APPENDIX E

NONTECHNICAL CONSTRAINTS AND BARRIERS TO THE IMPLEMENTATION OF ITS: 1996 REPORT TO CONGRESS

A Report to Congress

Nontechnical Constraints and Barriers to the Implementation of Intelligent Transportation Systems

*Update **of** the 1994 Report*

U.S. Department of Transportation
Federal Highway Administration
Joint Program Office for Intelligent Transportation Systems
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TABLE OF CONTENTS

1. SUMMARY

The Inter-modal Surface Transportation Efficiency Act of 1991 (ISTEA) mandated that the Secretary submit to Congress a report addressing the nontechnical constraints to the implementation of the Intelligent Transportation Systems (ITS) Program and that the initial report be updated in 1996. The initial 1994 Report to Congress featured a comprehensive discussion of nontechnical issues that were believed to be impediments to the successful deployment of ITS. Over the past two years, the U.S. Department of Transportation (U.S. DOT) has commissioned extensive studies of institutional and legal issues. Reviews of ITS field operational tests and demonstration projects; abstracts of scholarly papers and presentations; summaries of interviews with state, regional, and local transportation practitioners; and reviews of state and local procurement and partnering practices represent a few of the many materials used to compile this supplemental report. This report, which fulfills the requirements under ISTEA to update the 1994 Report, contains a discussion of the nontechnical issues identified for further study in the initial Report to Congress and summarizes the conclusions to be drawn from the recent studies.

The overriding conclusion is that there are no nontechnical "show stoppers" to the deployment of ITS technologies. While institutional and legal impediments do exist, they either *have been* or *can* be overcome. In some areas, such as privacy, public-private partnerships, and government procurement regulations; legislative change may be necessary. In other areas, including staffing and education and liability; outreach, technical training, and education are necessary. In all areas, the key to overcoming most constraints is realizing that certain problems *will* arise and must be addressed early in project planning.

The staffing and education needs of transportation agencies and the development of design and performance standards are two of the most pressing nontechnical issues confronting the ITS Program today. Fulfilling staffing, training, and education needs has been a constant challenge for transportation agencies. For the successful deployment of ITS, existing employees must be retrained or individuals with new skills must be hired. Change is essential at all levels of government but presents a particular problem for local transportation agencies, which often lack the funding and staff to travel to informational sessions. Participants in studies and field operational tests have also noted that there is a need to educate elected and appointed officials and the general public. This outreach is considered crucial to increase awareness of the ITS Program, including the staffing challenges it presents. The Department should take the lead in training technical staff at all levels of government and in reaching out to public officials and the general public.

The development of standards is also an issue which has received significant attention and will be the focus of mora scrutiny over the coming years. The lack of standards has been presented as an impediment since the inception of the ITS Program. ITS project participants feared that a dearth of standards would prevent private firms from researching, developing, and marketing ITS products. Participants also feared that public-sector agencies would not deploy technologies that would later be incompatible with newer systems. Industry analysts realize that there are

risks associated with the setting of standards. However, many members from both the public and private sectors are eager for the development of standards which they believe will enable the deployment of consistent, non-interfering, and reliable systems on local, regional, and national levels. A second important role for the Department is to facilitate the development of standards.

In considering potential barriers to ITS deployment, the *legal* community also expressed some initial concerns. Legal experts theorized that the deployment of ITS technologies would result in increased tort and product liability claims and that fear of litigation would have a "chilling effect" on the entry of the private sector into this field. Studies show these fears were unfounded. There has been no significant litigation, and there is no evidence that fear of liability has deterred industry involvement. Concerns still exist, however, with respect to potential liability arising out of the failure of proposed systems for advanced vehicle control in which the control of the vehicle is transferred from the driver to the automatic system (e.g., automatic braking systems and automated highways). As these technologies are developed, concomitant studies should be performed to investigate the legal risks they may pose; the resulting legal-risk management options should then be explored.

On the other hand, an area of continuing concern to the private sector is the question of allocation of potentially valuable rights in intellectual property (computer programs, patentable inventions, proprietary technical data) developed with public funds. Unless project participants address these issues early in the process, negotiation of the allocation of rights in intellectual property and clauses protecting preexisting data and trade secrets can cause significant delays in establishing public-private partnerships. Studies indicate that current Federal policy can accommodate the reasonable expectations of both private and public entities in intellectual property developed under federally funded ITS projects. As samples of successful clauses circulate and Federal policy regarding protection of proprietary information and allocation of intellectual property rights is disseminated, delays related to negotiation of intellectual property rights should be dramatically reduced.

An area where some individuals have indicated concern is the loss of privacy resulting from ITS data collection. Of course, privacy concerns extend to all types of surveillance and electronic information-gathering and storage activities, not solely those that relate to ITS. The privacy concerns expressed by the public about ITS technologies are similar to those expressed at the advent of automated teller machines (ATMs). However, the majority of Americans seem willing to weigh the benefits of such technologies against a slight loss of privacy. When surveyed, only 25 percent of the public is totally opposed to any loss of privacy regardless of the social good which may result. To date, there have been no serious constitutional or statutory challenges to the use of ITS technologies on the grounds of invasion of privacy.

In response to these concerns, the Privacy Task Group of the Legal Issues Committee of ITS America has formulated Fair Information and Privacy Principles, which provide a voluntary standard for participants in ITS projects. The principles include a respect for individual privacy, compliance with Federal and State privacy laws, and the visible maintenance of these standards in ITS deployment. The Department must encourage public discussion and wide dissemination of these principles. Also, the Department should continue vigilant operational monitoring to

determine whether there is misuse of ITS-generated information and whether Federal legislation is necessary to establish ground-rules for collection, storage, sale, and use of ITS information.

ISTEA also mandated a study of whether antitrust laws would impede ITS deployment. However, it appears that antitrust concerns have become a "non-issue" since the 1994 Report. There has been no civil litigation over ITS antitrust issues, nor have any of the field operational tests required the review of the Department of Justice (DOJ). It appears highly unlikely that antitrust issues will create even a slight impediment to ITS deployment in the future.

To realize the full potential of ITS deployment, the Department has encouraged the formation of public-private partnerships. Government agencies and private-sector firms together can achieve what neither can do alone. Successful projects demonstrate that by sharing the risks both parties share the rewards: the public sector achieves its transportation management objectives and the private sector obtains a return on investment. It has become clear, however, that the areas in which public-partnerships will succeed is limited. Although partnerships were initially thought possible in all areas of ITS, the primary place for partnerships now appears to be in the provision of traveler information services as information service providers (bundling information from various sources) and in developing traffic management technology. State and local transportation agencies must develop the infrastructure that will permit the private sector to access basic transit and traffic data.

It is evident that to be successful, public-private partnerships require cooperation, trust, and mutual benefit. They also require new legal and institutional mechanisms for public-private cooperation. Equally important is the requirement for multi-jurisdictional coordination among public agencies to provide for the integration of ITS projects within a region. The required changes in culture and attitude are occurring, but public-sector inter-jurisdictional coordination is lacking in many areas. States, localities, and other public entities are only slowly addressing the need for cooperation and must be encouraged to enter into dialog and new relationships with other public entities. The Department should continue to promote activities, such as regional planning studies, that require interagency coordination and to encourage the incorporation of ITS development into the tradition of transportation planning process.

Both the public and private sectors have recognized that the methods supported by government procurement regulations suitable for highway construction projects present an ongoing impediment to ITS deployment. State and local agencies need the authority to use flexible procurement procedures and will need to gain experience in exercising these procedures. For ITS to be successfully deployed, change will have to occur in state and local agency procurement processes and in the types of contracts awarded.

The impact of ITS deployment on the environment is still unclear. Careful deployment of ITS may yield environmental benefits in terms of improved air quality and reduced fuel consumption. Recent research has included studies of the relationship between ITS and travel behavior, transportation system performance, vehicle emissions, fuel consumption, and air quality. However, work remains to be completed in addressing these issues.

Current modeling efforts should be continued and directed towards an eventual goal of integrated modeling of travel behavior, traffic, vehicle emissions, and fuel use. Integrated models should be able to model the influence of a number of ITS technologies and user services, rather than the effect of a single service, as ITS will most likely be implemented in "bundles" of services. Additionally, validation, maintenance, and application of new models must be considered.

There are also advocates for expanding the definition of environmental impact to include a number of factors beyond air quality and fuel use. These other "environmental" issues include the influence of ITS on land use, the social equity of the benefits and burden of ITS, and the role of ITS in building sustainable communities.

2. STAFFING AND EDUCATION NEEDS

ISSUE: *Public sector transportation staff lack the education, skills, and experience necessary to plan, deploy, and operate new ITS technologies.*

Introduction

The introduction of new technologies necessitates changes in the existing work force. Employees must acquire new skills, or the number of workers with existing skills must be increased. Just as the work force changed to accommodate previous advancements in transportation and in other fields, so too is the ITS Program dependent on such a modification. This change, however, may lag behind the advancement of the technology. Transportation officials have placed an increasing emphasis on developing effective techniques for defining and satisfying training needs, as well as for measuring the results of training. Although effective training is expensive and time consuming, transportation officials have found that the benefits far outweigh the costs. [1]

The 1994 Report to Congress

The 1994 Report highlighted three principal areas:

- *Skill requirements for ITS*
- *Staffing requirements for ITS*
- *Private sector and public sector staffing challenges.*

The Report identified several concerns, including: (1) a lack of qualified engineers and technicians, (2) a lack of expertise required to staff operations and management centers, and (3) a lack of university training in new technologies for students entering the field. [2] The Report concluded that although, in the long term, there will not be a shortage of trained workers for the ITS Program, state and local transportation agencies may be unable to hire and retain adequately skilled workers because of low pay or hiring constraints.

Findings

The following summarizes the most recent research on education and training needs:

- *Field Operational Tests*

  Lack of Skills

  Solution

  During the evaluation of ITS operational tests, some participants stated that current staffs lacked the skills necessary for ITS projects. The newness of the ITS Program is the likely cause of this problem, which resulted in project delays. Participants resolved the issue by hiring additional technical and administrative staff, training existing staff, and relying on consultant. [3]

Promotion of ITS

Interviewees also stated that ITS technologies must be promoted to state and local organizations, the general public, and the private sector in order to increase the awareness of the ITS Program. Interviewees stressed that funding must be committed for this outreach. [4]

Development of Educational Materials

A report based on the evaluations of field tests recommended that the U.S. DOT and other agencies involved in ITS should develop educational materials for state and local transportation agencies. The educational material should include information on ITS products and services, the benefits of deploying ITS, the identification of successful ITS deployments, the explanation of Federal and State policies and procedures, and the formation of public-private partnerships. [5] The report also suggested the creation of a fellowship program for staff at state, regional, and local agencies.[6]

- *ITS America Annual Meeting*

"Responding to ITS Training Needs: A Curriculum for 21st Century Professionals"

Two papers at the 1994 Annual Meeting addressed ITS education and training needs. The first stated that a department can ensure the continued delivery of quality transportation services by making its employees "aware of the coming technological changes, their probable effects, and how to take advantage of them." [7] The author suggested six objectives for a curriculum to introduce advanced technology concepts to current transportation officials. Objectives include increasing employees' understanding of the role of advanced technology in transportation departments and familiarizing employees with the capabilities and benefits of advanced transportation technologies.[8]

"IVHS Staffing and Education: The Labor Supply Response"

The second paper stated that "an important component in shifting workers into ITS-related fields is the development and implementation of quality training programs to complement the existing education, experience, and job skills workers bring to the market." [9] For example, "although there are large numbers of electrical engineers in the labor force, many lack experience in transportation and traffic management. Similarly, there are many computer programmers and software engineers, but few who can assure high software quality and reliability required for ATMS [advanced traffic management systems] and AVCS [advanced vehicle control systems]."""

Current Thinking

- *Urban Traffic Engineering Issues and Answers*

In 1995, the Institute of Transportation Engineers (ITE) and the Federal Highway Administration (FHWA) reported on a project that investigated the needs of urban traffic engineering agencies nationwide. As part of this research effort, two surveys were conducted: *Operations and Maintenance of Urban Signal Systems and Advanced Traffic Management Systems,* which focused on local agencies, and *Operations and Maintenance **of** Freeway Advanced Traffic Management Systems,* which focused on state agencies.

Local Agencies

In the survey of the local agencies, 44 percent of the respondents judged their ability to operate and maintain their systems at a fair or poor level." Thirty-five percent of these respondents stated that the lack of qualified technical and maintenance personnel was a severe or major problem, and 32 percent cited it as a minor problem. The lack of qualified *professional* personnel was cited as a severe or major problem by 23 percent of the respondents; 46 percent rated it as a minor problem. [12]

State Agencies

In the survey of State agencies, one-half of the respondents rated their ability to *operate* automated systems as fair or poor while 66 percent rated their ability to *maintain* such systems as fair or poor.[13] Of the respondents who rated their ability at a fair or poor level, 71 percent felt that improved training of personnel would increase their ability to *operate* their systems and 100 percent said improved training would increase their ability to *maintain their* systems.[14]

- *Urban Traffic Engineering Education and Training Needs*

The ITE also conducted a third survey, *Education and Training in Traffic Engineering.* Survey results indicate that nearly 75 percent of responding agencies have used short courses covering basic traffic engineering in contrast to less than 18 percent using a short course for ITS. Forty percent of the respondents anticipate needing ITS-related courses, but only 33 percent are aware that such courses exist.[15] "This finding, combined with NHI [National Highway Institute] estimates that 300 new entrants into the field

300 New Entrants Necessary

will be necessary to meet the needs of emerging ITS technology, emphasizes the need to expand existing programs to meet these needs."[16]

Reasons for Inadequate Training

A report prepared under the ITE research effort states five major reasons why staff members do not receive adequate training: (1) heavy workload, (2) unavailable funding to participate, (3) long duration of courses, (4) inconvenient place of training, and (5) inconvenient time scheduling of training.[17] This paper recognized that ISTEA presents metropolitan planning organizations (MPOs) and state and local transportation agencies "with many new challenges that require additional technical skills." The report concluded that there is "room for adding newer courses, enhancing existing courses, and improving the delivery process for training."'*

- *Metropolitan Area Reviews*

During a review of seven metropolitan areas," many interviewees emphasized that existing employees at the state and local level need more technical training and education to meet the demands of ITS. Furthermore,

Expanded Definition of Training and Education

many interviewees expanded the concept of training and education to include reaching out to elected and appointed officials and the general public to make them aware of the ITS Program. Lack of awareness or support for the ITS Program by politicians, upper management, and the general public is a barrier to ITS deployment.

