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Title: Evaluation of the Motoring Public's Acceptance of a Real-Time Travel Time Prediction System in a Freeway Construction Work Zone

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ABSTRACT

A real-time travel time prediction system (TIPS) was evaluated in a construction work zone. TIPS includes changeable message signs (CMSs) displaying the travel time and distance to the end of the work zone to motorists. The travel times displayed by these CMSs are computed by an intelligent traffic algorithm and travel-time estimation model of the TIPS software, which takes input from strategically placed microwave radar sensors that detect the vehicle traffic on each lane of the freeway. Besides the CMSs and the radar sensors, the TIPS system includes the computer and microcontroller computing the travel times, 220 MHz radios for transmitting data from the sensors to the computer and from the computer to the CMSs, and trailers with solar panels and batteries to power the radar sensors, CMSs, and radios. The evaluation included two parts, the first part included an accuracy analysis between the predicted and actual recorded travel times, reported separately, and the second part included a survey of the motoring public regarding the acceptance of this system, reported here. Three crews driving independently of each other in the traffic stream recorded predicted and actual travel times at three CMSs to the end of the work zone for 12 hours each day for three consecutive days, resulting in 119 trial runs. The data recorder in each crew also recorded the license plate numbers of private non-commercial vehicles with Ohio license plates in the traffic stream. A total of 3177 different license plate numbers were recorded and a questionnaire was sent to each one by the Ohio Department of Transportation. A total of 660 completed surveys were returned and analyzed. About half (48%) of respondents were frequent users who drove through the work zone almost every day or more frequently. Survey responses indicated that the motoring public does perceive a certain inaccuracy in the travel times. However almost 97% of surveyed motorists felt that a system like TIPS providing real-time travel time information in advance of work zones and in advance of open exit ramps is either outright helpful or maybe helpful. In summary we may conclude that in the eyes of the motoring public the real-time TIPS system represents a definite improvement over any static non-real-time display system.

INTRODUCTION

Lack of real-time travel time or delay information in freeway construction work zones is one of the main causes for motorist frustration today [1]. Currently, "Freeway construction work zones not only lead to traffic conditions that violate motorists' expectations but also expose construction workers hazardously close to fast moving vehicles. Currently, motorists are generally warned on traffic conditions in work zones through signs posted along the freeway. The typical signs display "Construction Ahead - Expect Delays" or "Possible Delay Ahead" - but for how long and why, nobody knows" [2]

The need for better information for drivers in work zones is reinforced by the fact that "each year upwards of 1,000 fatalities occur in work zones alone" [2]. In 1999 there were 868 work zone accident fatalities [3]. In addition, there are many more injuries, accidents, and higher levels of stress associated with travel through work zones. "Major contributing factors to work zone accidents include exceeding safe speeds / speed limit and high travel speed differentials upstream of the work zone. In addition, major work zone operations inevitably produce congestion, which frustrates travelers whether they be commuters, commercial vehicle operators, or tourists. Furthermore, industry studies cite 'lack of credible information' as a key source of stress facing all travelers. Current static signs and stand-alone, preprogrammed Changeable Message Signs (CMS) do not adequately address the cited problems, because their messages are often obsolete and/or not detailed enough to be useful." [2]

To answer this need, the Travel Time Prediction System (TIPS) has been developed by P. D. Pant, Professor of Civil and Environmental Engineering at the University of Cincinnati, with support from the Ohio Department of Transportation (ODOT) and the Federal Highway Administration (FHWA). Quoting from the TIPS website [1]: "The Travel Time Prediction System (TIPS) is a portable automated system for predicting and displaying travel time for motorists in advance of and through work zones, on a real-time basis. It collects real-time traffic flow data using roadside non-contact sensors, processes the data in an on-site personal computer, computes estimated travel time between different points on the freeway, and displays travel time information on several portable, electronic changeable message signs positioned at pre-determined locations along the freeway." These predetermined CMS locations along the freeway are usually before open exit ramps, allowing travellers familiar with the area to choose an alternate route to their destination when a long predicted travel time is displayed.

The TIPS website adds [1]: "The key advantage of TIPS is providing travel time information to motorists in advance of and through work zone, on a real-time basis. TIPS is designed to be portable from one work zone to another and to work with minimal human supervision. The system has been designed to incorporate features that make the system adaptable to different work zones, easily modifiable, and easy to use. TIPS allows motorists to make decisions about staying on the freeway or taking an alternate route, based on the travel time information displayed on the changeable message signs." More complete information on TIPS is available in the report *A Portable Real-Time Traffic Control System for Freeway Work Zones* by Prahlad D. Pant [4]. In addition to TIPS, a second somewhat similar system exists. Called Adaptir, it was developed by the Scientex Corporation. [2]

TIPS was implemented in a work zone on a 21 km (13 mile) stretch of I-75 northbound near downtown Dayton, Ohio that was regularly subject to traffic congestion, especially at peak times. The present study of TIPS was conducted during this implementation. The accuracy and utility of TIPS were measured, both through field measurements and through a survey of motorists. A report on the accuracy of TIPS will be presented separately.

