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16. Abstract

The Houston *Smart Commuter* 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 *Smart Commuter* 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 *Smart Commuter* ITS Operation Test in FY 1997. Information is provided on recruiting and training the initial group of test participants, the before and six-month travel surveys and travel diaries of the participants and the control group, the functional and acceptance testing of the information delivery systems, and the ongoing coordination between the local and national evaluations. The report also presents the anticipated activities and schedule for FY 1998.

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HOUSTON *SMART COMMUTER* ITS OPERATIONAL TEST: SIX-MONTH EVALUATION AND FY 1997 STATUS REPORT

by

Katherine F. Turnbull
Research Scientist
Texas Transportation Institute

Stephen P. Farnsworth
Assistant Research Scientist
Texas Transportation Institute

and

Darryl D. Puckett
Associate Research Scientist
Texas Transportation Institute

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TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas 77843-3135

IMPLEMENTATION STATEMENT

Metropolitan areas in Texas and throughout the country are facing major problems with traffic congestion, air quality concerns, and declining mobility. Intelligent Transportation Systems (ITS) and other advanced technologies are being used in many areas to help address some of these issues. The Houston *Smart Commuter* Operational Test represents one such effort.

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 vehicle (HOV) 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 procedures for using the bus in their homes and work places may be more likely to use public transportation and other high-occupancy commute modes. For example, the travel time savings and travel time reliability offered by the Houston HOV lanes provide incentives for changing travel modes. Individuals may alter their travel times or travel routes based on this information.

The results of the Houston *Smart Commuter* ITS Operational Test will be of benefit to TxDOT, METRO, FHWA, FTA, and other groups interested in utilizing ITS technologies to encourage HOV and alternative commute modes. This report provides a summary of the activities accomplished on the project in FY 1997, the six-month evaluation of the initial I-45 North participants and control group, and the anticipated activities and schedule for FY 1998.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the findings and conclusions 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, and is not intended for construction, bidding, or permit purposes.

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SUMMARY

The Houston *Smart Commuter* Intelligent Transportation Systems (ITS) Operational Test is one of the federally sponsored advanced technology projects currently being conducted in the United States. The Houston *Smart Commuter* Operational Test is being 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 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 procedures for using the bus in their homes and work places 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 phase 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 will result from the provision of current traffic and transit information to individuals in their homes and work places through state-of-the-art technologies. A second phase is being considered to test the use of pagers to provide real-time traffic and transit information. This test is different from the originally anticipated second phase, which focused on real-time ridematching in the I-10 West (Katy) corridor. This change is being considered due to the Quick Ride priority pricing demonstration on the Katy HOV lane, which allows daily discretionary use of the HOV lane by two person carpools during the periods restricted to carpools with three or more occupants.

This report summarizes the activities conducted on the Houston *Smart Commuter* ITS Operational Test in FY 1997. These include the functional and acceptance testing of the Sony Magic Link™ and the interactive touch tone telephone system, recruiting and training the initial group of participants, and conducting the before and six-month travel surveys and travel diaries with the test and control groups. In addition, the technical problems with the FM subcarrier were addressed. Ongoing communication was also maintained with the initial participants and additional individuals were recruited. Finally, communication and coordination were maintained

with the consultants responsible for the national evaluation. This report also presents the anticipated activities and schedule for FY 1998.

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, and initiating the operational test. Interagency agreements between the various agencies have also been completed.

This document summarizes the activities conducted on the operational test during Fiscal Year (FY) 1997, the period from September 1996 to August 1997. It also outlines those activities anticipated in FY 1998. 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. Chapter Three describes the major activities and accomplishments completed during FY 1997. Chapter Four examines the before and six-month travel surveys and travel diaries for the initial participant and control groups. Chapter Five presents the anticipated work activities and schedule for FY 1998. Copies of the surveys and travel diaries are provided in the appendices.

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 first, then the concepts being tested are described. The organizational structure for the operational test and the roles and responsibilities of the different agencies are also outlined.

Background

Like many 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 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, *The 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 million 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, in their homes and work places, 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.

Initially, the focus of the second component was on the suburb-to-suburb travel market in the I-10 West corridor to the Post Oak/Galleria area. The use of a comprehensive employer-based carpool matching service was going to be tested in this corridor, which is more difficult to serve

with traditional, regular-route bus service. Due to the pending implementation of the Quick Ride value pricing demonstration on the Katy HOV lane, the use of pagers to provide real-time traffic and transit information will be considered for the second phase of the operational test.

