U.S. Department
of Transportation

Research and
Special Programs
Administration

IVHS INSTITUTIONAL ISSUES AND CASE STUDIES

DOT-VNTSC-FHWA-94-12
FHWA-SA-94-059

Final Report

TravTek CASE STUDY

John A.Volpe National
Transportation Systems Center
Economic Analysis Division
Cambridge, Massachusetts

April 1994

Prepared for

U.S. Department of Transportation
Federal Highway Administration
Office of Traffic Management and ITS Applications

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE April 1994	3. REPORT TYPE & DATES COVERED Final Report June 1993 – January 1994

4. TITLE AND SUBTITLE
IVHS Institutional Issues and Case Studies
ADVANCE Case Study

5. FUNDING NUMBERS

HW452/H4054
Contract
DTRS–57–89–D-00090
Technical Task
Directive RA 3078

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Science Applications International Corporation (SAIC)*
1710 Goodridge Drive
McLean, VA 22102

8. PERFORMING ORGANIZATION REPORT

DOT-VNTSC-FHWA-94-12

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Department of Transportation
Federal Highway Administration (FHWA)
400 7th St., S.W.
Washington, DC 20590

10. SPONSORING OR MONITORING AGENCY REPORT NUMBER

FHWA-SA-94-059

11. SUPPLEMENTARY NOTES
*Under contract to:

U.S. Department of Transportation
Volpe National Transportation Systems Center
55 Broadway
Cambridge, MA 02142

12a. DISTRIBUTION/AVAILABILITY

This document is available to the public through the National Technical Information Service, Springfield, VA 22161

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This operational test case study is one of six performed in response to a Volpe National Transportation Systems Center technical task directive (TTD) to Science Applications International Corporation (SAIC) entitled, "IVHS Institutional Issues and Case Studies." ADVANCE, Advantage I-75, HELP/Crescent, TRANSCOM/TRANSMIT, TravTek, and Westchester Commuter Central were the subjects of the six case studies. The case studies were performed to determine (1) institutional issues and legal impediments encountered during the operational test, (2) the point in life cycle of the operational test at which the impediments occurred, (3) how project partners and participants overcame impediments, and (4) lessons that were learned that are applicable to future deployments of IVHS products and services. This case study also describes the operational test and documents its history. Interviews for this case study were conducted during the summer of 1993.

14. SUBJECT TERMS
Intelligent Vehicle Highway Systems (IVHS), Advanced Traveler Information Systems (ATIS), Institutional Issues, Non-technical Impediments, Operational Test, Legal Issues, Lessons Learned, and Transportation

15. NUMBER OF PAGES
44

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

Final Report

IVHS Institutional Issues and Case Studies

TRAVTEK Case Study Report

Contract DTRS-57-89-D-0090

Technical Task Directive RA 3078

Prepared for
Volpe National Transportation Systems Center

Prepared by
Science Applications International Corporation
1710 Goodridge Drive
McLean, Virginia 22102

TABLE OF CONTENTS

Preface

This case study on the TRAVTEK operational field test is one of six performed in response to a Volpe National Transportation Systems Center technical task directive (TTD) to Science Applications International Corporation (SAIC) entitled, "IVHS Institutional Issues and Case Studies." Other case studies were performed on the following projects: ADVANCE; Advantage I-75; HELP/Crescent; TRANSCOM/TRANSMIT; and the Westchester Commuter Central. SAIC conducted interviews and case studies of the ADVANCE, HELP/Crescent, TRANSCOM/TRANSMIT, and Westchester Commuter Central projects, and is leading the production of a separate "Analysis and Lessons Learned" report that synthesizes results from all six case studies. Cambridge Systematics, Incorporated (CSI), SAIC's primary subcontractor for this TTD, assisted with interviews of ADVANCE personnel and independently conducted interviews and case studies for the Advantage I-75 and TRAVTEK programs. CSI is also assisting with production of the Analysis and Lessons Learned Report.

"Intelligent Vehicle-Highway Systems" (IVHS) is part of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 that formed the basis for the Department of Transportation's (DOT) initiative to solicit proposals for operational field tests of IVHS products and services. The goals of the DOT IVHS Program are:

1. To improve the safety of surface transportation.

2. To increase the capacity and operational efficiency of the surface transportation system.

3. To enhance personal mobility and the convenience and comfort of the surface transportation system.

4. To reduce the environmental and energy impacts of surface transportation.

5. To enhance the present and future productivity of individuals, organizations, and the economy as a whole.

6. To create an environment in which the development and deployment of IVHS can flourish. (DOT, 1992)

In response to the ISTEA's emphasis upon meeting both the technical and non-technical challenges toward achieving the above goals, the Federal Highway Administration developed the "1992 Intelligent Vehicle Highway Systems Institutional Issues (Non-technical Constraints)

Program." As part of this program, the Volpe Center TTD has initiated the performance of six case studies with the primary purpose of answering four questions:

1. What institutional and legal impediments were encountered establishing partnerships and deploying IVHS services and products during the operational test?

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

3. How were these impediments overcome?

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

The secondary purpose of the case studies is to describe the operational test and document its history.

Information to support the development of the case studies included available documents on each program as well as interview notes and summaries based on an interview protocol especially created for this contract. A detailed description of the standardized procedures and methods followed during the conduct of the interviews is documented within a "Detailed Field Guide," produced as a separate deliverable of this TTD. A list of agencies interviewed is provided as Appendix A, and a bibliography of key references to the project being studied is provided as Appendix B.

Unlike many case studies where projects have been deployed and positive and negative lessons were learned after the total success of the system could be assessed, this case study report is on a project that was still under evaluation. Therefore, interviews represented a snapshot in time during the progress of the project, and issues identified at the time of the interviews may only be temporary.

Interviews for this case study were performed during the summer of 1993 and attempted to provide a balanced presentation of the issues as portrayed by those interviewed. An attempt was made to use corroborating stories as evidence of the accuracy and/or significance of issues raised. However, as with any report heavily dependent upon interviews, the accuracy and completeness are only as good as the accuracy and completeness of personal accounts told to and recorded by the interviewers. To help ensure accuracy and a balanced view of the issues, the TRAVTEK program manager received a draft of the case study report for his project and was given the opportunity to comment. These comments were received and the author has responded to them in this version. Nevertheless, the author takes sole responsibility for the accounts portrayed in the case study reports.