BRIEF DESCRIPTION OF TIPS

TIPS was developed to answer a need by drivers for more information regarding the delays they experience driving through work zones, specifically the time lost due to longer travel times. The concerns associated with the development of TIPS include: mitigating driver frustration and rage, improving the safety of workers in zones, alleviating traffic congestion as drivers may choose alternate routes, and reducing the number of accidents in and around work zones.

A work zone can be divided into four parts: an advance warning area where motorists are notified of construction, a transition area where traffic is redirected into a suitable path, an activity area where the actual work

occurs, and a termination area where normal driving is resumed. TIPS works by collecting traffic flow rate information throughout the zone to generate input for signs placed in the warning area, and perhaps additional areas as warranted.

According to [1], TIPS consists of the following components:

- Microwave radar sensors for vehicle detection on each lane of the freeway;
- Microcontroller with a specially-written program for calculating traffic volume and occupancy for each lane and responding to polling requests;
- 220 MHz radios for transmitting traffic flow data from each microcontroller to the on-site personal computer (PC);
- Intelligent traffic algorithm and travel-time estimation model residing in the specially-developed TIPS software in Windows NT environment;
- 220 MHz radios for transmitting travel time information from the PC to portable changeable message signs;
- Changeable message signs for displaying travel time information to motorists;
- Trailers for mounting sensors and radios, and solar panels for supplying electrical power for their operation.

The TIPS algorithm computes travel times based on weighted average lane occupancies [4, p50-55]. The velocity is modeled as a decaying exponential $v=v_0e^{-kOCCW}$, where v is velocity and $OCCW$ is weighted average lane occupancy, and v_0 and k are parameters whose values depend on which of three regions the value of $OCCW$ lies: 0-20%, 20-35%, or 35-90%. The travel time is computed by figuring out the travel time between stations as time = distance /v, and summing all the travel times to get a total travel time from a CMS to the end of the work zone. This procedure is executed every 30 seconds. The four most recent travel times, including the current one, are averaged to compute the message travel time. If this message travel time differs from the displayed travel time for a given period of time (the consistency time), the time displayed on the CMS is changed (3 minutes in this installation). Further description of the TIPS system and its benefits is included in [4].

Figure 1 shows a changeable message sign with a message generated by the TIPS system predicting the travel time remaining to the end of the work zone and the same sign displaying the distance left to travel to the end of the work zone.

OBJECTIVES OF STUDY

The objective of the second part of this study was to assess the perceptions of the motoring public about the usefulness, potential problems, and the perceived accuracy of TIPS. Results of a concurrent measurement of the accuracy of the travel times provided by TIPS are presented separately [5,6].

METHOD

Description of Test Site

The TIPS system was deployed on I-75 (north bound) in the Dayton area on July 14, 200 and was in operation daily 7 days a week from 5 AM to 8 PM until November 4, 2000. On a few occasions, TIPS was operated until 12 Midnight and was run continuously 24 hours a day from September 22 to September 25 to facilitate nighttime construction and an additional lane closure during this period.

There were three Changeable Message (time/distance) Signs (CMS) as illustrated in Figure 1, and 5 microwave radar sensor stations. Each CMS was placed in the advance of an exit. Based upon a suggestion of one

of the authors, these signs displayed alternately not only the predicted travel time to the end of the work zone (as initially configured) but also the distance in miles to the end of the work zone. The decision to display the total travel time through the work zone rather than the delay time was decided by a committee before installation of the TIPS system. There was an initial CMS in advance of the three time/distance message signs advising the motorists: "WORKZONE ENDS 14 MILES". The resolution of the system was 4 minutes; it predicted travel times through the work zone to the nearest multiple of 4 minutes. The consistency time was 3 minutes.

Description of the Experimental Procedure

Three ODOT crews consisting of one driver and one data recorder were used for three days (Thursday, October 12, 2000; Friday October 13, 2000; and Saturday, October 14, 2000). Each crew drove 12 hours each day and made between 11 and 17 runs through the work zone on I75 northbound from SR 73 to Stanley Avenue.

The drivers and data recorders were given oral and written instructions. The first crew started at 5 AM, the second at 6 AM, and the third started at 7 AM each day and drove within the traffic stream as instructed. While driving northbound toward and through the work zone within the traffic stream, the data recorder recorded on a special data collection sheet as many Ohio license plate numbers as possible from private vehicles. No license plate numbers from commercial or out-of-state registered vehicles were recorded.

