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| 16. Abstract The Houston <i>Smart Commuter</i> ITS Operational Test is assessing the potential to gain more efficient use of major travel corridors through greater utilization of high-occupancy commute modes, shifts in travel routes, and changes in time of travel through the application of innovative approaches using advanced technologies. The Houston <i>Smart Commuter</i> ITS Operational Test is a federally sponsored project and is jointly funded by the Metropolitan Transit Authority of Harris County (METRO), the Texas Department of Transportation (TxDOT), the Federal Highway Administration (FHWA), and the Federal Transit Administration (FTA). This report documents the activities conducted on the <i>Smart Commuter</i> ITS operational Test in FY 1998. The report summarizes the results of the ongoing assessment of the I-45 North component, including changes in the travel behavior of test participants. The report also presents the anticipated activities and schedule for FY 1999. | | | | | |
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**HOUSTON *SMART COMMUTER* ITS OPERATIONAL TEST:
FY 98 STATUS REPORT**

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Project Management Assistance and Study Design, Data Collection,
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CHAPTER ONE – INTRODUCTION

The Houston *Smart Commuter* Intelligent Transportation Systems (ITS) Operational Test is one of the federally sponsored advanced technology projects currently conducted in the United States. The Houston *Smart Commuter* Operational Test is funded and implemented through the joint efforts of the Metropolitan Transit Authority of Harris County (METRO), the Texas Department of Transportation (TxDOT), the Federal Highway Administration (FHWA), and the Federal Transit Administration (FTA). The Texas Transportation Institute (TTI), a part of the Texas A&M University System, assisted with the development of the operational test concept design and is responsible for conducting the local evaluation and providing ongoing project support.

The Houston *Smart Commuter* Operational Test began in 1990. Since that time a number of activities have been accomplished. These include completing a preliminary feasibility study, developing a concept plan and proposal, securing funding for the first phase, finalizing the local evaluation plan, completing interagency agreements between the various agencies, initiating the operational test, and evaluating the first phase of the test.

This document summarizes the activities conducted on the operational test during Fiscal Year (FY) 1998, the period from September 1997 to August 1998. It also outlines those activities anticipated in FY 1999. The remainder of the report is divided into four sections to accomplish this objective. Chapter Two provides an overview of the Houston *Smart Commuter* Operational Test. The major elements and the organizational structure for the operational test are summarized, and the technology used in the I-45 North component is discussed. Chapter Three describes the major activities and accomplishments completed during FY 1998. Chapter Four examines the results of the travel surveys and travel diaries completed by participants in the test and control groups, including reported changes in travel behavior. Chapter Five presents the anticipated work activities for FY 1999. Copies of the surveys and travel diaries are provided in the appendices, along with more detailed survey results.

CHAPTER TWO — OVERVIEW OF THE HOUSTON *SMART COMMUTER* OPERATIONAL TEST

This chapter provides an overview of the development of the Houston *Smart Commuter* ITS Operational Test. The background of the project is summarized and the concepts being tested are described. The organizational structure for the operational test and the roles and responsibilities of the different agencies are outlined. The technology being used to provide real-time information to the test participants in the I-45 North corridor is described.

Background

As in many other major metropolitan areas, traffic congestion continues to be a significant problem in the Houston area, especially during the morning and afternoon peak-periods. Although recent improvements in the transportation system have reduced congestion levels in some corridors, Houston ranks as one of the top 15 most congested cities in the country (1). The annual cost of this congestion, based on the costs associated with time delay and fuel, is estimated to be approximately \$2 billion (1). Air quality and environmental issues are also major concerns. Houston is currently in severe violation of the Environmental Protection Agency (EPA) standards for ozone emissions. In order to meet the requirements of the 1990 Clean Air Act Amendments, the area must develop measures to control growth in vehicle miles of travel and initiate other programs.

In response to the combination of increasing demands on the system and limited resources, the agencies responsible for transportation in the Houston area have often utilized innovative approaches to address mobility and congestion problems. The regular development and publication of a multimodal Regional Mobility Plan, the extensive system of high-occupancy vehicle (HOV) lanes, park-and-ride lots, transit centers, express bus services, the expansion of the freeway and toll road system, and the development of TranStar, the Greater Houston Transportation and Emergency Management Center, represent just a few of the approaches that are being utilized in Houston.

The development of these projects has occurred through the coordinated and cooperative efforts of TxDOT, METRO, the city of Houston, Harris County, the Houston-Galveston Area Council (HGAC), and others. TTI has provided technical assistance on many of these projects. In preparing to move Houston forward into the 21st century, these agencies continue to work together to ensure that the transportation system will meet the needs of future generations. Incorporating advances in technology, such as those offered through the application of Intelligent Transportation Systems (ITS), is an important part of this overall approach.

The Houston *Smart Commuter* ITS Operational Test is a further example of this multi-agency approach. The development of the Houston *Smart Commuter* ITS Operational Test began

in 1990. A planning and feasibility study funded by FTA, METRO, and TxDOT was conducted by TTI in 1990 and 1991. This study examined the concepts behind the project, analyzed available literature on commuting behavior and mode choice selection, and examined the market potential for real-time traffic, transit, and rideshare information through the use of focus groups and surveys. Also assessed were potential technologies for providing the real-time traffic and transit information to individuals in their homes and work places. A series of reports documenting the different elements of the study are available (2, 3, 4, 5, 6). The final report, *Houston Smart Commuter IVHS Demonstration Project: Concept Design and Implementation Program Outline* (6), summarizes the major elements of the operational test and contains a preliminary implementation program, budget, and evaluation plan for the project.

This report formed the basis for federal funding requests by METRO and TxDOT to FTA and FHWA, respectively. A total of \$5,000,000 has been committed for the first phase of the proposed multiyear *Houston Smart Commuter* ITS Operational Test. Both METRO and TxDOT have committed \$1,250,000 to fund the first phase; FTA has provided \$500,000 in funding, and FHWA has provided \$2,000,000. The concepts being tested in the *Smart Commuter* project are described next, followed by a more detailed discussion of the roles and responsibilities of the different groups involved in the project.

Houston *Smart Commuter* Concepts

The Houston *Smart Commuter* Operational Test is evaluating the potential for gaining more efficient use of major travel corridors through greater utilization of high-occupancy commute modes, shifts in travel routes, and changes in time of travel through the application of innovative approaches using advanced technologies. Commuters who have quick and easy access to relevant, accurate, and up-to-date information on existing traffic conditions, bus routes, bus schedules, and directions for using the bus, may be more likely to use public transportation and other high-occupancy commute modes. The travel time savings and travel time reliability offered by the Houston HOV lanes add further incentives for changing travel modes. In addition, individuals may alter their travel times or travel routes based on this information.

The initial component of the *Smart Commuter* Operational Test focuses on the traditional suburb-to-downtown travel market in the I-45 North corridor. This element encourages a mode shift from driving alone to riding the bus, changing travel times, and shifting travel routes. These changes in travel decisions may result from the provision of current traffic and transit information to individuals in their homes and work places through state-of-the-art technologies. Changes in travel behavior are being evaluated by comparing a test group with a control group not participating in the project.

A second component will test the use of pagers to provide real-time traffic and transit information to a group of commuters. TxDOT and METRO may partner with private sector technology firms in this portion of the project.

Organization of the Houston *Smart Commuter* ITS Operational Test

The development of the Houston *Smart Commuter* ITS Operational Test has been accomplished through the joint efforts of METRO, TxDOT, FHWA, FTA, HGAC, and TTI. This multiagency coordinated approach is also being used to implement, monitor, and evaluate the operational test. This section outlines the overall organization of the operational test, and the roles and responsibilities of the different agencies.

METRO, TxDOT, FHWA, and FTA have agreed on the overall organizational structure for implementing and evaluating the Houston *Smart Commuter* ITS Operational Test. METRO is providing the overall project management responsibility for the operational test and has appointed a project manager. TxDOT is involved throughout the project and is coordinating with METRO on key activities. FTA and FHWA are providing federal oversight. TTI is responsible for the local evaluation and ongoing technical assistance. The roles of each agency are highlighted next.

METRO. Houston METRO is responsible for the overall management of the operational test. METRO has appointed a project manager and is providing other support functions for the project. METRO has received funding from FTA for a portion of the project and has executed an agreement with TxDOT for reimbursement of funding from FHWA.

TxDOT. TxDOT is involved in all aspects of the operational test. TxDOT has received funding from FHWA for a portion of the project and has executed an agreement with METRO for use of these funds. TxDOT has also been responsible for developing the real-time traffic information system that forms a major part of the I-45 North component.

U.S. DOT — FHWA and FTA. FHWA and FTA representatives are providing federal oversight and guidance throughout the operational test and participating in periodic meetings as appropriate. Although FTA has the overall federal monitoring responsibilities for this operational test, these responsibilities are shared and coordinated with FHWA, especially the FHWA Austin office.

TTI. TTI is responsible for conducting the local evaluation of the operational test under contract to METRO and TxDOT. This includes finalizing the study design and local evaluation program (7), and completing the ongoing data collection, monitoring, and evaluation activities. TTI is also responsible for coordinating the local evaluation with the national evaluation being sponsored by FTA. The Volpe National Transportation Systems Center is administering the national evaluation. The Volpe Center is using the consulting firm, Multisystems, Inc., to conduct the national evaluation of the Houston *Smart Commuter* ITS Operational Test. TTI is also providing ongoing technical assistance for the project.

I-45 North Real-Time Information System and Technology

Figure 1 illustrates the geographical area included in the I-45 North corridor component. A group of participants living in this area and working in downtown Houston, or another transit-accessible location, are receiving real-time traffic and static transit information through a hand-held device and a telephone system. As shown in Figure 2, real-time traffic information for the I-45 North Freeway and HOV lane, and the Hardy Toll Road is available to participants. Information on transit services in the corridor and in downtown Houston is also available.

Information on real-time traffic conditions, accidents, road work, and bus routes and schedules is provided to participants through two technologies. These two delivery systems are an enhanced Sony Magic Link™ Personal Intelligent Communication (PIC)-1000 and an interactive touch-tone telephone system. Both systems were developed by a team headed by TRW, which was selected in 1996 through a competitive two-step procurement method.

