vehicles
Δ2: -259 vehicles
Δ3: -334 vehicles
Δ1: -184 vehicles
Δ2: -132 vehicles
Δ3: -144 vehicles
Δ3: -46 vehicle
Legend
Toll Plaza
Toll Gantry – No Cash
Tolled Exit or Entrance Ramp
Tolled Exit or Entrance Ramp – No Cash
Direct Connect Flyover Bridge (not tolled)
Toll Roads Now Open
Toll Rates
Tolls are based on how far you drive and what kind of vehicle you're driving. Drivers pay a toll each time they pass through a toll plaza P. Depending on where they get on or get off the toll road, drivers also pay a toll on certain entrance and exit ramps R.

- Net differences in transactions among successive SH-130 toll stations during typical weekend

  - Northbound

Ave typical Net difference For North bound	Net difference in transaction between stations (Δ)							
	Car				Truck			
Time	308-SH45	307-308	306-307	305-306	308-SH45	307-308	306-307	305-306
D6H21	29	173	310	-444	1	3	6	-5
D6H22	23	164	238	-370	1	2	5	-4
D6H23	20	137	166	-282	1	1	2	-4
D7H0	15	81	121	-187	1	2	-1	-2
D7H1	8	38	76	-109	1	1	1	-2
D7H2	8	23	65	-86	1	1	2	-2
D7H3	5	15	36	-48	1	1	0	-2
D7H4	7	17	18	-30	0	1	1	-2
D7H5	17	43	5	-38	0	2	2	-3
D7H6	16	71	54	-98	0	6	3	-9
D7H7	30	94	147	-193	-4	7	6	-10
D7H8	38	107	216	-259	-2	7	6	-11
D7H9	35	125	270	-322	1	8	8	-14
D7H10	44	151	372	-435	3	7	7	-11
D7H11	56	205	426	-539	1	9	8	-14
D7H12	52	218	514	-637	2	6	9	-14
D7H13	55	222	516	-670	1	7	9	-13
D7H14	63	250	543	-727	2	6	8	-15
D7H15	72	243	530	-739	2	4	6	-13
D7H16	73	240	566	-770	0	5	7	-11
D7H17	75	235	539	-751	0	4	7	-11
D7H18	68	236	516	-703	3	4	6	-10
D7H19	56	187	395	-566	1	4	5	-8
D7H20	48	159	298	-449	1	2	3	-5
D7H21	37	132	267	-398	1	1	2	-3

D7H22	35	125	233	-360	0	1	3	-3
D7H23	36	95	160	-264	0	0	2	-3
D1H0	25	59	113	-177	0	0	1	-2
D1H1	14	34	82	-120	0	0	1	-2
D1H2	8	28	75	-101	0	1	1	-1
D1H3	6	15	44	-59	0	0	0	0
D1H4	4	17	25	-37	0	0	1	-1
D1H5	11	43	8	-42	0	0	1	-1
D1H6	14	56	41	-79	0	0	1	-1
D1H7	15	58	86	-114	0	1	2	-2
D1H8	19	70	114	-140	1	2	2	-3
D1H9	28	102	182	-213	0	1	4	-4
D1H10	37	133	250	-303	1	3	3	-6
D1H11	52	187	302	-430	2	2	5	-9
D1H12	63	217	418	-545	2	3	5	-10
D1H13	75	222	450	-618	3	3	7	-12
D1H14	88	272	470	-690	5	3	7	-13
D1H15	93	286	488	-725	5	5	6	-11
D1H16	106	276	527	-747	2	4	7	-12
D1H17	106	273	503	-739	4	3	8	-12
D1H18	99	257	436	-654	4	4	9	-11
D1H19	78	206	368	-555	1	2	6	-6
D1H20	64	156	260	-414	2	2	3	-4
Mean	42	141	267	-374	1	3	4	-7