Procedure for Survey of Motorist Responses

The recorded license plate numbers were entered into a computer and multiple identical license plate numbers were subsequently eliminated. A questionnaire with ODOT letterhead, ODOT contact person address, return instructions, and thank-you note was sent to the survey participants through ODOT. The questionnaire contained a total of 7 questions (see Figure 2 through Figure 8). The questionnaire also contained two pictures showing a CMS displaying the distance to the end of the work zone and the predicted travel time (See Figure 1).

The first question dealt with how often a motorist drove through the work zone. The second question assessed to what degree and extent the motorist experienced traffic delays because of the work zone. The third question assessed whether or not and to what extent the motorist used the predicted travel time information to exit at an earlier than planned exit and travel an alternate route to get to the planned destination. The fourth question assessed whether or not the motorist felt that the presented real-time information was accurate and reliable. The fifth question assessed whether or not, based on the motorist's experience, the predicted travel times provided useful information. The sixth question assessed whether or not the provided distance/time information was easy to read. The seventh question asked the motorist whether or not such a travel prediction system in advance of and through the work zone is helpful to the motoring public. Motorists were also asked at the end of the questionnaire for other comments.

The license plate number lists were then electronically transferred as an ASCII text file to the Ohio Department of Public Safety to get a computerized list of the names and addresses for all the recorded license plate numbers. The addresses were then transferred onto adhesive labels and attached to the survey envelopes. A survey envelope containing the two page survey questionnaire form and a self-addressed (ODOT address) stamped envelope was sent to each motorist. All survey questionnaire responses were collected by ODOT and subsequently forwarded to the authors for the analysis. None of the returned survey questionnaires contained any respondent names or addresses and were, therefore, completely anonymous.

RESULTS

Analysis of the Survey Questionnaire Responses

The responses to the motorist survey questionnaire responses are presented as a function of motorist exposure to the work zone in Figure 2 through Figure 8. These survey results are discussed in greater detail in a report created for ODOT [5]. Overall, 3270 Ohio license plate numbers were recorded. After eliminating 93 duplicate license plate numbers, a sample of 3177 numbers remained, and the corresponding car registrants were each sent a survey questionnaire. Of these, 809 survey questionnaires were returned, which included 149 (18.4%) marked with "don't

remember driving through the work zone." A number of these "don't remember" returns might be explained by the fact that the registrant was not the same person driving the car when it was observed. Out of the 809 returned survey questionnaires, 660 were analyzed (20.8% return rate).

The analysis of Question #1 (see Figure 2) indicates that 29% of the responding motorists seldom drove through the work zone, while 23% drove through the work zone once or twice per week. Another 34% drove through the work zone almost every day, while 14% drove through the work zone more than once per day. Thus it appears that almost half (48%) of the responding motorists drove through the work zone almost every day or more often, and therefore could qualify as frequent users of the road who would be expected to have a pretty solid experience with the TIPS system on which to base their questionnaire responses.

The responses to Question #2 (see Figure 3) indicate that overall about 2/3 of the motorists experienced some longer or mostly longer traffic delays. Looking at the frequent users ("almost every day" and "more than once per day"), the corresponding percentage is, as expected, even higher at about 80%.

The responses to Question #3 (see Figure 4) indicate that overall about 60% have used the predicted travel time information to exit I-75 at an earlier than initially planned exit. Looking at the frequent users, the corresponding percentage is, as expected, even higher at about 72%.

The responses to Question #4 (see Figure 5) indicate that overall about a quarter of the respondents don't know whether or not the displayed predicted travel times were accurate or not. The corresponding percentage for the frequent users indicate that about 1/6 of these motorists don't know whether the predicted travel times are accurate or not. It is interesting to note that only about 28% of the responding motorists indicate that the predicted travel times are accurate and reliable enough for them. About 30% of the frequent users gave the same answer, which is fairly close and consistent with regard to the overall percentage. It should be noted that overall about 42% of the responding motorists indicate that the predicted travel time information is sometimes accurate and reliable and sometimes not accurate and reliable. Again, the corresponding percentage for the frequent users group is about 45%, which is again fairly close and not much different with regard to the overall percentage. This result would indicate that almost one half of the respondents are aware that the predicted travel times are sometimes accurate and sometimes not, which may lead motorists to second guess the system and take chances with regard to their selection of a plan of action (either selecting an earlier exit or stay on the freeway until reaching the initially planned exit). It appears that overall only about 5% of the responding motorists indicated that the predicted travel times are not accurate and reliable enough for them.

The responses to Question #5 (see Figure 6) indicate that overall about 90% of the motoring public thinks that the predicted travel times are sometimes or always useful. For the frequent users, the corresponding rate is about 86%, or just slightly less than the percentage of the overall responses. It appears that 10% of the motorists think that the predicted travel time information is not useful, which is about twice the approximately 5% of the respondents who responded "not accurate or reliable enough for me" to Question #4.