The *Smart Commuter* Operational Test, will be implemented and evaluated over a multi-year period. As noted, funding has been secured for the first phase of the operational test which includes finalizing the local evaluation plan, selecting the technology to provide the real-time information to individuals in their homes and work places, implementing the operational test, and completing the first six-month and first-year evaluations.

The *Smart Commuter* Operational Test represents the first major test of the use of ITS technologies to encourage an increase in average vehicle occupancy. It provides an opportunity to test the ability to collect, process, and transmit current traffic and transit information to individuals in their homes and work places through a variety of advanced technologies. The *Smart Commuter* Operational Test also provides an opportunity for highway and transit interests to work together to better manage the overall transportation system through the innovative application of ITS technology, enhanced information, and improved services.

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 organization 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.

CHAPTER THREE – SUMMARY FY 1997 ACCOMPLISHMENTS

A number of activities were completed on the various elements of the Houston *Smart Commuter* Operational Test during FY 1997. These activities focused on the I-45 North bus components of the project. Major activities included pre-testing the Sony Magic Link™ information device and the telephone information system, finalizing the selection and training of the initial participants, conducting the before and six-month travel surveys and travel diaries of the participants and the control group, addressing the technical problems encountered with the FM radio subcarrier, obtaining feedback from participants through newsletters and telephone calls, and recruiting additional participants. Ongoing communication and coordination between the local and the national evaluation was also maintained. This chapter highlights these major accomplishments and activities. A detailed discussion of the before and six-month evaluation is presented in Chapter Four.

Functional and Acceptance Testing of the Information Delivery Systems

Two delivery systems are being used in the *Smart Commuter* Operational Test to provide real-time information to participants. These 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. The TRW team was selected in 1996 through a competitive two-step procurement method.

The Magic Link™ 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 for the operational test. A number of enhancements were made to the Magic Link™ for the project. First, 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™.

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. The real-time traffic information from the TranStar facility is being sent through an FM subcarrier subsystem. A radio antenna has been attached to the Magic Link™. To obtain the real-time information, a participant simply turns on the Magic Link™ device. The real-time information is updated every 10 seconds or as needed.

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. 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™.

All of these elements were developed by the TRW team. 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.

METRO's contract with the TRW team included both a 15-day functional test of the Magic Link™ and the interactive telephone system hardware and software components, and a 30-day acceptance test. The functional and acceptance tests on both information delivery systems were conducted in the fall of 1996. The performance of the Magic Link™ and telephone system was reviewed against the criteria listed in the specification documents during both tests.

Recruiting and Training the Initial Test Group

Recruitment of the initial test group was completed during the fall of 1996. A number of techniques were used to identify potential volunteers for the project. The recruitment process focused on commuters living in the Kuykendahl park-and-ride lot market area and working in downtown Houston or in an area with good bus service from the I-45 North corridor. Techniques used to recruit participants included direct contact with major employers in the downtown area and other transit accessible activity centers, changeable message signs on the I-45 North Freeway, press releases, and information booths at the Woodlands Mall and the Park Mall.

An initial group of approximately 275 individuals signed up to participate in the test. 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. Twelve training sessions were held for these individuals in December of 1996, and one additional session was held in mid-February. The sessions were split between locations in downtown Houston and in the I-45 North corridor.

Representatives from METRO, TRW, and TTI conducted the training sessions. 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 useage 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.

Before and Six-Month Travel Surveys and Travel Diaries

The participants and the control group completed travel surveys and travel diaries prior to the start of the operational test, and travel diaries after six months. The results of these surveys were coded, entered into the database, and analyzed. Chapter Four provides a detailed discussion of the procedures for conducting these surveys and the results.

Addressing Technical Problems

Some technical problems were encountered with the use of the Magic Link™ information system during the first six months of operation. The problems focused primarily on the low signal strength and the directional signal pattern from the FM subcarrier. These two issues — the low signal strength and the broadcast pattern — resulted in some participants not being able to access the real-time traffic information or experiencing lengthy delays in obtaining updated information. Problems were also encountered by participants in uploading the travel diaries due to these issues. These issues appear to have had an impact on participation and the survey results.

The TRW team took a number of actions to correct these problems. These included changing the location of the broadcast tower, changing the broadcast frequency, and moving the broadcast equipment from the tower into a radio station. A series of tests were conducted by METRO and TTI staff to ensure that the signal strength and signal direction were adequate for

sending the real-time information. Based on the results of these tests, the changes appear to have addressed the problems.

