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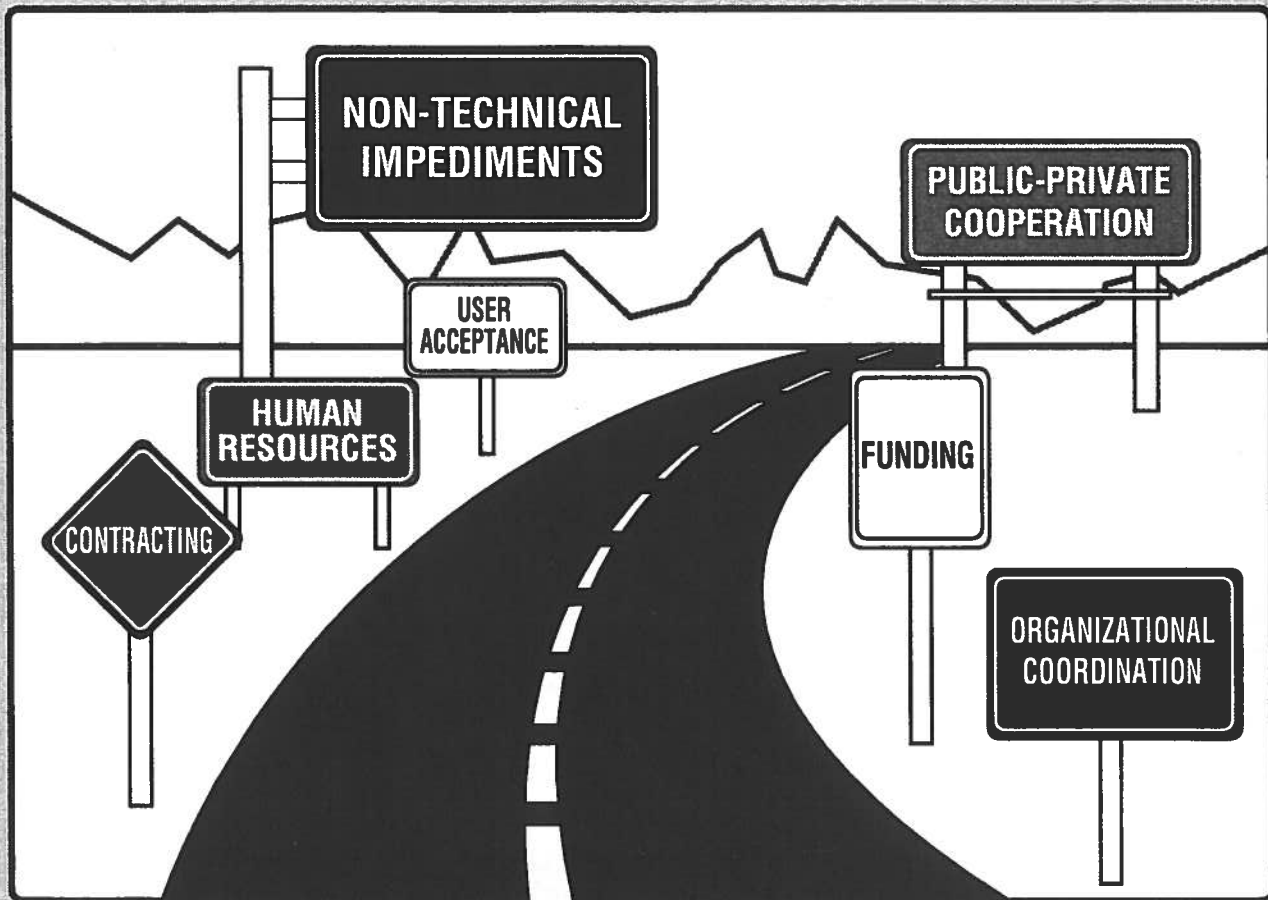
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**Federal Highway
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**Final Report
June 1994**

REVIEW OF THE FAST-TRAC OPERATIONAL TEST



**Research and
Special Programs
Administration**

**John A. Volpe National
Transportation Systems Center**

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Final Report

**IVHS INSTITUTIONAL AND
LEGAL ISSUES PROGRAM**

**REVIEW OF THE FAST-TRAC
OPERATIONAL TEST**

Allan J. DeBlasio
Stephen G. Gehring
Elisabeth F. Borg
Dr. Steven E. Underwood

June 1994

Prepared by

U.S. Department Of Transportation
Research And Special Programs Administration
Volpe National Transportation Systems Center
Cambridge, Massachusetts

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Washington, D.C.

METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

- 1 inch (in) = 2.5 centimeters (cm)
- 1 foot (ft) = 30 centimeters (cm)
- 1 yard (yd) = 0.9 meter (m)
- 1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

- 1 square inch (sq in, in²) = 6.5 square centimeters (cm²)
- 1 square foot (sq ft, ft²) = 0.09 square meter (m²)
- 1 square yard (sq yd, yd²) = 0.8 square meter (m²)
- 1 square mile (sq mi, mi²) = 2.6 square kilometers (km²)
- 1 acre = 0.4 hectares (he) = 4,000 square meters (m²)

MASS - WEIGHT (APPROXIMATE)

- 1 ounce (oz) = 28 grams (gr)
- 1 pound (lb) = .45 kilogram (kg)
- 1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

- 1 teaspoon (tsp) = 5 milliliters (ml)
- 1 tablespoon (tbsp) = 15 milliliters (ml)
- 1 fluid ounce (fl oz) = 30 milliliters (ml)
- 1 cup (c) = 0.24 liter (l)
- 1 pint (pt) = 0.47 liter (l)
- 1 quart (qt) = 0.96 liter (l)
- 1 gallon (gal) = 3.8 liters (l)
- 1 cubic foot (cu ft, ft³) = 0.03 cubic meter (m³)
- 1 cubic yard (cu yd, yd³) = 0.76 cubic meter (m³)

TEMPERATURE (EXACT)

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METRIC TO ENGLISH

LENGTH (APPROXIMATE)

- 1 millimeter (mm) = 0.04 inch (in)
- 1 centimeter (cm) = 0.4 inch (in)
- 1 meter (m) = 3.3 feet (ft)
- 1 meter (m) = 1.1 yards (yd)
- 1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

- 1 square centimeter (cm²) = 0.16 square inch (sq in, in²)
- 1 square meter (m²) = 1.2 square yards (sq yd, yd²)
- 1 square kilometer (km²) = 0.4 square mile (sq mi, mi²)
- 1 hectare (he) = 10,000 square meters (m²) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

- 1 gram (gr) = 0.036 ounce (oz)
- 1 kilogram (kg) = 2.2 pounds (lb)
- 1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

VOLUME (APPROXIMATE)

- 1 milliliters (ml) = 0.03 fluid ounce (fl oz)
- 1 liter (l) = 2.1 pints (pt)
- 1 liter (l) = 1.06 quarts (qt)
- 1 liter (l) = 0.26 gallon (gal)
- 1 cubic meter (m³) = 36 cubic feet (cu ft, ft³)
- 1 cubic meter (m³) = 1.3 cubic yards (cu yd, yd³)

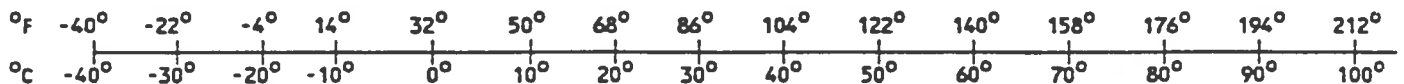
TEMPERATURE (EXACT)

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PREFACE

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

This report was prepared by the U.S. DOT's John A. Volpe National Transportation Systems Center (Volpe Center) for the Federal Highway Administration's (FHWA) Office of Policy Development and Office of Traffic Management and Intelligent Vehicle - Highway Systems (IVHS). The Volpe Center is providing analytical support to the FHWA under the Operational Test Case Studies subject area of the *Institutional and Legal Issues Program*, 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 IVHS technologies and services and the important lessons that have been learned and may be applied in future deployments of IVHS products and services. The operational tests represented the three IVHS functional areas of greatest interest to the FHWA: (1) Advanced Traffic Management Systems (ATMS), (2) Advanced Traveler Information Systems (ATIS), and (3) Commercial Vehicle Operations (CVO).

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

1. *What non-technical 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. *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 IVHS products and services?*

In order to place the non-technical issues in the life cycle of the development and the deployment of the IVHS 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.

The FAST-TRAC (Faster and Safer Travel through Traffic Routing and Advanced Controls) operational test was one of the eight tests selected by the FHWA. The Volpe Center team coordinated their review of the FAST-TRAC test with analysts from the University of Michigan who are responsible for the internal evaluation of the FAST-TRAC operational test. During the spring and summer of 1993, this team, in accordance with the Volpe Center Project Memorandum, *IVHS Institutional Issues - Monitoring Program Framework*, interviewed and sent questionnaires to 22 project participants at the FAST-TRAC project. During this time, the study team also attended project committee and subcommittee meetings and reviewed project documentation.

The interviewees and questionnaire respondents represented federal, state, and local governments; academia; manufacturing, electronic, communication, and automotive companies; and consultants and contractors to the test. These individuals were involved in various aspects of the operational test from policy making to program management to technical and administrative support. They included chief executives, corporate officials, program administrators, attorneys, engineers, professors, researchers, and evaluators. Many were involved in the initiation of the project while others were involved in day-to-day project activities. This diverse group of individuals provided the study team with a broad range of views about the FAST-TRAC operational test and the IVHS program in general.

The authors were sensitive to the criticism that project evaluations either seek out negative aspects of the project with little emphasis on positive lessons, are biased, or lay blame. The authors acknowledge that the assessments were oriented toward finding problems, but these assessments were also structured to identify positive lessons that were learned and that could be shared with others.

The authors thank the interviewees and questionnaire respondents for taking time from their busy schedules to answer our questions and for their openness in doing so. The issues, lessons, and insights that they discussed will benefit the entire IVHS effort.

Section 1 of this report is a summary of the project and of the issues and lessons learned that were discussed by the interviewees and questionnaire respondents. **Section 2** describes the scope, history, management structure, and participants of the FAST-TRAC operational test. It also discusses the stated project goals and objectives, the goals and objectives of the project participants, the benefits the interviewees and questionnaire respondents foresee for participating in the project, the risks that they or their organization may be taking, and what they see as the critical success factors of the project. **Section 3** section presents a more detailed discussion of the institutional issues and lessons learned.

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The first part of the study examined the relationship between job satisfaction and organizational commitment. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to be committed to their organization.

The second part of the study examined the relationship between job satisfaction and turnover intentions. The results showed a negative correlation between the two variables. This suggests that employees who are satisfied with their jobs are less likely to intend to leave their organization.

The third part of the study examined the relationship between job satisfaction and organizational citizenship behaviors. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to engage in positive behaviors that benefit their organization.

The fourth part of the study examined the relationship between job satisfaction and organizational performance. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to contribute to their organization's success.

The fifth part of the study examined the relationship between job satisfaction and organizational culture. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to be part of a positive organizational culture.

The sixth part of the study examined the relationship between job satisfaction and organizational identity. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to identify themselves with their organization.

The seventh part of the study examined the relationship between job satisfaction and organizational reputation. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to have a positive view of their organization's reputation.

The eighth part of the study examined the relationship between job satisfaction and organizational trust. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to trust their organization.

The ninth part of the study examined the relationship between job satisfaction and organizational loyalty. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to be loyal to their organization.

The tenth part of the study examined the relationship between job satisfaction and organizational citizenship behaviors. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to engage in positive behaviors that benefit their organization.

The eleventh part of the study examined the relationship between job satisfaction and organizational performance. The results showed a positive correlation between the two variables. This suggests that employees who are satisfied with their jobs are more likely to contribute to their organization's success.

1. SUMMARY

This section presents an overview of the FAST-TRAC operational test and a summary of the issues and lessons learned that were discussed by the interviewees and questionnaire respondents

1.1 PROJECT OVERVIEW

Oakland County, Michigan is the site of the **FAST-TRAC** (Faster And Safer Travel through Traffic Routing and Advanced Controls) IVHS operational field test. FAST-TRAC began in the City of Troy and is expected to encompass most of the Oakland County communities as it progresses. FAST-TRAC began with the Quick-Step Phase in June 1992. To date, the federal government has appropriated \$40.5 million and has funded it through Fiscal Year 1994.

In the mid-1980's, Oakland County experienced sharp population and economic growth and a general increase in repeated use of the county road network. With a view toward improving traffic mobility and safety in Oakland County, the Road Commission for Oakland County (RCOC) began to examine how to improve upon the existing infrastructure without tremendous economic risk. Through this operational test, the project participants are attempting to integrate advanced traveler information system (ATIS) and advanced traffic management system (ATMS) technologies. FAST-TRAC is employing and integrating three IVHS technologies: the Ali-Scout dynamic route guidance system, the Sydney Co-Ordinated Adaptive Traffic System (SCATS), and AUTOSCOPE™ - 2003 (AUTOSCOPE) Video Vehicle Detection System (RCOC, 1993).

The Ali-Scout system is an ATIS technology. It is the U.S. adaptation of the Euro-Scout System developed in Germany by the parent company of Siemens Automotive L.P. (Siemens). It consists of three primary components: a system of roadside infrared beacons, specially equipped vehicles with on-board computer systems, and a central computer that contains route guidance and traveler information. An infrared communication link between the vehicle and roadside beacons allows for an exchange of traffic and route guidance information between the vehicle and the central computer.

The SCATS is an adaptive traffic management system developed by the Road and Traffic Authority, New South Wales, Australia (RTA). It monitors traffic flow and adjusts signal timing in response to changes in traffic. AUTOSCOPE uses a digital video camera to detect vehicles and transmits traffic information to the SCATS. The video image processing system also provides the potential to identify traffic incidents and provide input to speed and vehicle classification studies.

An Executive Committee consisting of members from the RCOC, Siemens, the Federal Highway Administration (FHWA), the Michigan Department of Transportation (MDOT), and Oakland County manages FAST-TRAC. The RCOC is responsible for administering the project and the FAST-TRAC program manager is an RCOC employee. The program manager reports to the

Executive Committee, chairs for the evaluation and integration subcommittees, and oversees the implementation of the ATIS and ATMS work orders.

A RCOC engineer is the ATMS program manager and is responsible for executing work orders involving the implementation of the traffic management system. Siemens is responsible for executing work orders involving the ATIS. A Siemens employee serves as the ATIS program manager and chairs the vehicle operations subcommittee. The FHWA is responsible for approving the work plans, contracts, and work orders developed by the RCOC. The MDOT provides administrative support and also approves work plans, contracts, and work orders.

Representatives from the Ford Motor Company, the Chrysler Corporation, the General Motors Corporation, and the Nissan Corporation are also participants in the program. Their primary responsibility is to provide a portion of the test vehicles for Ali-Scout installation for each of the three phases. These participants also serve on the vehicle operations and evaluation subcommittees.

Under Phase I of the FAST-TRAC operational test, 95 intersections were placed under SCATS control, 30 Ali-Scout beacons were installed, and 60 vehicles were equipped with the Ali-Scout system. Additionally, a state of the art traffic operations center has been established in Troy.

The next phase of FAST-TRAC moves into the northern Oakland County communities of Pontiac, Auburn Hills and Rochester Hills. Phase II has been separated into two parts, Phase IIA and Phase IIB. Phase IIA includes the ATMS expansion of FAST-TRAC into the above communities. SCATS controllers and AUTOSCOPE detection will be installed in the Auburn Hills and Pontiac areas by June 1994 in order to manage the traffic conditions coinciding with the World Cup soccer games at the Pontiac Silverdome. Also more comprehensive evaluation activities will begin with Phase IIA.

1.2 ISSUES ENCOUNTERED BY THE PROJECT PARTICIPANTS AND LESSONS LEARNED

This subsection outlines the institutional issues and lessons learned that were discussed during face-to-face interviews or in responses to the questionnaires. The issues and lessons were divided into ten categories:

- New Business Relationships
- Project Evaluation
- Contracting
- Human Resources
- Funding
- Organizational Coordination

- Auditing and Accounting
- Intellectual Property Rights
- Public Perception of the Project
- Technology and Standards.

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

1.2.1 New Business Relationships

The need to develop new business relationships and the problems that were encountered in doing so were the topics that the interviewees and questionnaire respondents discussed most often. The issues encountered while developing a public-private partnership occurred in the early stages of the project. Participants addressed these issues through open and continuous communications, a strategy they used to address most of the issues they faced.

The overwhelming lesson shared by the participants was **it is possible for the public and private sectors to work together**, although developing a partnership is a difficult and time-consuming process. They stated that all partners must be actively engaged in the *decision making process* and that the *concerns* of both the public and private sectors must be considered. Both sides of the public-private partnership have to be aware of each other's business practices and be open to *new ways* of doing business.

Public sector participants stated that the concept of such a relationship was *new* to all parties, and they had no previous models to emulate. Public and private sector partners were not familiar with the agendas of the other sector. Private sector representatives mentioned that the *management structure* and the *roles and responsibilities* of the partners were not clearly defined at the start of the project.