The responses to Question #6 (see Figure 7) indicate overall that the information was not always easy to read due to glare (13.3%), obstructions or other traffic (12.65%), or not enough time (4.22%). On the other hand, about 41% indicated that the predicted travel time information was always easy to read during daytime, and about 27% indicated the information was always easy to read during night time. The corresponding percentages for the frequent users are very similar when compared to the overall percentages.

The responses to Question #7 (see Figure 8) indicate that overall about 86% of the surveyed motoring public think that such a travel time prediction system is helpful to the motoring public, while only about 2.5% indicate that the system would not be helpful. Another 11% indicate that such a system could, maybe, be useful to the motoring public. Again, the responses for the frequent user group are fairly close to those of overall surveyed motorists. Combining the "Yes' and "maybe" responses to Question #7 indicates that almost 97% of the responding motorists think that such a system is either outright helpful or maybe helpful. This endorsement for a real-time travel time prediction system is really not surprising considering the responses to some of the earlier survey questions.

DISCUSSION AND CONCLUSIONS

The survey responses to Question #4 (42% of the responding motorists indicate that the predicted travel times are sometimes accurate and reliable and sometimes not accurate and reliable) appear to indicate that the motoring public is sensitive and does perceive a certain inaccuracy contained in the predicted travel times.

A further evaluation and possible refinement of the prediction time steps (presently 4 minutes), the holding time for a predicted time value (presently 3 minutes), as well as the prediction time algorithm would seem to be beneficial in order to possibly further increase the prediction accuracy and the motoring public's confidence into the accuracy and reliability of the time prediction system. It is, however, not clear whether or not such an effort would actually result in significantly more accurate predicted travel times, considering that the traffic flow process is a stochastic process with a certain inherent non-predictable variability. It should also be noted that in spite of the observed somewhat limited predicted travel time accuracy (investigated in part 1 of this study and reported separately), as well as the motorists' inaccuracy perceptions, according to the survey questionnaire responses to Question #7 almost 97% of the motoring public think that such a system is either outright helpful or maybe helpful.

Based on the survey results from Question #6 it would seem useful and beneficial to evaluate and possibly improve the readability or legibility of the displayed information (improve the readability under glare and under night time conditions) by the changeable message signs through the use of better and state of the art changeable message signs.

In summary we may conclude that the real-time TIPS system represents a definite improvement over any static non-real-time display system. It provides in general and most of the time useful and relatively accurate travel time predictions to the motoring public and appears to be perceived by almost 97% of the motoring public as a helpful and useful.

ACKNOWLEDGMENTS

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[2] The Scientex Corporation, "Adaptir Home page", http://www.scientexcorp.aa.psiweb.com/ad-main.htm.

[3] Federal Highway Administration, "National Work Zone Awareness Week 2001", http://safety.fhwa.dot.gov/fourthlevel/nwzaw01.htm.

[4] Prahlad D. Pant, *A Portable Real-Time Traffic Control System for Freeway Work Zones*, Report No. FHWA/OH-2000/011, July 2000.

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[6] Helmut T. Zwahlen and Andrew Russ, "Evaluation of the Accuracy of a Real-Time Travel Time Prediction System in a Freeway Construction Work Zone", Paper prepared for Presentation at the 81st Annual Meeting of the Transportation Research Board, January 13-17, 2002, National Academy of Sciences, Washington DC, Paper No. 02-2371.

LIST OF FIGURES

a) b)

Figure 1.. Changeable Message Sign in TIPS system displaying time (a) and distance (b) to the end of the work zone in alternating messages. This pair of figures was placed at the beginning of the questionnaire sent out to Ohio motorists to illustrate the system and serve as a reminder.

Question #1: During summer and fall 2000, how often did you drive northbound on I-75 south of Dayton through the work zone? Please mark one.

Exposure		Total
Seldom	Number	189
	Percentage	28.6%
Once or twice each week	Number	151
	Percentage	22.9%
Almost every day	Number	226
	Percentage	34.2%
More than once per day	Number	94
	Percentage	14.2%
Total	Number	660
	Percentage	100.00%