As with any case study or lessons learned report, authors are subject to criticism that their evaluations either seek out the negative aspects with little emphasis on positive lessons, or are incorrect, biased, or lay blame. It is with great sensitivity to these issues that this case study report was written. Postured to identify issues, the authors acknowledge the fact that interviews

were oriented toward finding problems; however, some attempt to identify positive lessons was also made, and so reported. The intent of the authors was to avoid inaccuracies, bias, or blame, and to provide helpful hints to others who are about to embark on similar initiatives.

Separate from this case study, the "Analysis and Lessons Learned Report" will provide conclusions and observations about the institutional issues identified across the six case studies. It will also provide lessons that can be applied to the deployment of IVHS products and services and recommendations regarding: new procedures and programs; the relative magnitude of barriers and respective priorities for their amelioration; and, training requirements for those entering into IVHS programs.

Acknowledgements

Of special note is the expert consultation and review provided to this effort by a specially formed, "Institutional Barriers Advisory Group." This group, chaired by Mr. John Mason of SAIC, consisted of Dr. Christopher J. Hill of Castle Rock Consultants, Mr. Lance Grenzeback of Cambridge Systematics, and Mr. Kenneth Orski of Urban Mobility Corporation. The contributions of this group added greatly to the insight of the interviewers and writers.

The authors would gratefully like to acknowledge the assistance rendered by the TRAVTEK field test program manager and the TRAVTEK public and private sector partners. Also, special thanks go to all of those who participated in the interview process and contributed such thoughtful insights that can be valued by others facing similar tasks. Finally, many thanks go to Mr. Allan DeBlasio from the Volpe Center for his guidance, understanding, and support.

1.0 Summary

TRAVTEK was a joint public/private sector project to develop, test, and evaluate an integrated advanced driver information system. For TRAVTEK, 100 Oldsmobile Toronados were specially equipped to provide navigation, real-time traffic information, route guidance, and motorist information services. Seventy-five of the cars were in a car rental fleet used by visitors to Orlando, and 25 cars were used by local residents and for controlled tests. The vehicles were operated in a 1,200 square mile area surrounding the city of Orlando, Florida. The one-year operational field test was completed in March 1993; the evaluation of the operational test is now being conducted.

To understand the institutional issues encountered in the TRAVTEK project, as well as the project's history, milestones, and accomplishments, interviews were conducted with a representative sample of people knowledgeable about the TRAVTEK project. The 10 interviewees were selected to ensure coverage of both the public and private sectors, various project roles, and involvement in all project stages. The interviews, which followed a structured protocol, collected quantitative and qualitative data, which were summarized, integrated, and interpreted. These data are the source of the opinions and perceptions that form the body of this report.

Most of the interviewees were the leaders, initiators, and champions of the TRAVTEK project who have been with the project since it began and are very knowledgeable about the issues that were encountered, as well as how they were resolved. Their roles have included serving on the project Steering Committee and on the Technical and Evaluation Working Groups, as well as working as the project contractors.

The project's development, goals and objectives, management structure, initiators and champions, and selection and involvement of sponsoring agencies are described in Section 2.0 of this report, along with a description of the operational field test.

Section 3.0 of this report summarizes the non-technical impediments that were faced by the project. The most significant issues identified were as follows:

- Problems with planning for and conducting the operational test evaluation;
- Costs associated with database coordination and reconciliation;
- Insufficient hands-on management during the operational test;
- Problems with contractor selection and performance;
- Problems with evaluation software and support systems;

- Concerns about the protection of proprietary information; and
- Potential partner liability.

A variety of strategies were developed to address these issues. Some strategies were more effective than others; some were simply developed too late to solve the problems encountered in TRAVTEK. Examples of some of the successful strategies employed for major issues include the following:

- Planning for the Operating Test Evaluation

  The evaluation plan required specific demographic categories to be filled in order to get a representative driver sample for the operational test. When AAA ran into problems filling the categories, the project partners broadened the recruitment efforts by using other forums, such as IVHS America meetings, and frequent flyer magazines. Using this broadened recruitment strategy, they were eventually able to satisfy the most critical demographic requirements for the evaluation test.

- Database Coordination and Reconciliation

  Two of the project partners preferred that their own database be used exclusively for the in-vehicle system. After a great deal of negotiation and discussion, the partners agreed to marry the two systems together; one focused on navigation and display, and the other on route guidance. Although this strategy increased the cost of the project, it resulted in a very successful in-vehicle database system.

- Operational Test Manager

  The lack of a designated manager to oversee the day-to-day management of the operational test was an important issue. In an attempt to address this, FHWA and the project partners modified the evaluation and TMC support contracts. This strategy met with only modest success, because it was not done until the test was already underway, and because the support person did not have sufficient authority to resolve issues quickly.

- Contractor Selection and Performance

  FHWA was responsible for funding the TRAVTEK contractors. Project partners did not have an opportunity to participate in the selection of the TMC contractor, since it was done through normal FHWA contracting procedures. This resulted in some dissatisfaction with the TMC contractor. For the selection of the evaluation contractor, FHWA modified its procedures and the project partners were allowed to review the evaluation RFP and proposals. Although the partners were pleased to be able to participate, the success of this strategy was constrained because partners were not allowed to keep these documents during the selection process.

? Protection of Proprietary Information

Project partners were very concerned about protecting proprietary information and data developed from the TRAVTEK project. In addition to the protection clauses in the Partners' Agreement, the partners developed a strategy to transmit vehicle data directly from Orlando to GM in Michigan, who would then turn it over to the evaluation contractor. This strategy avoided placing project data in a Florida public official's files, which would then become public record and be available for public review, according to Florida's Freedom of Information Law.

? Potential Partner Liability

Project partners were concerned about potential liability issues related to the accuracy of the routing data base. The project partners developed an informed consent form to be signed by the driver prior to driving an experimental car. Although this did not become an issue during the operational test, it would have been a minimally successful strategy, since the informed consent form would only offer limited liability protection. Project partners, however, also felt that they had an ethical obligation to the drivers to inform them about the experimental nature of the operational test.

The interviewees were also asked to project which issues they expected to be the most critical should a TRAVTEK-like project reach commercial deployment. They believe that the most critical issues are likely to be the following:

? Market uncertainty regarding willingness to pay to establish and maintain the system;

? Coordination of multiple jurisdictions;

? Potential liability of public and private sector project managers;

? Legal acceptability of new technology;

? Absence of standards and protocols for a national architecture; and

? Difficulties with cooperative research efforts.

More detail on these issues may be found in Section 4.0 of this report.

