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# TRAVELER PATH CHOICE DURING FREEWAY CLOSURE

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**ABSTRACT**

Construction activities and numbers of related work zones on urban freeways have grown significantly. 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. Full freeway closures are sometimes implemented to expedite project completion and thereby reduce the cumulative impact of construction on travelers. Traffic diversion strategy is one way to improve the management of traffic and reduce user costs. 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.

Construction on the SH-71/IH-35 interchange required complete closure of all IH-35 main lanes. IH-35 is an important business corridor, conveniently connecting four large Texas cities, as well as, facilitating trade between Mexico and the United States. A parallel route, the SH-130 toll road, was made free to travelers during those closures.

The purpose of this paper is to investigate driver route switching behavior during IH-35 closure and explore options for relieving delays on IH-35 during future closures. The Austin highway network was analyzed. However, usage of SH-130 was less than anticipated, and there was significant traffic queuing on IH-35 at the work zone. 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.

**INTRODUCTION**

As the aging transportation infrastructure increasingly requires repair and renewal, construction activities and related work zones on urban freeways have grown significantly. An effective diversion plan can play a critical role to control traffic in work zones. 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. Careful analysis of diversion strategies is needed to develop more efficient and effective strategies.

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.

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 misapplying 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 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.

**More Information on Traffic Control Concepts**

A summary of available information on work zone traffic control concepts with emphasis on Changeable message signs and lessons learned from full highway closure experiences is presented in this section.

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 motorists. Previous studies of several work zones on high-speed roadways in Texas suggest that 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. Proper PCMS message design and use requires application of both human factors and traffic engineering principles. PCMS design and use guidelines 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 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

**FHWA Road Construction Case Study**

Case studies have been published by the Federal Highway Administration (FHWA) that provide information about essential planning measures, benefits and impacts of full freeway closure [FHWA report, 2003]. The cost and duration of construction in most cases was reduced (for example Columbus, OH, Detroit, MI, and Portland OR). Tables 1 and 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’s at the construction project sites cover 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 extensively during the I-405 full weekend closure. They examined travel time and purpose of trip and found that a large number of drivers did not cancel planned trips because of the closure. Alternate routes are critical elements in traffic control plans for full closure because they help carry diverted traffic and reduce congestion. 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 many drivers found other routes. Effinger J., et al. (2011) presented a case study quantifying driver diversion and its impacts during the I-43/I-894 full freeway closure event in October 2010 in Milwaukee [Effinger et al, 2011].

A 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 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 | - | - |
| Project Date | 2002 | 2003 | 2007 | 2008 | 2008 | 2011 |

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

**Case Study: Construction on the Sh-71/Ih-35 Interchange**

IH-35 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. For the 5 level stack construction on the SH-71/IH-35 Interchange, three main lane closures happened during three weekends in 2011.

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 section.

**Data Collection**

To analyze how traffic patterns changed during the IH-35 weekend closures, it is a prerequisite to establish a typical weekend pattern. However, traffic count data on IH-35 was available only for two locations (one located 0.3 miles south of FM1626, south of and in the vicinity of the closure and the other one located near San Marcos 0.9 miles south of FM 2001, roughly 30miles from the closure)

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.

To predict typical hourly SH-130 traffic, the most recent five-months of transaction data (Jan-May 2011), were used. Although 12 months of historical transaction data for SH 130 was available, transaction totals were changing rapidly during the earlier months compared to the Jan-May totals that were relatively stable. 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 3. The transaction data on SH-130 is directional, 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 Figure 1.

**The Toll Status**

During the SH-71/IH-35 interchange construction, two diversion plans were defined 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 plan, which was the main interest of this project, was designed to divert traffic to the SH-130 toll road. The SH-130 toll road is a parallel route to IH-35 and the toll status during the full closure was changed to free to reduce traffic congestion at the construction zone. Clearly driver understanding of the free status played a vital role in the potential success of the diversion plan.

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

In this traffic control plan, a message providing the time and location of the closure was posted three days before the beginning of each closure. 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.

**Data Analysis**

TXDOT provided prior notice to travelers about the closures hoping to reduce numbers of unnecessary trips and stimulate path changes during the closure. To analyze how traffic patterns changed during the closures and to find how successful they were at achieving their goal, 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. On the other hand, 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-month data (Jan-May 2011).