Local Needs Overlooked

Municipal representatives overwhelmingly expressed the opinion that neither the U.S. DOT nor ITS America have approached *local* transportation officials in an attempt to understand local needs, including the need for technical training. Funding and travel constraints often prevent local staffs from pursuing ITS information, with the result that staffs may be unaware of successful ITS applications and behind in technical training.

Special Skills Needed

Agency representatives also stated that special skills are required to work on ITS projects. Skills are needed in the areas of systems integration, telecormnunica-tions, electronics, computer hardware and software, information systems, and incorporating ITS functions

into current transportation modeling systems. A lack of staff expertise in these areas can hinder routine consideration of ITS as a transportation solution. Officials also discussed that technical training must be ongoing. They are concerned that rapid changes in ITS technologies cause the information acquired by training to become moot in a very short time.[20]

Ongoing Need for Technical Training

- ***ITS Architecture Implementation Strategy***

The System Architecture team stated that steps should be taken in education and training to ensure the early successful implementation of ITS.[21] The team cited two significant areas in which staff skills or availability will not be sufficient. The first area is the staffing and managing of regional transportation management centers, especially in rural areas. Staff will be required to understand a broad array of electronic devices and systems and the labor pool may not have the skills or education to do so.[22] The second area is the maintenance of ITS services. The architecture team envisions agency staff, equipment manufacturers' field staff, and private service providers sharing the responsibilities in this area. All these entities require trained technicians. A heavier burden, however, is placed on the public sector because, regardless of the service provider, public agencies must still employ staff capable of understanding the system, interpreting the outputs, and communicating with the service provider.[23]

The team states that "over time, the need for customized training could level off, as...systems become increasingly routine... However, this will not reduce...the requirement for the new generation of transportation professional."[24] They also note that formal curricula presented by educational institutions must change to incorporate informational technology and system design courses into the current curricula and that the delivery format of training must change to ease the burden of training and education.[25]

- ***Key Opportunities and Issues***

A paper prepared for the 1996 ITE International Conference noted that existing transportation agency staff may not have the skills and knowledge required to operate in a high-tech, information-rich environment

such as will be provided by intelligent transportation systems. This paper presented two alternatives for agencies to acquire the necessary skills: by retraining existing personnel or by creating new positions staffed by individuals with the required skills. Either way, funding must be identified and allocated to ensure that adequately skilled personnel are hired or retained.

Solution

The report also cited two programs that could be used by state departments of transportation (DOTs) to provide their current and future staffs with the knowledge and skills to operate and maintain ITS. One possible program could be similar to that of the military. The military sends its technicians to factory schools on virtually every new item of equipment purchased. These technicians become experts at servicing that particular item. Another way to ensure that staff receives the proper skills to operate and maintain systems is through the procurement process. During procurement, state and local DOTS should make sure the contractor has adequate experience with preparing training plans and performing training of technical personnel.[26]

- ***1995 ITS America Workshop***

In 1995, ITS America sponsored a workshop to address ITS training and education needs. The needs were divided into the demand for training and the supply of training.

The most striking observation is the need for education and training in two specific areas: economics and awareness. First, the lack of understanding on the benefits and costs of ITS and comparisons of ITS technology with other means of addressing critical mobility needs was felt to be a significant deterrent to deployment. Second, lack of awareness of what ITS is and what it can do to improve societal mobility was cited as another major hurdle. Even among ITS providers, public transportation agency leaders and technology company executives need greater exposure to ITS and the nature of the ITS market.

- ***Five Year Strategic Plan for Professional Capacity Building***

  Solution

The FHWA Office of Traffic Management and ITS Applications released the "Five-Year Strategic Plan for Professional Capacity Building" in March 1996. This report identifies the parties that require training and education and defines the ITS knowledge and skills required in the short term (l-2 years) and the long term (5+ years). The knowledge and skills cited were: (1) awareness-general awareness and overview knowledge of ITS program elements, (2) ***overview*** basic knowledge of specific ITS program elements, (3) specialized-intermediate knowledge of specific ITS program elements, and (4) intensive-advanced in-depth knowledge of specific ITS elements and emerging state-of-the-art technology.[27] The report then outlines a plan for meeting the training and education needs of these parties.

During this fiscal year, the Department will concentrate on staffing and educating the federal transportation work force. This includes increasing the visibility of ITS among U.S. DOT generalists and providing specialized and intensive training to the Department's technical staff. In the following years, the Department will focus on other sectors of the transportation community. The Department currently is developing an executive overview of ITS and training in six key areas (public-private partnerships, procurement and project delivery strategies, planning, systems engineering and architecture, ITS and transit, and telecommunications) which will be presented this year.

- ***Identification of Similar Needs***

The Capacity Building Plan's training and education goals for state and local transportation officials are closely in line with the requests made by the state and local officials interviewed during the metropolitan area reviews. The officials reported that training and education should be provided for elected and appointed officials, transportation professionals and technicians, and the general public.

Conclusions

The training of transportation staffs is the most pressing nontechnical issue confronting the ITS Program today. Studies conducted after the initiation of the Interstate Program found that

the retention, performance, and training of personnel are of "primary importance-because the efficiency with which any organization can operate depends more on effective utilization of human resources than on any other single factor."[28] Consequently, fulfilling staffing, training, and education needs for transportation staffs has been a constant challenge for transportation agencies. This is especially true when program emphasis changes, such as in the implementation of the Interstate Highway Program, and when new technologies are introduced. The ITS Program incorporates both of these conditions. It is changing the transportation emphasis from building new roadways and other physical facilities to better managing the existing system. It also uses the latest electronics, communications, information, and computer technologies to affect this change. The need to educate ITS Program participants has been discussed since the inception of the program; the need for education still exists. Staff require training and education to carry out this new ITS mission.

The Department has placed a high priority on training and education and will be expending considerable resources to initiate and maintain an effort in this area. The amount of staff time devoted to prepare, test, and present course material, however, may reduce the staffing available for other deployment activities and may create an adverse impact on these activities.

Transportation staffs in all levels of government require training, but it is most difficult for local transportation staff to acquire it. Local practitioners do not have the funds to travel. City and county officials often have tight budgets and are unable to travel outside of the state. These travel restrictions often apply to state agencies as well.

It has also been noted that the education process should be expanded to include elected and appointed officials and the general public. ***Reaching out to these officials and the general public to make them aware of the benefits of ITS is another important issue that must be addressed.***

Recommendations

- Continue the development of the U.S. DOT's Professional Capacity Building Plan and fund the recommended strategies.[29]
- Provide awareness opportunities and technical training directly to state, regional, and local transportation staff.
- Promote and publicize the ITS Program to state and local elected officials and the general public.
- Develop an information (or technology) transfer program to provide information directly to local and regional transportation agencies.
- Assign points of contact who can provide answers to specific technical and nontechnical questions from state and local officials.
- Investigate the merit of an ITS practitioner certification program.
- Provide guidance on the use of Federal resources for ITS. Identify what technologies are eligible for Federal funding and publicize the criteria that are used to determine the appropriate funding sources. Identify funding sources for training that cover the ongoing operations and maintenance of completed ITS.

Endnotes

1Highway Research Board, ***Recruiting, Training, and Retaining Maintenance and Equipment Personnel,*** National Cooperative Highway Research Program, Synthesis of Highway Practice 10, Washington, DC, 1972, p.32.

2 Many of the findings and conclusions presented in the Report to Congress were drawn from the paper, ***IVHS Staffing and Educational Needs,*** which was commissioned by the U.S. DOT and prepared by the Urban Institute.

3 Volpe National Transportation Systems Center, ***Analysis of ITS Operational Test: Findings and Recommendations,*** FHWA-JPO-95-009, Final Report, September 1995, pp. 59-60.

4 ***Ibid.,*** p. 85.

5 ***Ibid.,*** p. 88.

6 ***Ibid.,*** p. 91. For example, a fellowship program would help those who wish to develop greater expertise in the field of ITS.

7 Paul P. Jovanis, "Responding to IVHS Training Needs: A Curriculum for 2 1 st Century Professional Education," ***Moving Toward Deployment,*** Proceedings of the IVHS America 1994 Annual Meeting, Atlanta, April 1994, p. 96.

8 Other objectives for a curriculum include introducing employees to liabilities and risks associated with advanced transportation technologies (both for department and system users); providing employees with a framework to understand the forces at work in the development of advanced transportation technologies in the economy as a whole; suggesting new skills for workers to apply to their jobs; and identifying opportunities in managing technological change and understanding how technology may change the form and function of the transportation department organization.

9 Patrice Flynn et al., "IVHS Staffing and Education: The Labor Supply Response," ***Moving Toward Deployment,*** Proceedings of the IVHS America 1994 Annual Meeting, Atlanta, April 1994, p. 117.

10 ***Ibid.***

11 Institute of Transportation Engineers, ***UrbanTraffic Engineering Issues and Answers: Operation and Maintenance of Electronic Traffic Control Systems,*** Washington, DC, 1995, p. 12.

12 ***Ibid.,*** p. 14.

13 ***Ibid.,*** p. 17.

14 ***Ibid.,*** p. 18. All of the respondents also said increased staff size would add to their ability to both operate and maintain their systems.

15 Institute of Transportation Engineers, ***Urban Traffic Engineering Issues and Answers: Urban Traffic Engineering Education and Training Needs,*** Washington, DC, 1995, p.12.

16 ***Ibid.,*** p.15.

17 Conrad L. Dudek, "White Paper 2. Education, Training, and Technology Transfer," ***Urban Traffic Engineering Issues and Answers: Operation and Maintenance of Electronic Traffic Control Systems,*** Washington, DC, 1995, p. 29.

18 ***Ibid.,*** p. ***30***

19 In 1995, analysts from the John A. Volpe National Transportation Systems Center (Volpe Center) conducted seven reviews (Boston, Denver, Miami/Ft. Lauderdale, Milwaukee, Phoenix, Pittsburgh, St. Louis) for the Department's Joint Programs Office for ITS. The principal goal of

these reviews was to assess the development and deployment of ITS products and services in metropolitan areas. Analysts interviewed a broad cross-section of state and local transportation officials, who represented various positions and levels within their organizations, from executive directors and managers to engineers and planners.

20 Officials interviewed offered several recommendations in the area of training and education.

21 U.S. Department of Transportation, Federal Highway Administration. ***ITS Architecture: Implementation Strategy,*** June 1996, p. 3-40.

22 ***Ibid.,*** p. 3-40.

23 ***Ibid.,*** p. 3-42.

24 ***Ibid.,*** p.. 3-41.

25 ***Ibid.,*** p 3-42.

26 Michael L. Patten et al., "Key Opportunities and Issues in ITS Implementation at the State and Local Levels," ***Moving Forward in a Scaled-Back World,*** Resource papers for the 1996 ITE International Conference, Dana Point, CA, 1996, p. 9.

27 Federal Highway Administration et al., "Five-Year Strategic Plan for Professional Capacity Building," March 1996, p. 3.

28 Highway Research Board, ***op. cit.,*** p. 5.

29 Specific suggestions were presented in the literature reviewed and from individuals interviewed on the topic of training and education in the ITS arena. Most of these suggestions are compatible with and should be considered in tandem with the FHWA's "Five-Year Strategic Plan for Professional Capacity Building."

3. DESIGN AND PERFORMANCE STANDARDS

ISSUES: ***The lack of standards will inhibit private sector firms from researching, developing, and marketing ITS products.***

Public-sector agencies will not deploy technologies that later may be incompatible with newer systems.

Introduction

The implementation of standards may be a boon to the ITS Program, speeding up the development and deployment of ITS technologies and making products more marketable. However, given the number of industries involved in the research and design of ITS technologies, a consensus on design and performance standards may be difficult to reach.