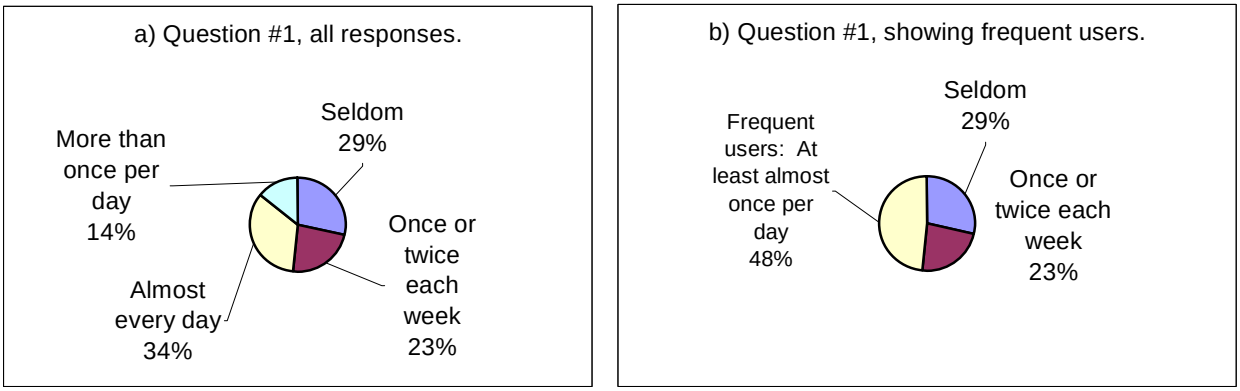

Figure 2. Question #1 of survey, responses, and pie graphs. a) all responses. b) all responses, with "Almost every day" and "More than once per day" responses grouped together as "Frequent users." There were 320 frequent users, 48.4% of respondents.

Question #2: While Driving northbound on I-75 south of Dayton in advance of the work zone and through the work zone, what type of traffic delays have you experienced? Please mark one.

Exposure (Question #1)		Total	No response	Only minor	Some longer	Mostly longer
Seldom	Number	189	2	109	62	16
	Percentage	28.6%	1.1%	57.7%	32.8%	8.5%
Once or twice each week	Number	151	0	50	75	26
	Percentage	22.9%	0.0%	33.1%	49.7%	17.2%
Almost every day	Number	226	0	42	104	80
	Percentage	34.2%	0.0%	18.6%	46.0%	35.4%
More than once per day	Number	94	0	18	32	44
	Percentage	14.2%	0.0%	19.1%	34.0%	46.8%
Total	Number	660	2	219	273	166
	Percentage	100.00%	0.30%	33.18%	41.36%	25.15%
Frequent users	Number	320	0	60	136	124
	Percentage	100.00%	0.00%	18.75%	42.50%	38.75%

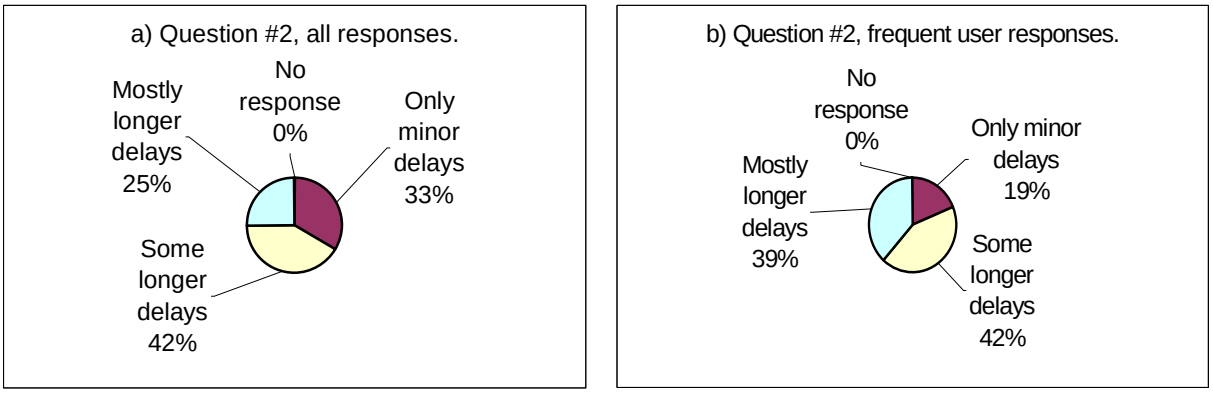

Figure 3. Question #2 of survey, responses, and pie graphs. a) all responses. b) frequent user responses ("Almost every day" and "More than once per day" responses to Question #1). Percentages in b) are of the frequent user group only, not all the respondents.

Question #3: Have you used the predicted real-time travel time information presented on the three changeable message signs to exit I-75 at an earlier than initially planned exit and selected an alternate route to get to your destination? Please mark one.

Exposure (Question #1)		Total	No response	Never	A few times	Quite often
Seldom	Number	189	2	114	66	7
	Percentage	28.6%	1.1%	60.3%	34.9%	3.7%
Once or twice each week	Number	151	0	56	79	16
	Percentage	22.9%	0.0%	37.1%	52.3%	10.6%
Almost every day	Number	226	0	64	118	44
	Percentage	34.2%	0.0%	28.3%	52.2%	19.5%
More than once per day	Number	94	0	27	48	19
	Percentage	14.2%	0.0%	28.7%	51.1%	20.2%
Total	Number	660	2	261	311	86
	Percentage	100.00%	0.30%	39.55%	47.12%	13.03%
Frequent users	Number	320	0	91	166	63
	Percentage	100.00%	0.00%	28.44%	51.88%	19.69%