Several participants recommended *guidelines* be published for the benefit of project participants and especially for private sector participants who have not worked previously with federal or state transportation agencies. These guidelines would help participants understand the laws, regulations, and procedures they must follow. Seven areas should be covered: public-private partnerships, contracting procedures, intellectual property rights, auditing practices, funding and fund matching (reimbursable activities and percent of local match required), termination clauses, and warranties.

The participants also learned that a local unit of government is capable of administering a federal-aid project. This was a *new approach* taken by the public sector participants at the start of the project. Although the RCOC staff had participated previously in federal-aid projects, they had never been the lead agency.

Another lesson that the participants presented was **it is possible to deal with a local government in a foreign country**. The staff of the RCOC decided to use the SCATS for the ATMS portion of the FAST-TRAC project. SCATS was developed by the RTA in Sydney, New South Wales, Australia. This meant that the staff of the RCOC had to work and sign an agreement with a local unit of government in a foreign country. This issue had a minimal effect on the project. On the positive side, the RCOC was able to obtain excellent support services from the developers of the system. On the negative side, representatives of some companies that have a license to sell SCATS in the United States were upset that the RCOC dealt directly with the RTA.

1.2.2 Project Evaluation

The second topic the interviewees and respondents discussed quite often was the project evaluation. The issues discussed occurred in the early stages of the project.

The most important lesson the project participants offered was **the evaluation must be valued by the partners**. The evaluation must be part of the OFT design from the beginning of the project and be "inextricably intertwined" with the rest of the project. The evaluation plan and the contract between the project partners and the evaluation team should be in place at the same time--or before--implementation.

The foremost issue in this area was the need for the FHWA to ensure that the *national evaluation objectives* would be met and to convince the project participants to reserve an appropriate amount of funding for the evaluation. During the discussions of how the evaluation should proceed, *differences* in priorities and interests in work of the parties became clear. Also, the FHWA recommended that the *designers* of an OFT not participate in the evaluation. At the start of discussions on the evaluation, it was not apparent how much the staff of the University of Michigan (UM) participated in developing the initial definition of the FAST-TRAC project.

A significant issue was the *delay* in signing the contract to conduct the evaluation. The issue was resolved but too late to prevent it affecting the project. Because of this delay, the evaluators will never have pure "before" data, even on the Phase II intersections and corridors, required to access SCATS. It prevented the Michigan State University evaluators from obtaining all of the desired "before" data to evaluate Phase I implementation and may hinder their collection of "before" data on the Phase II implementation.

1.2.3 Contracting

Contracting issues surfaced very early in the project. Through open and continuous communications, the partners resolved these issues for the first phase of the project. These issues, however, may reappear in later phases.

The most significant lesson was a significant amount of *time* was required by public and private partners to make the procurement process work. Although the discussions in this area strained relations among the partners at first, it was a valuable lesson and experience. Several private sector participants suggested that federal procurement requirements need to be less restrictive when operating in a partnership arrangement with the private sector. *Different procurement practices* should be reviewed, such as the use of cooperative agreements and grants. They also said that the process of authorizing work orders requires streamlining. The project plan should be approved as a unit and not on a work order basis.

Private sector participants stated that the *construction contract model* used for roadway construction is an inappropriate structure for a research-and-development-type project or operational field test. They felt that the contract was too rigid in its allocation of funds. Although *work orders* were listed in the contract, a more detailed description of the work order had to be written and submitted for review before work could start. Funds were allocated by work order and there could be no re-allocation of funds among the work orders.

Private sector participants also felt that to plan properly, private sector firms must know, in a timely manner, what resources they will receive. Therefore, they suggested that private sector partners actively engage the contracting process in order to secure contracts on a timely basis.

1.2.4 Human Resources

Issues involving human resources also appeared in the early stages of the project. They were of greater concern to the public sector than to the academic and private sectors.

Public sector officials offered three strong lessons. First, *adequate training* is not a luxury; it is a significant and important element of a successful deployment. Training must be provided up front and provided continuously. They also concluded that redundancy must be built into the in-house administrative and technical skills to guard against a project crisis in case an important technical employee leaves. The RCOC officials recognized that the RCOC staff did not possess the *skills* required for working with new technologies. Although this issue initially hindered the progress of the project, it eventually produced a very positive effect. The new technology became a challenge and *motivated* the staff. The staff developed an appreciation of the system. They also developed a spirit, a sense of pride and satisfaction.

Second, the participants felt that one individual should be assigned the duties of project *management* who is dedicated full time to the project and is willing to take control and responsibility. This project manager must be supported by additional staff or outside consulting support as required and by the project participants.

Third, the interviewees and respondents stated that *staffing levels* should be considered early in the development process. If an agency is going to commit to administering an OFT, the agency's management must understand the stress that additional responsibilities will place upon the staff

and the effect on its normal operations. The project must be staffed and funded appropriately, and staffing and funding must grow as the project grows.

1.2.5 Funding

The funding issues that the project participants discussed surfaced in the early stages of the project. Project participants offered several **lessons** that they learned while addressing these issues.

First, representatives from the RCOC stressed that local units of government should not hesitate to search for *alternative sources of funding*. They also stated that local seed funding serves as a display of local commitment and a facilitating factor in getting federal support. Experience, however, indicates that it takes 2 to 3 times longer than originally anticipated to secure funding.

The principal reason the FAST-TRAC project was initiated was because the RCOC did not have sufficient funding to alleviate the county's mobility problems and needed to obtain additional funding. The management of the RCOC realized that their traditional forms of funding would not be sufficient to address the needs of the county and that *new funding sources* must be identified. They also recognized the need to deploy new technologies but did not have sufficient funding to deploy them.

Second, some participants recommended that the *entire project* should be funded from the beginning and that funding for each year should be identified a couple of years in advance. Others suggested that funding for IVHS projects should be made similar to funding for construction projects including the requirement for local matching.

The project participants also do not know the *total amount of funds* that will be allocated to the project. The FAST-TRAC project has been granted funds earmarked by the Congress. Federal funds set aside for the FAST-TRAC project are approved *incrementally*, one fiscal year at a time, and funding for succeeding fiscal years is not guaranteed.

Third, representatives from the public and private sectors stressed that public agencies must *clearly define* what constitutes the local match early in the project. They also mentioned that there should be *more leeway* in determining the local match and the eligible activities so that more public and private sector organizations will participate.

At the start of the project, the match that the non-federal participants would have to provide was not clear. Local, state, and private contributions were uncertain. The uncertainty of determining the value of some of the eligible activities and the detailed documentation required to verify the local match also contributed to this issue.

A fourth lesson that some participants stated was that the recipients of "*non-competitive*" funds, either congressionally earmarked funds or a sole source contract, are placed under additional scrutiny. Sometimes the recipients of sole source contracts are perceived as lacking cost controls

or operating inefficiently. To overcome these perceptions, the recipients have to take time to build strong working relationships.

The participants stated two positive lessons in this area: (1) the award of a sole source contract to Siemens made it easier to *develop the partnership* and to share costs among sectors and (2) the additional scrutiny and other perceptions cause recipients of "non-competitive" funds to become more motivated to seeing that the project is done well.

1.2.6 Organizational Coordination

Issues involving organizational coordination developed early in the project's life. There were two categories of issues: intra-agency and inter-agency.

To alleviate *intra-agency* stress, several **lessons** were offered. Public sector representatives suggested that the IVHS program be promoted to all workers so these employees feel that they are a part of the bigger scheme or goal. One official emphasized that there must be a clear and concise commitment by any agency that wants to participate in an operational test. There cannot be opposing forces within an agency. The interviewees from the private sector suggested that management be informed that participation in an OFT does not mean that a product will be endorsed or a profit will be made. They also recommended that lower levels of management be empowered to make decisions.

The FAST-TRAC project forced two government agencies into a new way of doing business. The RCOC had to change the way it had been doing business for 75 years and the FHWA had to make adjustments. The RCOC management had to overcome the *reluctance* of some employees to use new technologies and apply them on the roads. The FHWA modified the procedures for managing projects.

A different type of intra-agency issue developed at the UM. Some members wanted to contract with the FAST-TRAC participants to perform *design work* for the project. These staff members believe personnel from one organization can design for and evaluate the same operational test. The FHWA, however, does not want members of the same institution to perform both tasks. This issue was resolved when an internal decision was made that stated that UM staff members would not perform design work. The principal investigator had to actively obtain agreements from other staff members that they would not procure design work from the FAST-TRAC project.

Private sector participants mentioned that obtaining *upper management approval* is time consuming. They stated factors such as busy executive schedules, lack of priority within the organization for the FAST-TRAC project, the multiplicity of areas in which the corporation is involved, and the physical distance between the FAST-TRAC project and upper management as causes to this issue. One interviewee also stated that upper management too often want IVHS efforts to produce revenues in a short period of time.

Project participants said that they learned a valuable **lesson** by addressing *inter-agency* issues: **Multi-jurisdictional cooperation is possible**. They stated that all parties must be involved actively in the project and that close partner involvement is a must.

Representatives from the public and private sectors discussed that inter-agency coordination among the FHWA, the MDOT, and the RCOC needed to be enhanced. This significant issue was resolved as the level of *communication* and *cooperation* among the representatives of these three agencies increased. All parties became more aware of the others activities and goals.

Two public sector representatives discussed the participation of *local municipalities*. The project partners knew that in order for FAST-TRAC to be successful, they had to gain support from the local municipalities. Previous inter-agency cooperation among the RCOC and the local units of government was a facilitating factor for the project. One interviewee offered this **lesson**: Do not let the concern over intergovernmental cooperation deter anyone from initiating an operational test. Another representatives from the public sector said to build on current intergovernmental interactions, the communications, trust, and understanding that already exist.

1.2.7 Auditing and Accounting

One representative of the private sector presented this **lesson**: Reexamine the government auditing requirements placed on partners from the private sector. Effective accounting and accountability procedures must be established early in the project.

Two issues developed in the area of auditing and accounting in the early first of the project. First, the private sector is reluctant to provide certain *financial information* to units of government because this information could become available to the public. Representatives of the private sector feel that a rival company may use this information to gain a competitive advantage. Also, they are concerned that the records of the entire company must be open to inspection, not just the records of the unit working on the project. In addressing this important issue, Siemens management created a separate entity with its own auditing system.

Second, the partners did not clearly understand what *record keeping* would be required to document work they performed. The private sector partners were not accustomed to dealing with the federal, state, and county governments and did not have a good understanding of what the public sector required for record keeping and auditing. The public sector was not sure what record keeping would be required from the partners. This issue has not been fully resolved and is still causing uncertainty for private sector firms.

1.2.8 Intellectual Property Rights

Two **lessons** were learned in this area. First, a private sector representative suggested that intellectual property rights should be used as an *incentive* for getting the private sector to participate. Companies must be enticed to enter the IVHS area. Second, a public official recommended that

legal counsel be involved early in the process in order to secure private sector concerns regarding proprietary information.

In the initial phase of the project, it was not clear which party would own the technology developed and knowledge gained during the operational test. Traditionally, *intellectual property* developed in publicly-funded projects remained in the public domain. Project participants did not realize that the FAR allows and encourages private partners to retain rights to intellectual property. This issue was partially resolved when the FHWA modified the intellectual property rights clauses that were required in the cooperative agreement. It may surface again when contracts for the next phase are negotiated.

1.2.9 Public Perception

Project participants from all three sectors offered **lessons** regarding public perception. One public sector representative said that attention must be paid to the *importance of perception*. Recognize that the public will be the biggest critic and they are vocal. Representatives from all three sectors said project participants should not *oversell* the system. One private sector official stated that a *good public relations* effort is required. One public official warned not to send visible groups on foreign travel to assess new technologies. As a result of these lessons, the project partners assigned staff to address public relations concerns.

1.2.10 Technology and Standards

Representatives of the private sector mentioned two **lessons**. First, there is a need to be more open-minded and to accept technologies from other countries; transportation is not local but *international* in scope. Second, IVHS technologies developed abroad need to be *enhanced* in order to be adapted for use in the U.S. A representative of the public sector suggested a third. The "Buy-American" provision is a significant factor with IVHS projects. It must be considered when purchasing equipment. Finally, one participant stated that standards are very important and should not be overlooked.

The use of SCATS and Ali-Scout technologies created some controversy; both are *foreign technologies*. Some individuals felt that the use of these products conflicted with the "Buy American" requirements contained in the FAR and the State of Michigan procurement requirements. Also, the RCOC had to be convinced that Ali-Scout would work in the United States.

Representatives from the public and private sectors mentioned another issue: the *integration* of an ATMS and an ATIS has never been tried. Also the SCATS and the AUTOSCOPE system had to be successfully integrated before the integration of the ATIS and the ATMS could proceed. One project participant mentioned that the integration of the ATIS and the ATMS did not start fast enough and feared that time and money may run out before the work is completed. This issue has not been resolved because the partners are currently working on the integration of the two systems.

A third issue was that the IVHS program *lacks standards*, especially in the ATIS area. Because the IVHS program is new, these standards have not yet been developed. This means that different technologies are being developed and tested, some of which may not meet the standards.

1.2.11 Lessons Learned not Related to Specific Issues

- Know what to expect. Potential partners must approach the project with an awareness that issues will arise, a true commitment to the project, and a willingness to cooperate.
- Identify and foster project champions. They must be aggressive to push the project forward and must be involved for the duration of the project.
- Project personnel must become knowledgeable of IVHS concepts and practices so that they can convince the appropriate persons of the benefits of IVHS..
- Develop a national perspective of IVHS. The participants of operational tests must be willing to share information with others at a national level.
- Define clear project goals and objectives.
- Plan for an early success, which will build momentum, help obtain future funding, ensure public support, garner valuable participants, and set the stage for future success.
- Develop support for the IVHS industry. Establish local or state IVHS organizations. Involve entrepreneurs, not just large established companies.

1.3 ISSUES THAT MAY BE ENCOUNTERED BY THE PROJECT PARTICIPANTS

This subsection presents the more important issues that project participants said they may encounter as the FAST-TRAC operational test continues into later phases and if it moves into full deployment:

- Funding for the project may not continue.
- The project may lack continued commitment from project partners.
- Municipalities may not be able or willing to provide local matching funds.
- The general public and private and public decision makers may not be "sold" on the technology.
- The project may not meet the public's expectations and may lose its credibility.
- The public may suspect that technology is being used for surveillance and will infringe upon personal privacy.

- The evaluation may lack methodologies by which to evaluate the integration of the ATIS and the ATMS.
- The FAST-TRAC measures of effectiveness (MOEs) may be inadequate to address national IVHS goals.
- The project may lack the appropriate number of vehicles and drivers.
- Participants selected in the evaluation phase may have "technophobia," a fear of using high technology products.
- Liability for accidents occurring with public sector installed equipment manufactured by the private sector is not clear.

1.4 ISSUES THAT MAY BE ENCOUNTERED IN FUTURE OPERATIONAL TESTS OR DEPLOYMENTS

This subsection lists the significant institutional issues that the interviewees and respondents thought participants in future operational tests or deployment of IVHS products and services may encounter:

- The private sector may be discouraged from participation in operational tests by its lack of familiarity with government contracting and auditing procedures.
- Confusion may occur over public vs. private sector responsibility for operating and maintaining a privately developed system that is installed on a public right of way or for public purposes.
- Project participants may fail to recognize the need for a good evaluation effort.
- Partners may fail to dedicate appropriate resources to establishing an evaluation framework.
- Implementation priorities may conflict with the evaluation schedule, leaving the evaluation in a constant state of flux.
- The use of construction-type contract models may limit private sector participation in operational tests and hinder the development of new software.
- Local units of government may lack resources for training.
- Local units of government may not have the in-house capabilities to develop expertise required by new IVHS technologies and may have to contract out for it.
- Private and public sector participants may not understand which one of them is responsible for funding deployment.
- The ISTEA gives metropolitan planning organizations (MPOs) programming authority on regional IVHS issues. Jurisdictions within the MPO may have conflicting interests.
- Local municipalities may not be willing to cooperate with the project.

- Participating companies may not be willing to cooperate fully or design only products that they can use, products based on propriety concepts and developments. This would prevent the public sector from receiving the best technology.
- The general public and private and public decision makers may not be "sold" on the technology.
- The public may suspect that technology is being used for surveillance and will infringe upon privacy.
- The project may not meet the public's expectations and may lose its credibility.

2. PROJECT OVERVIEW

This section describes the scope, history, management structure, and participants of the FAST-TRAC operational test. It also discusses the stated project goals and objectives, the goals and objectives of the project participants, the benefits the interviewees and questionnaire respondents foresee for participating in the project, the risks that they or their organization may be taking, and what they see as the critical success factors of the project.