**Average Hourly Base Data Analysis:** Based on IH-35 limited count data, to analyze how traffic patterns changed during the closures, hourly traffic on typical weekends were predicted and compared with hourly traffic during each closure. 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 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. Clearly, TxDOT was successful in encouraging drivers to avoid some unnecessary trips.

SH-130 hourly traffic transaction counts were the second available data source. The transaction data on SH-130 is directional, defined by segments corresponding to toll collection stations (Figure1). The data related to each station ID is the cumulative number of transactions on main lanes and exit ramps located in the same segment. To see the how successful the diversion plan was, we ran tests on SH-130 data. Table 3 shows 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. And "typical" weekend average hourly traffic for the closure times is shown in Table 4. Typical conditions were based upon approximately 5 months of transaction data.

| 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 |

| 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 3: SH-130 average hourly volumes by segment during closures for NB and SB.

| 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 |

| 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 4: Typical hourly transaction on SH-130 for closure days/times.

These tables show that 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. We hypothesized 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. Test results show a significant increase in traffic flows in both directions for all stations was observed. Although this is evidence of diversion, one cannot quantitatively state how much diversion because more detailed data on IH-35 is needed to conduct the analysis that can help answer the question. Unfortunately, such detailed IH-35 traffic data is not available.

**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.

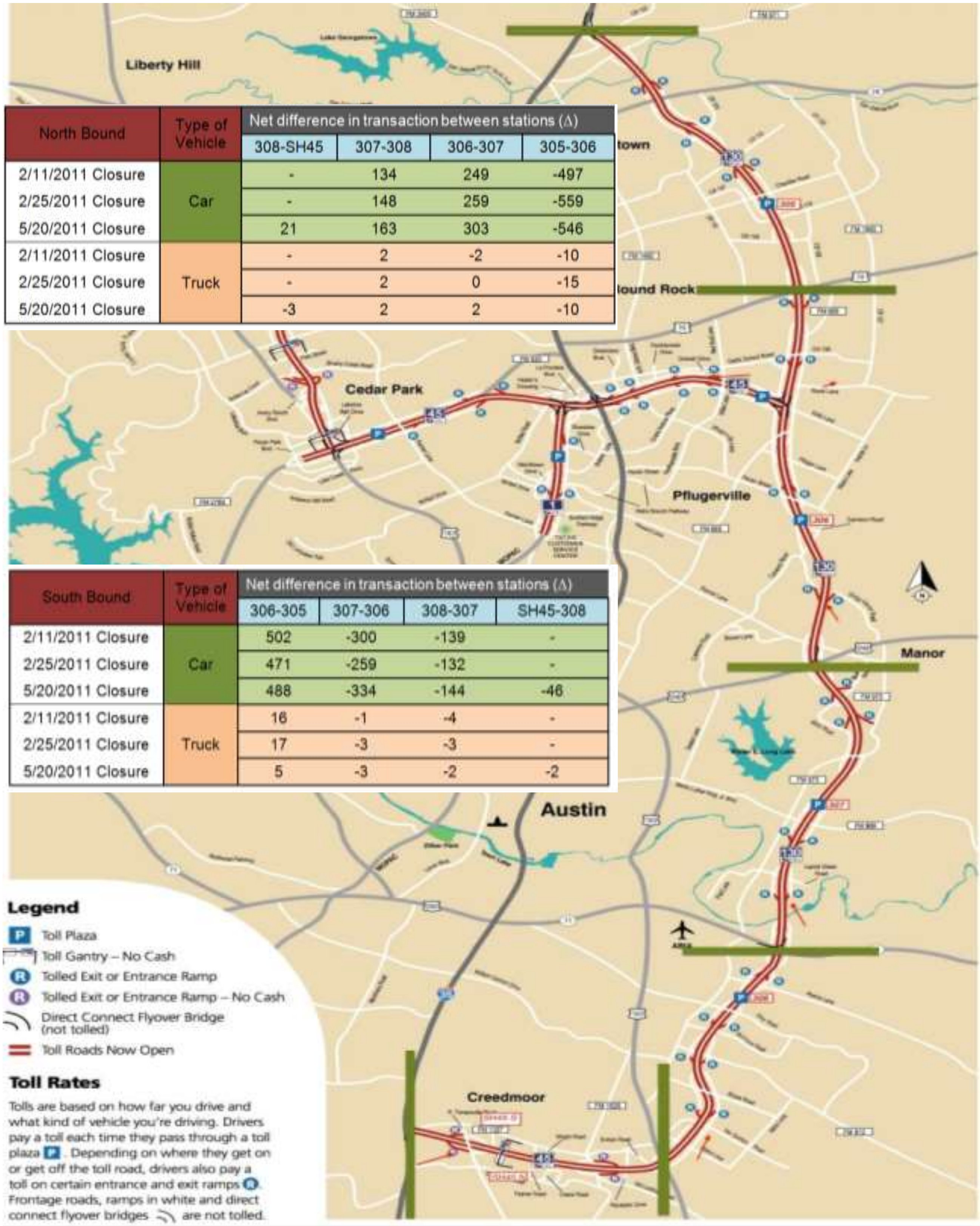
Using the segment transaction net differences (Figure 1), one can roughly calculate that 80 percent of north bound traffic that entered SH-130 from feeder highways south of the most northern segment exited SH-130 in the most northern segment and 90% of south bound traffic that entered from feeder highways 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 IH-35 and SH-130 interchange. Between the interchange and the toll station there 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 average 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% could possibly have traveled through to points north of Austin or 26% 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% 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: Time 1 (midnight to early morning 2300-0600), Time 2 (morning and late evening 0700-0900, 1900-2200), and Time 3 (mid-day through PM peak 1000-1800).