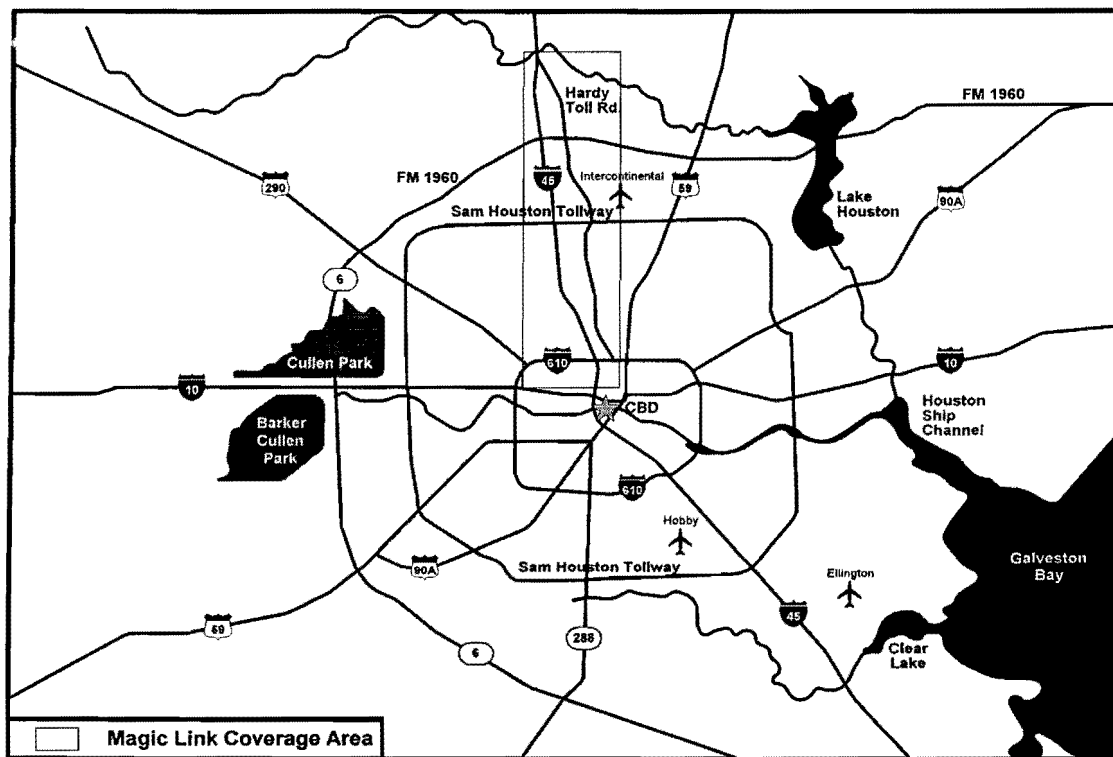
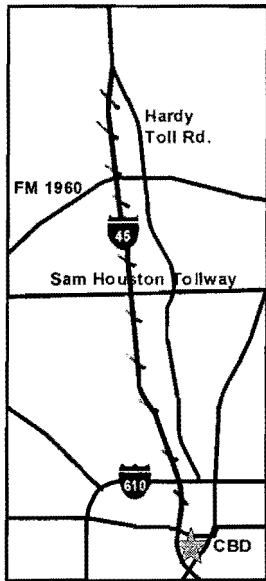
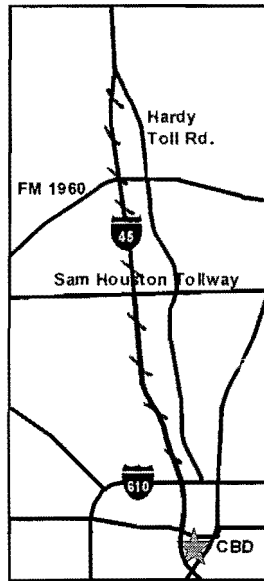


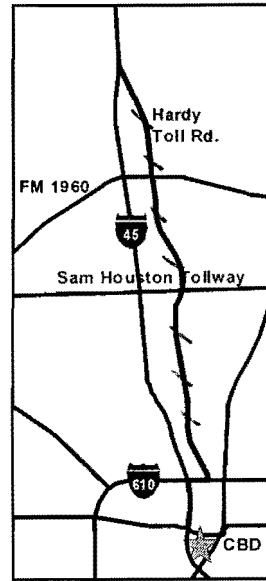
Figure 1. I-45 North Corridor Test Area



**I - 45 Mainlane
Travel Times**



**I - 45 HOV Lane
Travel Times**



**Hardy Toll Rd.
Travel Times**

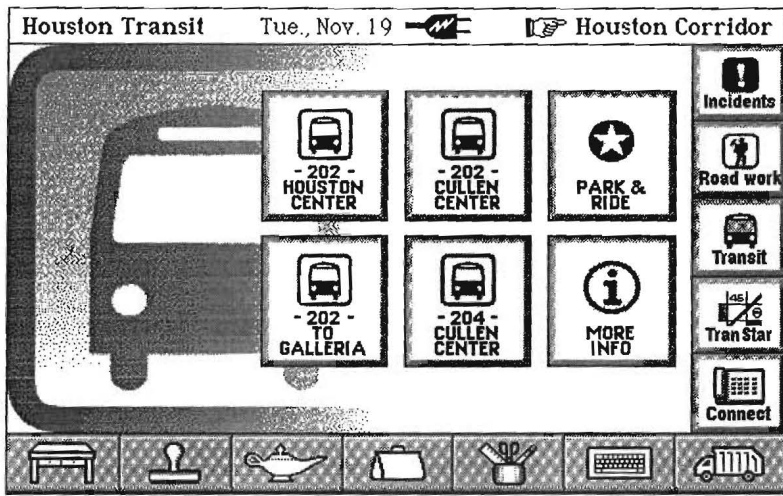
Figure 2. I-45 North Corridor Freeway and Toll Facilities

The Magic Link™, shown in Figure 3, is a commercially available battery-operated handheld personal information device. Users can access a wide range of programs and information on the Magic Link™ through the LCD touch screen. The basic Magic Link™ unit includes functions such as a datebook, a notebook, a calculator, a spreadsheet, a dictionary, games, and other capabilities. It also includes a communication platform that will allow users to access telephone, e-mail, fax, pager, and other devices.

The TRW team used the Magic Link™ as the basic platform and added a number of enhancements for the project. First, as illustrated in Figures 4 and 5, information on METRO services was added, including bus routes, schedules, and fares. Maps showing the locations of the park-and-ride lots in the I-45 North corridor, as well as in the downtown area, were developed and incorporated into the Magic Link™. Figure 6 shows the location of bus stops in the downtown area.



Figure 3. Magic Link™ Handheld Personal Information Device



- Route 202 serves the Kuykendahl Park-and-Ride (with midday service to Spring Park-and-Ride) and has three possible destinations
- Route 204 serves only the Spring Park-and-Ride and Cullen Center (Downtown)
- **More Info** will link you to information on HOV lane policies, bus fares, transfers, etc.

Figure 4. Example of Transit Information

Touch to change direction of schedule information

Touch to show the downtown bus stops for this route

Houston Transit Details 12:76 Houston Transit

202 Inbound Cullen Center *display stops*

| Spring Park & Ride | Kuykendahl Park & Ride | Milam / Congress | Calhoun / Smith | Jefferson / Smith |
|--------------------|------------------------|------------------|-----------------|-------------------|
| 900a | 910a | 934a | 943a | - |
| 935a | 945a | 1009a | 1018a | - |
| 1010a | 1020a | 1044a | 1053a | - |
| 1045a | 1055a | 1119a | 1128a | - |
| 1120a | 1130a | 1154a | 1203p | - |
| 1155a | 1205p | 1229p | 1238p | - |
| 1230p | 1240p | 104p | 113p | - |
| 105p | 115p | 139p | 148p | - |
| 140p | 150p | 214p | 223p | - |
| 215p | 225p | 249p | 258p | - |
| 250p | 300p | 324p | 333p | - |
| 325p | 335p | 359p | 408p | - |

Incidents, Road work, Transit, TranStar, Connect

Touch to scroll for viewing the entire schedule

Figure 5. Example of Transit Schedule Information

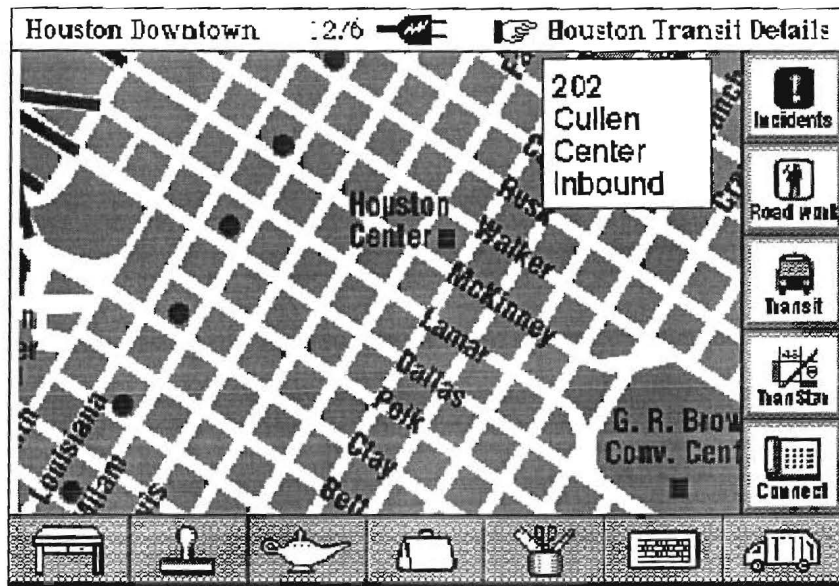


Figure 6. Example of Map with Downtown Bus Stop Locations

Participants are also able to access real-time traffic information on the I-45 North HOV lane and Freeway, as well as the Hardy Toll Road. Figure 7 highlights the freeway, HOV lane, and toll road sections covered by the Automated Vehicle Identification (AVI) real-time traffic system. The real-time traffic information from the TranStar facility is sent through an FM subcarrier subsystem. A radio antenna is attached to the Magic Link™. To obtain the real-time information, a participant simply turns on the Magic Link™ device. The components of the Magic Link™ system are shown in Figure 8.

✱ Travel times and average travel speeds are provided on the freeway segments indicated on this map.