2.1 PROJECT DESCRIPTION

FAST-TRAC (Faster And Safer Travel through Traffic Routing and Advanced Controls) is an IVHS operational field test (OFT) in Oakland County, Michigan, a suburban county north of the City of Detroit. The OFT started within the City of Troy and will ultimately encompass the majority of the communities comprising Oakland County. Currently the cities of Troy, Rochester Hills, Auburn Hills, and Pontiac are participating in the project. Additional jurisdictions will likely become involved as the project matures.

Through this operational test, the project participants are attempting to integrate advanced traveler information system (ATIS) and advanced traffic management system (ATMS) technologies. FAST-TRAC is employing and integrating three IVHS technologies: the Ali-Scout dynamic route guidance system, the Sydney Co-Ordinated Adaptive Traffic System (SCATS), and AUTOSCOPE™ - 2003 (AUTOSCOPE) Video Vehicle Detection System (RCOC, 1993).

The Ali-Scout system is a ATIS technology. It is the U.S. adaptation of the Euro-Scout System developed in Germany by the parent company of Siemens Automotive L.P. (Siemens). It consists of three primary components: a system of roadside infrared beacons, specially equipped vehicles with on-board computer systems, and a central computer that contains route guidance and traveler information. An infrared communication link between the vehicle and roadside beacons allows for an exchange of traffic and route guidance information between the vehicle and the central computer.

The SCATS is an adaptive traffic management system developed by the Road and Traffic Authority, New South Wales, Australia (RTA). It monitors traffic flow and adjusts signal timing in response to changes in traffic. AUTOSCOPE uses a digital video camera to detect vehicles and transmits traffic information to the SCATS. The video image processing system also provides the potential to identify traffic incidents and provide input to speed and vehicle classification studies.

The project was initiated with the Quick-Step phase in Troy. "Quick-Step" was activated in June 1992 although the planning and execution of this phase could be traced back to early 1990. Currently FAST-TRAC is funded through fiscal year 1994 and is expected to continue well beyond this time frame.

2.2 MANAGEMENT STRUCTURE

FAST-TRAC is managed through the Executive Committee consisting of members from the Road Commission for Oakland County (RCOC), Siemens, the Federal Highway Administration (FHWA), the Michigan Department of Transportation (MDOT), and Oakland County. The RCOC is responsible for administering the project and the FAST-TRAC program manager is an RCOC employee. The program manager reports to the Executive Committee, chairs for the evaluation and integration subcommittees, and oversees the implementation of the ATIS and ATMS work orders. Work orders and contracts are approved by the FHWA and the MDOT prior to execution.

There are three subcommittees under the Executive Committee: the Evaluation Subcommittee, the Vehicle Operations Subcommittee, and the Systems Integration Subcommittee. The Systems Integration Subcommittee has four working groups: the ATMS/ATIS Integration Work Group, the Communications Work Group, the Traffic Operations Center (TOC) Functions Work Group, and the Freeway/Surface Street Integration Work Group.

2.3 PROJECT MISSION

The mission of FAST-TRAC is to implement an OFT of a combined ATM/ATI system leading to improved mobility and safety on the roads and freeways of Oakland County. FAST-TRAC will provide information regarding the public and private costs, benefits and utility for such a system, as well as implementation considerations for decision making on the potential for deployment in Oakland County and other areas throughout the country (Barbaresso and Grubba, 1992).

Phase I of FAST-TRAC will encompass 95 intersections under the SCATS control, 30 Ali-Scout beacons, 60 vehicles, a TOC, and AUTOSCOPE traffic video detection. It will also include an ATMS/ATIS integration study, preliminary evaluation data collection, and a completed evaluation plan.

Phase II will encompass 200 intersections under the SCATS control, 100 Ali-Scout beacons, and 1000 vehicles equipped with Ali-Scout equipment. It will also include the linkage of the TOC with the MDOT's Metropolitan Transportation Center (MTC), the integration of the surface street ATMS with freeway operations, an ATIS/ATMS integration study, and data collection for the evaluation activity.

Phase III will encompass: 1000 intersections under the SCATS control, 200 Ali-Scout beacons, up to 5000 vehicles equipped with Ali-Scout equipment, a fully functioning TOC linked to the MTC, freeway and surface street operations integrated, and continued evaluation activities (Barbaresso and Grubba, 1992).

2.4 PROJECT PARTICIPANTS

The major participants in FAST-TRAC include the RCOC, Siemens, the FHWA and the MDOT. The RCOC is responsible for administering the project, which includes developing work plans, contracts, and work orders. The RCOC is also responsible for chairing the integration and evaluation subcommittees. A RCOC engineer is the ATMS program manager and is responsible for executing work orders involving the implementation of the traffic management system (RCOC, 1992).

Siemens is responsible for executing work orders involving the ATIS. A Siemens employee serves as the ATIS program manager and chairs the vehicle operations subcommittee. The FHWA is responsible for approving the work plans, contracts, and work orders developed by the RCOC. The MDOT provides administrative support and approves work plans, contracts, and work orders. Representatives from all four organizations serve on the executive committee.

Representatives from the Ford Motor Company, the Chrysler Corporation, the General Motors Corporation, and the Nissan Corporation are also participants in the program. Their primary responsibility is to provide a portion of the test vehicles for Ali-Scout installation for each of the three phases. These participants also serve on the vehicle operations and evaluation subcommittees.

2.5 PROJECT HISTORY

Oakland County experienced a tremendous surge in population and economic growth during the mid-1980's. This growth coupled with a shift in traditional commuting patterns (going to the same place at the same time over the same route and returning home at the same time over the same route) has placed significant demands upon the county road network (Grubba and Barbaresso, 1993). This phenomenon has been especially evident about the City of Troy located in the center of the county.

In 1985 the RCOC began a strategic planning process. This process enables the RCOC to work closely with the local bodies of government in forecasting future road network needs. By 1988 the RCOC management realized that there were insufficient funds to support the future road requirements and that the current network would have to be used more efficiently in order to meet future demand.

The RCOC does not receive funds from property taxes; its sole source of funding is a portion of the state gasoline tax and state vehicle registration fees. In the spring of 1989, the RCOC sought \$100 million from the Oakland County Board of Commissioners for county road expansion of which \$2 million was to be applied to a computerized traffic signal system. The County Board of Commissioners rejected this initial request for road funding.

These circumstances forced the RCOC to consider alternative sources of funding and to identify new methods of managing the road network more efficiently. In February 1989, Road Commission Board Chairman Richard Vogt and Managing Director John L. Grubba attended the first international conference on the application of computer technology to traffic management sponsored by the American Society of Civil Engineers. The AUTOSCOPE video imaging system for traffic detection, which would become part of FAST-TRAC, was discovered at this conference.

The RCOC officials presented the County Board of Commissioners a concept for an ATMS in southeast Oakland County in November 1989. This concept would operate the existing road network more efficiently. During 1990 the RCOC continued its aggressive research of traffic management approaches. The SCATS was selected for computerizing the signal system and Siemens' Ali-Scout system was selected for dynamic in-vehicle navigation. AUTOSCOPE, the SCATS, and Ali-Scout would become the foundation of FAST-TRAC (Barbaresso and Grubba, 1992).

The second annual Mobility 2000 meeting in Dallas during March 1990 marked the beginning of the working relationship among the RCOC and Siemens Automotive. James Haugen, a consultant from Oakland County, introduced Mr. Grubba to Ronald Knockeart of Siemens (Grubba and Barbaresso, 1993). Representatives from the RCOC and Siemens began working together to initiate a traffic management project in Oakland County which would be a public-private partnership. Representatives from General Motors, Ford Motor Company and Chrysler Corporation were informed about the project and agreed to participate. The RCOC submitted a proposal to the FHWA and the MDOT for financial support. This initial proposal was turned down. Congressman Bob Carr (D-Michigan), Chair of the Transportation Subcommittee of the U.S. House of Representatives Appropriations Committee was informed about the project at this time.

In August 1990, the City of Troy was selected by the partners as the site for an initial ATMS/ATIS demonstration project. Siemens Automotive committed \$1 million in seed funding for the project. On November 2, 1990 a formal kickoff meeting was held with the partners and the project was dubbed the Oakland/Ali-Scout Program. At this point the MDOT became involved in the program and the partners recognized the need to involve the FHWA. The RCOC approached the County Board of Commissioners again to request \$2 million in funding to support the program. In December 1990, the Board agreed to appropriate the funding for the ATMS activities in the City of Troy.

In April 1991, representatives of the RCOC traveled to Australia to begin negotiations with the RTA for licensing the SCATS. The SCATS licensing agreement was granted in October 1991 and installation began in the City of Troy. Also in April, Mr. Grubba conducted a formal presentation to the Transportation Subcommittee of the U.S. House of Representatives Appropriations Committee seeking \$10 million in federal funding for the Oakland/Ali-Scout Program. Congressman Carr supported the project. This support was critical to the congressional appropriation of \$10 million for IVHS in Oakland County. The appropriation

became part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the program was dubbed FAST-TRAC.

Federal, local and private sector funds supported the Quick-Step phase of FAST-TRAC in the City of Troy. As part of "Quick-Step", 28 intersections were placed under SCATS control, and 23 AUTOSCOPE detectors and 10 Ali-Scout beacons were installed. On June 2, 1992 the RCOG "flipped the switch" on "Quick-Step" and the first phase of FAST-TRAC was completed. FAST-TRAC was then expanded and "Quick-Step" became part of a larger Phase I portion of the program.

Phase I extends FAST-TRAC implementation in the City of Troy. As part of Phase I, 95 intersections under SCATS control, 30 Ali-Scout beacons, and 60 Ali-Scout equipped vehicles will be operational by the end of 1993. Additionally, a state of the art traffic operations center has been established in Troy and will be a vital part in the integration of the ATMS and ATIS systems.

In April 1992, Mr. Grubba made another presentation to the Transportation Subcommittee of the U.S. House of Representatives Appropriations Committee seeking additional federal funding for Phase II of FAST-TRAC. Federal funding of \$10.5 million was approved for Fiscal Year (FY) 1993.

The University of Michigan (UM) was awarded the evaluation contract by the RCOG in November 1992. The UM developed an evaluation plan in conjunction with Michigan State University during 1993 and some initial evaluation activities were performed.

2.6 FUTURE WORK

The next phase of FAST-TRAC moves into the northern Oakland County communities of Pontiac, Auburn Hills and Rochester Hills. Phase II has been separated into two parts, Phase IIA and Phase IIB. Phase IIA includes the ATMS expansion of FAST-TRAC into the above communities. SCATS controllers and AUTOSCOPE detection will be installed in the Auburn Hills and Pontiac areas by June 1994 in order to manage the traffic conditions coinciding with the World Cup soccer games at the Pontiac Silverdome. More comprehensive evaluation activities will begin with Phase IIA.

Phase IIB will expand the ATIS activities of FAST-TRAC. Ali-Scout roadside beacons will be installed in Pontiac, Auburn Hills and Rochester Hills. A total of 500 vehicles will be equipped with the dynamic navigational unit. Federal funding of \$20 million was appropriated for FY 1994 to support Phase IIB.

To date \$40.5 million of federal funds has been appropriated to FAST-TRAC. The Oakland County Board of Commissioners has appropriated \$2 million of funding. The RCOG has appropriated a significant portion of their resources to FAST-TRAC. The private sector has also

donated time, money and material to the program. All of the funds and resources will support the installation and evaluation of the SCATS, AUTOSCOPE and the Ali-Scout system (Knockeart and Bauer, 1993).

2.7 GOALS AND OBJECTIVES

The project's goals and objectives were taken from the FAST-TRAC Phase One Work Program (FAST-TRAC, 1992):

- To integrate an ATIS and an ATMS.
- To improve mobility and safety in congested areas.
- To evaluate the benefits and utility of an integrated system.
- To exhibit an early winner as part of the U.S. IVHS program
- To increase IVHS exposure and gain pragmatic insights through deployment in the backyard of and involvement with the U.S. auto industry.
- To demonstrate a number of technical features.
- To build a better understanding of the considerations for public and private administration of an ATMS, an ATIS, and a combined ATM/ATI system.
- To develop requirements for deployment of such an integrated system in Oakland County and other areas.
- To build an international IVHS linkage.

The project goals were compared to the goals stated by the interviewees and respondents to identify possible conflicts. No conflicts were found. The participants strongly supported two of the stated project goals: *to improve mobility and safety* and *to evaluate benefits*. They generally supported two others: *to integrate an ATMS and an ATIS* and *to demonstrate technical features*. Of the remaining four goals, three were not specifically mentioned by the participants but support could be implied from the goals that were mentioned. One goal, *to exhibit an early winner*, was not mentioned by the participants. Nine goals and objectives were mentioned three or more times or by three or more individuals:

- To understand the market for traveler information and guidance systems. (10-5)
- To develop an IVHS industry in Oakland County and the U.S. (8-5)
- To improve the Oakland County transportation system using IVHS technologies. (7-5)
- To improve safety. (6-5)
- To work within the national IVHS program. (6-4)
- To identify costs and benefits of deploying an integrated system. (4-4)
- To gain real world knowledge. (5-2)

- To provide opportunities for university staff and students to gain experience in a new field. (4-2)
- To make FAST-TRAC the best operational test in the nation. (3-2)

(The numbers in parentheses in the preceding list and in the next three lists represent the number of times an item was mentioned and the number of individuals who mentioned it.)

While the public and private sectors representatives generally identified the same goals, the private sector placed a heavy emphasis on *understanding the market*. The public sector placed a heavy emphasis on *improving the transportation system, developing an IVHS industry, and improving safety*. Policy makers felt that *understanding the market* was important, while participants providing technical support stressed *improving the transportation system and developing an IVHS system*.

2.8 BENEFITS

The benefits discussed by the interviewees and respondents were closely related to the goals that they expressed. *Gaining expertise; improving mobility, safety, and the efficiency of the system; and working within the national program* were emphasized again. Nine benefits were mentioned three or more times or by three or more individuals:

- The project participants will gain experience and knowledge in a new field. (11-8)
- The mobility of Oakland County residents will be improved. (6-4)
- The safety of the road network will be improved. (5-5)
- The efficiency of the transportation system will be improved. (5-4)
- The reputation of the partners will be enhanced and they will gain publicity. (5-4)
- The project participants will be able to influence the development of the national IVHS program. (4-3)
- The air quality will improve. (3-3)
- The project participants will establish contacts with others involved in IVHS activities. (3-3)
- The project participants will be able to leverage their resources. (3-3)

The representatives from the public sector placed a heavy emphasis on *improving mobility and safety* and also felt that *gaining expertise, improving air quality, and obtaining good publicity* were important. The private and academic sectors emphasized *gaining experience and knowledge*. Policy makers were concerned with *gaining expertise and improving the transportation system*. Individuals providing technical support viewed *enhancing the project's reputation* as important.

2.9 RISKS

The interviewees and respondents identified several risks that they or their organization may face because of their participation on the FAST-TRAC project. The risks that they mentioned most frequently dealt with failure or the consequences related to failing. Seven risks were mentioned three or more times or by three or more individuals:

- The image and reputation of the participants' organizations could be tarnished if the project fails. (7-5)
- The participants and their organizations could lose their financial investment. (6-5)
- The individual components, such as SCATS, Ali-Scout equipment, and AUTOSCOPE camera may fail. (5-3)
- The integration of the ATIS and the ATMS may fail. (3-3)
- The project may fail or be perceived as not providing expected benefits. (3-3)
- The general public does not accept the system or is not willing to pay for it. (3-3)
- The increased workload may hinder the day-to-day operations of the participants' organizations. (4-2)

Representatives from all three sectors emphasized the possibility of *damage to their organization's image*. Representatives of the public and private sectors also stressed the *loss of their financial investment*. The public officials were also concerned with the *failure of the technology* and the *increased workload*. Policy makers viewed the *tarnished corporate image* and the *loss of their investment* as the greatest risks.

2.10 CRITICAL SUCCESS FACTORS

The interviewees and questionnaire respondents discussed critical success factors (CSFs) for the project. A CSF is a key area that must be successfully completed in order for the project to be considered a success. Four of the CSFs most frequently mentioned directly correspond to four risks: technology, integration, public perception, and expected benefits. Nine critical success factors were mentioned three or more times or by three or more individuals:

- The evaluation must accurately assess the technical and non-technical components of the test. (16-8)
- The public's perception of the project must be positive. (8-7)
- The benefits of the project must be demonstrated clearly. (8-7)
- The technological components must work. (8-6)

- The project receives the funds necessary to complete the deployment of the system and the evaluation. (7-5)
- The partners must maintain their level of cooperation. (6-5)
- The implementation of the project must remain on schedule. (5-5)
- The ATMS and the ATIS must be integrated successfully. (5-4)
- The partners must continue their commitment. (4-3)

Representatives from all three sectors stressed the importance of a *good evaluation*. Representatives from the public and private sectors also emphasized a *positive public perception*, *demonstrated benefits*, and *viable technologies*. Public officials expressed a concern over *continued funding*. Policy makers, project administrators, and individuals in other positions all saw a *good evaluation* as a key area. Policy makers also emphasized *demonstrable benefits* and *maintaining the schedule*. Project administrators stressed *continued funding* and *functioning technologies*. Individuals in other positions also stressed *continued funding* as well as a *positive public perception* as being key areas.