The 1994 Report to Congress

The Report discussed four issues related to ***de facto,*** voluntary, and regulatory standards:

- ***The benefits and costs of industry standards***
- ***Priority areas for technical standards***
- ***The role of government agencies in setting standards***
- ***Current and planned U.S. DOT activities.***

The Report concluded that the establishment of design and performance standards is important for the successful deployment of ITS products and services. It identified six priority areas for technical standards: (1) systems architecture, (2) communications technologies and radio frequencies, (3) spatial information databases, (4) hazard analysis and system safety, (5) human factors and traveler safety, and (6) international harmonization.' The Report further suggested reliance on private standards-setting organizations within the ITS community, thereby limiting the role of the Federal Government to setting standards for ITS technologies that concern safety.[2] The Report noted that the U.S. DOT would work to identify and evaluate ITS standards through the definition of a standard systems architecture for ITS technologies, through the sponsorship of related research, and by working with standards development organizations (SDOS).[3]

Findings

- ***Field Operational Tests***

During the evaluation of ITS operational tests, several participants stated that the lack of technical standards has the potential to become a serious impediment to the deployment of ITS products and services. An immediate effect on the operational tests would be that expansion of the products and services into other agencies and geographical areas would be delayed. Also, participants stated that public-sector officials

would hesitate deploying new ITS products if they thought that the technologies would be made obsolete by future standards. The interviewees also noted that a lack of standards may stifle research and development (R&D), since private firms may be reluctant to invest in a technology that does not meet future standards.[4]

Needs Identified

Participants of commercial vehicle operations (CVO) operational tests have uncovered several areas that lack standards. These areas include the electronic interchange of commercial vehicle data among states, transponder communications technology, and protocols for message transmission between the vehicle and the roadside. In advanced traveler information system (ATIS) operational tests, participants identified the need for standards to address the protocol (format) for delivering transportation information and the media (communications) through which it will be provided.[5]

- ***Role of Standards in Today's World***

Some ITS proponents postulate that the lack of standards has already impeded the development and deployment of ITS. In the absence of standards, regional and national interoperability of ITS technologies may not be achieved. The lack of standards also affects decisions in selecting system architectures and communications media.[6]

Benefits of Standards

Standards can benefit both the public and private sectors. Standards would encourage suppliers to create products which, in the long term, would increase the availability and reduce the costs of such products. Purchasers would also be able to specify standards-based products in requests for proposals in lieu of more detailed technical specifications. For vendors, "standards offer access to global markets, the ability to specialize and still offer compatibility, the premise of reduced developing costs, and a level playing field."[7]

- ***ITS Architecture Implementation Strategy***

The ITS Architecture Implementation Strategy states that "appropriate standards are fundamental to the establishment of an open ITS architecture. Standards will enable deployment of consistent, non-interfering, reliable systems on local, regional, and national levels. Open standards will further benefit the consumer by enhancing competition for the range of products

necessary to implement the ITS user services. Producers benefit from standards because they assure a wide market over which the product can be sold. As deployment occurs, diverse systems will be developed to address the special needs of urban, suburban, and rural environments. Standards must ensure interoperability across these implementations without impeding innovation as technology advances and new approaches evolve.'"

This report suggests four levels of interoperability: national, regional, product, and none. Of 125 interfaces, the report identified approximately 45 as requiring nationwide Compatibility.[9]

Standards Development Plan

The ITS Architecture Standards Development Plan identifies three risks associated with the implementation of standards. Standards may (1) hinder the development of new technologies, (2) jeopardize some investments made in incompatible ITS technologies prior to the establishment of standards, and (3) inhibit market competition. However, the report also acknowledges the benefits of standards, including interoperability of diverse systems, preservation of investment, technology insertion, creation of broader markets, and interchangeability. [10] Technologies that are "near-term" (soon to be deployed) have the greatest need for standards. Specifically, the Intelligent Transportation Infrastructure (ITI) and the Commercial Vehicle Information Systems and Networks (CVISN) were noted as near-term deployments. [11]

The report identified priority standards and reported areas in which SDOs have already made significant progress. The report also identified areas in which further work on standards is required. The priority areas with existing standards activity include traveler information, traffic control, digital short-range communications, map data bases and position determination, and commercial vehicle operations. [12] Priority areas for new standards are emergency management, mayday, transit, and hazardous materials.[13]

Standards Requirements Document

The Standards Requirements Document serves as a reference material that provides eleven "high priority" standards requirements packages for the architecture program:

1. Dedicated short range communications (DSRC)
2. Digital map data exchange
3. Information service provider wireless interfaces
4. CVO inter-center data exchange
5. Personal, transit, and hazmat maydays
6. Traffic management subsystems to other centers
7. Traffic management subsystems to roadside
8. Signal priority for transit and emergency vehicles
9. Emergency management subsystem to other centers
10. Information service providers to other centers
11. Transit subsystem to vehicles and stops.[14]

These packages were assembled based on stakeholder interests and architecture interoperability assignments.

Current Thinking

- ***ISTEA Directive***

Under the ISTEA, the U.S. DOT is required to promote compatible standards and protocols to promote the widespread use of ITS technologies. To fulfill this mission, the Department developed an architecture and standards program with five specific objectives:

1. To provide an environment for which public sector agencies (and others) have multiple vendors from which to choose when procuring products and services.
2. To provide an environment which will promote the creation of an ITS market.
3. To facilitate interoperability at interagency, inter-jurisdictional, state, and national levels.
4. To ensure the safety of the traveling public.
5. To facilitate the deployment of ITS.

To achieve these objectives, the Department is currently involved in several activities.

- ***Standards for the Intelligent Transportation Infrastructure***

The Department identified 44 areas in which standards are needed for IT1 deployment and signed cooperative agreements with five SDOs to spur the development of

these standards. The Society of Automotive Engineers (SAE) is developing standards on in-vehicle and traveler information systems; the ITE, standards on traffic management, transit operations, and transportation planning systems; the Institute of Electrical and Electronics Engineers (IEEE), standards on electronics and communication message sets and protocols; the American Association of State Highway and Transportation Officials (AASHTO), standards on roadside infrastructure; and the American Society for Testing and Materials (ASTM), standards on ITI-unique short-range communications systems.

- ***Dedicated Short-Range Communications***

The stated goal for many DSRC industry members has been to develop a system that will allow uninterrupted travel by motorists or movement of freight from one end of the country to the other through toll booths and roadway management systems. This has not happened and is not expected to happen until interoperability exists among different DSRC systems. In order to achieve this interoperability, the Department is proposing that CVO operational tests and model deployments incorporate DSRC equipment that is interoperable and compatible with the ASTM proposed Draft No. 6 standard. The Department is also proposing that the DSRC system be compatible with the CVISN DSRC Interface Requirements of April 2, 1996 developed by The Johns Hopkins University.

The Department is also pursuing other alternatives to promote DSRC interoperability. The Department has initiated discussions with policy makers and purchasers to develop a process to bring about DSRC standardization. The components of the process are: (1) an interagency or interstate agreement by which all signatories agree to abide by certain standards in their procurement of DSRC equipment, (2) a migration plan that will determine how to link the operation of future equipment with existing equipment, and (3) a standardized concept of operations that will provide an understanding of how the pieces of the overall system best fit together and to provide a target for accomplishment.

- ***National Transportation Communications for ITS Protocol***

In May 1993, the Department sponsored a symposium to identify barriers to deploying ITS technologies. The lack

of compatible communications protocols used by numerous traffic management devices was raised as a significant issue by the participants. As a result, the Department is supporting the development of the National Transportation Communications for ITS Protocol (NTCIP), which was initiated by the National Electrical Manufacturers Association (NEMA). The NTCIP will be a suite of standards which specify requirements for the structure of communications and the management of the standards. A companion set of standards for public transit is also part of the NTCIP effort. The Transit Communications ITS Protocol (TCIP) is being guided by the NTCIP steering committee to ensure compatibility between traffic and transit and to take advantage of the NTCIP work that has been completed to date. The standards will provide for interoperability and interchangeability of transportation management devices within the same communications infrastructure and support communications among traffic and transit management centers.

Conclusions

The lack of standards has been raised as an impediment since the inception of the ITS Program. Members from both private and public sectors have called for the development of standards because standards would help promote research and development efforts by private industry and facilitate the procurement and installation of ITS technologies by the public sector. For example, commercial products are already on the market that comply with one of the first ITS standards adopted, SAE J1708, the standard for interconnecting "smart" electronics on transit buses. The effort to develop standards must continue to ensure the successful deployment and integration of ITS products and services.

Recommendations

- Continue to support the development of standards that will ensure the success of "near-term" ITS deployments such as the IT.1 and CVISN.
- Sustain an environment that encourages development of voluntary standards by the private sector.
- Identify the areas in which a Federal agency should be the SD0 and areas in which other organizations should develop the standards.
- Actively promote approved standards that will facilitate the deployment of ITS products and services through outreach, education, and training and through innovative techniques such as the creation of a public domain NTCIP software library.

Endnotes

1U.S. Department of Transportation, ***Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems,*** A Report to Congress, Washington, DC, June 1994, pp. 4-3 to 4-4.
2 ***Ibid.,*** p. 4-4.
3 ***Ibid.,*** pp. 4-5 to 4-6.
4 Volpe National Transportation Systems Center, ***Analysis of ITS Operational Tests: Findings and Recommendations,*** FHWA-JPO-95-009, Final Report, September 1995, p. 68 and Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies: Analysis and Lessons Learned,*** FHWA-SA-94-061, Final Report, April 1994, p. 2-64.
5 Booz-Allen & Hamilton Inc., "Field Operational Tests: Lessons Learned," May 6, 1996, pp. 22-24.
6 Ramon K. Patel, "Role of Standards in Today's World," ***Moving Forward in a Scaled-Back World,*** Resource papers for the 1996 ITE International Conference, Dana Point, CA, 1996, p. 17.
7 ***Ibid.,*** p. 17
8 U.S. Department of Transportation Federal Highway Administration, ***ITS Architecture: Implementation Strategy,*** June 1996, p. 2-52.
9 ***Ibid.,*** pp. 2-53 to 2-55.
10 U.S. Department of Transportation Federal Highway Administration, ***ITS Architecture: Standards Development Plan,*** June 1996, p. 4-5.
11 ***Ibid.,*** p. 14.
12 ***Ibid.,*** p. 18.
13 ***Ibid.*** p. 19.
14 U.S. Department of Transportation Federal Highway Administration, ***ITS Architecture: Standards Requirements,*** June 1996. pp. l-2.

4. LIABILITY

ISSUE: ***The threat of potential liability for accidents will have a "chilling effect" on development and deployment of ITS technology.***

Introduction

Although one of the goals of the ITS Program is increased driver safety, manufacturers, sellers, and operators of the systems initially expressed concern that deployment of ITS technologies would result in increased exposure to tort law claims. Experience to date indicates that the fear of accident litigation outweighs the actuality, and there is no evidence that liability concerns have had a negative impact on entry of private sector firms into this field. However, liability concerns will increase if and when crash avoidance systems are designed and deployed which assume increasing levels of control over the operation of the vehicle.

The 1994 Report to Congress

The Report discussed product and tort liability in five areas:

- ***Advanced traffic management systems***
- ***Advanced traveler information systems***
- ***Advanced public transportation systems***
- ***Collision avoidance systems***
- ***Automated highway systems.***

The Report concluded that to date there was no compelling evidence that concerns over potential liability have inhibited development and deployment of ITS technologies for traffic management and traveler information. Sound engineering practices and rigorous testing should result in reduction of liability risk. The Report also stated that instant and dynamic ride-sharing options, which match riders with unknown drivers, may create the perception of greater liability and proposed further study in this area.

Findings

A growth in federal aid for ITS purposes has resulted in the initiation of approximately 80 field tests during the last three years.' The following is a summary of the findings in the liability area with respect to the technologies deployed to date, which include ATIS, such as in-vehicle navigation and guidance units, and ATMS, such as changeable traffic message signs, traffic signal timing, and electronic toll collection.

- ***Lack of Litigation*** — Research has failed to reveal significant tort or product liability litigation related to use of these ITS technologies to date. [2]

- ***Engineering Solutions*** — Creative engineering solutions may help ITS developers to avoid liability. For example, concerned that drivers would be distracted by an ATIS in-vehicle navigation system, TravTek project developers prohibited the manipulation of the system by the driver while the vehicle was in motion.[3] Accuracy of the database and proven performance were identified as major reasons for the absence of liability claims in the TravTek study.[4]

- ***Risk Allocation*** — Public and private-sector ITS developers, owners, and operators have allocated liability by contract (Travlink), disclaimed all warranties except standard commercial warranties (SWIFT), or agreed to dispute resolution by other than lawsuits (Orange County).[5] These agreements limit accident liability disputes among the signatories, although they do not affect tort claims by third parties.

- ***Indemnity*** — Indemnity agreements are required from drivers in Orange County who obtain a transponder to make electronic toll payments and from drivers using the TravTek displays.[6]

- ***Warnings*** — In some field operational tests, volunteer participants were asked to sign an "informed consent" acknowledging possible risks associated with the use of the technology.[7] No one refused to sign.[8]

- ***Sharing Rides*** — Advanced public transportation systems (APTS), especially those for ride-sharing and ride-matching, are still being put to the test. Currently, strangers ride with one another across the Oakland-San Francisco Bay Bridge and in the Shirley Highway High Occupancy Vehicle (HOV) Lanes near Washington, DC.[9]

Current Thinking

There is heightened focus on the impact of liability concerns on development and implementation of Crash Avoidance Technologies.

- ***No Chilling Effect*** — Crash avoidance technology such as "intelligent cruise control" is now undergoing testing, indicating that the fear of accident liability has not deterred industry involvement in these technologies." With respect to liability issues, such technologies do not differ significantly from measures such as anti-lock brakes being introduced voluntarily by manufacturers.

