DIRECT
Operational Field Test Evaluation Natural Use Study

Part 3: Evaluation of Driver Behavior and Measurement of the Effectiveness of the DIRECT Communications Technologies Based on Vehicle Tracking Around Incidents

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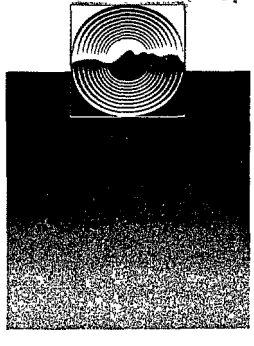

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ABSTRACT

Vehicle tracking systems were installed on all DIRECT vehicles to help investigate the relationships between the drivers' actual travel experiences and their opinions about the systems they used. The purpose of this report is to look more carefully at driver behavior as recorded by the tracking system and to see if this provides any further insight on the effectiveness of the DIRECT systems. The report first describes the tracking system and the traffic messages delivered to the drivers, then it goes on to analyze which drivers responded to the messages by diverting as shown by the tracking system. The last section addresses how the messages and diversions may have affected the drivers' reported level of satisfaction with the system they used. Here are some core findings from the report:

1. The DIRECT drivers rarely diverted from their routine commute. However, on those occasions when a driver did divert it was likely that they were responding to a traffic message delivered by RDS/SCA. The majority of diverted drivers used RDS/SCA. Furthermore, the tracking data show that about one third of the tracked RDS/SCA equipped vehicles diverted around heavy construction. This diversion rate was much higher than the rates of diversion for the other systems used. We speculate that the high diversion rate of RDS/SCA resulted from the distinct timeliness and broad coverage of the RDS/SCA message interrupts.

2. The most relevant message components include incident location and incident duration. Queue length is another important message element. These message components will be used with the expanded fleet.

3. Drivers that encountered incidents while using RDS/SCA reported higher levels of satisfaction with the system than drivers that encountered incidents while using the other systems Table 4 shows that RDS/SCA has the highest satisfaction rating followed by LPHAR, AHAR, and Cellular.

4. A measure of effectiveness based on information content, system reliability, and sound quality showed that RDS/SCA was most effective and Cellular was the least effective system tested in DIRECT.

The tracking system provided information that was crucial for the evaluation of the traffic message system and driver behavior. Tracking was one of the most useful tools implemented in the DIRECT project. A more reliable tracking system would have provided even more insight. However, the system used in this evaluation was sufficient for the tasks where it was applied.

1. INTRODUCTION

The Driver Information Radio using Experimental Communication Technologies (DIRECT) Operational Field Test (OFT) uses different radio technologies to transmit traffic incidents messages. The objective is to increase the number of drivers who are aware of traffic incidents. The test route was a 15-mile segment of I-75 in the Detroit area. Recruited drivers [l] who used the segment on their commute route drove vehicles equipped with one of five delivery methods. Traffic information was provided by a professional announcer located at the Michigan Intelligent Transportation Systems Center (MITSC). Both broadcast and roadside localcast delivery methods were tested [2][3][4]. The broadcast method used the Radio Data System (RDS/SCA) and the Subsidiary Communications Authority (SCA) subcarriers. Four roadside localcast transmitter sites on the I-75 segment implemented a localized Low Power Highway Advisory Radio (LPHAR) and an Automatic Highway Advisory Radio (AHAR). In addition some drivers used cellular phones to learn of incident occurrences. The complete system is shown in Figure 1.

All DIRECT vehicles contained tracking equipment that recorded the latitude and longitude of their positions along their commute routes in addition to time, vehicle speed and communications system type. This information proved invaluable and enabled us to correlate the communications system effectiveness around incidents with the commuters' overall satisfaction level. Vehicle tracking is one of the best ideas implemented in the DIRECT project. We could have gained even more insight and understanding if we had a more reliable tracking system. However we provided our recommendations for a reliable tracking system tailored to incidents trapping.

2. OBJECTIVES

The DIRECT OFT aims at increasing the number of drivers aware of traffic incidents on their commute route and to provide earlier awareness of such incidents. Hypothetically Incident awareness is expected to:

1) Reduce drivers' anxiety by providing them with information about the incident location and extent.
2) Increase the drivers' chances of avoiding becoming trapped in a segment of blocked or impeded expressway as the possibilities of diversion are higher the farther the driver is from the incident location. This will also contribute to both individual and aggregate reduction in travel times.

Vehicle tracking equipment was installed aboard DIRECT vehicles. This equipment recorded commuters' routes including those in response to rapid traffic incident messages. In this report we look at the pool of drivers who received incident alerts. For those drivers we investigate the following:

- The effectiveness of the communications system they use.

- Commuter behavior around incidents.
- Types of incidents that increase the commuters' willingness to divert, and most commonly used system used by commuters who diverted.

We also correlate the above measures to the commuter's individual rating of the system used.

3. DIRECT SYSTEM DESCRIPTION

DIRECT traffic information originated at MITSC and is located in down town Detroit. The MITSC infrastructure, composed of connected buried loops as well as camera coverage of portions of the instrumented section, was combined with incident detection data from other sources (helicopters, State Police reports, Michigan Emergency Patrol, etc. A professional announcer employed by Metro Networks provided the audio reports.

The DIRECT project (1) pursued delivery methods for the traffic messages that are low-cost to the driver, so as to attract the largest number of users. This led to the use of one-way radio, either broadcast or localcast.. The broadcast method used the Radio Data System (RDS/SCA) digital subcarrier of WDTR's FM signal to interrupt the RDSISCA entertainment radio when an incident message is available. The incident information is put on the Subsidiary Communications Authority (SCA). One roadside localcast method used a Low Power Highway Advisory Radio (LPHAR.) and another used a custom method of automatically interrupting a special radio in the vehicle-called Automatic Highway Advisory Radio (AHAR). In addition, for purposes of comparison, a cellular-call-in method was tested. A message computer at MITSC feeds all four delivery methods with message content and also controls access to the transmitters by sequentially dialing the specific communication link. A telephone line connects the message computer to the FM station, the cellular call server, and the LPHAR digital recorder. An 800 MHz trunked radio is used to connect the message computer to the AHAR digital recorders.

In addition to minimizing cost to the driver, a second aspect of DIRECT's approach was the automatic interrupt or alerting for the radio methods. This is the most important of these experimental technologies. This feature enables the driver to know about the incident the instant it is sent over the airwaves. This is a distinct advantage over cellular calls.

MDOT leased 27 Cheverolet Lumina test vehicles and equipped them with one of the delivery system receivers and a tracking system. Five cars had RDS/SCA/SCA receivers; five had AHAR receivers; five had cellular phones; five had LPHAR which uses the standard AM band, and five vehicles were used as control which function as the baseline for traffic messages. Two test vehicles were equipped with all four receivers and served as spares. All vehicles contained tracking equipment.

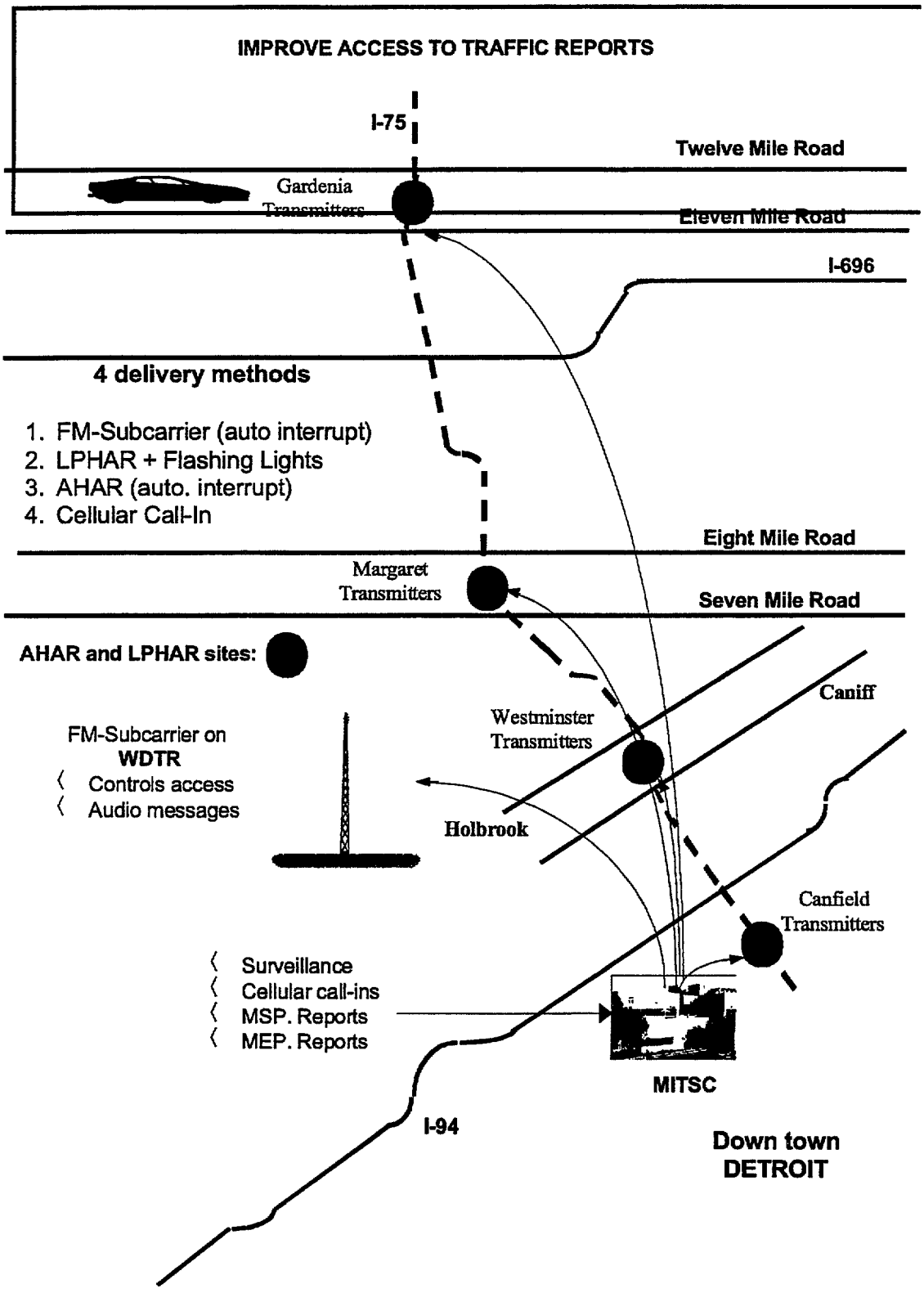

Figure 1 DIRECT system diagram.

4. TRACKING SYSTEM DESCRIPTION AND PERFORMANCE

In this section we review the hardware and software used for the DIRECT implementation of the tracking system. We illustrate a variety of hardware and software problems that we discovered during the course of the study. These problems affected our data collection efforts. We compiled a total of 188 incidents during the test period, however the AVTrak software captured 41 incidents only. In addition many vehicles past Group 3 failed to transmit their data streams, consequently these incidents did not have the complete experience of DIRECT vehicles at the incidents. Finally we offer our recommendations for a future tracking software tailored to incident trapping

Tracking system hardware: The in-vehicle hardware is composed of a Trimble Global Positioning System (GPS) receiver, an IBM compatible computer, and a Cellular Digital Packet Data (CDPD) modem. A Unix workstation is located at MITSC and runs the vehicle tracking software. A data stream is assembled every 30 seconds by the in-vehicle computer. This data stream is transmitted by the CDPD through the AMERITECH cell tower to the Unix workstation via a 64 kbps modem. The data stream is composed of position fixes composed by the GPS receiver, the active radio station channel, and a time stamp. Delco designed the necessary interface to accomplish this task using their RDS/SCA radios. This information is vital since we need to know if the driver was listening to the appropriate channel whenever an incident occurs.

Tracking system software: The tracking software AVTrak is designed by Advanced Vehicle Tracking Corporation. This software has the following capabilities: 1) Allows vehicles to have distinct numbers and colors. 2) Track the geographic location of each vehicle. 3) Display vehicle speed at the corresponding instant of time. 4) Pan and zoom within a geographic area. 5) Playback a vehicle tracking session at different speeds with the capabilities to pause, back track, and move forward. Figure 2 shows a display of the AVTrak software during a playback session.

Hardware problems: Two distinct problems in the tracking system were encountered during the project namely:

- In-vehicle computer failure after six months of the test. This was caused by the computer motherboard battery drainage. This caused the loss of the BIOS setup parameters.

- Corrupted and lost data streams due to CDPD malfunctions. The tracking log files were composed of the daily activity of all the DIRECT vehicles. In some instances a whole day data were missing and in other instances the log file of today contained the data of a previous as shown in this section of the log file of September 1 1997.