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 were divided into ten categories:

- New Business Relationships
- Project Evaluation
- Contracting
- Human Resources
- Funding
- Organizational Coordination
- Auditing and Accounting
- Intellectual Property Rights
- Public Perception
- Technology and Standards.

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

3.1 NEW BUSINESS RELATIONSHIPS

The need to develop new business relationships, the problems that were encountered in doing so, and the lessons that were learned were the topics that the interviewees and questionnaire respondents discussed the most. Developing these new business relationships included activities such as initiating and maintaining a public-private partnership, selecting a local agency to administer a Federal-aid highway project, and working with a local government of a foreign country. Some issues discussed here could have been listed under another category, such as issues related to inter-agency cooperation. We tried to make a distinction between the issues related to developing new business relationships and all others. If the issue involved relationships or ways of doing business that did not exist before the FAST-TRAC project started, then it is listed here. If the issue involved relationships that already existed, then it is listed elsewhere.

This section is divided into three issue areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues, (2) issues that project participants may encounter, and (3) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.1.1 Issues That Were Encountered by the Project Participants

In this subsection, each issue area is placed into one of three major groupings: (1) issues related to initiating and maintaining a public-private partnership, (2) issues related to a local unit of government administering a federal-aid project, and (3) issue related to dealing with a government in a foreign country.

3.1.1.1 Initiating and Maintaining a Public-Private Partnership

The project participants encountered six issues while developing a public-private partnership. These issues occurred in the early stages of the project. Because these issues are so closely inter-related, the lessons learned dealing with public-private partnerships are discussed at the end of the subsection because the lessons address all four issues:

ISSUE 1: A PUBLIC-PRIVATE JOINT VENTURE WAS NEW TO ALL PARTICIPANTS

Only local public sector representatives offered comments in this area. They worded this issue in several ways. The private sector is uncertain how to invest in a public venture. Public-private partnerships are foreign to all government units. The public sector does not know how to handle the funding of private sector activities. The public sector does not know how to request private sector participation, both financial support and services. The RCOC staff had to work with private companies with whom they had no prior working relationship, and these companies had little or no knowledge of the RCOC, state, and FHWA procedures and contracting requirements.

The principal cause for this issue was *newness*. The implementation of an IVHS and a public-private joint venture approach were new to the participants. The IVHS area is bringing together governmental agencies and private firms that had not worked together previously. The private firms in the IVHS area are not the typical road building and contractor companies that normally work on federally-funded construction projects. Some companies, such as Rockwell, may have had relationships with the federal government through the Department of Defense but not with the FHWA or state and local governments. Other companies, such as Siemens, had no previous involvement with local, state, or federal governments. Also, the *technology* was new and had to be understood by the various partners. Installing privately-owned equipment on the public right-of-way was a new adventure for the participants.

The second cause was *tradition*. Public sector participants tried to apply old practices in a new area. They were used to the "arms-length" approach, such as long established contracting rules and regulations and stringent purchasing regulations. Also tax-supported governments, especially at the political level, normally avoid private contributions. They want to avoid scandal or the appearance of impropriety.

A third cause was *difference*. Private sector concerns, such as proprietary information and intellectual property rights, differ from public sector concerns, such as protecting the interests of the public. The fourth cause was a *lack of knowledge* in the public sector in how to solicit and handle private sector contributions and in all sectors in how to develop an acceptable and workable partnership.

All the individuals who discussed this issue mentioned one major effect. Working through the new relationships has *delayed* the initiation and implementation of the project. Time had to be spent explaining the processes that had to be followed. Numerous meetings and decisions with various parties were required to start the implementation process. The intensity of these meetings and discussions placed a significant *strain* on the RCOC staff in implementing FAST-TRAC. These meetings, however, were instrumental in helping the project to succeed.

ISSUE 2: A MANAGEMENT STRUCTURE AND THE ROLES AND RESPONSIBILITIES OF THE PARTNERS WERE NOT DEFINED AT THE START OF THE PROJECT

Two private sector participants mentioned that in the early phase of the project the roles of the partners were unclear. The project partners had to develop a practical design for the project and roles which were meaningful for all involved parties. They stated that the cause of this issue was that there was no precedent for this new type of partnership.

One effect of this issue was that defining the *management structure* and identifying the *roles* increased the time to form the partnership. The positive effects were that the project partners learned about each other and the project was able to succeed.

ISSUE 3: THE CONTRACTING PROCESS IS CUMBERSOME

This issue was also worded several ways. A contracting mechanism was not available to recognize that the project changes and to respond quickly to those changes. Three levels of government and a private firm were involved in the process; this necessitated four levels of contracting. There was a delay in the signing of the cooperative agreements between the FHWA and the MDOT and between the MDOT and the RCOC and the contract between the RCOC and Siemens. Once funding was approved, it took one year to sign a contract between the RCOC and Siemens.

Also the partners did not understand fully the contracting procedures that had to be followed. The public and private sectors have different agendas when negotiating contracts--the public sector usually works under freedom of information and must disclose information considered propriety to the private sector partners, such as pay rates, job descriptions, and product information. The FHWA was not able to react quickly to new ways of doing business and delayed the contracting process. These comments were offered primarily by private sector and federal government representatives.

The first cause was *newness*. The contracting process was a new experience for all of the project participants. Unique and new methods of doing business were involved, and no one knew how to deal with it. Everyone was searching for how the contract process was going to work. Initially, no one knew how the funding was going to flow--through the FHWA or the MDOT. Also, it was not clear how private sector partners would provide a share of the project costs and how to reimburse them for work that they performed, such as paying Siemens for engineering work.

Tradition also played a role. The FHWA determined that it would channel funds through the MDOT rather than pass them directly to the RCOC or to Siemens. Neither the RCOC or Siemens were able to negotiate a cooperative agreement with the FHWA.

Another cause was *difference*. Private companies have privacy concerns while the public sector must hold all parties accountable for money spent. The private sector companies desire to make a profit while the public sector desires to achieve the most cost effective and best investment of public funds. Also, the FHWA wanted to spend funds to move a product from development to deployment; it did not want to pay for product research and development with public funds.

A fourth cause centered around the governmental *contracting and auditing requirements*. The Federal Acquisition Regulation (FAR) had to be followed. Siemens was not familiar with Michigan laws and the FAR; the RCOC was not totally familiar with the FAR. Siemens did not want to be audited by a public agency and have certain information become public knowledge. The private sector was concerned that the Freedom of Information Act would require disclosing certain private sector information.

Participants suggested two other causes. First, the roles of the involved parties were not defined clearly at the start of the project. Second, the fleet size was uncertain. These two causes just added more confusion to the process.

The primary effect of this issue was *delay*. It slowed down the project. Everyone up and down the chain of command has to approve changes to the contract and that took time. Although the funding was appropriated in October 1991, the cooperative agreement between the MDOT and the RCOC was not signed until June 1992. The contract between the RCOC and Siemens was not signed until December 1992. The delay caused Siemens to invest more money than expected.

Another effect was the tremendous amount of *time and effort* that was required to facilitate the contracting process. This issue increased the staffing workload and caused other work to suffer. A fair amount of communications was required to understand the concerns of both sides. Although this issue may have stretched the project schedule, an understanding among the partners grew. This effort was beneficial because it made a good case that the money would be spent wisely and prudently.

Another effect was *strained relationships* among the partners. Some interviewees suggested that some partners were ready to withdraw. Representatives from Siemens had to put extra effort in

promoting interest in the project among the partners. No partner withdrew and a better understanding of each partners' process developed. Siemens agreed to be open to federal and state audits and established a separate entity for auditing purposes.

The contracting problem is still an issue; Phase IIA was delayed due to the contracting process.

ISSUE 4: THE PUBLIC-PRIVATE PARTNERSHIP IS STRAINED WHEN ONE PARTNER BECOMES A VENDOR TO ANOTHER PARTNER

One interviewee defined a partner and a vendor, "A partner is responsible for contributing resources, planning general progress of project, and concurring with project elements; a vendor is responsible for implementing a specific task within the project for a fee." The problem arises when a partner is also a vendor. In the case of FAST-TRAC, the RCOC signed a sole source contract with Siemens Automotive to provide Ali-Scout equipment. This meant that the representatives from Siemens who are partners and members of the Steering Committee became vendors as well. The private sector's legal status as a vendor created a problem with the partnership. The *legal distinction* between a partner who was also a vendor was not clear.

Two public sector representatives reported that *significant effort*, conversation and expense were required to negotiate these new procurement practices and explain the nature of the partnership. The RCOC and Siemens' lawyers worked together to resolve this issue but the issue had a negative effect on the goals to provide services. Some waivers were required and granted. They felt that the initiation of the project was *delayed*. The partners are comfortable with this relationship, but the interviewees expressed the concern that this issue may cause the relationship with a partner to change.

ISSUE 5: THE FEDERAL HIGHWAY ADMINISTRATION DID NOT MAKE A SMOOTH TRANSITION FROM THE TRADITIONAL CONSTRUCTION-VENDOR RELATIONSHIP TO THE NEW ENGINEERING AND DEVELOPMENT PARTNER RELATIONSHIP

The private sector representatives who discussed this issue felt that the FHWA management, as well as the private sector and other public sector agencies, was faced with a new form of doing business, for which they were not prepared. They listed several causes that they felt contributed to this issue. First, the FHWA staff had to administer a project that received *earmarked* funds and there was some uncertainty as to how to handle it. Second, because IVHS was a new program area, the FHWA management wanted *control* of the project to remain at headquarters. Third, the FHWA management was reluctant to pass federal funds directly to a private company for services and other non-tangibles. Fourth, the FHWA management decided to use their normal federal-aid *procedures* and work through the state DOT.

The private sector interviewees felt that the *traditional way* of doing business was not appropriate for an IVHS project. They said that the current procedures lack flexibility for evolution that was needed for an IVHS project. This also caused a delay in the project and made the project more difficult. The FHWA and the MDOT had to sign a cooperative agreement. Then the

MDOT and the RCOC had to sign one. The RCOC had to sign a reimbursable contract with Siemens to pass federal funds to Siemens. This also meant that several iterations of contract reviews were required.

ISSUE 6: THE ROAD COMMISSION FOR OAKLAND COUNTY HAD NEVER WORKED WITH A PRIVATE COMPANY AS A PARTNER

The IVHS program is bringing together governmental agencies and private firms that had not worked together previously. The public-private partnership relationship was new to the RCOC as well as to the other partners. Normally, the RCOC dealt with private companies under construction contracts. Now the RCOC staff was working with non-traditional private sector participants; they were not familiar with the companies or the products. The RCOC previously dealt with "low-tech" businesses while the new partners were "hi-tech" firms. Also these companies had little or no knowledge of the RCOC's (and state and FHWA) procedures and contracting requirements.

Private and public sector representatives stated that the lack of familiarity *delayed* the initiation and implementation of the project. Also, time had to be spent explaining the processes that had to be followed.

Lessons learned related to initiating and maintaining a public-private partnership

Representatives of all three sectors who were involved in setting policy, with administering the project, and in other disciplines that support the project presented the lessons listed here. The most significant lesson that they offered was that **it is possible for public and private sectors to work together**, although developing a partnership is a difficult and time-consuming process. The project participants offered these additional lessons:

- Cooperation among partners and the sharing of resources are vital. Develop a team of participants and an advisory team that are compatible and work together rather than each being interested only in their own part of the project.
- Actively engage all of the partners in the decision making process.
- The concerns of both the public and private sectors must be considered. Each sector must educate the other sector as to how it operates:
 - ◆ A participant must understand the points of view of both the private and public sector.
 - ◆ The private sector must clearly understand that the major responsibility of the public sector (government) is to ensure that funds are used to benefit the public interest.
 - ◆ The public sector must understand that the private sector must have a marketable product and is in business to make money. Private companies are willing to bend but still are protective of the bottom line.
- Everyone is protective of their dollars. Private entities may be reluctant to contribute real dollars without an assurance of something being returned. Because the public sector

moves slower than the private sector, private sector firms should not be overly aggressive in committing resources.

- Clearly define the nature of the project, the roles of the participants, and the contracting process that will be used:
 - ◆ Develop a practical design which involves everyone and is acceptable to all parties. Obtain the acceptance of all the partners.
 - ◆ The roles of the partners must be defined at the outset of the project. Identifying and assigning responsibilities to prospective partners should occur as soon as possible.
 - ◆ Be as specific as possible when clarifying the roles of the participants.
 - ◆ There is a need to define a partnership better, especially in the legal area. Define the role of a partner and the relationship among partners, especially when a partner from the private sector is involved.
 - ◆ Alternate procurement and partnership agreements are needed which do not place partners in a subordinate role.
 - ◆ The FHWA must clarify their policies, processes, practices, expectations, and interpretation of the FAR and educate participants of the operational tests as to these items. This information also must be fed to the operating level of the FHWA.
 - ◆ The FHWA must identify one individual who has the authority to commit resources, establish a project start date, and stick to it.
- Guidelines should be published for the benefit of project participants and especially for the private sector participants who have not worked previously with federal or state transportation agencies. These guidelines would help the participants understand the laws, regulations, and procedures they must follow. Seven areas should be covered: public-private partnerships, contracting procedures, intellectual property rights, auditing practices, funding and fund matching (reimbursable activities and percent of local match required), termination clauses, and warranties.
- Both sides of the public-private partnership have to be open to new ways of doing business. A lack of flexibility could kill a project. Participants must break out of the old ways of doing business; however, they should record the reasons behind their decisions if they depart from normal practices.
- Because of the involvement of non-traditional firms in FAST-TRAC project, the RCOC needs to develop a different method of assessing the standing and competence of the participants (vendors) and products.
- Having more than 5 partners increases the complexity and difficulty of managing the partnership. Also, it is possible for junior partners to have stronger voices than project champions or full partners.
- Do not be afraid of taking the initiative. Become a driving force within the OFT. Initiate the conversation and keep communications open

3.1.1.2 Administering a Federal-aid Project by a Local Unit of Government

The interviewees and questionnaire respondents discussed two interrelated issues in this category. These issues developed early in the project's life cycle:

ISSUE 7: A LOCAL UNIT OF GOVERNMENT WAS SELECTED TO ADMINISTER A FEDERAL-AID HIGHWAY PROJECT

When the FAST-TRAC project was being initiated, the State of Michigan had a new state administration. As a result of this new administration, the staff at the MDOT was being reduced and the MDOT officials did not know how the administration of the FAST-TRAC project would fit into the new organizational structure. Because the FAST-TRAC project was receiving federal funds, the representatives from the FHWA, who normally work through the MDOT, were interested in identifying the agency that would manage the project. Because of the new partnership arrangement, the FHWA representatives wanted an organization that did not have or appear to have a conflict of interest. They also wanted the project to move at an acceptable rate and wanted a project manager that would keep the project moving. The parties involved agreed to give the RCOC the opportunity to administer the project.

The project structure gives the RCOC a *unique position*--a local agency managing a federal-aid project. The role of project manager, however, placed more responsibility and a burden on the RCOC by increasing the *workload* on the administration, engineering, legal, and finance staff. The role also may have placed RCOC personnel in an uncomfortable situation when dealing with other partners. They were a partner as well as a contract "supervisor."

Despite these negative effects, the interviewees felt that work on the project was expedited. They stated that the project moved along *quicker* because some reviews and prior-approvals by the state and federal DOT's were eliminated. One interviewee said, "The project will move better. The RCOC has a direct interest (both pride and financial resources) in the project's success." Another called the RCOC a "can-do" organization.

The project participants shared these *lessons* that they learned. First, personnel in local units of government are *responsible* and have *expertise* to administer contracts according to federal-aid procedures. Second, the staffs of local government agencies can *relieve* the state DOT of duties related to the project administration of federal-aid projects. Third, local units of government are willing to adapt to changes. Finally, local government officials can do a good job representing the federal interest to private partners.

ISSUE 8: THE ROAD COMMISSION FOR OAKLAND COUNTY WAS UNFAMILIAR WITH FEDERAL-AID CONTRACTING PROCEDURES

Although the staff at the RCOC had participated previously in federal-aid highway projects, they were never the lead agency. They had to learn the finer points of the federal and state contracting requirements. The state audited the RCOC's procedures, recommended some changes, and

worked with the RCOC staff to implement these changes. The RCOC's procedures were approved after the modifications were made.

3.1.1.3 Dealing with a Government in a Foreign Country

One issue arose in this category and it occurred at the beginning of the project:

ISSUE 9: THE ROAD COMMISSION FOR OAKLAND COUNTY HAD TO WORK WITH A LOCAL GOVERNMENT IN A FOREIGN COUNTRY

The staff of the RCOC decided to use the SCATS for the ATMS portion of the FAST-TRAC project. SCATS was developed by the RTA in Sydney, New South Wales, Australia. This meant that the staff of the RCOC had to work and sign an agreement with a local unit of government in a foreign country. This issue had a minimal effect on the project. On the positive side, the RCOC was able to obtain excellent support services from the developers of the system. On the negative side, representatives of some companies that have a license to sell SCATS in the United States were upset that the RCOC dealt directly with the RTA.