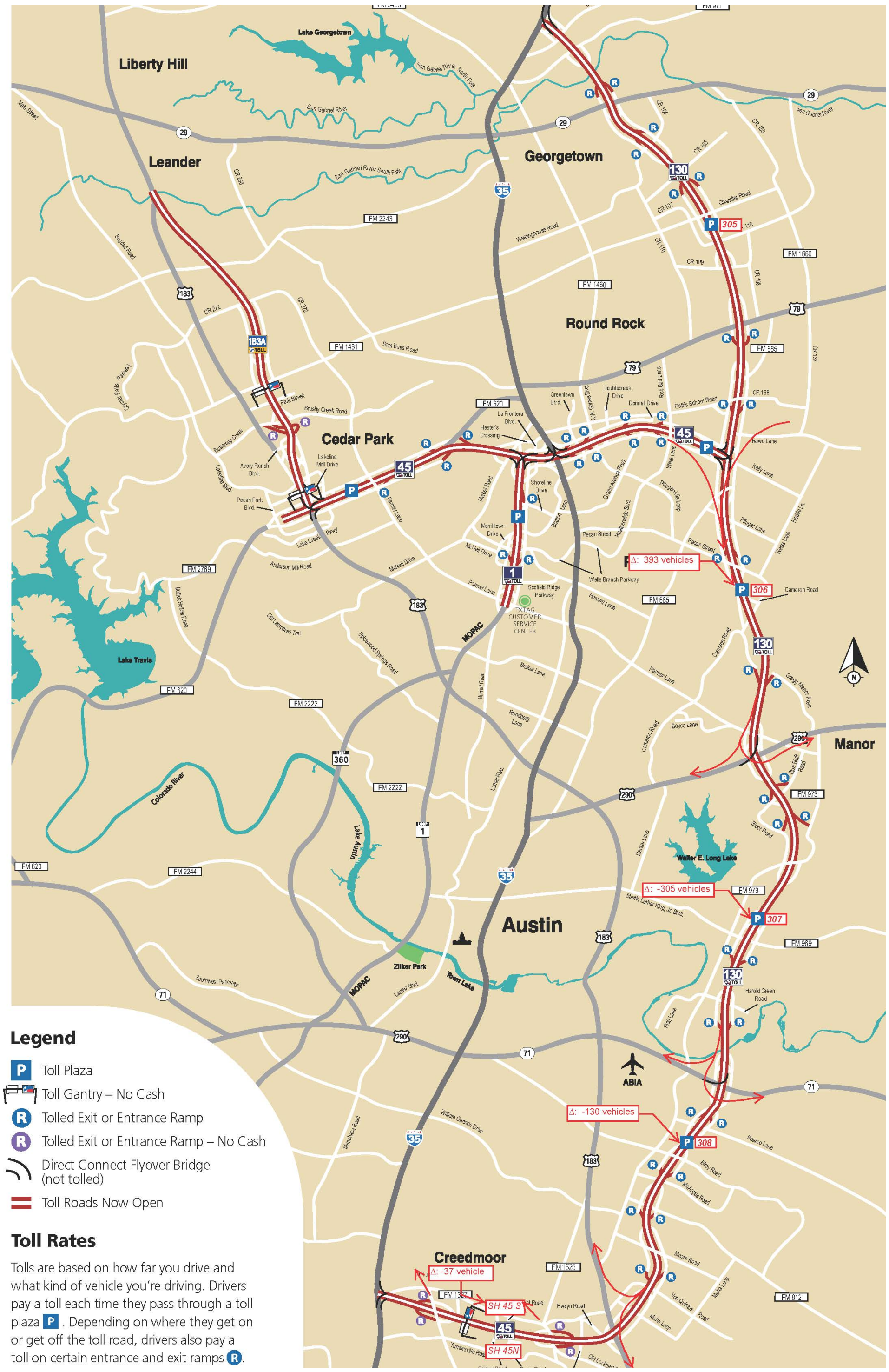
Northbound, average typical net difference in transaction between stations

- Southbound

Ave typical Net difference For South bound	Net difference in transaction between stations (Δ)							
	Car				Truck			
Time	306-305	307-306	308-307	SH45-308	306-305	307-306	308-307	SH45-308
D6H21	261	-203	-110	-34	5	0	-3	-1
D6H22	232	-166	-99	-36	4	-1	-1	-1
D6H23	113	-71	-66	-22	2	-1	0	-1
D7H0	66	-52	-31	-15	1	-2	0	0
D7H1	43	-32	-18	-11	2	-1	-1	-1
D7H2	30	-20	-15	-8	1	0	-1	0
D7H3	37	-24	-20	-7	3	-2	-1	-1
D7H4	75	-41	-47	-8	3	-3	-1	-1
D7H5	158	-96	-79	-16	5	-4	-2	-2
D7H6	158	-96	-79	-16	5	-4	-2	-2
D7H7	474	-372	-147	-34	16	-11	-7	0
D7H8	623	-529	-162	-47	17	-12	-8	0
D7H9	713	-574	-203	-49	17	-10	-10	-3
D7H10	776	-615	-218	-64	18	-9	-10	-6
D7H11	775	-611	-213	-60	15	-8	-8	-4
D7H12	799	-628	-226	-53	15	-6	-8	-3
D7H13	805	-623	-231	-64	16	-7	-8	-2
D7H14	771	-570	-239	-74	16	-9	-8	-4
D7H15	701	-507	-236	-68	14	-8	-7	-3
D7H16	662	-501	-224	-71	10	-4	-4	0
D7H17	656	-477	-208	-62	9	-6	-3	0
D7H18	595	-460	-168	-47	7	-4	-2	-1
D7H19	426	-317	-131	-49	5	-3	-1	1
D7H20	320	-252	-106	-37	4	-2	-1	0
D7H21	262	-206	-97	-38	4	-2	-1	-1
D7H22	215	-168	-76	-27	2	-2	0	0
D7H23	130	-104	-49	-25	1	-1	0	0