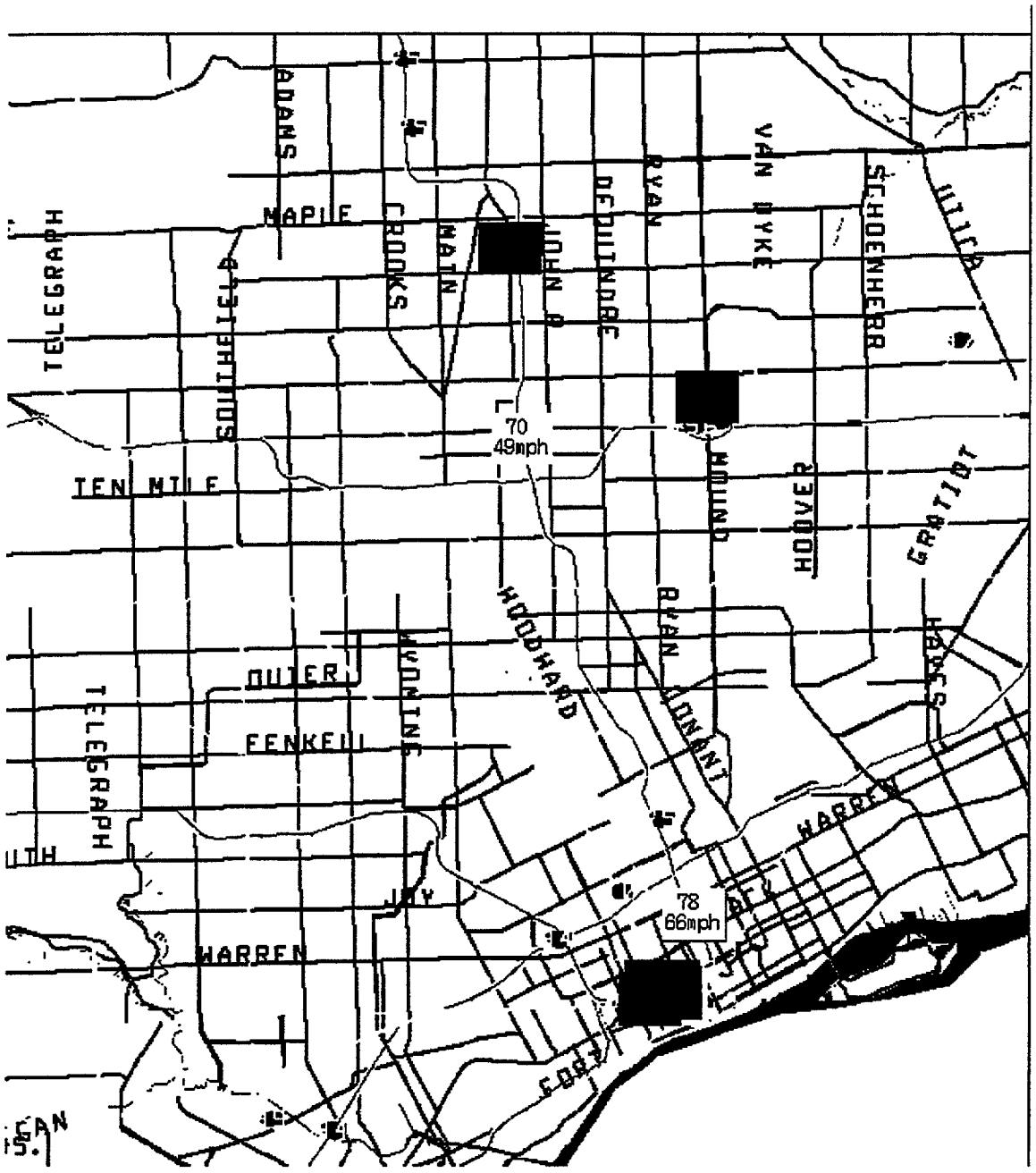

Figure 2 AVTrak software display.

Figure 3 shows a section of 09/01/97 log file. The bold characters indicate position data on 08/30/97 that is 2 days before. Consequently during trip playback of September 1st one would view some vehicles from previous days without knowing so.

