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INTELLIGENT TRANSPORTATION SYSTEMS
INSTITUTIONAL AND LEGAL ISSUES PROGRAM

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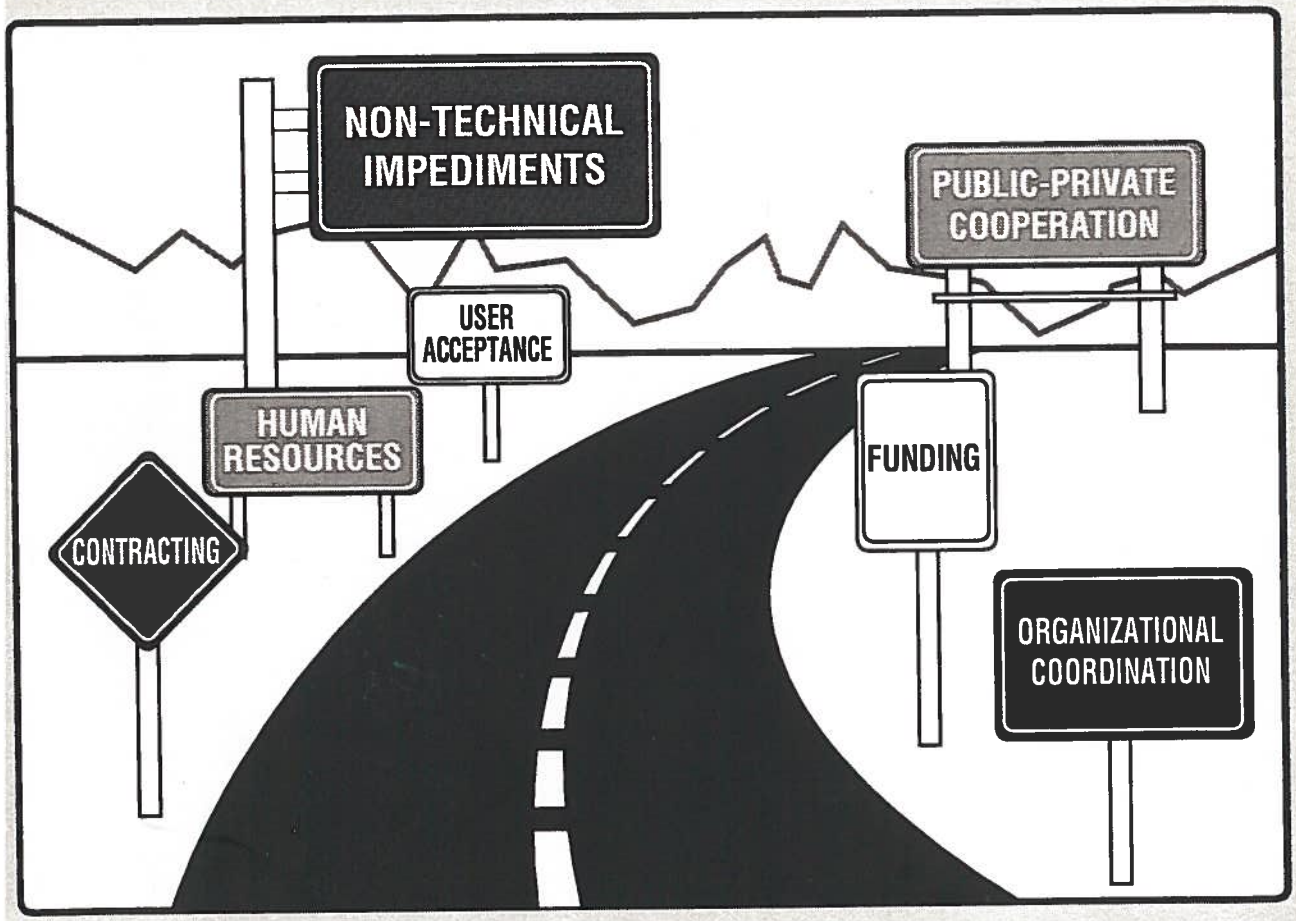
Final Report
June 1995

REVIEW OF THE HOUSTON SMART COMMUTER OPERATIONAL TEST



tesearch and
Special Programs
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John A. Volpe National
Transportation Systems Center

Final Report

ITS INSTITUTIONAL AND LEGAL ISSUES PROGRAM

REVIEW OF THE HOUSTON SMART COMMUTER OPERATIONAL TEST

David W. Jackson
Allan J. DeBlasio

June 1995

Prepared by

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. ABSTRACT (Maximum 200 words)

he Houston Smart Commuter operational test was chosen by the FHWA to be the subject of a case study. Several
se studies were performed under the Intelligent Transportation Systems (ITS) Institutional and Legal Issues
rogram, which was developed in response to the Intermodal Surface Transportation Act of 1991. The objective of
ch case study was to determine (1) the institutional issues and legal impediments encountered during the
stablishment of partnerships and deployment of ITS services and products during the operational test, (2) the point
the life cycle of the operational test at which the impediments occurred, (3) how project partners and participants
vercame impediments, and (4) lessons that were learned that are applicable to future deployments of ITS products
nd services. This case study also describes the operational test and documents its history. Interviews for this case
udy were conducted during the fall of 1994.

. SUBJECT TERMS
telligent Transportation Systems (ITS), Intelligent Vehicle Highway Systems
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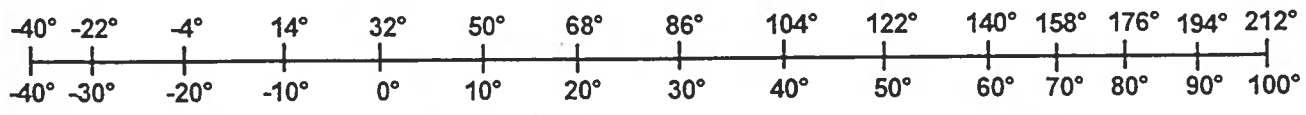

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PREFACE

In response to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the United States Department of Transportation (U.S. DOT) developed the *Intelligent Vehicle-Highway Systems (IVHS) Institutional and Legal Issues Program* (now called the *Intelligent Transportation Systems (ITS) Institutional and Legal Issues Program*). This program was designed to identify (1) issues that may constrain the full deployment of ITS products or services, (2) the means to overcome nontechnical barriers to ITS deployment, and (3) the lessons that were learned that might expedite the full deployment of ITS technologies.

This report was prepared by the U.S. DOT's John A. Volpe National Transportation Systems Center (Volpe Center) for the U.S. DOT's ITS Joint Program Office (JPO). The Volpe Center is providing analytical support to the JPO under the Operational Test Case Studies subject area of the *Institutional and Legal Issues Program*. This subject area calls for a national, independent, and cross-cutting evaluation of several operational tests. This evaluation will identify the problems and issues that participants in operational tests encountered when deploying ITS technologies and services and the important lessons that have been learned and may be applied in future deployments of ITS products and services. Other reports produced in the Operational Test Case Studies subject area are listed in Appendix C.

The Volpe Center has assessed twelve federally sponsored operational tests with the **primary purpose** of answering four questions:

1. *What nontechnical impediments were encountered establishing partnerships and deploying ITS services and products during the operational test?*

2. *Where in the life cycle of the operational test did these impediments occur?*

3. *What were the causes of these impediments and how were they overcome?*

4. *What lessons were learned in dealing with these impediments that can be applied to future deployments of ITS products and services?*

In order to place the nontechnical issues in the life cycle of the development and the deployment of the ITS product or service, the **secondary purpose** of the assessments is to describe the operational test and document its history. These assessments are intended to be illustrative and descriptive in nature. They are not intended to be evaluative (i.e., comparing an observed outcome of the operational test to an expected level of performance) or show cause-and-effect (i.e., identifying whether the operational test has contributed to changes to a base condition or event). Also, these assessments are not intended to evaluate the technical components of the operational tests.

TABLE OF CONTENTS

1. SUMMARY

This section presents an overview of the Houston Smart Commuter (HSC) operational test and a summary of the issues and lessons learned that were discussed by the interviewees.

1.1 PROJECT OVERVIEW

The **Houston Smart Commuter** operational test, both an advanced traveler information system (ATIS) and an advanced public transportation system (APTS), has been developed with the goal of encouraging motorist to use buses, vanpools, carpools, and high-occupancy vehicle (HOV) lanes for their travel. This operational test is based on the hypothesis that commuters who have quick and easy access to relevant, accurate, and up-to-date information in their home and workplace on existing traffic conditions, bus routes, bus schedules, how to use the bus, and instant ridematching services will be more likely to use public transportation and other high-occupancy commute modes, as well as shift their travel routes, or change their time of travel. By providing the necessary information, through the application of innovative approaches using advanced technologies, the HSC project will mean less wasted travel time, less traffic congestion, and improved air quality.