In summary, based on the TRAVTEK experience, the most important lessons learned are as follows:

? Building trust among project participants is difficult but important;

? Project management style is crucial in complex, multiple partner efforts;

? Poorly defined project goals, strategies, and methodology create significant and

costly problems;

- Upper-management buy-in contributes to project success;
- Contracting flexibility is important;
- Lack of clarity in participant roles and responsibilities wastes time and money;
- Partners' responsibilities must be clear; and
- Administration of the evaluation process should be objective.

These lessons are discussed in detail in Section 5.0, along with recommendations for addressing the types of issues encountered in this project.

2.0 Project Description

2.1 Project Background

Project Development

General Motors (GM) had been working on developing and testing an advanced vehicle information system for several years before entering into discussions with the American Automobile Association (AAA) about a joint project. GM and the AAA then approached the Federal Highway Administration (FHWA) for funding assistance, and the first TRAVTEK meeting with these three partners was held in March 1989.

GM was appointed the project manager and systems engineer for TRAVTEK, and the search began for an operational test site. The search soon focused on Orlando, Florida. Orlando was an attractive site for the project because of its large rental car market, and because the AAA was in the process of relocating its headquarters there. In the late spring, GM contacted the City of Orlando and the Florida Department of Transportation (FDOT) to discuss their participation. At the first Partners' Steering Committee meeting in June 1989, the partners began to develop an agreement on systems and requirements, and a general definition of responsibilities. Once the Partnership Agreement was signed in May 1990, technical work began on the in-vehicle engineering and supporting systems by the Technical and Evaluation Working Groups.

Partnership Agreement

The 10-page Partnership Agreement described "mutually agreeable terms to engage in a cooperative project to develop, implement, operate, and evaluate a motorist information system known as TRAVTEK." In the agreement, TRAVTEK goals were defined and partner responsibilities were generally described. The agreement also stipulated that a statement of work was to be prepared to "detail the manner in which the parties will carry out these responsibilities." The agreement allowed each partner to withdraw from TRAVTEK with only 30 days written notice and to discontinue funding at its own discretion.

Project costs are not defined in the agreement, except for Section 2(f), which stated:

> "It is understood that the cost to each party responsible for executing specified tasks may change as a result of changes in task definitions, more detailed estimations of the costs of carrying out tasks, shifts in task responsibilities among parties, or other unforeseen reasons. If a party does not accept the resultant increased financial responsibility for such changes, the steering committee provided in Section 3 of this

agreement shall either modify the statement of work or arrange for other means of funding affected tasks."

The agreement contains several clauses specifically addressing intellectual property. These clauses protect the partners from the transfer of proprietary information without their approval, define the phrase "intellectual property," specify that TRAVTEK data were to be made available to all project partners, proscribe the right to use the data ventures without permission from the Steering Committee, and provides a mechanism to revise proprietary intellectual property.

The Statement of Work mentioned in the Partnership Agreement provides more detail about the responsibilities of each of the project partners; defines system engineering requirements and specifications for the in-vehicle subsystem, the TRAVTEK Information and Services Center (TISC), the Traffic Management Center (TMC), and the radio base station subsystem; and briefly describes system testing and evaluation.

Goals and Objectives

The primary goal of TRAVTEK was to develop, test, and evaluate a state-of-the art integrated advanced traveler information system (ATIS). Other project goals described by the interviewees include:

- Developing a tool to help travelers avoid congestion delays, ease environmental problems, and facilitate traffic movements;
- Evaluating an in-vehicle navigation device married to real-time traffic data so that routing is based on actual conditions;
- Getting public exposure and feedback on an in-vehicle dynamic route guidance system;
- Establishing a metropolitan traffic management center to increase awareness of traffic management techniques and coordination with congestion and incident management;
- Developing an evaluation report acceptable to the research community;
- Ascertaining the benefits of an in-vehicle ATIS in the "real world;"
- Determining what information travelers want to have in a car, evaluating the safety aspects of an in-vehicle display, and determining the mechanics and logistics of creating the supporting systems;

- Demonstrating an effective, working IVHS project, and also that public/private partnerships work; and
- Improving safety.

Management Structure

The TRAVTEK project was directed by a Steering Committee, with a representative from each of the five project partners. The Steering Committee was responsible for establishing project policies, guidelines, and direction. The project was managed by a Technical Working Group chaired by GM. This group undertook the technical systems design, developed the operational test, established the Evaluation Working Group, and designed the evaluation plan. The working groups included representatives from each partner organization with functional expertise in human factors systems design, in-vehicle navigation and route guidance systems, systems evaluation, and traffic information systems.

Initiators/Champions

Bill Spreitzer (GM) was named by almost all interviewees as the prime initiator of the TRAVTEK project; others considered to be initiators included Jim Rillings (GM) and Harold Yankelovitz (AAA). Those listed most frequently as champions of the project were Jim Rillings, Harold Yankelovitz, Dennis Judycki (FHWA), and Frank Mammano (FHWA).

Sponsoring Agencies

Government participants in the TRAVTEK project included the FHWA, the FDOT, and the city of Orlando. Of the government participants, the FHWA was the primary sponsoring agency in terms of project funding. Private sector partners were GM and the AAA.

Participant Selection

GM and the AAA had a long-established private sector market interest in developing and testing in-vehicle guidance and information systems. The FHWA has designated Intelligent Vehicle-Highway Systems (IVHS) as a national priority; TRAVTEK falls into the ATIS functional area of IVHS. Florida DOT and the city of Orlando were approached by GM and the FHWA because of Orlando's suitability as a test site. Orange County, although not a formal project partner, also participated in the TRAVTEK project through the city of Orlando.

In addition to these participants, two contractors were hired to support TRAVTEK, one to develop the traffic management center, and one to evaluate the operational test.

Level of Involvement

Based on quantitative ratings, GM, the AAA, and the FHWA provided most of the project funds. Both GM and the AAA spent more on the TRAVTEK project than they had originally anticipated, but were reluctant to disclose their total contribution to the project. The city of Orlando and the FDOT primarily contributed staff time and expertise. The original TRAVTEK budget was estimated to be about $8 million, funded with 50/50 public and private monies. Funding sources were the FHWA, GM, and the AAA. As the in-vehicle systems and the TMC became more defined, the project budget was increased to $12 million. Ultimately, following contract modifications in support of the operational test, and a larger budget due to the much-broadened evaluation plan, the project budget was estimated to be much more than this, although project partners are reluctant to disclose how much was actually spent. GM was responsible for overall project management, systems engineering, engineering the in-vehicle routing and navigation systems, and for designing the operational test evaluation. The AAA developed the in-vehicle information systems and information services center, and also was responsible for rental car driver recruitment and follow-up interviews.