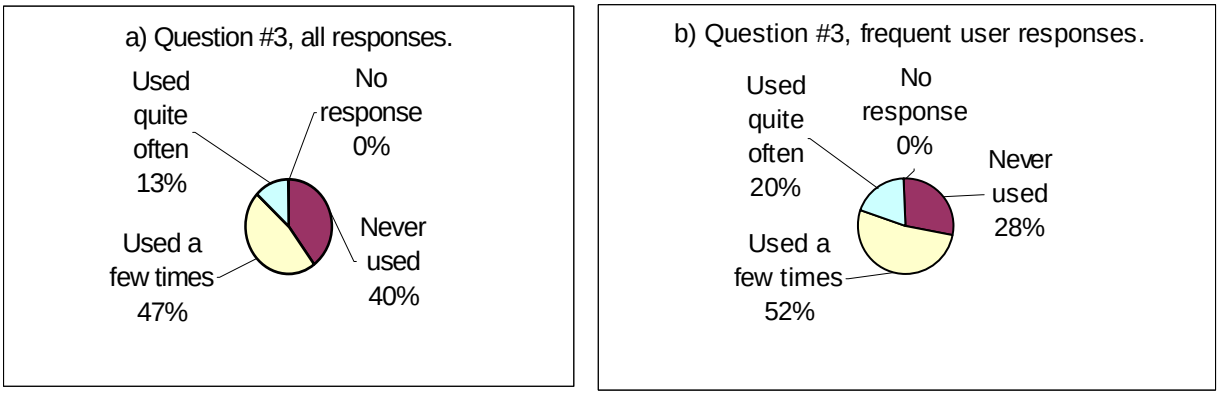

Figure 4. Question #3 of survey, responses, and pie graphs. a) all responses. b) frequent user responses ("Almost every day" and "More than once per day" responses to Question #1). Percentages in b) are of the frequent user group only, not all the respondents.

Question #4: Based on your driving experience, when driving northbound on I-75 in advance and through the work zone, do you feel that the presented real-time travel times to the end of the work zone were accurate and reliable? Please mark one.

Exposure (Question #1)		Total	No response	Not accurate
Seldom	Number	189	4	4
	Percentage	28.6%	2.1%	2.1%
Once or twice each week	Number	151	0	5
	Percentage	22.9%	0.0%	3.3%
Almost every day	Number	226	0	15
	Percentage	34.2%	0.0%	6.6%
More than once per day	Number	94	0	9
	Percentage	14.2%	0.0%	9.6%
Total	Number	660	4	33
	Percentage	100.00%	0.61%	5.00%
Exposure (Question #1)		Sometimes	Always Accurate	Don't know
Seldom	Number	59	52	70
	Percentage	31.2%	27.5%	37.0%
Once or twice each week	Number	65	39	42
	Percentage	43.0%	25.8%	27.8%
Almost every day	Number	113	63	35
	Percentage	50.0%	27.9%	15.5%
More than once per day	Number	38	31	16
	Percentage	40.4%	33.0%	17.0%
Total	Number	275	185	163
	Percentage	41.67%	28.03%	24.70%
Frequent users	Number	320	0	24
	Percentage	100.00%	0.00%	7.50%
Frequent users	Number	151	94	51
	Percentage	47.19%	29.38%	15.94%

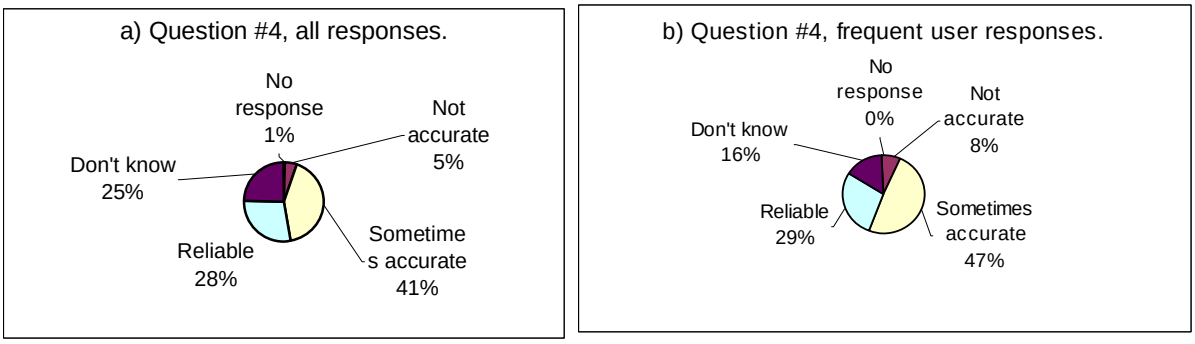

Figure 5. Question #4 of survey, responses, and pie graphs. a) all responses. b) frequent user responses ("Almost every day" and "More than once per day" responses to Question #1). Percentages in b) are of the frequent user group only, not all the respondents.