- Missing data of a particular vehicle within a specific day shows a vehicle jump of few miles in one step. Also missing log files of whole days.

```
## File /opt/avt/data/970901.log opened 970901 080947

0809470056      970830103122+04262100-08293385042166
0809480056      970830103128+04262000-08293386036186
0809480056      970830103132+04261940-08293394028182
0809480056      970830103137+04261910-08293411015254
0809480056      970830103142+04261910-08293467018266
0809480056      970830103147+04261900-08293533019268
0809480056      970830103152+04261910-08293593008252
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Figure 3 Section of September lst log file.

Software problems: Following are the software errors that we encountered while reviewing the vehicles' routes around incidents:

- Figure 4 shows the features selection menu of the AVTrak software. Some of these features allow the viewer to observe when the commuter placed a phone call, or received an RDS/SCA or AHAR interrupt and message, also it would indicate when the commuter tuned to the LPHAR frequency of 1610 or the WJR or WWJ frequencies. In reality none of these features worked except for the reception of WJR and WWJ. In our analysis we reverted to more complex methods to identify these occurrences. This information is crucial to the analysis

- Figure 5 shows the date and time selection menu. However during relaying the log files we found that when the indicated vehicle time is 11:00 AM it was in fact some where between 7:00 AM and 8:00 AM. Consequently when the vehicle time indicated was 7:00 PM the true vehicle time was some where between 3:00 and 4:00 PM. This automatically disallowed us from reviewing most afternoon incidents. The date and time menu does not all replay of vehicles position past 7:00 PM.

- The vehicles assignment were incorrect, for example vehicle 56 is an LPHAR vehicle, however it was assigned in the AVTrak software an AHAR vehicle. However we corrected this problem by the data provided by our own records that contain across reference between the actual vehicle numbers and the communications system installed.

- The AVTrak software could not open many log files. Especially those of Group 7.

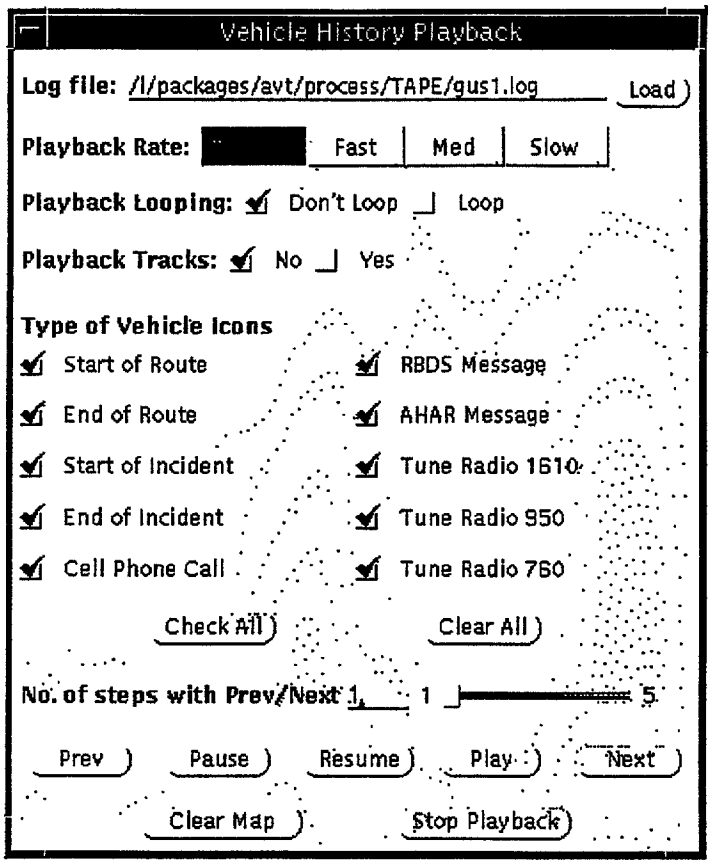

Figure 4 User selected features menu.

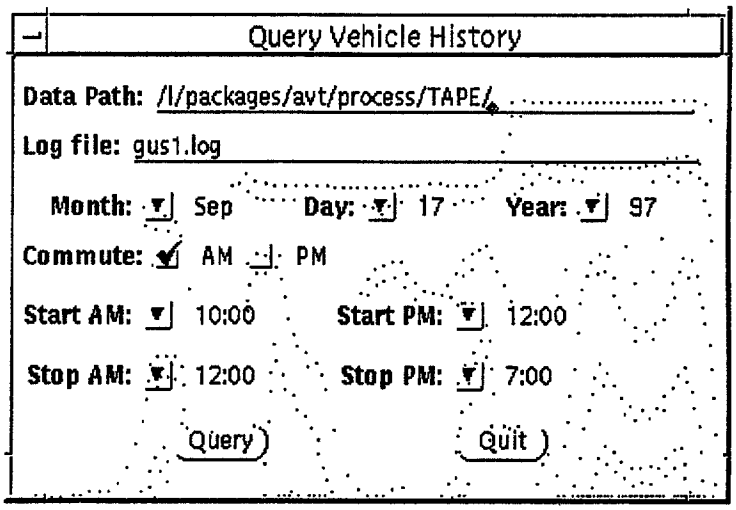

Figure 5 Date and time selection menu.

Summary and recommendations: Vehicle tracking technologies have been available for quite sometime. Such systems should not have had the problems described above, in addition we offer the following recommendations for a future system tailored to vehicle tracking around incidents:

- Prompt the user when a file reviewing has ended.
- Display of a clock that is concurrently changing with vehicles' activity.
- Define events based on time of day and highway segment boundaries. This would be ideal for trapping incidents. DIRECT traffic incident messages were ideal as they provided the traveler with the most important information, namely the location of the incident and its occurrence and expected clearance times. These pieces of information are a subset of the information we intend to provide travelers with in the expanded fleet study in addition to the escape and reentry exits.

5. TRAFFIC MESSAGES GENERATION TRANSCRIPTION AND ANALYSIS

In this section we look at different aspects of traffic messages from the moment they are generated at the traffic center until they are received by the in-vehicle receiver. We transcribed the subset of traffic messages that comprised incidents. These messages are listed in Appendix A. We reviewed the DIRECT vehicles that experienced these incidents using the AVTrak software. We divided the traffic messages into 3 general categories for the purpose of observing the category that contains the highest diversions. We also looked at the syntax of these traffic messages and realized that they most often are composed of 4 fundamental pieces of information. This organization is natural yet places the important pieces of information at the beginning and end of the message. This placement of information makes it ideal for the driver to remember and recall easily.

Traffic messages generation and transmission: Traffic messages are composed based on the data available at MITSC from the different data sources. An announcer speaks each traffic message through a microphone. The message is then digitized and stored in the message communications and control computer then sent to the different transmitter sites. Morning commute traffic messages were aired between 6:00 and 9:00 AM. The afternoon commute messages were aired between 3:30 and 6:00 PM. A Visual Basic application enables the announcer to select the sites and the communications system that a particular traffic message would be assigned to.

Traffic message sound files contents: Traffic messages are between 10 to 15 seconds in length, they are sampled at 11 kHz; each sample is converted to an 8 bit word and the corresponding 15 seconds digitized message is 165 kbytes. The digitized message is saved as a file with .wav extension in a directory that contains all broadcast messages.

Traffic messages transcription: About 1800 different messages were compiled at the MITSC message communications and control computer through out the duration of the project. About 90 % of these messages were found to be test messages. These test

messages were sent periodically to check the proper operation of the different system components. 188 messages were incident related messages. These messages are shown in Appendix A along with the date and time of occurrence of the incident and its level of severity (LOS) as defmed in the next subsection. Based on the date and time information we were able to preview the appropriate tracking log files. Incident messages transcription was done automatically using a computer that plays the sound (*.wav) files and another computer running the IBM ViaVoice Executive speech recognition software. The software converted speech to text. The setup is shown in Figure 6. The sound card output of the first computer is connected to the input of the sound card of the second computer.

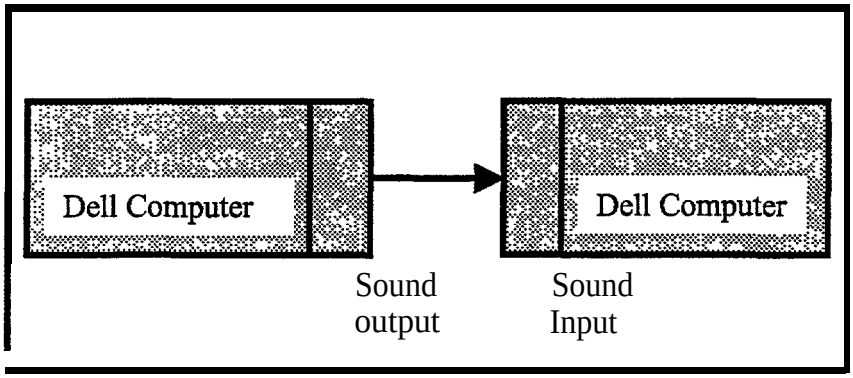

Figure 3 Computers connection for message transcription.

Traffic messages classification: We divided the traffic messages into 3 main categories as follows:

1) Crash related messages. These messages are in turn divided into 4 classes depending on the level of severity (LOS) of the crash as follows:

   a) L Incident clears within half and hour.
   b) M Incident clears between half an hour and an hour.
   c) H Incident clears between one hour and one hour and a half.
   d) VH Incident clears in more than one hour and a half.

2) Weather related messages such as icy and slippery conditions, heavy rain, and flooding.
3) Construction related messages such as lane closures. These are in turn divided into two main categories as follows:

   a) L Construction that causes minor reduction in traffic capacity as pavement patching.
   b) H Construction that involves lane closures and extends for few hours.

We observe that Construction related traffic messages are mostly severe and lead to significant traffic backups and delays. DIRECT communications technologies are ideal to deal with such persistent problem as explained in the next section.

The traffic messages are shown in Appendix A and are distributed as shown in Table 1:

Table 1 Traffic messages classification.

Crash related messages				Weather related messages				Construction	
L	M	H	VH	Icy	Flood	Rain	Fire	L	H
50	74	26	7	3	1	1	1	1	24

Traffic messages format: We found that each traffic message is composed of a minimum of two pieces of information and a maximum of four pieces of information. These pieces of information had the following natural ordering:

a) Incident location
b) Cause of the incident
c) Effect of the incident
d) Clearance time of the incident, or incident duration

Checking 100 of the messages listed in Appendix A we found out that 22 messages did not contain the incident duration, 4 messages did not contain the effect of the incident, 3 messages had the incident duration before the effect of the incident.

An example of a typical traffic message is:

" (1) On I75 Southbound near Big Beaver (2) an accident in the center lane (3) is causing traffic to pass on the shoulder look for slowdowns for at least 2 miles (4) looks like it's going till 7: 15 or 7:30 this morning, "

Because of human limited memory it is recommended that the sentence ***'is causing traffic to pass on the shoulder'*** is eliminated. In addition the sentence ***'look for slowdowns for at least*** 2 ***miles'*** is quite relevant as it will give the commuters an idea of the extent of the accident and helps them figure out the length of the queue and the location of the escape exit in order to divert. An example of an ideal traffic message is message number 429-l:

' (1) On I75 Southbound near Rochester Road (2) an incident on the shoulder (3) is causing up to 2 miles backup (4) look for slowdowns there up till 7:45 or even 8 o 'clock this morning '

This is also a brief message (13 seconds in duration) and does not load the commuters' memory with irrelevant data.

Recommendations for traffic message composition: The most relevant pieces of information are the incident location (1) and the clearance time or incident duration (4)

hence their location at the beginning and end of the message is ideal for memory retention. The cause of the incident component (2) and effect of the incident (3) are less important and are more of news that feed human curiosity to know. However one could include in item 3 relevant information as queue length or backup information as demonstrated in the above message. This would provide the commuter real information relevant to the incident ahead. This information as queue length would give the commuters another piece of information concerning the severity of the incident and help them decide about a possible diversion.

Having defined these pieces of information and their respective locations we decided to include them in the messages proposed for the expanded fleet study.

Traffic message sound quality: Few of the traffic messages were saturated. That is the announcer was too close to the microphone or his voice was too loud and hence saturated the input amplifier of the sound card. Amplifier saturation has an adverse impact on intelligibility.

6. DIVERSION ANALYSIS

We compiled a total of 41 incidents. These incidents are listed in Appendix B along with the following information for each vehicle in a chronological manner,

- Date and time of the incident
- Incident type or level of severity
- Driver number
- Vehicle number
- Communications technology used
- Average speed during the incident
- Queue length
- The highway segment affected
- Diversion maneuver
- Communication system is active or not
- The probability that the specific vehicle at the specific location could have received the traffic message

Case of severe weather: Investigating the DIRECT vehicles commute routes during severe weather alerts we found no change in the routes taken by commuters. The only difference was the lower speed as expected.

Case of construction sites: Construction usually reduces traffic capacity for a long stretch of the highway, (compare to an incident which reduces the capacity starting from the accident location). Consequently the affected highway stretch is far longer than that caused by an accident. Analysis of our data shows that clearly. The severity of this condition was sufficient to cause many drivers to avoid the normal commute route through the construction area and drive through alternate routes. Table 2 shows the normal commute routes on September 11 for the vehicles that later encountered the

construction. This was necessary to correctly identify diversions. In the speed field the term FF stands for free flow speed.

Table 2 Vehicles normal commute route.

Veh. #	Type	Route	Speed
57	Control	I75	FF
72	Cellular	696-I75	FF
122	RDS/SCA	VanDyke-696	FF
56	LPHAR	I75	FF
70	AHAR	I75	FF
68	Cellular	I75	FF
61	LPHAR	I75	FF
121	RDS/SCA	696-I75	FF
71	AHAR	I75	FF
60	Control	VanDyke-I94	FF
74	Control	I75	FF
76	RDS/SCA	I75	FF
66	Control	I75	FF
69	AHAR	I75	FF
75	AHAR	JohnR	FF
77	RDS/SCA	I75-Davison-Woodward	FF
78	RDS/SCA	I75	FF

Table 3 shows the listing of DIRECT vehicles commute routes on the morning of 9/12/96 and 9/13/96. The traffic message was:

'On 17.5 Southbound from 8 mile to the Davison area we got construction blocking the right lane, there are significant delays there particularly during rush periods, this construction is scheduled to go through Friday the 13th of September. '

Looking from top to bottom we find that the speeds are decreasing as time progresses and the length of congested part of the highway or the queue length is increasing as expected. Also there were 7 diversions out of the observed 17 trips. In addition the traffic message were a sort of an early warning to some commuters as #61, #71 ,and #78 who diverted early on, while others diverted within the congested area as #69 From the data shown in Appendix B and considering the messages that alerted to construction with expected delays that span half a day we counted a total of 51 trips 16 trips had diversions. We conclude that l/3 of the commuters are willing to divert in the case of construction with heavy delays.