The HSC project comprises two distinct test elements - the Interstate 45 North (I-45N) bus component and the Interstate 10 West (I-10W) carpool component. The I-45N component will provide real-time traffic and transit information to 700 commuters and measure the effect the use of this information has on their travel behavior in this suburb-to-downtown corridor, particularly changes from driving alone to using the bus. (A total of up to 1400 commuters will be involved in this component). The I-10W component will provide real-time traffic and travel information to 1200 commuters partaking in a comprehensive employer-based rideshare program, and will measure the effect the use of this information has on their rideshare usage in this suburb-to-suburb corridor. Each component will utilize particular corridors of the Houston area's extensive 100-mile HOV system.

There are four project partners in the $5 million HSC operational test. The Federal Transit Administration (FTA) is the lead federal agency and has provided $500,000 for the HSC project. The Federal Highway Administration (FHWA) also assists in project oversight and has funded the HSC in the amount of $2 million. The Texas Department of Transportation (TxDOT) has provided $1.25 million to the HSC project, and furnishes real-time traffic data, technical support, and statewide coordination to the project. The Metropolitan Transit Authority of Harris County (METRO) serves as the managing agency for the project and has committed $1.25 million to the project.

In addition, the Texas Transportation Institute (TTI) is conducting the local evaluation and assists with on-going project management. The Greater Houston Transportation and Emergency Management Center (GHTEMC), also an active participant, provides coordination between the

as to what information and level of details are required in the agreement. In addition, the language of this agreement must be compatible with the language of the FTA-METRO grant agreement and the FHWA-TxDOT cooperative agreement. The parties are currently meeting to resolve all concerns regarding the agreement language so it may be signed and the project may proceed.

The HSC project involvement includes two federal agencies - the FTA and the FHWA, a state agency - the TxDOT, and numerous regional and local agencies - METRO, GHTEMC, Harris County, the City of Houston, the Houston-Galveston Area Council (HGAC), as well as other public and private organizations, including TTI. With the inclusion of the large number of organizations, in particular, four principal partners, decision making and project reviews are very complex processes. Since mid-1993, when METRO appointed a lead project manager, this issue has been reduced in scale as the number of parties heavily involved have been reduced.

Ten interviewees related a variety of **lessons** that they learned in addressing new business relationship issues. The most important lessons are to **designate a lead agency and a lead individual for every Intelligent Transportation Systems (ITS) project,** and that **all principal parties, including legal staffs, should be involved early in the project**. A lead individual would have kept the HSC project on schedule and made sure that the principal reviewing personnel were involved with the development of the required inter-agency agreement from the beginning of the project.

Other lessons involved the difficulties encountered in the development of inter-agency agreements, further complicated by the involvement of several funding agencies. Federal representatives, echoed by state officials, provided the lesson that **if possible, ITS project participants should avoid signing multiple-agency agreements, including funding from more than one federal source, or using more than one federal funding mechanism.** Representatives from all public agencies agreed that the resolution of this issue is **not to permit inter-agency agreements to linger. Resolution will require open communication between all parties and meetings to occur early and often.** State and regional interviewees added that **the United States Department of Transportation (U.S. DOT) should develop standardized language for ITS inter-agency agreements.**

Policy makers from the region and state stated as a lesson that **multiple-agency involvement is both necessary and potentially very beneficial for all ITS projects**. However, the administrators noted with the involvement of several agencies, **parties should plan for delays in the project schedule**. A federal representative learned that **ITS projects should be manageable in size,** therefore reducing the number of agencies involved, the cost, and the overall project complexity and potential delays.

1.2.2 Organizational Coordination

Two organizational coordination issues arose in the Houston Smart Commuter project. The first involved the HSC project management structure. The second involved the FHWA work order

1.2.3 Human Resources

Limited staff resources were cited as a major human resource issue by five interviewees. The participants noted that project staffing had been limited in a variety of ways. First, the number of people assigned and the hours that they worked on the project had been too few. Second, no individual was initially assigned to direct this project. Third, the knowledge base of the staff expertise was too heavily technical and not inclusive of other necessary skills.

A number of causes for this issue were listed. The causes cited were the slowness in receiving federal and local funding which created pressure to staff other funded projects, no opportunity to take advantage of private sector knowledge, the need for METRO's reorganization, and turnover in principal project staff at METRO and the TxDOT. Most of the staffing problems have been resolved. The METRO reorganization, leading to the creation of the Traffic Management Department in April 1993 to manage ITS projects, greatly assisted the parties in resolving major staffing difficulties.

The five individuals offered a variety of **lessons** they learned from dealing with staffing limitations. The first lesson concerned project management and copied the on-going theme of one party in-charge. **The ITS project management team should be led by one designated individual.** The second lesson concentrated on staff composition. **The project staff should exhibit a variety of experience and comprise a stable work force.** The third lesson, provided by regional representatives, realized the importance of top management in ITS projects in order to obtain adequate staff and a high priority level. **In order for an ITS project to succeed, upper management must support it.**

1.2.4 Technology and Standards

The difficulty in selecting and defining a product technology for the project was highlighted as a major HSC issue falling in the technology and standards category. A second related and **potential** issue that dealt with the inadequacy of the product ultimately selected was also discussed.

The interviewees listed a variety of causes that created the difficulty in selecting a technology. There was an attempt by the technical committee developing the IDS specifications for the I-45N request for proposals (RFP) to obtain the "best" technology, but limited by cost constraints. The committee placed too great an emphasis on designing a product rather than detailing what functions the selected product must perform. The great speed in which the ITS technology was advancing added confusion as to what was the "best" technology. The committee was not sure what the consumers would want and the committee could not receive input from the private sector on developing "realistic" specifications. The committee also had to consider other items, such as how portable the product should be and if advertising would be allowed.

Both the TxDOT and METRO have other projects within their agencies that compete with the HSC project for intra-agency funding. Federal funding commitments for the HSC project were extensive processes that resulted in delays in the development and signing of the inter-agency funding agreement between METRO and the TxDOT. The FTA funding approval had minor delays. The FHWA funding approval was delayed while the details of the HSC project and the Houston Priority Corridor were completed.

The individuals declaring this issue provided **lessons** they learned related to project funding processes and project budgeting. The participants offered the following lessons experienced by the local parties in gaining federal funding. **The approval process for ITS projects is very long. Project schedules should reflect the lengthy process.**

The parties also examined how the local level should best organize the financial components of the project in order to limit confusion, delays and streamline the financial reviews. **Project budgets for each task should be as simple as possible to avoid confusion by federal reviewers and local project managers. The project manager should be given the full trust and authority to manage project funds from all sources.**

1.2.7 Lessons Learned Not Related to Specific Issues

Interviewees offered **lessons** on developing and *increasing support of the ITS program* with professional associations, politicians and the general public:

- Professional transportation associations must be included within the ITS community.
- The U.S. Congress needs to see "winners" and results from the ITS projects in order to maintain interest and funding for the ITS Program.
- Support from the general public for the ITS Program and individual projects will not be widespread until benefits to the individual can be widely demonstrated.

Regarding *increasing private industry involvement*, participants warned that **the private sector will not invest at any greater level in the ITS program until a profit motive has been provided.** Participants discussed the importance of *project preparation* and noted that **solid pre-proposal planning will alleviate implementation and deployment delays.** Interviewees felt strongly that **both the *local and national project evaluations* should be the responsibility of local project agencies**, parties that have detailed background knowledge regarding both the project and its principal participating agencies.

1.3.2 Funding

The uncertainty of on-going financial support could delay the HSC project from moving beyond a demonstration to wide-scale implementation. An individual noted that the best way to avoid this potential issue of uncertain long-range financial support would be to develop private sector support, reducing the dependence on federal support. The individual expressed the **lesson** that **closer public-private cooperation from the outset of projects would be helpful in guaranteeing that future funding sources would be available.**

1.3.3 Environmental

Three participants discussed the potential that the environmental community may oppose the HSC and other ITS projects if environmental benefits are not shown. The parties noted that environmental representatives are currently skeptical that conflicts between the transportation projects and environmental legislation, especially the federal Clean Air Act, can be reconciled. These parties maintained that a result of better managed highways from ITS projects may be an increase in vehicle traffic and more vehicle-borne air pollution. These potential environmental conflicts in Houston, a non-attainment air quality region, are of great local concern.

The interviewees submitted two **lessons** that can be applied to environmental issues. **Major environmental benefits of the ITS program must be stressed by program administrators.** The communication of benefits can be accommodated by local parties, but some issues can only be resolved by the federal government. **The federal government must sort out conflicts between implementing the ITS program and the requirements of the federal Clean Air Act.**

1.3.4 Full Deployment

This area reviews how the current and potential issues may affect the project's full deployment, and if similar issues could affect the full deployment of other ITS projects.

1.3.4.1 New Business Relationships

The interviewees felt that the slow progress on the inter-agency agreement delayed the eventual deployment of the HSC project, but the potential for greater effects will be minimal. Anytime multi-agency agreements are required, there is potential to make the progress of an ITS project to full deployment very difficult. The difficulties will remain unless new boiler plate agreements and processes are developed.