- ***ITS America Liability Task Force Meeting***

On June 21,1996, ITS America convened a group of lawyers from industry and the public sector to discuss the potential for tort liability arising from deployment of advanced ITS technologies such as real-time navigation devices, hazard warning systems, collision prediction, collision avoidance, and vehicle control. [11]

Control Remains with Driver

There was general agreement that crash avoidance technologies, such as warning systems, advanced cruise control, and perimeter detection devices, can be developed and deployed under the current liability structure, ***provided ultimate control of the vehicle remains with the driver.*** Such innovations do not change the responsibilities of the parties, private or public, or the risk of accident liability litigation, which would be based on familiar claims (negligence, product liability, failure to warn, failure to fulfill maintenance responsibilities, etc.) and subject to familiar defenses (compliance with accepted standards, assumption of risk, contributory negligence, sovereign immunity).

AVCS Liability Issues

On the other hand, there was consensus that AVCS, including sophisticated collision detection and avoidance devices, automatic braking, and automated highways with varying degrees of driver disengagement (e.g., "platooning"), may represent a quantum leap with respect to risk of accident liability for developers, owners, and operators, ***as control of the vehicle is transferred from the driver to the AVCS.*** Such systems carry the threat of increased severity of damage resulting from higher speeds and reduced spacing of vehicles. Participants speculated that there may be a tendency for the driver to rely on these automated systems and to reduce attention, even to doze off. Particularly on automated highways, drivers may tend to act more like passengers than vehicle operators and, it was suggested, perhaps they should be treated as such.

- ***Extent of Automation of Driver Functions***

The extent to which driver functions (steering, acceleration, braking, navigation, collision avoidance) should be automated is currently being debated in the United States and the world.[12] The choice of technology will determine the distribution of sensors, communications, and control between the individual

vehicles and infrastructure and, therefore, will tend to affect the identity of potential defendants in tort claims.[13]

- ***Evaluation of Safety Designs*** — Safety designs for a range of ITS technologies are under evaluation, from sensors for vehicle-to-vehicle distances to "short-headway platoons." Results of such testing, including drivers' responses to system failures and behavior adaptation which could nullify the advantages of the technology, will provide needed input to these discussions. [14]

Conclusions

Tort and product liability has not appeared to inhibit U.S. entries in the ITS field to date. Crash avoidance technologies, such as warning systems, advanced cruise control and perimeter detection devices, where ultimate control of the vehicle remains with the driver, can also be developed and deployed under the current liability structure.

The focus of concern in the legal community has shifted to the potential for liability resulting from advanced collision avoidance systems, particularly those that remove control from the driver. Many believe that because of the litigious nature of our society, these ITS technologies are more likely to be introduced in countries other than the United States, as developers adopt a wait-and-see approach. However, experience indicates that the likely cost of litigation is only one factor considered by industry in deciding whether to enter the field; other factors include market demand, available production capacity, and profitability.

Recommendations

- Continue monitoring ITS-related litigation as the crash avoidance technologies are deployed.
- Evaluate the legal pros and cons of promulgating industry standards for design and construction of automated systems and the legal implications of requirements such as warning notices and data-storage recorders to provide factual data for post-accident investigations.
- Study legal-risk management options including the role of tort liability as an incentive for safe design and construction.[15] The analysis should identify and analyze the need for innovative alternatives for recompensing victims by pooling the risk of legal liability of manufacturers, owners and operators of AVCS through an administrative system such as workers' compensation or industry-wide indemnification agreements.
- Educate the public on the limitations of and risks associated with ITS technology as well as its potential financial and safety benefits.

Endnotes

1Booz-Allen & Hamilton, Inc. for U.S. Department of Transportation Systems Joint Program Office. ***Field Operational Tests: Lessons Learned,*** May 6, 1996, p. 1.

2 Comprehensive search of LEXIS databases for tort and product liability cases found none which could be related to use of ITS traffic management or traveler information technologies. Anecdotal information provided by public and private practitioners, including industry counsel, at the ITS America Legal Issues Committee: Liability Task Force Meeting with National Automated Highway System Consortium, June 21, 1996, and elsewhere, confirmed the absence of significant litigation related to the current technologies.

3 Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies-TravTek Case Study,*** FHWA-SA-94-059, Final Report, April 1994, p. 17.

Ibid. p. 20.

5 L.S. Gallegos & Associates, Inc. for U.S. Department of Transportation, Federal Highway Administration. ***Innovative Contracting Procedures for ITS,*** Preliminary Draft, July 1996.

6 Ibid.

7 Such forms were developed in TravTek, for example, ***TravTek Case Study, supra,*** p. 17. Partners in the ADVANCE operational test also planned to provide a consent statement identifying possible risks. See Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies: ADVANCE Case Study,*** FHWA-SA-94-055, Final Report, April 1994, p. 21.

8 This refers to participants in the TravTek operational test. Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies: Analysis and Lessons Learned.*** Final Report, March 1994, p. 2-50.

9 Walbridge, Edward W., "Real-Time Rideshare Matching with Wireless Access to the Matching Computer," 1995 ITS AMER. PROC. 463 at 468.

10 See, for example, Shubhayu Chakraborty and Daniel G. Smedley's ***Adaptive Cruise Control for Heavy Duty Vehicles,*** 1995 ITS AMER. PROC. 145, which describes an adaptive cruise control system for heavy duty vehicles.

11 ITS America Legal Issues Committee: Liability Task Force Meeting with National Automated Highway System Consortium, June 2 1, 1996.

12 See, e.g., Interview with Jun Shibata, General Manager, ITS R & D Department, Sumitomo Electric Industries, Ltd., in which Japan's commitment to the advancement of ITS is discussed, ***ITS America*** News, June 1996.

13 A favorite proposal of the private sector is to have the Federal Government pass legislation which would (in order of preference) indemnify AVCS developers and operators, disallow claims based on strict liability, or strictly limit awards for accident liability. For more information, see Volpe National Transportation Systems Center's ***Analysis of U.S. DOT-Sponsored Reports on Non-Technical*** Issues, prepared for U.S. Department of Transportation Joint Program Office for Intelligent Transportation Systems, December 1995, pp. 48-53.

14 Smiley, Alison. "Overview and Methodologies of the ITS Safety Evaluation Process." ***ITS Quarterly,*** Vol. IV, No. 1, 1996, pp. 31-42.

15 ***See, San Diego Building Trades Council v. Garmon, 359*** U.S. 236, 247 (1959), where the Supreme Court said: "Regulation can be as effectively exerted through an award of damages as through some form of preventive relief. The obligation to pay compensation can be, indeed is designed to be, a potent method of governing conduct and controlling policy."

5. INTELLECTUAL PROPERTY

ISSUE: ***Concerns over the allocation of rights in intellectual property developed with public finding and fear of disclosure of proprietary data will inhibit the creation of public-private partnerships and slow the progress of the ITS Program.***

Introduction

There is a continuing concern in the private sector that state or Federal laws will require firms participating in public-private ITS partnerships to surrender valuable rights in intellectual property (computer programs, patentable inventions, proprietary technical data, etc.) developed with public funds. On the other hand, the public sector strives to give the public the "full benefit" of public spending by acquiring at least the right to use such intellectual property for "government purposes." Government officials also cite a generalized concern about creating a monopoly for certain technologies. Although the issue of intellectual property rights has not been a "show stopper" to the ITS Program, it merits close scrutiny because it has caused delays in operational testing, and the same issues may arise in connection with ITS deployment projects using Federal funds.'

The 1994 Report to Congress

The 1994 Report discussed the following five intellectual property issues:

- ***Laws and concepts regulating intellectual property***
- ***Federal Government patent rights***
- ***Copyrights and rights in data***
- ***Private sector concerns regarding intellectual property***
- ***Balancing intellectual property interests of state and local agencies with the private sector.***

The 1994 Report identified the differing expectations of the public and private sectors in the field of intellectual property rights and the impact of law and regulation on these expectations. With respect to federal patent law, the Report concluded that it afforded sufficient protection for private developers involved in federally funded research. However, the Report identified as a significant issue the fact that current Federal law does not allow copyrighting of computer programs and other data produced wholly or in part by Federal employees. According to the Report, this prohibition inhibits partnerships and cooperative development between the public and private sectors and the transfer of Federal technology to the private sector, since it effectively limits the commercial potential for such software.

The Report recommended continued monitoring of the disposition of intellectual property rights in ITS operational tests and deployment. It also suggested that ITS partners should address intellectual property issues early in the negotiations.

Findings

The following is a summary of the progress that has been made in the field of intellectual property rights since the 1994 Report.

- ***Field Operational Tests***

FAST-TRAC
Guidestar
TravelAid

Disputes about the retention of rights caused delays in the FAST-TRAC, Guidestar, and TravelAid field operational tests.2 In general, the public sector wanted products developed with public funds to remain in the public domain, whereas the private sector feared lost profit.[3] As a solution, private partners were advised to copyright pre-existing technologies and to separate out other applications of the technology.[4]

Solution

TravelAid

In the TravelAid test, problems arose during the development of consultant agreements by the Washington State Department of Transportation (WSDOT).[5] An ambiguous original contract did not specify the ownership or future use of products and information developed with a mix of public and private funding. The problem was resolved by rewording the contract to indicate that intellectual property developed by private entities with Federal funds would only be used for Federal applications[6]

Solution

ADVANCE

In another operational test, ADVANCE, securing an intellectual property and proprietary rights agreement proved difficult.[7] Representatives of the Illinois Universities Transportation Research Consortium (IUTRC)[8] wanted to be able to copyright their work in developing the concept of a traffic information center, while Motorola did not want to jeopardize the proprietary status of its hardware or software products, which included in-vehicle navigation and route guidance systems.' The parties finally agreed upon mutually acceptable wording in the Master Agreement. Participants did not view this as a serious problem, although negotiations were time-consuming."

Solution

SaFIRES

In the SaFIRES test, conflict arose when a firm that was a direct competitor of one of the partners was contracted as the technical manager (TM) for the project. The partner expressed concern that the TM would have access to proprietary information. The problem was solved when nondisclosure agreements were signed by the parties.' [10]

Solution

A dispute also arose over the retention of the rights to the software produced during this project. It was resolved contractually by allowing all the non-Federal partners to retain intellectual property rights with two limitations: (1) the FHWA and Federal Transit Administration (FTA) reserve a royalty-free, nonexclusive and irrevocable license to use for Federal Government purposes the copyright in works developed in the agreement or under a subcontract or contract of the agreement; and (2) the FHWA and FTA have a license to any copyright to which the Virginia Department of Rail and Public Transportation, its sub-grantee, or contractor purchases ownership with Federal assistance.[12] The FHWA and FTA were also given the right to use or enhance any software systems developed for the project in up to four other operational tests.[13] In this instance, negotiations over intellectual property rights did not cause a significant delay in the project.[14]

- ***1994 ITS Workshop on Intellectual Property***

Workshop[15] participants identified problems in the field of intellectual property and proposed solutions. Participants recommended the use of a pre-agreement memorandum of understanding between potential partners on issues which include audit, cost-sharing and intellectual property rights distribution.[16] The private sector remains uncertain about the allocation of rights to intellectual property developed through public-private partnerships. Since there is little uniformity among the states in this area, some participants suggested enactment of a federally-preemptive policy. Another issue which needed exploring was whether retention of government rights would permit the government to use intellectual property for revenue-raising purposes.[17]

Modes of Intellectual Property Law Implicated

According to the featured speaker at the workshop, there are seven "modes" of intellectual property law that may be implicated by ITS deployments." These areas include trade secret law, trademarks, contract law, copyrights, design patents, utility patents, and sui ***generis*** law (e.g., chip mask law). The speaker presented a hypothetical ITS deployment which featured all seven modes as an indication of the attention to detail required in intellectual property negotiations.

- ***ITS America Annual Meeting*** — Participants at the 1994 Annual Meeting of ITS America confirmed the need to address intellectual property rights as early as possible, assuring that rights among the parties are established by contract and integrating intellectual property protection and infringement avoidance into the ITS development process."

- ***ITS Deployment Programs*** — In general, intellectual property agreements do not seem to have generated controversy in ITS deployment programs. However, to the extent that deployment programs involve use of Federal funds, lessons can be learned from the testing program which should minimize delays in clarifying allocation among the parties of rights in intellectual property such as data.

Conclusions

The allocation of rights in intellectual property, in particular the right to commercially exploit intellectual property developed in part with government funds and the secondary use of data collected during use of ITS systems, has been a significant negotiating hurdle in developing public-private partnerships. However, current policy can accommodate the reasonable expectations of both private and public entities in jointly funded ITS projects.

In general, the studies note a continuing perception on the part of private firms that state and Federal governments afford insufficient protection to trade secrets. The applicability of freedom of information laws to proprietary information is a particular, though probably unjustified, concern.

Experience indicates that appropriate language protecting proprietary information and trade secrets and allocating rights in intellectual property can be agreed upon, provided there is good communication regarding law and procedures among the parties and provided that these issues are addressed early in the process.

The studies provide no substantive evidence to support the conclusion stated in the 1994 Report to Congress that partnerships between the public and private sectors have been inhibited by the fact that Federal law does not permit copyrighting of computer programs written wholly or in part by Federal employees.

Recommendations

- Develop Federal policy in two areas:
  - clarify the applicability of Federal laws and regulations to intellectual property and protection of trade secrets in ITS ventures; and
  - describe the scope of Federal licenses to be retained for intellectual property in ITS projects.

- Recommend to ITS partners that the issues of retention of intellectual property rights be raised in the early stages of negotiation between the public and private sectors.
- Disseminate guidance on these policies together with examples of successful contract clauses.