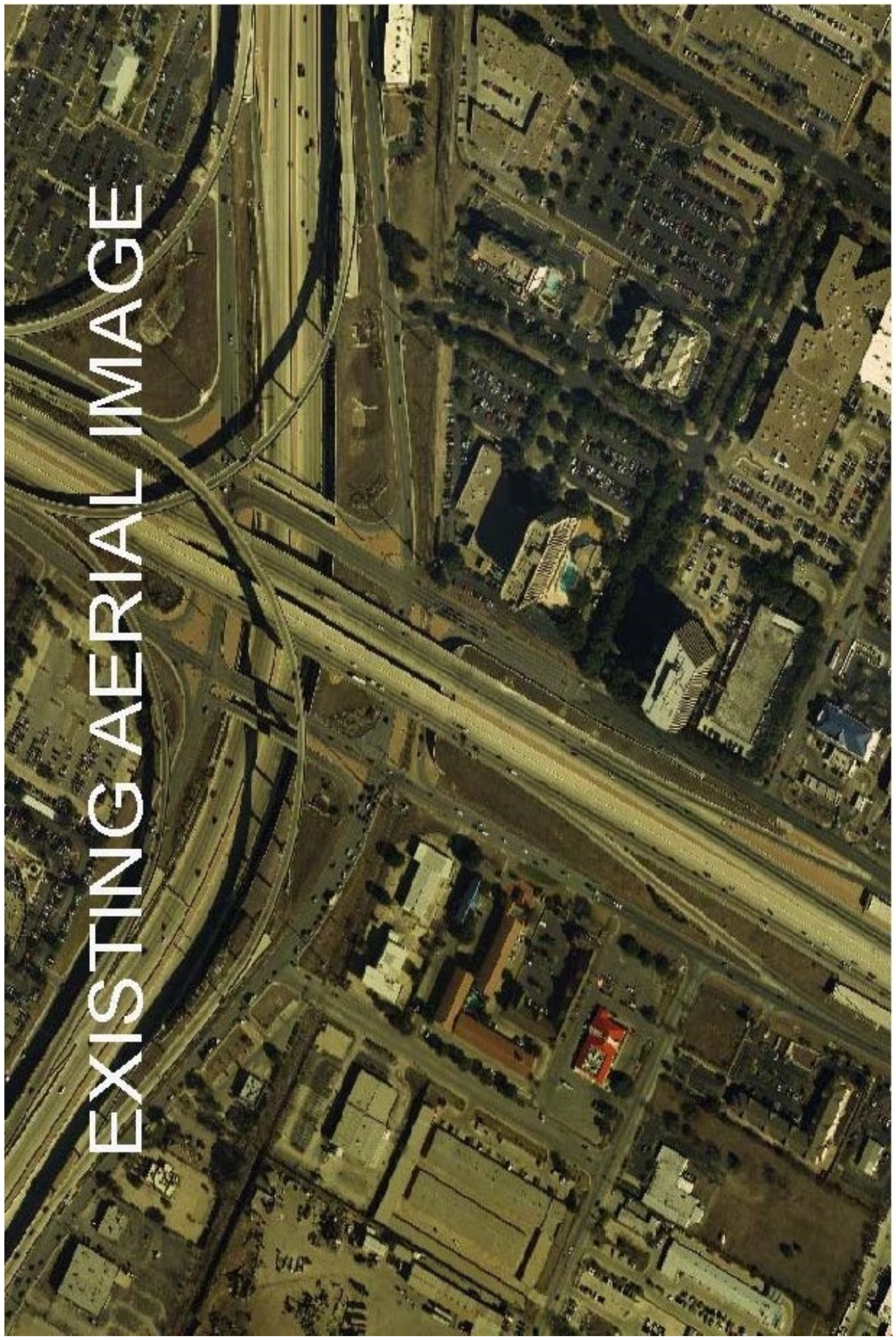
D1H0	84	-64	-29	-15	0	-1	0	0
D1H1	57	-43	-18	-11	1	-1	-1	0
D1H2	33	-18	-14	-11	1	0	-1	0
D1H3	33	-20	-16	-6	1	0	0	0
D1H4	69	-41	-43	-6	2	-2	0	0
D1H5	126	-72	-72	-9	1	-1	-1	0
D1H6	177	-116	-88	-12	4	-3	-1	-1
D1H7	229	-206	-91	-14	4	-3	-2	-1
D1H8	356	-297	-115	-24	5	-4	-2	-1
D1H9	476	-427	-156	-40	6	-5	-3	-1
D1H10	631	-511	-191	-47	8	-6	-3	-4
D1H11	626	-518	-200	-51	8	-7	-5	-2
D1H12	664	-560	-203	-55	8	-11	-2	-3
D1H13	710	-581	-224	-65	7	-10	-3	-2
D1H14	694	-551	-240	-69	10	-11	-2	-2
D1H15	685	-533	-234	-69	8	-7	-3	-1
D1H16	655	-520	-232	-72	10	-10	-2	0
D1H17	614	-463	-215	-54	9	-8	-2	-1
D1H18	481	-370	-156	-45	6	-5	-2	0
D1H19	335	-247	-120	-43	4	-4	-1	0
D1H20	252	-193	-90	-31	3	-3	-1	-1
Mean	393	-305	-130	-37	7	-5	-3	-1

- Southbound, average typical net difference in transaction between stations



Appendix B

The sequence of construction on IH-35/SH-71 is presented here in figure format.