As indicated in Table 1 the majority of Construction related messages caused heavy traffic delays. 24 of the 25 construction messages caused extensive delays and long queues. Many of these messages were in the afternoons consequently the tracking software did not record them because of AVTrak software coding errors as explained in Section 4. In addition a large part of these incidents occurred beyond group 3 where the tracking system hardware deteriorated to the extent we had 2 to 3 tracking systems

functional. However we were lucky to have morning construction that occurred early on in the project and was experienced by group 1 drivers where many of the vehicles' tracking systems were functional. The days are September 12, 13, and 17 in 1996. These experiences are tabulated in Appendix B.

Table 3 Vehicles' behavior in response to construction on September 111996.

Veh #	Type	Div	Route	Sp	Len	Section
57	Control	Yes	I75-696-39			
72	Cellular	No	I75	55	3	8 mile-Davison
122	RDS/SCA	No	Van Dyke-8 mile –I75	55	3	8 mile-Davison
56	LPHAR	No	I75	15	2	696-8mile
70	AHAR	No	I75	15	2	696-8mile
68	Cellular	No	I75	50	3	8 mile-Davison
61	LPHAR	Yes	Dequinder-696W-Sfld-8 mile-Telegraph.	30		
121	RDS/SCA	Yes	696E-I75S-9mile-Woodward			
71	AHAR	Yes	Rochester-Main-Livernois-Woodward			
60	Control	No	Van Dyke-I96			
74	Control	No	11 mile-I75S	10	6	11mile-Davison
76	RDS/SCA	No	JohnR-14mile-I75S	10	8	14mile-Davison
66	Control	No	8 mile-Mound			
69	AHAR	Yes	14mileE-JohnR-I75-Oakland-I75			
75	AHAR	No	JohnR-14mile-I75			
77	RDS/SCA	Yes	14 mile-Rochester-12mile-I75-6mile-Woodward	10	6	12mile-6mile
78	RDS/SCA	Yes	Dequinder-I75-10mileE-Mound-I75			

Case of vehicle crashes: In this case we found out that in a total of 100 commute trips there were only 6 diversions. This constitutes a ratio of 6%. It is expected that with appropriate communications and familiarization of the driver to the alternate routes this ratio would increase significantly.

Diversion analysis findings: We had two major findings to this analysis

1. The data in Appendix B is extracted from the traking data. This data is essential to perform diversion analysis. Table 4 summarizes our results. We found out that in a total of 122 trips where an incident occurred, the vehicles that had RDS/SCA system had the highest diversion rate where as the vehicle with the Cellular or the Control vehicles had the lowest diversion rates. The AHAR and LPHAR vehicles had a medium diversion rate. We conclude that automatic interrupts are quite important. In addition when an excellent sound quality as provided by RDS/SCA is combined with the timely alerts then the commuter will be willing to trust the system. This is a very insightful and significant finding of this report.

Table 4 Diversion rate per method.

LPHAR	AHAR	RDS/SCA	Cellular	Control
6/122	4/122	10/122	1/122	1/122

2. We had 22 diversions in 123 trips. 16 of these diversions out of 50 trips were in response to construction messages. Which means that about third of commuters receiving construction related messages divert as opposed to 10% receiving normal accident messages. This indicates that commuters are willing to take risks, explore alternate routes, and divert if it is clear that the penalty not to do so is quite high.

7. NATURAL USE SYSTEM RATING

In this section we examine the commuters reaction to the question concerning the overall satisfaction with the system. Commuters were to rank the system on a scale from 1 to 5 where 1 indicates extreme dissatisfaction and 5 indicates extreme satisfaction.

This analysis is concerned with the commuters who encountered the incidents listed in Appendix B. The motivation behind this analysis is that each system's effectiveness is revealed during incidents. We consider each trip has the rating of the corresponding driver. Consequently if a specific driver with rating ***a*** makes *x* trips then the cumulative score is *ax*. In the same token if another driver with rating *b* of the same system makes *y* trips through the incidents the cumulative points for this driver is *by*. The weighted average of the system then is $\frac{ax + by}{x + y}$ The entries in Table 5 are computed in this fashion. Consequently the rating of a commuter who made a large number of trips is higher weight than the rating of a commuter who made a small number of trips.

Table 5 Communications systems rating.

	Group1	Group2	Group3	Group4	Group5	Group6	Average
AHAR	10/7	9/3	62/20	5/3	*	17/12	1.64
LPHAR	16/7	*	46/13	*	*	8/7	2.667
Cellular	15/10	4/4	14/10	28/11	13/13	18/10	1.57
RDS/SCA	46/19	*	42/13	10/5	45/9	28/10	3.05

These results assert our findings in Table 4 where the RDS/SCA system has the highest rating followed by LPHAR, AHAR, and Cellular had the lowest rating.

8. SYSTEMS MEASURE OF EFFECTIVENESS BASED ON THE TRACKING SYSTEM DATA DURING INCIDENTS

In this section we compute a measure of effectiveness (MOE) of each system. These MOEs are dependent on the particular implementation of the system. It gives us a deeper insight into the understanding of the criteria that the commuter used to evaluate the different systems.

There are three fundamental criteria that enable the commuter to make a judgement about the particular system that he uses. Figure 4 encapsulates these criteria, We explains these criteria as follows:

1. The commuter needs to receive a clear message that is easy to remember. If the message is complex and difficult to remember or comprehend that would make the commuter less interested in the information provided and consequently in the system. However as explained in Section 5 the DIRECT messages were straightforward and easy to remember. Consequently we gave them a measure of 100%.
2. The broadcast message needs to be received in a timely fashion in the vehicle.
3. The sound quality of the received should be acceptable to the user.

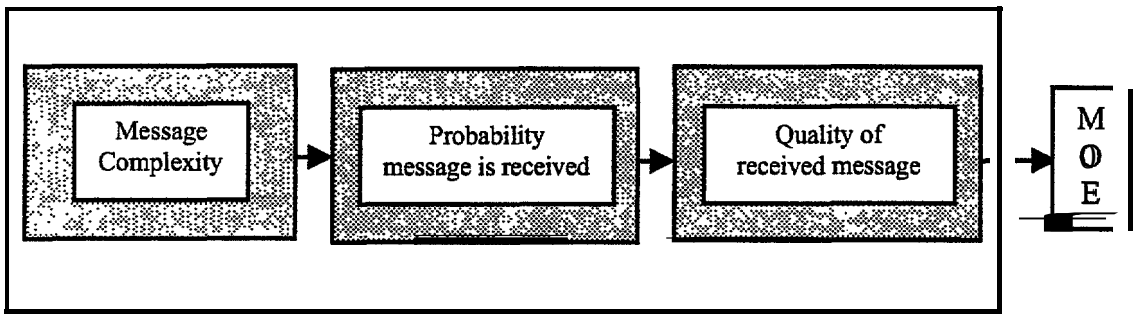

Figure 4 Communications system MOE generator during incidents

MESSAGE RECEPTION PROBABILITY

Now we will analyze the middle block in the Communications system MOE generator. The probability of a received message is computed based on our weekly sampling of the DIRECT's system various components [4]. We transmitted test messages to the various transmitters (see Figure 1). Afterwards we drove along the span of the I-75 expressway and confirmed the reception of these test messages. Based on this data we are able to assign message reception probability numbers to all these transmitters. In Appendix B, we inserted a column called probability. The values in this column correspond to the probability of reception of a specific traffic message by a specific vehicle type.

Cellular call message reception probability: In this analysis we looked at the cellular calls log from AMERITECH. When a call is made after the traffic message is broadcast the probability of message received is assigned the value 1. In the same token, when no call is made after the traffic message is broadcast then the probability of a received message is assigned the value 0, this includes the fact that many calls may be placed before the actual traffic message is transmitted.

We divided the kinds of failed cellular calls into two categories: The failed call (call shortly before the message is transmitted) and the no call as opposed to the successful call. The results of this division provide insight into understanding the dynamics of the poll calling as opposed to the interrupt or alerting mechanisms of the proposed technologies. Table 6 summarizes the statistics of such calls per group.

Table 6 Distribution of Cellular calls

Group1		Group2		Group3		Group4		Group5		Group6		Total	
Fail	No	Fail	No	Fail	No	Fail	No	Fail	No	Fail	No	Fail	No
9/16	2/16	3/3	0/3	5/11	1/11	4/6	0/6	9/12	1/12	3/9	1/9	33/57	5/57

Table 6 indicates that a total of 57 calls were made. Out of these calls 33 commuter attempts of failed calls as opposed to only 5 no calls. This means that although commuters were interested in getting traffic information by placing a call, they would realize later that an accident has occurred and they are trapped just because their placed call was a little bit before the traffic message was sent. This clearly demonstrates the distinct advantage of having a traffic delivery system based on interrupts. In addition this makes the chances of such commuters to divert is quite minimal as they would have to think about a diversion route once they observe the incident and loose the advantage of an earlier warning that an RDS/SCA system would provide.

RDS/SCA reception probability: The RDS/SCA system worked almost perfectly as the technology of RDS and SCA encoders is mature. The RDS/SCA reception was down only for a short period caused by malfunction in the WDTR FM station itself. Consequently the probability column entries contain the value 1.

LPHAR reception probability: The LPHAR transmitters were quite reliable. The reiability report [4] shows that the 4 LPHAR stations worked perfectly 71% of the time. From this piece of information and the LPHAR are equally reliable. Consequently we may compute the probability of success a of each transmitters as follows:

Probability (all transmitters are operational) is:

$$a4 = 0.71$$

Consequently

$$\mathbf{a = 0.92}$$

This is also the probability of reception of an LPI-IAR message at any receiver. Since AM receivers are very reliable.

The probability of reception past two transmitter sites is:

$$1-(1-a)^2=0.99$$

This means that the probability of having two successive failed LPHAR sites is one per thousand. In fact we never witnessed such a case. Having computed these probabilities, we are now able to fill the probability column in Appendix B with the appropriate value depending on the incident location.

AHAR reception probability: AHAR system implementation is experiemntal in nature. The Gardenia transmitter had a directional antenna and consequently a limited section of the highway was exposed to the AHAR signal. The Westminster transmitter was sandwiched between the Margaret and the Canfield transmitters and consequently the in-vehicle AHAR scanner was unable to unlock from the frequency of these transmitters and lock to its frequency. AHAR reception via the Canfiled and Westminster transmitters was quite comparable and superior to the Gardenia and Westminster's sites for the problems just mentioned.

Probability of reception at the Margaret and Gardenia is comparable to their LPHAR sites. Consequently we estimate that probability at

a = 0.92

We estimate the probability of message reception via the Westminster site = 0.4. Also data from [4] indicate that the probability that all transmitters are operational = 0.21. Hence, the probability of reception at the Gardenia site is:

$$\frac{0.21}{0.92\ ta.92 <\text{-}0.4} = 0.62$$

This is an approximation, however it is reasonable as our experience that the reception success rate at the Gardenia site was more frequent than at the Westminster site.

Now we compute the probability of reception at either the Gardenia or Margaret as follows:

$$1 - (1 - 0.62)(1- 0.92) = 0.97$$

This is pertinent for morning incidents that occur between 8 and 6 mile roads.

The probability of reception at either the Gardenia or Margaret or the Westminster site is:

$$1- (1 - 0.62)(1-0.92)(1 - 0.4)= 0.98$$

At last the probability that any transmitter is working is:

$$1 - (1 - 0.62)(1 - 0.92)(1 - 0.4)(1 - 0.92) = 0.995$$

Which is practically 1. That is it is impossible not to receive a message if we are on a morning commute and we are close to Canfield.

We now fill the corresponding figures in the probability column in Appendix B based on the incident location according to the above results.

Probability analysis: The values from the probability column in Appendix B are added and averaged. The result is summarized in Table 7. It is clear that the RDS/SCA and LPHAR had almost perfect performance. Where as on the average a cellular caller needs to make three different trials on the average to capture an incident message.

Table 7 Communications systems probability of received message.

	Group1	Group2	Group3	Group4	Group5	Group6	Probability
AHAR	9.11/13	1.86/3	14.76/18	1.62/2	1.97/2	8.76/9	0.81
LPHAR	6.79/7	*	14.2/15	*	*	5.84/6	0.97
Cellular	5/16	0/3	5/11	2/6	2/12	5/9	0.33
RDS/SCA	19/19	*	17/17	4/4	7/7	6/9	0.95

QUALITY OF RECEIVED MESSAGE

Measurement of the quality of received messages is detailed in [4]. A group of jurors ranked the quality of about 100 different traffic messages organized randomly and received y the 4 different communications technologies. The ranking scale range begins from a minimum of 1 for unacceptable messages to a maximum of 5 for excellent messages. Table 8 contains the outcome of this measurement.

Table 8. Judged sound quality average per system

RDS/SCA	LPHAR	Cellular	AHAR
4.43	4.22	3.87	3.09

The quality of the SCA FM subcarrier, with access controlled by the RDS/SCA subcarrier, was the highest. Both the LPHAR and the Cellular had a reception quality rated high, but not as high as the SCA subcarrier. The AHAR was judged to have an appreciably lower quality than the other three, which corresponds to the authors' experience during hundreds of receptions.

MEASURE OF EFFECTIVENESS OF THE COMMUNICATIONS SYSTEMS

From the data of Tables 7 and 8. The different systems MOEs are computed by simple multiplication of each system's probability of received message by its corresponding judged sound quality. Table 9 contains the corresponding MOEs.