Endnotes

1 49 CFR $18.34.
2 Volpe National Transportation Systems Center, ***Analysis of ITS Operational Tests: Findings and Recommendations.*** FHWA-JPO-95-009, Final Report, September 1995, p. 55.
3 Ibid., p. 56.
4 ***Ibid.***
5 Volpe National Transportation Systems Center, ***ITS Institutional and Legal Issues Program: Review of the TravelAid Operational Test,*** FHWA-JPO-95-003, Final Report, January 1995, pp. 37-38.
6 ***Ibid.,*** p. 38.
7 Volpe National Transportation Systems Center, *IVHS* ***Institutional Issues and Case Studies: ADVANCE Case Study,*** FHWA-SA-94-055, Final Report, April 1994.
8 IUTRC, one of four partners associated with ADVANCE, is composed of the University of Illinois at Urbana-Champaign, the Illinois Institute of Technology, the University of Illinois at Chicago, and Northwestern University. IUTRC's role in ADVANCE included, among other things, designing and implementing the hardware and software for the Traffic Information Center.
9 Volpe National Transportation Systems Center, ***ADVANCE Case Study, supra,*** p. 15.
10 Ibid.
11 Volpe National Transportation Systems Center, ***ITS Institutional and Legal Issues Program-Review of the SaFIRES Operational Test,*** FHWA-JPO-95-008, Final Report, June 1995, p. 3.
12 Contract between Virginia Department of Rail and Public Transportation and Federal Highway Administration, January 20, 1994, p. 3, section 8.
13 ***Ibid.***
14 Interview with Eric Marx, Manager of Planning for the Potomac and Rappahannock Transportation Commission (PRTC)/Omni Ride, July 19, 1996.
15 "Workshop on IVHS and Intellectual Property," cosponsored by U.S. Department of Transportation and IVHS America, held January 25, 1994, Arlington, VA.
16 IVHS ***Legal Issues Newsletter,*** Vol. 2, No. 2, Spring 1994, pp. 25-26.
17 ***Ibid.*** p. 26.
18 ***IVHS Legal Issues Newsletter,*** Vol. 2, No. 2, Spring 1994, pp. 22-24.
19 ***IVHS Legal Issues Newsletter,*** Vol. 2, No. 3, Summer 1994, pp. 12-14.

6. PRIVACY

ISSUE: ***Privacy concerns will impede the development of ITS, because legal challenges will arise and because public acceptance and use of ITS technology will be affected by fears of potential loss of privacy.***

Introduction

Studies show that Americans have privacy concerns over technologies that collect personal information. In 1993,75 percent of Americans expressed a distrust of government and concern over misuse of technology.' Of course, privacy concerns are not unique to ITS and are to be expected as society progresses into the "Information Age.[2] The privacy challenges connected with ITS technologies are not insurmountable.

The majority of Americans seem to be willing to weigh the benefits of such technologies against their detriments. According to a 1990 Harris-Equifax study, 57 percent of the public are "privacy pragmatists," often willing to sacrifice a slight loss of privacy in order to reap the benefits of technologies; 18 percent of the public are unconcerned about the loss of privacy; and 25 percent of the public are opposed to ***any*** loss of privacy, no matter what social good may come from it.[3]

The 1994 Report to Congress

The report separated the privacy issue into five elements:

- ***Privacy concerns over ITS surveillance technologies***
- ***Privacy concerns over electronic payment services***
- ***Privacy concerns over ride-sharing information***
- ***Privacy concerns over commercial vehicles***
- ***Research and related activities.***

In concluding that privacy was not a "show stopper" to the ITS Program, the Report recommended that the U.S. DOT should: (1) consider public sensitivity to the use of personal information, (2) continue in the debate about privacy standards, and (3) insist on "appropriate conduct" in the handling of information.[4]

The Report recommended that the Legal Issues Committee of ITS America propose voluntary guidelines for use of ITS information and stated that evaluations of U.S. DOT-funded tests and the FWWA-funded Santa Clara University School of Law project will further refine the issues relating to privacy. Public Docket respondents urged the U.S. DOT to pursue a privacy code through legislation.

Findings

The following is a summary of the most recent research on privacy issues:

- ***Field Operational Tests***

  Although the majority of field tests did not describe privacy as a "pressing issue,"[5] concerns materialized in two tests. In the TRANSCOM/TRANSMIT study of read-write E-Z Pass toll-payment technologies, many drivers feared that the government could locate their vehicles at any time and that information about vehicle speed would be turned over to law enforcement officials.[6] Concerns were addressed in three ways: (1) assigning random numbers to vehicles for record-keeping purposes, (2) refusing to give speed and travel time to law enforcement authorities, and (3) conducting a public awareness campaign.[7]

  TRANSCOM/TRANSMIT Participants' Concerns

  Solution

  HELP/Crescent Participants' Concerns

  In the HELP/Crescent test of an integrated commercial vehicle monitoring system, participants expressed three concerns: a "Big Brother" fear of constant tracking; a fear by drivers that employers could use ITS-obtained information against them; and a fear by industry that the competition might access data about routes and travel times.[8] Selecting a third-party contractor for data collection, storage, and reporting solved the problem.'

  Solution

- ***Santa Clara University School of Law Study, Symposium, Meeting***

  Santa Clara University School of Law's FHWA-funded study of privacy implications arising from ITS technologies" culminated in a special issue of the ***Santa Clara Computer and High Technology Law Journal,*** [11] as well as in the convening of a public meeting[12] and a two-day scholarly symposium.[13]

  Participants' Concerns

  Participants noted that researchers need to understand why people may see ITS as threatening, understand when concern is warranted, and figure out how to address these concerns.[14] It is as important to prevent the ***actual*** misuse of data gathered from ITS technologies as it is to prevent the ***fear*** that data is being misused.[15]

  Solution

- ***Law-Related Challenges***

  California

  In Los Angeles, people have requested tapes from cameras which provide advanced traffic management services. To avoid involvement, the city adopted a "no recording" policy. [16]

  Solution

New York Solution

In New York, the State Thruway Authority has been subpoenaed to provide account information on cars passing through automatic toll booths. [17] Since account information is obtained through video monitoring, the State passed legislation limiting the use of such video records to the public authority.'"

- ***Privacy Principles***

The Privacy Task Group of the Legal Issues Committee of ITS America has formulated fair information and privacy principles. These principles are advisory in nature and represent a base which can be modified by initiators and participants in specific ITS projects. The principles include a respect for individual privacy, compliance with Federal and State privacy laws, and the "visible" maintenance of ITS so that individuals know what type of personal data is collected about them." The principles, which have been approved in "draft final" form by ITS America, will be circulated among interested stakeholders outside the ITS community for review and comment before being submitted in final form to the ITS America Board of Directors.

Current Thinking

"New" concerns have arisen over the secondary use of ITS information.

- ***Law Enforcement Nexus***

The fear is that ITS data will be used for automated enforcement of traffic laws (e.g., speeding, running red lights) as well as for enforcement of other criminal laws (e.g., child support, bank robbery) and civil actions (e.g., divorce).

Solution

There may be a trade-off of some loss of privacy for increased safety and crime reduction. Some remedies have been adopted. For example, data gathered from the toll monitors of the New York State Thruway will not be released to law enforcement agencies except as clearly required by law or court order.[20] Also, the technology is not used for speed enforcement, except for identifying cars that speed through the tolls.[21]

- ***Commercial Uses of Information***

Operators could profit from the sale of ITS information. A federally directed legislative policy such as the Driver's Privacy Protection Act of 1994,[22]

could establish limits on the dissemination of data. The New York State Thruway Authority has created its own solution by refusing to sell or release customer information.[23] However, a blanket prohibition on the secondary use, release, or sale of ITS information in some contexts may infringe upon the freedom to contract.

Solution

- ***Data Security*** — Data bases, especially those with individual-specific information, must be securely maintained to prevent interception of data. Work needs to be done to assure that interception is nearly impossible, both to safeguard legal privacy rights and allay public concerns. The Electronic Communications Privacy Act of 1988 regulates the illegal interception of electronic and other communications (although probably not video records).[24]

Solution

Federal and state freedom of information acts (FOIAs), which generally require public records to be made available to the public, may represent one of the biggest challenges to overcome in protecting individual informational privacy.

- ***Collection by Public Agencies*** — Tapes of video surveillance made by a government agency may be considered to be subject to public review.[25] One way to remedy this is to establish a "no recording" policy, as was done by Los Angeles.[26] Alternatively, using private entities to store data collected by the operator may lessen the freedom of information challenge, since records held by a private party may not be subject to disclosure under FOIAS.[27]

Solution

Constitutional and statutory challenges may also be made to ITS technologies. A Fourth Amendment claim is the biggest concern, but the absence of litigation in this area should be a reassurance.

- ***Fourth Amendment*** — An allegation that ITS surveillance constitutes an unreasonable search and seizure in violation of the Fourth Amendment will likely fail because of the limited expectation of privacy of a driver in a car.[28] Surveillance of a vehicle traveling on public streets is not considered a search within the Fourth Amendment.[29]

- ***Other Constitutional Challenges*** — It is possible to imagine other constitutional challenges to the use of ITS technologies. A First Amendment

First Amendment	challenge would allege that the tracking of vehicles restricts one's freedom of association and freedom of speech- one cannot go where one pleases, especially into "unpopular" areas to associate with "unpopular" people or to engage in "unpopular" speech. Such a challenge will most likely be unsuccessful provided the effect on free speech is minor and the underlying governmental purpose is legitimate.30
Fifth Amendment	A Fifth Amendment challenge would allege that the use of ITS-obtained evidence violates the protection against self-incrimination. 31 A Sixth Amendment challenge could be made if ITS data is used as criminal evidence.32
Sixth Amendment	

None of the above has so far surfaced as a significant threat to the development and deployment of ITS. Moreover, these statutory and Constitutional challenges are no different than those that could be made in connection with numerous other automation activities aside from ITS technologies.

Conclusions

Privacy issues need to be monitored and addressed. ITS professionals should work as hard to prevent the actual misuse of information obtained from ITS technologies as to prevent the fear that data are being misused. As the Harris-Equifax Survey indicates, there will always be people who feel that technology of any kind infringes upon privacy rights. However, more Americans are willing to trade a slight invasion of privacy for the major technological enhancements that will come from ITS.

From a legal perspective, the ITS Program is on firm ground with respect to privacy issues. A Fourth Amendment challenge is the greatest concern. However, in light of several Supreme Court decisions about search and seizure, a Fourth Amendment challenge is unlikely to be successful.

Recommendations

- Continue research and public outreach to educate drivers about the capabilities and limitations of ITS technologies and to reduce the fear of misuse of information.
- Encourage public discussion and wide dissemination of the ITS America Fair Information and Privacy Principles.
- Support design considerations which seek to balance personal privacy and freedom with greater safety and improved traffic flow.
- Continue operational monitoring to identify problems and innovative solutions.
- Conduct a study on the value of Federal legislation to prevent actual misuse of ITS-generated information. Such legislation could establish ground rules for collection, storage, sale, and

use of ITS information, leaving states free to pass their own statutes consistent with the Federal law.

Endnotes

1 Belair, Westin & Mullenholz. ***Privacy Implications Arising From Intelligent Vehicle-Highway Systems,*** December 8, 1993, p. 18, prepared under FHWA Contract No. DTFH61-93-C-00087.

2. The co-author of the Inter-modal Surface Transportation Efficiency Act of 1991 addressed this in saying: "IVHS privacy issues are not fundamentally different from those raised by the rapid introduction of automatic teller cards and machines. ATMs also record an individual's location at a specific time, as well as personal data and a personal transaction. Automatic tellers were not rejected because of privacy considerations. On the contrary, ATMs gained acceptance because of their efficiency and convenience, and because privacy was as assured as it could be for any transaction done in a public place." Norman Y. Mineta, Remarks at Community Meeting about Transportation Technologies and Privacy at the campus of Santa Clara University, August 30, ***1994, published in*** Santa Clara Computer & High Tech. L.J., Vol. 11, No. 1 (March 1995), p. 8.

3. Louis Harris & Associates, and A.F.Westin, 1991. ***Harris-Equifax Consumer Privacy Survey 1990,*** Atlanta, Georgia, pp. 6-7.

4 U.S. Department of Transportation, 1994. ***Report to Congress on Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.*** Washington, DC June, p. 8-8.

5. Booz-Allen & Hamilton, Inc., for U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office, ***Field Operational Tests: Lessons Learned,*** May 6, 1996, p. 25.

6 Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies-TRANSCOW/ TRANSMIT Case Study,*** FHWA-SA-94-058, Final Report, April 1994, p. 20. The concern arose because some participants in the E-Z Pass system possessed a read-write electronic tag which enabled their vehicles to be used as "probes" to reveal information about incidents, traffic congestion, and vehicle speed and travel time.

7 ***Ibid.***

8 Volpe National Transportation Systems Center, ***IVHS Institutional Zssues and Case Studies-HELP/ Crescent Case Study,*** FHWA-SA-94-057, Final Report, April 1994, pp. 1 1- 12.

9 Ibid.

10 Federal Highway Administration Grant No. DTFH6 1-93-X-00020.

11 ***Santa Clara Computer & High Tech.*** L.J., ***supra.***

12 "Community Meeting about Transportation Technologies and Privacy," held August 30, 1994, at the campus of Santa Clara University.

13 "Santa Clara Symposium on Privacy and Intelligent Vehicle-Highway Systems," held July 29-30, 1994, on Santa Clara University Campus.

14. Norman Y. Mineta, Remarks at Community Meeting about Transportation Technologies and Privacy at the campus of Santa Clara University, August ***30,*** 1994, ***pubhshed in Santa Clara Computer & High Tech.*** L.J., ***supra,*** at 6.