Ongoing Communication with Participants

A *Smart Commuter* Newsletter was used to communicate with members of the test group. Three issues of the newsletter were produced and mailed to participants during the spring and summer of 1997. The newsletters provided information on the project, including the problems with the FM radio subcarrier discussed previously.

Recruitment of Additional Participants

Efforts were initiated during May and June of 1997 to recruit additional participants for the operational test. METRO contracted with a private mailing service to assist with this activity. METRO obtained the names and addresses of approximately 80,000 individuals residing in zip code zones in the I-45 North corridor. The initial list was narrowed down to some 44,000 individuals in targeted zip codes zones. The company mailed a *Smart Commuter* brochure to these individuals. Approximately 1,000 people responded indicating an interest in participating in the project. Based on their work location, some 400 participants have been recruited from this group for the test and another 600 are being considered.

Ongoing Coordination of the Local and National Evaluations

TTI researchers continued to coordinate activities related to the local and national evaluations of the *Smart Commuter* Operational Test during FY 1997. In addition to conducting and analyzing the before and six-month travel surveys and travel diaries described in the next chapter, TTI researchers periodically consulted with representatives from Cambridge Systematics and Multisystems, the consulting firms responsible for the national evaluation. Periodic telephone conversations were held to discuss the status of various elements of the operational test and to ensure ongoing coordination between the local and national evaluation. Electronic mail (e-mail) was also used as part of the ongoing communication between TTI researchers and the national evaluation team.

CHAPTER FOUR – BEFORE AND SIX-MONTH EVALUATION OF THE INITIAL TEST GROUP AND CONTROL GROUP

A major component of the *Smart Commuter* Operational Test is monitoring and evaluating the use of the information delivery system devices and documenting any changes in travel behavior resulting from the provision of the traffic and transit information. This chapter discusses the methodology used to conduct the travel surveys and the travel diaries of the participants and the control group prior to the start of the project and after the first six months of operation. The results from both sets of surveys are summarized, along with the other data collection activities conducted during the year.

Methodology

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 of operation. 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. Two different methodologies were used to obtain the completed surveys and diaries from the test group and the control group.

Copies of the travel survey and the travel diary were mailed to the initial group of *Smart Commuter* participants prior to the training sessions. The participants were asked to complete the survey and to record their commute trips for the week of November 18, 1996. The participants were required to bring the completed surveys to the training session in order to obtain a Magic Link™ information device. The same procedure was used with the small group of participants joining the project in February, except they completed travel surveys for a week in January. A total of 273 travel surveys and travel diaries were received prior to the start of the test from the initial group of *Smart Commuter* participants.

In June, the participants were asked to complete a second travel diary as part of the six-month evaluation. A total of 42 members of the participant group completed and returned their travel diaries by the beginning of August. It appears that the problems with the FM subcarrier discussed in the previous chapter may have influenced the low response rate from the test group. METRO and TTI staff are communicating with the initial group of participants to resolve these issues and to obtain additional travel diaries. As a result of these problems, the responses may not be representative of those expected if the devices had been fully functional over the six-month period.

The control group for the test 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 as part of the six-month evaluation of the initial test. A total of 110 completed surveys were returned by the first of August. 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.

Both the control and participant groups are adequate to provide a valid sample size at a 90 percent confidence interval, with a ± 5 percent margin of error. With these parameters, a sample size of 250 to 270 people is considered adequate. The formula used to make this determination is:

$$n \geq [(za/2) / E]^2 \times \frac{1}{2} \times \frac{1}{2}$$

where:

n = number needed to ensure validity
$za/2$ = confidence interval
E = margin of error

Given the limited responses to the six-month survey, however, especially from the participant groups, the results presented here should not be transferred to the population at large. They do provide an indication of the travel characteristics of both groups, however, and the use of *Smart Commuter* components by the participants. It is anticipated that the responses to future surveys will provide a better measure of the use of the devices and any changes in travel behavior.

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 test group and the control group are presented first. The general socio-economic characteristics of participants in the two groups are provided next.

Normal Commute Mode

As shown in Table 1, the vast majority of individuals in both the test and the control groups normally drive alone to and from work. Almost 90 percent of the individuals in both groups reported they always drive alone. Under 10 percent indicated they normally carpool, while less than five percent typically ride the bus. These figures are not surprising given that the recruitment of volunteers for both groups focused on individuals currently driving alone to and from work. Both groups contained some occasional transit users, with 29 percent of the test group and 11 percent of the control group indicating that they ride the bus occasionally.