The FHWA provided the funding for the operational test and the evaluation design contracts, as well as grant funds to the city of Orlando for the traffic management center. The FHWA's responsibilities also included funding contracts for the development of the traffic management center and for an evaluation of the operational test. The city of Orlando contributed staff and expertise to the traffic management center, as well as data and coordination with the AAA on map routing and accuracy. The city also provided coordination with all Florida counties included in the operational test area. The FDOT contributed the freeway surveillance system with support from the Florida Highway Patrol, which provided the incident data to the traffic management center.

Risks and Benefits for Project Partners

Involvement in the TRAVTEK project posed potential risks as well as benefits to each organization. The FHWA's reputation and credibility would suffer if TRAVTEK were considered a failure or was badly run. The FHWA also did not want to be perceived as throwing money away, or as causing negative publicity for IVHS projects and programs, because of its accountability to Congress. Potential benefits for the FHWA included determining the benefits of ATIS systems, positive media exposure, and establishing the acceptability of public/private ventures.

GM gained a great deal of experience and knowledge from participating in the TRAVTEK study, and believed that learning to work in public/private sector teams was significant for the company. In addition, the positive publicity generated about TRAVTEK has enhanced its reputation. On the other hand, there were groups within GM who believed that GM should avoid this type of collaborative research because of its associated risks. The major risk for GM was that its competitors would learn from GM's experience and would be in a position to bring a product to market more quickly once TRAVTEK and GM lowered the market barriers. There also was concern that some stockholders perceived TRAVTEK to be a "frivolous" project for the

corporation at a time of dwindling profits and personnel layoffs. Other risks included the system proving to be unsafe, an inability to achieve the technical goals of the project, and that resources would be invested without resulting in a marketable product.

As a highly customer-oriented organization, the AAA perceived that its primary risks were that the system would not work as "advertised," or that incorrect information would be provided to vehicle drivers. Because the AAA was responsible for driver recruitment, they believed that people would view TRAVTEK, at least initially, as a AAA project. If TRAVTEK failed, the AAA's conservative, customer-oriented image was at risk. On the other hand, the AAA had been working on in-vehicle information systems as part of an overall corporate strategy to develop new technologies to serve its members. TRAVTEK fit nicely into this strategy, and was viewed both internally and (in the AAA's eyes) externally, as a progressive program. The AAA also believed that the good publicity and visibility generated by TRAVTEK was beneficial to the organization.

The city of Orlando perceived that the risks of participating in TRAVTEK were minimal, other than the potential of being associated with a failed project. Other minor risks were the time and effort spent on in-house management of the city's participation in the project, the expense and effort of dealing with the grant application for the traffic management center (TMC), and the city's liability for the TMC. From Orlando's perspective, the potential benefits to be gained from the project far outweighed the potential risks. The city gained a permanent TMC in Orlando, financed by the FHWA, and the city's staff gained important technical training and expertise in traffic management. Orlando also believed that the favorable publicity from TRAVTEK helped to elevate the city's reputation as a technology center, and that the favorable national attention TRAVTEK received could attract corporate relocations to Orlando and improve the city's business climate.

The FDOT saw only minimal potential risk from participating in TRAVTEK. Most of its participation consisted of activities that the department considered routine (but perhaps on an advanced schedule). There was a potential image risk from being associated with a failure, and concerns about potential safety and liability problems. Perhaps the most significant risk was that the FDOT would have to assume the expense of maintaining the freeway surveillance system installed as part of TRAVTEK. The FDOT supports advancing IVHS programs, rather than constructing more capacity, as a means of handling congestion. The FDOT also believed that a direct benefit from TRAVTEK was the demonstration of significant alternate methods of alleviating congestion through the use of technology.

2.2 Operational Field Test Description

The TRAVTEK operational test ran for one year, from March 1992 until March 1993, in a 1,200 square mile area surrounding Orlando. TRAVTEK had three major elements: a TRAVTEK

Information Services Center (TISC), the TRAVTEK vehicle, and the traffic management center (TMC), which provided drivers with real-time traffic and incident data.

For TRAVTEK, GM provided 100 two-door Toronados specially equipped with touch screen-based navigation and driver information systems linked to traffic and information centers by radio data communications. Seventy-five of the cars were allocated to a car rental fleet used by 3,000 visitors to Orlando, and 25 cars were used by local residents and for controlled tests. The TRAVTEK in-vehicle device displayed maps of the Orlando area, including traffic and congestion locations, information about traffic incidents or available services, and route guidance instructions which used simple user-friendly graphical cues, such as directional arrows. When the driver selected a destination, TRAVTEK determined the best route and used both graphic displays and synthesized voice to give route instructions. Service information, such as hotels, restaurants, and tourist attractions were either indicated on the map or described as text on the in-vehicle display screen.

The operational test divided the technological options into three groups: Navigation Plus (NAVPLUS), Navigation (NAV), and Services Only in order to evaluate the effectiveness of each level of service option. Drivers in the NAVPLUS group had access to all navigation functions, real-time data communications with the traffic management center, and all service functions. All cars also included a cellular telephone. The NAV group was able to use all navigation features and the service directory, but did not have real-time data communications with the traffic management center. Drivers in the Services group had access to the service directory only. This was the evaluation control group against which the other groups are compared. The control group cars were equipped with in-vehicle navigation and data logging systems, but these were not available to the drivers. Data such as vehicle position, heading, speed, and stops were automatically collected with this equipment.

The TMC was designed and implemented by a contractor. The TMC obtained information from various sources (such as Metro Traffic Control and the Florida Highway Patrol), combined and processed the information, and generated real-time reports about incidents and congestion, link travel times, and parking lot information. These reports were transmitted to the TRAVTEK vehicles, the TISC, and back to the information sources.

Another contractor was selected by the FHWA to undertake the design, management, implementation and support for the evaluation of the TRAVTEK project. This included field studies with rental car users and local drivers, a yoked driving study, a navigational test, camera car study, the collection of preference, perception and marketing data by interviewers and questionnaires, modeling and analysis studies, analysis of the system architecture and an overall evaluation of the TRAVTEK project.