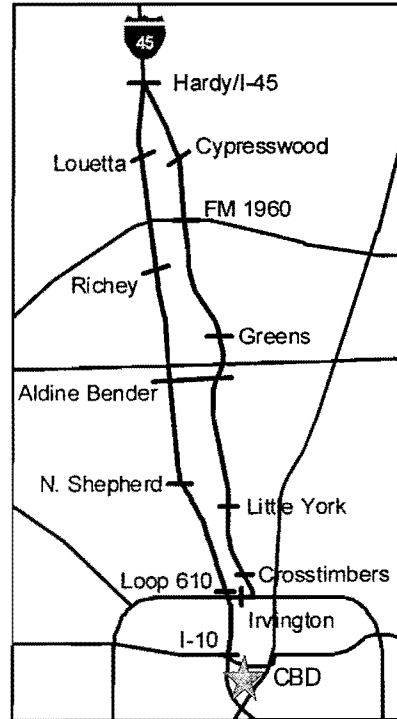


Figure 7. Freeway, HOV, and Toll Road Segments

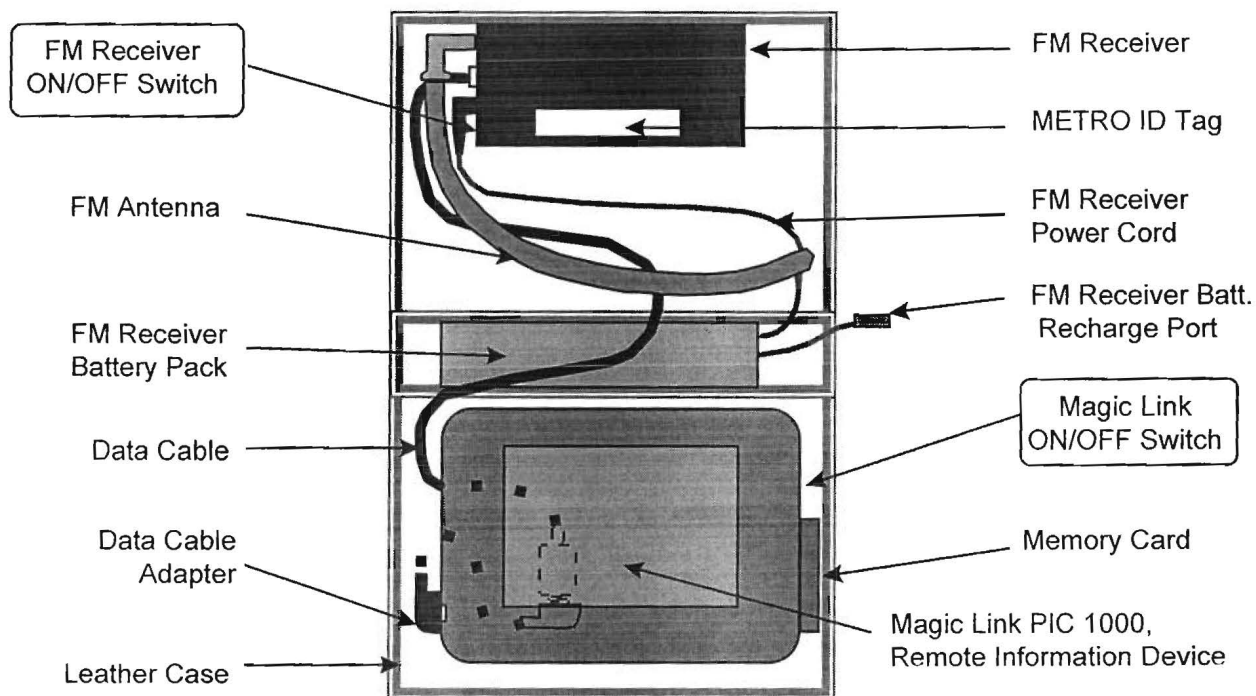


Figure 8. Magic Link™ Components

As illustrated in Figure 9, the Magic Link™ screen automatically defaults to a map of the I-45 North corridor. The user can then access more detailed screens with specific information on travel speeds, travel times, and other information. Icons show the travel speeds and the travel times for the I-45 North HOV lane, the general purpose freeway lanes, and the Hardy Toll Road. Figures 10 and 11 provide examples of these screens. Other screens are accessed by simply touching the face of the Magic Link™. In addition, participants are able to complete periodic travel diaries using the Magic Link™.

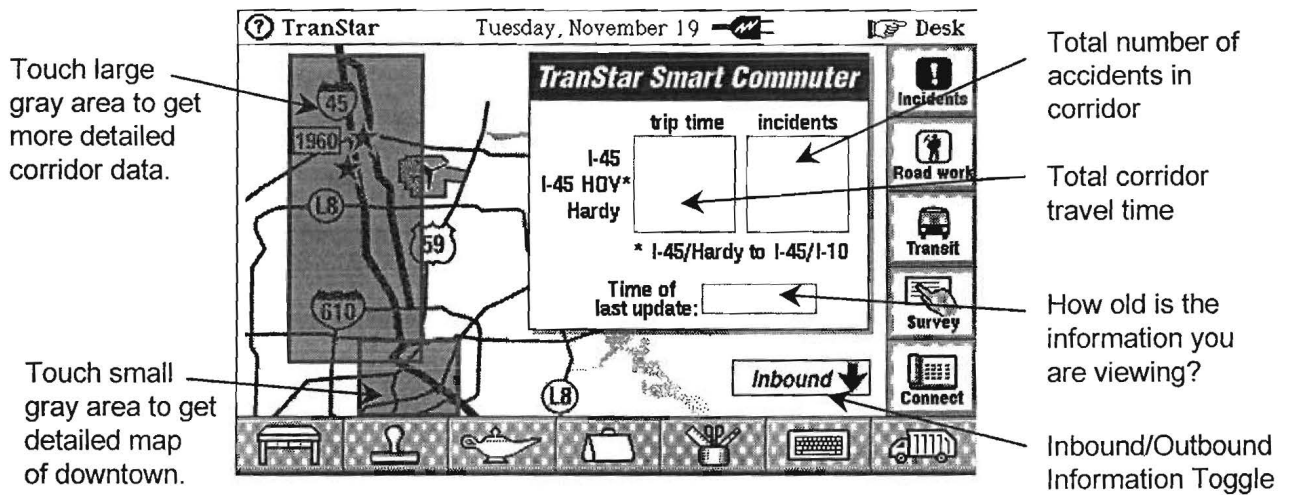


Figure 9. I-45 North Default Map

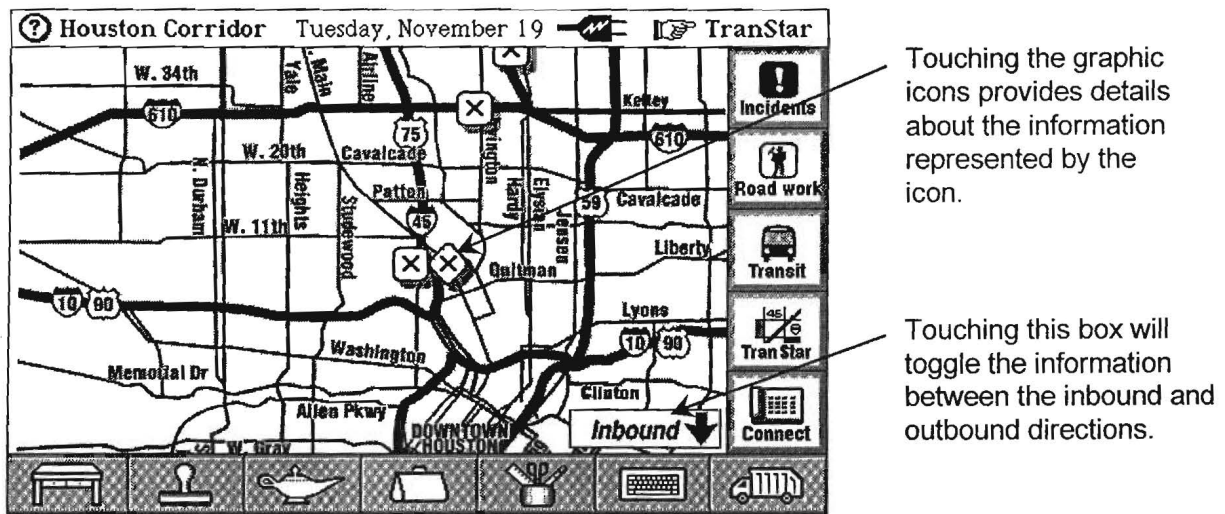


Figure 10. Example of Detailed Corridor View

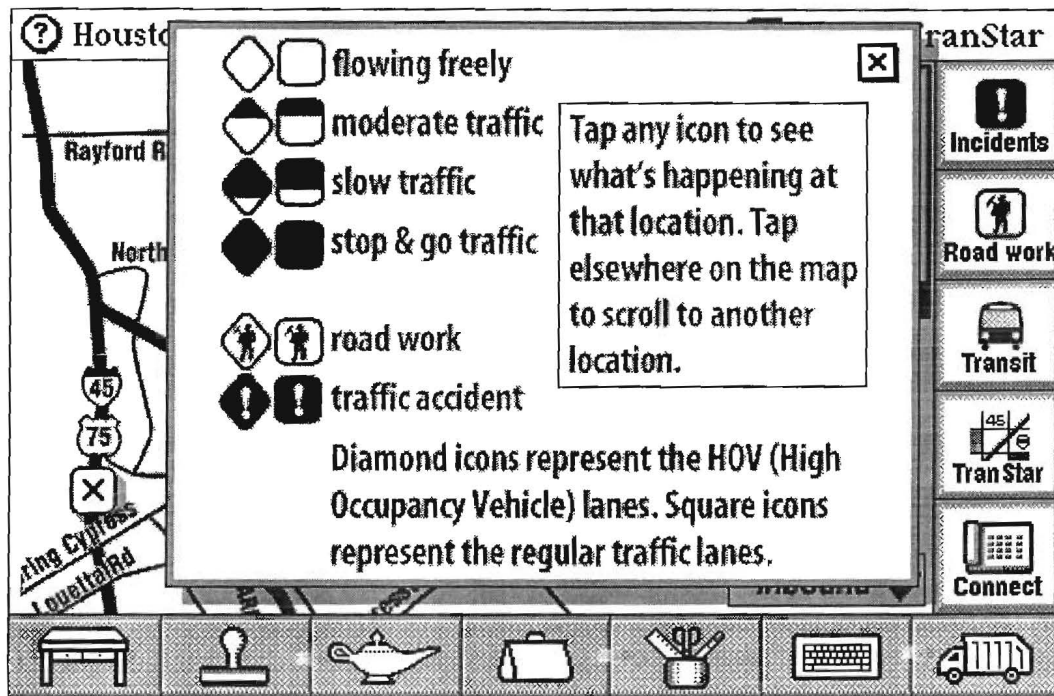


Figure 11. Example of Graphic Icons

These elements were developed by the TRW team, METRO staff, and TxDOT personnel. The specific components unique to the *Smart Commuter* Operational Test include the system interface to the TranStar real-time traffic database provided by TxDOT, which followed the Interface Control Document prepared by TxDOT; the link through the FM subcarrier; the design of the maps and icons for the traffic and transit information; the METRO route, schedule and fare information; and user surveys and travel diaries.

The interactive telephone system represents the second information delivery method. The system utilizes pre-recorded speech files which are produced and stored digitally. *Smart Commuter* participants access the system by calling a local telephone number. After a welcome message, participants are asked to enter their personal identification number (PIN). Participants may then obtain information on travel times, bus routes and schedules, and construction activities for the I-45 North HOV lane, the freeway lanes, and the Hardy Toll Road. The information is updated every 10 seconds or as needed so that callers receive current traffic conditions and scheduled departure times for the next few buses. The system provides inbound information in the morning and outbound information in the afternoon. A caller can either step through the various messages or go directly to specific information.

CHAPTER THREE – SUMMARY FY 1998 ACCOMPLISHMENTS

A number of activities were completed on the various elements of the Houston *Smart Commuter* Operational Test during FY 1998. These efforts focused primarily on the I-45 North bus components of the project. Major activities included conducting the one-year and 18-month travel diaries with the initial participants and the control group, recruiting and training a second test group, conducting the before and six-month travel diaries with the new participants, and obtaining feedback from participants through newsletters and telephone calls. Ongoing communication and coordination between the local and the national evaluation was also maintained. Work was initiated on the second component, which tested the use of pagers to provide real-time traffic information. This chapter highlights these major accomplishments and activities.