Based on the cooperative history of most of the parties involved and because the project administrators are becoming more comfortable dealing with the numerous parties, full deployment of the HSC project should not be affected by the large number of participating

1.3.4.6 Funding

Project participants believed that federal funding issues, such as long and extensive funding processes, could affect and delay full deployment of other ITS projects. Most of the parties felt that the funding for this operational test was committed and should not affect the deployment of the HSC test.

One party stated that the lack of guaranteed long-range funding for the HSC project could present major potential problems for the HSC project when moving beyond the test phase to the expanded regionwide deployment. Two federal representatives declared that the lack of long-range funding could also affect other ITS projects because the local management may be reluctant to either begin projects or finance them through to full post-test deployments. Current transit industry budget cuts and competition from other transportation projects were cited as funding problems that must be overcome.

1.3.4.7 Environmental

Environmental conflicts were presented as containing potential issues that could affect full deployment of the HSC and other ITS projects. The respondents listing this potential issue said that resolution to most of these conflicts must come from the federal agencies.

1.3.4.8 Cooperation By Modal Agencies

Two regional officials added a final lesson, warning that unless the attitudes of transportation agencies change, full deployment of many ITS projects could be affected. The transit agencies must stop thinking solely about buses and trains, and the highway agencies must allow highways to be open to buses and rights-of-ways for trains. The individuals noted that the different modal agencies were working together well on the HSC project.

2. PROJECT OVERVIEW

This section describes the scope, participants, management structure, and history of the Houston Smart Commuter (HSC) operational test. It also discusses the stated goals of the project, the goals of the project participants, the benefits the interviewees foresee for participating in the project, the risks that they or their organization may be taking, what they see as the critical success factors of the project, and major milestones that have or will occur within the project.

2.1 PROJECT DESCRIPTION

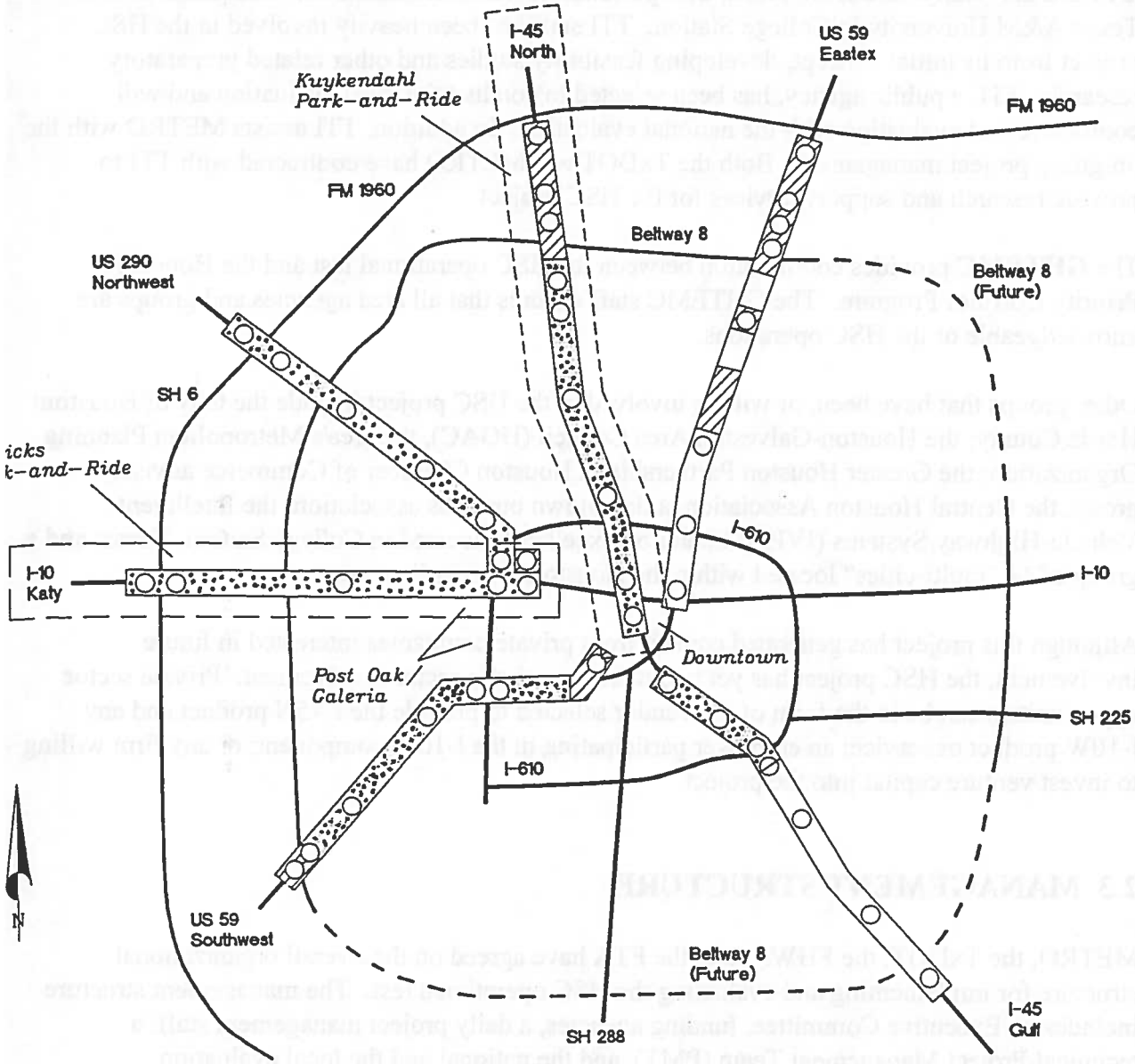
The **Houston Smart Commuter** operational test project is one of many creative solutions that agencies in Houston have taken over the past fifteen years to address mobility and congestion problems. Houston is the fourth largest city in the country. The metropolitan area is among the ten most congested in the country. Traffic congestion is a major public issue in the area. Air quality and environmental issues are also major concerns. Houston is currently in severe violation of the EPA standards for ozone emissions and must develop measures to control growth in vehicle travel in order to meet the requirements of the 1990 Clean Air Act Amendments.

The HSC project is an advanced public transportation system (APTS) and an advanced traveler information system (ATIS). The project is being jointly sponsored by the Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA). Funding is being provided by the two federal sponsors, and the Texas Department of Transportation (TxDOT), and the Metropolitan Transit Authority of Harris County, Texas (METRO). The HSC project has two components - the Interstate 45 North (I-45N) bus component (APTS and ATIS) and the Interstate 10 West (I-10W) carpool component (ATIS). Both components will utilize the extensive high-occupancy vehicle (HOV) highway system, which is presently over 60% complete. The I-45N element will cover a 26-mile corridor and the I-10W element will cover an 18-mile corridor.

The I-45N component focuses on a traditional suburb-to-downtown travel market, encouraging commuters to change modes from driving alone to using HOV's, such as carpools, vanpools, and buses. Up to 1400 commuters, living in the area near the Kuykendahl park-and-ride lot along I-45N and working downtown, will be sought to participate in this three-year test. Half of the participants will be given products with which they can receive real-time traffic and transit information at their home and work. It is the goal of this component that with the information, the participants will be encouraged to use HOV's, change their travel times to non-peak periods, or shift their travel routes. The other half will act as the control group and not receive any product or information. Product technologies under consideration include touch-tone and cellular telephones, interactive cable television, video text terminals (i.e., computers and information kiosks), pocket information systems, and personal digital assistants.

The I-10W component focuses on a suburb-to-suburb travel market, and is designed to encourage a shift from driving alone to traveling in carpools, using instant carpool-matching services. Up

HOUSTON SMART COMMUTER
ITS OPERATIONAL TEST
TEST AREA, MAJOR FREEWAYS AND HOV LANE FACILITIES



LEGEND

- Operational HOV Lanes
- HOV Lanes Being Designed/Planned
- HOV Lanes Under Construction
- HOV Lane Access Locations
- Suburb-to-Downtown Bus Demonstration Corridor
- Suburb-to-Suburb Instant Carpool Demonstration Corridor