Employment, Commute Length, and Commute Travel Time

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

The majority of individuals in both groups live over 20 miles from their place of employment. Further, most have commute travel times of at least 30 minutes. Table 3 highlights the one-way distance from home to work and Table 4 identifies the corresponding travel time for this trip.

Knowledge of Transit

Individuals in both groups 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 5, participants in the test group expressed slightly higher levels of understanding of the various transit system components than those in the control group. For example, 93 percent of the test group participants 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 both the test group and the control groups were asked to identify the reasons they currently drive alone and the factors that may influence them to use to a different mode.

Table 6 identifies the factors cited most frequently by respondents in both groups for driving alone to and from work. The responses by participants in both 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 1. Normal Commute Mode

Mode/Frequency	Test Group	Control Group
Drive Alone		
Always	88%	89%
Occasionally	11%	9%
Never	1%	2%
Carpool		
Always	5%	9%
Occasionally	37%	20%
Never	58%	71%
Vanpool		
Always	.5%	-
Occasionally	3.5%	1%
Never	96%	99%
Ride the Bus		
Always	2%	3%
Occasionally	29%	11%
Never	69%	86%
Other		
Always	2%	5%
Occasionally	8%	6%
Never	90%	89%

Table 2. Employment Status of Test and Control Group Participants

Employment Status	Test Group	Control Group
Full-Time	94%	91%
Part-Time	2%	6%
Other	4%	3%

Table 3. Home to Work Distance for Test and Control Group Participants

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

Table 4. Home to Work Travel Time for Test and Control Group Participants

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

Table 5. Knowledge of Bus Service

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

Table 6. Reasons for Driving Alone*

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

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

Table 7 highlights the responses to questions on the factors that may influence changes in commute modes. As shown in Table 7, 34 percent of the test group participants and 44 percent of the control group respondents indicated that nothing would influence them to ride the bus. On the other hand, 28 percent of the test group 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 14 percent to 20 percent of the respondents in both groups.

Twenty percent of the test group participants 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 7. Factors Influencing Commuting Habits*

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

***multiple response possible**

The availability of a guaranteed ride home program would influence approximately 37 to 38 percent of the respondents in both groups to consider using a high-occupancy commute mode. Variable or flexible work hours was noted as a positive influence by 25 percent of the test group participants and 21 percent of the control group members. Other factors receiving lower levels of interest included increased parking costs and mid-day shuttle services.

Employer Provided Commute Benefits

Table 8 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 percent of the test group participants reported this benefit. Fifteen percent of the individuals in the test group and 16 percent of the control group reported that their employer subsidizes bus passes. Sixteen percent of the test group and 11 percent of the control group indicated that on-site bus pass sales are provided. Less than 10 percent of the respondents in both groups reported employer subsidized vanpools and guaranteed ride home programs.

Table 8. Employer Provided Commute Benefits*

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

***multiple responses possible**

Traffic and Transit Information

Tables 9 through 11 summarize the responses to a series of questions relating to the use of commercially available information on traffic conditions. As highlighted in Table 9, radio traffic reports are the most common source of information used by individuals in both groups.

Approximately 65 percent of the participants in the test and the control groups listen to radio traffic reports. Television is the next most frequently noted source of information, but is used by only about 25 percent of the participants in both groups. Six percent of the test group members indicated they use the Internet to obtain traffic information, while three percent of both groups use the newspaper. Five percent of the control group and two percent of the test group responded that they do not seek traffic or transit information.

As highlighted in Table 10, most individuals reported seeking traffic and transit information on their way to work. Approximately 50 percent of participants in both groups responded that they seek information during their trip to work. This response corresponds 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 18 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. About 50 percent of the respondents in both groups indicated that the availability of traffic and transit information was very important in their selection of radio and television stations. Another 39 percent of the test group and 32 percent of the control noted that it was somewhat important.

Table 9. Sources of Traffic and Transit Information*

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

***Multiple responses possible**

Table 10. Time When Traffic and Transit Information is Obtained

Time	Test Group	Control Group
Before leaving for work	33%	35%
On way to work	50%	47%
At work before leaving to go home	17%	18%

Table 11. Importance of Availability of Traffic Information in Choice of Radio or Television Stations

Importance Rating	Test Group	Control Group
Very Important	53%	50%
Somewhat Important	39%	32%
Somewhat Unimportant	4%	7%
Not Important At All	4%	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.