3.0 Past and Present Institutional Issues

Many of the issues mentioned as important institutional concerns of the TRAVTEK project were related to the organization and management of the project's evaluation. These issues surfaced during the design of the operational test, and continued during the evaluation design effort, through the operational test, and into the evaluation itself. The issues include the initial contracting process, the design of the evaluation in the RFP, the structure of the evaluation, conflicts with operational test requirements, evaluation data collection requirements, and the testing and performance of evaluation data collection software during the operational test. These issues received among the highest quantitative ratings of problem severity. Another critical organizational issue, which many interviewees believed adversely affected the progress of the test, was the lack of an operations manager for the test phase of the project. The other major issue concerns the decision to use two data bases for the in-vehicle routing and navigation systems.

3.1 Organization and Management Issues

Evaluation Planning Problems

A number of issues were raised concerning planning for the evaluation of TRAVTEK. In the beginning, the depth and scope of the evaluation was not well defined or agreed upon by all of the project partners. In part, this is because the concept of TRAVTEK essentially evolved from a "demonstration" project to an "operational test," which entailed, to at least some of the project partners, the need for a more comprehensive evaluation.

The vagueness of the evaluation plan as described by the Statement of Work (attached to the Partners' Agreement) contributed to the problems with evaluation design. Section 10.0 in the Statement of Work described the overall evaluation goals as follows:

- "The AAA and GM shall conduct an evaluation of TRAVTEK during operations to determine the degree of Customer acceptance and satisfaction with the concept and execution of TRAVTEK. The Public Sector shall conduct an evaluation to determine the effectiveness of TRAVTEK technology to collect real time traffic information and to control and influence traffic congestion. Each Team Member shall define their own set of evaluation objectives and goals."

The lack of clarity about the kind of evaluation that would be conducted also reflected the partners' different corporate and organizational objectives and market positions. The AAA is

highly member-oriented and focused on market research; GM and the FHWA were more focused on the scientific integrity of the evaluation process. Despite its emphasis on research, GM did not assign anyone early in the project to work on the evaluation design, nor was the evaluation considered an integral part of the operational test design at the project's inception. The partners, especially GM, focused primarily on making the operational test work, not on defining what they needed to collect and measure in order to evaluate the operational test.

The first draft of an evaluation plan with specific operational test goals was developed by GM in 1990, after the appointment of the Evaluation Working Group chair. The draft, based on overall project goals, was highly controversial. Some partners believed that the extent of the proposed evaluation was much greater than they thought was necessary; it was implied that they might not have signed the Partners' Agreement had it explicitly included an evaluation of this magnitude. For example, GM, supported by the FHWA, believed that TRAVTEK could not make any claims about the potential benefits of an in-vehicle navigation, route guidance, and information system unless those benefits could be documented with a valid evaluation methodology. To have a statistically valid evaluation, they were convinced that a control group was needed to gather baseline data. From the AAA's perspective, however, conducting a rigorous scientific evaluation (including the establishment of a control group) was less important than doing more straightforward market research exposing drivers to the system and finding out what they liked and did not like about it.

Eventually, with some persuasion by the FHWA, all of the partners agreed to undertake a scientifically valid evaluation. The FHWA also committed to provide the additional funding required by the evaluation contract. This agreement significantly affected the overall TRAVTEK project. It dramatically raised the level of effort required for both the operational test and the evaluation, and substantially increased the funding required by the project. Although the FHWA provided the funding for the contractors, GM and the AAA contributed considerable additional corporate resources for the evaluation. The project partners could not have anticipated the cost of the final evaluation plan, given their lack of early understanding of what would be required for the evaluation.

Once the parameters of the evaluation had been established, there were issues related to the evaluation contracting process. The contractor responsible for the traffic management center was also responsible for developing the first outline of the evaluation plan, based on the early draft plan developed by GM. There was concern that this task was assigned to the TMC contractor as an afterthought; it was the last task that this contractor was to address, and was not thought through as well as it should have been.

Ultimately, despite these problems, the evaluation plan that was developed and undertaken was considered by all project partners to have been of the highest quality. All of the partners attributed this to the dedication and integrity of the people who worked on the design. They also agreed that many of these problems might have been avoided if there had been a clear understanding of the scope and cost of the evaluation required by TRAVTEK at the beginning of the project.

Lack of an Operational Test Manager

One of the biggest problems during the operational test phase was the lack of a designated person who was knowledgeable about the project to oversee the day-to-day management of the operational test. The project partners assumed that GM would continue in its project management role during the operational test, as was spelled out in the Partnership Agreement and Statement of Work.

Once the test began, it quickly became clear that it was necessary to have someone be in charge on-site. For example, when a two-way radio link went down between the freeway surveillance system and the TMC, there was no real-time traffic data being communicated to the TMC because there was no one on-site to handle the problem, the radio link stayed down for an extended period of time, causing problems with the data that were collected.

All of the project partners agreed that the designation of an on-site operational test manager with sufficient authority would have reduced the response time when problems arose. This would have increased the period during which valid data were collected. This problem was never really satisfactorily resolved, although both the evaluation and the TMC support contracts were modified to provide operational test support. Unfortunately, this was not done until the operational test was well underway, and the person put in place did not have sufficient project background or authority to be effective in resolving issues.

Contract and Contractor Problems

The participants identified problems with both of the contractors regarding the development of the traffic management center and the evaluation design. Some of these issues appear to have arisen because the contractors were not brought into the process early enough. Several interviewees observed that contract modifications should be expected in this type of project, and that a system should be established to accommodate the evolving nature of the project. For example, when it became apparent that an operational test manager was needed on-site in Orlando to respond to day-to-day problems concerning the cars, driver recruitment, or the in-vehicle systems, too much time elapsed before existing contracts could be modified to provide this type of support.

Based on partner dissatisfaction with the process used to select the TMC contractor, all project partners were able to participate in the evaluation contractor selection process. Meaningful participation was constrained, however, when partners were not allowed to keep the evaluation Request for Proposals (RFP); they had to review it and return to the FHWA. In addition, some partners believed that the FHWA took far too long to approve modifications to the RFP, which delayed the issuance of the evaluation RFP and selection of the consultant. Once the contractor was selected, a cumbersome contract modification process made it very difficult to handle adjustments to the evaluation plan that came up as the operational test got underway.

Some of the partners attributed problems with the traffic management center to their unhappiness with the way in which the TMC contractor was selected. The FHWA used the standard bid, evaluation, and selection process in making this selection, with no input from other partners. Several partners believed that the winning contractor had underbid because it believed that its experience with IVHS would short-cut work that needed to done for the TMC. Partners were concerned that this approach would not meet TRAVTEK's operational requirements. Some partners also attributed problems with the under-capacity design of the TMC's computers to a low technical performance by the contractor; this would have been difficult to predict regardless of the selection process.