Figure provided by the Texas Transportation Institute, College Station, Texas

HOUSTON SMART COMMUTER ITS OPERATIONAL TEST

PROJECT MANAGEMENT STRUCTURE

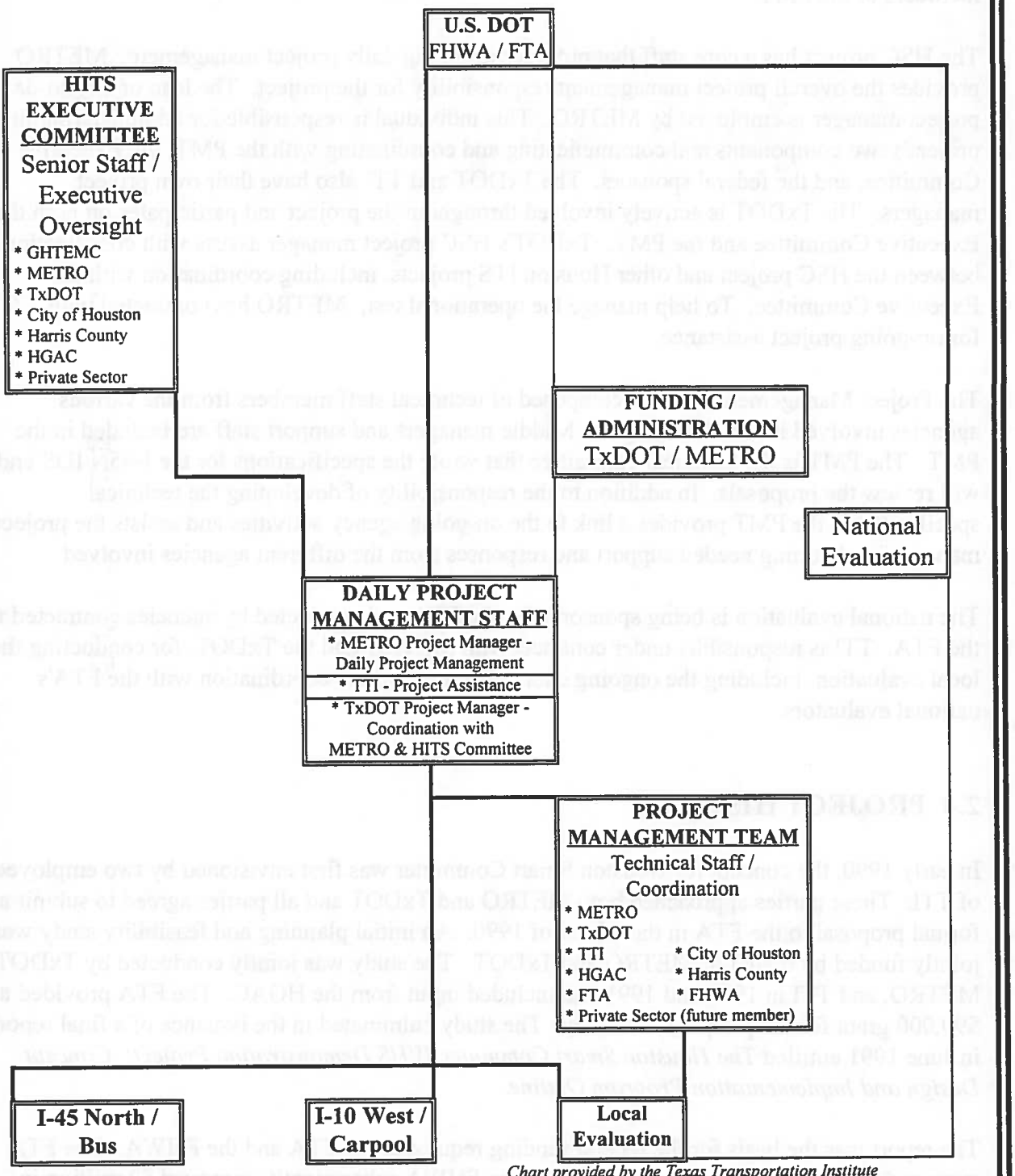


Chart provided by the Texas Transportation Institute

the HSC proposal prior to the first publicized ITS solicitation period held in 1992. The FTA's grant was received by METRO and the FHWA's grant was presented to the TxDOT. In order to facilitate the flow of funds between METRO and TxDOT, a third inter-agency agreement between the two agencies is required. The parties began working on this agreement in October of 1993. The effort to achieve a signed METRO-TxDOT agreement continues, but is nearing completion. This effort has been assisted by the development of a memorandum of understanding (MOU), in March 1994, that listed participants' roles and responsibilities.

Although funds may not be transferred between the TxDOT and METRO until the inter-agency agreement has been signed, other necessary tasks have been initiated. In January 1994, TTI completed the *Houston Smart Commuter IVHS Operational Test and Local Evaluation Program*. This document detailed how the local evaluation would be conducted, including the study design, the coordination with the national APTS project evaluation conducted by FTA-selected consultants, the operational test objectives, the measures of effectiveness, the data collection and monitoring activities, the data analysis activities, and the distribution of the evaluation results. TTI has recently begun collecting pre-test baseline data and recruiting businesses and employees to participate in both components of the project. Evaluations on each element will occur after six months, one-year, two-years, and three-years of operation.

The technical subcommittee of the PMT began meeting to develop the technical specifications for the I-45N IDS in October 1993. The technical specifications and the request for technical proposals (RFTP) was largely completed in June 1994. The RFTP was issued on March 13, 1995. I-45N project is scheduled to begin approximately seven months after the procurement contract has been signed.

There have also been concurrent tasks that had to occur during the development of the HSC project in order for this project to be successful; namely the procurement of the rideshare computer, the expansion of the automated vehicle identification (AVI) system, and the creation of the GHTEMC. METRO successfully procured a computer that has been dedicated to the metropolitan ridematching services. Computer use will include company-based and other smaller ridesharing programs, and potentially the I-10W component of the HSC project. The rideshare computer, installed in April 1995, uses specialized software that enables the commuter to locate instant carpool matches. This system is expected to be fully functional in mid-1995.

The PMT has initiated an evaluation of the capabilities of the new rideshare system. The PMT will use the evaluation results to decide whether the HSC's I-10W component will be able to utilize the new rideshare component or if alternative provisions will have to be made to meet the instant ridesharing needs of the project. If the new rideshare computer is used, it is anticipated that human operators will be used initially in the first phase of the operational test. If any additional technology is required, exclusive of METRO's rideshare computer system, an RFP will be issued after the I-10W component has been in operation and after the evaluation can determine how the initial telephone and rideshare computer systems have been operating.

In an effort to enhance the real-time travel information, the expansion of the AVI system was initiated with a major procurement of Amtech tags in 1994. The GHTEMC will be the central

(The numbers in parentheses in the following sections represents the number of times an item was mentioned and the number of individuals who mentioned it.)

- To increase HOV usage. (11-6)

  This goal is the basis of the entire project. This goal was mentioned by six individuals, representing the research consultant and the regional, state and federal levels of government. The majority citing this goal specifically noted that this goal would be achieved through the use of carpools, vanpools and public buses.

  Stated obstacles to achieving this goal included inadequate incentives for the commuters to change their travel modes and patterns, participants' uncomfortable feelings regarding riding the buses or in carpools, poor quality travel information provided to the project participant that does not interest the individual to change travel patterns, and any number of external factors not controlled by the project parties. While one public sector representative noted that it is very difficult to predict HOV usage, another said that marketing research and customer surveys prior to the test startup could reduce the level of uncertainty and aid in creating a system that customers would use, including an acceptable information delivery device, thus leading to increased HOV usage.

- To test products and procedures and learn what works. (8-4)

  This goal relates to the project as an operational *test*. Four individuals at the federal, state and regional levels provided a wide variety of objectives regarding learning that could be obtained from this project. All four individuals noted that this project would provide an opportunity to learn what information is needed for commuters to make travel decisions. One said that the project would instruct the project parties as to what information device and format is best suited for commuters' homes. Another interviewee said that a correlation could be developed between information provided and the use of the various modes of HOV travel, including the overall HOV lane usage.

  Several obstacles were presented that may prevent the achievement of this goal. Three interviewees mentioned obstacles related to the information distribution device. One individual noted that the project group does not currently have a clear direction as to what type of device technology to use. Another respondent stated that when the product is obtained, it may not perform as desired. The third party said that the information may not be presented in simple, user friendly terms. The three stated that the lack of public education and other factors may limit consumer participation. Two of the three parties also noted that the consumers' inert resistance to change may be difficult to overcome through this single project.

  Two individuals added lessons to be applied when seeking to meet this goal. One said that a broad based and aggressive outreach approach must be developed to obtain the general public's participation so the test may be initiated. The second said that information must be provided to the public in a non-technical format. The same party concluded, "Change is hard."

communication may prevent a successful project from occurring. A second individual said that on-going delays in the project, especially in issuing the RFPs may prevent a successful test.

2.6 BENEFITS

The benefits of reduced congestion and learning from the evaluation of the operational test highlighted the list of benefits mentioned by the respondents. Most of the benefits discussed by the interviewees were closely related to the goals that they expressed. However, the benefits noted by the participants went beyond the scope of the major goals outlined in Section 2.5. Seven benefits were stated by three or more interviewees.

- Learning from the evaluation of the operational test. (7-7)

  All parties that mentioned learning and applying that information as a goal also included obtaining knowledge for their organization as a benefit. One administrator felt that, apart from what will be gained from the evaluation results, actually conducting the evaluation will be a valuable learning experience. Another administrator specified that more understanding will be obtained regarding the effect of real time information on modal splits and rideshare effectiveness.