MAY 2010
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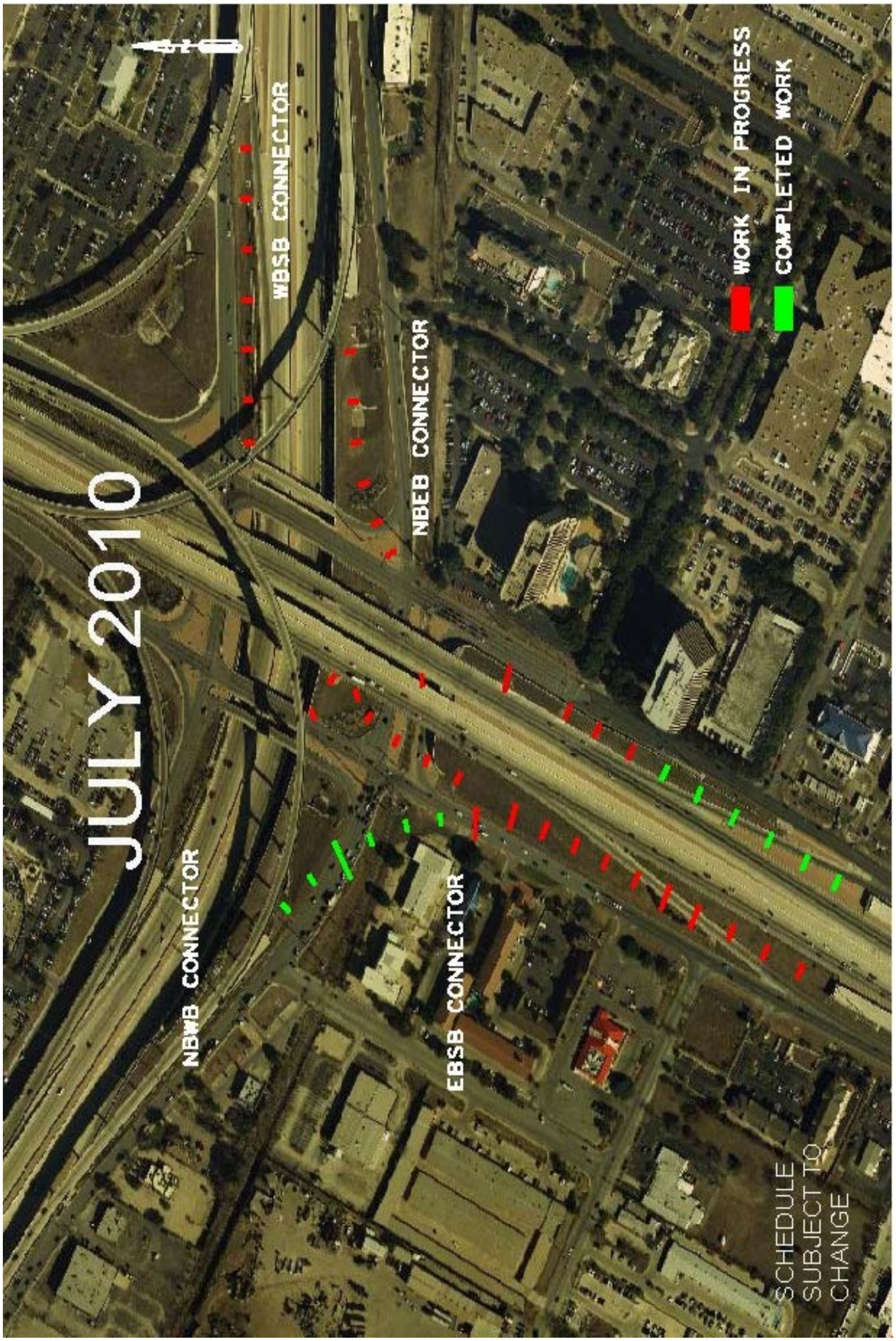
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


JUNE 2010
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE SUBJECT TO CHANGE


JULY 2010
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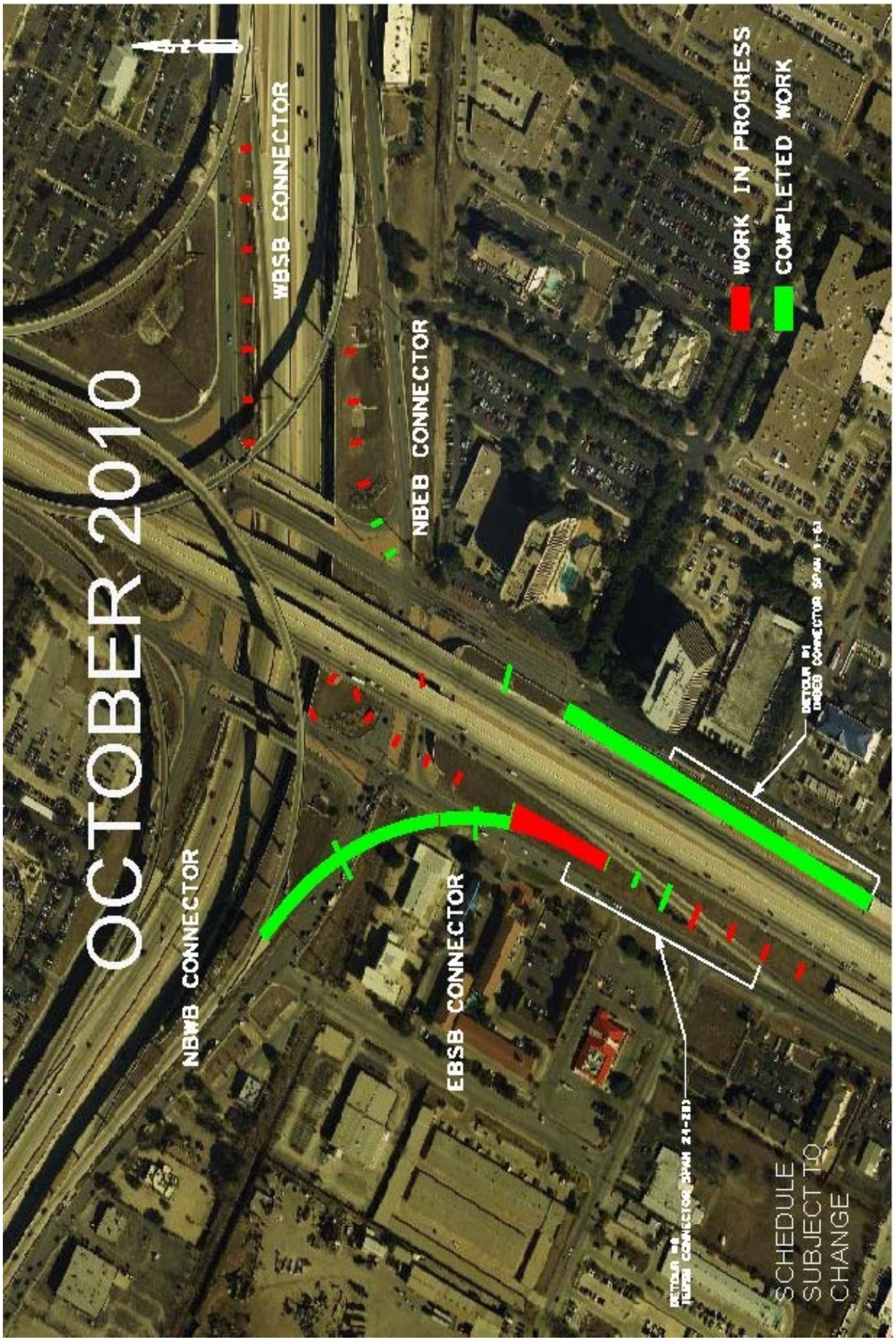
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE SUBJECT TO CHANGE


