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**A PUBLIC/PRIVATE SECTOR PARTNERSHIP  
TO PROVIDE TRAFFIC INFORMATION  
BY CELLULAR TELEPHONE REPORTS**

by

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Research Report 1941-1  
Research Study Number 7-1941  
Planning, Design, and Operation of Transportation Facilities in Houston—Phase II

Sponsored by

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TEXAS TRANSPORTATION INSTITUTE  
The Texas A&M University System  
College Station, Texas



## IMPLEMENTATION STATEMENT

This study has resulted in a number of valuable institutional, operational, and logistical lessons related to developing real-time travel information systems. The methodologies and procedures developed in the project for gathering, processing, and analyzing information were found to be effective. It further demonstrated that private citizens and the private sector will participate with public agencies in cooperatively administering transportation management programs.

The study purpose was not to promote cellular phone use as the primary tool for providing traffic data, but to present the cellular phone as the prototype and foundation for implementing a more cost effective technology (such as Automatic Vehicle Identification) in the corridor.



## **DISCLAIMER**

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation. It is not intended for construction, bidding, or permit purposes.

## ACKNOWLEDGEMENT

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- the 200 volunteer probes;
- Houston Cellular Telephone Company;
- Senterra Corporation;
- Metro Traffic Central;
- Shadow Traffic; and
- Infobanq, Inc.



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## **SUMMARY**

### **THE GOAL**

The goal of the study was to determine if a real-time travel information program could be established by forming a partnership between private citizens, private companies, and the public sector. The purpose was to provide timely information on the traffic conditions of the four roadways in the north corridor of Houston during peak period operation and to make this information available to the traveling public by way of radio reports (traffic service companies) and roadside changeable message signs. Motorists could then select a route that reduced their travel time.

### **STUDY AREA**

The three freeways (U.S. 59, I-45, Hardy Toll Road) in the study corridor are parallel and spaced such that they serve as alternate routes for each other. The High Occupancy Vehicle Lane on I-45 was also included in the program and identified as an alternate route for qualified motorists. Two hundred volunteer probes were used in the study. The recruiting criteria were that they must commute to or through the central business district during the peak traffic periods and travel through at least four of the seven predetermined station locations on each freeway. The probes were provided free cellular telephones and asked to make a brief report to the study office as they passed each station. The three commercial traffic service companies (Metro Traffic Central, Shadow Traffic, Infobanq, Inc.) provided operators and equipment at the study office to receive calls. The Houston Cellular Company provided free airtime for the use of the study telephone number at the study office.

### **OBJECTIVES**

Specific objectives of the partnership were:

1. Determine the variability of travel times of the three major freeway routes in the north corridor.
2. Evaluate the data reduction and processing requirements to provide the information to the users in a timely and effective format.
3. Evaluate the number of probes that are necessary to provide reliable and timely information for travel diversion in the corridor.
4. Determine the type and amount of data that needs to be collected from each of the probes to provide an accurate data base for travel diversion.
5. Assess the quality and quantity of in-vehicle information that is necessary to induce diversion to alternate routes.
6. Determine if low cost manual systems of surveillance are viable alternatives to more costly automated systems.

## **FINDINGS**

Results of the study are summarized as follows:

1. Travel time data collected was sufficient to provide reliable real-time information to the public during the commute time.
2. The study office was able to reduce and process the data in a timely manner. Information on the traffic condition of the freeways was faxed to the participating agencies and companies at fifteen-minute intervals during the peak traffic periods, and incident information was telephoned as soon as the reports were received.
3. It was determined that 200 probes was adequate to provide the needed peak period (approximately two hours) traffic information. However, the study was unable to obtain a sufficient number and uniform distribution of probes for the four hours of the AM and PM peak periods.
4. The data collected from the probes (travel speed and incident information) provided an accurate data base for travel diversion.

5. The quality and quantity of in-vehicle information necessary to induce diversion was not covered in depth in this study. Limited results indicated that individuals were reluctant to divert without receiving detailed information on the reason for the diversion (type of incident — major or minor, etc.).
6. The cellular telephone probe method was a successful, low cost, alternative for traffic surveillance for the short term. However, the low cost in this study is attributed to free airtime provided by a major cellular telephone carrier.

### **CONCLUSIONS OF THE STUDY**

1. Private citizens will participate in transportation management programs. The participation rate for the 200 probes over the one-year study period was over 80%.
2. The private sector participation through the three traffic service companies and cellular telephone company was successful. Two companies each provided an operator at the central control office. The third company provided computer equipment. The cellular telephone company provided free airtime for traffic reports by probes.
3. The use of cellular telephone was an acceptable and reliable source of real-time traffic information. There will be a place in future systems for the use of traffic reports from on-the-scene reporters, even though the determination of travel times will be accomplished automatically through traffic monitoring systems using advanced technologies such as Automatic Vehicle Identification (AVI) systems.





## INTRODUCTION

The historic nature of urban traffic operations has been one of increasing traffic demand and congestion as urban area population increases. The growth rate in traffic demand has been greater than the growth rate of population. The disparity in these growth rates has been attributed to increased per capita vehicle ownership and increased vehicle usage (e.g., more annual miles of travel per vehicle). In a similar manner, peak period traffic congestion tends to increase disproportionately to increases in traffic demand.

The traditional response by transportation agencies to increased traffic congestion has been to increase roadway capacity by construction of new highways. However, highway construction has always lagged behind need, even though federal and state funding increased significantly.

Passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) provided a new direction for transportation system development and operation in the United States. With completion of the Interstate Highway System, the focus of national transportation policy has shifted (with ISTEA) to multimodal approaches to efficiently utilize existing and upgraded facilities. One of the new programs included in ISTEA to address this new direction is the Intelligent Vehicle-Highway System (IVHS). This program provides research and implementation funding for application of advanced technologies to the operation of transportation systems. Thus, the new direction is away from continued construction of new highways and toward the improved operation of existing facilities and transportation services.

The essence of this program is to make significant improvements in mobility, highway safety, and productivity by improved transportation systems that apply advanced traffic control concepts, electronic technologies, and computer science.

The challenge of the IVHS legislation for major urban areas is to develop new approaches to minimizing peak period traffic congestion. One approach is to affect shifts in traffic demand in either space (route diversion), time (adjustments in time of departure), or travel mode (shifts to bus or carpool), based on receiving real-time information on travel conditions. To obtain the maximum benefits from IVHS, it is important to establish a close working relationship among the involved public agencies and private companies.

## **VALUE FOR REAL-TIME INFORMATION**

The predominate travel purpose during peak periods is the work trip. Drivers are typically keenly aware of peak period travel conditions, travel variability over time and available alternative routes, since this trip is made up to ten times per week. Many drivers are "finely tuned" in choosing their travel routes based on their knowledge of historic congestion patterns, information from radio traffic reports, and "cues" they receive by observing traffic during their trip.

Surveys have indicated the receptiveness of drivers to real-time information advising them of traffic conditions. A study in Seattle (1) found that only 23 percent of peak period drivers were unwilling to change departure time, route or travel mode. The other 77 percent were receptive to change, as follows:

- 21 percent willing to change route;
- 40 percent willing to change departure time and route; and
- 16 percent willing to make pre-trip changes in time, route, or mode.

The primary assistance which can be provided motorists for pre-planning or in-progress trip changes is meaningful, accurate, and timely information on travel conditions. The Houston joint public/private sector partnership determined that real-time reporting of travel times measured along the freeways would be the traffic information supplied to motorists in this demonstration project.

## **USE OF VEHICLE PROBES**

Recent developments in electronics and communications technologies have provided options for developing travel time data which were not previously available. Automatic Vehicle Identification (AVI) and Automatic Vehicle Location (AVL) systems have the potential for developing significant amounts of travel time data for driver information systems.

The AVI technology was favored for potential implementation on Houston freeways. With the AVI system, transponder-equipped vehicles (probes) would be automatically identified at specific reader locations to provide the system with vehicle identification, time of arrival, and location. With multiple reader locations along a route, accurate travel times and average speeds can be determined. However, the cost and time required for implementation of an AVI system suggested the use of another medium (cellular telephones) to test the efficiency and validity of the concept of providing real-time travel time data in a motorist information system.

This study implemented the vehicle probe concept of sampling freeway travel times. The medium used was the cellular telephone, which was considered sufficient in assessing the efficiency and validity of the vehicle probe approach.

## **STUDY PARTICIPANTS**

To encourage cooperative public/private relationships, the Houston office of the Texas Department of Transportation (TxDOT) organized a partnership of public agencies and private sector companies (Table 1). The companies selected would not only participate in discussions of IVHS needs and opportunities, but their individual company operations would benefit by having current traffic condition information on the freeways in the study area.

Table 1. Transportation Management Partnership	
Public Sector	Private Sector
City of Houston Aviation Department Police Department Transportation Department	Federal Express  Houston Lighting and Power Company
Harris County Metropolitan Transit Authority (METRO)	Metro Traffic Control
Harris County Toll Road Authority (HCTRA)	ATE Bus Lines
Texas Department of Transportation (TxDOT)	Shadow Traffic
Texas Transportation Institute (TTI)	Infobanq, Inc.

## PROJECT NEED AND PURPOSE

During subsequent partnership meetings, discussions centered around the need for real-time travel information on the freeways primarily during peak period operation. A consensus was developed to initiate a project using a technology that would track vehicles through a corridor in a manner so that travel times could be monitored in real-time. The travel time information could then be provided to motorists to assist them in trip route and time decisions. Automatic Vehicle Identification (AVI) and Automatic Vehicle Locator (AVL) systems were considered the best technologies, but a technique using manual data collection and transmission was selected to meet the requirement for early implementation. A study format was developed which was based on using citizen volunteers who would serve as traffic reporters or "probes" during their commute trips to and from work in or near the central business district. The probes would make their reports by cellular telephone provided by the study. The study proposal is contained in Appendix A and provides a discussion of the project concept and study process.

The purpose of the study was to provide timely information on the traffic conditions of the freeways during peak periods of operation. The study office would monitor the traffic conditions and relay this information to motorists by commercial radio and TxDOT's variable

message signs. This would enable motorists to alter or select a route that reduced their travel time. TxDOT provided funding and TTI conducted the study.

## **STUDY AREA**

The North Houston Corridor (Figure 1) was selected as the study area because of the close proximity of three parallel freeways within its boundary and the ability for traffic diversion based on the flexibility of routing. They are I-45 (North), Hardy Toll Road, and U.S. 59 (Eastex). The HOVL on I-45 was also included in the study. There were several factors that favored the selection of this corridor:

- The three parallel freeways are spaced such that they can serve as alternate routes for each other.
- The U.S. 59 Eastex Freeway was scheduled for reconstruction, starting in 1992, and the installation of a traffic management system would not start until the construction activities were completed in three to four years.
- There were eight electronic variable message signs installed within the corridor, providing traffic diversion potential. These signs were installed by TxDOT with funding assistance from the Harris County Toll Road Authority (HCTRA) who operates the Hardy Toll Road.
- The traffic management system being installed on I-45 North Freeway was not scheduled to be operational for two years. No immediate traffic management or monitoring systems were planned for the Hardy Toll Road.
- The North Houston Corridor serves several major activity centers including:
  - Houston Intercontinental Airport;
  - Woodlands and Kingwood residential communities;
  - Downtown Houston and the Greenway Plaza employment centers; and
  - Texas Medical Center.
- The North Houston Corridor carries a high volume of commercial traffic.