- Opportunity to reduce congestion. (7-5)

  Four public sector representatives and one research participant regarded the reduction of congestion, along with its related reduction in pollution, as a benefit to their agency and a reason for their participation in the HSC operational test. Consistent with the goals, this benefit was mentioned by public policy level staff from each level of the government.

- Increasing the usage of the HOV lanes and services. (6-4)

  Three of the four public sector individuals listing increased HOV usage as a benefit also identified it as a project goal. The fourth stressed goals related to congestion management, not specifically by increasing HOV usage. Interestingly, none of the four discussing this benefit singled out one particular mode of travel in the HOV lanes. This is consistent with one of the project objectives to increase HOV lane travel utilizing any multiple-occupancy vehicle available, not by promoting one mode over another.

- Opportunity to utilize existing relationships and improve inter-agency cooperation and coordination. (4-4)

  This benefit was mentioned by public sector representatives of every government level, equally divided between administrative and policy level staff. All participants interviewed remarked at various times that a strong and lengthy relationship exists between the TxDOT and METRO offices. The benefit infers that this and other relationships, including ones between federal government departments and the state, regional and local governments, should improve as a result of the HSC project. Also, by

overall thought that if there are any risks, they are minimal. One remarked that Houston's traffic problems are so great and its transit ridership is so low, any gains from this project will be seen in a very positive light. Another individual believed that HSC should be seen as a challenge, rather than as a risk. Eight risks were mentioned three or more times by the interviewees.

- No accomplishments may be attained from conducting the Houston Smart Commuter operational test. (5-5)

  A cross-section of all public agencies involved, including regional, state and federal government representatives mentioned this risk. They included in this risk no congestion improvements, no learning from the test, no usable data obtained, and the complete failure of the products and projects (summed up as "time spent, nothing happened").

- This project may result in a waste of resources. (4-4)

  State and federal representatives identified this risk. The waste of funds was cited by all four parties, while two said the investment of staff time could also go for naught if benefits are not shown in the project results.

- The public may react negatively to this project. (4-3)

  State and federal representatives expressed their concerns that the general public will perceive an unsuccessful project negatively, creating political embarrassments and projecting impressions that the agencies involved are poorly managed.

- Bad or inadequate products may be procured. (4-3)

  Three state and regional representatives identified risks associated with the procurement of undesirable information delivery devices. One individual added that this risk is reduced because HSC is only a "test."

- Agency reputation may be damaged by its involvement. (3-3)

  All three individuals noting this risk expressed concerns that their organizations may be held accountable if HSC continues to move slowly. Two agency representatives regarded many of the delays beyond their control, yet felt that they and their organizations' reputations could suffer if the very slow progress continues.

- Inter-agency relationships may be damaged. (3-3)

  Surprisingly, none of the four respondents that listed improved inter-agency relationships as a benefit from their involvement with HSC said that damage to the relationships could also occur, and vice versa. The three parties who offered this as a potential risk were mainly commenting on the long-term relationship among the TxDOT, METRO and TTI.

- Poor results by this project could affect the future of other programs. (3-2)

  Two state representatives felt if the HSC project, a nationally high profile ITS project, is not successful or has limited success, federal funds and support may be reduced for the

the new and different partnerships created by ITS projects may present obstacles to providing successful project management. One felt that a lesson learned from the HSC experience is that a strong project management team and a project "champion" are needed to guide and push the project along. However, the person added that due to time constraints on the existing public staff, the project management of ITS projects needs to be contracted out.

- Cooperation is displayed by all participating agencies. (4-3)

Three state and regional personnel echoed the feelings expressed previously in other interview topics that inter-agency cooperation is a key factor in the success of this project. Two parties noted that success could be measured by the continued participation of all project organizations and their future decisions to continue funding the project through subsequent post-test phases. One individual espoused that a critical aspect to this factor's success is that legal personnel involved must cooperate with other parties.

One respondent said that having no executed inter-agency agreement between the TxDOT and METRO could affect this CSF. The administrator added that staff involvement in other day-to-day activities could limit the time to communicate with the personnel of other agencies. Another remarked that change in key personnel, lack of funding, or any key political decisions could affect this CSF.

- The products are used by the participants. (4-3)

Individuals from the state and regional governments, and the research agency emphasized the importance of the use of the information distribution devices, especially to allow a meaningful evaluation. All three agreed that the use of the devices will be measured by the number of inquiries made on the system. One added that the number of complaints regarding the system will also be a good indicator of the level of use.

A number of items were listed that could impede product use. The unanimous barrier cited that could preclude factor success was obtaining a bad product. Two interviewees also noted that having the wrong people participating, as well as an inadequate number, will reduce use. The public sector parties also cited liability issues regarding system safety and comfort, and liability issues relating to the installation in participant's homes as potential roadblocks to achieving adequate product use.

- Systems external to the Houston Smart Commuter project must function properly. (4-3)

Three of the respondents asserted that the HSC project is dependent on receiving accurate information about ridesharing, bus service, and overall traffic patterns from sources not directly supervised by the HSC administration. The parties stated that it is imperative that the transit system adheres to the posted bus schedules, the ridematching system be operating, and that real-time travel information supplied to the participants be thorough and accurate. Any glitch in these external systems can compromise the success of this factor and the HSC project.

A regional representative believed that the low-bid process could result in a bad product and the selection of an incompetent contractor. The person described three different procurement options: (1) selection of the low bidder; (2) a two-step bid process with the bidders' competency and ability, along with the technical proposals screened in phase one and the price proposals submitted in phase two; and (3) the selection of the best technical proposal with the price to be negotiated with the vendor after the selection. It was this person's contention that the first option may result in the least qualified contractor with the most inferior product being selected, but may not produce the number of accompanying claims of an unfair and discriminatory procurement process that could result from implementing the second and third options.

- Public knowledge and acceptance of the project is evident. (3-3)

  Three state and regional staff members identified general public support and involvement in the project as a CSF. The three said that support can be measured in many forms, including surveys of the test groups, positive evaluations, and no opposition to continue the project to the next phase of expanded deployment. Two administrators said that poor marketing and educational efforts could damage or reduce the general public's acceptance and involvement with HSC. One of the two espoused that the correct personnel should market the project. Technicians should not be the group marketing the project to the general public. The individual added that the outreach effort must be aggressive and broad based in order to reach all potential public participants. The third party said that a poorly designed product and incorrect travel information could dramatically affect the public's desire to be included in the project.

- Participants to test the product are located. (3-3)

  Two of the parties identifying the need for public support added that after the public support is obtained, the next critical success factor is selecting qualified participants for the program. A federal representative agreed with this CSF. All parties emphasized that the pool of participants must not only be large enough to accommodate test drop-outs, but the majority of the participants must be sophisticated enough to use the equipment with limited training. Proper representation from the specific geographic test areas must be satisfied by the pool of participants. In addition, other problems such as the loss of test group's interest created by poor on-going marketing, an inferior product, and poor results from the use of the product could have consequences on successful participation. The federal representative added two lessons from reviewing this factor: first, the participant must have high quality information to initiate and maintain interest, and second, the information delivery device must perform its desired function.

- The project participants change their travel behavior as a result of using the product. (3-3)

  Three interviewees maintained that it is not only imperative that the users use the products, but they actually change their travel patterns as a result of their involvement in the project. This change can be measured in the short run by examining bus ridership volumes, carpool trips, and any reductions in the non-HOV mainlines. One remarked that

- Installation and start-up of the rideshare computer. (5-3)

  Three people from the state and region, and the research agency noted the external milestone involving the rideshare computer. This rideshare computer will be utilized by more than just the HSC project participants. The computer will be used to match participants throughout the Houston metropolitan area. However, this computer is potentially a key device with the I-10W carpool component of the HSC project and, therefore, must be operational in order for this component to proceed and be tested. System procurement occurred during the second half of 1994. Installation of the rideshare computer occurred in April 1995. One of the three parties also included the installation of another external system, the AVI system, as a vital milestone for this project.

- Developing and issuing the product RFP. (9-7)

  The same seven individuals listing the inter-agency agreements as a milestone, identified the issuance of the product RFP as a pivotal milestone. It was originally thought that the RFP would not be issued until after the TxDOT - METRO inter-agency agreement had been signed. However, after prolonged delay in the signing of the agreement, the RFP was issued in March 1995 without a completed agreement.

- Awarding of the contract for the product procurement and installation. (6-5)

  Three public administrators and two public policy makers regarded the review of the proposals leading to the selection of a private vendor to provide and install the product as a major milestone to accomplish in the near future of the project.

- Recruitment of the commuters and businesses. (4-4)

  Three regional, state, and federal administrators and one regional policy maker identified the successful recruitment of commuters for both project components as a major project milestone. Two of the interviewees specifically included the recruitment of businesses for the I-10W rideshare component.

- Field testing of the product. (5-4)

  This milestone was expressed by four parties representing all three government levels and the research consultant. One of the respondents said that this milestone will begin when the information distribution devices are physically placed in the participants' homes and the devices are fully operational.