Question #5: Do you think that, based on your experience, the presented real-time travel times provided you with useful information, even if you couldn't exit earlier to avoid traffic delays? Please mark one.

Exposure (Question #1)		Total	No response	Always	Sometimes	Not useful
Seldom	Number	189	5	86	83	15
	Percentage	28.6%	2.6%	45.5%	43.9%	7.9%
Once or twice each week	Number	151	2	62	76	11
	Percentage	22.9%	1.3%	41.1%	50.3%	7.3%
Almost every day	Number	226	3	99	102	22
	Percentage	34.2%	1.3%	43.8%	45.1%	9.7%
More than once per day	Number	94	4	40	38	12
	Percentage	14.2%	4.3%	42.6%	40.4%	12.8%
Total	Number	660	14	287	299	60
	Percentage	100.00%	2.12%	43.48%	45.30%	9.09%
Frequent users	Number	320	7	139	140	34
	Percentage	100.00%	2.19%	43.44%	43.75%	10.63%

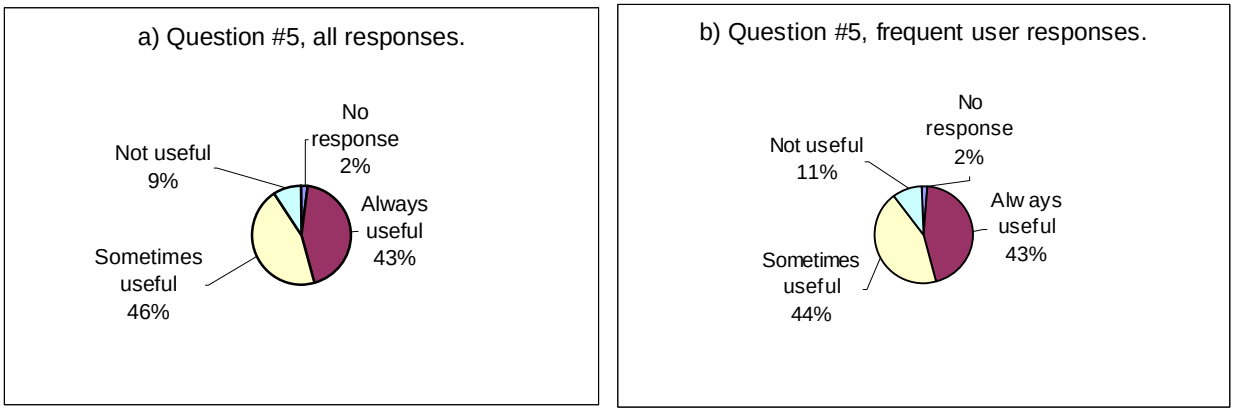

Figure 6. Question #5 of survey, responses, and pie graphs. a) all responses. b) frequent user responses ("Almost every day" and "More than once per day" responses to Question #1). Percentages in b) are of the frequent user group only, not all the respondents.

Question #6: Was the presented real-time travel time information to the end of the work zone easy to read? Please mark those that are applicable.

Exposure (Question #1)		Respondents	Total	No response	Always, day	Always, night
Seldom	Number	189	266	9	111	71
	Percentage	28.6%	100.0%	3.4%	41.7%	26.7%
Once or twice each week	Number	151	227	4	85	60
	Percentage	22.9%	100.0%	1.8%	37.4%	26.4%
Almost every day	Number	226	340	4	142	94
	Percentage	34.2%	100.0%	1.2%	41.8%	27.6%
More than once per day	Number	94	139	4	57	38
	Percentage	14.2%	100.0%	2.9%	41.0%	27.3%
Total	Number	660	972	21	395	263
	Percentage	100.0%	100.00%	2.16%	40.64%	27.06%
Exposure (Question #1)		Glare	Obstruction	Not enough time		
Seldom	Number	32	32	11		
	Percentage	12.0%	12.0%	4.1%		
Once or twice each week	Number	33	35	10		
	Percentage	14.5%	15.4%	4.4%		
Almost every day	Number	48	40	12		
	Percentage	14.1%	11.8%	3.5%		
More than once per day	Number	16	16	8		
	Percentage	11.5%	11.5%	5.8%		
Total	Number	129	123	41		
	Percentage	13.27%	12.65%	4.22%		
Frequent users	Number	320	479	8	199	132
	Percentage	100.00%	149.69%	2.50%	62.19%	41.25%
Frequent users	Number	64	56	20		
	Percentage	20.00%	17.50%	6.25%		