# NORTH HOUSTON CORRIDOR

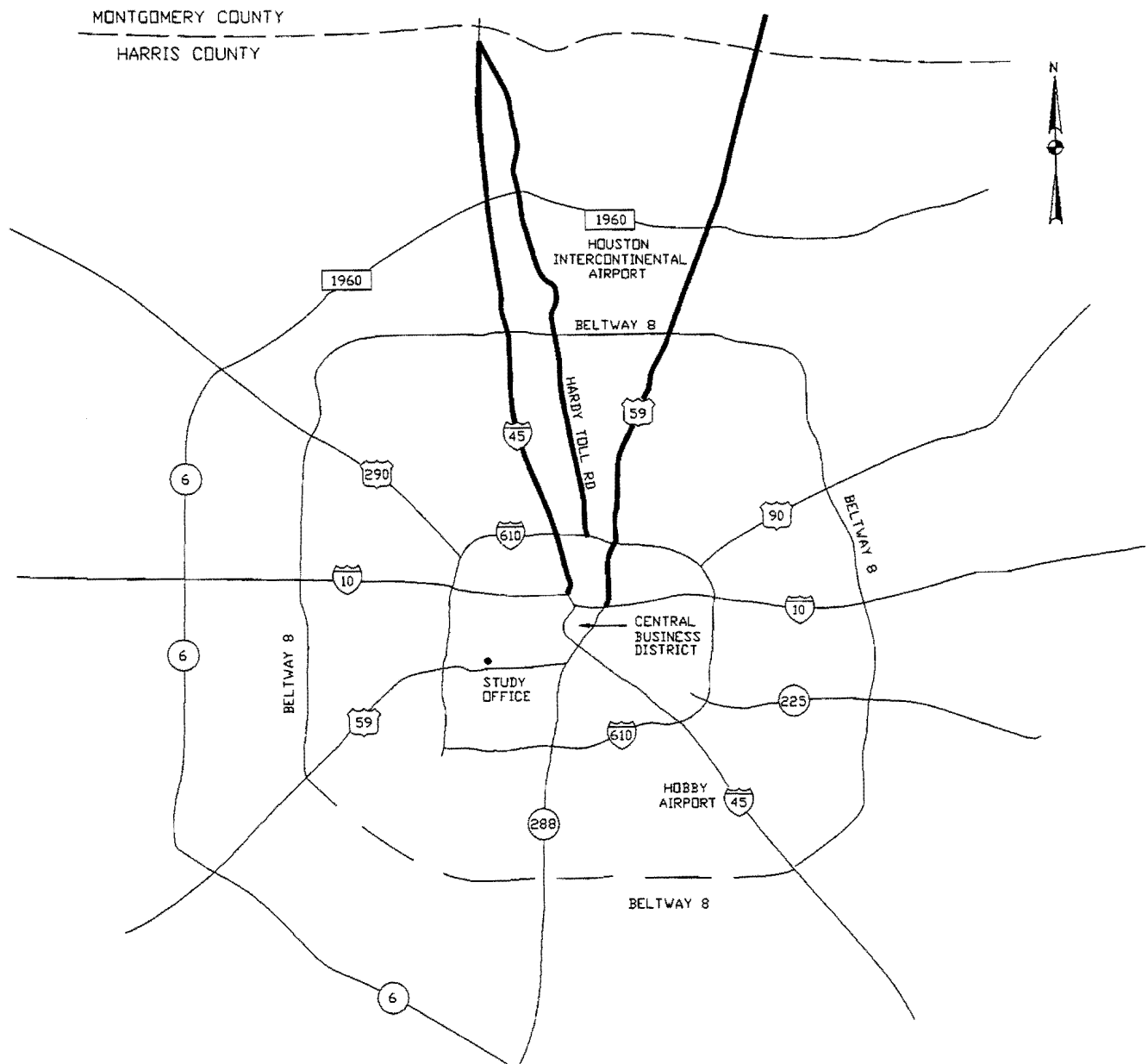


Figure 1

## **STUDY ORGANIZATION**

The study was designed as a one-year demonstration of the concept of collecting travel time and freeway incident data and providing this real-time information to motorists in the corridor. The use of cellular telephones as the reporting/data collection method was used as a functional prototype before implementation of an AVI system. The project was approved and TTI began the study in early 1991.

### **CELLULAR TELEPHONE SYSTEM**

TTI conducted a one-week pilot project using TTI and TxDOT employees to determine the number of volunteers (and cellular telephones) needed to provide an acceptable level of real-time travel information in the corridor. The demonstration project determined that 200 volunteers, assigned proportionally to the four roadways, would provide an acceptable measure of real-time data within the constraints of the budget.

An important consideration in structuring the study was the cost of telephone airtime. The probes would be making between ten and fourteen calls a day to the study office. Cellular telephone companies require a minimum one-minute charge per call. Using an average cost of \$0.30 per call, this projected to a total cost of \$180,000 for the one-year study which exceeded the budget. In order to move forward within the established budget, it was necessary to enlist the participation of a cellular telephone company to provide free airtime for the calls.

The two cellular telephone companies in Houston were contacted to determine their interest in participating in the study. Houston Cellular Telephone Company, which is active in community affairs and which presently provide free cellular telephone airtime for the Motorist Assistance Program (MAP), responded affirmatively, and discussions for an agreement were held.

Key points that were presented to Houston Cellular were as follows:

- The calls would average ten seconds, except for incident reports.
- Two hundred new cellular telephones would be purchased.
- The monthly access charge for the 200 telephones would be paid to Houston Cellular by the study.
- Houston Cellular would benefit from acquiring 200 new subscribers.

Houston Cellular agreed to provide the free airtime under these conditions with the stipulation that each participant be required to sign a contract with Houston Cellular for any personal airtime charges. Houston Cellular explained this was necessary because after the telephones were activated, they could not limit calls to the study office number only. A mutual agreement was reached between TTI and Houston Cellular based on these terms.

TTI developed specifications for the purchase of 200 telephones, and received bids from four local companies that were affiliated with Houston Cellular. American Cellular won the award for providing the 200 units, with installation and maintenance for a one-year period. The terms of the bid are provided in Appendix B.

## **DATA REQUIREMENTS**

Data requirements for determining travel times were the time of day, vehicle identification, and the vehicle location recorded at intervals of three or four miles on the four roadways. The study length from the central business district for the four roadways is approximately 20 miles (32 km) for I-45 (North) and U.S. 59 (Eastex), 17 miles (27 km) for the Hardy Toll Road, and 10 miles (16 km) for the High Occupancy Vehicle Lane (HOVL) on I-45 (North). The study design established seven stations on I-45 (North) and U.S. 59 (Eastex), six stations on Hardy Toll Road, and four stations for the HOVL. The expected average time interval (headway) between probe vehicles was five minutes over the three-hour commute time periods, and two to three minutes during the critical peak periods. The challenge to the study staff, in order to meet these criteria, was enlisting the participation of 200 volunteers for the one-year study.



Before enlisting volunteers, the study staff established the requirement that in order to qualify for the study, persons must travel within this corridor to or through the central business district and report at a minimum of four stations. Persons could alter their routes within the corridor, i.e., travel on one of the roadways to work and on another from work, but reporting on the roadway they were traveling.

## **ENLISTMENT OF VOLUNTEERS**

The process of locating potential volunteers began by corresponding with large employers in the central business district. In the correspondence (Appendix C), the study staff described the project and asked permission to contact their employees through a company representative. Several company officials were apprehensive, thinking the company was going to be asked to contribute to the funding of the project. Apparently, major companies receive numerous requests for funding assistance from various private organizations. One company only participated after having one employee sign up for the program to see if the benefits promised were delivered. The company then agreed to notify their employees about the project.

Following consent of a company, study staff met with the employees during their lunch hour and explained the project. Some of the companies, agencies, and groups that participated in the program included the Exxon Corporation, First City Bank, Houston Medical Center, and TxDOT. Many individuals contacted the study office, after learning of the project from friends that had signed up. An advertisement for volunteers was also placed in both the Houston Post and Chronicle (Appendix D).

### **Initial Enlistment**

In the meetings that were held at the various companies, the study staff distributed a one-page handout describing the project (Appendix F) along with a sign-up card (Appendix G). The Exxon Corporation developed notices (Appendix H) that were placed on their bulletin boards and displayed through their computer system. The sign-up card identified the participants, their normal route of travel, point of entry, and estimated time of entry onto the roadway. This

information was used by the study staff to prepare the participation list. It was not required that the participants identify their employers, and several elected not to do so.

Even though most participants were contacted through their employers, the study staff emphasized to these individuals that it would be a voluntary effort on their part, totally separate from the company. They were reminded that they would not be rewarded by their company if they participated nor would they be penalized if they did not. At the presentations, the study staff appealed to their sense of civic duty to help address the traffic congestion problem, and also pointed out that the project offered real incentives to them for their time and effort in participating in the study. The incentives were:

- A quality cellular telephone (Motorola Model MC310 or NEC Model 3800 in the installed or transportable model), which they could keep following the completion of the study.
- Free installation.
- Free monthly access charges for one year.
- Free airtime for traffic related calls.
- Government rates for airtime charges for personal calls.

### **Agreement with Volunteers**

Recognizing that people do not travel to work each weekday for one year, the project established a 75 percent participation goal. The 75 percent goal provided for holidays, vacation, and sick leave. The volunteers were asked to sign an agreement (Appendix E) that they would participate at this level for the one-year study. In return, they would benefit from the incentives and, upon completion of the study, would be given the cellular telephone.

The agreement was non-binding from a legal standpoint. It was an effort by the study staff to stress to the individual that a firm commitment to the study was needed. Volunteers were also advised that if, for any reason, they did not want to or could not continue in the study, all they had to do was return the cellular telephone and the agreement was cancelled. They were also told that in case of job transfers, they could return the telephone or purchase the telephone from TTI at the bid price. Two individuals exercised this option during the course of the study. Cellular telephones that were turned in were reissued to other volunteers to maintain the coverage. Of the original 200 volunteers, 178 completed the study.

American Cellular Telephone Company, an agent for Houston Cellular, was the low bidder to provide the cellular telephones. An individual had the option of a hands free installed model or transportable model. The study office stressed the installed model because of the safety aspect, but only 57 participants selected the installed model while 143 opted for the transportable. Most people wanted the flexibility of moving the telephone from vehicle to vehicle. This also enabled persons in carpools to participate. Each carpool was provided one telephone. The carpoolers selected which person would be assigned the telephone.

A policy was developed to address stolen telephones. TTI would replace a stolen telephone one time at no cost to the participant. If a telephone was stolen a second time, it would be the responsibility of the participant to replace it. Two transportable telephones were stolen and replaced during the course of the study.

### **Requirement for Credit Check**

One unexpected problem in volunteer recruitment was a credit rating check required by Houston Cellular for each participant because of personal airtime charges. If an individual had a poor credit rating, Houston Cellular required a \$300 deposit. Each potential participant was advised of this requirement during their interview and most stated that they were confident that their credit rating was satisfactory. This proved not to be true and resulted in the need to process 301 applications in order to obtain 200 participants. No individual with a poor credit rating elected to place the \$300 deposit in order to participate. The credit check requirement

delayed the recruitment of the 200 participants. The delay was compounded by the decision to wait until each application was processed before seeking other potential participants. Many individuals did not submit their applications and yet would tell the study staff they had.