Recruiting and Training the Second Test Group

An initial group of approximately 275 individuals registered as *Smart Commuter* participants in the fall of 1996. These individuals met the criteria of residing in zip code zones in the Kuykendahl and Spring park-and-ride lot market areas, working in downtown Houston or other transit accessible locations, and driving alone to work most of the time. These individuals completed travel diaries and travel surveys before they received a Magic Link™ in December 1996. Due to the technical problems encountered with the FM subcarrier transmission to the Magic Link™ devices during the first six months of operation, which are documented in the FY 97 report (8), a number of individuals dropped out of the test. As a result, additional commuters were recruited in the fall of 1997 to participate in the project.

A number of techniques were used to identify potential volunteers living in the Kuykendahl and Spring park-and-ride lot market areas. Initial techniques included direct contact with major employers in the downtown area and other transit accessible activity centers, the METRO Web Site on the Internet, changeable message signs on the I-45 North Freeway, press releases, and information booths at the Woodlands Mall and the Park Mall.

To help recruit the second group of participants, METRO contracted with a private mailing service to obtain the names and addresses of approximately 80,000 individuals residing in the appropriate zip code zones. The initial list was narrowed to some 44,000 individuals, who were sent a copy of the *Smart Commuter* brochure. Approximately 1,000 people responded indicating an interest in participating in the project. Most of these individuals did not meet the criteria for the test. After screening out those that were not employed, those who worked outside the target area, and those who did not use the I-45N corridor on a regular basis, 226 individuals registered to participate in the test.

Representatives from METRO and TTI conducted the training sessions for the new participants in October, November, and December of 1997. Each session started with an overview

of the project, including the objectives of the operational test and the various components. Hands-on instruction was provided on the use of the Magic Link™ and the telephone system. Individuals were shown how to operate the unit, how to access the normal Magic Link™ features, and how to use the *Smart Commuter* functions. The use of the interactive telephone system was also described and demonstrated.

Participants were required to bring their completed travel survey and travel diary with them to the training session. These surveys had been mailed previously to each participant. During the training, participants were shown how to access, complete, and submit the periodic surveys using the Magic Link™, as well as how to upload usage statistics through the built-in telephone modem. The participants were also provided with information on what to do if they experienced any problems or difficulties with either of the information delivery systems.

Travel Surveys and Travel Diaries

Conducting and analyzing the travel surveys and travel diaries with the two test groups and the control group represented a major focus of the FY 98 work effort. Table 1 highlights the travel survey and travel diary schedule for the various groups. Participants in the initial test group and the control group completed one-year travel diaries in January 1998, and 18-month travel diaries in June 1998. The second group of participants completed travel surveys and travel diaries before receiving the Magic Link™ devices in October 1997, and travel diaries at one month in January 1998, and at six months in June 1998.

Table 1. Travel Survey and Travel Diary Schedule

| Group | Before ¹ | Six-Month ² | One-Year ^{2/3} | 18-Month ^{2/3} | Two-Year ³ |
|-------------------|----------------------------|------------------------|-------------------------|-------------------------|-----------------------|
| Control Group | November 1996 | June 1997 | January 1998 | June 1998 | January 1999 |
| First Test Group | November 1996 ⁴ | June 1997 | January 1998 | June 1998 | January 1999 |
| Second Test Group | October/November 1997 | June 1998 | January 1999 | — | — |

¹ - Travel Surveys and Travel Diaries.

² - Travel Diaries.

³ - Anticipated.

⁴ - 17 participants in the first test group completed the before surveys and diaries in February 1997.

The returned surveys and diaries were coded, entered into the database, and analyzed. Chapter Four provides a detailed discussion of the procedures for conducting these surveys and highlights the results of the preliminary analysis.

Ongoing Communication with Participants

A variety of techniques were used to communicate with the *Smart Commuter* participants. These included newsletters, e-mail, and special help sessions or workshops. A *Smart Commuter* Newsletter was used to communicate with members of the test group. The newsletters provided information on the project, including the schedules for the surveys and workshops. A *Smart Commuter* electronic mail (e-mail) address was also given to participants. The e-mail came to TTI researchers, who were able to quickly respond to questions and problems. This approach proved to be a very successful method of communication with participants who had access to e-mail.

In addition, four workshops were held at METRO in January 1998. The workshops provided participants with the opportunity to obtain help directly from METRO staff and TTI researchers. Individuals wishing to discontinue their participation in the test were also able to return their Magic Link™ devices at the sessions.

Ongoing Coordination with the National Evaluation

TTI researchers, METRO staff, and TxDOT personnel continued to coordinate activities related to the local and national evaluations of the *Smart Commuter* Operational Test during FY 1998. A meeting was held in February 1998 in Houston with representatives from Multisystems, the consulting firm responsible for the national evaluation. Periodic telephone conversations and e-mail were used to discuss the status of various elements of the operational test and to help coordinate the local and national evaluations. Preliminary information on the I-45 North component was provided to the national evaluation team.

Assistance with Pager Component

Staff from METRO, TxDOT, FHWA, and FTA worked to define the possible scope and approach for this portion of the Operational Test. Rather than the carpool concept initially envisioned for the second part of the project, the revised approach would provide real-time traffic information to commuters through an alphanumeric pager.

CHAPTER FOUR – ONGOING ASSESSMENT OF THE TEST AND CONTROL GROUPS

The ongoing monitoring and evaluation of participants' use of the information delivery system devices represents a major component of the *Smart Commuter* Operational Test. This chapter discusses the methodology used to conduct the travel surveys and the travel diaries throughout the test. The results from the various surveys and travel diaries are summarized, including changes in travel behavior resulting from the provision of the traffic and transit information.

Methodology

Participants in the test and control groups are completing travel surveys and travel diaries at approximately six-month intervals over the course of the project. Members of the initial test group and the control group completed travel surveys and travel diaries prior to the start of the project, and travel diaries after six months, one year, and 18 months of operation. The second test group completed travel surveys and travel diaries prior to their participation in the project, and travel diaries after one month and six months. The schedule for these surveys and diaries is highlighted in Table 1 in Chapter Three.

A copy of the travel survey is provided in Appendix A and a copy of the travel diary is provided in Appendix B. The surveys were developed through the coordinated efforts of TTI, METRO, and TxDOT personnel. Table 2 highlights the number of completed travel surveys and diaries for each time period. The procedures used to conduct the surveys and diaries with the test and control groups are described next.

Table 2. Number of Completed Travel Surveys and Diaries

| Group | Number of Completed Surveys/Diaries | | | |
|-------------------|-------------------------------------|------------------------|-----------------------|-----------------------|
| | Before ¹ | Six-Month ² | One-Year ² | 18-Month ² |
| Control Group | 466 ³ | 110 ³ | 74 ³ | 76 ³ |
| First Test Group | 290 | 42 | 69 | 43 |
| Second Test Group | 226 | 85 | — | — |

¹ - Travel Surveys and Travel Diaries.

² - Travel Diaries.

³ - 51 of the 466 control groups respondents indicated a willingness to complete future travel diaries. Only these individuals were sent travel diaries at six months, 12 months, and 18 months.

Travel surveys and travel diaries were mailed to test group participants prior to the training sessions in the fall of 1996 and 1997. The participants were asked to complete the survey and to record their commute trips for a specific one-week period before the training session. The participants were required to bring the completed surveys to the training session in order to obtain a Magic Link™ information device. A total of 290 travel surveys and travel diaries were received prior to the start of the test from the initial group of *Smart Commuter* participants. The second test group was comprised of 226 individuals. Completed travel surveys and diaries were received from this group prior to the start of their participation in 1997.

Members of the initial test group completed six-month travel diaries in June 1997. As noted previously, and documented in the FY 97 report (8), the response by the first group of participants to the six-month travel diaries was low. It appears that the low response was due to the problems encountered with the FM subcarrier, which hampered the transmission of the real-time information to the Magic Link™ devices. Individuals in the initial test group who continued to participate in the project were asked to complete travel diaries at one year in January of 1998, and at 18 months in June of 1998.

Participants in the second test group completed before travel surveys and travel diaries in October 1997. A total of 226 individuals started in this group. Participants were asked to complete a one-month travel diary in January 1997 to coincide with the one-year diaries completed by the initial test group and the control group. A total of 153 one-month diaries were completed and 85 diaries were received at six months in June 1998.

The control group for the project is comprised of commuters in the I-45 North Freeway corridor. The following procedure was used to obtain information from the control group. The techniques are similar to those used by TTI, METRO, and TxDOT on other surveys and projects.

First, TTI researchers videotaped the license plate numbers of vehicles traveling in the I-45 North Freeway general purpose lanes for 2.5 hours during the afternoon peak-period. The videotaping was conducted in September 1996. Of the 6,300 vehicles observed during the time period, the videotape produced 5,308 readable license plates. The license plate numbers were transcribed and sent to the Texas Department of Motor Vehicles (DMV).

The DMV provided TTI with a list of names and addresses for the owners of the videotaped vehicle license plates. The list was reviewed by TTI researchers and vehicles belonging to commercial businesses, rental car companies, and individuals from out-of-state were deleted. A total of 3,754 useable names resulted from this process. These individuals were sent a letter explaining the *Smart Commuter* project and requesting assistance by completing and returning the travel survey and travel diary. A copy of this letter is provided in Appendix C. A total of 466 surveys were returned accounting for a response rate of approximately 8 percent.

The last question on the survey asked if the individual would be willing to complete another travel diary in six months. A space was provided for their name and address. Over half the respondents, or 251 individuals, indicated a willingness to complete a second survey.

A second letter and travel diary, similar to the first, were sent to these individuals in June of 1997 as part of the six-month evaluation of the initial test. A total of 110 completed surveys were returned. Five people responded that they were no longer using the I-45 North Freeway due to a change in either their home or work location and three individuals indicated that they had retired. Three surveys were also returned as undeliverable.

Control members were asked to complete two more waves of travel diaries at one-year and 18-months. As highlighted in Table 2, 74 responses were received to the one-year survey and 76 diaries were completed at 18-months. Two of the surveys mailed in January were returned as undeliverable.

Before Travel Surveys

The results of the responses to the travel surveys conducted prior to the start of the operational test are presented in this section. The employment, work hours, commute time, travel modes, and the factors influencing commute behavior of the individuals in the control groups are presented first. The general socio-economic characteristics of participants are briefly summarized. More detailed socio-economic information on the participants is provided in Appendix D.

Normal Commute Mode

As shown in Table 3, the vast majority of individuals in both the test and the control groups normally drive alone to and from work. Between 72 and 89 percent of the participants reported they always drive alone. Under 10 percent of the first test group and the control group indicated they normally carpool.

The second test group contained slightly more carpoolers, with 21 percent indicating they normally carpool. Less than 5 percent of the individuals reported they typically ride the bus. These figures are not surprising given that the recruitment of volunteers focused on individuals who primarily drive alone to and from work. As noted, however, the test and control groups do contain some carpoolers and transit users.