Table 9 MOE's of the DIRECT communications systems.

RDS/SCA	LPHAR	Cellular	AHAR
4.21	4.1	1.3	2.5

8. CONCLUSIONS

The RDS/SCA attained the highest MOE, rated highest among commuters who had to go around incidents, and commuters who diverted were most likely users of the RDS/SCA system. Adding to these conclusions the fact that RDS/SCA is the cheapest to deploy, has a wide coverage, and the new model cars are fitted with RDS radios. All these factors makes RDS/SCA the ideal technology for transmission of traffic incidents information.

DIRECT traffic messages were 15 seconds in duration. They were composed of few pieces of information starting with incident location and ending with the incident duration or time to clear. We recommend that the middle segment of information to contain the expected queue length. This would help commuters decide their diversion route. This compact but vital pieces of information are easy to retain. In addition we recommend that this message structure becomes a standard. If such standard is rigorously followed then commuters would anticipate the incoming pieces of information and retain their contents better.

Drivers do not usually divert unless in severe circumstances. We have shown that such is the case of construction sites and our data indicated that the third of the commuters do divert around construction sites. However with a reliable and high quality sound system as the RDS/SCA the ratio of commuters opting to divert is expected to increase.

The DIRECT project goal to experiment with interrupt driven traffic messages was on target. This is ascertained by the low MOE of the Cellular system where the randomness of incident occurrences entails an active role on the commuters' part to constantly call the traffic center for the presence of incidents. Commuters had to call on the average 3 times before they receive an incident message given that an incident occurred during their commute.

Vehicle tracking provides a wealth of information about system effectiveness and is an excellent predictor of human behavior. It is a distinguishing feature of the DIRECT OFT among the other national OFTs. The above results proved its worthiness

9. FUTURE RESEARCH

Based on the conclusions of this research we find that the RDSISCA system is a clear winner. However in the near term it would be difficult to lease both RDS and SCA subcarriers from FM stations in order to broadcast incident messages. The short term goal that would be part of the expanded fleet study would be to use the RDS subcarrier to broadcast text incident messages.

As explained in [5] [6] and based on our analysis of the incident messages we will dedicate the first four bytes of the text message to the location, and the last for bytes to the clearance time of the message. The intermediate information is related to the queue length however it will be more instructive to the commuter to provide the escape exit and the reentry exit in a dynamic fashion. We intend to use the information provided by embedded loops at MITSC. This information will be fed automatically to a computer algorithm and will compute queue length and locate the closest escape exit.

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Appendix A

DIRECT TRAFFIC INCIDENTS MESSAGES

Incid	Date	Time	LOS	Description
255_1	12 00 AM	3 52 PM	L	I75 Northbound before I696 an accident on the right side and debris on the left lane has traffic slowing from eight mile
256_1	12 00 AM	3 16 PM	L	On I75 northbound near 11 mile a car fire on the right side slows traffic from south of I696
263_1	12 00 AM	3 40 PM	L	On I75 northbound past 8 mile an accident blocks the left lane State police just arriving on the scene as of 3 40
265_1	12 00 AM	4 45 PM	L	I75 northbound at Square lake road a multiple vehicle accident slows travel
271_1	12 00 AM	4 07 PM	rain	It's Friday afternoon the 6th of September there is some heavy rain reported in some of the northern suburbs as a result I75 traffic northbound is heavy and slow from about Holbrook and Canuff all the way up to the Troy area expect delays this afternoon.
290_2	12 00 AM	8 02 AM	H	On I75 Southbound before 9 mile an accident is in the left lane Police is on the seen look for backup there from before 11 mile
291_2	12 00 AM	8 38 AM	Cons	On I75 Southbound from 8 mile to the Davison area we got construction blocking the right lane, there are significant delays there particularly during rush periods, this construction is scheduled to go through Friday the 13th of September
292_1	12 00 AM	8 48 AM	Cons	On I75 Southbound from 8 mile to near the Davison area you'll find construction blocking the right lane significant delays through the stretch this construction project will continue through Friday the 13th of September
329_2	12 00 AM	8 38 AM	Cons	On I75 Southbound between 8 mile and I94 you'll find construction blocking the left lane major slowdown during the heavy traffic volume time periods, figure on slowdown there that construction will go through Wednesday morning at least perhaps into Wednes
331_1	12 00 AM	3 44 PM	M	On I75 Northbound at Canuff you'll find an accident blocking the two left lanes the backup as of about 3 40 is from about East Grand Blvd look for this accident to take from half hour to 45 minutes to clear
334_1	12 00 AM	4 41 PM	L	On I75 north of Adams road a rollover accident in the median over traffic look for backups starting at about Big Beaver road.
342_1	12 00 AM	3 54 PM	Cons	On I75 northbound from I94 to 8 mile construction blocks the left lane watch for significant backups in that area this construction will be in force through Monday morning the 23rd of September
402_1	12 00 AM	3 31 PM	Cons	On I75 northbound from I94 to Davison there is construction blocking the right lane That construction is scheduled to go through Thursday afternoon the 26th of September
406_2	12 00 AM	6 05 PM	Cons	I75 northbound from I94 to 8 mile you find the right lane closed for construction until midnight Friday
414_1	12 00 AM	2 55 PM	Cons	On I75 northbound from East Grand Blvd to about 8 mile you'll find construction blocking the left lane Expect delays through that entire stretch
419_1	12 00 AM	4 55 PM	M	On I75 northbound past I696 an incident on the left shoulder slowing traffic from 9 mile look for delays until probably 5 30
420_1	12 00 AM	7 54 AM	M	On I75 Southbound near Big Beaver an accident involving several vehicles is on the shoulder it's got traffic slow for about mile and a half up to 2 miles leading into that area looks like that slowdown might keep going up till 8 30 this morning
428_1	12 00 AM	3 41 PM	M	I75 Northbound before I94 an accident in the area slowing traffic state police on the scene look for slow downs there up till 4 30 this afternoon
429_1	12 00 AM	7 14 AM	M	On I75 Southbound near Rochester road an accident on the shoulder is causing up to 2 mile backup look for slow downs there until probably 7 40 45 or even 8 00 o'clock this morning
435_1	12 00 AM	3 59 PM	M	I75 Northbound and 7 mile reported debris in the roadway from an earlier accident
436_1	12 00 AM	4 48 PM	L	I75 Northbound ramp to I94 Eastbound an accident slows traffic
440_1	12 00 AM	4 57 PM	L	I75 Northbound ramp to I94 Eastbound a stalled car slows traffic
441_1	12 00 AM	5 13 PM	L	I75 Northbound ramp to I94 Eastbound an accident slows traffic
470_1	12 00 AM	6 57 AM	M	On I75 Southbound before East Grand Blvd an accident blocks the right center lane there are 3 cars involved the accident occurred about 6 50 should take about 45 minutes to clear so look for slowdowns till about 7 30 or 7 45
471_1	12 00 AM	7 26 AM	L	On I75 Southbound before Rochester road an accident partially blocks the left lane that accident occurred about 7 20 should be cleared by about 8 o'clock
472_1	12 00 AM	6 46 AM	M	On I75 Southbound near Big Beaver an accident there in the center is causing traffic to pass on the shoulders look for slowdowns for at least 2 miles before that looks like that's going to go till about 7 15 or 7 30 this morning
473_1	12 00 AM	6 35 AM	H	On I75 Southbound before 7 mile an accident is blocking the two right lanes delays begin around 696 look for that problem to be there until 7 30 this morning
495_1	12 00 AM	5 25 PM	L	On I75 Northbound before I696 a multi-vehicle accident blocks the left and center lanes the back up is from at least 8 mile it's about 4 30 since the accident is being reported and count on backups occuring until 5 15 or 5 30
533_1	12 00 AM	4 34 PM	M	On I75 northbound and 9 mile an accident blocks he two right lanes slow down will begin before 8 mile
538_1	12 00 AM	2 26 PM	VH	On I75 northbound before Clay an accident blocking the right lane look for this accident to be working till 3 30 or 3 45 this afternoon.
542_3	12 00 AM	5 20 PM	L	On I75 northbound just before 14 mile the 3 car accident continues to block the right lane police and emergency vehicles are there you'll find slow travel from about 7 mile looks like its going to be 5 30 perhaps 5 45 before it clears
571_1	12 00 AM	3 32 PM	H	On I75 northbound approaching I696 traffic is slow due to a police situation that closes I696 Eastbound just past I75 its around 3 30 and this situation could go on through out the afternoon hours
604_1	12 00 AM	5 17 PM	L	On I75 northbound post Crooks there is an accident blocking the right lane police is on the scene its about 5 15 and it is estimated that the problem should be cleared within half an hour
606_1	12 00 AM	3 27 PM	L	I75 northbound ramps and 9 mile John R is partially blocked by a disabled semi use caution.
612_1	12 00 AM	3 13 PM	M	I75 northbound at Woodward heights just before I696 a 4 car accident blocks the two right lanes
614_1	12 00 AM	4 32 PM	L	I75 northbound before 7 mile an accident blocks the right center lane
655_1	12 00 AM	6 59 AM	M	On I75 Southbound past Rochester road a multi-vehicle accident on the left shoulder is causing slowdowns the accident just occurred before 7 o'clock should take about 45 minutes to clear
661_1	12 00 AM	8 39 AM	M	I75 Southbound before Wattles rd an accident blocks the right lane
673_1	12 00 AM	4 14 PM	M	On I75 Northbound before 9 mile an accident blocking the left lane its approximately 4 15 its going to be half hour to 45 minutes before it is cleared
843_1	12 00 AM	6 40 AM	L	On I75 Southbound near the Davison there is a disabled vehicle blocking the right center lane its 6 40 it's probably going to take 15 minutes to half hour to get that out of the way look for slowdowns through that area until sometime shortly after 7 o'clo
844_1	12 00 AM	7 38 AM	M	On I75 Southbound past Big Beaver we get an accident reported it is partially blocking the lane there it's about 7 30 and may take half an hour to 45 minutes to clear police is just arriving on the scene
854_1	12 00 AM	7 00 AM	ICE	Numerous spinouts all the way in very icy conditions through out be very careful today
863_1	12 00 AM	5 04 PM	L	On I75 Northbound past 12 mile a disabled vehicle blocks the left lane its around 5 o'clock and should be cleared out within 10 to 15 minutes
871_1	12 00 AM	3 17 PM	M	On I75 Northbound near I94 State police are on the way to check the situation out it is 3 15 look for slow downs within the half hour to 45 minutes
887_1	12 00 AM	7 30 AM	M	On I75 Southbound near Canuff We got an accident blocking the right lane that accident just happened in couple minutes its about 7 30 probably you will block the right lane look for slow downs half an hour or so this morning
899_1	12 00 AM	8 15 AM	L	On I75 Southbound near 7 mile an accident blocks the left center lane its about 8 15 looks for that to tie up things for anything from twenty minutes to about half hour
905_1	12 00 AM	4 10 PM	H	On I75 Northbound before 12 mile an accident involving a semi and a car is on the right side traffic is slow from 696 it's a little bit after 4 o'clock it will probably be 4 45 or 5 that clears out there
906_1	12 00 AM	4 40 PM	Cons	On I75 Northbound coming out of downtown we got a moving patching crews slowing traffic look for delays as a result
916_1	12 00 AM	3 33 PM	L	I75 Northbound at Warren there is an accident on the shoulder slowing traffic all the way downtown It is about 3 30 should take 15 minutes to half hour to clear out of there
942_1	12 00 AM	7 32 AM	M	I75 Southbound before 9 mile an accident blocks the left center lane its about 7 30 it probably going to take half an hour to 45 minutes to get that cleared out of the way so that it has no impact Look for slowdowns in the area
943_1	12 00 AM	8 17 AM	L	I75 Southbound near I696 we got an accident in the left lane an ambulance on the scene its about 8 15 looks it is another 15 minutes to half hour before its cleared out
956_1	12 00 AM	5 21 PM	M	I75 Northbound at ADAMS an accident blocks the center lane
979_1	12 00 AM	7 31 AM	L	On I75 Southbound near 12 mile we got an accident on the shoulder it slowing traffic from about Maple its now about 7 30 probably its going be 20 minutes to half hour before these vehicles get moved off the road
1045_	12 00 AM	3 07 PM	M	On I75 Northbound past I94 an accident on the right side slowing traffic in the area its few minutes after 3 o'clock probably takes half hour for that to clear out.
1057_	12 00 AM	4 08 PM	L	On I75 Northbound before 8 mile we got a disabled vehicle blocking the right lane reports of back up to the Davison