The decision to limit the list of applicants to exactly 200 was based on the enthusiastic response of the individuals to participate in the program and the reluctance of the study staff to call a qualified participant and tell them they were not needed. In retrospect, the project would have been better served by advising potential participants that selection would be on a first come, first serve basis and continuing to advertise for volunteers. This was eventually done as word of the project spread. People who called after the original 200 participants were selected were advised that their names would be placed on a list as replacements if a participant dropped out of the project. These replacements would then participate for the remainder of the original one-year contract and keep the telephone at the end of the study.

## **EXPERIENCE WITH VOLUNTEER PARTICIPATION**

During the course of the study, six individuals discontinued making traffic reports and efforts to contact them were unsuccessful. The study staff was able to determine their continued personal use of their cellular telephone through Houston Cellular. The policy established to address this problem was to send a series of three letters to the individual (Appendix I). If there was no response from the first two letters, the third letter advised that telephone service was being terminated and asked that the cellular telephone be returned. None of the six returned their telephones. It was decided that no legal action would be taken against these individuals nor would the study office report them to the credit bureau. The loss of these telephones was considered part of the cost of conducting the study. Six new telephones were purchased and assigned to replacement participants. Handling these situations required a cooperative relationship between the study office and Houston Cellular. These six individuals were paying their personal airtime charges on time and were considered good customers by Houston Cellular.

Later in the study, Houston Cellular asked permission to stop service to a participant because of lack of payment for personal airtime charges. The study office agreed, although this

individual had an excellent rate of participation in the study. He cleared up his late charges with Houston Cellular and went on to complete the study.

Two participants developed serious illnesses shortly after beginning the study and one participant died during the one-year study period. Family members were not aware of their involvement in the study and upon contact by the study office, returned the telephones and cleared their accounts with Houston Cellular.

The study staff considered it necessary to keep the participants informed as to the progress of the study. A monthly newsletter (Appendix J) was prepared and mailed to each participant. The newsletter contained general information regarding progress of the study, billing information, and other information. Each individual's participation rate for that month, on a personal basis only, was sent with the newsletter. The newsletter was well received by the participants and served the important function of maintaining contact during the study.

Upon completion of the one-year study, each participant was presented a certificate of achievement. Participants were also advised through correspondence that the cellular telephone was now their property. They were told of the upcoming Automatic Vehicle Identification (AVI) program and invited to participate.



## STUDY OPERATIONS

This section discusses project operations and the field and office procedures used to assemble, analyze, and disseminate travel time as well as incident data.

### TIME DISTRIBUTION OF PROBES

One consideration in recruiting the 200 volunteers was the distribution of trips by time of day and roadway normally travelled. The distribution of the probes by time of day and by roadway are provided in Table 2. It was difficult to enlist persons for some time periods and roadways. The hourly distribution of probes that traveled to work in the AM is somewhat disproportionate to the PM return trips. This is attributed to people leaving for work earlier to avoid heavy traffic, eat breakfast, or for other reasons. However, there appears to be a tendency to leave work promptly at the end of the normal work day.

The distribution of probes by roadway was proportionate to traffic volumes on the roadways. As volunteers were recruited, an effort was made to maintain this proportional distribution.

Table 2. Probe Distribution by Time of Day and by Roadway			
Distribution by Time of Day			
AM	Number	PM	Number
6:00—7:00	106	3:00—4:00	18
7:00—8:00	73	4:00—5:00	58
8:00—9:00	18	5:00—6:00	89
9:00 -10:00	3	6:00—7:00	35
Distribution by Roadway			
Roadway		Number	
I-45 (North)		95	
I-45 HOVL		14	
Hardy Toll Road		20	
U.S. 59 (Eastex)		<u>71</u>	
Total		200	

## **REPORTING PROCEDURES**

After the participants (probes) received their cellular telephones, they were mailed an instructional packet (Appendix K) that included the following:

- A map of the corridor for both the AM and PM operation identifying the station numbers and location.
- Procedure for placing calls to the central control center.
- A drawing of the station signs.

The station locations were placed at or near major thoroughfare crossings to provide the probe with a physical identification point. The blue-on-white roadside station signs were placed to both identify the station number and to remind the probe to make the call.

Probes were instructed to make a brief report at each station giving their identification number and station location. This usually took five to ten seconds. They were also asked to report any incidents or accidents they encountered. An incident was described as anything that was impeding the flow of traffic on the mainlanes. This could include a stalled car, flat tire, debris, or other. They were asked to report if assistance was being provided (e.g., police officer, wrecker). If no assistance was present, the center operator would notify the MAP dispatcher of the incident.

### **False Incident Reports**

There were cases of false incident reports being given to the center. Reports were confirmed as false when a probe (or someone) reported an incident and closely following probes (2-3 minutes) reported that the roadway was clear. This happened several times and was baffling to the study staff. These possibilities were considered:

- A probe identifying a wrong roadway.



- A disgruntled person who had been turned down for the study.
- Someone with their own personal cellular telephone, who was familiar with the study, playing a prank.

The probes whose identification numbers were used in these false reports were not contacted for an explanation. This could have resulted in upsetting an innocent person and accomplish nothing in trying to resolve the question. The problem of false reports was discussed with all probes by an article in the monthly newsletter, which suggested that the instigators were probably outside sources. However, the article cautioned probes to take extra care to ensure the accuracy of incident reports. False reports were received throughout the study, but were few in number.

### **Route Changes**

The probes were asked to notify the center if they were taking another roadway within the corridor, if they were leaving the roadway system completely, or if they were going to make a stop on their usual route. If they were going to make a stop, they were asked to notify the center when they were leaving the roadway and again when they reentered. The computer program could not correct travel times for this, but it did allow the operator to manually correct the travel time data before distribution.

Probes were reminded that during their commute to work, their first obligation was to their employer to get to work on time. They were not expected to remain on their normal commute route in order to make their reports if that roadway was experiencing heavy congestion. In fact, they were encouraged to benefit from the study just as any other motorists.

### **Safety**

Personal safety of the probes was a major concern of the study staff. They were told not to call in their report if the traffic situation was such that their safety and the safety of other motorists would be placed in jeopardy. The probes were asked to spend a week familiarizing themselves with the station locations and practicing using the telephone before beginning to make

official reports to the center. There were no reports of accidents by the probes during the one-year study.

## **STUDY OFFICE OPERATIONS**

The study office, located in Greenway Plaza, was the focal point for receiving and disseminating travel information. Senterra Development Corporation provided office space at cost. The study office was equipped with six computers, printers, and fax machines (Figure 2). TxDOT's interim central control facility was located adjacent to the study office. TxDOT used the real-time information to operate the variable message signs. TxDOT staff also dispatched the Motorists Assistance Program (MAP) vans and emergency vehicles to incidents as reported by the probes.

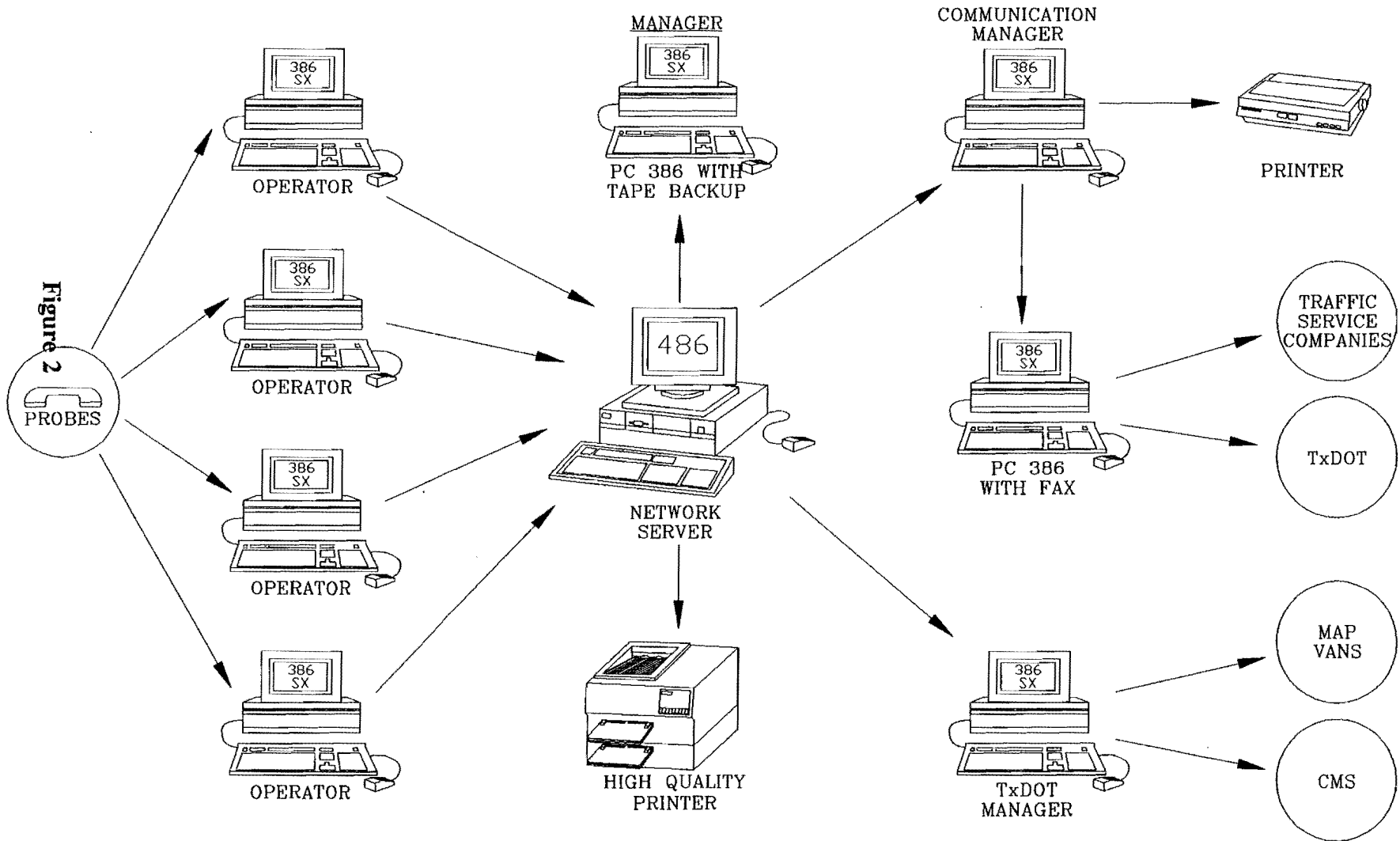
The study office was staffed with three operators. Two of the operators were provided by two of the three traffic advisory services, Metro Traffic and Shadow Traffic. The third operator was provided by the study office. A third traffic advisory service, Infobanq, provided equipment in lieu of personnel support. Supervision of the control center was provided by TTI. Personnel that staffed the study office were required to work both the AM and PM periods. This split shift operation of the personnel worked well. There was minimal turnover of operators during the one-year study. The study office was operational from 6:00—10:00 a.m. and 3:00—7:00 p.m. daily during weekdays only.