Table 12 provides information on the gender of individuals in both the test and control groups. Males account for a slightly higher percentage of test group participants than the control group.

Table 12. Gender of Test and Control Group Participants

Gender	Test Group	Control Group
Male	72%	59%
Female	28%	41%
Total	100%	100%

Both groups reflect fairly similar age distributions. As highlighted in Table 13, the largest percent of individuals fall within the 35 to 44 age group, followed by the 45 to 54 and the 21 to 34 age groups.

Table 13. Age of Test and Control Group Participants

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

Both groups reflected fairly similar income levels. As presented in Table 14, test group participants reported slightly higher incomes than the control group members.

Table 14. Income of Test and Control Group Participants

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

Table 15 presents information on the household size of the test group and the control group. Both groups reflect similar patterns, with two-person households the most common, followed by three-person households.

Table 15. Household Size of Test and Control Group Participants

Number of Individuals in Household	Test Group	Control Group
1	8%	15%
2	71%	57%
3	13%	17%
4	7%	8%
5 or more	1%	3%

Reported vehicle ownership per household is also similar among participants in the two groups. As noted in Table 16, the majority of individuals in both groups have two or more vehicles available.

Table 16. Number of Vehicles per Household of Test and Control Group Participants

Number of Vehicles in Household	Test Group	Control Group
1	11%	19%
2	67%	54%
3	17%	17%
4 or more	5%	10%

The ethnicity of individuals in both groups is also similar. Table 17 highlights the breakdown of participants in both the test and control groups.

Table 17. Ethnicity of Test and Control Group Participants

Ethnicity	Test Group	Control Group
White	89%	83%
Afro-American	4%	5%
Hispanic	4%	7%
Asian	2%	4%
Other	1%	1%

Before and Six-Month Travel Diaries

Participants in both the test group and the control group completed travel diaries for a week before the start of the initial *Smart Commuter* Operational Test and after six months of operation. The travel diary included a log of travel to and from work, midday trips, stops on the way to and

from work, travel mode, use of traffic information, and changes in travel behavior based on this information. A copy of the travel diary is provided in Attachment 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.

Individuals were also asked to record if they obtained traffic information before leaving home in the morning or work in the afternoon, or on the way to and from work, and if they changed their travel behavior based on this information. Tables 18 through 21 summarize the responses to these questions.

As highlighted in Table 18 and Table 20, the majority of individuals in the test group and the control group seek traffic information on a regular basis. Approximately 80 percent of the participants in both groups reported checking traffic information before leaving home in the morning or on the trip to work. Radio traffic reports were the most frequently cited source of information, followed by television, the newspaper, and the Internet. Approximately 24 percent of the test group participants reported using the *Smart Commuter* information devices on a regular basis in the six-month evaluation. This somewhat low usage may be reflective of the problems with the FM subcarrier discussed in the previous chapter that resulted in participants not being able to obtain the real-time traffic information on a consistent basis.

Table 18. Seek Traffic Information Before Leaving for Work or on the Way to Work

	Test Group		Control Group	
	Before	**Six-Month**	**Before**	**Six-Month**
Yes	84%	83%	81%	71%
No	16%	17%	19%	29%
If yes, sources*				
Television	16%	9%	19%	19%
Radio	81%	62%	80%	79%
Newspaper	2%		.5%	2%
Internet	1%	1%	.5%	
Smart Commuter		28%		

***multiple responses possible**

Although the majority of individuals in both the test and the control groups reported seeking traffic information, few made changes in their travel behavior based on the information. As highlighted in Table 19, the majority of participants in both groups did not change their travel behavior based on available traffic information. Approximately 21 percent of the before test group participants and 15 percent of the before control group reported making changes in their travel based on traffic information. Only eight percent of individuals in both groups reported making changes in the six-month evaluation. The small number of test group participants responding to the six-month survey may influence these results.

Altering their travel route was most frequently cited by those individuals in both groups who did change their travel behavior based on available traffic information in the before survey. Control group members who reported changes in their travel behavior in the six-month survey most frequently changed their travel route. Fifty percent of the test group participants who reported changing their travel behavior in the six-month survey changed their time of travel, while 50 percent changed their travel route. Changing the time of their trip was the second most frequently noted alteration. A smaller percentage, between three and five percent, reported changing their mode of travel, while between one and five percent said they did not make the trip.