1058_	12 00 AM	4 16 PM	H	On I75 Northbound past Livernois we got a rollover accident in the Median there are assisting vehicles on the scene significant backup there it's about 4 15 looks like its going to take an hour or so to get this cleared out of the way
1078_	12 00 AM	3 08 PM	M	On I75 Northbound past 14 mile we got an accident in the Median that is slowing traffic in the area its about ten after 3 at this point its probably going to take thurty to forty five minutes to get that cleared out of the way look for continued slowdowns

1092	12 00 AM	4 26 PM	M	I75 Northbound past 14 mile an earlier accident in the median there still slowing traffic in the area look for delays until probably about 5 15 to 5 30
1095	12 00 AM	3 39 PM	L	I75 Northbound before I 696 an accident slows travel
1129	12 00 AM	4 37 PM	M	I75 Northbound past 7 mile a truck lost part of its load blocking the right lane its about 4 40 probably it will be 5 15 before that is cleared
1140	12 00 AM	3 48 PM	H	On I75 Northbound before 12 mile a rollover accident on the right side is causing slow down downs from before 1696 its just before 4 o'clock probably going to take at least an hour to clear that out of the way
1141	12 00 AM	6 41 AM	H	On I75 Southbound at Square Lake road an accident blocks couple lanes there look for backups of two to three miles
1142	12 00 AM	3 11 PM	L	I75 Northbound before Jocelyn road an accident blocks the right lane
1178	12 00 AM	4 34 PM	H	On I75 at Square lake road a brush fire in that area slows traffic in both directions probably its going to be sometime after 5 o'clock before that all gets cleared out
1179	12 00 AM	6 42 AM	H	On I75 Southbound at Rochester road an earlier accident has been moved to the shoulder police and wreckers on the scene its about 6 30 looks like it might take as much an hour to get that finally cleared out of the way
1183	12 00 AM	5 31 PM	M	On I75 Northbound past 9 mile an accident blocks the right lane look for slowdowns there it's a little after five it'll probably be 5 30 or 5 45 before that is cleared out of the way
1184	12 00 AM	7 09 AM	M	On I75 Southbound past Rochester road there is a vehicle in the median due to an earlier accident wreckers are now hooking to it expect minor delays through this stretch its about 7 o'clock probably take half hour to 45 minutes to get that out of the way
1186	12 00 AM	8 38 AM	M	On I75 Southbound past I94 you'll find an accident involving 3 or 4 cars blocking the right lane the backup currently is backed up to Holbrook its just about 8 30 as it is reported police are not on the scene yet probably it will be 9 o'clock or so before
1187	12 00 AM	3 05 PM	M	On I75 Northbound before 8 mile we got wood debris blocking the right and right center lanes its 3 o'clock it will probably be 3 30 before that is cleared out
1188	12 00 AM	5 34 PM	L	On I75 Northbound before 696 we got an accident on the shoulder that is slowing traffic its 5 20 it probably will take another 15 minutes to clear that out of the way look for minor delays
1221	12 00 AM	4 43 PM	M	On I75 Northound before I94 an accident blocks two right lanes look for slowdowns all the way downtown Its about 4 30 looks like it's going at least 45 minutes or so to clear that of the way
1222	12 00 AM	4 50 PM	L	On I75 Northound before 13 an accident on the left side slowing traffic from 696 it's now 4 35 and it'll about 5 before that is cleared out of the way
1223	12 00 AM	3 50 PM	M	An accident on I696 Eastbound is causing slowdown on I75 Northbound you'll see a slowdown starting about 9 mile and effects mostly the 2 right lanes if you stood in the left you will do a little better but it will be slow there it is about 3 45 I figure t
1224	12 00 AM	6 52 AM	VH	On I75 Southbound past Adams a gravel hauler has lost its trailer its blocking the left lane looks like its going to take a while to clear it all up its 6 45 figure these slowdown will be through the morning commute traffic slows from at least M59
1225	12 00 AM	4 44 PM	M	On I75 Northbound past the Davison an accident on the left side slows traffic look for slowdowns back from the Holbrook area its about 4 40 and looks like it takes half hour to 45 minutes to get that cleared out of the way
1242	12 00 AM	6 48 AM	M	On I75 Southbound before 13 mile an accident blocking the left lane, it is 6 45 looks like it will take 45 minutes before that gets cleared out look for substantial delays
1368	12 00 AM	5 03 PM	M	On I75 Northbound before 12 mile a 2 car accident on the left shoulder slows traffic its just before 5 o'clock it probably will take half hour or so to get that cleared out
1454	12 00 AM	5 04 PM	M	On I75 Northbound past 14 mile road a rollover accident in the median is slowing traffic it's couple minutes before 5 o'clock probably 5.30 or 5 45 before we get that cleared out of the way
1461	12 00 AM	7 55 AM	M	On I75 Southbound past 11 mile an accident on the right shoulder slowing traffic it's about 7 45 and probably will take about half hour to 45 minutes to get that cleared out of the way
1465	12 00 AM	4 58 PM	M	On I75 South of Adams there is an accident in the median slowing traffic due to gawkers It's little bit before five it will be half hour to 45 minutes to get that cleared out of the way
1466	12 00 AM	7 35 AM	M	O I75 South of Rochester road an accident in the median causing gawkers slowdown its about 7 30 and should take about 45 minutes to get that cleared out.
1476	12 00 AM	7 55 AM	L	I75 the Fisher northbound of Woodward an accident slows travel
1477	12 00 AM	3 11 PM	M	I75 Northbound before Gratiot Avenue a large pothole is in the left lane traffic is slowing to avoid it use caution
1480	12 00 AM	6 00 PM	L	I75 Northbound before I696 watch for a disabled vehicle in the left lane
1484	12 00 AM	3 09 PM	M	I75 North of Rochester road there is a spun out accident in the median that is causing a gawker slowdown it's about 3 o'clock it will be there for at least 45 minutes look for slowdowns in the area.
1486	12 00 AM	3 54 PM	H	On I75 North of 13 mile we got a rollover accident in the median gawker on the Northbound side slowdown between 13 and 14 mile its about 3 45 look for that for that to slow things for at least an hour
1487	12 00 AM	5 22 PM	L	On I75 Northbound past 9 mile an accident on the right side is slowing traffic from 8 mile its about 5 15 it will be 20 minutes or so before that is out of the way
1467	12 00 AM	3 44 PM	M	I75 Northbound an accident past I696 blocks the right lane
1478	12 00 AM	4 50 PM	L	I75 Northbound at McNichols, a car fire on the shoulder slows travel
1503	12 00 AM	7 19 AM	L	I75 Northbound at Big-Beaver, an accident in the median slows travel I75 Northbound at Sashabaw, traffic is heavy and slow
1526	12 00 AM	4 06 PM	VH	I75 Northbound and Squirrel Road, a multi-vehicle accident blocks several lanes
1530	12 00 AM	8 35 AM	VH	I75 Southbound past Rochester Road, an accident involving a semi blocks the right lane
1535	12 00 AM	3 14 PM	M	I75 Northbound at Coolidge, an accident blocks the left lane
1588	12 00 AM	8 53 AM	VH	I75 Southbound ramp to the Fisher is closed due to a rollover accident
1620	12 00 AM	4 26 PM	L	I75 Northbound and seven mile a rollover accident slows travel
1640	12 00 AM	3 41 PM	H	I75 Northbound before I696 an injury accident blocks the right lane
1697	12 00 AM	4 34 PM	Cons	I75 NB between I94 and the Davison Freeway construction blocks the left lane
1729	12 00 AM	4 36 PM	L	I75 NB of Mack a stalled car blocks the center lane
1495	12 00 AM	4 07 PM	H	On I75 Northbound before Square Lake a multi-vehicle accident involving a semi and several cars blocks the center lane its about 4 o'clock looks like it takes as much as an hour to get that out of there backups are now from Big Beaver
1488	12 00 AM	6 44 AM	M	On I75 Southbound before East Grand Blvd an accident blocks the left center lane its about 6 35 look for that to take half hour to 45 minutes to get that cleared out of the way
1503	12 00 AM	7 19 AM	Cons	I75 Southbound from 8 mile to I94 the left lane is going to be blocked for construction until Friday afternoon
1505	12 00 AM	7 04 AM	Cons	I75 Southbound construction continues starting at 8 mile you are going to get significant backups this construction is scheduled to continue until Friday afternoon
1507	12 00 AM	3 12 PM	H	I75 Northbound before I696 an accident on the shoulder is causing backups its about 3 o'clock it'll take probably an hour or so to clear it out of the way
1508	12 00 AM	4 50 PM	M	On I75 Northbound near Adams we got a two car accident on the shoulder that is causing slowdowns its about 4 30 and it'll about 45 minutes or so to clear that out of the way
1509	12 00 AM	5 10 PM	M	I75 Northbound at 11 mile an accident blocks the left lane also cars on both shoulders it's 5 o'clock it'll probably going to take 45 minutes or so to clear that out of the way
1510	12 00 AM	6 41 AM	Cons	I75 Southbound beginning at 8 mile you'll find a lane restriction in fact one lane is blocked that construction project continues this week look for slowdowns each day until further notice
1516	12 00 AM	3 18 PM	H	I75 Northbound before 13 mile an accident involving a jack knife semi has left only the left lane open its about 3 o'clock and will take probably an hour or so to get that cleared.
1517	12 00 AM	4 18 PM	H	On I75 Northbound before the Davison a rollover accident in the center lane is causing backs ups from the Ford you'll probably want to avoid that if you can it is just before 4 o'clock it'll probably be 5 o'clock before it is cleared
1521	12 00 AM	7 04 AM	Cons	Southbound I75 beginning at 8 mile the left lane is blocked down to I94 so look for backups and the till slow movement we had the last week or two
1523	12 00 AM	5 17 PM	L	On I75 Northbound before I696 an accident blocks the right lane, it's around 5 o'clock apparently a minor accident should be out of there in 20 minutes to half hour
1524	12 00 AM	6 42 AM	Cons	On I75 Southbound there is construction now from about the Davison down to I94 you'll find the left lane blocked significant backups there you'll see slowdowns all the way from the Royal Oak Madison Heights area
1525	12 00 AM	4 40 PM	M	On I75 Northbound before I696 we got two accidents reported in the area slowing traffic there it is about 4 30 it'll be 45 minutes to an hour to get out of there
1526	12 00 AM	4 07 PM	H	On I75 Northbound on Square road past the Adams kind of a multi-vehicle accident it's about 4 o'clock and it'll be an hour or so to clear that out of the way
1535	12 00 AM	3 16 PM	M	On I75 Northbound at Coolidge an accident blocks the left lane, it's about 3 o'clock and it'll take about 45 minutes to get that cleared out of the way
1547	12 00 AM	3 16 PM	M	On I75 Northbound near the Davison an accident blocks the left lane look for slowdowns there it's about 3 o'clock and it'll probably take about 45 minutes to get that of the road

1548_	12 00 AM	3 40 PM	M	On I75 Northbound near the Davison an accident blocks the left lane it's about 3 25 looks like it probably half hour to get that cleared out of the way
1549_	12 00 AM	3 47 PM	H	On I75 near Big Beaver a roll over accident in the median blocks the Northbound left lane it's about 3 30 and it'll probably take an hour to get this out of the way
1550_	12 00 AM	4 36 PM	H	I75 Northbound past Adams a trailer blocking the left lane its now 4 20 and it'll probably take an hour to get that out of the way
1556_	12 00 AM	3 11 PM	VH	I75 Northbound near Camff a serious injury accident has the expressway completely closed down it's a little before 3 o'clock it'll be probably 4 30 before that is totally cleared up look for alternate routes this afternoon
1558_	12 00 AM	4 01 PM	M	I75 Northbound past I696 a car fire on the left shoulder slows traffic its 3 45 figure on 45 minutes to get that cleared out of the way
1559_	12 00 AM	6 59 AM	Flood	I75 has numerous closures as you head in ether direction due to flooding from yesterdays storms look for delays and try to follow detour signs
1566_	12 00 AM	8 35 AM	M	I75 Southbound ramp to I696 an accident slowing traffic from 11 miles look for slowdowns there it is a little after 8 o'clock it will be 30 minutes or so before that is moved out of the way
1569_	12 00 AM	7 02 AM	Cons	We still got the construction on I75 slowing things a bit there
1586_	12 00 AM	3 10 PM	H	On I75 Northbound at Wattles a semi in the ditch from this morning is being removed a lane is blocked there and traffic is very very slow Troy police advising its going to be very slow before that is out of there look for slowdowns from as far back as Msp
1587_	12 00 AM	7 45 AM	H	On I75 Southbound the ramp to 375/Gratiot an accident on that ramp is slowing traffic its about 7 45 and looks like it'll take an hour or so to get that out of there
1590_	12 00 AM	4 55 PM	M	On I75 Northbound past 12 mile looks like a 2 car accident on the left shoulder is slowing traffic there its about 4 45 it'll probably take 45 minutes to an hour to get that cleared
1591_	12 00 AM	5 02 PM	M	On I75 Northbound past Warren a multi-vehicle accident blocking the right lane police and emergency vehicles are on the scene its now 4 55 look for slowdowns for half hour to 45 minutes
1597_	12 00 AM	3 52 PM	Cons	On I75 Northbound ramp to 11 mile construction blocking the ramp entirely looks like it is going to be blocked through the afternoon rush hour
1606_	12 00 AM	8 21 AM	M	On I75 Southbound and McNicols an accident blocking the left lane its about 8 15 and probably will take half hour or so to get that out of the way