Aggressive Project Schedule

Nearly every participant agreed that TRAVTEK had an ambitious project schedule. TRAVTEK's schedule was perceived by some as overly aggressive, allowing insufficient time and resources for a shakedown of the cars and their systems. The failure to allow for a proper shakedown period contributed to problems in the early operational testing phase. For example, some believe that because the evaluation software systems were not sufficiently tested prior to the operational test, a significant amount of data collection was compromised due to faulty software performance. The lack of a shakedown period appears particularly glaring in light of high anxiety among some of the partners about how their reputations depended upon meeting the public's high performance expectations.

The aggressive schedule also may have contributed to credibility problems among the project partners. For example, the cars were late being delivered by GM; some believed this affected their credibility as the TRAVTEK project manager. As it was, the start of the operational test was delayed by two months, from January until March 1992. This is a minor delay given the scope of the TRAVTEK project; some other IVHS projects are up to two years behind schedule.

Roles and Responsibilities: Who Should Be a Partner?

During the operational test, AVIS Rent-A-Car was recruited to assist with driver recruitment. AVIS expressed a desire to become a partner, but the offer of a partnership was not extended. It was generally agreed that AVIS devoted considerable resources to the project, and that their driver recruitment and orientation activities (which made the rental process more time consuming, thereby reducing their productivity) contributed to the project's overall success. Partnership concerns revolved around defining and quantifying their contribution. However, given their ultimate importance to the project, there was some regret that AVIS could not take credit for its role more formally. This issue had no direct effect on the operational test.

Roles and Responsibilities: Conflict Over Data Base Selection

The AAA owns part of NAVTEK, and GM has a formal relationship with ETAK. Both partners wanted their preferred data base to be used exclusively for the in-vehicle systems. After much negotiation and discussion between the AAA and GM, they agreed to use both data bases. ETAK, at the time, was the foremost navigation and display system, while NAVTEK was considered to be particularly strong on route guidance. Some believed that marrying the two systems may have created a technically superior system, but at a very high cost of staff time and project money. All of the interviewees would have preferred a single system selected at the very beginning of the project. This issue increased project costs and contributed to a delay in the schedule.

Roles and Responsibilities: Problems Relating to Driver Recruitment and Vehicle Selection

The evaluation plan defined a number of demographic categories that had to be filled in order to get a representative driver sample for the operational test. Some cells in the demographic categories were difficult to fill, particularly for the "Services Only" car. The AAA originally was solely responsible for recruiting rental drivers from its membership, but it became clear that using this as the sole means of recruitment was not going to provide a demographically broad enough driver sample.

In addition to the demographic groups represented by the AAA's membership, there was a public relations component to TRAVTEK which several interviewees felt had not been thought through sufficiently. The lack of a coherent approach complicated driver recruitment, because the media focused almost exclusively on the high-tech attributes of the NAVPLUS car, which made recruiting for the NAV and Services Only vehicles difficult. The AAA did pay for developing an advertising campaign which it had not anticipated at the beginning of the project, but it did not solve this problem. Several drivers refused to participate if they were assigned any vehicle other than NAVPLUS.

The TRAVTEK partners developed a variety of strategies to deal with these difficulties. They began recruiting through other forums, such as at IVHS America meetings and in airline frequent flyer magazines. They added an advertising consultant to develop a driver orientation tape and training materials. AVIS recruited walk-ins to fill the Services Only vehicles, and provided discounted rental car rates. Local drivers were able to get cars at no cost. The partners eventually were able to satisfy the evaluation requirements by broadening the recruitment effort.

Intrapartner Communications: Problems Communicating Changes in the Road Network

Another issue revolved around the AAA's high expectations of, and concerns for, the accuracy of the roadway data. The project partners had developed a notification process for changes to the road network. Orlando, however, has different departments responsible for maintenance and construction of the city streets. Changes to the city's streets (i.e., street directions, paving, and light signal changes) were not always communicated to the TRAVTEK contact people within the city administration; without notification of these changes, the data base used by the in-vehicle systems will be wrong. For example, the city changed the direction of some important one-way streets two weeks prior to the operational test without notifying the TRAVTEK team. Although this situation was resolved before the operational test began, there was concern that there were mistakes in the data base as a result of these kinds of unexpected changes during the course of the operational test.

Interpartner Communications: Designation of Appropriate Project Representatives

Although all project partners were committed to TRAVTEK, occasionally a staff person would be assigned who had the appropriate credentials and stature, but would be incapable of cooperating with other working group team members. In such a case, others openly refused to work with this difficult person, and the partner eventually had to appoint a new representative to the project. This was disruptive to the working group, although it had no direct effect on the operational test.

3.2 Regulatory and Legal Issues

Concern About Access to Project Information

Under Florida's Freedom of Information Law, any document in a public official's files is part of the public record and must be available for public access. The project partners believed that it was inadvisable to maintain the data library at the traffic management center because it would be available on demand. Partners also feared that preliminary data would be obtained, leading to erroneous conclusions. The strategy developed to address this was that vehicle data would be transmitted directly from Orlando to GM in Michigan, which would then turn it over to the evaluation contractor. The contractor was concerned about this process, because it felt that it was inappropriate that data from the operational test, upon which the evaluation was to be based, was in the hands of the group that designed the operational test. In any case, there were no freedom of information requests submitted to FDOT for TRAVTEK data, so this issue did not actually become a reality, or affect the operational test.

Legality of CRT Display

Florida law precludes the in-car use of a television screen visible to the driver of the vehicle. If the in-vehicle display screen was considered to be a television, it would not be allowed to operate in Florida. The TRAVTEK partners resolved this issue by getting a ruling from the FDOT and the Florida Highway Patrol that the data display screen was not a television. This issue had no direct effect on the operational test.

Liability Concerns

The project partners were concerned about their liability for accidents or incidents involving the TRAVTEK vehicles. There also were concerns about potential liability issues related to the accuracy of the routing data base; no one knew how a driver would react if instructions given through the data base conflicted with real-life visual cues. In response to these concerns, the partners developed an informed consent form to be signed by driver participants, with the understanding that this form would offer only limited liability protection. In addition, the ability to manipulate the data screen while a vehicle was in motion was proscribed. Informed consent was also an ethical issue to some of the project partners, who believed that they were responsible for informing users about the test and the uses to be made of the data. Ultimately, this issue had no direct effect on the operational test.