Tables 20 and 21 present similar information for the trip from work to home. Fewer individuals reported regularly checking traffic information for this trip. Between 54 and 75 percent of individuals in both groups seek traffic information before leaving work or during the trip home. Radio traffic reports were the most frequently reported source for those who do seek information for the trip home. Over 90 percent of the before test group participants and the before and six-month control group respondents listen to the radio for traffic information on the trip from work to home. This percentage dropped for the six-month test group participants due to 34 percent using the *Smart Commuter* information devices. The percentage of participants reporting use of the Internet and the devices was higher at work or after leaving work than for the morning commute.

Less than 15 percent of the individuals in both groups reported making changes in their travel behavior for the trip home based on available traffic information. As presented in Table 21, altering their travel route was the most frequently made change by individuals in both the before test group and the control group. Approximately 82 percent of respondents in both groups indicated a change in route. At six months, however, test group respondents reporting a change in route dropped to 76 percent. It should also be noted that the same group increased their likelihood to change their time of travel from 16 percent before the test started to 24 percent after six months, while the control group remained relatively constant at between 10 and 13 percent. Four percent of the control group participants indicated they changed their travel mode.

Table 19. Changed Travel Behavior Due to Information

	Test Group		Control Group	
	Before	**Six-Month**	**Before**	**Six-Month**
Yes	21%	8%	15%	8%
No	79%	92%	85%	92%
If yes, changed mode*				
Changed route	72%	50%	72%	66%
Changed time of travel	22%	50%	19%	24%
Changed mode of travel	5%		5%	5%
Eliminated trip	1%		4%	5%

***multiple responses possible**

Table 20. Seek Traffic Information Before Leaving for Home or on the Way Home

	Test Group		Control Group	
	Before	**Six-Month**	**Before**	**Six-Month**
Yes	65%	75%	59%	54%
No	35%	25%	41%	46%
If yes, sources*				
Television	4%	-	3%	4%
Radio	90%	57%	96%	94%
Newspaper	1%	2%	-	-
Internet	5%	7%	1%	2%
Smart Commuter		34%		

***multiple responses possible**

Table 21. Changed Travel Behavior Due to Information

	Test Group		Control Group	
	Before	**Six-Month**	**Before**	**Six-Month**
Yes	14%	14%	12%	15%
No	86%	86%	88%	85%
If yes, changed mode*				
Changed route	83%	76%	82%	83%
Changed time of travel	16%	24%	13%	10%
Changed mode of travel	-	-	4%	3%
Eliminated trip	1%	-	1%	4%

***multiple responses possible**

CHAPTER FIVE – ANTICIPATED FUTURE ACTIVITIES

This chapter briefly summarizes the anticipated schedule of activities for FY 1998. These include completing the before travel surveys and travel diaries for the new test group participants, conducting the training sessions for these individuals, completing the one-year evaluation of the initial test and control groups, conducting the six-month evaluation of the new test group, and working on the next phase of the project. Each of these items is briefly described next, along with the anticipated schedule.

- **Finalize Additional Test Group Participants and Conduct Training.** Recruitment of additional participants in the test group will be completed by late August or early September. The Texas Medical Center was added as an eligible work destination as part of the additional recruitment efforts. As of mid-August, approximately 400 individuals had been confirmed as possible participants and another 600 individuals were potential candidates. The current schedule is to start training sessions for the new test group during the week of September 11, 1997. METRO and TTI personnel will conduct the training sessions in downtown Houston and at selected locations in the corridor. The training sessions will follow the same format as used with the initial group. Participants will learn how to use both the Magic Link™ units and the interactive telephone system at these sessions.

- **Conduct Pre-Test Participant Surveys.** Individuals participating in the new test group will complete surveys and travel diaries prior to receiving the Magic Link™ information device. The surveys will be distributed to participants before the training sessions. It is anticipated that travel diaries will be completed for the week of September 15-19, 1997. Providing a completed survey will be a condition for receiving a Magic Link™ unit at the training session.

- **Analyze Before Surveys and Data for New Participants.** TTI researchers will compile, reduce, and analyze the new participant travel surveys and travel diaries. The results of the surveys and travel diaries will be compiled with the other baseline data to establish the conditions and travel patterns prior to implementation of the operational test. The results will also be compared with those from the previous test and control group members. This task will be completed from November 1997 through January 1998.