3.1.2 Issues That May Be Encountered by the Project Participants

Two concerns were discussed in this area. A representative of the private sector and one from the public sector stated that a lack of a continued *commitment* from the partners could be a potential issue. There is a possibility that a partner may become alienated and would no longer support the project. The possible loss of a partner's expertise and knowledge of the project would be costly to project; the indoctrination of a new partner would be time-consuming.

To prevent this potential issue from becoming a reality, some **lessons** were suggested. A representative from the academic sector stressed that flexibility and cooperation among the participants are needed. It is essential that there be mutual understanding of the overall goal of the demonstration plus a desire to work together to accomplish this goal. A private sector representative agreed by stating that project participants should direct their energy to achieving program objectives. They should focus their attention on end results and tolerate any issues that may develop.

The second concern was *liability*. One representative from the public sector and one from the private sector mentioned that liability could be an issue. They raised several questions. Could the FAST-TRAC project partners be held liable if a project participant (driver involved in the evaluation) has an accident while operating a vehicle equipped with the Ali-Scout system? Could they be held liable if a driver has an accident using the in-vehicle device once it is available to the general public? If a public agency installs equipment by a private company, who would be held liable if an accident occurred because of poor maintenance or operation of the system?

3.1.3 Issues That May Be Encountered in Future Operational Tests or Deployments

The project participants offered one possible impediment, two suggestions, and five questions to be considered by those planning to deploy an IVHS product or service. The possible **impediment** is that the lack of familiarity with governmental *contracting and auditing* procedures may dissuade private sector organizations from participating in the IVHS world.

The first **suggestion** is that future OFT participants must know the requirements of establishing partnerships. The second is that private sector companies accustomed to working with the Department of Defense must learn new working relationships with other federal agencies and state and local governments. The representatives of these companies must also understand that local governments want technologies that are needed to solve a problem and not technologies that a company wants to apply somewhere.

One public sector representative offered five **questions**:

1. Can a government unit become a partner in a corporation?
2. Can the public sector participate in the profits from a privately-developed system that is installed and implemented on public right-of-way?
3. Who owns or is responsible for maintaining a privately developed system that is installed and implemented on public right-of-way--keeping it in operating condition?
4. Who pays for equipment, needed to achieve benefits, that is installed in private vehicles?
5. Who pays for the system; the general public (taxpayers), the users, or the private sector?

The public sector representative offered these questions because of the uncertainty regarding the roles of the public and private sectors and the consumer. These questions may have to be answered before the full deployment of some IVHS products and services can be accomplished. If the answer to the first two questions is yes, then these strategies may be used to share profits among participants, to allow non-profit agencies to make a profit legally, and to protect proprietary information, a concern of the private sector.

3.2 PROJECT EVALUATION

This section discusses the issues and lessons learned in the area of the project evaluation. It is divided into three issue areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues, (2) issues that the project participants may encounter and suggestions to avoid them, and (3) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.2.1 Issues That Were Encountered by the Project Participants

There were three issues that the project participants encountered in the area of evaluations. All of these issues occurred in the early stages of the project:

ISSUE 1: THE FEDERAL HIGHWAY ADMINISTRATION NEEDED TO ENSURE THAT THE NATIONAL EVALUATION OBJECTIVES WOULD BE MET AND TO CONVINCING THE PROJECT PARTICIPANTS TO RESERVE AN APPROPRIATE AMOUNT OF FUNDING FOR THE EVALUATION

When the FAST-TRAC project received federal funds, the scope of the project changed from a local one to a national one, and the FHWA became a participant. Some interviewees indicated that during initial discussions between the FHWA and the other project participants, the *differences* in the major interests of the parties became clear. These differences caused some relationships to become *strained*.

One of these differences was how much *money* should be allocated for the evaluation. At the start of the project, the original project participants wanted to funnel as much funding as possible into the field deployment activities. As one interviewee said, "There were two schools of thought on funding evaluations: (1) the budget rules the evaluation or (2) the evaluation rules the budget." As discussions continued, the project participants agreed that the evaluation is a critical, and challenging, component of the OFT and should be given the appropriate resources. This issue is being resolved as an evaluation plan is being developed that is acceptable to the project participants.

Two private sector representatives offered four **lessons** that they learned:

- The evaluation must be valued by the partners.
- The evaluation component must be part of the fundamental plan of an OFT. It should be "inextricably intertwined" with the rest of the project.
- A good evaluation is required to determine if future public and private investment is warranted.
- The evaluation process will have to conform to "real life" constraints of equipment, timing, costs, etc.

ISSUE 2: THE FEDERAL HIGHWAY ADMINISTRATION QUESTIONED THE USE OF THE UNIVERSITY OF MICHIGAN AS THE EVALUATOR OF THE FAST-TRAC PROJECT

In order to obtain independent evaluations of the OFTs, the FHWA recommended that the designers of an OFT not participate in the evaluation. They did not want the designers evaluating themselves. At the start of discussions on the evaluation, it was not apparent how much the staff of the UM participated in developing the initial definition of the FAST-TRAC project. Also,

staff members of the UM who were not on the evaluation team wanted to participate in the design work for the project.

The effects on the project were minimal. The issue prompted meaningful *discussions* of roles and responsibilities of the project participants, especially those doing the evaluation. It was determined that the UM could be the evaluators and that no staff members from the university would participate in the design. One interviewee expressed this view, "The OFT is fortunate to have the University of Michigan responsible for the evaluation."

ISSUE 3: THE SIGNING OF THE CONTRACT TO CONDUCT THE EVALUATION WAS DELAYED

The contract for the evaluation could not be signed until the cooperative agreements between the FHWA and the MDOT and between the MDOT and the RCOC were executed. The signing of these two agreements were delayed. Also, there was some controversy over whether the Michigan universities were to be authorized to conduct the evaluation because university staff members may have participated in the definition of the project or might be involved with the design of the project.

The issue was resolved but too late to prevent its affecting the project. The start of the evaluation was *delayed*. Because of this delay, the evaluators will never have pure "before" data, even on the Phase II intersections and corridors, required to access SCATS. It prevented the Michigan State University (MSU) evaluators from obtaining all of the desired "before" data to evaluate Phase I implementation and may hinder their collection of "before" data on the Phase II implementation. Because of this absence of "before" data, the impact of SCATS on individual intersections or corridors may not be known until after Phase II is completed and the planning for Phase III is completed.

This issue affected the project in two ways. First, the orientation of the SCATS evaluation was changed from the first set of intersections to the second set. Second, the MSU evaluators had to modify the research plan for evaluating special event traffic.

Two interviewees, one from the public sector and one from the academic sector, provided these lessons that they learned:

- The evaluation must be part of the OFT from the beginning.
- The evaluation plan and the contract between the project partners and the evaluation team should be in place at the same time--or before--implementation.
- The evaluation plan needs to be designed as the details of the project are designed.
- Without good evaluation data (before and after), it will be more difficult to justify additional expenditures for IVHS.

3.2.2 Issues That May Be Encountered by the Project Participants

The project participants offered several impediments that could affect the project. These areas of concern were expressed by representatives of the private and academic sectors:

- The integration of an ATIS and an ATMS presents a challenge to the evaluation group. New methodologies may have to be developed to evaluate this integration. The model developed and used in the evaluation may not replicate SCATS, Ali-Scout, or the integration of the two systems.
- The number of vehicles involved in the operational test (5,000-10,000) may be less than the number required for a viable evaluation.
- There may be a lack of drivers willing to participate or an improper mix of participants.
- It may be difficult retaining volunteer drivers.
- The universe from which participants are drawn may not be properly educated in the use of technology or may fear using it (technophobia).
- The evaluation participants may not provide good feedback for the evaluation.
- Inadequate measures of effectiveness that yield poor or wrong conclusions may be used.
- The travel times involved for most commuters may be too short to be important in the choice of a route.
- The network may not lend itself to alternate routes.

One private sector individual expressed a **concern** that others may decide that the FAST-TRAC evaluation lacked measures of effectiveness (MOEs), or used MOEs inadequate, to address national IVHS goals. If this does happen, the interviewee was afraid that the people in authority would reject the results because they perceived that the evaluation was not done well.

Two **suggestions** to overcome some possible impediments were proposed by a private sector interviewee:

- The evaluation participants need to be properly instructed on the use of the ATIS equipment.
- The human factors component of the FAST-TRAC operational test and the physical configuration of the hardware must be planned and evaluated properly.

3.2.3 Issues That May Be Encountered in Future Operational Tests or Deployments

The project participants offered several impediments that could be encountered by others deploying IVHS technologies. They also suggested ways to avoid possible problems in evaluating such deployments. These possible impediments were expressed by representatives of the public and academic sectors:

- The participants fail to recognize the need for a good evaluation or the evaluation effort does not have the full cooperation of all parties.
- Implementation priorities may conflict with the evaluation schedule, leaving the evaluation in a constant state of flux.
- The participants do not devote sufficient time and forethought in setting evaluation framework, i.e., sorting out the MOEs that will get the answers required.
- The project evaluators do not receive adequate guidance because the evaluators of some other OFTs are unwilling to share information and procedures.

Representatives from all sectors offered these **lessons and suggestions** to alleviate future problems:

- A single organization must control the evaluation contract. The project evaluation should be centralized.
- A clear distinction of each person's role in the evaluation is desirable.
- The sponsors must understand the value of learning and must assimilate the lessons they have learned in their experience with the OFT. They must be willing to share their knowledge with others, internally and externally to the project.
- The system needs to be implemented to have an effective evaluation.
- Good communication is needed between program managers and evaluators to ensure that the evaluation adapts to changes in implementation priorities and schedules.
- Rigorous research methods are important.
- An independent assessment is needed to substantiate funding.
- External perceptions can be managed through a good evaluation.
- There must be flexibility in conducting evaluations of complex projects. It is difficult to foresee all of the delays, and if a rigid plan is established, evaluations might fail.
- Using the experience gained at other operational tests, a short course on how to evaluate OFTs should be developed and presented.

3.3 CONTRACTING

This section discusses the issues and lessons learned in the area of contracting. It is divided into two issues areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues and (2) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.3.1 Issues That Were Encountered by the Project Participants

There were three issues that the project participant encountered in the area of contracting. The first two issues developed in the early stages of the project while the third one still exists. All of these issues were cited by representatives of the private sector:

ISSUE 1: THE EXECUTION OF A CONTRACT BETWEEN THE ROAD COMMISSION FOR OAKLAND COUNTY AND SIEMENS AUTOMOTIVE INVOLVED A SLOW AND CUMBERSOME PROCESS

The project participants followed the normal federal-aid contracting process, which meant that the contracting hierarchy included the FHWA, the MDOT, the RCOC and Siemens. The contract between the RCOC and Siemens could not be executed until two cooperative agreements were signed. Because of the number of documents that had to be reviewed and the serial nature of the review process, a substantial amount of time and effort was required to complete the process. The start date of the contract was a moving target and was not defined properly. This also meant that Siemens had to sign a contract with the RCOC and not sign a cooperative agreement with the FHWA or be awarded a grant.

There were several causes behind this issue. First, this type of project was *new* to the FHWA. Second, the project received *earmarked funds*, which some interviewees stated, are viewed as "tainted" and were handled extremely carefully. Third, the FHWA decided to follow the *traditional contracting* process. Fourth, initially it was not clearly identified which party would be *responsible* for the contracting process.

Fifth, a *government entity* was the prime contractor and this entity, the RCOC, normally used contracts. Sixth, the RCOC felt that the use of *contracts* would protect Siemens' interests. The final cause was that the contract between the RCOC and Siemens had to be approved by the FHWA and the MDOT. This caused *additional questions* to be raised at each step in the process. Also, the contract had to be reviewed by several levels within the FHWA.

This issue effected the project in several ways. First, the contract was signed substantially later than expected. This *delayed* the implementation of the project and added to its cost and caused some partners to work on the project without a contract. This delay also caused some credibility problems internal to Siemens. Siemens had staff assigned to the IVHS area in expectation of a signed contract date but they could not start working.

Second, representatives from Siemens had to carefully manage the process and perform many redundant steps up and down the hierarchy in order to complete the process. This required extra management *time and expense*. Third, during the contract negotiating period, some of the relationships between the partners became *strained*.

Fourth, because the normal federal-aid contracting process was used, representatives from Siemens felt that there was *little left to negotiate*, such as the use of a cooperative agreement rather than a contract. Finally, the *slowness* of the contracting process affected the execution of

the evaluation contract. Other project participants could not begin significant work on the project because a contract was not in place.

Although only representatives from the private sector discussed the issues, representatives from both the public and private sectors offered **lessons** that they learned. These lessons were offered by individuals involved in setting policy, those involved with administering the project, and those involved in other disciplines that support the project.

The comment from one individual sums up the lessons, "The technical part of FAST-TRAC has been easy. **The contractual portion of the project has been the challenge.**" Another added this lesson, "A significant amount of time was required by public and private partners to make the procurement process work. This strained relations among the partners at first but it was a **valuable lesson and experience.**"

There were several additional lessons that were mentioned:

- Uniformity is needed in contracting procedures. Procedural issues should be addressed and clarified as soon as possible, such as the requirement to pre-audit contractors and subcontractors.
- There is no model or pattern for contracts and clauses to cover these new public-private arrangements:
 - ◆ Local units of government must know more about the federal procurement practice. The federal government should train these local units regarding procurement.
 - ◆ Compile the applicable governmental laws, regulations, policies, and procedures for private sector participants. Work with them to make the system understandable to them.
 - ◆ There is a need for tools or processes through which government agencies can determine qualifications of private sector participants and products.
- The OFTs are demonstrations and not contracts for proved products. Part of a demonstration is that it may show that a product or service may not work. The contracting parties should take this fact into consideration when writing and executing contracts.
- Review federal, state, and local contract requirements, including the FAR. Look for ways to make them "leaner," to reduce the number of reviews, and to reduce the time involved in signing a contract. Change them if they are too rigid for research-and-development-type programs.
- Federal procurement requirements need to be less restrictive when operating in a partnership arrangement with the private sector. Therefore, look at different procurement practices. Other means besides contracting, such as the use of cooperative agreements and grants should be used in a public-private partnership.
- Give careful attention to non-standard practices. Thoroughly plan how goods and services will be acquired to complete the project. Tie it down to avoid misunderstandings.

- To plan properly, private sector firms must know, in a timely manner, what resources they will receive. Therefore, private sector partners need to actively engage the contracting process in order to secure contracts on a timely basis. Schedule regular meetings to review progress; include representatives of all legal staffs in these meetings.
- Need fewer levels of government, and one level of government, the Federal, must identify one individual who has the authority to commit resources, establish a project start date, and stick to it.
- Implementing contracting and procurement arrangements can be a complicated process when applied to a partnership such as FAST-TRAC. It is a matter of negotiation and becoming familiar with basic contract clauses.

ISSUE 2: THE CONTRACT MODEL WAS A CONSTRUCTION TYPE THAT IS USED FOR ROADWAY CONSTRUCTION

A contract type was considered to be an inappropriate structure for a research-and-development-type project or operational field test. The contract was too rigid in its allocation of funds. Work orders were listed in the contract. Before work could start, however, a more detailed description of the work order had to be written and submitted for review. This review involved multiple levels. Separate authorizations were needed for each work order. Funds were allocated by work order and there could be no re-allocation of funds among the work orders.

Also, the method for compensation under this contract did not cover the cost of planning and program development. As part of this process, the RCOC requested that Siemens post a construction bond. Also warranties were not originally incorporated into the contract and the intellectual property rights clause was inadequate to protect the private sector's interests.

The primary cause of this issue was that the process was based on the *traditional construction* contracting procedures. The current FHWA, MDOT, and RCOC contracting process is geared to road building and not the development, implementation, and testing of new technologies. It is meant for a vendor relationship and not for a partnership.

The major effect that this issue had on the project was *delay*. It took several months of negotiations to iron out the details. Siemens hired a lawyer familiar with the FAR to assist in these negotiations. The approval of the work orders caused delays and these delays added to cost.

Another effect was that this contracting mechanism *decreased the flexibility* required in research and development programs. Also, Siemens was not compensated for planning and program development and committed more *money* to the match than initially expected. Relationships were also *strained* in the process.

A very positive effect was that discussions were initiated concerning the intellectual property rights clause and changes are being made.

The interviewees offered several **lessons** that were learned:

- The process is time-consuming and requires an extra effort in completing requirements for the project.
- Project plan needs to be open and flexible. Some work cannot be defined because it involves developing and testing new technologies.
- Program plans should allocate funds for planning future phases.
- The authorization of work orders requires streamlining. Approve the project plan as a unit and not on a work order basis. Look for other ways in which doing business may be improved.
- The public sector still operates in a customer-supplier fashion in its relations with the private sector.