Employment, Commute Length, and Commute Travel Time

Most of the individuals in the test groups and the control group are employed on a full-time basis. As shown in Table 4, over 90 percent of the participants in all groups are full-time employees. Between 2 percent and 6 percent are employed on a part-time basis. The remaining participants reported they were university students or seeking employment.

The majority of individuals in the test groups and the control group live over 20 miles from their place of employment. Further, most have commute travel times of at least 30 minutes. Table 5 highlights the one-way distance from home to work and Table 6 identifies the corresponding travel time for this trip.

Knowledge of Transit

Individuals were asked to respond to a series of questions relating to their knowledge of the transit system and bus services in their area. As highlighted in Table 7, participants in the test groups expressed slightly higher levels of understanding related to the various transit system components than those in the control group. For example, 93 percent of participants in the test groups indicated a knowledge of the park-and-ride lot nearest to their house, compared to 82 percent of the control group members. The test group participants also reported more familiarity with transit schedules, bus stop locations, and fares.

Factors Influencing Commuting Behavior

The surveys included a series of questions relating to the factors influencing the use of different modes and commuting behavior. Individuals in the test and control groups were asked to identify the reasons they currently drive alone and the factors that may influence them to use a different mode.

Table 8 identifies the factors cited most frequently by respondents for driving alone to and from work. The responses by participants in the test and control groups were fairly similar. Work schedules that do not permit sharing a ride was the most frequently noted reason, followed by the need for an automobile before and after work, and the need for a car during the work day.

Table 3. Normal Commute Mode

| Mode/Frequency | First Test Group | Second Test Group | Control Group |
|-----------------------|-------------------------|--------------------------|----------------------|
| Drive Alone | | | |
| Always | 88% | 72% | 89% |
| Occasionally | 11% | 26% | 9% |
| Never | 1% | 2% | 2% |
| Carpool | | | |
| Always | 5% | 21% | 9% |
| Occasionally | 37% | 33% | 20% |
| Never | 58% | 46% | 71% |
| Vanpool | | | |
| Always | 0.5% | - | - |
| Occasionally | 3.5% | 0.5% | 1% |
| Never | 96% | 99.5% | 99% |
| Ride the Bus | | | |
| Always | 2% | 3% | 3% |
| Occasionally | 29% | 30% | 11% |
| Never | 69% | 67% | 86% |
| Other | | | |
| Always | 2% | - | 5% |
| Occasionally | 8% | 3% | 6% |
| Never | 90% | 97% | 89% |

Table 4. Employment Status of Test and Control Group Participants

| Employment Status | First Test Group | Second Test Group | Control Group |
|--------------------------|-------------------------|--------------------------|----------------------|
| Full-Time | 94% | 92% | 91% |
| Part-Time | 2% | 5% | 6% |
| Other | 4% | 2% | 3% |

Table 5. Home to Work Distance for Test and Control Group Participants

| One-Way Miles from Home to Work | First Test Group | Second Test Group | Control Group |
|--|-------------------------|--------------------------|----------------------|
| 0-9 Miles | - | 0.5% | 1% |
| 10-19 Miles | 3% | 3.5% | 15% |
| 20-29 Miles | 44% | 39% | 44% |
| 30-39 Miles | 37% | 45% | 29% |
| 40-49 Miles | 10% | 11% | 6% |
| 50+ Miles | 6% | 1% | 5% |
| Total | 100% | 100% | 100% |

Table 6. Home to Work Travel Time for Test and Control Group Participants

| One-Way Time from Home to Work | First Test Group | Second Test Group | Control Group |
|---------------------------------------|-------------------------|--------------------------|----------------------|
| 0-9 Minutes | - | 0.5% | - |
| 10-19 Minutes | - | - | 1% |
| 20-29 Minutes | 1% | 2.5% | 7% |
| 30-39 Minutes | 9% | 6% | 9% |
| 40-49 Minutes | 33% | 35% | 34% |
| 50+ Minutes | 57% | 56% | 49% |
| Total | 100% | 100% | 100% |

Table 7. Knowledge of Bus Service

| Question | First Test Group | Second Test Group | Control Group |
|--|-------------------------|--------------------------|----------------------|
| Are you aware of a park-and-ride lot located near your house? | | | |
| Yes | 93% | 93% | 82% |
| No | 7% | 7% | 18% |
| Subtotal | 100% | 100% | 100% |
| How familiar are you with the following features of park-and-ride bus service? | | | |
| Schedules | | | |
| Very Familiar | 17% | 23% | 13% |
| Somewhat Familiar | 37% | 32% | 28% |
| Not Familiar | 46% | 45% | 59% |
| Subtotal | 100% | 100% | 100% |
| Bus Stop Locations | | | |
| Very Familiar | 21% | 26% | 17% |
| Somewhat Familiar | 40% | 38% | 35% |
| Not Familiar | 39% | 36% | 48% |
| Subtotal | 100% | 100% | 100% |
| Cost | | | |
| Very Familiar | 22% | 27% | 21% |
| Somewhat Familiar | 35% | 36% | 28% |
| Not Familiar | 43% | 37% | 51% |
| Subtotal | 100% | 100% | 100% |

Table 8. Reasons for Driving Alone*

| Reason | First Test Group | Second Test Group | Control Group |
|--|-------------------------|--------------------------|----------------------|
| Cannot find anyone to ride with | 8% | 10% | 9% |
| Need car for work during the day | 18% | 22% | 15% |
| Need car before/after work for errands | 19% | 19% | 18% |
| Enjoy privacy, do not care to share a ride | 8% | 7% | 12% |
| Need car to take/pick up child at daycare | 6% | 4% | 6% |
| Work schedule does not permit sharing a ride | 21% | 21% | 20% |
| Need car in case of emergencies | 11% | 10% | 11% |
| Other | 9% | 7% | 9% |

***Respondents were asked to check no more than two**

Table 9 highlights the responses to questions relating to factors that may influence changes in commute modes. As shown in Table 9, 34 percent of the first test group participants, 27 percent of the second group, and 44 percent of the control group respondents indicated that nothing would influence them to ride the bus. On the other hand, 28 to 29 percent of the test groups and 22 percent of the control group responded that having their employer subsidize bus passes would influence them to use the bus. Late evening bus service and more information on existing bus routes were also noted as positive factors by respondents in the test and control groups.

Twenty percent of participants in the test groups and 29 percent of the control group members responded that nothing would influence them to carpool or vanpool. Factors cited as possible inducements to sharing a ride included access to the HOV lane, vehicles available for midday work trips, free ridematching services, employer vanpool subsidies, and preferential parking for rideshare vehicles.

Table 9. Factors Influencing Commuting Habits*

| Factors | First Test Group | Second Test Group | Control Group |
|---|-------------------------|--------------------------|----------------------|
| Bus Service | | | |
| More information regarding bus routes | 16% | 18% | 18% |
| Late evening bus service | 20% | 23% | 14% |
| None, I ride bus regularly | 2% | 3% | 2% |
| Employer pays portion of bus pass | 28% | 29% | 22% |
| Nothing would influence me to ride a bus | 34% | 27% | 44% |
| Carpool and Vanpool | | | |
| Free matching with other convenient carpoolers and vanpoolers | 15% | 12% | 15% |
| Vehicles at work available for midday business trips | 19% | 20% | 14% |
| Employer pays part of vanpool cost | 13% | 14% | 14% |
| None, I carpool or vanpool now | 3% | 9% | 4% |
| Preferential parking at work | 10% | 10% | 8% |
| Access to HOV lanes | 20% | 15% | 16% |
| Nothing would influence me to carpool or vanpool | 20% | 20% | 29% |
| General | | | |
| Guaranteed ride home for emergencies and overtime | 38% | 43% | 37% |
| Increased parking costs that I would have to pay | 15% | 10% | 8% |
| Variable/flexible work hours | 25% | 23% | 21% |
| Midday shuttle service to restaurants or shopping | 10% | 16% | 13% |
| Other | 12% | 8% | 21% |

***multiple response possible**

The availability of a guaranteed ride home program would influence between 37 and 43 percent of the respondents to consider using a high-occupancy commute mode. Variable or flexible work hours were noted as a positive influence by 21 to 25 percent of the participants. Other factors receiving lower levels of interest included increased parking costs and midday shuttle services.

Employer Provided Commute Benefits

Table 10 identifies the commute benefits provided by the employers of participants in the test and the control groups. Free parking was the most frequently reported benefit. Slightly over half of the control group participants receive free parking from their employer, while 42 to 45 percent of the participants in the test groups reported this benefit. Fifteen to 19 percent of the individuals in the test groups and 16 percent of the control group reported that their employer subsidizes bus passes. Eleven to 16 percent of participants in all groups indicated that on-site bus pass sales are provided. Less than 10 percent of the respondents reported employer subsidized vanpools and guaranteed ride home programs.

Table 10. Employer Provided Commute Benefits*

| Type of Benefit | First Test Group | Second Test Group | Control Group |
|------------------------------|-------------------------|--------------------------|----------------------|
| Free Parking | 42% | 45% | 55% |
| Bus Pass Subsidy | 15% | 19% | 16% |
| Vanpool Subsidy | 6% | 4% | 3% |
| On-Site Bus Pass Sales | 16% | 15% | 11% |
| Guaranteed Ride Home Program | 7% | 8% | 4% |
| Other | 14% | 9% | 11% |

***multiple responses possible**

Traffic and Transit Information

Tables 11 through 13 summarize the responses to a series of questions relating to the use of commercially available information on traffic conditions. As highlighted in Table 11, radio traffic reports are the most common source of information used by individuals in all groups. Sixty percent or more of the participants in the test and control groups listen to radio traffic reports.

Television is the next most frequently noted source of information, followed by the Internet and the newspaper. Five percent of the control group participants and 2 percent of individuals in the test groups responded that they do not seek traffic or transit information.

It is interesting to note the difference in the use of the Internet by the two groups of test participants. The surveys for the first group were completed in the fall of 1996, while the second were conducted in the fall of 1997. The reported use of the Internet as a source of traffic information by the second group was almost double that of the first group. Further, the second group was ten times more likely than the first group to use the Internet as a source of information. The growth in the use of the Internet and the availability of the Houston AVI real-time traffic map Website may partially account for this increase. Another potential factor influencing these results is that individuals knowledgeable in technology and the Internet may have been more likely to volunteer to participate in the test.

As highlighted in Table 12, most individuals reported seeking traffic and transit information on their way to work. Approximately 50 percent of the participants responded that they seek information during their trip to work. These responses correspond to the heavy reliance on radio traffic reports noted previously. Some 33 to 35 percent of the respondents seek information before they leave home, and 17 to 20 percent obtain information before they leave work for their trip home.

Finally, participants were asked to rate the importance of traffic and transit information in their choice of radio and television stations. Between 50 and 56 percent of the respondents indicated that the availability of traffic and transit information was very important in their selection of radio and television stations. Another 32 to 39 percent noted that it was somewhat important.