- **Conduct One-Year Evaluation of Initial Test Group and Control Group.** Participants in the initial test group and the control group will be asked to complete travel surveys and travel diaries after one year. The surveys and diaries will be mailed to control group members. The test participants will complete their travel surveys and diaries through the Magic Link™ devices. The one-year surveys and diaries will be

conducted in December 1997. TTI researchers will compile, reduce, and analyze the surveys and travel diaries. These activities will be conducted in January through April 1998.

- **Conduct Six-Month Evaluation of Additional Participants**. Participants in the new test group will be asked to complete surveys and travel diaries after six months. TTI researchers will compile, reduce, and analyze the results from the surveys and diaries. The results will be analyzed and compared to the pre-test surveys, and the initial test group and control group results. Assuming the before surveys and diaries are completed in September and October 1997, the six-month travel diaries will be completed by participants in March and April of 1998. The results will be compiled, reduced, and analyzed during May through July 1998.

- **Phase One Report**. The results from the one-year surveys and travel diaries of the initial test group and control group, along with the results of the six-month assessment of the additional test participants 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 1998.

- **Phase Two Activities**. Representatives from METRO, TxDOT, FHWA, and FTA have been discussing possible phase two activities on the *Smart Commuter* Operational Test. Initially, the second phase was to test a real-time ridematching system in the Katy (I-10 West) corridor. A demonstration project testing the use of value pricing on the Katy HOV lane is scheduled for implementation in the fall of 1997. The Quick Ride Program will allow two-person carpools to use the HOV lane for a fee during the morning and afternoon peak hour, when a 3+ requirement is in effect. Testing the real-time ridematching in the same corridor may be confusing to travelers and may bias the results of both projects. The use of pagers to provide real-time traffic and transit information is being considered for the second phase of the *Smart Commuter* project as a result. It is anticipated a decision on the nature and scope of this effort will be made by late 1997 or early 1998 and appropriate activities can be initiated.

- **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?

	Always or Almost Always	Occasionally	Never
a. Drive alone	❑1	❑2	❑3
b. Carpool	❑1	❑2	❑3
c. Vanpool	❑1	❑2	❑3
d. Ride the bus	❑1	❑2	❑3
e. Other (Specify) _____	❑1	❑2	❑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?

	Very Familiar	Somewhat Familiar	Not At All Familiar
a. Schedule	❑1	❑2	❑3
b. Bus stop locations	❑1	❑2	❑3
c. Cost	❑1	❑2	❑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)
☐1 Full-time. Hours are from __:__ a.m./p.m. to __:_ a.m./p.m. (Circle One) (Circle One)	Mon. Tues. Wed. Thur. Fri. Sat. Sun.
☐2 Full-time. Hours are irregular .	
☐3 Part-time. Hours are from ___:__ a.m./p.m. to ___:__ a.m./p.m. (Circle One) (Circle One)	Mon. Tues. Wed. Thur. Fri. Sat. Sun.
☐4 Part-time. Hours are irregular.	

☐5 Student. Attend school (*Circle One*): Full-time or Part-time

☐8 Other (*Specify*): _____

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

☐1 More information regarding bus routes

☐2 Late evening bus service

☐3 None, I already ride the bus on a regular basis

☐4 Your employer paying a portion of your bus pass

☐5 None, nothing would influence me to ride a bus

Carpool-Vanpool

☐1 Free matching with other convenient car/vanpoolers

☐2 Vehicles at work available for midday business trips

☐3 Employer paying a portion of your vanpool seat (vans only)