AUGUST 2010
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


SEPTEMBER 2010
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
DETOUR #4
(EBSB CONNECTOR SPAN 19-20)
DETOUR #1
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


OCTOBER 2010
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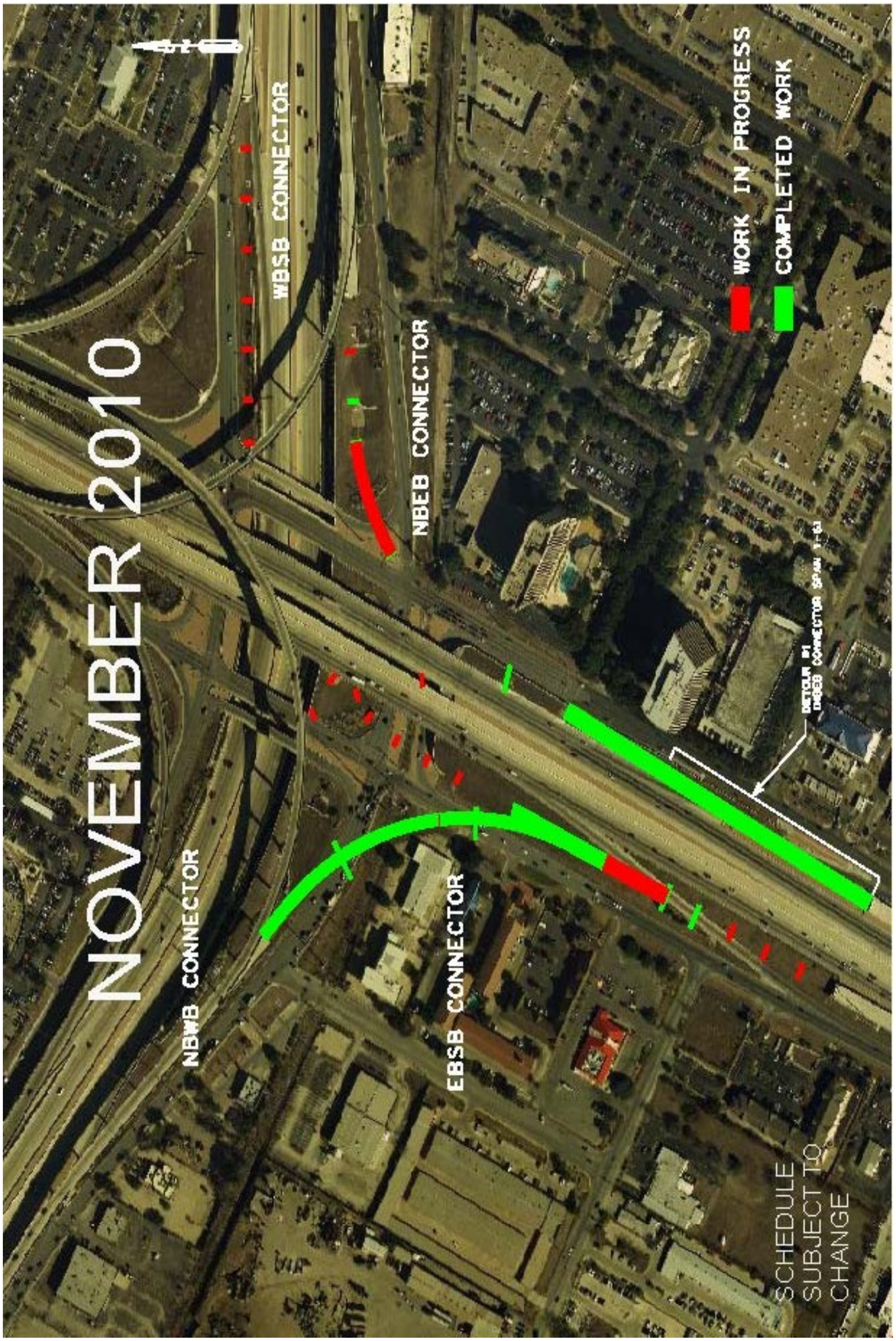
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE SUBJECT TO CHANGE