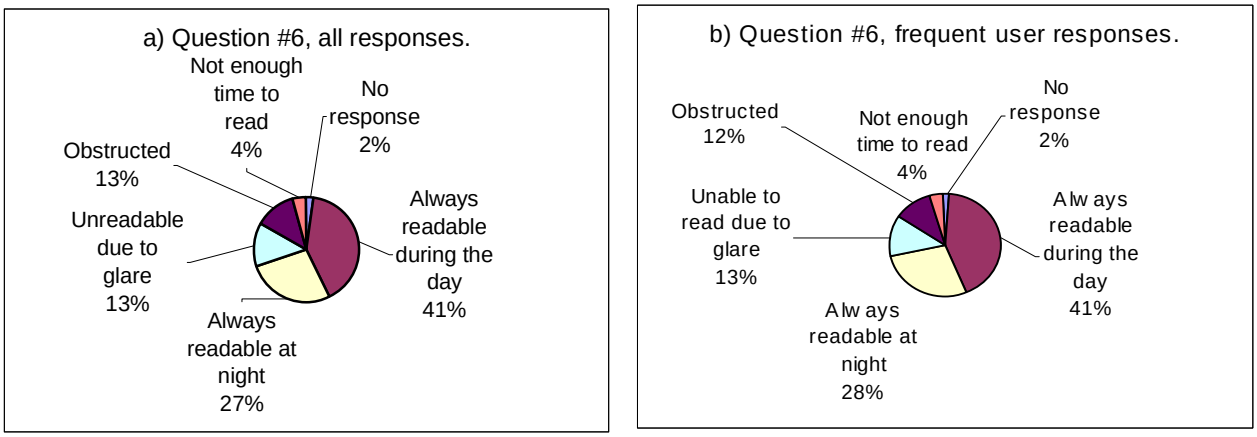

Figure 7. Question #6 of survey, responses, and pie graphs. a) all responses. b) frequent user responses ("Almost every day" and "More than once per day" responses to Question #1). Percentages in b) are of the frequent user group only, not all the respondents.

Question #7: Do you think that such a travel time prediction system in advance of work zones and in advance of exits on heavily traveled freeways where drivers could select an alternate route in situations where long travel times to the end of the work zone are predicted is helpful to the motoring public? Please mark one.

Exposure (Question #1)		Total	No response	Yes	No	Maybe
Seldom	Number	189	4	166	4	15
	Percentage	28.6%	2.1%	87.8%	2.1%	7.9%
Once or twice each week	Number	151	0	131	2	18
	Percentage	22.9%	0.0%	86.8%	1.3%	11.9%
Almost every day	Number	226	1	193	7	25
	Percentage	34.2%	0.4%	85.4%	3.1%	11.1%
More than once per day	Number	94	0	75	4	15
	Percentage	14.2%	0.0%	79.8%	4.3%	16.0%
Total	Number	660	5	565	17	73
	Percentage	100.00%	0.76%	85.61%	2.58%	11.06%
Frequent users	Number	320	1	268	11	40
	Percentage	100.00%	0.31%	83.75%	3.44%	12.50%

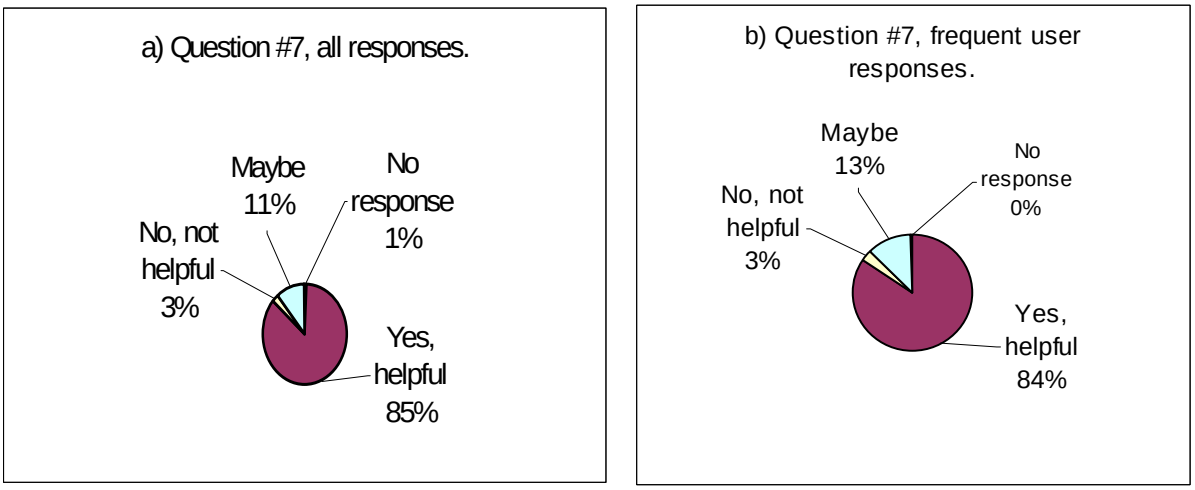

Figure 8. Question #7 of survey, responses, and pie graphs. a) all responses. b) frequent user responses ("Almost every day" and "More than once per day" responses to Question #1). Percentages in b) are of the frequent user group only, not all the respondents.