15. Reiman, Jeffrey H. "Driving to the Panopticon: A Philosophical Exploration of the Risks to Privacy Posed by the Highway Technology of the Future," ***published in Santa Clara Computer & High Tech.*** L.J., ***supra,*** at 44.

16. Booz-Allen & Hamilton, Inc., ***Institutional Impediments to Metro Traffic Management Coordination,*** Final Report, September 13, 1993, p. 6-3.

17. Telephone Interview with Charles T. Randall, Esquire, Chief Assistant Counsel for the New York State Thruway Authority, June 14, 1996.

18 N.Y. PUB. AUTH. LAW § 2985.14 (Consol. 1996), which states, in part: "All photographs, microphotographs, videotape or other recorded images prepared pursuant to this section shall be for the exclusive use of a public authority in the discharge of its duties under this section and shall not be open to the public or used in any court in any action or proceeding pending therein unless such action or proceeding relates to the imposition of or indemnification for liability pursuant to this section."

19. See Appendix for list of the Privacy Principles.

20. See E-Z Pass Interagency Group Guidelines, "Requests for Customer Information and Privacy Notice." Revised February 1995, p. 2, which reads in part that: "Unless prior written consent from an E-Z Pass subscriber is obtained, personal identification or transaction information related to an E-Z Pass customer will not be disclosed, except in the following instances: disclosure is required by court order, disclosure is necessary to render or conduct a legitimate business activity related to the E-Z Pass program; or if the request is made by a state agency with a demonstrated right to know. It is the intent of the Interagency Group, in those instances, to notify the subscriber of such order prior to the release of information."

21. Telephone Interview with Charles T. Randall, supra.

22. 18 U.S.C. §§ 2721-2725. The Driver's Privacy Protection Act prohibits the release or sale of motor vehicle record information by a state motor vehicle department except when information is for law enforcement uses and/ or 12 permissive uses, some of which require the owner's consent. However, the Act may not survive a Tenth Amendment challenge by a state or a First Amendment challenge by the press.

23. Telephone Interview with Charles T. Randall, supra ***referring to*** "E-Z Pass Policy Statement, Requests for Customer Information," an administrative policy statement of New York State Thruway Authority.

24. 18 U.S.C. §§ 2510-2521 (1988).

25. Booz-Allen & Hamilton's ***Institutional Impediments, supra,*** p. 6-3,4.

26. ***Ibid.***

27. ***Ibid.***

28. ***Cardwell v. Lewis,*** 417 U.S. 583,590 (1974).

29. ***United States v. Knotts, 460*** U.S. 276,281 (1983).

30. ***Younger v. Harris,*** 401 U.S. 37,51 (1971).

31. Belair & Bock, ***Remote Camera Surveillance of Public Streets, Colum. Hum. Rights L. Rev. 4;*** 193-194 (1972) ***as quoted in*** Belair, Westin & Mullenholz's ***Privacy Implications, supra,*** p. 31.

32. ***Ibid.***

7. ANTITRUST

ISSUE: ***The development and deployment of ITS technologies will be impeded by private partners' fears that joint ventures could be found to violate the antitrust laws.***

Introduction

Antitrust issues have not proved to be even a slight impediment to ITS. Courts have held that fiis may form joint ventures, provided conduct is reasonable.

The 1994 Report to Congress

The Report discussed six issues:

- ***The Sherman Act and other antitrust laws***
- ***Sherman Act standards on joint ventures***
- ***Standards-setting activities under the Sherman Act***
- ***Congress' reduction of antitrust liability for joint ventures***
- ***Enforcement agencies' guidance to alleviate fear of liability***
- ***ITS America's antitrust guidelines.***

The Report looked to judicial decisions, recent congressional action and the antitrust review procedures used by the Department of Justice and the Federal Trade Commission in concluding that antitrust laws will not be an impediment to the ITS Program. The Report stated that the U.S. DOT plans to address specific antitrust concerns if any are identified.

Findings

- ***Federally-Funded Operational Test of ITS*** — No collaborative venture has required the review of the U.S. DOJ. Furthermore, there has been a lack of civil litigation in the antitrust area.

Conclusions

The fact that there has been a lack of litigation and that no operational tests have required a DOJ review is encouraging. It is highly unlikely that antitrust issues will arise during the course of ITS deployments.

Recommendation

- Address specific antitrust issues if and when they are identified.

8. PUBLIC-PRIVATE PARTNERSHIPS

ISSUE: ***The inexperience of public transportation agencies and private sector firms in partnering with one another will slow the development of the ITS Program.***

Introduction

In order to realize the full potential and benefits of deploying ITS, there must be private-sector involvement. Although public-private partnerships are cost-effective and allow the public to benefit from private firms' expertise in developing, marketing, deploying, and maintaining new products, difficulties in the formation of public-private partnerships have delayed field operational tests an average of six to twelve months.[1] Private firms were expected to account for up to 80 percent of total expenditures for ITS products and service[2], and initially partnerships were thought possible in all areas of ITS. The primary place for partnerships now appears to be in provision of traveler information services. The private sector needs to find the "income stream to defray the capital and operating costs and provide a reasonable profit."[3]

The 1994 Report to Congress

The Report discussed three topics:

- ***Reasons for having public-private partnerships***
- ***Potential barriers to increased private-sector participation in the deployment of ITS technologies***
- ***Research and other initiatives to reduce potential barriers to private-sector participation.***

The Report identified traditional attitudes about public-sector responsibility for highways, the lack of experience in the formation of public-private partnerships, and the need for a long-term funding commitment by the public sector as potential barriers to private sector participation in the deployment of ITS. The Report concluded that the ITS Program is "well-suited" to the formation of public-private partnerships and will benefit from U.S. DOT studies and workshops designed to identify and reduce legal and regulatory barriers, as well as educate potential partners on the goals and principles of public-private partnerships.

Findings

The following is a summary of the most recent research on public-private partnership issues:

- ***Field Operational Tests***

  Difficult to Define and Implement Public-Private Partnerships

  The formation of public-private partnerships arose as an issue in several operational tests.[4] Project participants recognized early on that a partnership in the formal legal sense- an agreement to share risks, gains and losses-is not intended.[5] Parties now reportedly routinely insert boilerplate text in their ITS contracts stating that no legal partnership is being created.[6] This leaves parties to

establish on a case-by-case, time-consuming basis the nature of the partnering relationship they intend.[7]

Solution

Extensive negotiations and a newly-enacted Minnesota statute[8] enabled Travlink to become one of the first of the operational tests to execute successful formal partnership agreements.[9] At issue in the negotiations was the form and scope of the private-sector contribution, which included both goods and services.[10]

- ***Workshops and Regional Meetings***

Under contract from the FHWA, Klick, Kent & Allen, Inc., developed and conducted six regional workshops to address the issue of public-private partnerships in the ITS Program by providing examples of successful and unsuccessful partnering agreements.[11] While stressing the necessity of public-private partnerships, workshop participants noted several impediments to the formation of such partnerships, including institutional and cultural barriers, a lack of local or regional plans for the deployment of ITS, a lack of fundamental economic underpinnings, and minimal input from consumers of ITS technologies as to their technological wants and needs.[12]

Current Thinking

- ***Metropolitan Area Reviews***

Minimal Private Sector Involvement

During a review of seven metropolitan areas,[13] public-sector transportation officials indicated that the private sector was only minimally involved in the deployment of ITS in roles other than consultants and equipment providers and installers. Most current ITS activity involves the development of the physical infrastructure, which is still seen as a role for the public sector.[14]

Lack of an ***Implementation Plan***

Several transportation officials stated that the public sector has not developed an ITS plan under which the private sector can prepare to become involved. They also stated that the public-sector has yet to convince the private sector of the benefits of participating in ITS activities, nor has the public sector provided sufficient incentives for private sector invo1vement.[15]

Lack of Proven Benefits and Incentives

Lack of Consensus

Another reason for the lack of involvement centers around the lack of consensus that exists among these transportation officials concerning the role of the private sector in ITS.16

Lack of Experience

An additional barrier that hinders the establishment of public-private partnerships is the lack of experience within the public sector in developing such partnerships.17 Public-sector employees are uncertain how to structure a partnership to meet their needs without giving undue advantage to the private-sector partner in procurements to implement the project or evoking the perception of favoritism.

State Laws

Also, in some states, public-private partnerships present legal issues, because state statutes prohibit private companies from profiting from public infrastructure or functions.18 Some state laws prohibit private companies from purchasing traffic data or from carrying out highway operation functions.19

- ***Shared-Resource Activities***

Solution

Several public-sector officials foresee sharing public rights-of-way (ROWs) with telecommunications companies as a favorable area for joint ventures between the public and private sectors. In return for the use of the ROW, the telecommunications company will provide the public owner of the ROW with access to the telecommunications system and varying levels of service.20

- ***ITS Architecture Implementation Strategy***

Partnerships Defined

Public-Sector Role

Private-Sector Role

The Implementation Strategy of the ITS Architecture identifies a public-private partnership as "an attitude leading to cooperation and trust and a productive working relationship with tangible benefit to each of the partners."21 The Implementation Strategy views the public sector as implementers, operators, and maintainers of traffic, transit, and emergency management systems. The private sector will invest in and market private consumer products, such as in-vehicle navigation and traveler information units and collision avoidance technologies.22

Area for Partnering

The Implementation Strategy identifies the processing and provision of traveler and traffic information as an area that will foster public-private partnerships. It suggests that the public sector provide the infrastructure or data to encourage the production and deployment of information dissemination subsystems.23 The Strategy envisions private-sector firms as information service

providers (ISPs), bundlers of information from various ITS sources.24

- ***Successful ISP*** — In Boston and Cincinnati, SmartRoute Systems, a private-sector company which provides advanced traveler and traffic information, has teamed with state DOTs. SmartRoute Systems provides all capital costs, and the DOTS pay for information services. The partners then split the revenue generated by the resale of the database to private companies.25

- ***Minnesota Department of Transportation RFPP*** — The Minnesota Department of Transportation (MnDOT) has developed an innovative process which involves the private sector in the initial identification of ITS partnering opportunities. Rather than issuing a request for contract proposals for specific projects already defined by the public sector, the MnDOT issues a request for proposed partners (RFPP) which contains a broad strategic plan presenting multiple possible applications of ITS. Private firms then respond with specific project partnering approaches and technologies to meet the state's overall objectives.26

- ***RFPI of New York and New Jersey Port Authority*** — The Port Authority of New York and New Jersey recently employed a similar methodology in a request for partnership information (RFPI) in connection with TRANSCOM's sale of regional transportation information and products. The RFPI asked for "expressions of interest and information on (a) potential partnership."27

Conclusions

A successful ITS deployment partnership must support not only public objectives, such as reduced congestion and increased safety but also private objectives, including recovery of development costs and profitability. 28 In general, the basic infrastructure to support private investment must be implemented through public investment before the private sector will become involved.

Public-private partnerships meet with another challenge at the state level, where there is often a lack of flexible legal authority to enter into innovative partnering agreements which differ from traditional highway construction contracts.29 At a minimum, authority is needed to award contracts through negotiation after receipt of competitive proposals; even better would be flexible partnering authority in addition to contracting authority.

The potential for development of public-private partnerships is now seen as being more limited in scope than previously thought. The area of information processing and dissemination, such as operating an ATIS or portion of the CVISN, is regarded as the most promising area for public-private interaction.

Successful partnerships can be formed.30 Disseminating information on such successes to industry, the public, and public officials could help in building their support.

Recommendations

- Identify incentives for changing the current culture; educate both the public and private sectors so that each understands the "levels of risks and rewards" that accompany partnering agreements.31
- Establish the core Intelligent Transportation Infrastructure and permit the generation of basic traveler, transit, and traffic data to be accessed by the private ISPs.
- Identify what functions will remain the responsibility of and be funded by the public sector, so that the private sector can plan involvement in functions which will satisfy private sector objectives.32
- Review and and recommend modification to Federal and State laws to accommodate public-private ventures. Examples of existing and model legislation which would give state and local agencies clear authority to engage in ITS public-private partnerships should be distributed to interested parties.
- Through peer-to-peer workshops, widely disseminate information on the mechanisms used to develop successful partnerships and the difficulties to be overcome, as well as sample agreements and other documents.33

Endnotes

1Ibid.

2 IVHS AMERICA, ***Strategic Plan for Intelligent Vehicle-Highway Systems in the United*** States, May 20, 1992, p. 11-14, as cited in U.S. Department of Transportation's ***Report to Congress on Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems.*** Washington, DC June 1994, p. l-l.

3 Booz-Allen & Hamilton, Inc. for U.S. Department of Transportation Intelligent Transportation Systems Joint Program ***Office, Field Operational Tests: Lessons Learned,*** May 6, 1996, p. 19.

4 Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies: Analysis and Lessons Learned,*** Final Report, March 1994, pp. 2-2 to 2-4. The six operational tests studied were: ADVANCE; Advantage I-75; HELP/Crescent; TRANSCOM/TRANSMIT; TRAVTEK; and Westchester County Commuter Central.

5 Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies: ADVANCE Case Study,*** FHWA-SA-94-055, Final Report, April 1994, p. 16.

6 Partnerships in the Implementation of ITS: Workshop Reference Materials, prepared by Klick, Kent and Allen, Inc., under contract with the Federal Highway Administration Office of Traffic Management and ITS Applications. 1994, Appendix C, p. C5 and App. G, p.G8.