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. 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. Analysis shows that 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. 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). 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.

Figure 2 presents 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 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.



| 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 |

| 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 |



Figure 1: SH-130 segment/station descriptions and Net changes in southbound SH 130 traffic transactions among successive toll stations during closures

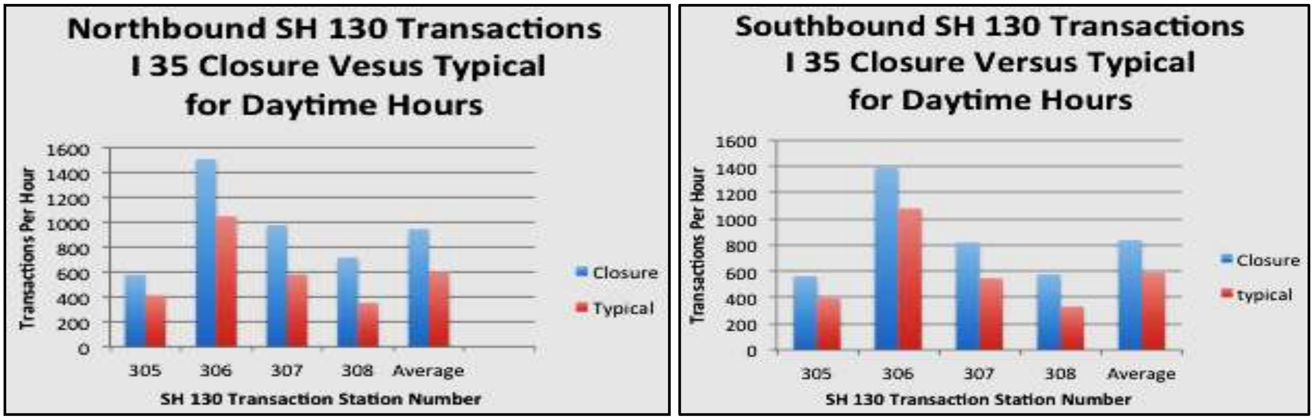



Figure 2: SH 130 transactions by toll station during daytime hours
[Station 308 is most southerly, 305 is most northerly].

**CONCLUSION**

During the IH-35/ Ben White Boulevard construction, the increase in SH-130 (as an alternative path) 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 were 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.

Based upon both volume and net difference tables, one might hypothesize that a large fraction or specifically more than half of the weekend traffic on SH-130 northbound and southbound appears to be destined for locations in the metropolitan area rather than locations north or south of the Austin area. In addition, the location of the construction zone could have had a significant effect on traffic pattern changes. Since the construction zone was located south of the metropolitan area, the south bound traffic was more likely to be informed about the closure. Considering these 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 metro-Austin they would not likely 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 metro-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.

**Suggestions**

To ameliorate the lack of diversion from IH-35 to SH-130 the following suggestions are provided for future diversion efforts: 1) 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. 2) Provide information through CMS’s, TV, and newspapers regarding the ease of connection from SH-130 to metro-Austin destinations. 3) If the diversion road is a toll road that is made free for the diversion plan, communication of the free status to travelers is vitally important. 4) 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.

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