Table 11. Sources of Traffic and Transit Information*

| Source/ Technology | First Test Group | Second Test Group | Control Group |
|---|---------------------|----------------------|---------------|
| Radio | 64% | 60% | 65% |
| Television | 25% | 26% | 26% |
| Newspaper | 3% | 1% | 3% |
| Internet | 6% | 11% | 1% |
| Do not seek out traffic or transit information | 2% | 2% | 5% |

*Multiple responses possible

Table 12. Time When Traffic and Transit Information is Obtained

| Time | First Test Group | Second Test Group | Control Group |
|-----------------------------------|-------------------------|--------------------------|----------------------|
| Before leaving for work | 33% | 35% | 35% |
| On way to work | 50% | 45% | 47% |
| At work before leaving to go home | 17% | 20% | 18% |

Table 13. Importance of Availability of Traffic Information in Choice of Radio or Television Stations

| Importance Rating | First Test Group | Second Test Group | Control Group |
|--------------------------|-------------------------|--------------------------|----------------------|
| Very Important | 53% | 56% | 50% |
| Somewhat Important | 39% | 37% | 32% |
| Somewhat Unimportant | 4% | 4% | 7% |
| Not Important At All | 4% | 3% | 11% |

Socio-Economic Characteristics

The final questions on the survey requested information on the basic socio-economic characteristics of the respondent. These included education, income, gender, age, and ethnicity. As summarized in this section, individuals in both the test and control groups reflect fairly similar socio-economic characteristics. The detailed information for each group is provided in Appendix D.

- Males account for a slightly higher percentage of test group participants than the control group. Test Group participants are 72 percent and 80 percent male, while 59 percent of the control group are male.

- All groups reflect fairly similar age distributions. Thirty-five to 44 percent of participants fall within the 35 to 44 age group, while 24 to 28 percent are 45 to 54 and 20 to 26 percent are 21 to 34 years of age.
- Participants reflect fairly similar income levels, although more test group participants are in the higher income brackets than control group members. Seventy percent of the first test group and 82 percent of the second reported incomes of \$50,000 or higher, compared to 63 percent of the control group.
- The reported household size of participants in all groups was fairly similar. Two-person households were the most common, followed by three-person households.
- Reported vehicle ownership per household is similar among participants. The majority of individuals in all groups have two or more vehicles available.
- The ethnicity of individuals in both groups is similar. The majority, 83 to 89 percent of participants, are White, while 4 to 7 percent are Afro-American, 4 to 7 percent are Hispanic, and 2 to 4 percent are Asian.

Travel Diaries and Changes in Travel Behavior

As noted previously, travel diaries are being completed by participants at selected points throughout the test. Participants in the initial test group and the control group completed travel diaries for a week before the start of the *Smart Commuter* Operational Test, and after six months, 12 months, and 18 months of operation. Members in the second test group completed travel surveys and diaries before they started, and travel diaries after one month and six months. The diary includes a log of travel to and from work, midday trips, stops on the way to and from work, travel mode, use of traffic and transit information, and changes in travel behavior based on this information. A copy of the travel diary is provided in Appendix B.

The information in the travel diaries on commute modes and travel times reflects the trends presented previously. The majority of participants in both groups drive alone to and from work, have one-way commute trips of at least 20 miles, and have commute travel times of 40 minutes or more. Further, individuals in both groups frequently reported making stops on the way to and from work to pick up or drop off children, run errands, or take care of other personal business.

The travel diaries provide a wealth of information on the commute patterns of participants in the test and control groups. Researchers are analyzing the results from the diaries in different ways and examining the responses to various questions in more detail. Travel diaries were received from all participants before their involvement in the project. Since all participants did not complete travel diaries at each subsequent period, however, the results are being examined in different ways. Researchers are analyzing all the responses received from the test and control

groups at each survey period, as well as tracking subgroups of individuals who provided diaries on a regular basis.

Participants completing travel diaries before the start of the project, at one midpoint, and at the most recent survey period are being examined in one subgroup analysis. To be included in this analysis, participants in the initial test and control groups must have completed a diary before the start of the project, at either six months or one year, and at 18 months. Participants in the second test group must have completed the before, one-month, and six-month surveys to be included. The preliminary results from this analysis indicate some interesting differences in the travel behavior among individuals in the test groups and those in the control group.

As shown in Table 14, 35 individuals in the first test group, 72 participants in the second test group, and 63 control group members met these criteria. The number of days with completed diaries for each of these subgroups were analyzed and compared. Since individuals were asked to complete the travel diaries for a full week, a total of five days per respondent is possible. The actual number of days reported may be less, however, reflecting vacation, sick leave, telecommuting, business trips, or other factors. Table 14 highlights the actual number of days with completed travel diaries for each of the subgroups.

Table 14. Test and Control Subgroups Completing at Least Three Travel Diaries¹

| Subgroup Characteristics | First Test Group | | Second Test Group | | Control Group | |
|------------------------------|------------------|-----------|-------------------|----------|---------------|-----------|
| | Before | 18-Months | Before | 6-Months | Before | 18-Months |
| Number of Participants | 35 | 35 | 72 | 72 | 63 | 63 |
| Total Days of Travel Diaries | 166 | 142 | 311 | 305 | 287 | 266 |

¹ - To be included in the subgroups, individuals must have completed travel diaries before the start, at one mid-point, and at the most recent time point.

As highlighted in Table 15, differences appear in the reported travel behavior among participants in the test groups compared with those in the control group. The percentage of individuals in the two test groups driving alone to work decreased by a greater amount at the six-month or 18-month surveys and the percentage of days commuting by carpooling or taking the bus to work increased more than the control group participants. For example, reported drive alone days dropped from 90 to 82 percent for individuals in the first test group, an 8 percent decline, and from 69 to 62 percent, a 7 percent drop, for participants in the second test group. Carpool commute days increased from 7 to 10 percent for the first group and from 18 to 24 percent for the second group, a 3 and 6 percent increase, respectively. Reported days of commuting by bus increased by 5 percent and 1 percent, respectively, for the two test groups. On the other hand, control group members reported only a 3 percent decline in drive alone commute trips, no change in carpooling, and a 3 percent increase in bus trips.

While it is not known at this time if these changes are specifically attributed to the *Smart Commuter* information and participation in the project, the results indicate a greater propensity over time among test group members to carpool and ride the bus. The discussion groups with participants, which will be held in FY 99, will provide the opportunity to obtain more feedback on the factors influencing these changes in travel behavior and the impact of the *Smart Commuter* information systems.

Table 15. Changes in Reported Travel Mode by Subgroups

| Mode to Work | First Test Group ¹ | | Second Test Group ² | | Control Group ³ | |
|------------------------------|-------------------------------|-----------|--------------------------------|----------|----------------------------|-----------|
| | Before | 18-Months | Before | 6-Months | Before | 18-Months |
| Total Days of Travel Diaries | 166 | 142 | 311 | 305 | 287 | 266 |
| Drive Alone | 90% | 82% | 69% | 62% | 91% | 88% |
| Carpool | 7% | 10% | 18% | 24% | 8% | 8% |
| Bus | 3% | 8% | 11% | 12% | 1% | 4% |
| Vanpool | — | — | 1% | — | — | — |
| Other | — | — | 1% | — | — | — |

¹ - 35 participants.

² - 72 participants.

³ - 63 participants.

At the same time, individuals in the subgroups reported seeking traffic information on fewer days at the 18-month or six-month reported periods. In all three subgroups, this decline occurred among commuters driving alone. The percentage of days carpoolers and bus riders obtained traffic information increased for bus riders in the test and control group. It also increased for carpoolers in the test groups, while it remained constant for carpoolers in the control group.

A decline was reported among all subgroups in the number of days individuals changed their travel patterns to work based on this information, although the ranking of changes remained similar. As highlighted in Table 16, participants in all groups reported making fewer changes in their trips to work in the six-month and 18-month travel diaries. These trends may reflect the previously discussed changes in mode. It appears that some participants have changed from driving alone to taking the bus and carpooling on a somewhat regular basis. Thus, individuals who previously made these changes in response to traffic information have now made them a more permanent part of their travel patterns. As a result, they may seek traffic information on fewer days because they have already changed their travel behavior. Of the respondents who reported altering their behavior, changing travel routes was the most frequently reported change during all

survey time periods. Altering the time of travel, changing the mode of travel, and eliminating the trip followed as the next most frequently noted behavior changes.

Table 16. Changes in Travel Behavior to Work by Subgroups

| Changes in Travel Behavior to Work | First Test Group ¹ | | Second Test Group ² | | Control Group ³ | |
|------------------------------------|-------------------------------|-----------|--------------------------------|----------|----------------------------|-----------|
| | Before | 18-Months | Before | 6-Months | Before | 18-Months |
| Total Days of Travel Diaries | 166 | 142 | 311 | 305 | 287 | 266 |
| Number of Days | 24 | 17 | 60 | 34 | 58 | 21 |
| Percent of Days | 14% | 12% | 19% | 11% | 20% | 8% |

¹ - 35 participants.

² - 72 participants.

³ - 63 participants.

The use of different media to obtain traffic information also changed slightly among the subgroups. Participants in the test subgroups reported less use of the radio and more use of the Magic Link™ devices and television from the before period to the most recent survey. Individuals in the control subgroup reported a slight increase in radio use and slight declines in television and newspaper use. Correspondingly, participants in the control subgroup reporting changes in travel behavior did so on the basis of information obtained from radio and television reports, while participants in the test groups did so based on radio, television, and *Smart Commuter* information.

Finally, researchers examined the use of the Magic Link™ devices by participants in both test groups. The Magic Link™ automatically records each time the device is turned on, the duration of these sessions, and the information requested. Participants are asked to download these use logs every two weeks through the telephone modem. The use logs are also automatically sent when a participant submits their travel diary electronically. These use logs were examined on a quarterly basis. The periods when it appeared that an individual left the device on for a major portion of the day were discounted from this analysis. Although the overall number of sessions has declined on a quarterly basis, the average session duration has increased and the percent of time individuals examine traffic information has increased. The time using the basic Magic Link™ functions has declined, which appears to indicate that after an introduction or testing period, participants are using the devices primarily for the added traffic information features and not the notebook, games, and standard features of the devices.

As noted previously, researchers are continuing to examine these elements in more detail. The discussion groups should help clarify some of the questions emerging from this preliminary analysis. A short questionnaire may also be used in conjunction with the January 1999 travel diaries to obtain additional information from the test and control group participants.

CHAPTER FIVE — ANTICIPATED FUTURE ACTIVITIES

This chapter briefly summarizes the anticipated schedule of activities for FY 1999. These include conducting discussion groups with test participants, completing the two-year and one-year travel diaries with the test and control groups, assisting with the pager component, and coordinating with the national evaluation.