When an employee of either Metro or Shadow Traffic was absent due to illness or vacation, the companies would attempt to provide a replacement. Due to their work load, they were sometimes unable to do this. In such situations, a TTI employee would substitute.

The telephone calls from the probes were received by the three operators who input the information directly into the computer system. This provided for travel times to be computed on the freeways immediately. The probes also reported incidents and accidents. All data was faxed to the traffic service companies and other participating companies every fifteen minutes. A sample travel time and incident report is provided in Figure 3.

# STUDY OFFICE OPERATIONS

(LAN - Token Ring Topology Running Netware 3.11)



**SAMPLE TRAVEL TIME SUMMARY AND INCIDENT REPORT**

<b>TRAVEL SUMMARY FOR 21 JULY 1992 AT 4:45 P.M.</b>					
<b>Roadway</b>		<b>Distance (miles)</b>		<b>Travel-Time (min)</b>	
North Freeway (I-10 to Holzwarth)		19.5 (31.4 km)		28.9	
North Freeway HOV Lanes		10.8 (17.4 km)		14.4	
Hardy Toll Road (No. Toll to 1960)		16.8 (27.0 km)		17.0	
Eastex Freeway (I-10 to FM 1960)		16.5 (26.6 km)		28.4	
<b>INCIDENT INFORMATION</b>					
<b>Time Reported</b>	<b>Freeway</b>	<b>Cross Street</b>	<b>Type</b>	<b>Comments</b>	<b>Status</b>
1.16:35	59/NB	Laura Koppe	Accident	2 cars blocking left lane	HPD on scene

**NOTE:** This travel time and incident information is automatically faxed every 15 minutes. If you fail to receive any fax, please contact us at 840-9470.

**SOURCE:** Texas Transportation Institute  
3800 Buffalo Speedway  
Phone: 840-9470

**Figure 3**

## STUDY RESULTS

This one-year study has resulted in a number of valuable institutional, operational, and logistical lessons related to developing real-time travel information systems. The project also served as a prototype system for later full-scale implementation of AVI technology for measuring actual vehicle travel times. Importantly, the project demonstrated the viability of a public/private partnership in cooperatively administering and controlling a sustained operation.

Key results of the project have been divided into two areas and include the following:

### Organizational

- A public/private sector partnership, involving seven public and six private organizations, worked together effectively for a sustained period of time.
- Public/private involvement is predicated upon each organization's responsibilities and/or its own "enlightened self interest."
- Use of citizen volunteers was an effective approach to operating "probes." However, the continuing management and administrative effort was necessary throughout, to keep sufficient level of involvement.
- Estimated summary cost of project was:

— Capital Costs	\$ 47,000
— Operating Costs	\$426,000

(Includes private sector in-kind donations of \$346,000.)

### Technical

- The cellular telephone approach is an acceptable and reliable means for communicating travel time information.
- The vehicle probe concept was shown to be an accurate method of obtaining real-time travel time data, with 200 probes found adequate for this pilot study area.

- Methodologies and procedures developed in the project for gathering, processing, and analyzing information were found to be effective.
- The computer system architecture and software were effective and will be used for the full-scale AVI application.
- Importantly, the project served as an effective prototype and foundation for implementation of AVI technology in the corridor.

## REFERENCE

1. Haselkorn, Mark, Woodrow Barfield, Jan Spyridakis, Brian Goble, and Margaret Garner. "Traffic Reporter: A Real-Time Commuter Information System." *Proceedings of the Second International Conference on Applications of Advanced Technologies in Transportation Engineering*. American Society of Civil Engineers. New York, NY, 1991, pp. 26-30.





**APPENDIX A**

**Proposed Use of Personal Vehicles as Roving Sensors**

## **PROPOSED USE OF PERSONAL VEHICLES AS ROVING SENSORS**

It is proposed that commuters using the I-45 North Freeway/U.S. 59 Eastex Freeway Corridor be enlisted to serve as roving sensors (probes) of traffic conditions for the demonstration project on real-time transportation information for Intelligent Vehicle Highway Systems. The purpose would be to obtain travel time information on alternate routes and to detect and locate traffic incidents that would significantly increase travel times during the peak periods. Information from the commuters engaged in the collection of traffic conditions would be transmitted to a central office for processing, and the resultant information be made available to the public and/or specific agencies in various forms for various applications. The primary purpose of this exchange of information is to permit the users of the freeways, transitways, and arterial streets to select the route that provides the best travel times through the corridor.

## **CELLULAR TELEPHONE/RADIO VOICE COMMUNICATION**

The first phase of this demonstration project proposes to use voice communication to transmit the information from the vehicles to the central office. The radios or cellular telephones would be used to simulate the collection of data by an automated system that would use automatic vehicle identification and location devices and a computer monitoring system.

### **Objectives**

This study would accomplish several objectives.

1. Determine the variability of travel times by the three major freeway routes in the study corridor.
2. Evaluate the data reduction and processing requirements to provide the information to the users in a timely and effective format.
3. Evaluate the number of probes that are necessary to provide accurate and timely information for travel diversion in the corridor.
4. Determine the type and amount of data that needs to be collected from each of the probes to provide an accurate database for travel diversion.
5. Determine if low cost manual systems of surveillance are viable alternatives to more costly automated systems.

### **Study Procedures**

Persons who have radios or telephones that can be used to transmit travel information to a central office will be contacted to participate in the demonstration project for a specific length of time. A three to six month trial period is proposed for initial study. Potential participants include:

- GLK Drivers operating from the park and ride facilities in or near the study area.
- Commuters that live north of the City and work in the Central Business District or Greenway Plaza.
- Selected persons working for transportation agencies, such as the City, METRO, County, and State that travel the study corridor during the peak periods.

At least 200 persons should be enrolled in the project to provide the coverage and frequency desired.

### **Information Transmitted**

Each person will be assigned an identification number. The person will call the central office at preassigned locations and report the following: identification number, location number, time of day, if different from current time. Each person will be asked to call the central office whenever an incident is observed that will cause delay to traffic. For these cases, the person reports the following: identification number, location of incident type of incident, and time of day, if different from current time. The objective of the format for transmission of information is to reduce the amount of airtime required. If the call can be completed within one minute of the time required, then the person would not have to state the time to the central operator.

There is other information that is desired in the control center: the location when traffic speeds drop below 30 miles per hour and the location when traffic speeds resume to above 40 miles per hour. It may be difficult to obtain this information from all of the probes, but a selected number may be asked to provide this additional information.

### **Central Office Operations**

Several operators will man the telephones and radios to receive and record the information transmitted by the probes. In a three hour peak period, with 200 vehicles traveling through the corridor, each vehicle would generate an average of five calls or a total of 1,000 transmissions. If each call requires 15 seconds for processing, the total transmission time would be 250 minutes of airtime over a three-hour period. With a four telephone system and with 20 percent of the calls made on radio, the total per operator would be approximately 50 minutes of airtime over a 180 minute period, but with a peaking of 60 percent during one hour. That is, 30 minutes of airtime during the peak hour per operator.

With some experience and diligence by the drivers and operators, the time required for transmission can be five to ten seconds. For example, a typical call from a driver on the North Freeway would be: N26—L1—8:36, meaning North Freeway driver number 26 at Location 1 at 8:36. If we can drop the time reading, the message can be delivered in a very short time, and confirmed by the operator. The time required for the report of an incident is expected to take a longer time of transmission.

The operators will enter the information into a computer database that will compute the average speeds and travel times for the various roadway segments and total trip paths through the study corridor. The data will be formatted in graphical and tabular forms for study.

## **Evaluation**

The output of the travel time information will be inputs to programs to study the impact of diverting traffic from one route to another. The amount of time saved will be applied to the number of vehicles that would be able to take advantage of the diversion to determine the total travel time savings.

## **AUTOMATED VEHICLE IDENTIFICATION/LOCATION SYSTEMS**

The second phase of the study proposes to automate the transmission of information concerning the vehicle identification, location, and time. The same information as transmitted before to the central office operator would be put into the computer direct for the processing of travel times and speeds. For special information concerning the locations and types of incidents, either special digital codes or voice communications could be used.

### **Types of AVI/AVL Systems Available**

There are a number of technologies that could be employed to provide the type of information requested of this study: Global Positioning System (GPS), LORAN C Systems, Dead Reckoning/Map Navigation, Roadside Reader/Transponder. Most of these systems will provide more information, more often than the manual system could, but a higher cost. Some systems require an expensive device to be installed on the vehicle, while others require expensive devices to be installed outside of the vehicle.

There are questions of reliability, accuracy, and maintenance and operation costs that need to be answered before determining the type of system to be deployed. Many of the systems have not been applied with the same requirements of this project. Others have not been fully field tested in the urban environment.

It is proposed that companies with equipment for AVI and AVL be invited to submit letters of interest for providing a system with their technology to track up to 100 vehicles at one time, with new information on locations and identifications every five minutes for each vehicle. The system would consist of instrumentation of at least 300 different vehicles, with expansion capabilities to 1,000 or more. These numerical requirements would be subject to change depending on the experience of Phase 1 of the study, the scope of the demonstration project, and the outlook for funding.

For those companies that submit a letter of interest and adequate supporting documentation, a pre-bidders conference would be held with the committee to enable the suppliers of the equipment to discuss and explain their systems.

### **Potential Funding Sources**

It would appear that a project to equip 300 vehicles with automated sensor systems to cover three or more freeways, 20 miles long, would be expensive and that several funding sources may be required. Some funding sources that have been suggested include:

Energy Funding

METRO

State (TxDOT through 3-G funds, research, Interagency)

State Construction Funding—U.S. 59 Eastex Reconstruction

Private Sector Participation

Commercial Interests



**APPENDIX B**

**Terms of Cellular Telephone Bid**

## TERMS OF THE CELLULAR TELEPHONE BID

Terms of the bid for the cellular telephones which American Cellular will provide are:

- \* Houston Cellular Rate Plan 26
  - Monthly Access Charge \$27.00 per month
  - Peak Period Usage 7 a.m.—7 p.m. 0.27 per minute
  - Off Peak Usage 7 p.m.—12 p.m. 0.16 per minute
  - Night Usage 12 p.m.—7 a.m. 0.05 per minute
  - Wide Area Access Charge 2.75 per month
  
- \* 200 cellular telephones installed \$95.00 each
  - Motorola MC 310 or
  - NEC 3800
  - Hands free installed or the transportable model.

Houston Cellular Telephone Company will provide free airtime for calls made to the study number.



**APPENDIX C**

**Letter to Major Employers**

## TRAVEL TIME DEMONSTRATION PROJECT

The Texas Department of Transportation (TxDOT) is presently studying various transportation management systems to more effectively maintain traffic flow on our freeways and transitways.

One of the major complaints we receive from motorists is of trip delay because of incidents on the freeways. It is especially serious when an incident occurs during peak hours of operation.

We have a Freeway Incident Management Team that responds to clear the incident as soon as possible. Other motorists become trapped in traffic congestion because they were unaware of the incident.

In this regard, we have asked the Texas Transportation Institute (TTI) to assist us in developing a Motorists Information Program, which will collect, process, and distribute real time traffic condition information. This program will provide timely information on the traffic condition of the freeways during peak periods of operation. With this information, the motorists can select a route that will reduce their travel time. The information would be relayed to motorists by radio and/or Changeable Message Signs (CMS).