NOVEMBER 2010
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WORK IN PROGRESS
COMPLETED WORK
NBWB CONNECTOR
EBSB CONNECTOR
SCHEDULE
SUBJECT TO
CHANGE

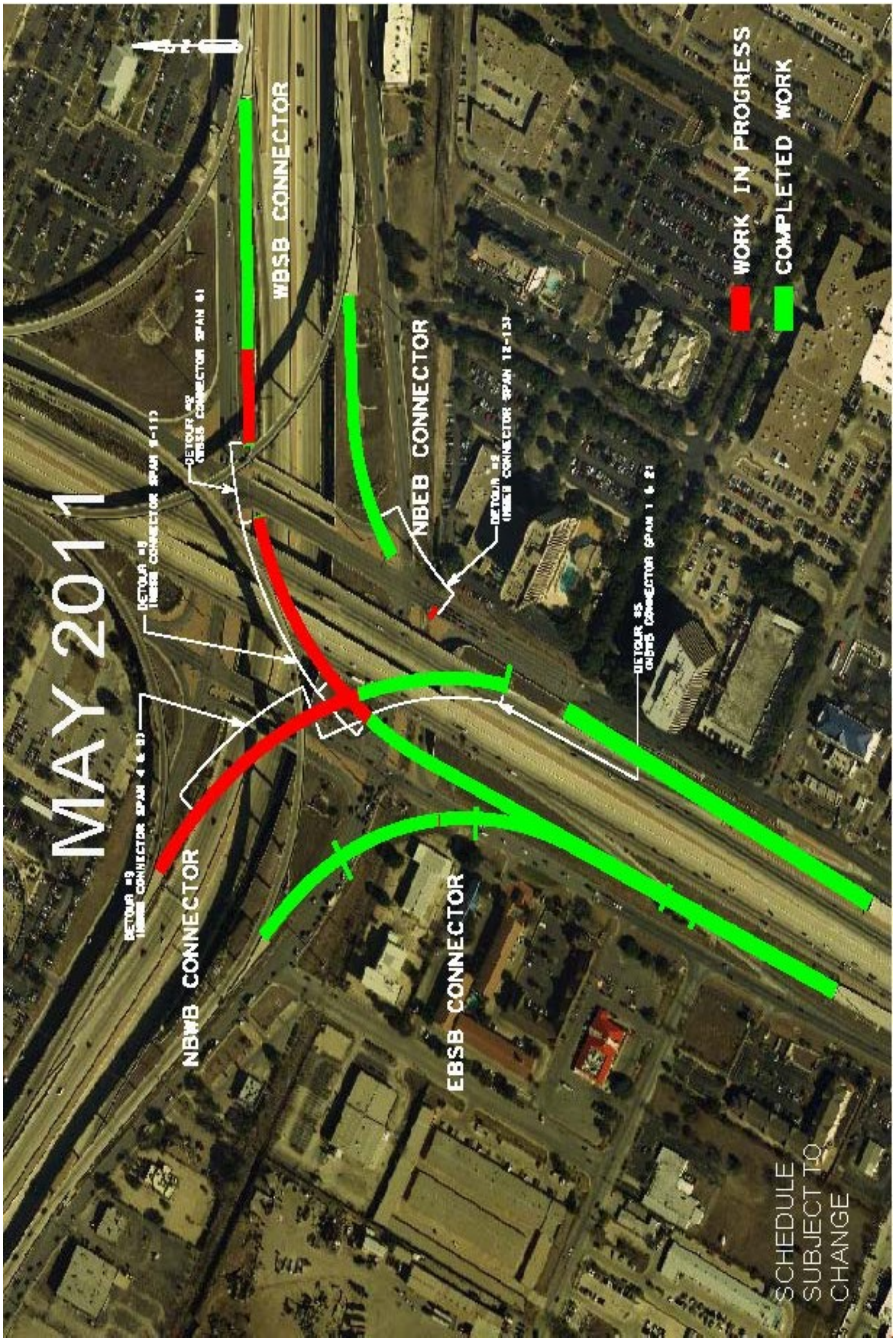

DECEMBER 2010
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


JANUARY 2011
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


FEBRUARY 2011