- **Conduct Discussion Groups with Test Participants.** Discussion or focus groups will be conducted with test participants. The approach and the script for these sessions will be developed by TTI researchers, METRO staff, and TxDOT personnel, with input from the national evaluation team. The sessions will provide the opportunity for more extensive discussions with participants on the use of the Magic Link™ and the telephone systems, changes in travel behavior, and ideas on the provision of real-time traffic and transit information. These discussion groups will be scheduled from November 1998 through February 1999.
- **Conduct Two-Year and One-Year Travel Diaries with Test and Control Groups.** Participants in the test and the control groups will be asked to complete travel surveys and travel diaries in January 1999. These will be the two-year surveys for the initial test and control groups, and the one-year surveys for the second test group. The surveys and diaries will be mailed to test and control group members. The test participants may also complete their travel surveys and diaries through the Magic Link™ devices. TTI researchers will compile, reduce, and analyze the surveys and travel diaries. These activities will be conducted in January through April 1998.
- **Phase One Report.** The results from discussion groups, surveys, and travel diaries will be documented in a report. Information from other elements of the local evaluation will also be examined and included. This report will be completed by August 1999.
- **Pager Component.** Representatives from METRO, TxDOT, FHWA, and FTA have been discussing possible phase two activities on the *Smart Commuter* Operational Test, focusing on the use of pagers to provide real-time traffic information. Researchers will assist in activities associated with this component as appropriate.
- **Ongoing Communication and Coordination with the National Evaluation.** Ongoing communication and coordination will be maintained with representatives from Volpe and Multisystems, Inc., who are responsible for the national evaluation.

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APPENDIX A—TRAVELER SURVEY

I-45 NORTH FREEWAY TRAFFIC INFORMATION SURVEY

Thank you for participating in this very important study. As a traveler on the I-45 North Freeway, please complete this survey and the attached travel diaries for the week of **November 18-22, 1996**.

Home Zip Code _____

Work Zip Code _____

1. How often do you use the following modes of transportation for commuting to or from work?

| | <u>Always or Almost Always</u> | <u>Occasionally</u> | <u>Never</u> |
|--------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| a. Drive alone | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |
| b. Carpool | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |
| c. Vanpool | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |
| d. Ride the bus | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |
| e. Other (Specify) _____ | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |

2. Are you aware of a Park & Ride bus lot located near your home? ₁ Yes ₂ No

2.1 Which Park & Ride bus lot is nearest your home? _____

2.2 How familiar are you with the following features of Park & Ride bus service?

| | <u>Very Familiar</u> | <u>Somewhat Familiar</u> | <u>Not At All Familiar</u> |
|-----------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| a. Schedule | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |
| b. Bus stop locations | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |
| c. Cost | <input type="checkbox"/> ₁ | <input type="checkbox"/> ₂ | <input type="checkbox"/> ₃ |

3. What are your work hours and schedule? (Check all that apply, indicate hours, and circle a.m. or p.m.) If you work full-time or part-time, circle which days of the week you work.

| HOURS | SCHEDULE (Circle all that apply) | | | | | | | | |
|--|--|------|-------|------|-------|------|------|------|--|
| <input type="checkbox"/> ₁ Full-time. Hours are from ___:___ a.m./p.m. to ___:___ a.m./p.m. <div style="text-align: center; margin-top: 5px;"> (Circle One) (Circle One) </div> | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px dashed black; padding: 2px 5px;">Mon.</td> <td style="padding: 2px 5px;">Tues.</td> <td style="padding: 2px 5px;">Wed.</td> <td style="padding: 2px 5px;">Thur.</td> </tr> <tr> <td style="border-right: 1px dashed black; padding: 2px 5px;">Fri.</td> <td style="padding: 2px 5px;">Sat.</td> <td style="padding: 2px 5px;">Sun.</td> <td></td> </tr> </table> | Mon. | Tues. | Wed. | Thur. | Fri. | Sat. | Sun. | |
| Mon. | Tues. | Wed. | Thur. | | | | | | |
| Fri. | Sat. | Sun. | | | | | | | |
| <input type="checkbox"/> ₂ Full-time. Hours are irregular. | | | | | | | | | |
| <input type="checkbox"/> ₃ Part-time. Hours are from ___:___ a.m./p.m. to ___:___ a.m./p.m. <div style="text-align: center; margin-top: 5px;"> (Circle One) (Circle One) </div> | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px dashed black; padding: 2px 5px;">Mon.</td> <td style="padding: 2px 5px;">Tues.</td> <td style="padding: 2px 5px;">Wed.</td> <td style="padding: 2px 5px;">Thur.</td> </tr> <tr> <td style="border-right: 1px dashed black; padding: 2px 5px;">Fri.</td> <td style="padding: 2px 5px;">Sat.</td> <td style="padding: 2px 5px;">Sun.</td> <td></td> </tr> </table> | Mon. | Tues. | Wed. | Thur. | Fri. | Sat. | Sun. | |
| Mon. | Tues. | Wed. | Thur. | | | | | | |
| Fri. | Sat. | Sun. | | | | | | | |
| <input type="checkbox"/> ₄ Part-time. Hours are irregular. | | | | | | | | | |
| <input type="checkbox"/> ₅ Student. Attend school (<i>Circle One</i>): Full-time or Part-time | | | | | | | | | |
| <input type="checkbox"/> ₈ Other (<i>Specify</i>): _____ | | | | | | | | | |

4. On an average workday, how many minutes do you spend commuting one-way? _____

5. How many miles, one-way, is it from your home to work location? _____

6. Which of the following would influence your commuting habits? (*Check all that apply*)

Bus Service

- | | |
|---|---|
| <input type="checkbox"/> ₁ More information regarding bus routes | <input type="checkbox"/> ₄ Your employer paying a portion of your bus pass |
| <input type="checkbox"/> ₂ Late evening bus service | <input type="checkbox"/> ₅ None, nothing would influence me to ride a bus |
| <input type="checkbox"/> ₃ None, I already ride the bus on a regular basis | |

Carpool-Vanpool

- | | |
|--|---|
| <input type="checkbox"/> ₁ Free matching with other convenient car/vanpoolers | <input type="checkbox"/> ₅ Preferential parking at work |
| <input type="checkbox"/> ₂ Vehicles at work available for midday business trips | <input type="checkbox"/> ₆ Access to HOV Lanes |
| <input type="checkbox"/> ₃ Employer paying a portion of your vanpool seat (vans only) | <input type="checkbox"/> ₇ None, nothing would influence me to car/vanpool |
| <input type="checkbox"/> ₄ None, I already car/vanpool on a regular basis | |

General

- ₁ Guaranteed ride home for emergencies/overtime ₄ Midday shuttle service to restaurants/shopping
- ₂ Increased parking costs which I would have to pay ₈ Other: _____
- ₃ Variable/flexible work hours

7. If you drive alone to work, what are the two most important reasons you do so? (*Check 2*)

- ₁ Can't find anyone to ride with ₅ Need car to take/pickup child to/from child care
- ₂ Need car for work during day ₆ Work schedule doesn't permit sharing a ride
- ₃ Need car before/after work for errands ₇ Need car in case of emergencies
- ₄ Enjoy my privacy, do not care to share a ride ₈ Other: _____

8. How many passenger vehicles does your household own or have available for use? _____

9. How many individuals, including yourself, are 16 years old or older in your household? _____

10. For your trip to/from work, do you regularly seek out traffic or transit information from the following? (*Check all that apply*)

- ₁ Radio ₃ Newspaper ₉ Do not seek out traffic or transit information
- ₂ Television ₄ Internet

10a. When do you normally seek out this information? (*Check all that apply*)

- ₁ Before leaving for work ₂ On my way to work ₃ At work before leaving to go home

10b. How important is availability of traffic information in your choice of a radio station or television station?

- ₁ Very Important ₃ Somewhat Unimportant
- ₂ Somewhat Important ₄ Not Important At All

11. Does your employer provide any of the following commuting benefits? (Check all that apply)

- ₁ Free parking ₄ On-site bus pass sales
₂ Subsidizes bus passes at \$ _____ per month ₅ Guaranteed emergency ride home
₃ Subsidizes vanpool seat at \$ _____ per month ₈ Other:
-

The last few questions are for statistical purposes only to ensure a representative sample of survey participants.

12. What is the highest level of education that you have completed?

- ₁ Some high school ₃ Technical/Vocational school ₅ College graduate
₂ High school graduate ₄ Some college ₆ Post graduate studies

13. What is your total annual household income (range) before taxes?

- ₁ Under \$20,000 ₃ \$35,000 to \$49,999 ₅ \$75,000 to \$99,999
₂ \$20,000 to \$34,999 ₄ \$50,000 to \$74,999 ₆ \$100,000 or more

14. What is your gender? ₁ Male ₂ Female

15. Please check the appropriate age (range)?

- ₁ Under 21 ₂ 21-34 ₃ 35-44 ₄ 45-54 ₅ 55-64
₆ 65 or older

16. What is your race/ethnicity?

- ₁ White ₂ African American ₃ Hispanic ₄ Asian
₈ Other _____

If you would be willing to complete another survey in 1997, please provide your name and address below.

| | |
|--------------|---------------|
| Name | |
| Home Address | |
| City | Home Zip Code |

Thank you for your assistance in completing this survey. We would also like you to record your trips to and from work for the week of **Monday, November 18 thru Friday, November 22, 1996**. Please complete the attached travel diaries for this time period.

APPENDIX B—DAILY TRAVEL DIARY

DAILY TRAVEL DIARY Monday, November 18, 1996

Morning Commute

| | | | | | | | | | | |
|---|---|---|--|--|--|---|---|--|---|--|
| 1. What time did you begin your morning commute? | 2. What time did you end your morning commute? | 3. Did you make any stops on your way to work? | 3a. If you made stops, please specify where? (check all that apply) | 3b. If you made a stop (or stops), how far out of the way was this trip? | 3c. If you made a stop (or stops), was it on the way to the Park-and-Ride lot? | 4. How did you get to work today? | 5. Did you use the HOV lane? | 6. If you used a Park-and-Ride lot, how did you get to the Park-and-Ride lot? | 7. Did you check traffic information before leaving or while on your way? | 8. Did this information change your behavior? |
| <input type="checkbox"/> Before 6:00 <input type="checkbox"/> 6:00-6:30 <input type="checkbox"/> 6:30-7:00 <input type="checkbox"/> 7:00-7:30 <input type="checkbox"/> 7:30-8:00 <input type="checkbox"/> 8:00-8:30 <input type="checkbox"/> 8:30-9:00 <input type="checkbox"/> After 9:00 <input type="checkbox"/> Did not commute today | <input type="checkbox"/> Before 6:00 <input type="checkbox"/> 6:00-6:30 <input type="checkbox"/> 6:30-7:00 <input type="checkbox"/> 7:00-7:30 <input type="checkbox"/> 7:30-8:00 <input type="checkbox"/> 8:00-8:30 <input type="checkbox"/> 8:30-9:00 <input type="checkbox"/> After 9:00 | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Day care/school <input type="checkbox"/> Eat <input type="checkbox"/> Shopping <input type="checkbox"/> Errands <input type="checkbox"/> Park-and-ride lot <input type="checkbox"/> Pick up carpool / vanpool member <input type="checkbox"/> Other | <input type="checkbox"/> On the way to work <input type="checkbox"/> 1/4 Mile or less <input type="checkbox"/> 1/2 Mile to 1 Mile <input type="checkbox"/> More than 1 Mile | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Drove alone <input type="checkbox"/> Carpooled with 1 person <input type="checkbox"/> Carpooled with 2 people <input type="checkbox"/> Carpooled with 3 people <input type="checkbox"/> Carpooled with 4 people <input type="checkbox"/> Vanpooled <input type="checkbox"/> Rode the bus <input type="checkbox"/> Other | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Drove <input type="checkbox"/> Dropped off <input type="checkbox"/> Carpooled <input type="checkbox"/> Vanpooled <input type="checkbox"/> Bicycled/walked <input type="checkbox"/> Bus <input type="checkbox"/> Did not use the Park-and-Ride | <input type="checkbox"/> Yes <input type="checkbox"/> No 7a. If yes, please specify (check all that apply) <input type="checkbox"/> TV <input type="checkbox"/> Radio <input type="checkbox"/> Newspaper <input type="checkbox"/> Internet <input type="checkbox"/> Smart Commuter | <input type="checkbox"/> Yes <input type="checkbox"/> No 8a. If yes, please specify (check all that apply) <input type="checkbox"/> Changed route <input type="checkbox"/> Changed time of travel <input type="checkbox"/> Changed mode of travel <input type="checkbox"/> Eliminated a trip |