There are several methods to collect and process traffic data automatically, and the State will be implementing these in the future. But for the immediate needs for getting current traffic information from the freeways to our Central Control Center, we have investigated various methods. Vehicles equipped with cellular car telephones seem to be one of the most promising techniques.

For this program to be effective, it will require having individuals travel the freeways during the peak periods at specified time of day. We do not have the personnel to perform this service on a continuing basis. Therefore, we are asking for assistance from other public agencies and the private sector.

We are planning to conduct a travel time demonstration project for the North Houston Corridor to begin in the spring of 1991. We are seeking 200 to 500 volunteers that daily drive I-45 (North) Freeway, Hardy Toll Road, and U.S. 59 (Eastex) Freeway. The project will last from six months to one year. The volunteers would call in travel times, by cellular telephone, at predetermined locations and report incidents as they are encountered.

As a major employer in the central business district of Houston, we would like to know if you would permit us to contact your employees at their work place to solicit their participation in this project. At this point, there are many details to be worked out. We are also asking for assistance from several cellular telephone companies.

If you would consider allowing and encouraging your employees to meet with us, please identify a person at your company that we may contact to present a more detailed explanation.

We hope that we can count on your cooperation as we all strive to improve mobility in the Greater Houston Area.

NOTE: This letter was sent by TxDOT to Exxon, Shell, Chevron, Houston Lighting and Power, METRO, City of Houston, and Harris County.



**APPENDIX D**

**Newspaper Advertisements for Volunteers**

A-24 / The Houston Post / Thursday, January 23, 1992

**FREE CELLULAR TELEPHONE !!**

The Texas Transportation Institute (TTI) of Texas A&M University is seeking volunteers to participate in a travel time demonstration project in the North Corridor of Houston. TTI will provide a free cellular telephone for participants to call in traffic conditions on the four roadways, in the corridor, during the one year study. The study requires that you travel I-45 (North), U.S. 59 (Eastex), Hardy Tollroad, or the North Freeway HOVL, to or through downtown Houston, between 6:00–10:00 a.m. and return between 3:00–7:00 p.m. weekdays only. You must enter the road no further south than Beltway 8 (North).  
For more information, contact Dennis Smalley at (713) 686-2971.

Sunday, March 29, 1992

Houston Chronicle

3C

**FREE CELLULAR TELEPHONE!!**

The Texas Transportation Institute (TTI) of Texas A&M University is seeking volunteers to participate in a travel time demonstration project in the North Corridor of Houston. TTI will provide a free cellular telephone for participants to call in traffic conditions on the four roadways, in the corridor, during the one year study. The study requires that you travel I-45 (North), U.S. 59 (Eastex), Hardy Tollroad, or the North Freeway HOVL, to or through downtown Houston, between 6:00-10:00 a.m. and return between 3:00 to 7:00 p.m. weekdays only. You must enter the road no further south than Beltway 8 (North).  
For more information, contact Dennis Smalley at (713) 686-2971.

**APPENDIX E**

**Agreement to Participate in the North Houston Corridor  
Traffic Information Demonstration Project**

## **AGREEMENT TO PARTICIPATE IN THE NORTH HOUSTON CORRIDOR TRAFFIC INFORMATION DEMONSTRATION PROJECT**

The undersigned (Participant) agrees to participate with the Texas Transportation Institute (TTI) in the collection of traffic information in the North Houston Corridor for a one-year period, beginning within 30 days from the effective date of this agreement. The information will consist of specified traffic reports concerning the morning and afternoon commute trip to and from home to work, Mondays and Fridays, excluding holidays. The information will be transmitted over mobile cellular telephones provided by TTI to the Participant.

The cost of the cellular telephone, installation of the telephone and antennae in the Participant's vehicle, and the monthly assessment costs to the Houston Cellular Telephone Company will be paid by TTI during the one year of the study.

Airtime charges for telephone calls made to the TTI project number to report traffic information will not be charged to the Participant. These costs will be paid by Houston Cellular Telephone Company.

Airtime charges for personal calls made by the Participant to numbers other than the project number will be paid by the Participant.

In consideration of the services provided by the Participant, the telephone will become the property of the Participant after successful completion of the requirements of the one-year study. Successful completion of the requirements will be determined to be participation in the collection of traffic information for at least 75 percent of the weekdays, excluding holidays. For example, from September 1, 1991 to August 31, 1992, there are 261 weekdays, for which there are six national holidays (Labor Day, July 4th, Thanksgiving Day, Christmas, New Years Day, and Memorial Day). Seventy-five percent of 255 days is 191 days. Therefore, the Participant would be required to report traffic conditions on 191 weekdays during one year.

At the end of the one-year study, the Participant would assume the full responsibilities for the monthly costs of the telephone. These costs include: the monthly access fee, the wide area coverage fee, airtime charges, and any enhanced services that the Participant selected in the Customer Service Agreement with Houston Cellular Telephone Company.

If the Participant elects to leave the Project prior to completing the 191 days of traffic reporting, there are two options available:

1. The telephone equipment can be returned to TTI at no cost to the Participant and this agreement with the Participant is terminated.
2. The Participant can pay TTI for the cost of the telephone and installation charges (see special note below) and then assume the monthly access charges with the Houston Cellular Telephone Company.



Until such time as the Participant has completed the study or has elected to leave the project and exercise one of the two available options, the equipment remains the property of the State of Texas and cannot be transferred to another individual or entity during that time by the Participant.

The Participant will be fully responsible for the operation of his/her vehicle during the conduct of the study. TTI will not be liable for property damage or injuries resulting from accidents occurring during the study period.

APPROVAL: I, \_\_\_\_\_, have read and understand  
Name (please print or type)

the terms of this Agreement and agree to abide by them.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name (please print or type)

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip

\_\_\_\_\_  
Telephone Number



## **APPENDIX F**

### **Real-Time Information Program Travel Time Demonstration Project**

## REAL TIME INFORMATION PROGRAM TRAVEL TIME DEMONSTRATION PROJECT

The Texas Transportation Institute (TTI) of Texas A&M University is seeking volunteers to participate in a travel time demonstration project in the North Corridor of Houston. This would include the following roadways:

- I-45 (North Freeway) from the Hardy Toll Road Interchange or FM 1960 to the Central Business District.
- North Freeway High Occupancy Vehicle Lane (HOVL) from the Northern Terminus (Beltway 8) to the Central Business District.
- Hardy Toll Road from the I-45 (North Freeway) Interchange or FM 1960 to the Central Business District.
- U.S. 59 (Eastex Freeway) from FM 1960 to the Central Business District.

Participants will leave their home/office at a specified time during morning and afternoon peak traffic periods. They will use a cellular phone (provided by TTI) to call a Central Control Office at predetermined locations along their routes. They will also report incidents to the Central Control Office as they are encountered.

The purpose of the project is to provide timely information on traffic conditions of the four roads during peak periods of operation. The Central Control Office will be able to monitor the traffic conditions of the four roadways simultaneously and relay this information to motorists by radio and Changeable Message Signs. This will enable motorists to alter or select a route that reduces their travel time.

Volunteers will be asked to commit to the program for one year and to participate on an average of approximately three days per week.

In consideration of the services provided by the Participant, the telephone will become the property of the Participant after successful completion of the requirements of the one year study. **During this period, the Participant will incur no cost for the use of the telephone, other than airtime charges that may be incurred during personal use of the telephone.** Telephone calls made to the Project to report traffic information will not be charged to the Participant.

For the Project to be successful, it will require responsible participation by the volunteer. However, if for some reason the volunteer chooses to drop out of the study, the phone will be removed free of charge or the individual may purchase the telephone at the retail price plus installation charges.

This is an opportunity for you, as a private citizen, to assist a transportation agency in an effort to improve travel times on roadways in the Greater Houston Area.

Texas Transportation Institute  
701 North Post Oak, Suite 430  
Houston, Texas 77024  
Tel (713) 686-2971 Fax (713) 686-5396

Dick McCasland  
Dennis Smalley

**APPENDIX G**

**Volunteer Sign Up Card**

NORTH CORRIDOR  
TRAVEL TIME DEMONSTRATION PROJECT

- |   |   |
|---|---|
| <input type="checkbox"/> I am interested in participating in the study. | <input type="checkbox"/> I may be interested in participating in the study. |
|---|---|

NAME: _____ <i>(PLEASE PRINT)</i>	
ADDRESS: _____	
HOME PHONE: _____	WORK PHONE: _____

PRIMARY ROUTE TO AND FROM WORK

<input type="checkbox"/> I-45 (NORTH) FREEWAY	<input type="checkbox"/> HARDY TOLL ROAD
<input type="checkbox"/> US 59 (EASTEX) FREEWAY	<input type="checkbox"/> I-45 (NORTH) HOVL
Point of Entry in AM _____	PM _____
Departure Time: From Home _____ AM	From Work _____ PM

Return to: Bill Wigglesworth Rm 3829 EB Ext. 6-4402

**APPENDIX H**

**Exxon Employee Notice**

# employee information

## EXXON USA

### BE A PART OF THE "TRAFFIC SOLUTION" AND GET A FREE CELLULAR CAR PHONE

Employees who commute downtown from the following areas are needed for a Texas Department of Transportation study:

- I-45 N from Hardy Tollroad Interchange or FM 1960
- N. Freeway HOV Lane from Beltway 8
- Hardy Tollroad from the I-45 N Interchange or FM 1960
- US 59 from FM 1960

#### STUDY PURPOSE

Texas A&M will be conducting a study to provide timely information on North Corridor traffic conditions during peak travel coming to and from work. This will allow motorists to select a route that best reduces their travel time. The program will be conducted for 12 months (9/91 – 9/92).

#### FREE CELLULAR TELEPHONES

Volunteers will be provided with installed, hands-free cellular telephones which they will use to report their travel positions at designated locations traveling to and from work.

#### COST TO PARTICIPANTS

Installation, monthly fees, and all charges to the Traffic Control Center are free to the volunteer. Only air time for personal calls will be charged to the individual. (No personal calls — NO COST).

At the end of the 12 month study, the telephone will be given to the volunteer who will have the option to continue cellular phone service through a personal account with one of the area cellular phone services.

If for some reason a volunteer chooses to drop out of the study, the phone will be removed free of charge, or the individual can purchase the telephone at the retail price plus installation charges.

INFORMATION MEETINGS WILL BE HELD IN THE C-LEVEL AUDITORIUM

TUESDAY, JULY 23, 1991 — 12:00 NOON

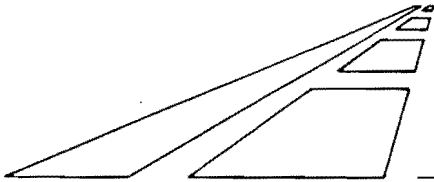
&

TUESDAY, JULY 30, 1991 — 12:00 NOON



**APPENDIX I**

**Letters to Non-Participating Volunteers**



FREEWAY OPERATIONS PROGRAM

Telephone (713) 686-2971  
TexAn 850-1390  
FAX (713) 686-5396

April 9, 1992

Ms. Jeanne L. Moore - ID #37  
7507 Misty Morning  
Humble, TX 77346

Dear Ms. Moore:

Our records indicate that your level of participation in the Travel Time Study, for the last two months, has been very low. Budget constraints for the project will not permit us to pay the monthly access charge for the telephone under these conditions. We ask that you contact this office to discuss your situation.