ISSUE 3: THE MEMORANDUM OF UNDERSTANDING DESCRIBING THE PARTNERS' PARTICIPATION IN THE PROGRAM HAS NOT BEEN FINALIZED

Not all of the memoranda of understanding (MOU) between the RCOC and the different partners have been signed. There was some disagreement concerning the language and implications of the MOU. This issue has not been resolved yet.

A private sector representative stated that the completion of the MOU, which describes the partners' participation, should have been made a priority item.

3.3.2 Issues That May Be Encountered in Future Operational Tests or Deployments

The project participants offered a couple of impediments that could be encountered by others deploying IVHS technologies. First, the use of a construction-type contract model may limit private sector participation in operational tests and hinder the development of new software. Second, if an individual in the approval process does not want to approve a work order, this will delay the project and someone will have to pay for this delay.

3.4 HUMAN RESOURCES

This section discusses the issues and lessons learned in the area of human resources. It is divided into two issues areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues and (2) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.4.1 Issues That Were Encountered by the Project Participants

There were four issues that the project participants encountered in the area of human resources. All of these issues developed at the start of the project. These issues were discussed primarily by representatives of the public sector with some input from representatives of the academic sector:

ISSUE 1: THE STAFF OF THE ROAD COMMISSION FOR OAKAND COUNTY DID NOT POSSESS THE SKILLS REQUIRED BY THE NEW TECHNOLOGIES

In the FAST-TRAC project, the RCOC staff is responsible for the acquisition, installation, and maintenance of the SCATS and the AUTOSCOPE cameras and for some installation of Ali-Scout equipment. The RCOC staff was not familiar with these new technologies.

There were several effects to this issue. First, it caused some *delay* in the implementation of the project. Second, RCOC staff had to be *trained* in the use of this new technology. The RCOC created a position to coordinate a training program and set aside significant *funding* for this training. The training was primarily for SCATS, but some of it was also for Ali-Scout and AUTOSCOPE. Third, RCOC officials realized that they had to train *additional staff* in the technology to minimize the risk to the project in the event that key technical individuals leave the RCOC.

Fourth, to receive SCATS training, an engineer from the RCOC had to *travel* to Australia and spend an considerable amount of time there. Fifth, once the training was completed, the RCOC was able to use *in-house labor* for installation and maintenance of the systems and allowed the RCOC staff to manage the operations of SCATS.

This issue produced a very positive effect. The new technology became a challenge and *motivated* the staff. The staff developed an appreciation of the system. They also developed a spirit, a sense of pride and satisfaction.

There were several **lessons** learned from this issue. These lessons were offered by representatives of the public sector involved in making policy, administering the project, and in the technical aspects of the project with input by those involved in the academic sector. One of these individuals contributed this important lesson, "Busy people are happy people. **Involved employees become motivated and are a key to the success of the project.**" Another individual agreed, "**People are important. Pay attention to them and motivate them.**"

Several additional lessons were presented:

- Adequate training is not a luxury; it is a significant and important element of a successful deployment. Provide training up front; provide training continuously.
 - ◆ Training and staffing are factors which need serious consideration at the start of projects, such as FAST-TRAC.
 - ◆ Local units of government must make time and money available for training.

- ◆ Without adequate, and recurring training, people get frustrated, spin their wheels, and are constantly having to reinvent the wheel.
- Learning "new things" helps to build morale. Retain a portion of the work for the internal staff.
- Because IVHS technology is new, many public agencies currently do not have the expertise required by this technology.
- Build redundancy into the in-house administrative and technical skills to guard against a project crisis in case an important technical employee leaves.
- Positions and skills required by a new technology may not fit into the agency's current classification categories.
- Technical knowledge, which is required for the project, can reside in all levels of government. Also, it must reside with each participant.

ISSUE 2: PARTICIPATION IN THE FAST-TRAC PROJECT SIGNIFICANTLY INCREASED THE WORKLOAD ON THE STAFF OF THE ROAD COMMISSION FOR OAKLAND COUNTY

The existing staff at the RCOC had to assume the additional responsibilities of the project which significantly increased their workload. They assumed their new responsibilities using resources and staffing at the level prior to the initiation of the FAST-TRAC project. The RCOC does not have sufficient administrative staff to support the project's reporting requirements and from whom the other partners can obtain data.

The primary cause of this issue was that the RCOC was given the responsibility of *program administration*. Second, the RCOC did not increase its *staff* to handle the new workload and all key RCOC staff members have other duties and responsibilities. Third, at the start of the project, RCOC officials did not know if *funding* would be continued.

This issue has given "**additional gray hairs**" to several RCOC staff members and affected the project in several other ways. First, additional *stress* was placed on the existing staff. Second, project management became more aware of the project's workload and the need to hire additional staff. They submitted a federal grant request for *funds* to cover increased staffing, education, and training.

Third, it has *slowed* the project at times. Activities that could have been done in parallel were handled in series instead. Also, obtaining data from the RCOC has been slower and more difficult than anticipated. Fourth, there is a *lack of relief* for the project manager. Fifth, current *work suffers* and opportunities to do other work are lost. Finally, some *jealousy* developed within the other RCOC departments because additional resources were given to the RCOC staff administering the FAST-TRAC project. Although changes have been made, several interviewees felt that this issue has not been resolved.

One participant volunteered this lesson: **Be prepared to make a large commitment!** Several other lessons were offered by representatives of the public and academic sectors involved in making policy, administering the project, and in the technical aspects of the project.

- Staffing levels should be considered early in the development process. Recognize the level of resources required to administer the OFT at the out-set of the project.
- Do not over-look administrative and technical staffing requirements:
 - ◆ If an agency is going to commit to administering an OFT, the agency's management should analyze the availability and capabilities of its people. They must understand the stress that the additional responsibilities will place upon the staff and the effect on its normal operations.
 - ◆ Think in advance about what is required for project administration, the technical expertise that is needed internally, the ability of current staff to manage and deploy the system, and the commitment of resources.
 - ◆ Not only is a knowledgeable staff needed, but also an adequate number of staff.
- Staff and fund the project appropriately. Grow as the project grows. As the need for administrative staff increases, provide it. It should not be a one-man show.
- Participation in an OFT may hinder day-to-day operations.
- Emphasize training. Identify training needs in administration and program management and provide that training. An IVHS curriculum would be useful.
- The effective program management role must be kept up.

ISSUE 3: PROGRAM MANAGEMENT IS A TIMELY AND LENGTHY PROCESS

Some project participants mentioned that the process of managing the project was time consuming and often required the serial processing of documents. They expressed the need for a project manager dedicated full time to the project, who was willing to take control and responsibility. They stated that implementing projects, such as FAST-TRAC, are new experiences for the public sector and there is much to learn. The process of approving documents serially may impede progress and delay the project. The project manager must monitor the flow of documents closely.

The project participants offered several **lessons** in the area of project management:

- One individual should be assigned the duties of project management.
- The project manager must be responsible, dependable, and efficient.
- The project manager should be supported by additional staff or outside consulting support. For example, a systems integrator might be added to develop specifications.
- Project participants must support the project manager.
- Sufficient overhead or administrative funds should be provided for a full time project director or liaison officer--aside from political and contract duties.

- There is a need to better utilize project management tools and methods in order to implement large scale IVHS projects.

ISSUE 4: THE FEDERAL HIGHWAY ADMINISTRATION DIVISION OFFICE LACKED THE TECHNICAL EXPERTISE TO REVIEW PROJECT DETAILS

The IVHS program is new and requires new skills. At the start of the project, the FHWA Division Office staff did not have the expertise to review the details of the project. Most of the technical experts in the FHWA reside in the Washington Office with some in the regional offices. This meant that Washington and regional office "experts" had to be consulted. This in turn added time to the review process.

3.4.2 Issues That May Be Encountered in Future Operational Tests or Deployments

The project participants offered two possible impediments and one suggestion for those planning to deploy an IVHS product or service. The first possible **impediment** is that local units of government may not have *resources* for training, especially to train staff members in anticipation of the project and before project funds are authorized.

The second impediment is that a local unit of government may not have the *in-house capabilities* to develop the expertise required by the new IVHS technologies and may have to contract out for this expertise. This issue has three possible effects. First, gaining this expertise is *costly*. Second, there is the possible *loss of the contractor* along with its expertise and knowledge of project. Then, a new contractor would have to be educated on the project. This consumes time and money. Third, hiring a contractor may cause internal *labor problems*. One interviewee recommended that when outside support is required, try to maintain contractor expertise and knowledge of the project.

The **suggestion** is that the defense industry has a lot of qualified people which could bolster the IVHS industry. Employ this existing expertise.

3.5 FUNDING

This section discusses the issues and lessons learned in the area of funding. It is divided into three issue areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues, (2) issues that project participants may encounter, and (3) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.5.1 Issues That Were Encountered by the Project Participants

In this subsection, each issue area is placed into one of three major groupings: (1) issues related to obtaining project funds, (2) issues related to matching federal funds, and (3) issues related to receiving "noncompetitive" funds.

3.5.1.1 Obtaining Project Funds

There were four issues that the project participants discussed in this area. The first issue was the reason that the FAST-TRAC project was started. The other three issues occurred in the early phases of the project; the fourth issue, however, has not been resolved:

ISSUE 1: THE ROAD COMMISSION FOR OAKLAND COUNTY DID NOT HAVE SUFFICIENT FUNDING TO ALLEVIATE THE COUNTY'S MOBILITY PROBLEMS

The traffic generated as a result of the Oakland County development boom in the 1980's could not be handled by the road system. The RCOC conducted several strategic planning exercises to identify the transportation needs of the county and the cost to alleviate those needs. The costs far exceeded the revenues that the RCOC would receive. The management of the RCOC realized that their traditional forms of funding would not be sufficient to address the needs of the county and that new funding sources must be identified. They also realized that they could not use the traditional approach of increasing capacity through new construction and roadway widening as their only means to increase the system's capacity. They recognized the need to deploy new technologies but did not have sufficient funding to deploy them.

There are three causes for this lack of funds. First, the state of Michigan has the lowest per capita spending on roads in the country. Second, the RCOC is funded through revenues generated from the state gasoline tax, which has not been increased since 1984, and from vehicle registration fees. Third, the RCOC is not supported by an income tax or local property taxes.

The management of the RCOC recognized the need for *alternative approaches*; they decided that they had to be more aggressive, bigger risks takers, and innovative. They solicited funding from non-traditional sources. First, they developed a strong relationship with their congressman and lobbied for a national IVHS program. Second, they lobbied the state legislature to amend the state's Transportation Economic Development Fund to include ATMS as an eligible category under congestion relief. They took every opportunity to secure new forms of funding.

Although this issue is not directly related to the implementation of an IVHS project, it is one that many local and state governments will face. The **lesson** that representatives from the RCOC offered is applicable to all units of government: **Do not hesitate to search for alternative sources of funding.**

ISSUE 2: THE INITIATORS OF THE PROJECT WERE NOT SURE IF THEY COULD RAISE THE REQUIRED SEED MONEY TO SHOW STRONG LOCAL SUPPORT FOR THE PROJECT

When the initiators of the project were soliciting funds, they were told that they must show local support for the project. This support had to include financial support. The initiators approached the County Board of Commissioners and requested \$2 million. They also requested that Siemens, a possible private partner, provide a \$1 million match. They were not sure if either entity would provide the necessary funding.

One of the causes of this uncertainty was that the County's Board of Commissioners not responsible for maintaining or funding any roads in the county. That is the *role* of the RCOC. Second, while the RCOC's request for funding was not unprecedented, funding for a program like FAST-TRAC was *unprecedented*. The request involved a new technology and was limited to only one community, the City of Troy.

The project leaders held their discussions with the County Board and with the Siemens management during 1988 and 1989. The management of Siemens Automotive agreed to commit \$1 million in August 1990. The County Board approved the expenditure of funds in December 1990. Both representatives of the public and private sector agreed that the project would not have got off the ground without this funding. The combined funds initiated the "Quick-Step" phase in the form of a small public-private partnership.

This commitment of funds served as proof to Congress of local *commitment*. These funds served as seed funding for the earmarked funding from Congress, which followed, and were accepted as the local match for the first federal appropriation of \$10 million.

Those individuals who discussed this issue brought out one **lesson**. They said that local seed funding serves as a display of local commitment and a facilitating factor in getting federal support. Another representative from the private sector offered a second lesson: Experience indicates that it takes 2 to 3 times longer than originally anticipated to secure funding.

ISSUE 3: THE ROAD COMMISSION FOR OAKLAND COUNTY RETAINED A PORTION OF THE PROGRAM FUNDING WHEN THE ADMINISTRATION OF THE PROJECT WAS PASSED TO THE ROAD COMMISSION

The partners agreed that the RCOC would administer the project and funds were provided for program administration. This reduced the funding that was available for the technical and evaluation aspects of the project. One representative from the private sector said that this allocation of funds was overlooked and caused the match from the private sector to increase. There was some concern that the remaining funds would not be enough to properly support the technical portion of the program.

This private sector representative mentioned an old cliché as a **lesson**: "Don't count your chickens until they are hatched. When an OFT is funded, do not expect the full level of funding that was allocated initially."

ISSUE 4: THE PROJECT PARTICIPANTS DID NOT KNOW THE TOTAL AMOUNT OF FUNDS THAT WILL BE ALLOCATED TO THE PROJECT.

IVHS projects may have different sources of funds. The FAST-TRAC project has been granted funds earmarked by the Congress. This is the primary cause of this issue. Federal funds set aside for the FAST-TRAC project are approved *incrementally*, one fiscal year at a time, and funding for succeeding fiscal years is not guaranteed.

One private sector representative felt that this issue affects private industry more than the public sector. In order to *plan properly*, private sector firms must know, in a timely manner, what resources they will receive. A public sector representative added that advance planning is required to balance the implementation of the project to the funding but this planning cannot occur until the level of funding is known.

The project participants offered several **lessons** learned and suggestions. One public sector representative put it this way, "It would be better if **funding was identified up front**; the future is uncertain enough without having to worry about whether the project will have to be scrapped next year because of a lack of funds." Others had these suggestions:

- Funds must be committed to the project. If an IVHS project is approved, it should be appropriately funded.
- The entire project should be funded from the beginning.
- Funding for each year should be identified a couple of years in advance.
- Make funding for IVHS projects similar to funding for construction projects including the requirement for local matching.

3.5.1.2 Matching Federal Funds

This issue developed in the early phase of the project and has not been resolved completely. There is still some concern as to how to place a value on products that are provided by a partner:

ISSUE 5: THE PERCENTAGE OF LOCAL MATCH REQUIRED AND THE EXPENSES THAT WOULD CONSTITUTE THE LOCAL MATCH WERE NOT DEFINED CLEARLY

Private sector and federal government representatives expressed this issue. At the start of the project, the match that the non-federal participants would have to provide was not clear. Local, state, and private contributions were uncertain. The uncertainty of determining the value of some of the eligible activities and the detailed documentation required to verify the local match also contributed to this issue. The interviewees stated several causes for this issue.

First, the federal government *policy* that federal funds should be leveraged with state and local funds was applied to IVHS programs. Second, Congressional earmarking forced the FHWA into the project and set the amount that was required as match to receive the funds. Because the FAST-TRAC project was initiated prior to the passage of ISTEA, the original match was thought to be an 80% / 20% split. Third, the ISTEA bill does not specify the requirements or percentage of matching funds. An 80% / 20% match is the maximum, but the goal of the IVHS program is to receive maximum leverage of the federal funds by recommending a 50% / 50% match. Fourth, there was *no clear-cut definition* of what constituted matching funds. It was unclear what contributions would qualify as matching funds and if the private sector partners could apply the costs of startup activities as a portion of the local match.

Fifth, previous to this project, the public and private sectors never had to *determine the value* of eligible activities and products. Sixth, the FHWA or the MDOT documents did not mention a standard *accounting practice* to be used to track activities eligible for local match. Seventh, the private sector could not easily provide detailed documentation in the early phases of the project.

This issue affected the project in several ways. First, the partners negotiated over a long period of time to reach an agreement on this issue. These negotiations created some *frustration* and animosity among the partners and *delayed* the project. Second, some work completed prior to the initiation of Phase I was accepted as eligible. Third, the use of other federal-aid funds could be applied as a "match". Fourth, some interviewees felt that the use of the 80%-20% ratio would cause the federal government to pay closer attention to the activities that are applied to the local match and to future work plans.

The interviewees recommended three **lessons**:

- There should be more leeway in determining the local match and the eligible activities so that more public and private sector organizations will participate. This participation would benefit the project.
- Public agencies must clearly define what constitutes the local match while developing contracts.
- The private sector must understand that local match is subject to approval by the public sector and that the private sector must have proof that the work has been completed.