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE

MARCH 2011
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


APRIL 2011
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


MAY 2011
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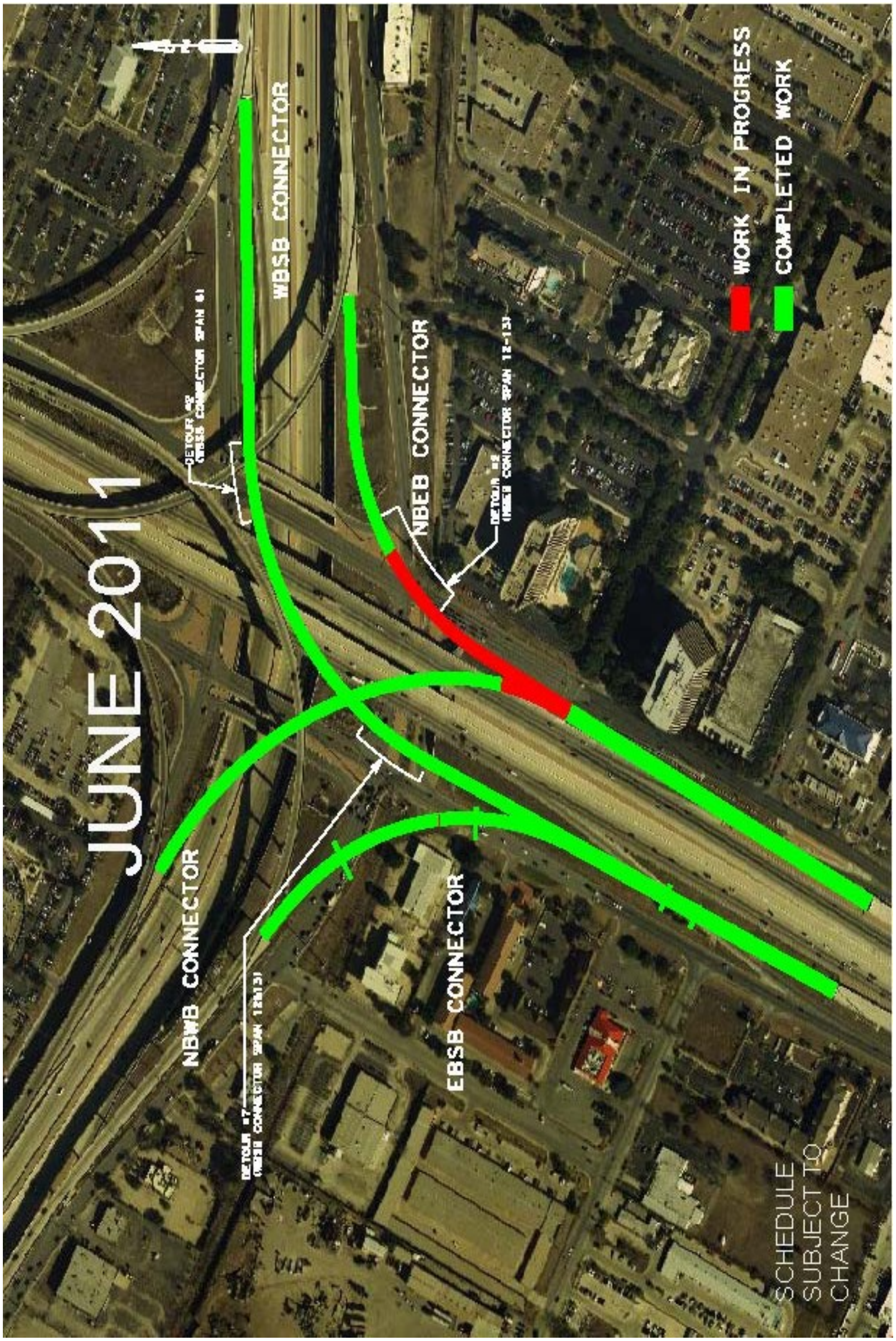
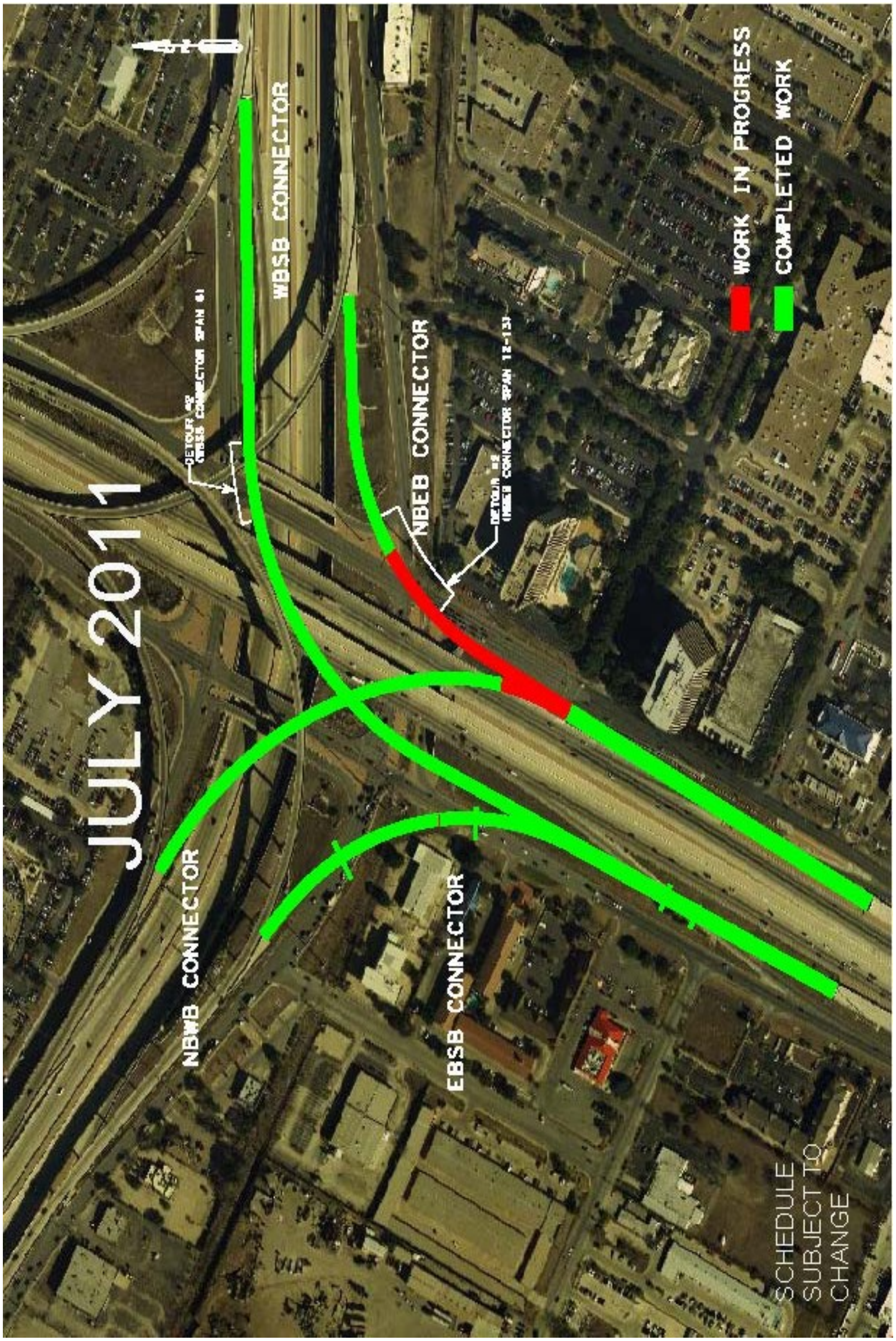
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE