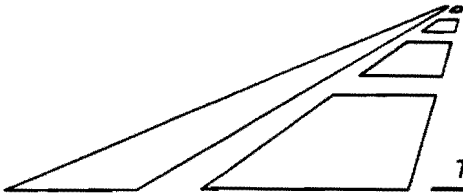
If you decide to drop out of the program, you are reminded that you may purchase the telephone from TTI if you move to another plan with Houston Cellular.

We would appreciate a reply from you as soon as possible.

Sincerely,

Dennis G. Smalley  
Assistant Project Manager

DGS:lp



FREEWAY OPERATIONS PROGRAM

Telephone (713) 686-2971  
TexAn 850-1390  
FAX (713) 686-5396

May 14, 1992

Ms. Jeanne L. Moore - ID #37  
7507 Misty Morning  
Humble, TX 77346

Dear Ms. Moore:

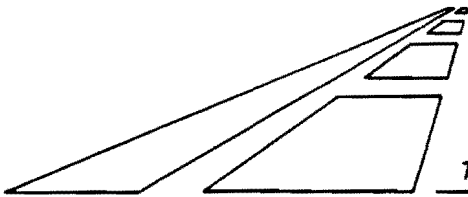
Our records indicate that you have stopped participating in the North Corridor Travel Study. If you disagree with this, please contact this office as soon as possible.

The program requires every volunteer that was issued a phone participate at a 75% level. Budget constraints will not permit us to pay the monthly access charge for a participant that is not participating at the required level. If you feel that you cannot continue in the program, we ask that you return the phone to Mr. Steve Stoute at American Cellular (964-5000). You are reminded that this was our initial agreement with you.

Sincerely,

Dennis G. Smalley  
Research Associate

DGS:lp



FREEWAY OPERATIONS PROGRAM

May 29, 1992

Telephone (713) 686-2971  
TexAn 850-1390  
FAX (713) 686-5396

## MEMORANDUM

**TO:** Annette Maclaine  
Houston Cellular

**FROM:** Dennis Smalley *D.S.*

**SUBJECT:** North Corridor Travel Study

This office requests that telephone service be discontinued to the following study participants, effective this date. This action is being taken because of their failure to participate in the study.

<u>Name</u>	<u>Telephone Number</u>
Jeanne L. Moore	594-2492
Robert E. Moore	594-2491
Kathleen Hubert	594-5043

We have asked these individuals for the return of the phones. To date we have been unsuccessful.

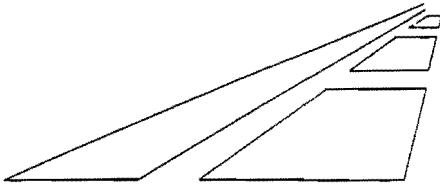
Please confirm this request.

DGS:lp

xc: Darrell Borchardt  
Dick McCasland  
Bobby Siegfried  
Nitin Vaidya

**APPENDIX J**

**Sample Participant Newsletter**



**Activity Report**

The project operated for 22 days during June. There were 27,541 station calls received by the study office and 234 incidents were reported.

Your *daily participation rate for June* was \_\_\_\_\_ percent.

Your *daily participation rate since you began* in the study is \_\_\_\_\_ percent.

If you question your individual participation rate, please contact this office at 686-2971.

**Special Notes**

We think we have the phone line problem solved; however, if you still experience a continued busy signal at certain stations, please make your study office operator aware of this at your next station.

In the April newsletter we asked that you contact Mr. Steve Stoute at American Cellular to discuss your phone options on how to cancel your contract after the one year TTI contract is completed. We now need to correct this announcement.

Apparently there has been a change at American Cellular. Steve Stoute is no longer with American Cellular and they no longer operate out of their building on the Southwest Freeway. They are now the Houston Mobile Phone Works and are located on I-10(W) at Heights Boulevard. They have assured us that they will continue to honor the TTI contract and the warranties on the phones. Houston Cellular is concerned that because of this change at

American Cellular, they may not have the information that some of you may have given to Steve Stoute.

*We apologize but Houston Cellular asks that we start over and have you contact them directly to discuss plan options or to cancel your agreement.* To discuss plan options or to cancel, please call Ms. Marnie Henderson at 553-2302. You may also cancel by notifying her by mail at:

Houston Cellular  
1 West Loop South, Suite 300  
Houston, TX 77027

*Remember, you must do this thirty (30) days prior to the end of the one year agreement.* We will try to contact you or send you a reminder shortly before the 30-day notification requirement.

**Progress Report**

We have tried to explain the purpose of the travel study to each of you when you agreed to participate in the program. We thought we would take this opportunity to briefly describe how the information that we receive from you is processed and disseminated.

The study office is located in the Senterra Building at Greenway Plaza on the ground floor. The operators that take your calls are located in that office and are supervised by TTI personnel. The Texas Department of Transportation has an adjacent office that is manned by their Motorist Assistance Program (MAP) dispatcher. The MAP program has the vans that are operated by a Harris County Sheriff's deputy. The deputies

travel the freeway system providing assistance to stranded motorists and responding to incidents. The MAP dispatcher can also control the Changeable Message Signs (CMS) located in the corridor.

Your reports are inputted directly into a computer by the operators at Greenway. The travel times are computed instantaneously. The travel time and incident information is automatically faxed every fifteen minutes to the traffic advisory service companies for radio traffic reports and is also provided to the MAP dispatcher. This is done continuously through the peak traffic periods. *Your reports are providing the most current traffic information ever presented to the motoring public in the Houston area.*

Testing is underway of a computer terminal located in the MAP office that displays the travel time and incident information as it is received. We are working toward placing these type terminals at various public/private sector work places in the near future.

We hope this better explains the detail operation of the study and assures you that the effort you are putting forth is truly appreciated.

**GOOD WORK!!!**

William McCasland  
Dennis Smalley

TEXAS TRANSPORTATION INSTITUTE  
 CELLULAR PHONE STUDY  
 PARTICIPATION BY PROBES  
 JUL1992

PROBE ID	NAME OF PROBE	NUMBER OF CALLS	ACTIVE DAYS	WORKING DAYS	ACTIVITY %	REMARKS
1	William R. McCASLAND	46	13	23	57 %	
2	Dennis G. SMALLEY	105	20	23	87 %	
3	Karan CRAIG	149	20	23	87 %	
4	J.C. HARRIS	149	20	23	87 %	
5	Anne COURTRIGHT	140	22	23	96 %	
6	James W. AMBROSE	212	21	23	91 %	
7	James R. ATTEBURY	202	21	23	91 %	
8	Bill BANZHAF	57	10	23	43 %	NA 7/10-7/27
9	Melinda BRYAN	75	18	23	78 %	
10	Anita CLEAVER	107	17	23	74 %	
11	Terry COLLINS	172	22	23	96 %	
12	Kenneth CUMMINGS	164	19	23	83 %	
13	Kerry DESPAUX	58	10	23	43 %	
14	Terrance B. FORD	107	21	23	91 %	Vac. 8/3-8/17
15	Bill FORD	193	15	23	65 %	NA 7/24-8/3
16	Daniel L. HAINING	113	21	23	91 %	NA 7/21-7/22
17	Steve CURRELL	124	19	23	83 %	
18	Robert ILES	133	20	23	87 %	
19	Roger JOHNSON	59	17	23	74 %	
20	Richard G. LALLASHER Jr.	237	20	23	87 %	NA 7/22-7/24
21	Scott LEONARD	118	15	23	65 %	
22	Elizabeth McCONNELL	155	16	23	70 %	NA 7/28-7/31
23	Irvine MOSES	59	11	23	48 %	
24	Gerald S. NIELSON	98	17	23	74 %	
25	Lowell NORRIS	124	17	23	74 %	NA 7/22-7/28
26	Syrisse ROWE	136	19	23	83 %	NA 6/23-6/25
27	Dwayne CHAPPELL	76	15	23	65 %	NA 7/20-7/24
28	.... GE REUSCH	.... no record of any calls ....				
29	Carole O. TOWNSEND	107	15	23	65 %	
30	Michael WADE	280	22	23	96 %	
31	.... DISCONNECTED	.... no record of any calls ....				
32	Ted DAVIS	145	22	23	96 %	
33	Martin SCHULMAN	113	13	23	57 %	
34	Brynn M. PINKERTON	1	1	23	4 %	
35	Jennifer STEVENS	2	2	23	9 %	
36	Louise M. SIMPSON	93	18	23	78 %	Vac. 7/31-8/17
37	.... DISCONNECTED	.... no record of any calls ....				
38	.... DISCONNECTED	.... no record of any calls ....				
39	Fred ZIKER	97	17	23	74 %	Vac. 7/28-8/3
40	Scott ROSEN, LUND	116	17	23	74 %	
41	Charles W. TIBBS	119	21	23	91 %	
42	Norris TURNER Jr.	19	4	23	17 %	Worknights till 7/11
43	David LERTEN	17	5	23	22 %	
44	Teri DUPLANTIS	252	20	23	87 %	NA 7/20-7/21
45	Shirley M. BATES	163	17	23	74 %	
46	Karen BAKER	144	13	23	57 %	NA 7/1-7/6
47	Micheal BEITLER	129	16	23	70 %	
48	Larry W. BLACKBURN	146	22	23	96 %	
49	Don C. BOLLWINKEL	36	12	23	52 %	
50	Lisa Ann BOLT	170	16	23	70 %	
51	Bill S. CHANCE	215	21	23	91 %	
52	.... Wanda J. DAVIS	.... no record of any calls ....				NA 6/22-7/2