☐4 None, I already car/vanpool on a regular basis

☐5 Preferential parking at work

☐6 Access to HOV Lanes

☐7 None, nothing would influence me to car/vanpool

General

❑$_1$ Guaranteed ride home for emergencies/overtime

❑$_2$ Increased parking costs which I would have to pay

❑$_3$ Variable/flexible work hours

❑$_4$ Midday shuttle service to restaurants/shopping

❑$_8$ Other: _____

_____

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

❑$_2$ Need car for work during day

❑$_3$ Need car before/after work for errands

❑$_4$ Enjoy my privacy, do not care to share a ride

❑$_5$ Need car to take/pickup child to/from child care

❑$_6$ Work schedule doesn't permit sharing a ride

❑$_7$ Need car in case of emergencies

❑$_8$ 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

❑$_2$ Television

❑$_3$ Newspaper

❑$_4$ Internet

❑$_9$ Do not seek out traffic or transit information

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

❑$_2$ Somewhat Important

❑$_3$ Somewhat Unimportant

❑$_4$ Not Important At All

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

❑$_1$ Free parking

❑$_2$ Subsidizes bus passes at $\_\_\_\_\_$ per month

❑$_3$ Subsidizes vanpool seat at $\_\_\_\_\_$ per month

❑$_4$ On-site bus pass sales

❑$_5$ Guaranteed emergency ride home

❑$_8$ 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

❑$_2$ High school graduate

❑$_3$ Technical/Vocational school

❑$_4$ Some college

❑$_5$ College graduate

❑$_6$ Post graduate studies

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

❑$_1$ Under $20,000

❑$_2$ $20,000 to $34,999

❑$_3$ $35,000 to $49,999

❑$_4$ $50,000 to $74,999

❑$_5$ $75,000 to $99,999

❑$_6$ $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 and 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?
__ Before 6:00 __ 6:00-6:30 __ 6:30-7:00 __ 7:00-7:30 __ 7:30-8:00 __ 8:00-8:30 __ 8:30-9:00 __ After 9:00 __ Did not Commute today	__Before 6:00 __6:00-6:30 __6:30-7:00 __7:00-7:30 __7:30-8:00 __8:00-8:30 __8:30-9:00 __After 9:00	__Yes __No	__Day care/school __Eat __Shopping __Errands __Park-and-ride lot __Pick up carpool / vanpool member __Other	__On the way to work __½ Mile or less __½ Mile to 1 Mile __More than 1 Mile	__Yes __No	__Drove alone __Carpooled with 1 person __Carpooled with 2 people __Carpooled with 3 people __Carpooled with 4 people __Vanpooled __Rode the bus __Other	__Yes __No	__Drove __Dropped off __Carpooled __Vanpooled __Bicycled/walked __Bus __Did not use the Park- and-Ride	__Yes __No **7a.** If yes, please specify (check all that apply) __TV __Radio __Newspaper __Internet __*Smart Commuter*	__Yes __No **8a.** If yes, please specify (check all that apply) __Changed route __Changed time of travel __Changed mode of travel __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?
__Before 11:00 __11:00-11:30 __11:30-12:00 __12:00-12:30 __12:30-1:00 __After 1:00	__Before 11:00 __11:00-11:30 __11:30-12:00 __12:00-12:30 __12:30-1:00 __After 1:00	__Yes __No	__Eat __Shopping __Errands __Other	__Drove alone __Carpooled with 1 other person __Carpooled with 2 other people __Carpooled with 3 other people __Carpooled with 4 other people __Vanpooled __Rode the bus __Walked	__Did not leave the building __½ Mile or less __½ Mile to 1 Mile __More than 1 Mile

20. If you did not commute today, why?

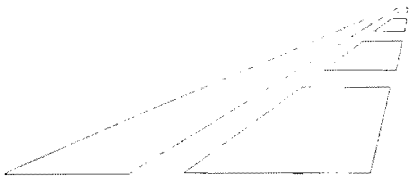
__ Vacation Day
__ Telecommuted
__ Worked out of town
__ Regular day off
__ Sick day
__ Other _____

COMMENTS:

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?
__Before 4:00 __4:00-4:30 __4:30-5:00 __5:00-5:30 __5:30-6:00 __6:00-6:30 __6:30-7:00 __After 7:00	__Before 4:00 __4:00-4:30 __4:30-5:00 __5:00-5:30 __5:30-6:00 __6:00-6:30 __6:30-7:00 __After 7:00	__Yes __No	__Day care/school __Eat __Shopping __Errands __Park-and-ride lot __Pick up carpool - vanpool member __Other	__On the way home __½ Mile or less __½ Mile to 1 Mile __More than 1 Mile	__Yes __No	__Drove alone __Carpooled with 1 person __Carpooled with 2 people __Carpooled with 3 people __Carpooled with 4 people __Vanpooled __Rode the bus __Other	__Yes __No	__Drove alone __Dropped off __Carpooled __Vanpooled __Bicycled/walked __Bus __Did not use the Park-and-Ride lot	__Yes __No **18a.** If yes, please specify (check all that apply) __TV __Radio __Newspaper __Internet __*Smart Commuter*	__Yes __No **19a.** If yes, please specify (check all that apply) __Changed route __Changed time of travel __Changed mode of travel __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 traveler's 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