1625_	12 00 AM	4 53 PM	L	I75 Northbound and 7 mile a rollover accident has traffic backed up to the Davison freeway
1626_	12 00 AM	5 39 PM	L	I75 Northbound and Warren avenue a disabled vehicle blocks the left lane traffic is backed up to the Fisher freeway
1627_	12 00 AM	3 14 PM	M	On I75 Northbound just past McNicols you'll find a multitude of vehicles and a trailer on the right side there is a guaker slowdown it is now 3 o'clock and I will probably take couple hours to get that out of the way
1628_	12 00 AM	5 11 PM	M	On I75 Northbound before Adams road a one car accident on the left shoulder slowing traffic from Big Beaver its about 5 o'clock look for that to last from half hour to 45 minutes before it is cleared
1630_	12 00 AM	5 33 PM	L	On I75 Northbound past Adams road an accident blocking the center lane it is causing traffic backups its about 5 20 it will probably take 20 minutes to half hour to get that to the side
1639_	12 00 AM	4 32 PM	H	On I75 Northbound at 13mile a rollover accident is reported look fr slowdowns there its about 4 15 it'll probably take an hour or more to clear that out of the way police on the way
1644_	12 00 AM	4 18 PM	M	I75 Northbound before Rochester road an accident on the left shoulder has traffic slow from 13 mile
1653_	12 00 AM	3 06 PM	M	On I75 Northbound before 14 mile an accident on the shoulder has traffic probably backing up before I696 it's about 3 o'clock it will probably take half hour to 45 minutes look for slow downs there
1659_	12 00 AM	3 16 PM	H	On I75 Northbound before I696 a minor accident on the shoulder slows traffic from myers 8 5 mile just past 8 mile
1674_	12 00 AM	3 11 PM	M	On I75 Northbound past 12 mile an accident on the left shoulder is causing minor slowdowns it's a little after 3 and will probably take half hour or so to clear that out there
1675_	12 00 AM	5 31 PM	L	On I75 Northbound and Warren a minor accident partially blocks the right lane look for minor slowdown there from about Mack its 5 10 and will take 20 to 30 minutes to clear that out of the way
1680_	12 00 AM	2 46 PM	HH	On I7 Northbound at 9 mile a rollover accident has the freeway completely blocked off traffic is backed up from McNicols you want to avoid that entirely it's a little before 3 o'clock its going to be a while past 4 o'clock perhaps even 5 o'clock before i
1681_	12 00 AM	7 48 AM	M	On I75 Southbound before Big Beaver an accident on the left shoulder is slowing traffic it's about 7 45 it will probably take a half hour to 45 minutes to get it cleared
1710_	12 00 AM	6 43 AM	L	On I75 Southbound at McNicols an accident blocks the right lane it's about 6 40 right now it'll be 20 minutes to half hour or so get that completely cleared out of the way
1725_	12 00 AM	7 51 AM	Cons	Construction on I75 Soutbound from about McNicols to the Blvd blocking the left lane look for slowdown for the entire trip this morning
1727_	12 00 AM	3 35 PM	M	I75 Northbound between 696 and 11 mile an accident causes congestion
1743_	12 00 AM	6 56 AM	L	On I75 Southbound just before Nevada that's 6and a half mile you'll find a 3 car accident on the left shoulder slowing traffic in that area its just before 7 o'clock it will probably take 20 minutes to half hour to get that out of the way
1747_	12 00 AM	3 04 PM	M	On I75 Northbound before 8 mile a clean up coming an earlier accident just leaves the right lane open it's slow from about I94 its best to avoid that entirely come back from 8 mile its about 3 o'clock it will probably take another half hour for them to co
1748_	12 00 AM	3 51 PM	M	On I75 Northbound at the Davison a disabled semi blocks the center lane it has got traffic backed up from about Mack, look for that lasting for quite a while it's about 3 45 and it will probably go for at least 45 minutes before they finally get that out
1776_	12 00 AM	4 45 PM	M	I75 Northbound at 12 mile an accident on the left shoulder is causing delays back to I696
1301_	12 00 AM	3 34 PM	Cons	I75 Northbound at Adams a construction project in the left lane slows traffic
1302_	12 00 AM	6 07 PM	L	I75 Northbound at 12 mile disabled semi blocks the right lane traffic is backed up to 696
1303_	12 00 AM	3 56 PM	L	I75 Northbound before 12 mile a rollover accident blocks the two right lanes traffic is backed up before 9 mile
1304_	12 00 AM	5 24 PM	L	I75 Northbound at Holbrook 3 car accident is causing on gawker delay
1313_	12 00 AM	6 38 AM	M	On I75 Southbound past 12 mile we get a gravel hauler that has lost trailer section in the right lane slow downs begin at Rochester road its about 6 35 and looks like this might take 45 minutes to an hour to get out of the way
1354_	12 00 AM	3 33 PM	H	On I75 at Rochester road a span out accident in the median slows traffic sue to gawkers in both directions its about 3 30 and will take an hour or so to get that out of the way
1367_	12 00 AM	3 33 PM	M	I75 Northbound just before I696 an accident blocks the left lane traffic is slow from 9 mile Wattles about 4 30 probably will take half hour to clear it out
1387_	12 00 AM	3 49 PM	Cons	I75 Northbound between McNicols and 7 mile construction blocks all but the left lane expect delays
1388_	12 00 AM	4 48 PM	Cons	I75 Northbound between 6 and 7 mile roads now only the right lane is blocked for construction
1392_	12 00 AM	3 34 PM	Cons	I75 Northbound at McNicols construction blocks the right lane expect delays
1394_	12 00 AM	6 54 AM	M	On I75 Southbound past the Davison a 4 car accident up against the left wall slowing traffic due to gawkers its about 6 45 it will probably take 45 minutes to an hour to clear that
1395_	12 00 AM	3 54 PM	H	I75 Northbound right under I94 we got a multi-vehicle accident on the left side that is causing a gawker slowdown it's little before 3 o'clock probably it'll be 4 30 or so before all those vehicles are out of there
1402_	12 00 AM	3 17 PM	M	On I75 Northbound before 8 mile an accident on the shoulder is slowing traffic in the area look for continued slowdowns for the next hour or so it's just about 3 o'clock you'll find slowdowns there as they trying to get those vehicles out of the way polic
1405_	12 00 AM	3 25 PM	L	On I75 Northbound at Clay an accident blocks the left center lane looks like a minor fender bender it's about 3 15 probably will take 15 minutes to half hour to clear out
1407_	12 00 AM	3 31 PM	M	I75 Northbound at Warren avenue an accident on the right shoulder is causing delays back to Mack
1416_	12 00 AM	6 39 AM	ICE	On I75 in both directions North of I696 watch for slippery conditions and minor accidents on the side of the road once you get south of that area you should be okay there
1417_	12 00 AM	6 51 AM	ICE	I75 slow in both directions North of about 8 mile due to slippery conditions also some spinout accidents in both directions look for slowdowns this morning
1419_	12 00 AM	4 33 PM	M	On I75 Northbound and 14 mile an accident on both shoulders is causing slowdowns it's 4 30 probably will take half hour to 45 minutes to clear that out
1420_	12 00 AM	5 15 PM	L	On I75 Northbound before 9 mile a disabled semi blocks the right center lane it's a little after 5 o'clock and looks like might take a while to get that out of there
1422_	12 00 AM	5 23 PM	M	On I75 Northbound before square lake road an accident blocks the right center lane look for backups in the area it's a little after 5 o'clock it will take half an hour or so to get those of to the side
1428_	12 00 AM	7 55 AM	H	I75 Southbound before Square lake road an accident blocks the center lanes it's about 7 45 looks like it's going an hour or so to get that out of the way
1438_	12 00 AM	7 54 AM	M	On I75 Southbound before 14 mile an accident on the left shoulder slowing traffic it's 7 45 it will probably take a half hour to 45 minutes to get that out of the way
1446_	12 00 AM	3 16 PM	M	On I75 Northbound before 12 mile an accident blocks the left and the center lanes it's slow from South of 696 it's 3 o'clock and will probably take half hour to 45 minutes to get that cleared out of the way
1802_	12 00 AM	5 12 PM	M	I75 Northbound and into 14 miles is closed enturely due to a police situation on 14 mile looks like it could be while before it is reopened its just before 5 o'clock look for delays in the area starting from I696 in the next few minutes

1803_	12 00 AM	8 06 AM	M	I75 Southbound just past 12 mules an accident blocks the right lane you'' find slowdown from about Rochester road it's about 7 45 and looks like it might take 45 minutes to get that cl
1804_	12 00 AM	6 58 AM	H	On I75 Southbound at Adams road a stalled vehicle blocks the right lane looks like that is going to be there through out the morning rush hour
1810_	12 00 AM	5 44 PM	L	I75 Northbound before 9 mule road an accident is on the left shoulder
913	12 00 AM	3 12 PM	Cons	I75 Northbound at 8 mule road, a patching crew blocks the left lane, expect delays
914	12 00 AM	3 40 PM	L	I75 Northbound ramp to I94 East, an injury accident slows travel
944	12 00 AM	5 07 PM	L	I75 Southbound near I696, accident left lane
945	12 00 AM	5 10 PM	L	I75 Northbound past Adams, an accident in the right lane slows travel
989	12 00 AM	3 39 PM	L	I75 Northbound at Holbrook, an accident blocks travel
991	12 00 AM	4 30 PM	L	I75 Northbound before 12 mule road, an accident on the left shoulder slows travel
1180	12 00 AM	8 22 AM	M	I75 at Square Lake, a brush fire in the area slows traffic in both directions

Appendix B

DIRECT INCIDENTS TRACKING

Incid	LOS	Date	Time	Drver	Veh.	Veh Type	AM	Prob	Active	Divert	Route	Speed	Len	Section
844	M	1/21/97	7:38:00 AM	334	72	Cellular		0	FALSE	No	I75 called (7:22 and before 7 times)	30	2	Livernois-Maple
				313	70	AHAR	760	0.62	TRUE	No	I75	30	2	Livernois-BigBeaver
				302	60	Control		0	FALSE	No	I75	20	3	Livernois-BigBeaver
				312	69	AHAR		0.62	TRUE	No	I75	20	3	Livernois-BigBeaver
				301	57	Control		0	FALSE	No	I75	20	3	Livernois-BigBeaver
				311	67	AHAR		0.62	TRUE	No	I75	20	3	Livernois-BigBeaver
				321	56	LPHAR		0.92	TRUE	No	I75	15	3	Livernois-BigBeaver
				344	121	RDS		1	TRUE	No	Rochester-I75	35	0.5	Rochester
854	ICY	1/23/97	7:00:00 AM	345	122	RDS		1	TRUE	No	I75S	35		
				324	63	LPHAR		0.92	TRUE	No	I75S	12		
				335	73	Cellular		1	TRUE	No	I75S called (7:13)	12		
				313	70	AHAR		0.62	TRUE	No	I75S	12		
				302	60	Control		0	FALSE	No	I75S	12		
				341	76	RDS		1	TRUE		Dequinder-Conant	12		
				333	68	Cellular		1	TRUE		12mileW-Telegraph-696E called (7:18)	12		
				342	77	RDS		1	TRUE		Ryan-8mile	12		
				312	69	AHAR		0.62	TRUE	No	I75S	12		
				321	56	LPHAR		0.92	TRUE	No	I75S	12		
				314	71	AHAR		0.62	TRUE		I75-Mound	10		
				303	62	Control		0	FALSE		Ryan	10		
				331	58	Cellular		1	TRUE	No	696E-I75 called (8:32)	10		
				343	78	RDS		1	TRUE	No	Mound-696E-I75	20		
863	L	1/23/97	5:04:00 PM	313	70	AHAR	950	0.62	TRUE	No	I75S	40	0.5	12mile-13mile
				324	63	LPHAR		0.92	TRUE	No	I75S	30	0.5	12mile-13mile
				312	69	AHAR	950	0 62	TRUE	No	I75S	30	3.5	696-14mile
				345	122	RDS		1	TRUE	No	I75S	35	3	696-13mile
				325	65	LPHAR		0.92	TRUE	No	I75S	35	3	696-13mile
				302	60	Control		0	FALSE	No	I75S	35		696-12mile
887	M	1/28/97	7:30:00 AM	314	71	AHAR		0.99	TRUE	No	I75S	10	1.5	6mile-Caniff
				333	68	Cellular		0	FALSE	No	I75S called (7:10 and 7:25)	15	1.5	6mile-Canif
				313	70	AHAR		0.99	TRUE	No	I75S	5	3.5	8mile-Caniff
				343	78	RDS		1	TRUE	No	I75S	5	5.5	696-Caniff
				301	57	Control	1610	1	TRUE	No	I75S	3	5.5	696-Caniff
				321	56	LPHAR		1	TRUE	Yes	I75S-8mileE-VanDyke South			
				342	77	RDS		1	TRUE	No	I75S	5	3.5	8mile-Caniff
				344	121	RDS		1	TRUE	No	U75S	5	6.5	10mile-Caniff
				331	58	Cellular	950	1	TRUE	?	SfldS-HWY10 called (8:10 & 8:25)	5	6.5	10mile-Caniff
				312	69	AHAR		0.99	TRUE	No	I75S	50		
				325	65	LPHAR		1	TRUE	No	I75S			
899	L	1/29/97	8:15:00 AM	345	122	RDS	950	1	TRUE	No	I75S	FF		
				334	72	Cellular		0	FALSE	No	I75S called (6:23 & 6:40)	FF		
				341	76	RDS		1	TRUE	No	696W-I75S			
				301	57	Control		0	FALSE	No	I75	27	0.5	7mile-6mile
				313	70	AHAR		0.99	TRUE	No	I75	28	0.5	7mile-6mile
				333	68	Cellular		0	FALSE	No	I75 called (7:16)	25	0.5	7mile-6mile
				312	69	AHAR	950	0.99	TRUE	No	I75S	20	3.5	696-6mile
				343	78	RDS		1	TRUE	No	696W-I75S	10	3.5	696-6mile
				311	67	AHAR		0.97	TRUE	No	I75S	10	3.5	696-6mile
				321	56	LPHAR	950	1	TRUE	Yes	I75S-8mileE-MoundS			
				314	71	AHAR		0.97	TRUE	Yes	9mile-I75S-6mileW-Davison-E-I75S	10	3.5	696-6mile
				302	60	Control		0	FALSE	No	I75S	10	3.5	696-6mile
				342	77	RDS		1	TRUE	No	8mileW-I75S	20	2	8mile-6mile
				325	65	LPHAR		1	TRUE	No	9.5W-I75S	20	3	9.5-6mile
				315	75	AHAR		0.97	TRUE	No	I75S	FF		
916	L	1/31/97	3:30:00 PM	315	75	AHAR		0.97	TRUE	No	I75N	FF		
				331	58	Cellular		0	FALSE	No	I75N no call	20	0.5	Warren-I94
943	L	2/5/97	8:17:00 AM	333	68	Cellular		0	FALSE	No	696E-I75S called (7:35)	34	3	696-8mile
				321	56	LPHAR	950	1	TRUE	No	I75S			
				302	60	Control		0	FALSE	No	I75S	15	4	11mile-7mile
				321	56	LPHAR		0.92	TRUE	Yes	I75S-8mileE-MoundS	15	4	11mile-8mile
				303	62	Control	760	1	TRUE		12mileW-I75S	10	4	696-7mile
				343	78	RDS		1	TRUE	No	696W-I75S	10	4	696-7mile
				314	71	AHAR		0.97	TRUE	No	696E-I75S	25	4	696-7mile
				325	65	LPHAR		0.92	TRUE	No	696E-I75S	35	3	696-8mile
				344	121	RDS	950	1	TRUE	No	I75S	FF		
				312	69	AHAR		0.97	TRUE	No	I75S	FF		
979	L	2/13/97	7:31:00 AM	313	70	AHAR		0.97	TRUE	No	I75S	30	3	Maple-12mile
				321	56	LPHAR	950	0.92	TRUE	No	I75S	30	3	Maple-12mile
				311	67	AHAR		0.97	TRUE	No	I75S	30	3	Maple-12mile

				301	57	Control	950	1	TRUE	No	I75S	FF		
				302	60	Control		1	TRUE	No	I75S	FF		
1140	H	3/4/97	3:48:00 PM	342	77	RDS	760	1	TRUE	No	I75S	FF		
				325	66	Control		0	FALSE	Yes	I75S			