TEXAS TRANSPORTATION INSTITUTE  
 CELLULAR PHONE STUDY  
 PARTICIPATION BY PROBES  
 JUL1992

PROBE ID	NAME OF PROBE	NUMBER OF CALLS	ACTIVE DAYS	WORKING DAYS	ACTIVITY %	REMARKS
53	Gene O. DAY	201	17	23	74 %	
54	Paul HEIDAKER	150	21	23	91 %	
55	Carolyn HUSER	111	14	23	61 %	
56	Lila KIRK	252	22	23	96 %	
57	Mary M. LEE	140	18	23	78 %	NA 7/13-7/17
58	DeAnn FORRESTER	76	12	23	52 %	SICK 7/23-7/24
59	Lisa G. MOORE	134	20	23	87 %	
60	Terry L. PILKENTON	144	19	23	83 %	
61	Sandra L. RIALS	224	22	23	96 %	NA 6/19-6/29
62	Keith ROBISON	256	22	23	96 %	
63	Joseph A. ROGERSON	116	14	23	61 %	NA 6/22-6/29
64	J.R. SALINAS	92	12	23	52 %	na 7/6-7/10
65	Rita L. SWINDALL	109	16	23	70 %	
66	Dee G. TICHELI	164	18	23	78 %	NA 7/15-7/21
67	Troy K. WALKER	222	19	23	83 %	
68	Ron WASHINGTON	159	21	23	91 %	NA 5/27 - 6/1
69	Lois Faye WATSON	163	19	23	83 %	NA 7/30-8/3
70	Karen WORNER	143	15	23	65 %	NA 7/20-7/24
71	William DRENNEN III	106	19	23	83 %	
72	Peter JOHNSTON	2	2	23	9 %	
73	.... Marvin BENTON	.... no record of any calls ....				Left job 6/18
74	.... Gwendolyn BAILEY	.... no record of any calls ....				
75	Paul BECK	105	17	23	74 %	NA 6/15-6/23
76	Sally W. BECK	138	19	23	83 %	
77	Perry J. EDGAR	222	22	23	96 %	
78	Patricia BLAIZE	250	22	23	96 %	NA 8/4-8/17
79	Leannah McCOMBS	137	20	23	87 %	
80	Lottie FANESTIEL	2	2	23	9 %	
81	Toby BATTAGLIA	14	2	23	9 %	
82	Devaki RADHAKRISHNAN	248	20	23	87 %	
83	Gary HARSTICK	26	4	23	17 %	
84	Lois HEDGES	76	16	23	70 %	
85	Linda MERRYMAN	166	18	23	78 %	
86	.... DISCONNECTED	.... no record of any calls ....				
87	Cara JARZOMBEK	126	17	23	74 %	
88	Peter J. PALMISANO	306	22	23	96 %	
89	Margaret A. RIVETTE	255	22	23	96 %	Vac. 8/3-8/7
90	DISCONNECTED	1	1	23	4 %	
91	.... Lorenzo DIAZ Jr.	.... no record of any calls ....				
92	Bill HIMPELE	129	12	23	52 %	NA 7/23-8/17
93	Robert J. NILLEN	21	7	23	30 %	Per 139, jobless 6/12
94	Gregory Kim DAGGETT	113	12	23	52 %	na 7/13-7/27
95	Tod BROWN	220	23	23	100 %	
96	Amiel DAVID	116	16	23	70 %	
97	Nick DESIMONE	105	15	23	65 %	
98	Edward DUBBS	224	18	23	78 %	
99	Rick DOWDALL	300	22	23	96 %	
100	.... James H. COX	.... no record of any calls ....				
101	Robbie BOYCE	174	19	23	83 %	NA 6/25-7/6
102	Milton BANKS	149	19	23	83 %	NA 7/3-7/7
103	Stephen Craig FLEMING	11	3	23	13 %	
104	Dan GRIZZLE	113	18	23	78 %	

TEXAS TRANSPORTATION INSTITUTE  
 CELLULAR PHONE STUDY  
 PARTICIPATION BY PROBES  
 JUL1992

PROBE ID	NAME OF PROBE	NUMBER OF CALLS	ACTIVE DAYS	WORKING DAYS	ACTIVITY %	REMARKS
105	Jana GRANA	139	19	23	83 %	
106	Victoria HAWKINS	116	19	23	83 %	
107	Shelia McGEE	145	17	23	74 %	NA 7/20-7/24
108	Richard HILL	28	7	23	30 %	NA 6/8-6/19
109	Robert P. KAISER	173	22	23	96 %	Vac. 8/3-8/7
110	.... Nilam KESWANI	.... no record of any calls ....				
111	Barry KLECKNER	80	19	23	83 %	NA 8/3-8/14 Had Baby
112	Donald LEE	136	13	23	57 %	NA 7/1-7/15
113	Robert MALLORY	149	22	23	96 %	
114	Ray MANSFIELD	245	22	23	96 %	
115	W.P. MORRIS	102	15	23	65 %	
116	Gary L. RAY	66	10	23	43 %	
117	Steven READ	1	1	23	4 %	
118	Michael ROMEO	205	18	23	78 %	
119	Hugh M. SCILLEY	152	13	23	57 %	
120	Ron SELLERS	121	13	23	57 %	
121	Alice Jo SHANNON	251	20	23	87 %	
122	Harry YEARSLEY	295	22	23	96 %	
123	Michael BUSINGER	146	19	23	83 %	
124	Rich THIBODEAUX	186	17	23	74 %	NA 7/27-7/31
125	Lenore R. THEISS	28	9	23	39 %	Vac. 7/20-7/24
126	Lee Van CLEAVE	144	16	23	70 %	NA 7/6-7/10
127	Sandy WALKER-SMITH	138	18	23	78 %	
128	Larry B. PERRY	72	6	23	26 %	NA 7/27-8/4
129	Kenneth YOKUM	225	21	23	91 %	
130	Harry O'BRYAN	254	20	23	87 %	
131	Cary N. BRAUNER	134	19	23	83 %	
132	Jeanette SHELTON	84	17	23	74 %	NA 7/9 - 7/14
133	Tina DeVRIES	139	20	23	87 %	
134	Elaine HANCOCK	264	20	23	87 %	
135	Kenneth HARWOOD	144	15	23	65 %	
136	Paul L. DENMAN	45	7	23	30 %	NA 6/26-7/20
137	Carol Ann SMITH	143	18	23	78 %	
138	Jerry WINTER	79	16	23	70 %	NA 6/21-7/6
139	Cindy McBRIDE	195	20	23	87 %	
140	Lana M. GAINES	70	16	23	70 %	
141	Alice C. MOSLEY	16	3	23	13 %	
142	Robert PURCELL	83	13	23	57 %	
143	Charlie MICHALAK	206	20	23	87 %	
144	Curt E. BECK	197	21	23	91 %	
145	J.K.HUNTER	127	19	23	83 %	
146	Gaynell THOMPSON	237	20	23	87 %	
147	Wayne M. WISCHNEWSKY	246	19	23	83 %	NA 5/26-6/12
148	Lyle A. SMITH	235	18	23	78 %	
149	James A. MULLINS	131	14	23	61 %	
150	Paul R. ZYLMAN	202	19	23	83 %	NA 7/14-7/20
151	Milani MERCY	113	21	23	91 %	NA 6/29-7/17
152	Daniel M. BOZ	173	18	23	78 %	NA 7/8-7/10
153	Frank C. O'NEIL	124	16	23	70 %	
154	Nancy STANLEY	106	20	23	87 %	
155	Henry HARTMAN	209	18	23	78 %	Vac. 7/28-7/30
156	Chris J. BARNHILL	78	14	23	61 %	NA 7/24-8/4

TEXAS TRANSPORTATION INSTITUTE  
 CELLULAR PHONE STUDY  
 PARTICIPATION BY PROBES  
 JUL1992

PROBE ID	NAME OF PROBE	NUMBER OF CALLS	ACTIVE DAYS	WORKING DAYS	ACTIVITY %	REMARKS
157	Richard L. GLISSON	150	18	23	78 %	
158	George WALKER Jr.	216	21	23	91 %	Vac. 7/31-8/11
159	Carrolyne WHITE	91	8	23	35 %	NA 6/29-7/19
160	Larry D. SILVEY	172	19	23	83 %	NA 6/26-6/29
161	Thomas B. WALLACE	175	20	23	87 %	
162	Laniel C. LENAUX	89	16	23	70 %	Vac. 7/27-7/31
163	Colleen MARTIN	248	22	23	96 %	
164	Robert PIETSCH	214	20	23	87 %	NA 6/24-7/1
165	John M. HAMAUEI	67	13	23	57 %	
166	Aarti PHANSALKAR	59	14	23	61 %	
167	Arthur T. STANLEY	123	15	23	65 %	Vacation 7/24-8/3
168	Jackie STULTING	134	16	23	70 %	
169	Mark BLANDFORD	180	18	23	78 %	
170	John R. POWELL	154	20	23	87 %	
171	Charles H. ADAMS	126	15	23	65 %	
172	Martin J. WALKER	154	18	23	78 %	
173	Jim FRIEDMAN	135	20	23	87 %	NA 6/25-6/29
174	Stephanie BRAND	74	12	23	52 %	NA 6/25-7/6
175	Diane J. JOHNSON	143	13	23	57 %	
176	Sally EGBERT	193	19	23	83 %	
177	Bob BRANDT	126	16	23	70 %	Surgery NA 7/20-7/30
178	Donna TRIVILINO	258	22	23	96 %	
179	Jacqueline T. VAUGHN	152	22	23	96 %	Accident NA -> 6/29
180	Amy DAVIS	133	15	20	75 %	
181	Suella COLLINS	131	22	23	96 %	
182	Peter SAILER	142	21	23	91 %	
183	Jeff MUELLER	133	17	23	74 %	
184	Carl S. GORSKI	239	20	23	87 %	Vac. 7/30-8/4
185	Earl REYNOLDS	210	18	23	78 %	
186	Marjorie KRUPKA	155	22	23	96 %	
187	John P. BIRD	115	18	23	78 %	na 7/8-7/10
188	Wilbur LARSEN	28	6	23	26 %	
189	Forest SMITH	39	13	23	57 %	
190	Tim ERVIN	180	18	23	78 %	NA 6/15-6/19
191	Frederica LOVELESS	297	22	23	96 %	
192	Rob LEBLANC	187	20	23	87 %	
193	Michael S. FANCHER	125	19	23	83 %	
194	David CUSIMANO	93	13	23	57 %	NA 8/3-8/7
195	Charles F. CONTANT	127	14	23	61 %	
196	Glen A. RIES	163	16	23	70 %	NA 7/27-8/7
197	Carl S. SMITH	165	19	23	83 %	
198	Mark E. ELLIS	68	13	23	57 %	NA 7/1-7/15
199	Eugene DODARO III	155	18	23	78 %	
200	McBee LANDRUM	236	22	23	96 %	NA 6/22-6/29

TOTAL CALLS : 26374

TOTAL INCIDENTS : 238



**APPENDIX K**

**Participants Reporting Information**

**PROCEDURE FOR PLACING CALLS TO INFORMATION CENTER**

**A. FOR NORMAL CALLS TO REPORT LOCATION**

1. Push "*Power On*" button.
2. First Call - *Dial* full number. e.g. 840-9477
3. Push "*Send*" button.
4. Operator *answers*.
5. State your assigned *I.D. Number*. e.g. This is Number 121
6. State the *Location Number*. e.g. At Station 101
7. Operator *acknowledges*.
8. Push "*End*" button.

**AS YOU APPROACH THE NEXT LOCATION NUMBER:**

9. Second Call - Push "*Send*" button.
10. Operator *answers*.
11. State your assigned *I.D. Number*. e.g. This is Number 121
12. State the *Location Number*. e.g. At Station 102
13. Operator *acknowledges*.
14. Push "*End*" button.

**CONTINUE THROUGH ALL STATIONS, REPEATING THE STEPS WITH DIFFERENT STATIONS NUMBERS.**

**B. FOR CALLS TO REPORT ON ACCIDENTS, INCIDENTS, OR ROADWAY CONDITIONS**

**SUPPOSE BETWEEN STATION 104 AND 105 YOU SEE AN INCIDENT, SUCH AS AN ACCIDENT WITH VEHICLES STOPPED IN THE RIGHT LANE OF THE FREEWAY:**

1. Push "*Send*" button.
2. Operator *answers*.
3. State your assigned *I.D. Number*. e.g. This is Number 121
4. State *Incident*. e.g. There is an Accident Southbound in the Moving Lane
5. State *Location*. e.g. Near the West Road Overpass Southbound direction
6. Operator *acknowledges*.
7. Push "*END*" button.