- Conduct the evaluation of the Houston Smart Commuter operational test. (15-9)

  All but two public policy makers declared that the evaluation was a critical point in the project timeline. According to the nine respondents, this future milestone will comprise the work from developing the evaluation plan to the final data analysis and the completion of the evaluation.

3. ISSUES AND LESSONS LEARNED

This section presents the institutional issues or non-technical constraints that the interviewees and questionnaire respondents discussed. It also includes the lessons that they learned when they addressed these issues. The issues and lessons learned were divided into seven categories:

- New Business Relationships
- Organizational Coordination
- Human Resources
- Technology and Standards
- Contracting
- Funding
- Environmental

The last subsection discusses lessons that the project participants offered that were not related to a specific issue.

3.1 NEW BUSINESS RELATIONSHIPS

This section discusses the issues that the project participants encountered and the lessons that were learned addressing the issues in the area of developing new business relationships. While the working relationship between the TxDOT and METRO is not new, the involvement of both the FTA and the FHWA, and the pooling of resources for the HSC project has created new relationship issues. The most significant issues that were contributed by the project participants involved the requirement for inter-agency agreements and the difficulties of conducting the project with the large number of principal parties involved:

ISSUE 1: THE INTER-AGENCY FUNDING AGREEMENT BETWEEN THE TEXAS DEPARTMENT OF TRANSPORTATION AND THE METROPOLITAN TRANSIT AUTHORITY OF HARRIS COUNTY HAS NOT BEEN SIGNED

All interviewees asserted that the greatest issue experienced by the HSC parties is the hurdle of completing the inter-agency agreement between the Texas Department of Transportation and the Metropolitan Transit Authority of Harris County, the two major implementing public agencies. This agreement, when signed, will allow the FHWA and Texas state transportation funds to be used by METRO for the HSC project. A reciprocal use of FTA and METRO funds by the TxDOT for the HSC project, if necessary, will likewise be accommodated by the agreement. However, until the agreement is signed, METRO may only use the $1.25 million it has allocated to the project, and the TxDOT may only use the $1.25 million it has allocated to the project. Currently, the funds may not be jointly combined and the $2.5 million allocated from the federal sources cannot be expended on major project items (i.e., the information delivery system).

project. One of the three respondents stressed that effects to project deployments can be avoided by getting legal counsel into the project discussions early. There is unanimity among the parties that the legal staffs should have been brought into the process much earlier.

Each lesson espoused by the interviewees regarding the development of inter-agency agreements can be combined into four categories:

- All principal parties, including legal staffs, should be involved early in the project.
  - Take the time to educate non-technical people, including legal staff, about the technical aspects of ITS projects.
- Resolution of inter-agency agreements should not be allowed to linger. Resolution will require open communication between all parties and meetings to occur early and often.
  - Define the roles of the participants early in the project so the roles will be available for inclusion within the inter-agency agreements and delays may be avoided.
  - Parties must spend all of their energy, effort and focus to get their inter-agency agreements in-place first before proceeding to the tasks involved with the operational tests.
  - Drafting legal agreements is not a quick and simple matter. It takes much time to execute an agreement; however, issues can be resolved more quickly if there is a need to move forward.
  - In order to complete the agreement, someone must take charge, and force all parties to sit down together and resolve the issues without further delay.
  - Do not think that the legal staffs agree; be sure they do.
  - The first big hurdle for any party involved in ITS projects is to understand that this is a new concept requiring new processes.
  - The early resolution of legal problems can avoid long delays.
  - Concentrate on executing any and all inter-agency agreements first.
- If possible, ITS project participants should avoid multiple-agency agreements, including funding from more than one federal source or using more than one federal funding mechanism.
- The United States Department of Transportation (U.S. DOT) should develop standardized language for ITS inter-agency grant agreements.
  - Inter-governmental agreements are usually relatively modest undertakings, but all agreements used in the HSC project must have standard language to allow for the legal transfer of funds.
  - The FHWA's cooperative agreement and the FTA's grant agreement contain the standardized language of the individual agencies and are not entirely compatible with each other. The U.S. DOT should develop standard language used by both agencies.
  - There is no need to reinvent work in the development of a project, including the concepts and the agreements. Parties should use documents and experiences shared by participants in other ITS projects.

The parties believed that this issue is resolved to the level that is possible. METRO management's appointment of a lead project manager in mid-1993 greatly reduced the involvement of some individuals, but involvement by too many parties still exists. The involvement of the local, state, and federal agencies requires that the rules and regulations of all parties must be followed as closely as possible.

In addition to the three individuals highlighting this HSC issue, two state officials and one researcher added related lessons. The most important of all **lessons** learned from addressing the issue of the involvement of too many agencies was that *every ITS project should designate a lead agency and have a project champion.* Each lesson stated regarding multiple-agency involvement can be compiled into four categories:

- Plan for delays in the project schedule.
  - Work involving several agencies has built-in delays. Although TxDOT and METRO work together smoothly, delays have still occurred.
  - The original HSC schedule was too optimistic. Agencies need to set a realistic schedule and budget enough staff time to account for delays created not only by their agency, but by other agencies involved.
- Designate a lead agency and a lead individual for every ITS project.
  - Projects need a designated agency and person in charge to push others and expedite the project.
  - Projects involving several levels of governments are difficult to implement.
  - A single federal funding agency or one federal funding mechanism may reduce the number of agencies involved in projects and the number of parties that review project material.
- Multiple-agency involvement is both necessary and potentially very beneficial for all ITS projects.
  - More benefits than negative aspects are derived from cooperative arrangements.
  - Inter-agency cooperation will prove efficient through the sharing of systems, thereby reducing the per agency cost of development, purchase, installation and maintenance.
  - Multiple agencies can work well together if each provides substantial funding and they have a common goal.
  - Coordination between different groups is critical for ITS projects.
  - The FTA and the FHWA must work together more closely on ITS projects and develop standard rules and regulations that project parties must follow.
- ITS projects should be manageable in size.
  - The HSC project should have been two smaller projects broken up by each component (I-10W and I-45N). The smaller projects would have involved fewer agencies and smaller budgets.
  - ITS projects should be well-defined, confined, small, and focused.

The parties agreed that multiple-agency involvement will delay the **deployment** of the HSC project, but can be overcome, especially based on the cooperative history of most of the parties

Along with the selection of a project manager, the federal agencies required the local parties to draft a project management structure for federal approval. The federal respondent also felt that as the project has progressed, all parties have become more comfortable with the unique administrating process displayed in this ITS project.

Part of the discussion concerning the inter-agency agreement involves the roles and responsibilities for the TxDOT and METRO directly related to the HSC project management. The roles and responsibilities should be resolved with the signing of the agreement. The state respondent said that, although not notably problematic, joint decisions would still have to be made and the existing HSC project management would not get any more streamlined. This party added that confusion as to the management and role of TTI exists because TTI has been contracted to provide similar work on this project by both the TxDOT and METRO. The individual added that there likewise remains confusion as to the role of the Transportation Management Center in this project and how the HSC project will fit in with the Houston Priority Corridor.

There were a number of **lessons** that the parties learned in dealing with problems arising from the project management structure. The lessons learned can be summarized in three categories:

- The project should be led by a single administrative agency.
  - The project participants should empower a single agency with full authority to manage the project and use other parties in an advisory role.
  - The preference is to have a single administrative agency and a single funding mechanism.
  - Project development and implementation must be centralized.
  - A single contract with the TTI should have been executed by METRO.
- Local participating agencies should be organized prior to the submittal of the project proposal to the federal agencies.
  - Parties should have written agreements detailing project roles and responsibilities prior to submitting their proposal to the federal agencies.
  - Project managers from each agency need to dedicate more time to and have greater involvement with this project, both before and after the federal project approval.
- Federal agencies should make quick determinations regarding project approvals and minimize excessive project management requirements.

The parties felt that once the agreement is signed, the problems derived from the management structure should not have any effect on the **full deployment** of the HSC. The state and federal public officials concluded that, nationally, other ITS projects will require similar cooperative arrangements, and a lack of a cohesive management structure could affect the decision-making process tied to the deployment of ITS products and services.

ISSUE 1: THE PROJECT PARTICIPANTS HAVE TO LIMIT THE STAFF RESOURCES THAT THEY CAN DEDICATE TO THE PROJECT

Five interviewees, representing both the government and research agencies, expressed a variety of staffing issues. The parties felt that staffing problems have been ongoing throughout the project, but some areas were now being resolved. Three public policy makers stated that the number of people staffing and the total time spent on the project were too few. Four of the five participants expressed concern that no individual was initially dedicated to and directing this project. A regional and a state public representative also said that a staffing constraint was that the knowledge base of the individuals working on the project was too technical and not inclusive of other necessary skills.