7 "Nearly every" operational test in the ITS Program experienced a 6- to 12-month delay caused by difficulties in the formation of teaming agreements between the public and private sectors and then between private partners in a project. Booz-Allen & Hamilton's ***Field Operational Tests: Lessons Learned, supra,*** p. 19.

8 See MINN. STAT. § 174.02, subd. 6a (1995) which says that the Commissioner of Transportation may "enter into agreements with other governmental or non-governmental entities for research and experimentation; for sharing facilities, equipment, staff, data, or other means of providing transportation-related services; or for other cooperative programs that promote efficiencies in providing governmental services or that further development of innovation in transportation for the benefit of the citizens of Minnesota."

9 See Wright, Nookala and Robinson's ***Minnesota Guidestar Project Travlink,*** 1994 ITS AMER. PROC. 171.

10 ***Ibid.***

11 Klick, Kent & Allen, Inc. ***Summary Documentfor FHWA Contract DTFH61-94-C-00116 Public/Private Partnership for Enhanced Traffic Engineering,*** 1996. The one- or two-day workshops were held at various sites across the United States from December 1994 to July 1995.

12 ***Ibid.*** pp. 5-8.

13 In 1995, analysts from the John A. Volpe National Transportation Systems Center (Volpe Center) conducted seven reviews (Boston, Denver, Miami/Ft. Lauderdale, Milwaukee, Phoenix, Pittsburgh, St. Louis) for the Department's Joint Programs Office for ITS. The principal goal of these reviews was to assess the development and deployment of ITS products and services in metropolitan areas. Analysts interviewed a broad cross-section of state and local transportation officials who represented various positions and levels within their organizations, from executive directors and managers to engineers and planners.

14 ***Ibid.***

15 ***Ibid.***

16 ***Ibid.***

17 ***Ibid.***

18 For example, until 199 1. private corporations were not allowed to build toll roads in Florida, according to state law. See Florida Bill Number HB 175: An Act relating to private transportation facilities, enacted in 1991, ***as cited in Partnerships in the Implementation of ITS: Workshop Reference Materials, supra,*** Appendix E, p. E3.

19. States are revising old laws or implementing new laws that favor public-private partnerships, however. For a summary of legislation from Arizona, California, Florida, Minnesota, Missouri, North Carolina, Pennsylvania, Puerto Rico, Texas, Virginia, and Washington, ***see Partnerships in the Implementation of ITS: Workshop Reference Materials, supra,*** Appendix E.

20 Klick, Kent & Allen's ***Summary Document, supra,*** p. 7, e.g., which says that the Missouri Department of Transportation offered "exclusive access to its interstate right-of-way in exchange for access to a fiber optic network needed to implement its St. Louis ATMS."

21 U.S. Department of Transportation Federal Highway Administration, ***ITS Architecture: Implementation*** Strategy, June 1996, p. 3-9. The passage continues: "The private sector brings strengths with regard to consumer understanding and awareness, whereas the public sector brings its orientation to public goals and can provide early financial support when benefits are uncertain to attract private sector capital . . . From the architecture perspective, it is important to note that the goal of the architecture would be to provide a framework which encourages appropriate private sector investment. And in this sense, public-private partnerships are implementation options to facilitate (not replace) such investments."

22 ***Ibid.,*** pp. 3-l 1 to 3-14.

23 ***Ibid.,*** p. 3-12.

24 ***Ibid.,*** p. ***3-8.***

25 ITS America, "Deliver ITS Services Using Public-Private Partnerships," ***ITS Action Guide: Realizing the Benefits,*** 1996, p. 48.

26. Klick, Ken& Allen's ***Summary Document, supra,*** pp.3,6.

27 See the Port Authority of New York and New Jersey's "Request for Partnership Information (RFPI) Sale of Information: Value of Transportation Information and Methods of Sale," July 1996.

28 Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies: Analysis and Lessons Learned, supra,*** pp. 2-3,2-10.

29. Volpe National Transportation Systems Center's ***Analysis of ITS Operational Tests: Findings and Recommendations, supra,*** p. 47.

30. Heavy Vehicle Electronic License Plate, Inc.. (HELP) of Phoenix is an example of one such partnership between government and industry. HELP, Inc., brings states, provinces, and territories in the United States, Canada, and Mexico together with individuals, corporations, partnerships and business enterprises which are directly or indirectly involved in the motor carrier industry. The incorporated entity stemmed from a field operational test of an integrated heavy vehicle monitoring system. HELP, Inc.'s mission statement is: "Develop and deploy advanced technology systems to create a cooperative operating and regulatory environment which improves the efficient and safe movement of commercial vehicles and the performance of the highway systems." "Transition Plan: Heavy Vehicle License Plate Program," February 5, 1993, p. ***3 as cited in*** H.E.L.P., Inc., Charter Board of Directors Meeting, March 21-24, 1993, Sacramento.

31 For example, Klick, Kent & Allen noted that "public sector resistance to change, fear of a changing political environment, (the) need to coordinate among multiple jurisdictions and restrictive government practices seem to inhibit the ability to even begin to explore the idea of public/private partnerships in many instances." Klick, Kent & Allen's ***Summary Document, supra,*** p. 6. Conversely, another study recognized that in establishing partnerships on a local level, "patience is necessary to clearly and fully explain agency need and incentives for ***private*** industry participation (emphasis added)." Michael C. Pietrzyk and Raymond A. Yettaw, ***Finding the Right IVHS Partnership on a Local Level,*** 1994 ITS AMER. PROC. 625 at 628.

32 The overlay of traditional public sector contractual terms in agreements between a public agency and a private party to a partnership may not be consistent with their partnering relationship, particularly with respect to accounting and cost data. See Volpe National Transportation Systems Center's ***Analysis of ITS Operational Tests: Findings and Recommendations, supra,*** p. 50. See, also "Government Procurement Regulations" in this Report. Private-sector partners' concerns with possible disclosure of cost-information or proprietary data must also be alleviated. See, "Intellectual Property" in this Report. Accounting and disclosure requirements almost caused the failure of the public-private partnership in the ADVANCE test.

33 An example of HELP's Letter of Intent appears in ***Partnerships in the Implementation of ITS: Workshop Reference Materials, supra,*** appendix B l-2.

9. INSTITUTIONAL AND MULTI-JURISDICTIONAL IMPEDIMENTS

ISSUE: ***The fragmentation of transportation management responsibility among numerous agencies and across jurisdictions will inhibit the successful implementation of specific elements of the ITS Program.***

Introduction

By their nature, ITS products and services are most effective when integrated within a metropolitan area or across state lines. However, to assure technologically and geographically seamless deployment, this integration requires the cooperation and coordination of many jurisdictions and agencies that are responsible for transportation management within a region or state.

The 1994 Report to Congress

The Report highlighted two areas:

- ***Centralized versus decentralized traffic and transit management***
- ***Current practices in traffic and transit management organizations.***

The Report noted that it is not necessary to organize large, centralized agencies to operate ITS. Fragmentation of responsibilities among agencies may not adversely affect the efficiency of managing the transportation system, but cooperation among the agencies is needed if ITS is to be adopted on a multi-jurisdictional, area-wide basis.'

In identifying current practices, the report draws information from a U.S. DOT-commissioned study, ***Institutional Impediments to Metro Traffic Management Coordination.*** 2 This study concluded that public transportation agencies and political jurisdictions generally work together to introduce and operate a traffic management system. 3 There is much support for interagency cooperation but little support for the integration of traffic management operations. The study also noted that cooperation among the agencies can be increased without significant changes in laws, regulations, and agency rules.4

Findings

- ***Field Operational Tests***

During the implementation of operational tests, several issues hindered interagency coordination. Some test participants postulated that full cooperation may never be achieved because agencies may continue to have conflicting philosophies and priorities. Also, the lack of proper communications among participating agencies impeded the progress of some projects. Participants often resolved interagency issues by clearly defining agency roles and responsibilities (usually committing

Different Agendas

Poor Communications

Solution

these to writing) and by establishing the proper channels of communications.5

Not Inclusive

Most operational tests reviewed were implemented by a distinct ITS group. Usually, operating agencies were not included in the initial discussions, which later made it difficult for the project implementers to obtain their support. Also, in some tests, local governments and MPOs were not included. Project participants were

Future Issue

concerned that future deployment of ITS products and services would not be fully successful if operating agencies, local governments, and MPOs were not widely involved.6

Commercial Vehicle Operations

Operational tests comprising commercial vehicle operations were especially susceptible to multi-jurisdictional issues. These tests created the need for otherwise disparate state organizations to work together much more closely. CVO projects required the participation of agencies involved in law enforcement, motor vehicle registration and inspection, revenue and tax collection, and utility regulation, as well as

Solutions

transportation. CVO operational tests also necessitated improved communications among intra-state agencies and a clearer definition of their responsibilities.7 The CVO planning studies dealing with institutional issues were instrumental in developing a multi-organizational and multi-regional approach to CVO planning. The studies were praised for their results.

- ***Metropolitan Area Reviews***

During a review of seven metropolitan areas,' researchers collected data on the level of interaction among transportation officials when planning and

Positive Effects

deploying ITS. The findings indicate a correlation between the level of interaction among area transportation professionals and the perception of ITS in the same geographic area. In areas where officials reported a "considerable" level of interaction, they also purported to have a "positive" opinion of ITS.

Agency Priorities

Transportation officials stated that, currently, they were inclined to deploy ITS if they saw a benefit for their own agency. Although most ***state-level*** officials recognized the desirability of integrating their systems with those of geographically adjacent agencies, agency

priorities often hindered that integration. Also, many local transportation officials were not convinced that coordination or integration beyond their city limits was necessary; they were more inclined to coordinate with other agencies within their municipality.

Regional Forums

Involvement in regional ITS forums increases the interaction among an area's transportation officials. Early deployment planning (EDP) studies were conducted in five of the seven metropolitan areas visited. In these five areas, the EDP steering committees were found to help stimulate interaction among the agencies participating in them. Incident management (IM) programs also increase the interaction among an area's transportation planning and operations staffs and law enforcement and other emergency response officials.

Non-Traditional Players

Many participants who were involved in the EDP Process recommended involving players who have not traditionally been involved in surface transportation or ITS planning. They suggested that other stakeholders, such as emergency response teams, air travel and airport-related service providers, busing and transit organizations, academic institutions, major employers, the tourism and resort industry, and operators of special event facilities, should be included in the process.

State DOTS

State transportation officials are leading ITS activities in many states. If these officials are aware that a wide range of stakeholders must be included in the ITS process, that the opinions of these stakeholders must be solicited, and that all modes of transportation must be considered, then interaction among all transportation agencies is greatly increased.

Metropolitan Planning Organizations

Although in most areas the staffs of the state DOT and the MPO have a good relationship, the extent to which they interact on ITS may not be fully developed. All MPO staffs realize that their authority has increased under the ISTEA, but some state officials have not grown accustomed to this changing role of the MPO. There is also a perception that many MPOs lack the technical expertise to understand and properly analyze ITS. Some MPO staffs hold this opinion and, therefore,

are reluctant to assert themselves in planning and deploying ITS.

Transit

Transit agencies, which traditionally acted independently, are interacting more with other transportation agencies. ITS planning activities have increased the interaction between transit agencies and other transportation agencies.

Local Governments

The degree of interaction between municipal transportation agencies and other transportation agencies varies considerably. However, officials from the core or central city within an area often have a more regional outlook than those from the outlying municipalities and, therefore, are more likely to interact with state and regional transportation officials. In some instances, local transportation officials were not fully involved in developing the ITS plan for their region and expressed a desire to be more involved in regional ITS planning and deployment activities.

Current Thinking

- ***ITS Architecture Implementation Strategy***

Need

Solution

The Implementation Strategy of the ITS Architecture notes that institutional cooperation is one issue that must be addressed during the implementation of ITS. It concludes that the need for public-sector cooperation pervades the ITS Program, and in the near term, that need is most acute for ATMS services. The report also proposes one way to overcome this impediment: minimize the extent to which early deployments require new levels of institutional cooperation, while at the same time create incentives to achieve such cooperation over time.

Regional Forums

The report notes that inter-jurisdictional cooperation may encourage the creation of a regional forum composed of members of the transportation community, including public transportation interests and independent service providers. The report suggests that MPOs could fulfill the function of facilitating inter-jurisdictional cooperation.' The report asserts that recent legislation strengthened the role of MPOs. In this role, the MPO "can be expected to play a crucial role in developing regional system designs and public funding

priorities for ITS. Moreover, this places them in an important position to assist in producing the inter-jurisdictional agreements necessary to achieve system-wide benefits.“”

Cost of Cooperation

The Implementation Strategy Report reasons that there is a cost associated with cooperating with other agencies, and transportation officials will not expend resources unless there are clear benefits to be gained. The report notes that agencies have been working together to improve transportation services, but agencies do so to serve their particular constituency better and not to achieve a regional goal.’ 1

- ***Increased Role for the MPO***

Benefits of public and private investment in ITS can be maximized through cooperative, comprehensive, and coordinated (3C) planning. Because major transportation organizations in a region are usually participants in the transportation planning process through the MPO structure, the MPO is being viewed as an effective mechanism to facilitate and coordinate ITS planning across modes, across political and functional boundaries, and between public-and private-sector organizations. Some MPOs have already incorporated private transportation providers into the regional planning process and are in a position to expand private-sector involvement to include private providers of ITS transportation, communications, and information technologies.”