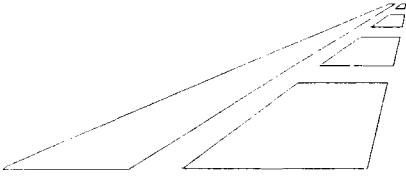
Lunchtime Activities

| | | | | | | |
|---|---|---|---|--|--|---|
| 9. What time did you begin lunch? | 10. What time did you end lunch? | 11. Did you leave your office building at lunch? | 11a. If you left your office building at lunch, please specify activities: (check all that apply) | 11b. If you left your office building at lunch, please identify mode of travel: | 11c. If you left your office building at lunch, please indicate how far away from the office you went? | 20. If you did not commute today, why? |
| <input type="checkbox"/> Before 11:00 <input type="checkbox"/> 11:00-11:30 <input type="checkbox"/> 11:30-12:00 <input type="checkbox"/> 12:00-12:30 <input type="checkbox"/> 12:30-1:00 <input type="checkbox"/> After 1:00 | <input type="checkbox"/> Before 11:00 <input type="checkbox"/> 11:00-11:30 <input type="checkbox"/> 11:30-12:00 <input type="checkbox"/> 12:00-12:30 <input type="checkbox"/> 12:30-1:00 <input type="checkbox"/> After 1:00 | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Eat <input type="checkbox"/> Shopping <input type="checkbox"/> Errands <input type="checkbox"/> Other | <input type="checkbox"/> Drove alone <input type="checkbox"/> Carpooled with 1 other person <input type="checkbox"/> Carpooled with 2 other people <input type="checkbox"/> Carpooled with 3 other people <input type="checkbox"/> Carpooled with 4 other people <input type="checkbox"/> Vanpooled <input type="checkbox"/> Rode the bus <input type="checkbox"/> Walked | <input type="checkbox"/> Did not leave the building <input type="checkbox"/> 1/4 Mile or less <input type="checkbox"/> 1/2 Mile to 1 Mile <input type="checkbox"/> More than 1 Mile | <input type="checkbox"/> Vacation Day <input type="checkbox"/> Telecommuted <input type="checkbox"/> Worked out-of-town <input type="checkbox"/> Regular day off <input type="checkbox"/> Sick day <input type="checkbox"/> Other _____ COMM - NTS: |

Evening Commute

| | | | | | | | | | | |
|---|---|---|--|---|---|---|---|--|--|---|
| 12. What time did you begin your evening commute? | 13. What time did you end your evening commute? | 14. Did you make any stops on your way home from work? | 14a. If you made stops, please specify where? (check all that apply) | 14b. If you made a stop (or stops), how far out of the way was this trip? | 14c. Was it on the way from the Park-and-Ride lot? | 15. How did you leave work today? | 16. Did you use the HOV lane? | 17. If you used a Park-and-Ride lot, how did you leave from the Park-and-Ride lot? | 18. Did you check traffic information before leaving or while on your way? | 19. Did this information change your behavior? |
| <input type="checkbox"/> Before 4:00 <input type="checkbox"/> 4:00-4:30 <input type="checkbox"/> 4:30-5:00 <input type="checkbox"/> 5:00-5:30 <input type="checkbox"/> 5:30-6:00 <input type="checkbox"/> 6:00-6:30 <input type="checkbox"/> 6:30-7:00 <input type="checkbox"/> After 7:00 | <input type="checkbox"/> Before 4:00 <input type="checkbox"/> 4:00-4:30 <input type="checkbox"/> 4:30-5:00 <input type="checkbox"/> 5:00-5:30 <input type="checkbox"/> 5:30-6:00 <input type="checkbox"/> 6:00-6:30 <input type="checkbox"/> 6:30-7:00 <input type="checkbox"/> After 7:00 | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Day care/school <input type="checkbox"/> Eat <input type="checkbox"/> Shopping <input type="checkbox"/> Errands <input type="checkbox"/> Park-and-ride lot <input type="checkbox"/> Pick up carpool / vanpool member <input type="checkbox"/> Other | <input type="checkbox"/> On the way home <input type="checkbox"/> 1/4 Mile or less <input type="checkbox"/> 1/2 Mile to 1 Mile <input type="checkbox"/> More than 1 Mile | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Drove alone <input type="checkbox"/> Carpooled with 1 person <input type="checkbox"/> Carpooled with 2 people <input type="checkbox"/> Carpooled with 3 people <input type="checkbox"/> Carpooled with 4 people <input type="checkbox"/> Vanpooled <input type="checkbox"/> Rode the bus <input type="checkbox"/> Other | <input type="checkbox"/> Yes <input type="checkbox"/> No | <input type="checkbox"/> Drove alone <input type="checkbox"/> Dropped off <input type="checkbox"/> Carpooled <input type="checkbox"/> Vanpooled <input type="checkbox"/> Bicycled/walked <input type="checkbox"/> Bus <input type="checkbox"/> Did not use the Park-and-Ride lot | <input type="checkbox"/> Yes <input type="checkbox"/> No 18a. If yes, please specify (check all that apply) <input type="checkbox"/> TV <input type="checkbox"/> Radio <input type="checkbox"/> Newspaper <input type="checkbox"/> Internet <input type="checkbox"/> Smart Commuter | <input type="checkbox"/> Yes <input type="checkbox"/> No 19a. If yes, please specify (check all that apply) <input type="checkbox"/> Changed route <input type="checkbox"/> Changed time of travel <input type="checkbox"/> Changed mode of travel <input type="checkbox"/> Eliminated a trip |

APPENDIX C — LETTER TO MOTORISTS IN I-45 NORTH CORRIDOR



TEXAS TRANSPORTATION INSTITUTE • The Texas A&M University
System

SYSTEMS PLANNING DIVISION
Telephone (409) 845-1535
FAX (409) 845-6008

Dear I-45 North Freeway User:

Your vehicle was recently observed traveling from downtown Houston on the I-45 North Freeway. As a user of this facility, your help is needed on the *Smart Commuter* project being conducted by the Texas Department of Transportation (TxDOT) and Houston METRO. The *Smart Commuter* project focuses on travelers' use of traffic information. The study is examining the sources of traffic information commuters listen to, watch, or read, and if any changes are made in travel as a result of this information.

Your help is needed in this study. We would like to ask you, as a traveler on the I-45 North Freeway, to complete the enclosed survey and to record your commute trips for the week of **November 18-22, 1996**. Please return the survey and the travel diaries in the enclosed postage-paid envelope. The study is being conducted by the Texas Transportation Institute, a part of The Texas A&M University System, for TxDOT and METRO.

Your cooperation and timely return of the survey is greatly appreciated. Thank you in advance for your time and assistance in this important undertaking. If you have any questions on the survey or study, please feel free to call Mr. Darryl Puckett at (713) 686-2971.

Texas Transportation Institute

Enclosures

APPENDIX D—DETAILED SOCIO-ECONOMIC CHARACTERISTICS

The detailed information on the socio-economic characteristics of individuals in the first test group, the second test group, and the control group are presented in this Appendix. The responses to questions on the before surveys relating to gender, age, income, household size, vehicles per household, and ethnicity of participants is provided in the following six tables.

Gender of Test and Control Group Participants

| Gender | First Test Group | Second Test Group | Control Group |
|---------------|-------------------------|--------------------------|----------------------|
| Male | 72% | 80% | 59% |
| Female | 28% | 20% | 41% |
| Total | 100% | 100% | 100% |

Age of Test and Control Group Participants

| Age Levels | Test Group | Second Test Group | Control Group |
|-------------------|-------------------|--------------------------|----------------------|
| Under 21 | - | 0.5% | 2% |
| 21-34 | 23% | 20% | 26% |
| 35-44 | 38% | 44.5% | 35% |
| 45-54 | 28% | 26% | 24% |
| 55-64 | 10% | 9% | 12% |
| Over 65 | 1% | - | 1% |
| Total | 100% | 100% | 100% |

Income of Test and Control Group Participants

| Income Level | First Test Group | Second Test Group | Control Group |
|----------------------|-------------------------|--------------------------|----------------------|
| Under \$20,000 | 1% | 1% | 4% |
| \$20,000 - \$35,000 | 8% | 4% | 16% |
| \$35,000 - \$50,000 | 13% | 12% | 17% |
| \$50,000 - \$75,000 | 26% | 32% | 28% |
| \$75,000 - \$100,000 | 25% | 20% | 18% |
| Over \$100,000 | 27% | 31% | 17% |

Household Size of Test and Control Group Participants

| Number of Individuals in Household | First Test Group | Second Test Group | Control Group |
|---|-------------------------|--------------------------|----------------------|
| 1 | 8% | 13% | 15% |
| 2 | 71% | 65% | 57% |
| 3 | 13% | 19% | 17% |
| 4 | 7% | 2% | 8% |
| 5 or more | 1% | 1% | 3% |

Number of Vehicles per Household of Test and Control Group Participants

| Number of Vehicles in Household | First Test Group | Second Test Group | Control Group |
|--|-------------------------|--------------------------|----------------------|
| 1 | 11% | 13% | 19% |
| 2 | 67% | 63% | 54% |
| 3 | 17% | 19% | 17% |
| 4 or more | 5% | 5% | 10% |

Ethnicity of Test and Control Group Participants

| Ethnicity | First Test Group | Second Test Group | Control Group |
|------------------|-------------------------|--------------------------|----------------------|
| White | 89% | 84% | 83% |
| Afro-American | 4% | 7% | 5% |
| Hispanic | 4% | 4% | 7% |
| Asian | 2% | 3% | 4% |
| Other | 1% | 2% | 1% |