1141	H	3/6/97	6:41:00 AM	324	63	LPHAR	1610	0.92	TRUE	No	I75S	3	10	Walton-Adams
				313	70	AHAR		0.62	TRUE	No	Lapeer-Opdyke			
				332	64	Cellular		1	TRUE	No	Lapeer-I75 called (6:54 & 7:22)	4	13	GiddingsRd-Adams
				301	57	Control	950	1	TRUE	No	I75S			
				312	69	AHAR		0.62	TRUE	No	I75S			
				301	57	Control	950	1	TRUE	No	I75S	15	13	GiddingsRd-Adams
				321	56	LPHAR	950	0.92	TRUE	No	Square Lake-I75	25	0 5	Square Lake-Adams
				302	60	Control		0	FALSE	No	Lapeer	25	13	GiddingsRd-Adams

Incid	LOS	Date	Time	Driver	Veh.	Veh Typ	AM	Prob	Active	Divert	Route	Speed	Len	Section
655	M	12/4/96	6:59:00 AM	231	58	Cellular		0	FALSE	No	I75 called (6:32)	25	0.5	Rochester
				203	62	Control		0	FALSE	No	I75	10	1.5	Livernois
				205	74	Control		0	FALSE	No	I75	7	2	Crooks
				215	75	AHAR		0.2	TRUE	No	I75	7	2.5	Big Beaver
				225	66	Control		0	FALSE	No	I75	12	2.5	Big Beaver
661	M	12/6/96	8:39.00 AM	215	75	AHAR	950	0.2	TRUE	No	Wattles-I75	45	0.5	Wattles
				235	73	Cellular	950	0	FALSE	No	I75 called (8:04)	18	1	Crooks
				233	68	Cellular		0	FALSE	No	I75 called (7:59)	18	1	Crooks
				225	66	Control		0	FALSE	No	I75-Crooks	20	1	Adams-Crooks
673	M	12/6/96	4.14:00 PM	212	69	AHAR		0.2	TRUE	No	I75			

Incid	LOS	Date	Time	Driver	Veh.	Veh Type	AM	Prob	Active	Divert	Route	Speed	Len	Section
844	M	1/21/97	7:38:00 AM	334	72	Cellular		0	FALSE	No	I75 called (7:22 and before 7 times)	30	2	Livernois-Maple
				313	70	AHAR	760	0.62	TRUE	No	I75	30	2	Livernois-BigBeaver
				302	60	Control		0	FALSE	No	I75	20	3	Livernois-BigBeaver
				312	69	AHAR		0.62	TRUE	No	I75	20	3	Livernois-BigBeaver
				301	57	Control		0	FALSE	No	I75	20	3	Livernois-BigBeaver
				311	67	AHAR		0.62	TRUE	No	I75	20	3	Livernois-BigBeaver
				321	56	LPHAR		0.92	TRUE	No	I75	15	3	Livernois-BigBeaver
				344	121	RDS		1	TRUE	No	Rochester-I75	35	0.5	Rochester
854	ICY	1/23/97	7:00:00 AM	345	122	RDS		1	TRUE	No	I75S	35		
				324	63	LPHAR		0 92	TRUE	No	I75S	12		
				335	73	Cellular		1	TRUE	No	I75S called (7:13)	12		
				313	70	AHAR		0.62	TRUE	No	I75S	12		
				302	60	Control		0	FALSE	No	I75S	12		
				341	76	RDS		1	TRUE		Dequinder-Conant	12		
				333	68	Cellular		1	TRUE		12mileW-Telegraph-696E called (7:18)	12		
				342	77	RDS		1	TRUE		Ryan-8mile	12		
				312	69	AHAR		0.62	TRUE	No	I75S	12		
				321	56	LPHAR		0.92	TRUE	No	I75S	12		
				314	71	AHAR		0.62	TRUE		I75-Mound	10		
				303	62	Control		0	FALSE		Ryan	10		
				331	58	Cellular		1	TRUE	No	696E-I75 called (8:32)	10		
				343	78	RDS		1	TRUE	No	Mound-696E-I75	20		
863	L	1/23/97	5:04:00 PM	313	70	AHAR	950	0.62	TRUE	No	I75S	40	0.5	12mile-13mile
				324	63	LPHAR		0.92	TRUE	No	I75S	30	0.5	12mile-13mile
				312	69	AHAR	950	0.62	TRUE	No	I75S	30	3.5	696-14mile
				345	122	RDS		1	TRUE	No	I75S	35	3	696-13mile
				325	65	LPHAR		0.92	TRUE	No	I75S	35	3	696-13mile
				302	60	Control		0	FALSE	No	I75S	35		696-12mile
887	M	1/28/97	7:30.00 AM	314	71	AHAR		0.99	TRUE	No	I75S	10	1.5	6mile-Caniff
				333	68	Cellular		0	FALSE	No	I75S called (7:10 and 7:25)	15	1.5	6mile-Canif
				313	70	AHAR		0.99	TRUE	No	I75S	5	3.5	8mile-Caniff
				343	78	RDS		1	TRUE	No	I75S	5	5.5	696-Caniff
				301	57	Control	1610	1	TRUE	No	I75S	3	5.5	696-Caniff
				321	56	LPHAR		1	TRUE	Yes	I75S-8mileE-VanDyke South			
				342	77	RDS		1	TRUE	No	I75S	5	3.5	8mile-Caniff
				344	121	RDS		1	TRUE	No	U75S	5	6.5	10mile-Caniff
				331	58	Cellular	950	1	TRUE	?	SfldS-HWY10 called (8:10 & 8 25)	5	6.5	10mile-Caniff
				312	69	AHAR		0.99	TRUE	No	I75S	50		
				325	65	LPHAR		1	TRUE	No	I75S			
899	L	1/29/97	8:15·00 AM	345	122	RDS	950	1	TRUE	No	I75S	FF		
				334	72	Cellular		0	FALSE	No	I75S called (6:23 & 6:40)	FF		
				341	76	RDS		1	TRUE	No	696W-I75S			
				301	57	Control		0	FALSE	No	I75	27	0.5	7mile-6mile
				313	70	AHAR		0.99	TRUE	No	I75	28	0.5	7mile-6mile
				333	68	Cellular		0	FALSE	No	I75 called (7:16)	25	0 5	7mile-6mile
				312	69	AHAR	950	0.99	TRUE	No	I75S	20	3.5	696-6mile
				343	78	RDS		1	TRUE	No	696W-I75S	10	3.5	696-6mile
				311	67	AHAR		0.97	TRUE	No	I75S	10	3.5	696-6mile
				321	56	LPHAR	950	1	TRUE	Yes	I75S-8mileE-MoundS			
				314	71	AHAR		0.97	TRUE	Yes	9mile-I75S-6mileW-Davison-E-I75S	10	3.5	696-6mile
				302	60	Control		0	FALSE	No	I75S	10	3.5	696-6mile
				342	77	RDS		1	TRUE	No	8mileW-I75S	20	2	8mile-6mile
				325	65	LPHAR		1	TRUE	No	9.5W-I75S	20	3	9.5-6mile
				315	75	AHAR		0.97	TRUE	No	I75S	FF		
916	L	1/31/97	3·30:00 PM	315	75	AHAR		0.97	TRUE	No	I75N	FF		
				331	58	Cellular		0	FALSE	No	I75N no call	20	0.5	Warren-I94
943	L	2/5/97	8:17:00 AM	333	68	Cellular		0	FALSE	No	696E-I75S called (7:35)	34	3	696-8mile
				321	56	LPHAR	950	1	TRUE	No	I75S			
				302	60	Control		0	FALSE	No	I75S	15	4	11mile-7mile
				321	56	LPHAR		0.92	TRUE	Yes	I75S-8mileE-MoundS	15	4	11mile-8mile
				303	62	Control	760	1	TRUE		12mileW-I75S	10	4	696-7mile
				343	78	RDS		1	TRUE	No	696W-I75S	10	4	696-7mile
				314	71	AHAR		0.97	TRUE	No	696E-I75S	25	4	696-7mile
				325	65	LPHAR		0.92	TRUE	No	696E-I75S	35	3	696-8mile
				344	121	RDS	950	1	TRUE	No	I75S	FF		
				312	69	AHAR		0.97	TRUE	No	I75S	FF		
979	L	2/13/97	7·31:00 AM	313	70	AHAR		0.97	TRUE	No	I75S	30	3	Maple-12mile
				321	56	LPHAR	950	0 92	TRUE	No	I75S	30	3	Maple-12mile
				311	67	AHAR		0.97	TRUE	No	I75S	30	3	Maple-12mile

				301	57	Control	950	1	TRUE	No	I75S		FF		
				302	60	Control		1	TRUE	No	I75S		FF		
1140	H	3/4/97	3:48:00 PM	342	77	RDS	760	1	TRUE	No	I75S		FF		
				325	66	Control		0	FALSE	Yes	I75S				
1141	H	3/6/97	6.41:00 AM	324	63	LPHAR	1610	0.92	TRUE	No	I75S		3	10	Walton-Adams
				313	70	AHAR		0.62	TRUE	No	Lapeer-Opdyke				
				332	64	Cellular		1	TRUE	No	Lapeer-I75	called (6:54 & 7:22)	4	13	GiddingsRd-Adams
				301	57	Control	950	1	TRUE	No	I75S				
				312	69	AHAR		0.62	TRUE	No	I75S				
				301	57	Control	950	1	TRUE	No	I75S		15	13	GiddingsRd-Adams
				321	56	LPHAR	950	0.92	TRUE	No	Square Lake-I75		25	0.5	Square Lake-Adams
				302	60	Control		0	FALSE	No	Lapeer		25	13	GiddingsRd-Adams

Incid.	LOS	Date	Time	Driver	Veh.	Veh Type	AM	Prob	Active	Divert	Route	Speed	Len	Section
1179	H	3/18/97	6:42:00 AM	432	64	Cellular	950	1	TRUE	No	Rochester, I75S called (7:06)	25	0.5	Rochester, I75S
				434	72	Cellular		1	TRUE	No	I75S called (7:13)	FF		
1184	M	3/20/97	7:09:00 AM	432	64	Cellular		0	FALSE	No	Rochester-I75 called 7:02)	13	0.5	Big Beaver-I75
				414	71	AHAR		0.62	TRUE	No	Rochester-I75S	10	1.5	Lvernois-
				443	78	RDS		1	TRUE	No	Rochester-I75	15	0.5	Big Beaver-I75
				434	72	Cellular		0	FALSE	No	I75S called (7:40)	FF		
				431	58	Cellular		0	FALSE	No	I75S called (8:02)	FF		
1186	M	3/21/97	8:38.00 AM	414	71	AHAR		1	TRUE	No	I75S	30	1	I94
				443	78	RDS		1	TRUE	No	I75S	30	1	I94
				435	73	Cellular		0	FALSE	No	I75S called (7:48)	30	1	I94
				434	72	Cellular		0	FALSE	No	I75S called (7:59)	30	1	I94
1224	VH	3/27/97	6:52:00 AM	431	58	Cellular		0	FALSE	No	I75S called (5:57)	FF		
				433	68	Cellular	950	0	FALSE	No	I75S called (6:53)	7	1	Adams
1242	M	4/2/97	6 48.00 AM	431	58	Cellular		0	FALSE	No	I75S called (5:53)	FF		
				413	70	AHAR		0.97	TRUE	No	I75S	FF		
				443	78	RDS	760	1	TRUE	Yes	Wattles, Rochester			
				445	122	RDS	950	1	TRUE	Yes	Livernois			
				434	72	Cellular		1	TRUE	Yes	Livernois called (7:33,7:39,7:55,8:16)			
					200	Spare		0	FALSE	No	Rochester, 12mile, I75S			
				444	121	RDS	950	1	TRUE	No	Dequinder, 14mile, I75S	FF		
1368	M	5/9/97	5:03:00 PM		200	Spare		0	FALSE		I75S,12mile	30	0.5	I75-12mile

Incid.	LOS	Date	Time	Driver	Veh.	Veh Type	AM	Prob	Active	Divert	Route		Speed	Len	Section
1179	H	3/18/97	6:42:00 AM	432	64	Cellular	950	1	TRUE	No	Rochester, I75S	called (7:06)	25	0.5	Rochester, I75S
				434	72	Cellular		1	TRUE	No	I75S	called (7:13)	FF		
1184	M	3/20/97	7:09:00 AM	432	64	Cellular		0	FALSE	No	Rochester-I75	called 7:02)	13	0.5	Big Beaver-I75
				414	71	AHAR		0.62	TRUE	No	Rochester-I75S		10	1.5	Lvernois-
				443	78	RDS		1	TRUE	No	Rochester-I75		15	0.5	Big Beaver-I75
				434	72	Cellular		0	FALSE	No	I75S	called (7:40)	FF		
				431	58	Cellular		0	FALSE	No	I75S	called (8.02)	FF		
1186	M	3/21/97	8:38:00 AM	414	71	AHAR		1	TRUE	No	I75S		30	1	I94
				443	78	RDS		1	TRUE	No	I75S		30	1	I94
				435	73	Cellular		0	FALSE	No	I75S	called (7:48)	30	1	I94
				434	72	Cellular		0	FALSE	No	I75S	called (7:59)	30	1	I94
1224	VH	3/27/97	6:52.00 AM	431	58	Cellular		0	FALSE	No	I75S	called (5:57)	FF		
				433	68	Cellular	950	0	FALSE	No	I75S	called (6:53)	7	1	Adams
1242	M	4/2/97	6:48:00 AM	431	58	Cellular		0	FALSE	No	I75S	called (5:53)	FF		
				413	70	AHAR		0 97	TRUE	No	I75S		FF		
				443	78	RDS	760	1	TRUE	Yes	Wattles, Rochester				
				445	122	RDS	950	1	TRUE	Yes	Livernois				
				434	72	Cellular		1	TRUE	Yes	Livernois	called (7:33,7:39,7:55,8:16)			
					200	Spare		0	FALSE	No	Rochester, 12mile, I75S				
				444	121	RDS	950	1	TRUE	No	Dequinder, 14mile, I75S		FF		
1368	M	5/9/97	5:03:00 PM		200	Spare		0	FALSE		I75S,12mile		30	0.5	I75-12mile

Incid.	LOS	Date	Time	Driver	Veh.	Veh Type	AM	Prob	Active	Divert	Route	Speed	Len	Section
1461	M	5/29/97	7:55:00 AM	534	72	Cellular		0	FALSE	No	I75S called (6:25)	FF		
				532	64	Cellular		0	FALSE	No	I75S called (7:08)	15	12	Livernois-Davison
				541	76	RDS		1	TRUE	No	I75S	15	12	Livernois-Davison
1476	L	6/3/97	7:55:00 AM	534	72	Cellular		0	FALSE	No	I75S called (6:23)	FF		
				541	76	RDS		1	TRUE	No	I75S	FF		
				532	64	Cellular	950	0	FALSE	No	I75S no call	20	3	Big Beaver-13mile
1488	M	6/6/97	6:44:00 AM	534	72	Cellular		0	FALSE	No	I75S called (6:40)	8	3	Davison-I94
				541	76	RDS		1	TRUE	No	I75S	8	3	Davison-I94
1503	L	6/10/97	7:19:00 AM	541	76	RDS		1	TRUE	No	I75S	10	3	10mile-7mile
				532	64	Cellular		0	FALSE	No	I75S called (7:11)	20	3	10mile-7mile
1505	Const	6/12/97	7:04:00 AM	534	72	Cellular		0	FALSE	No	I75S called (6:30)	18	2	9mile-7mile
				541	76	RDS		1	TRUE	No	I75S	18	2	9mile-7mile
				532	64	Cellular	760	1	TRUE	No	I75S called (8:05)	10	5	10mile-Davison
1510	Const	6/16/97	6:41:00 AM	534	72	Cellular		0	FALSE	No	I75S called (6:20)	20	1.5	9mile-8mile
				532	64	Cellular		0	FALSE	No	I75S called (6:10)	25	1.5	9mile-8mile
				541	76	RDS		1	TRUE	No	I75S	10	4	9mile-8mile
1521	Const	6/17/97	7:04:00 AM	534	72	Cellular	950	0	FALSE	No	I75S called (6:29)	15	4	9mile-Davison
				532	64	Cellular		0	FALSE	No	I75S called (6:44, 6:50)	15	4	9mile-Davison
				541	76	RDS		1	TRUE	No	I75S	15	7	10mile-Caniff
				515	75	AHAR		0.96	TRUE	?	696-Ryan-Davison-I75S	20	1	Davison-Caniff
1524	Const	6/18/97	6:42:00 AM	534	72	Cellular	950	0	FALSE	No	I75S called (6:39)	20	2	6mile-Caniff
				532	64	Cellular		1	TRUE	No	I75S called (7.29)	15	7	9mile-I94
				541	76	RDS		1	TRUE	No	I75S	10	7	9mile-I94
1530	VH	6/23/97	8:35:00 AM	541	76	RDS		1	TRUE	No	I75S	FF		
				532	64	Cellular		0	FALSE	No	Rochester-I75S no call	15	1	Big Beaver-Maple
1569	Const	7/11/97	7:02:00 AM	515	75	AHAR		0.97	TRUE	No	I75S	30	4	8mile-Caniff

Incid.	LOS	Date	Time	Driver	Veh.	Veh Type	AM	Prob	Active	Divert	Route	Speed	Len	Section
1606	M	8/7/97	8:21:00 AM	611	67	AHAR		0.97	TRUE	No	I75S	FF		
				631	58	Cellular		0	FALSE	No	I75S called (6.34)	30	3	8mile-Davison
				641	76	RDS		1	FALSE	No	696W-I75	30	3	8mile-Davison
				602	60	Control		0	FALSE	No	I75S	40	1	8mile-7mile
				621	56	LPHAR		1	FALSE	No	I75S	40	0.5	8mile-7mile
				614	71	AHAR		0.97	FALSE	No	I75S	45	0.5	8mile-7mile
				622	59	LPHAR		1	FALSE	No	I75S	40	1	8mile-7mile
				602	66	Control		0	FALSE	No	I75S	45	0 5	8mile-7mile
				612	69	AHAR		0.97	FALSE	No	I75S	20	2	8mile-6mile
				635	73	Cellular		0	FALSE	No	I75S no call	15	3	9mile-Davison
1681	M	9/5/97	7:48:00 AM	604	66	Control		0	FALSE	No	I75S	FF		
				624	63	LPHAR		0.92	FALSE	No	I75S	10	0.5	Big Beaver
				605	74	Control		0	FALSE	No	I75S	10	3	Wattles-BigBeaver
1710	L	9/11/97	6:43.00 AM	624	63	LPHAR		0.92	FALSE	No	I75S	20	2	7mile-Davison
				631	58	Cellular		1	TRUE	No	I75S called (7:55)	15	2	7mile-Davison
				601	57	Control		0	FALSE	No	I75S	10	2	8mile-6mile
				642	77	RDS		1	FALSE	No	I75S	10	2	8mile-6mile
				602	60	Control	950	1	TRUE	No	I75S	40	1	7mile-6mile
				643	78	RDS		1	TRUE	No	I75S	FF		
				641	76	RDS		1	FALSE	No	I75S	35	0.5	7mile-6mile
				635	73	Cellular	950	1	TRUE	No	I75S called (7:55)	35	1	7mile-6mile
				613	70	AHAR		0.97	FALSE	No	I75S	35	3	8mile-Davison
					200	Spare			FALSE	No	I75S	20	1	7mile-6mile
1725	Const	9/12/97	7:51.00 AM	624	63	LPHAR		1	TRUE	No	I75S	FF		
				631	58	Cellular		0	FALSE	No	696E-I75S call (6:52)	15	2	7mile-Davison
				621	56	LPHAR	1610	1	TRUE	No	I75S	15	2	7mile-Davison
				602	60	Control		0	FALSE	No	I75S	15	2	7mile-Davison
				642	77	RDS		1	TRUE	No	I75S	10	2	7mile-Davison
				612	69	AHAR		0.97	TRUE	No	I75S	10	2	7mile-Davison
				641	76	RDS		1	TRUE	No	I75S	10	2	696-Davison
				625	66	Control		0	FALSE	No	I75S	4	5	696-Davison
				613	70	AHAR	760	0.97	TRUE	No	I75S	5	5	11mile-Davison
				643	78	RDS		1	TRUE	No	I75S	8	6	11mile-Davison
					200	Spare			FALSE	No	I75S	8	7	12mile-Davison
				635	73	Cellular		0	FALSE	No	696-I75 called (7:49)	8	5	696-Davison
				634	72	Cellular		1	TRUE	No	I75S called (8:37)	8	7	12mile-Davison
1743	L	9/16/97	6:56 00 AM	631	58	Cellular	950	1	TRUE	No	I75S called (7:26)	8	1.5	7mile-Davison
				624	63	LPHAR		1	TRUE	No	I75S	8	1.5	7mile-Davison
				641	76	RDS		0	FALSE	No	I75S	8	1.5	7mile-Davison
				642	77	RDS	760	0	TRUE	No	I75S	9	2	7.5mile-Davison
				602	60	Control		0	FALSE	No	I75S	15	1	7.5mile-Davison
				614	71	AHAR		0.97	TRUE	No	696W-I75S	20	1	8miler-7mile
				612	69	AHAR	950	0.97	TRUE	No	I75S	20	1	8mile-7mile
				635	73	Cellular		1	TRUE	No	I75S called (7:26)	20	1	7.5mile-6.5mile
				613	70	AHAR	950	0.97	FALSE	No	I75S	25	1	7.5mile-6.5mile
				601	57	Control		0	FALSE	No	I75S	28	1	7.5mile-6.5mile
					200	Spare			FALSE	No	I75S	40	1	7.5mile-6.5mile
				644	121	RDS		0	FALSE	No	696W-I75S	30	1	7.5mile-6.5mile