JUNE 2011
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


JULY 2011
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NBWB CONNECTOR
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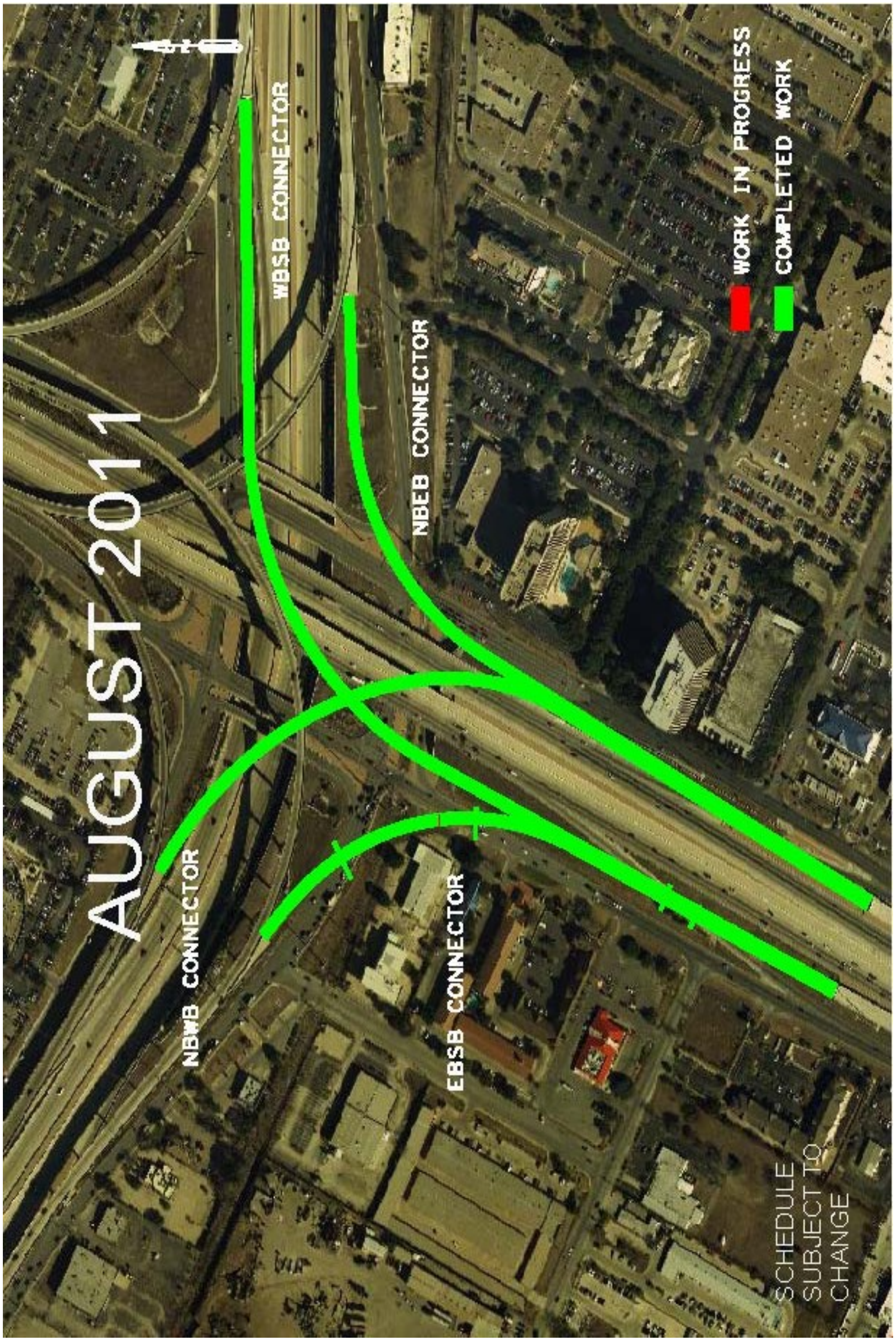
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE


AUGUST 2011
WBSB CONNECTOR
NBEB CONNECTOR
NBWB CONNECTOR
EBSB CONNECTOR
WORK IN PROGRESS
COMPLETED WORK
SCHEDULE
SUBJECT TO
CHANGE

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