3.3 Human Resource Issues

The only significant human resource issues mentioned by the interviewees related to the staff assigned to the project by the evaluation contractor. Changes in the personnel assigned to the project by this contractor affected the time it took for the contractor to come up to speed on the project. Some of this was attributed to the contractor's underestimation of the number of hours that tasks would take, perhaps due in part to the contractor's limited previous experience with similar transportation projects. In addition, one interviewee mentioned that the contractor occasionally used students who were not technically sophisticated enough to contribute meaningfully to the project. This issue affected the evaluation, rather than the operational test.

3.4 Financial Issues

Cost Sharing and Project Funding

The original funding structure proposed for TRAVTEK consisted of a central fund, out of which the in-vehicle systems and traffic management center would be developed. There was a great deal of discomfort with this arrangement because it did not define clearly enough what each partner's contribution to the project would be. The Technical Working Group adopted a three-part funding architecture, with the FHWA responsible for the traffic management center, the AAA responsible for the information service center and data base, and GM responsible for providing the cars and in-vehicle systems. Under this arrangement, each organization could spend its own money without having to account to outside parties, and no public monies went directly to private sector companies.

Some partners believe that GM ended up bearing a disproportionally large share of the project costs. Although neither the AAA nor GM will disclose what each organization actually spent on the project, both concede that their contributions exceeded the original $2 million estimated for each partner. The partners liked not having to be accountable to anyone outside of their own organizations for their contributions to TRAVTEK. Partners believed that not having to manage a single, overall project fund was better for the private sector organizations. ADVANCE was often cited as a financial model that would have been unworkable for TRAVTEK.

4.0 Issues Projected for Future Program Phases

At the time of the TRAVTEK interviews, the project's planning, design, and operational test phases had been completed, and the evaluation of operational test results was underway. The interviewees were asked which institutional issues they believed would be the most critical if a "TRAVTEK-type" project were to come to commercial deployment.

4.1 Organizational Issues

Coordination of Multiple Jurisdictions

The interviewees believe that commercial deployment would be viable only if the geographic coverage of the project was considerably larger than the 1,200 square mile test area. The number of involved jurisdictions would require greater inter-jurisdictional communications and coordination. This would be a concern if deployment were managed either privately or publicly.

Lack of Standards and Protocols

Many interviewees are concerned that the lack of a national architecture would certainly at least add to the cost of achieving commercial deployment, and at worst could prevent the project from coming to commercial deployment at all.

Undefined Market Potential

At least one project partner believed that the FHWA should have undertaken an analysis of the market potential of TRAVTEK, rather than leaving this up to the private sector partners. The lack of public data on market issues may complicate the planning for commercial deployment for other IVHS projects.

Lack of Deployment Plan

Some interviewees believe that the project should have included a deployment plan because public expectations were very high. This was particularly true after what appeared to be a highly successful (and visible) operational test.

4.2 Financial Issues

Who Will Pay?

Uncertainty about who is willing to pay for establishing and maintaining a TRAVTEK-type system, and how much could be charged for these services, was seen as an issue that could severely impede or prevent commercial deployment. Related questions include the potential for privatization of the entire project or of specific parts, such as maintenance of the map database; the value of real-time traffic information to system users; and the cost of the in-vehicle technology.

Uncertainty About Federal Funding

Uncertainty about continued federal support of IVHS programs was seen as an impediment to the commercial deployment of a broad-based ATIS project. There is also some fear that the federal government, after providing the funding to initiate a program, will require states to absorb all future maintenance costs of elements critical to the program, such as a freeway surveillance system.

4.3 Regulatory and Legal Issues

Liability Concerns

Liability will continue to be a major issue for both the private and public sectors should a TRAVTEK-type project achieve commercial deployment. The primary concerns are ensuring the accuracy of the database and the level of performance of the in-vehicle navigation and routing systems.

Legal Permissibility of New Technology

Depending on the jurisdictions involved, there is concern that legal reviews of proposed new technologies may be required before the public sector will agree to cooperate. The example most frequently cited was the "CRT issue," involving a touch screen monitor controlled by the driver. It also may be necessary to change laws in order to accommodate future applications of IVHS technologies for ATIS and other systems.

Proprietary Technologies

There is some concern that the private sector will have difficulty undertaking cooperative research and development projects, particularly if the goal is commercial deployment. Collaborative research in the private sector poses the risk that it will short-cut the developmental learning curve for competitors, enabling them to bring a product to market more quickly or efficiently and thereby preventing the original company from recouping its investment in research and development.

5.0 Lessons Learned

5.1 Findings

Project participants were extremely positive about the TRAVTEK project. They view TRAVTEK as a success not only because it advanced ATIS technology, but also because the state-of-the-art evaluation system developed for this project will be used as a national model for other IVHS projects. The participants also gained valuable experience by working in a public/private partnership which they believe will benefit them in future efforts.

Several findings can be drawn from the experience to date of the TRAVTEK project:

Building trust among project participants is difficult but important. Trust-building was an ongoing effort throughout the project, and included both project partners as well as contractors. Project partners believed that personalities were very important in the early stages of the project, when the partnership and trust were very fragile. When trust was missing, achieving consensus on project goals and resolving technical issues become very difficult. In addition, as new members became involved on the project team, they needed to be brought up to speed on the trust-building process. For the most part, the TRAVTEK project participants worked together successfully, despite some personality conflicts among specific team members.

Project management style is crucial in complex, multiple partner efforts. In TRAVTEK, many credited the project manager's non-confrontational approach with keeping all partners at the table and committed to the project, even when discussions surrounding technical or evaluation issues became very heated. Differences in organizational culture, requiring skillful management, also had an inhibiting effect in the early phases of the project, when participants from different organizations resisted compromise.

Poorly defined project goals, strategies, and methodologies create significant and costly problems. A lack of consensus on project goals will result in project partners pulling in different directions, thereby making consensus on technical issues difficult, if not impossible, to achieve. In TRAVTEK, each partner's understanding of project goals had to be worked through before the evaluation planning process began. The lack of a clear understanding of the evaluation strategy and methodology meant that the partners could not accurately estimate the level of resources required at the project's inception. Later, concerns over the level of effort required by the evaluation may cause resentment and friction between partners, as was the case with TRAVTEK.

Upper management buy-in contributed to the success of the project. This is particularly critical when upper-management must quickly intercede to resolve bureaucratic roadblocks or personnel issues. In the TRAVTEK project, a FDOT staff person concluded that there were severe budget and environmental impediments to Florida's participation in the TRAVTEK project. Through high level state support for TRAVTEK, this person was replaced by other

FDOT people who believed that TRAVTEK was a priority, the metropolitan planning commission was fully briefed on all environmental issues, and funds for the I-4 surveillance system were transferred from another budget item.