3.5.1.3 Receiving "Noncompetitive" Funds

The two issues stated in this subsection developed early in the project and have been resolved:

ISSUE 6: RECEIVING FUNDS EARMARKED BY CONGRESS HAS SOME DISADVANTAGES

Although most interviewees felt that congressional interest allowed the project to start more quickly, a few individuals saw some problems with receiving funds earmarked by the Congress. Since the congressional action superseded normal federal-aid procedures, some representatives of the federal and state DOTs were perceived as having a *negative opinion* of the FAST-TRAC project. *Strained relationships* had to be overcome. Trust and credibility had to be built with the parties who were skeptical of the project receiving earmarked funds or who thought they were bypassed in the decision making process.

There were several effects due to this issue. First, some interviewees mentioned that the project was started before the FHWA staff could review it. The FHWA staff had to take time to review the project, and some felt that this *delayed* the release of the federal funds. Second, because the concept was firmly established by the partners, some partners did not accept some of the initial FHWA comments. Originally, the FHWA felt that both the SCATS and Ali-Scout technologies could be adequately tested and evaluated on a smaller scale. Third, the FHWA is participating in the project in an extent greater than originally anticipated. Fourth, the FHWA granted informal approvals and established eligibility dates in order to allow the project to proceed.

One public sector representative felt that the receipt of earmarked funds caused the RCOC to become more committed to making the FAST-TRAC project successful. Another stated that congressional interest and cooperation has been a facilitating issue for FAST-TRAC.

ISSUE 7: RECEIVING SOLE SOURCE CONTRACTS HAS SOME DISADVANTAGES

Although the Board of Road Commissioners and the legal department prefer competitive bidding, the RCOC signed sole source contracts with Siemens and the UM. The RCOC was reluctant at first to award sole source contracting even though the federal government has been open to sole source contracts when dealing with the private sector. Some interviewees saw some positive and negative aspects of awarding these sole source contracts. First, the award of a sole source contract to Siemens made it easier to *develop partnerships* and to share costs among sectors. Second, the award of a sole source contract to the UM, allowed the partners to obtain the services of, as some interviewees stated, a well qualified and a major investigator.

Third, some individuals felt that recipients of sole source contracts are perceived as lacking cost controls or operating inefficiently and are placed under extra scrutiny. Even though the sole source contracts were used to expedite the project, some individuals were perceived as feeling that they might be "had" by the sole source contractors. Fourth, to overcome these perceptions, the recipients had to take time to build strong working relationships. Fifth, an individual stated that the use of sole source contracts may result in lost opportunities to the awarding party.

There were three lessons that were learned in this area:

- After receiving a sole source contract, the recipient may be motivated to seeing that the project is done well.
- The sole source contract may not necessarily be the best instrument to use. The recipient of the sole source contract has a lot of responsibility for making things work and is under more scrutiny.
- The FHWA is comfortable in the use of a sole-source arrangement in a partnership environment.

ISSUE 8: THE FHWA AND THE CONGRESS HAVE DIFFERENT PRIORITIES IN FUNDING

Representatives from the public and private sector identified the conflicting goals of the Congress and the FHWA as an issue. One participant said that it was unclear who has the authority and technical competence to decide which OFT has technical merit and should proceed. The Congress has continually earmarked funds for certain projects, such as FAST-TRAC, and the FHWA selects projects through a periodic solicitation process.

The cause of this issue is the *limited* amount of IVHS funds. The primary effect is the reduction of the discretionary funds that the FHWA has to allocate to the projects selected through the solicitation process. One interviewee said that this issue causes a *barrier* to develop between the partners of an OFT that receives earmarked funds and the FHWA staff. This barrier is usually dismantled but it takes time. A possible effect may be that the money allocated to an operational test selected through the solicitation process may not be enough to complete the project.

Two private sector representatives offered these **suggestions**. First, the FHWA must lobby the Congress to resolve differences between earmarked project grants and the FHWA IVHS project priority list. Second, the public sector decision makers need to be educated and trained on the new IVHS technologies in order to determine which OFTs have merit.

3.5.2 Issues That May Be Encountered by the Project Participants

The interviewees expressed two areas of concern in this area. The first concern was that *funding for the project may not continue*. Approximately one-fourth of the interviewees and questionnaire respondents, who represented all three sectors, discussed this potential issue. Most suggested that the cause of this issue is simple: Continued *earmarking* of FAST-TRAC funds may not continue. The Congress approves these funds *one fiscal year* at a time, and funding for succeeding fiscal years is not guaranteed. One individual from the private sector added the *economic recession* or other factors could potentially effect the level of participation of private sector partners.

All of the individuals who mentioned this issue knew what effect the loss of funds would have on the project. The worse possible situation would be that there would not be enough *money* to complete the project. Another possible situation would be that there would not be enough money to complete the evaluation.

A public official expressed another potential **impediment** by saying that municipalities may not be willing or able to provide the *local matching funds*. These matching funds would be required as the FAST-TRAC project expands into new geographical areas. The major cause of this issue is that many smaller local communities do not have the *financial resources* to implement new IVHS technologies. Other local units of government may not rank traffic management very high on its list of *priorities*. The major effect on the project would be that federal funds earmarked for the project would not be used because a local match for those funds was not found.

3.5.3 Issues That May Be Encountered in Future Operational Tests or Deployments

One representative offered one question and one possible impediment to be considered by those planning to deploy an IVHS product or service. The **question** is on funding the deployment. From where will the funds come? Is deployment a public issue and if so at what level? Or is it a private or public-private issue?

The **impediment** might be that the results from an OFT might be perceived as negative and, therefore, obtaining funds for full deployment may be difficult to obtain.

3.6 ORGANIZATIONAL COORDINATION

This section discusses the issues and lessons learned in the area of organizational coordination. It is divided into three issue areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues, (2) issues that project participants **did not** encounter, and (3) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.6.1 Issues That Were Encountered by the Project Participants

In this subsection, each issue area is placed into one of two major groupings: (1) issues related to **intra-agency** coordination, and (2) issues related to **inter-agency** coordination.

3.6.1.1 Intra-agency Coordination

There are four issues that project participants encountered in the area of intra-agency coordination. These issues developed in the early phases of the project. Representatives involved in policy making, project administration, and evaluation discussed these issues:

ISSUE 1: INVOLVEMENT IN THE FAST-TRAC PROJECT CHANGED THE WAY THE ROAD COMMISSION FOR OAKLAND COUNTY HAD BEEN DOING BUSINESS

There were several causes to this issue that was discussed by representatives from the public sector. First, as new strategies were being investigated, there was some internal *reluctance* to exploring alternatives to widening roads and a skepticism for new technology. Some individuals were hesitant in using new technologies and in trying and applying them on the roads. In other words, as one interviewee stated, they were reluctant to change the way the RCOC had been doing business for 75 years.

Second, the project involved the new technologies. The RCOC staff was familiar with existing technologies and had to *learn* how to use the new technologies. Third, the RCOC was given responsibility of *administering* a federal-aid project. The RCOC staff was not familiar with the federal-aid highway process from the administrator perspective.

The RCOC management resolved this issue by bringing the project into the agency's everyday working environment and including it in the strategic plan. The staff devoted a great deal of resources to this project, more than normally expended on a project.

The interviewees offered several lessons:

- Promote the IVHS program to all workers.
- Promote the program so people feel that they are a part of the bigger scheme or goal.
- There must be a clear and concise commitment by any agency that wants to participate in an operational test. There cannot be opposing forces within an agency.
- Involve the administrative personnel, such as legal, procurement, and contracting staffs early in the process. Similarly, project management must be involved in the legal discussions of the partners.

ISSUE 2: UNIVERSITY OF MICHIGAN STAFF MEMBERS WANTED TO CONTRACT WITH THE FAST-TRAC PARTICIPANTS TO PERFORM DESIGN WORK FOR THE PROJECT

This issue arose because some staff members within the UM believe personnel from one organization can design for and evaluate the same operational test. The FHWA, however, does not want members of the same institution to perform both tasks. Another cause was the absence of a central organization that oversees contracting at the UM. Because authority is decentralized, the

principal investigator for the UM evaluation contract has no direct authority over other staff members.

This issue may have placed the UM evaluation contract at risk. It was resolved when an internal decision was made that stated that UM staff members would not perform design work. The principal investigator had to actively obtain agreements from other staff members that they would not procure design work from the FAST-TRAC project.

ISSUE 3: THE ORGANIZATION WITHIN THE FEDERAL HIGHWAY ADMINISTRATION RESPONSIBLE FOR PROJECT MANAGEMENT WAS NOT IDENTIFIED CLEARLY

At the start of the IVHS program and the FAST-TRAC project, it was not clear which organization within the FHWA had project management responsibility. Traditionally, FHWA field offices have managed projects with little or no involvement from headquarters. Because of the size of the FAST-TRAC project, however, headquarters personnel felt they should be responsible. This issue was primarily caused because the IVHS program involves a new way doing business for the FHWA.

This issue was resolved as the headquarters and field office personnel learned to work together and trust each other. Also, project management responsibility for smaller operational tests was formally delegated to field offices.

ISSUE 4: OBTAINING UPPER MANAGEMENT APPROVAL IS TIME CONSUMING

Two representatives from the private sector discussed this issue. They stated factors such as busy executive schedules, lack of priority within the organization for the FAST-TRAC project, the multiplicity of areas in which the corporation is involved, and the physical distance between the FAST-TRAC project and upper management as causes to this issue. One interviewee also stated that upper management too often want IVHS efforts to produce revenues in a short period of time.

The interviewees suggested that management be informed that participation in an OFT does not mean that a product will be endorsed or a profit will be made. They also recommended that lower levels of management be empowered to make decisions.

3.6.1.2 Inter-agency Coordination

Two issues were discussed in the area of inter-agency coordination. Both developed in the early phases of the project, but the second one is not resolved. Representatives involved in project administration and technical support discussed the first issue and an evaluator discussed the second:

ISSUE 5: INTER-AGENCY COORDINATION AMONG THE FEDERAL HIGHWAY ADMINISTRATION, THE MICHIGAN DEPARTMENT OF TRANSPORTATION, AND THE ROAD COMMISSION FOR OAKLAND COUNTY NEEDED TO BE ENHANCED

Representatives from the public and private sectors discussed this issue and offered several causes. First, there was a lack of *communications* among the three parties. The representatives of the three were not fully aware of what the others were doing. One interviewee mentioned that the RCOC implemented Quick Step before Congress approved the first funds and that the FHWA was not aware of this work.

Second, the MDOT was developing an *IVHS plan* and was requesting federal funds. Because the MDOT gives the state trunk line systems its highest priority and views local systems as serving the state system, this plan focused on the freeway system and did not include the Oakland County system.

Third, historically federal highway funds were administered by the MDOT. The reduction in the MDOT staff resulted in the RCOC administering the project. *Local management* of a federally-funded highway project was contrary to normal procedures, and as a result, new procedures were required.

This issue affected the project in several ways. First, *friction* developed among the representatives of the FHWA, MDOT, and the RCOC. Some hard feelings developed. Second, it created some duplication and dilution of effort and *slowed* down the project. Third, a *mechanism* was developed to allow a local government to administer federal-aid projects. Fourth, all parties become more *knowledgeable* of MDOT's plans. This in turn resulted in plans to link the MDOT MTC and the FAST-TRAC TOC. Fifth, the level of coordination and cooperation among these parties has increased. This is exhibited in the fact that the MDOT is coming to Oakland County with an early deployment project. This will integrate MDOT's IVHS efforts with FAST-TRAC. A public official stated that this was accomplished through good communications between MDOT and RCOC representatives and the RCOC committing \$3 million of FAST-TRAC funding for freeway instrumentation and integration with FAST-TRAC technologies.

The interviewees offered several **lessons**:

- Multi-jurisdictional cooperation is possible.
- Close partner involvement is a must.
- All parties must be involved. Pursue one-on-one discussions, if necessary.
- The private sector should not hesitate in taking the initiative in educating the public sector decision makers on project plans.
- Education (of the partners) is at the heart of everything, but the education process just takes time.

ISSUE 6: THE FISCAL YEARS OF THE PARTICIPANTS ARE NOT COMPATIBLE

One interviewee discussed the fact that different fiscal years used by the project participants caused some difficulties, especially for the universities. Because the contract with the universities ends at the end of the federal fiscal year (September 30), one university cannot appoint graduate students for the fall semester. This means that graduate students are assigned in a non-optimal manner. This unresolved issue also creates extra paperwork.

3.6.2 Issues That Were Not Encountered by the Project Participants

Interviewees stated three potential issues that did not occur. First, private sector representatives mentioned that early in the project, the initiators of the FAST-TRAC project recognized the need to involve the Detroit-based *automotive companies* and anticipated that gaining the support of the auto firms might be an issue. This issue did not arise because the auto companies committed to participate very early in the project. One interviewee stated that being in close proximity to the domestic automotive manufacturers enhances the OFT; however, it also places the OFT under their critical eye.

The interviewees suggested several reasons for the participation by the auto firms. The first is that federal laws were changed, such as anti-trust laws, which permit the auto companies to work more closely. Second, the U.S. Council of Automotive Research was established. Third, IVHS America was established and provides a forum for cooperation.

Two public sector representatives discussed the second issue which dealt with the participation of *local municipalities*. The project partners knew that in order for FAST-TRAC to be successful, they had to gain support from the local municipalities. The RCOC has had a history of cooperation with the local governments and has maintained traffic signals in addition to the roads of many local communities. This inter-agency cooperation among the RCOC and the local units of government was a facilitating factor for the project.

Initially the Troy City Council hesitated in its acceptance of the RCOC's proposal to implement SCATS in Troy. The city council was not convinced that the technology was going to work and did not want to risk its image with Troy voters. Because of the existing relationship between the city and the RCOC, the City Council put its trust in the RCOC and supported the RCOC's efforts.

One representative also mentioned some other factors which were incentives to local municipalities to cooperate. The first was the traffic system itself. The municipalities would be gaining a more advanced system to replace their current traffic systems. The second incentive was the 80% / 20% funding. The local government only had to fund 20% of the project.

One interviewee offered this **lesson**: Do not let the concern over intergovernmental cooperation deter anyone from initiating an operational test. Other representatives from the public sector offered additional ones:

- Build on current intergovernmental interactions. Build on the communications, trust, and understanding that already exist.
- Court the local municipalities. Keep them informed. Share the spotlight with them. Seek their input constantly.
- Agencies with whom you work must be knowledgeable. Educate local government officials on IVHS, especially on ATMS. Educate them so that they can make their own judgments.
- Involve local governments and their respective city engineers early in the decision process in order to secure their support.
- A progressive local government can be a key factor in selling, promoting, and implementing an operational test.

One interviewee discussed a third potential issue that did not occur. Early in the project, participants thought that there might be a possible conflict between the *universities* on their respective roles in the evaluation. This did not occur because representatives from the universities and project management carefully defined the roles of the universities.

3.6.3 Issues That May Be Encountered in Future Operational Tests or Deployments

The role of *metropolitan planning organizations* (MPOs) was discussed as an issue that may arise in future deployments of IVHS products and services. The ISTEA gives MPOs programming authority with respect to regional IVHS issues. This could be a potential issue since the areas within its jurisdiction, i.e., suburban and inner city, may have different needs in the area of IVHS.

Another issue may be encountered. Although the inter-agency cooperation between the RCOC and the local units of government was a facilitating factor in the implementation of FAST-TRAC, one public official said that gaining the *cooperation* of local municipalities could be an issue at other locations.

3.7 AUDITING AND ACCOUNTING

This section discusses the issues that the project participants encountered and the lessons that were learned addressing the issues in the area of auditing and accounting.

3.7.1 Issues That Were Encountered by the Project Participants

The project participants encountered two issues in this area:

ISSUE 1: THE PRIVATE SECTOR WAS RELUCTANT TO DISCLOSE COMPLETE FINANCIAL INFORMATION TO LOCAL, STATE, AND FEDERAL GOVERNMENT AUDITORS

The private sector is reluctant to provide certain financial information to units of government because this information could become available to the public. Representatives of the private sector feel that a rival company may use this information to gain a competitive advantage. Also, they are concerned that the records of the entire company must be open to inspection, not just the records of the unit working on the project.

There were several causes for this issue. First, federal procurement *requirements* require that contract costs and local match be documented. Second, the partners questioned what constituted *propriety information* and what information should be made public. Third, the partners had different *interpretations* of the FAR and federal accounting procedures.

This issue effected the project in several ways. First, it *delayed* the execution of the contract between the RCOC and Siemens. Second, to eliminate the possibility that auditors could audit the entire corporation, Siemens created a *separate entity* for the project with its own auditing system. Third, this issue caused *strained relationships* between some partners. The private sector wanted to be viewed as a partner which was donating funds and not as a profit-making firm.

One representative of the private sector presented this **lesson**: Reexamine the federal auditing requirements placed on partners from the private sector.

ISSUE 2: THE PARTNERS DID NOT CLEARLY UNDERSTAND WHAT RECORD KEEPING WOULD BE REQUIRED TO DOCUMENT WORK THEY PERFORMED

This issue arose for several reasons. First, the project involved a *new* business relationship among the public and private sector partners. Second, the private sector partners were not accustomed to dealing with the federal, state, and county governments and did not have a good understanding of what the public sector required for record keeping and auditing. Third, the public sector was not sure what record keeping would be required from the partners.