The five individuals were not in agreement on the principal causes of this issue. One state participant said that the delay in receiving federal funding and locating local funds reduced the project participants' ability to provide staff, especially during the initial project stages. Three parties noted that other project priorities also created staffing problems. A research consultant and a federal public sector representative cited one cause of the limited staff issue as turnover in principal staff at METRO and the TxDOT, and the time necessary to replace the former staff and for the new staff to become familiar with the HSC project. One regional representative remarked that the void in the level of staff expertise for certain disciplines, such as marketing, created some delay in finding non-technical solutions. Another state representative felt that the additional expertise could have been obtained from the private sector, but the private sector was not permitted to enter into the project discussions. Two project administrators offered the need for METRO's reorganization as a cause for some of the staff issues.

Because METRO was the lead agency, their reorganization greatly affected the project. METRO's Traffic Management Department, created April 1993, was given the responsibility to organize and manage METRO's ITS projects. However, it took time for the new department to assume full responsibility of the HSC project from the numerous other METRO offices that previously had varying degrees of responsibility for the project. Prior to the reorganization, no METRO office had been willing to push the project along. After the reorganization, a definitive lead department for the HSC project emerged and a lead project manager was hired to work within METRO's newly created Traffic Management Department. Although it took a great amount of time to educate the new staff regarding the project, all parties were in agreement that the METRO reorganization and the filling of the project manager position were necessary steps to further this project.

The five individuals identifying the staffing limitation issues offered a variety of **lessons** that dealt with project leadership, staff experience and stability, and upper management support. The complete list of the lessons learned regarding human resource issues, ordered by the three categories, are:

- The ITS project management team should be led by one designated individual.
  - A project "champion" is needed to maintain consistent direction.

ISSUE 1: IT WAS DIFFICULT TO SELECT AND DEFINE THE MOST APPROPRIATE TECHNOLOGY FOR THE PROJECT

Although this issue has probably been resolved with the completion of the I-45N RFP, the decision as to what technology to incorporate has been a notable issue in the development of the HSC project. Seven of the interviewees, representing the research consultant and the federal, state and regional public sectors, cited this issue. This group included three policy makers and four administrators. The administrators have worked on the technical committee developing the technical specifications.

The process to develop the technical specifications was initiated in October 1993. However, problems with this issue actually arose after the preliminary work on the RFP. Much discussion occurred regarding this issue in March and April 1994, during the time that the technical committee was writing detailed specifications.

The interviewees listed a variety of causes that lead to this issue's prominence. First, the group developing the specifications were attempting to get the "best" technology for this project, but realized that they were constrained by cost. Second, an administrator maintained that there was too much emphasis placed on designing a product rather than describing what functions the selected product should perform. Third, all parties recognized that the rapid technological advances in ITS products likewise added to the confusion as to what type of technology or product to require.

Fourth, a number of the respondents raised the point that without additional consumer information, acquired from market research, they could not narrow the scope to provide exactly what the consumers would want. Fifth, a state and a regional public official believed that without the opportunity for input from the private industries, the technical committee would continue to have uncertainties regarding the specifications. Sixth, a state representative noted that two other items added to the confusion: (1) how portable the product should be, and (2) whether to allow advertising on the device.

As previously noted, the specifications for the commuter IDS for the I-45N corridor, developed during the summer of 1994, was initially scheduled for public bid shortly after the inter-agency agreement is signed. Instead of developing specifications targeting specific products, the initial specifications were revised to benefit from the quickly changing ITS technology. The functional specifications outline criteria, such as affordability, compactness, and technological standards, without being product specific. The parties felt that with these changes, more flexibility has been introduced into the RFP process. A project administrator felt that this flexibility allows selection of more than one contractor or more than one device.

All parties agreed that the extensive discussion related to the type of technology to use delayed the full development of the RFP. Because the inter-agency agreement had not been signed and the RFP was not to be issued until there was a signed agreement, this issue has had minimal effect on the project schedule. However, because of continued delay with the agreement, the partners agreed to issue the RFP ahead of the agreement in order to avoid additional delays in the

All parties remarked that the RFP could result in the selection of a bad or inadequate product which could then affect the participants' use of the product, and subsequently, the evaluation and project results. Ultimately, this may affect **full deployment** of the product.

ISSUE 2: FINDINGS OF THE EVALUATION MAY BE BIASED BY SELECTING PRODUCTS THAT USE OUTDATED TECHNOLOGY, OR ARE INFERIOR OR UNRELIABLE

The five individuals espousing this **potential** issue were concerned that the product selected to meet the specified requirements may not perform as required. The five, representing all government levels and the research consultant, suggested a number of effects that could result from the selection and use of an unsuitable product. They unanimously agreed that the greatest adverse impact would be that the test participants would experience great difficulty utilizing the device and the accompanying project services. This, in turn, would cause users to recommend not continuing the project through to full regional deployment.

The five respondents varied in how they described a potentially poor product. A state and a federal policy representative feared the selection of an inferior or unreliable device. Two regional public sector participants and a research participant specifically conveyed a concern that the product chosen may be functionally obsolete when installed. One of the causes of selecting an outdated product could be the amount of time between the specification development and the installation of the information delivery device in the participants' homes. One public sector individual also cited the rigid low-bid procurement process as a cause of obtaining archaic equipment. The parties stressed that outdated devices could inhibit the commuter's use, the level of participation in the program and adversely affect the evaluation. In fact, all were in agreement that any inadequate product could negatively skew the evaluation findings.

The parties, contributing the selection and use of an unsuitable product as an issue, identified several **lessons** as a result of reviewing this issue. These lessons are combined into four categories:

- The success of an ITS project can be directly influenced by the quality of products used in the project by the general public.
  - Parties involved should be aware that the reliability of the product used may affect the performance of the entire operational test.
  - Positive or negative evaluations from an ITS project will affect the development of other ITS projects.
  - While the selection of the best equipment to use is difficult to determine, many products can be easily ruled out because they are poor devices to use for the transmittal of information.
- ITS projects may be difficult to implement because the general public is not comfortable with high technology, and the success of the projects is dependent on the public using the high technology products.

and HOV lanes. The individual warned that ITS procurements throughout the country are becoming very competitive and controversial, so great care must be made to develop a legally defensible process for procurements.

The procurement issue arose during the development of the RFP. The parties felt that this issue may not be resolved and that all involved must learn to live with the current situation. As the three parties explained, the general cause of the procurement problems was that there were two procuring agencies involved, the TxDOT and METRO, and both had different procurement processes. One party felt that there were no clear choices as to which procurement process was best. Two expressed concern that METRO's process was very inflexible and restrictive, while the TxDOT had begun to utilize a "catalog" procurement process wherein vendors are pre-qualified for procurement contracts with the state, speeding up the entire process. The two individuals said that the TxDOT and METRO determined that METRO's bid process was the only process that can be used when conducting "joint" procurements.

A regional public official believed that because METRO's procurement process was chosen, a mid-course correction (dropping the first product for another product or revising the first product) would not be possible if the product selected proved inadequate. Two participants submitted that the process would not allow any private vendor input into the pre-bid technical design, thereby limiting the ability of the technical committee to develop innovative approaches. Without the private sector's knowledgeable input, outdated technology could be specified resulting in the purchase of poor or flawed equipment. One state interviewee said that the major effect from the agencies having different procurement processes was the additional time required for the participants to learn about the others' procurement methods.

Six participants, including a second state official and a federal representative, provided eight **lessons** they learned as a result of addressing the procurement issues. The list can be summarized into three categories:

- Alternative bid procedures need to be reviewed and developed for use in the ITS program.
  - All levels of government should review their current procurement procedures and make any changes necessary in order to better accommodate the full deployment of ITS projects.
  - Agencies need to review and learn from other bid and procurement processes.
  - Up-front communication by all parties on procurement issues is a much more efficient process than each agency individually reviewing and critiquing the procurement documents.
  - METRO's legal requirements need to be reviewed to see if METRO can change their procurement process.
- Procurement procedures should allow the selection of a product or service based on performance, not just price.
  - Procurements should be more flexible processes so that product functionality has greater merit in the product selection.

completed. A third party declared that all grant processes are naturally slow, but the FHWA's extended review slowed the process even further.

The funding agreements among all parties had to go through many iterations before the federal agencies were satisfied. Delays in receiving federal funding likewise delayed the development and signing of the inter-agency funding agreement between METRO and the TxDOT. The net result of the delays in obtaining federal funding was that only METRO or TxDOT funds have been used to date. Local parties tried to expedite all project tasks not tied to the federal funding. However, funding from the local, state and federal levels have now been secured and, after the inter-agency agreement is signed, this issue should not present any further problems for the HSC operational test.