Contracting flexibility is important. This is particularly true for projects with major research and development components. Unanticipated changes to the contracting schedule or contract scope of work should be expected, and a process set up to handle the changes. When the TMC and evaluation contracts had to be modified to include support for the operational test, the process was too cumbersome to quickly respond to the need to provide day-to-day operational test management support.

Partners' roles and responsibilities must to be clear. Without a clear understanding of what each partner is responsible for, the cost and overall progress of a project can be severely affected. In TRAVTEK, there was no clear designation of a project manager for the operational test. This prolonged the response time for issue resolution and data collection was compromised. Clarifying project management roles throughout all phases of the project would have eliminated confusion, shortened response time to problems, and provided overall project management continuity in TRAVTEK.

The administrative structure of the evaluation should be as objective as possible. Without a distinct separation of responsibilities for technical testing, which examines the integrity of a design; operational field testing, which is done from the point of view of the user; and testing the evaluation software systems, all may be compromised. Partners also believed that it was important to have the operational test designer and the evaluation designer work closely together in the design phase. Because this relationship did not exist with the TRAVTEK project, they felt that the communications about the changes required in the evaluation as a result of the operational test were problematic.

5.2 Recommendations Based on Interviews

The interviewees had a number of recommendations for addressing the institutional issues encountered during the course of the TRAVTEK project.

Roles and Responsibilities

Clearly define all partners' responsibilities throughout all phases of a project. A partners' agreement, or an additional memorandum of agreement which clearly spells out each partner's roles and responsibilities, should be developed and signed by all partners in the project's early planning phase.

Project Management Style

Particularly for large, multiple partner projects, encourage a consensual project management approach. Address each partner's concerns, act quickly to defuse personal friction, and avoid personalizing differences in project goals and objectives, especially in the project's early stages.

Evaluation Planning

Planning for the project evaluation should be an intrinsic and early component of design and development. Establish a cooperative relationship between the operational test designer and the evaluation plan designer. Evaluation needs should be determined at the beginning of a project so that sufficient resources can be allocated by the appropriate partners and to ensure that the operational test enables the collection of the types of data necessary to the evaluation. Structure the planning process so that the distinctions among technical equipment testing, operational field testing, and evaluation systems testing are clear.

Early Contractor Involvement

Get all of the projected contractors on board at the beginning of a project to eliminate costly ramp-up time and expand the pool of resources that can be applied to the operational test or evaluation design. Having both the operational test and evaluation contractors working as part of the project team should facilitate communication about changes to the operational test to accommodate evaluation requirements, or qualifications of evaluation data because of technical parameters.

Operational Test Manager

Designate an on-site operational test manager with clearly defined responsibilities. This person should be involved with the project from the beginning of the design phase so as to develop an understanding of the context of the project. The manager must have the authority to take independent actions and to call on the project partners to take action to resolve problems that arise during the operational test.

Contracting Process

For projects with significant research and development components, develop an "abbreviated," flexible contracting process to enable timely modifications to be made to existing contracts, or to execute a contract to meet needs that were unanticipated at the project's inception.

Shakedown Period

To reduce the amount of evaluation data compromised by faulty hardware or software, include an inviolable shakedown period in the project schedule so that all equipment, support systems, and evaluation systems are tested prior to formal operations. This includes preparing human research subjects and testing all equipment to be used prior to the start of the operational test.

Multi-Jurisdiction Coordination

Designate a third party to coordinate and negotiate multi-jurisdiction agreements necessary to operational test or deployment areas. This will reduce inter-agency and inter-jurisdictional disagreements about project support, especially among non-partner-level participants.

Market Potential

Allocate public resources to examine the market potential for new applications, particularly for projects that are researching and developing new technological applications. This includes potential willingness to pay for a service, the type of service configuration desired, the market size, and potential public and private sector roles.

Deployment Plan

Include the development of a deployment plan as part of the supporting contracts, particularly for projects testing new technologies that will attract high public visibility.

Legal Action

Clearly understand what legal action may be necessary for testing and commercial deployment to avoid delay or the prevention of an operational test. This may require getting a legal ruling or revising state laws in order to proceed with the project.

Marketing Plan

Develop a plan for marketing and press relations, especially for projects with public visibility. This plan should include strategies to handle subject recruitment, overall project promotion, and a follow-up once an operational test has been completed.

Project Funding

Establish a project funding plan that would allow private sector partners to contribute resources directly, rather than centralizing all public and private funds. This will reduce the administrative burden to companies to provide accounting for public funds, and allows greater discretion on how funds should be spent most efficiently.

****

The above recommendations are based on observations obtained in the process of interviewing TRAVTEK participants. The final report of this IVHS Institutional Issues and Case Studies technical task directive will be a lessons learned report that provides coverage across all projects studied and makes recommendations based not only on interviews with participants in the ADVANCE, TRAVTEK, HELP/Crescent, TRANSCOM/TRANSMIT, ADVANTAGE, and Westchester Commuter Central projects, but also upon the literature and experiences of the interview teams and members of the Institutional Barriers Advisory Group formed for this effort.

6.0 References

Intermodal Surface Transportation Efficiency Act of 1991. U.S. Public Law 102-240.

IVHS Institutional Issues and Case Studies: Field Guide. (June 1993). (Science Applications International Corporation, Contract No. DTRS-57-89-D-00090, RA 3078) Volpe National Transportation Systems Center (unpublished).

IVHS Strategic Plan: Report to Congress. (1992). U.S. Department of Transportation.

Appendix A

Organizations Interviewed

Federal Highway Administration
General Motors
American Automobile Association
Florida Department of Transportation
Florida Highway Patrol
City of Orlando
Evaluation Contractor

Appendix B

Bibliography

"Draft Partnership Agreement," April 18, 1990.

Contract with Federal Highway Administration for design and development of TMC. July 20, 1990.

"Statement of Work," James W. Lewis, General Motors Corporation, July 18, 1990.

Research and evaluation Plans for the TRAVTEK IVHS Operational Field Test, Document No. 912831, Rebecca N. Fleischman, General Motors Research Labs.

"TRAVTEK," Document No. 912819, James H. Rillings, General Motors Corporation, and James W. Lewis, Hughes Aircraft Co.

TRAVTEK Traffic Management Center, and TRAVTEK Information Network, Document No. 912822, Robert L. Rupert, Federal Highway Administration.