**IF THE OPERATOR WANTS MORE INFORMATION CONCERNING THE ACCIDENT, SHE WILL ASK FOR SPECIFIC DETAILS BEFORE ACKNOWLEDGING AND ENDING THE CALL.**

**C. GENERAL QUESTIONS CONCERNING THE PROCEDURES FOR MAKING CALLS TO THE CENTRAL INFORMATION CENTER**

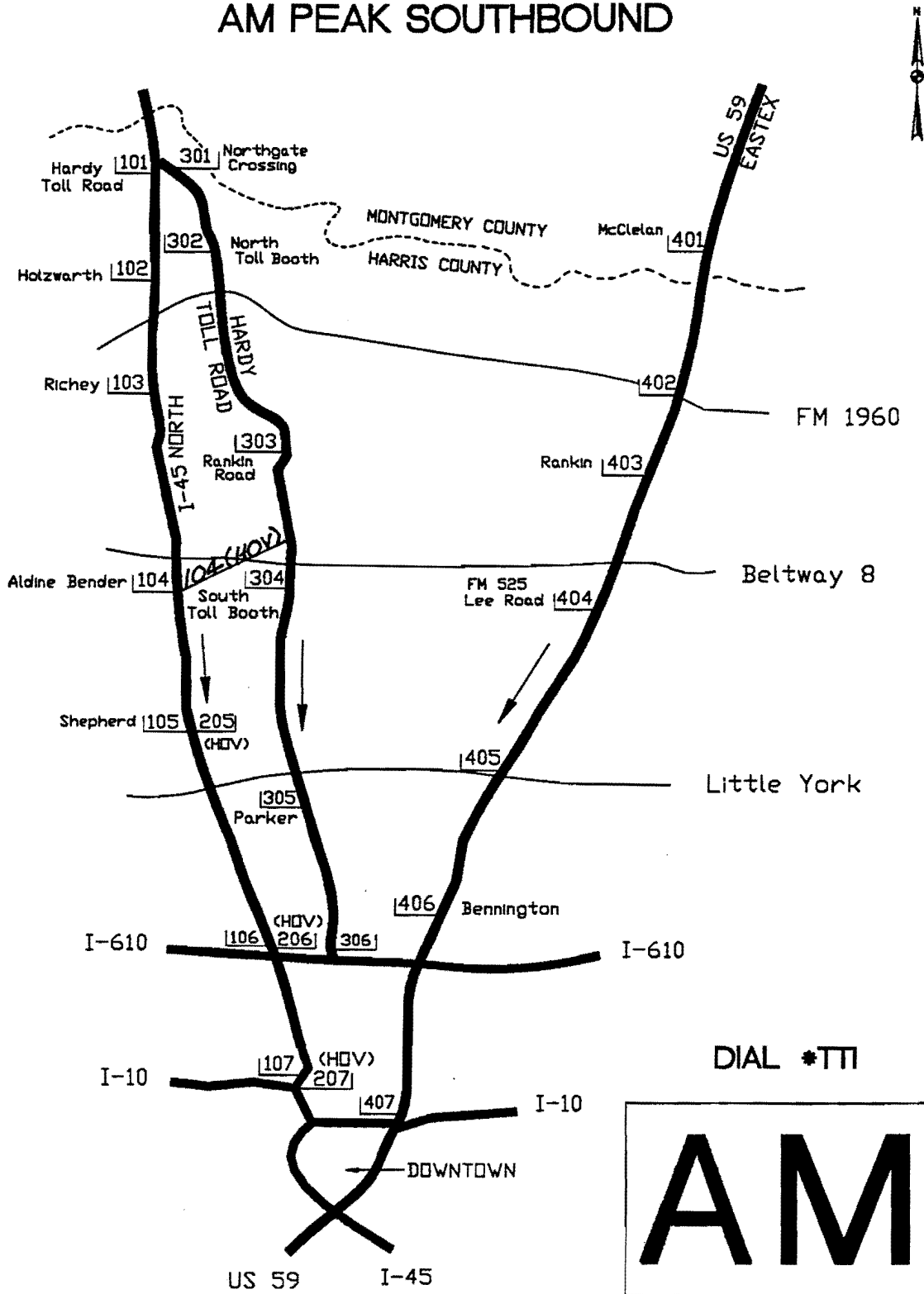
1. How will you remember the *Central Information Center Office Telephone Number*?
  - a. Tape the number on the back of the telephone.
  - b. Program the number in the first position in the memory for speed dialing.
2. How will you remember your *Identification*?
  - a. Tape a card on the back of the telephone.

3. How will you remember *Location Numbers*?
  - a. You will be given a map with the description of all the stations with their location numbers in the study area.
  - b. The TxDOT will install roadside signs, white letters with blue background, with the numbers.
  - c. After three or four days you will have the locations committed to memory.
  - d. If you have any questions, call the Operator (our Central Information Center Operator).
4. General Guidelines on *Reporting Incidents*.
  - a. Give the information in a brief form.
  - b. Most important items of information are location and if lanes are blocked.
  - c. If in doubt as to whether an incident is important enough to report, place the call.
5. Interruptions in Reporting
  - a. If you forget to place a call, continue to the next station and make a normal report.
  - b. If you leave the freeway during your trip (e.g. for gas), make a call to the operator, give your I.D. Number and state that you are "out of service". If you return to the freeway to continue your trip, make a normal call at the next station number.
  - c. If your driving tasks require your undivided attention as you approach a reporting station, do not try to place a call. **DRIVE SAFELY!!**



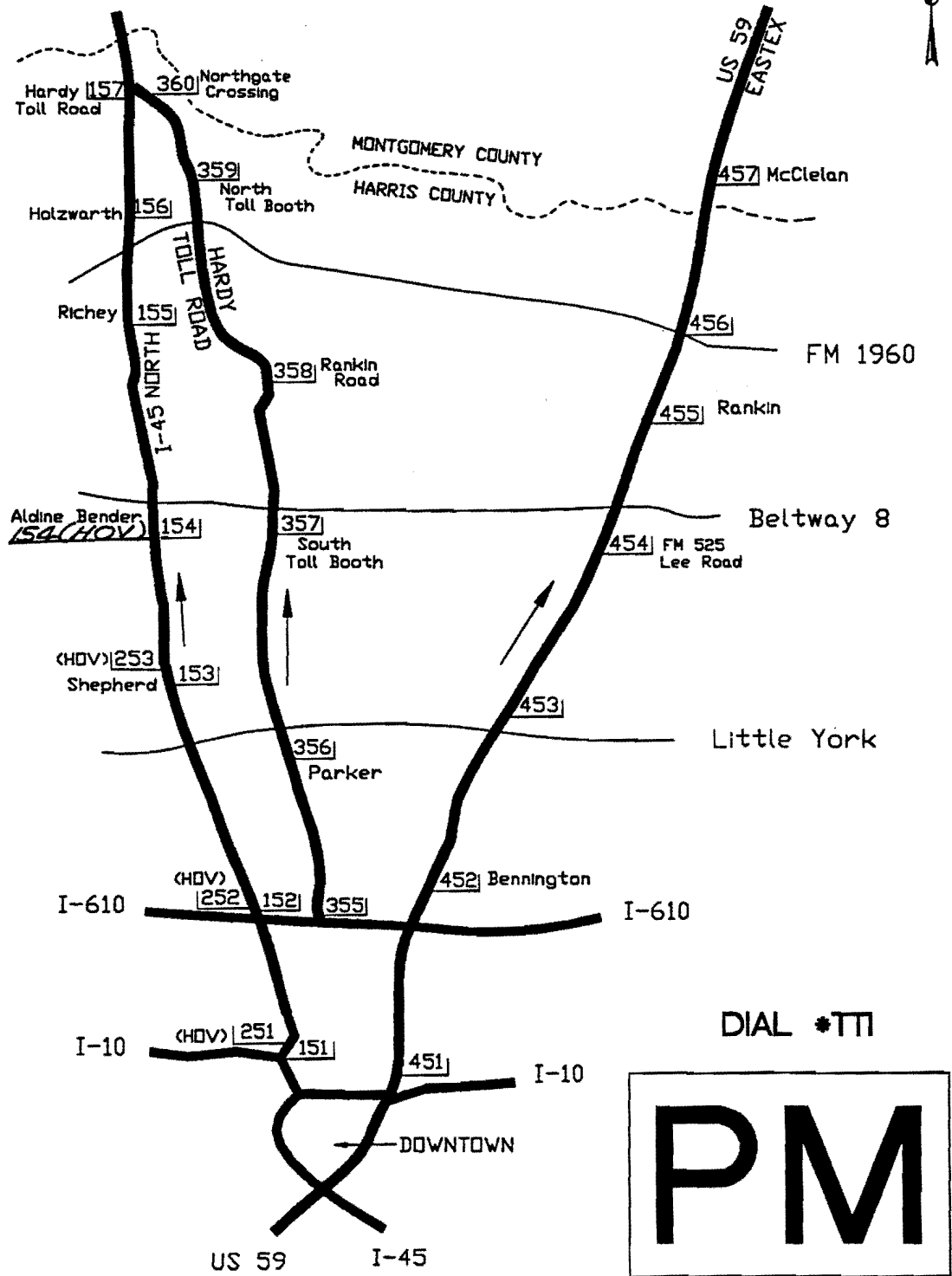
# NORTH HOUSTON CORRIDOR

## AM PEAK SOUTHBOUND

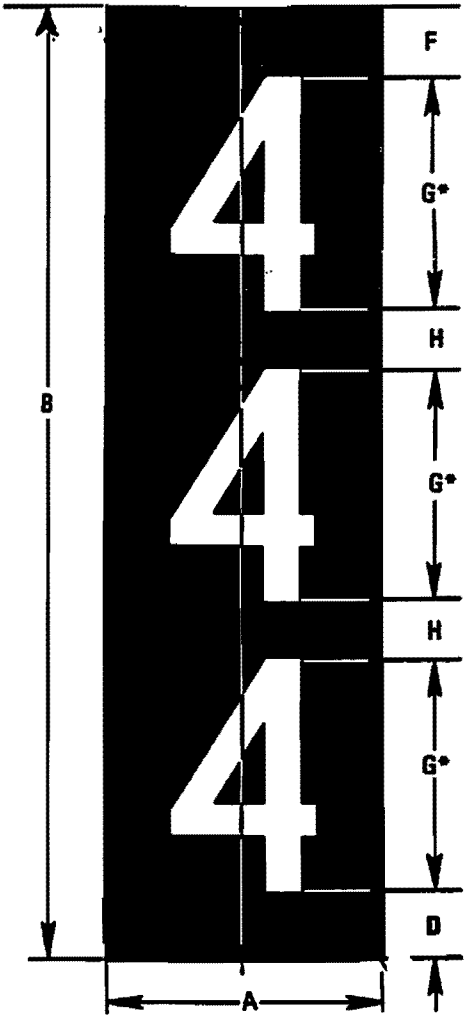


# NORTH HOUSTON CORRIDOR

## PM PEAK NORTHBOUND



**ROADSIDE STATION MARKERS**



**Colors**

**Legend - White (refl)**  
**Background - Blue (refl)**  
 (one side only)

**Holes drilled top and bottom.**

**Dimensions**

- A 9 to 12 inches(var)**
- B 30 inches**
- D 3 inches**
- F 3 inches**
- G 6 inches**
- H 3 inches**

**\* Optically center numeral about vertical centerline**