This issue has not been fully resolved and is still causing uncertainty for private sector firms.

One public sector representative put forth this **lesson**. Recognize that there are going to be many players from all sectors. Therefore, there needs to be a central record-keeping and accounting system for the project. Early in the project, establish effective accounting and accountability procedures.

3.8 INTELLECTUAL PROPERTY RIGHTS

This section discusses the issues and lessons learned in the area of intellectual property rights. It is divided into three issue areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues, (2) issues that project participants may encounter, and (3) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.8.1 Issues That Were Encountered by the Project Participants

The project participants encountered one issue in the area of intellectual property rights. This issue, which was discussed by representatives from both the public and private sectors, developed in the early phases of the project and have not been fully resolved:

ISSUE 1: THE OWNERSHIP AND USE OF THE INTELLECTUAL PROPERTY WAS NOT CLEAR

The ownership of the new technology developed and the knowledge gained during the operational test was not addressed adequately. This includes the rights to the software that will be developed during the integration of Ali-Scout, the ATIS, and SCATS, the ATMS.

The primary cause of this issue was *traditional thinking*. Intellectual property developed under publicly-funded projects usually is put into the public domain. Therefore, it was originally determined that all intellectual property belonged in the public domain even though a private company would pay for some of the development costs. No exceptions were granted under the first agreement.

A related cause was the *different interpretations* of the FAR. Some participants did not realize that federal law actually allows and encourages private partners to retain intellectual property rights and to gain from them.

The primary effect was that the project was *slowed* down. This discussion of intellectual property rights led the FHWA to *modify* the intellectual property right clauses and to describe them in clearer terms. This issue, however, has not been resolved. The interviewees and respondents stated that it will surface again when new contracts are negotiated between the public and private sectors.

Two **lessons** were learned in this area. First, a private sector representative suggested that intellectual property rights should be used as an incentive for getting the private sector to participate. Companies must be enticed to enter the IVHS area. Second, a public official recommended that legal counsel be involved early in the process in order to secure private sector concerns regarding proprietary information.

3.8.2 Issues That May Be Encountered by the Project Participants

Some project participants mentioned that this issue may occur again as new contracts are negotiated. They feared that this issue could cause a deterioration of the partnership, limit private sector participation in the operational test, or hinder the development of technology, and has a potential for litigation.

3.8.3 Issues That May Be Encountered in Future Operational Tests or Deployments

Project participants also mentioned that this issue may affect others planning to deploy an IVHS product or service. Because of intellectual property rights requirements, participating companies may be unwilling to share or cooperate fully. Companies may determine it is not in their best interest to design what others can use and sell. Companies may design only products that they can use, products based on propriety concepts and developments.

This might mean that the public sector does not receive the best technology. It may not receive a generic product but one that only works with a company's other products. A contractor could bias the integration of the two systems to work only with a specific system.

3.9 PUBLIC PERCEPTION

This section discusses the issues and lessons learned in the area of public perception. It is divided into three issue areas: (1) issues that the project participants encountered and the lessons that were learned addressing these issues, (2) issues that project participants may encounter, and (3) issues that others deploying IVHS technologies may encounter and suggestions to alleviate these possible issues.

3.9.1 Issues That Were Encountered by the Project Participants

There are two issues that project participants encountered in the area of public perception and relations. These issues developed in the early phases of the project. Representatives involved in policy making, project administration, technical support, and evaluation discussed these issues:

ISSUE 1: NEGATIVE PUBLIC PERCEPTION

Two representatives from the public sector and one from the private sector discussed this issue. One interviewee stated that the initial public perception of the project was negative because a *glitch* occurred when the project partners first turned on the SCATS. This incident caused traffic problems until the system was corrected.

Another project participant stated that some Oakland County residents feel that funds are not being spent appropriately. They want funds used to fix *potholes* and not spent on new technologies. Some of this negative perception may be caused by the media misrepresenting or misinterpreting the goals and objectives of the project. The RCOC receives an occasional complaint from residents who suggest that the RCOC improve road surfaces and not install new equipment.

A third interviewee mentioned that some public and private parties perceive Siemens is profiteering from the project. This perception is caused because the public and private sectors have goals that differ.

Project participants from all three sectors offered **lessons** regarding public perception. One public sector representative said that attention must be paid to the *importance of perception*. Recognize that the public will be the biggest critic and they are vocal. Be conscious of how the public perceives the project. Communicate with the public. Keep them informed of the benefits to them, long- and short-term costs, timetables for expansion, etc. The taxpayers are the ones who will ultimately decide if this project is going to work or not.

Representatives from all three sectors said do not *oversell* the system. Be accurate in the description of the system and its capabilities. Be realistic and do not overstate the benefits of the deployed system.

One private sector official stated that a *good public relations* effort is required. Identify key persons and organizations and dialogue with them. Educate key decision makers and the general public. Examine existing studies and surveys and counteract any negative perceptions.

The interviewees and respondents offered other lessons:

- Unfamiliarity with technology breeds negative reactions; perceived problems create negative impacts. Educate drivers regarding new traffic system. For example, the SCATS requires drivers to stop at the light bar in order to appropriately activate the system.
- The project must have an image of being a doable project.
- Have something to deploy at the end of the project; identify a deployed product.
- A public relations (PR) consultant should be added. Make an effort to manage crises from a PR perspective.
- A formal evaluation is a very important project element. It will help inform the public of the positive aspects of the project.
- The traveling public must perceive that the project is acceptable and worthwhile and that the deployment of IVHS technologies help the safety and mobility of the users.

ISSUE 2: THE VOTERS AND MEDIA OF OAKLAND COUNTY CONSIDERED THE TRIP TO AUSTRALIA BY OFFICIALS OF THE ROAD COMMISSION FOR OAKLAND COUNTY FRIVOLOUS

In addition to RCOC engineers, RCOC officials traveled to Australia to observe the SCATS and talk with RTA officials. The attendance of these officials was considered a frivolous use of taxpayers' money. Because of this issue, it is more difficult for RCOC staff to travel abroad thus restricting their exposure to new technologies. Also, this issue made the RCOC more aware of and sensitive to public perception.

One public official proposed one lesson. Avoid sending visible groups on foreign travel to assess new technologies. The public may not perceive such activity as a good investment of taxpayers' money.

3.9.2 Issues That May Be Encountered by the Project Participants

Several project participants mentioned that the lack of public acceptance may be an issue in future phases of the project. The general public and private and public decision makers may not be "sold" on the technology or its usefulness. An example was given. GM and Macomb County implemented Traffic Pack in the 1960's. This ATMS-like system was not accepted by the traveling public and was eventually canceled.

Also this lack of acceptance may be caused by the "Big Brother Syndrome." The public may perceive that the IVHS technologies will be used for surveillance and, therefore, infringe upon their privacy.

One project participant feared that the project may not meet the public's expectations and lose its credibility. The systems may not have the impact on the capacity of the system or the distribution of flow across the network as expected by the traveling public. Also travel times in the network may be so short that drivers will not see any advantage in altering their routes.

3.9.3 Issues That May Be Encountered in Future Operational Tests or Deployments

The project participants mentioned that the issues they may encounter may also be encountered by others deploying an IVHS product or service. They also stressed that a disregard of public perception by the operational test partners would severely hinder the operational test.

3.10 TECHNOLOGY AND STANDARDS

This section discusses the issues that project participants encountered and the lessons that were learned from addressing the issues in the area of technology and standards. The third issue, dealing with IVHS standards, will also be encountered in future operational tests and deployments.

3.10.1 Issues That Were Encountered by the Project Participants

The project participants encountered three issues in this area:

ISSUE 1: THE FAST-TRAC PROJECT USES FOREIGN SOFTWARE AND HARDWARE

The use of SCATS and Ali-Scout technologies created some controversy; both are foreign technologies. SCATS was developed by the Roads and Traffic Authority of New South Wales, Australia and Ali-Scout is the U.S. adaptation of the Euro-Scout System, which Siemens developed and tested in Germany. The main cause of this issue was the "Buy American" requirements contained in the FAR and the State of Michigan procurement requirements. Another cause was that the RCOC had to be convinced that Ali-Scout would work in the United States.

This issue *delayed* the project while participants reviewed the procurement regulations. They determined that the SCATS and Ali-Scout technologies involved non-restricted equipment and could be used in the project.

Three **lessons** were learned by addressing this issue. The first two were presented by representatives of the private sector and the third by a representative of the public sector:

- There is a need to be more open-minded and to accept technologies from other countries. Transportation is not local but international in scope.
- IVHS technologies developed abroad need to be enhanced in order to be adapted for use in the U.S.
- The "Buy-American" provision is a significant factor with IVHS projects. It must be considered when purchasing equipment.

ISSUE 2: THE INTEGRATION OF AN ADVANCED TRAFFIC MANAGEMENT SYSTEM AND AN ADVANCED TRAVELER INFORMATION SYSTEM HAS NEVER BEEN TRIED

Representatives from the public and private sectors mentioned that the integration of an ATIS (Ali-Scout) and an ATMS (SCATS) is a challenge for the FAST-TRAC partners. The cause of this issue is that the partners are breaking new ground. They are striving to do something which has never been done before. Also the SCATS and the AUTOSCOPE system had to be successfully integrated before the integration of the ATIS and the ATMS could proceed.

The interviewees expressed several concerns:

- Would the appropriate number of vehicles be operating in a wide enough area in order to serve as probes so the system knows where the congestion is?
- Would the appropriate number of intersections be under SCATS control?

- Will the system route traffic dynamically?
- Would the system update time be fast enough to provide timely data?

One project participant mentioned that the integration of the ATIS and the ATMS did not start fast enough and feared that time and money may run out before the work is completed. This issue has not been resolved because the partners are currently working on the integration of the two systems.

One interviewee said that the successful resolution of this issue would have two effects. First, the installation and effective operation of FAST-TRAC would reduce the need for extensive capital improvements for the counties roads. Second, the on-time installation will serve as a case for effective planning and implementation which the RCOC can use for other more traditional responsibilities.

ISSUE 3: THE IVHS PROGRAM LACKS STANDARDS, ESPECIALLY IN THE ATIS AREA

The Intermodal Surface Transportation Efficiency Act (ISTEA) requires the development of standards and protocols to promote the widespread use of IVHS technologies. Consumers must be able to purchase units that can operate in different locations. Because the IVHS program is new, these standards have not yet been developed. This means that different technologies are being developed and tested, some of which may not meet the standards.

This issue has been encountered by the current project participants and will also be encountered in future operational tests and deployments. The effect on the tests and deployment sites will not be known until the standards are developed. One effect of this issue may be that the nationwide standards that are developed may *differ* from the IVHS technologies used in the FAST-TRAC project. Another effect is that the lack of standards may *stifle* technological advancement because firms may not invest in a technology that may not meet the standards.

A representative of the public sector offered one simple lesson: Standards are very important and should not be overlooked.

3.11 LESSONS LEARNED NOT RELATED TO SPECIFIC ISSUES

This section lists the lessons that were learned by the interviewees and questionnaire respondents which are not related to a specific issue. Most of these lessons were offered by the interviewees and respondents when asked, "What was the most important lesson that you learned that you would share with others deploying IVHS technologies?" Others lessons were offered spontaneously by the project participants during the interview or while responding to the questionnaire.

One interviewee put it very succinctly, "**There's a lot to learn.**" Another said, "The most important lesson I learned was **patience**. The FAST-TRAC project has come far but it was a **slow process**." Another interviewee offered this suggestion--"**Do a good job.**" Apparently, this sug-

gestion is appropriate because a second individual learned this lesson--"FAST-TRAC has a lot of things going right for it. The people are motivated to **do a good job.**"

There were six significant lessons learned that were shared:

- Know What To Expect
- Identify and Foster Project Champions
- Develop a National Perspective of IVHS
- Define Clear Project Goals and Objectives
- Plan for an Early Success
- Develop Support for an IVHS Industry

The first three lessons were offered by approximately a fourth of the interviewees and respondents. The other three were mentioned by two or three individuals. Four of the six lessons were shared both by public and private sector participants. The lesson on developing a national perspective was offered by representatives of all three sectors; the lesson on planning for an early success was offered only by public sector participants. All six lessons were shared by those involved in setting policy, those involved with administering the project, and those involved in other disciplines that support the project.

Lessons learned or suggestions offered only once are listed under Other Comments and Suggestions. The first three were offered by private sector participants; the last two by the public sector. The first four were offered by those involved in setting policy:

LESSON 1: KNOW WHAT TO EXPECT

Potential OFT partners must approach the project with an awareness that issues will arise, a true commitment to the project, and a willingness to cooperate. They also must know the requirements of establishing partnerships. The project does not proceed as perceived and, at times, the process does not go smoothly. IVHS projects differ from highway construction projects and are not recurring projects. OFT participants should not get alarmed if institutional issues are encountered--addressing these issues builds character. Be prepared to invest a significant amount of time and effort into the project. Expect some things will be missed or overlooked, but they probably won't be important things.

LESSON 2: IDENTIFY AND FOSTER PROJECT CHAMPIONS

An OFT must have one or more strong local champions. They need to be aggressive and must push the project forward. They must be involved for the duration of the project. In the case of FAST-TRAC, John Grubba initiated the program, and Ron Knockeart had to sell the project to Siemens headquarters managers in Germany. These and other key individuals, who believed the project would be successful, convinced others that it would work.

Project personnel also must become knowledgeable in IVHS concepts and practices. They must develop a standing and competence in the IVHS area so that they can convince the appropriate persons--decision makers and potential users--of the benefits of IVHS.

LESSON 3: DEVELOP A NATIONAL PERSPECTIVE OF IVHS

The participants in IVHS activities need to generate a "what's good for the nation" enthusiasm among transportation agencies and industry. Openness from beginning to end is important. Operational test players must interact at the national level, gain knowledge from that interaction, and apply that knowledge to the local project. Knowledge must be gained from other tests; the test participants must understand what lessons have been learned at other operational tests. The participants of operational tests also must be willing to share information with others at a national level. This national interaction is required to achieve the required standards and seamless architecture required of IVHS. It is not in the national interest when participants in OFTs are not being open and do not want to talk about their IVHS activities.

LESSON 4 DEFINE CLEAR PROJECT GOALS AND OBJECTIVES

The OFT should not be a proving ground for hardware or software. An OFT must be conceived, designed, and have as a goal the solution to a real problem. Goals and objectives must have merit and offer significant gains to transportation in general. Clearly define reasonable project goals, objectives and deliverables at the out-set of the OFT. Sort out what you are gaining from participating.

LESSON 5 PLAN FOR AN EARLY SUCCESS

Success breeds success! Get an early success. An early success, even if small, will go a long way to build momentum, help obtain future funding, ensure public support, garner valuable participants, and set the stage for future success. Interest in IVHS will be built through demonstrations of success. Additional resources will follow successes.

LESSON 6: DEVELOP SUPPORT FOR AN IVHS INDUSTRY

Corporate America still looks at IVHS as "pie in the sky" while sitting in gridlock in a shiny new car with a cellular phone in hand. Develop support for IVHS. Establish local or state IVHS organizations. Get entrepreneurs involved, not just the large established companies. An IVHS industry must be developed.

OTHER COMMENTS AND SUGGESTIONS

- Progress is made by individuals with adequate support and resources who serve on committees, not by the committees themselves.

- The private sector needs customers - Customers need funds - Fund IVHS - Remove it from operational tests.
- There needs to be a long term vision of success, i.e., a 10-year or 20-year plan.
- Some stumbling blocks were not what were perceived previously, such as the Freedom of Information Act.
- FAST-TRAC must be a regional system. It should include other counties and, possibly, other states.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

Ali-Scout	Ali-Scout (dynamic route guidance) System
ATIS	advanced traveler information system
ATMS	advanced traffic management system
AUTOSCOPE	AUTOSCOPE™- 2003 Video Vehicle Detection System
CSF	critical success factor
CVO	commercial vehicle operations
DOT	Department of Transportation
FAR	Federal Acquisition Regulation
FAST-TRAC	Faster And Safer Travel through Traffic Routing and Advanced Controls
FHWA	U.S. Department of Transportation Federal Highway Administration
FY	fiscal year
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
IVHS	intelligent vehicle - highway system
MDOT	Michigan Department of Transportation
MOE	measure of effectiveness
MOU	memorandum of understanding
MPO	metropolitan planning organization
MSU	Michigan State University
MTC	(MDOT's) Metropolitan Transportation Center
OFT	operational field test
PR	public relations
RCOC	Road Commission for Oakland County
RTA	Road and Traffic Authority, New South Wales, Australia
SCATS	Sydney Co-Ordinated Adaptive Traffic System
Siemens	Siemens Automotive L.P.
TOC	(FAST-TRAC's) Traffic Operations Center

UM University of Michigan
Volpe Center U.S. Department of Transportation
 John A. Volpe National Transportation Systems Center

APPENDIX B

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REPORT

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