The parties offering this issue expressed several **lessons** learned dealing with federal approval, project schedules, local project budgets, and local daily management. The lessons were combined into four categories:

- The federal approval process for ITS projects is very long.
  - The U.S. DOT needs to sort out conflicting programs.
  - It is the responsibility of the U.S. DOT to make determinations regarding ITS projects relatively early and without long delays.
  - The federal government should streamline the federal approval process to reduce paperwork.
  - Private sector involvement is needed to increase the financial resources, reducing the dependence by ITS projects on federal funding and the lengthy approval and review delays that accompany the funding.
- Project schedules should reflect the lengthy approval process.
  - Some agencies oversell how fast the funding approval process occurs.
  - The local participants should be realistic with deadlines, building in adequate time for approvals and other unexpected delays.
- Project budgets for each task should be as simple as possible to avoid confusion by federal reviewers and local project managers.
  - Streamline the local funding and project budget process. Do not divide funding of parts of the tasks between numerous agencies.
  - Detailed definition of each task avoids confusion regarding who is responsible to perform the task and who pays for it.
  - Tie funding from each source to a specific task that runs throughout the entire project. This will allow one agency to be responsible for funding an entire task, not responsible for funding portions of several tasks.
- Trust in a single project manager will simplify the review of how the project funds are expended.
  - All parties must be comfortable with the project manager's ability to make daily project management decisions, including processing payments.

conflicts between the transportation projects and environmental legislation; the federal Clean Air Act, in particular.

The ITS program does present many potential environmental benefits through increased transit use, increased multiple-occupant-vehicle trips, and faster travel times leading to lower pollutants exhausted per vehicle trip. However, the state representative pointed out, the environmentalists are concerned that better managed highways may lead to more vehicle trips actually being taken, not necessarily a higher use of multiple-occupancy transportation modes.

Because Houston is a non-attainment air quality region, potential conflicts arising from the implementation of the HSC project, other regional traffic management projects, and meeting the Clean Air Act requirements are of great local concern. As previously noted, although not a goal of the HSC project, a result of these projects may be increased vehicle traffic on the highways and more vehicle-source air pollution.

Two applicable **lessons** were cited by the interviewees:

- Major environmental benefits of the ITS program (i.e., increased transit use, increased multiple-occupancy vehicle trips) must be stressed by program administrators.
- The federal government must sort out conflicts between implementing the ITS program and the requirements of the federal Clean Air Act.

All parties felt that this issue may potentially affect the **full deployment** of any ITS project. One party remarked that the environmental community is very hard to satisfy, and they could potentially block the full deployment of ITS projects. The parties discussing this problem were clear that the resolution to these conflicts must come from the federal agencies.

3.8 LESSONS LEARNED NOT RELATED TO SPECIFIC ISSUES

This section lists the lessons that were learned by the interviewees which are not related to a specific issue. Most of these lessons were offered by the interviewees and respondents when asked, "What is the most important lesson that you learned that you would share with others deploying ITS technologies?" Other lessons were offered spontaneously by the project participants during the interview or while responding to the questionnaire. A regional interviewee provided a spontaneous overall lesson for every participant in an ITS project, "**Have fun and develop a good sense of humor when dealing with ITS projects.**"

The majority of the additional comments dealt with building support for ITS projects and the national ITS program. While financial support was one of the main objectives, the participants understood that financial support would not occur unless professional, political, public, and private sector support were present. The participants offered other lessons covering pre-project planning, evaluations, and intermodal cooperation.

the 40 minutes that would have occurred without the program. If the person waiting had access to real-time traffic information, the commuter may have been able to avoid the delay completely by carpooling in the HOV lane. A third individual stressed that no matter how many benefits result from the ITS projects, ITS will not become commonplace until the general public can afford the individual ITS components. The party cited the current $2,000 cost for AVI systems in cars.

LESSON 4: THE PRIVATE SECTOR WILL NOT INVEST AT ANY GREATER LEVEL IN THE ITS PROGRAM UNTIL A PROFIT MOTIVE HAS BEEN PROVIDED

Two individuals conveyed a lesson on increasing the involvement of the private sector in ITS projects. A state individual expressing this thought contended that there was a great deal of enthusiasm and interest within the transportation industry for the ITS program; however, without a long-term funding commitment beyond the six years granted in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the private industry has been slow to commit greater resources. The party maintained that the current private investment level is well below that envisioned in ISTEA. A federal official and the state official agreed that the consumer demand for ITS products will not increase to allow a high level of private industry involvement until the ITS infrastructure has been installed, requiring the majority of funding to come from public sources.

LESSON 5: SOLID PRE-PROPOSAL PLANNING WILL ALLEVIATE IMPLEMENTATION AND DEPLOYMENT DELAYS

Three participants, two state and one regional official, specifically offered this lesson about what to do early in ITS projects. A state representative noted that extensive pre-proposal planning is easier said than done. Because of the fierce competition for ITS funding, there currently exist incentives to submit a proposal first and plan later. The individual believed that the federal government should require better planned projects before they are approved for ITS funding. Also, most of the interviewees admitted that there were many items that should have been addressed earlier in the HSC project. Based on their experience with the HSC project, the interviewees contributed a number of tasks that should be addressed early in any ITS project, including (1) communicating with all potential participants, including legal counsel, (2) detailing the participants roles and responsibilities with the project, (3) executing any and all inter-agency agreements, and (4) assembling the technical staff.

LESSON 6: NATIONAL EVALUATIONS SHOULD BE THE RESPONSIBILITY OF LOCAL PROJECT AGENCIES

The interviewees expressed concern regarding who should conduct the evaluation. This comment was provided by two individuals who felt an evaluator located outside the project area may not have the detailed background necessary to perform a proper evaluation on a local project. In the HSC project, TTI will be performing the local evaluation and two consultants selected by the U.S. DOT will be performing the national evaluation. The parties proposed that

APPENDIX A

ACRONYMS AND ABBREVIATIONS

APTA	American Public Transit Association
APTS	advanced public transportation system
ATIS	advanced traveler information system
AVI	automated vehicle identification
CSF	critical success factor
DOT	Department of Transportation
FHWA	U.S. Department of Transportation Federal Highway Administration
FTA	U.S. Department of Transportation Federal Transit Administration
GHTEMC	Greater Houston Transportation and Emergency Management Center
HGAC	Houston-Galveston Area Council
HOV	high-occupancy vehicle
HQ	headquarters
HSC	Houston Smart Commuter
I-10W	Interstate 10 West
I-45N	Interstate 45 North
IDS	information delivery system
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
ITS	intelligent transportation systems
IVHS	intelligent vehicle - highway systems
METRO	Metropolitan Transit Authority of Harris County, Texas (Houston)
MOU	memorandum of understanding
PMT	Project Management Team
RFP	request for proposals
RFTP	request for technical proposals
TTI	Texas Transportation Institute, Texas A&M University System

APPENDIX B
REFERENCES

"Cooperative Agreement Between The Federal Highway Administration and The Texas Department of Transportation for the Houston Smart Commuter IVHS Operational Test," September 30, 1992.

"Draft Agreement between the Texas Department of Transportation and the Metropolitan Transit Authority of Harris County for the Houston Smart Commuter IVHS Operational Test," November 1993.

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Gelb Consulting Group, Inc. "Exploratory Research on the Smart Commuter Concept," College Station, Texas: Texas Transportation Institute, The Texas A&M University System, February 1991.

"Memorandum of Understanding Between the Texas Department of Transportation, Metropolitan Transit Authority of Harris County and the Texas Transportation Institute: Houston Smart Commuter," March 1994.

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Turnbull, Katherine F. "Houston Smart Commuter IVHS Demonstration Project: Review of Existing Market Research Information (Working Paper No. 1)," College Station, Texas: Texas Transportation Institute, The Texas A&M University System, October 1990.

APPENDIX C

OPERATIONAL TEST CASE STUDY REPORTS

*IVHS Institutional Issues and Case Studies - **ADVANCE** Case Study*
FHWA-SA-94-055
DOT-VNTSC-FHWA-94-9
NTIS Number: PB 94-186160

*IVHS Institutional Issues and Case Studies - **Advantage I-75** Case Study*
FHWA-SA-94-056
DOT-VNTSC-FHWA-94-10
NTIS Number: PB 94-186145

*IVHS Institutional Issues and Case Studies - **HELP/Crescent** Case Study*
FHWA-SA-94-057
DOT-VNTSC-FHWA-94-11
NTIS Number: PB 94-187101

*IVHS Institutional Issues and Case Studies - **TRANSCOM/TRANSMIT** Case Study*
FHWA-SA-94-058
DOT-VNTSC-FHWA-94-13
NTIS Number: PB 94-183514

*IVHS Institutional Issues and Case Studies - **TravTek** Case Study*
FHWA-SA-94-059
DOT-VNTSC-FHWA-94-12
NTIS Number: PB 94-186111

*IVHS Institutional Issues and Case Studies - **Westchester Commuter Central** Case Study*
FHWA-SA-94-060
DOT-VNTSC-FHWA-94-14
NTIS Number: PB 94-186152

*IVHS Institutional Issues and Case Studies - **Analysis and Lessons Learned***
FHWA-SA-94-061
DOT-VNTSC-FHWA-94-15
NTIS Number: PB 94-184322