The need to coordinate the development of ITS between different agencies and between public and private sectors, to promote a multi-modal approach, and to implement transportation demand management techniques are reasons to increase the MPO’s role in coordinating a region’s ITS activities. MPOs are consensus-building organizations where transportation planning originates and where decisions on the development of transportation systems, including ITS, can benefit from outreach and public participatory structures that have been incorporated into the planning process.

Because it is not an operating agency, the MPO can provide the forum for the Federal, state, and local transportation agencies and other implementing agencies

to coordinate their respective roles in developing ITS. The MPO should become involved in ITS planning, system and general architecture development, coordination of ITS deployment, and system evaluation. [13]

Conclusions

Open interaction among transportation officials has a positive impact on ITS deployment. This interaction, however, requires an increased level of communications, which was fostered by the forums created by EDP and CVO studies and other regional ITS planning activities. Steering committees for these planning activities served as catalysts for getting representatives of the various transportation agencies to work together. These committees also proved to be effective tools for promoting continuing interaction.

These planning activities also bolstered a systems integration approach to planning for ITS deployment. The "stovepipe" approach to project development does not produce an integrated system and, therefore, does not reap the full benefits that can be gained from deploying ITS products and services. Planning the deployment of ITS as information systems rather than as isolated infrastructure improvements will create the systems integration needed to achieve the maximum potential from deploying an ITS.

Fully successful deployment of ITS, however, may be hindered by differing agency priorities, the exclusion of non-traditional players, and the fact that much ITS planning is taking place outside of the 3C planning process. MPOs are now seen as the forum to continue the interaction required to deploy ITS, to promote an integrated, region-wide rather than a project-oriented, agency-specific outlook to ITS, and to include all stakeholders in the ITS development process by incorporating ITS planning into the traditional 3C planning process.

Recommendations

- Promote activities, such as regional planning studies, that require interagency coordination. Activities in which agencies have to work together to address transportation system problems and achieve specific goals create an environment of interaction that, once established, can be used to promote continuing interaction.
- Equip MPO policy makers and staffs with the tools required to make MPOs effective forums in coordinating ITS activities in a region.
- Identify non-traditional players in the ITS process and encourage transportation officials to include these stakeholders in the process.
- Provide transportation officials with examples of the benefits achieved by the integration of ITS within a region to encourage a regional outlook to ITS.
- Sponsor training programs that bring state and local transportation officials from different modal agencies together. For example, if a training session is being presented at a transit agency, then officials from the other transportation and law enforcement agencies should be included to foster interaction.

Endnotes

1 U.S. Department of Transportation, ***Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems, A Report to Congress,*** Washington, DC, June 1994, pp. vi - vii and pp. 2-l to 2-2.

2 Booz-Allen& Hamilton, Inc., ***Institutional Impediments to Metro Traffic Management Coordination,*** Bethesda, MD, September 13, 1993, prepared for the Volpe National Transportation Systems Center.

3 U.S. DOT, ***op. cit.,*** pp. ***2-3.***

4 U.S. DOT, ***op. cit.,*** pp. ***2-4*** to 2-5.

5 Volpe National Transportation Systems Center, ***Analysis of ITS Operational Tests: Findings and Recommendations,*** FHWA-JPO-95009, Final Report, September 1995, pp. 35-36 and Volpe National Transportation Systems Center, ***IVHS Institutional Issues and Case Studies Analysis and Lessons Learned,*** FHWA-SA-94-06 1, Final Report, April 1994, pp. 2-10 to 2- 11.

6 Volpe Center, ***Findings and Recommendations, op. cit.,*** p. 37.

7 Volpe Center, ***Analysis and Lessons Learned, op. cit.,*** p. ***2-2*** 1.

8 In 1995, analysts from the John A. Volpe National Transportation Systems Center (Volpe Center) conducted seven reviews (Boston, Denver, Miami/Ft. Lauderdale, Milwaukee, Phoenix, Pittsburgh, St. Louis) for the Department's Joint Programs Office for ITS. The principal goal of these reviews was to assess the development and deployment of ITS products and services in metropolitan areas. Analysts interviewed a broad cross-section of state and local transportation officials who represented various positions and levels within their organizations, from executive directors and managers to engineers and planners.

9 U.S. Department of Transportation Federal Highway Administration, ***ITS Architecture: Implementation Strategy,*** June 1996, p. 3-32.

10 ***Ibid.,*** p. ***3-4.***

11 ***Ibid.,*** p. **C-5.**

12 David A. Zavattero and Alex J. Smoliak, "Local ITS Deployment and Consensus Building: The Metropolitan Planning Organization's Role in ITS Development in the Chicago Region," ***Intelligent Transportation: Realizing the Benefits,*** Proceedings of the ITS America 1996 Annual Meeting, Houston, TX, April 1996, pp. 85 l-852.

13 ***Ibid.,*** p ***856.***

10. GOVERNMENT PROCUREMENT REGULATIONS

ISSUE: ***Federal, state, and local procurement policies and the private sector's unfamiliarity with government procurement requirements will impede the development of ITS.***

Introduction

According to one study, procurement issues have been "the most time consuming and irritating legal constraint confronted by ITS participants."[1] ITS participants from both the public and private sectors are realizing that current procurement methods may not be suitable for all ITS deployments. New legislation may be necessary at both Federal and State levels to allow the parties flexibility to determine the appropriate procurement method based on the needs of the project.

The 1994 Report to Congress

The 1994 Report considered the following four issues relating to the procurement of ITS:

- ***Impediments to government high-technology procurements***
- ***Impediments caused by government-contracting regulations***
- ***Organizational conflict of interest limitations***
- ***Implementation of fair and reasonable public sector-private sector partnership agreements.***

The Report recognized that procurements of ITS by the Federal Government would benefit from procurement reforms then under consideration (and subsequently enacted) by the Congress, but that these changes would not affect state and local government procurement practices. The Report recommended that state and local public agencies help private-sector ITS vendors become familiar with the regulations governing their procurements of ITS, and that agencies review their procurement systems to identify streamlining opportunities. The 1994 Report observed that disparate procurement systems present problems for jurisdictions seeking to coordinate their procurements of ITS, frustrate firms seeking to sell ITS goods and services to state or local agencies, and generally fail to promote cooperative, public-private partnering relationships.

Findings

The following findings are made in response to lessons learned from field operational tests, ITS deployments and reports:

- ***Contracting Challenge*** — Participants in operational tests and other federally-sponsored ITS deployments have identified contracting laws and procedures as a continuing challenge to ITS deployment.* These procurement concerns are derived mainly from Federal statutory and regulatory

Detailed Cost Tracking

requirements applicable to FHWA's operational test and demonstration activities. Several of the fiis participating in these early ITS procurements had not previously contracted with the Federal Government and were not accustomed to tracking their costs in the detail needed for cost-reimbursement contracting. They were also unfamiliar with comprehensive Federal cost allowability rules specifying the extent to which the government would reimburse specific categories of costs. They also objected to what they perceived as intrusive government audits of their cost submissions. These concerns prompted an ITS America report to the U.S. DOT summarizing procurement-related issues.3 Because these concerns result from Federal procurement requirements, they should not significantly affect ITS procurements conducted by state and local governments under State law.4

ITS America Report

- ***Disparities in Contracting Authority***

Significant disparities exist among the states in the contracting authority provided to agencies charged with deploying ITS. State and local efforts to procure ITS are inhibited to varying degrees by lack of authority to use flexible contracting procedures (e.g., pre-award negotiation based on technical proposals); by lack of authority to award other than fixed-price contracts; and by a lack of familiarity with the specialized techniques for acquisition of state-of-the-art technology-based systems. Although Federal-aid highway funds have been expressly made available for capital and operating costs of ITS,5 the Federal preference continues for the use of competitive bidding procedures for the purchase of "construction," a term which includes ITS deployment projects.6

Lack of Flexibility

Lack of Authority

Lack of Familiarity

Current Thinking

- ***Use of Cost-Reimbursement Contracting***

Based on preliminary results from a FHWA-sponsored study of innovative contracting procedures to address ITS procurement problems7 a significant portion of ITS deployment involves developmental work to customize prototype ITS products and services for specific applications. Because the cost of this developmental work cannot be precisely estimated, the use of cost-reimbursement contracting is appropriate. Audit and cost-allowability determinations associated with cost-

FHWA-Sponsored Study

States' Use

reimbursement contracting provoked significant objection from participants in the early Federal procurements to field test ITS. States' use of cost-reimbursement contracting will likely cause these issues to recur. They will be more complicated, however, because individual states will likely implement their own cost allowability rules and audit verification procedures. Instead of a single Federal cost-reimbursement system, ITS contractors would then be confronted with a multiplicity of state systems.

- ***Design/Build Concept***

Federal law allows FHWA grantees to request permission from FHWA to use procurement methods other than submission of competitive bids, provided that the alternative method results in adequate competition." One such alternative particularly suited to the acquisition of a complete technology-based system is the "design/build" concept, under which a single contract is awarded for the design, construction, and installation of a system responsive to agency-specified performance requirements.9

- ***Organizational Conflicts of Interest***

ITS America's 1993 procurement issues report described ITS vendors' fear that application of organizational conflict of interest (OCI) restrictions would exclude a vendor from competition to implement an ITS if that firm participated in the design of the system. Federallyaided highway construction avoids OCI by separating the highway design phase from highway construction. Highway design work must be awarded to architects and engineers under "Brooks Act" selection procedures; construction contracts must be awarded using sealed bid procurement procedures. 10 The designer's opportunity to win resultant construction contracts is thus very limited.

It makes little sense to separate the design of ITS from system development and installation. Using techniques from the information resource management (IRM) industry as an example, the best system designers may also be the best system fabricators and installers. In recognition of this verity, Federal OCI regulations do not exclude system designers from supplying the system when developmental systems are being procured." Federal OCI regulations also permit the award of a single

contract for system engineering, development, integration, assembly and checkout.'* The design/build concept allows the same firm to both design and build an ITS.

Conclusions

Federal-sector contracting procedures represented early impediments to some ITS operational tests and demonstrations. Furthermore, some of these issues (e.g., contractor compliance with accounting standards, cost allowability) will continue to delay ITS deployment as responsibility for deployment shifts to the state and local level. State and local agencies will need authority to use flexible procurement procedures other than sealed bid and will need to gain experience in exercising these procedures. Wide variations in state procurement laws and practices may pose more barriers to the successful widespread deployment of ITS than did Federal law. In order for ITS to be successfully deployed, change will have to occur in state and local agency procurement processes and in the types of contracts awarded.

Recommendations

- Encourage FHWA grantees to test alternatives to sealed bidding for award of ITS procurements. Guidelines should describe the process for obtaining FHWA approval for use of alternative procurement procedures. Authority to approve grantee requests should be delegated to FHWA field offices.
- Encourage FHWA grantees to use more flexible types of contracts, such as cost-reimbursement contracts and design/build/operate contracts, for the initial development and deployment of state-of-the-art and developmental ITS.

Endnotes

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2. Volpe National Transportation Systems Center, ***Analysis of ITS Operational Tests: Findings and Recommendations,*** FHWA-JPO-95-009, Final Report, September 1995, pp. 47,79.

3. In October 1993, ITS America submitted a report prepared by its Legal Issues Committee describing significant procurement issues in early ITS deployments. These issues arose in federally procured research and development, and resulted primarily from Federal contracting requirements. "Procurement Issues in IVHS Development and Deployment," IVHS America (Legal Issues Committee), October 1993.

4. "Department of Transportation's Response to IVHS America's Procurement Recommendations," 59 ***Fed. Reg.*** 44566 (Aug. 29, 1994). The Department's response observed several burdensome Federal requirements would have limited application to state and local procurements of ITS: Federal cost accounting, audit, and cost and price certification requirements (p. 44567); Federal record-keeping and administrative requirements (pp. 445689); and Federal organizational conflict of interest requirements (p. 44569).

5. Pub. L. 104-59, §301(a), amending 23 U.S.C. §103(i)(8).

6 23 U.S.C. §112.

7. L.S. Gallegos & Associates, Inc. for U.S. Department of Transportation, Federal Highway Administration. ***Innovative Contracting Procedures for ITS*** (Draft, July 1996).

8. 23 U.S.C. §112(a).

9 However, many state agencies lack authority to conduct design/build procurements. See Beverly Russell's "Organizational Conflicts of Interest and Design/Build: A Federal Perspective," ***ITS Legal Issues Newsletter,*** ITS America Legal Issues Committee, Vol. III, No. 1, 1995.

10 23 U.S.C.

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12 FAR 9.505-1(a).

11. ENVIRONMENTAL CONCERNS

ISSUE: ***ITS projects will have an uncertain environmental impact.***

Introduction

The implementation of ITS user services may impact the environment in terms of air quality and fuel use. Environmental impact may range in scale from local to regional, and results from complex and multi-layered interactions among the user services, travel behavior, traffic flows, and vehicle emission and fuel consumption characteristics. Predicting and understanding the environmental impact of ITS user services requires an understanding of these components both individually and in interaction with the other components. In particular, it is necessary to understand the effects of user services on traveler behavior and on transportation system performance before the environmental impacts of ITS can be understood. Quantification of the environmental impact of ITS user services is motivated by both regulatory requirements and the hope that ITS technology can lessen the negative environmental impact of travel.

The current context of Federal air quality and transportation regulations, specifically, the Clean Air Act Amendments of 1990 and the ISTEA, links the air quality planning process and the transportation planning process. Collectively, legislation requires the full-scale implementation of federally supported transportation projects to conform with attainment of air quality goals.

Travel per capita, as measured by vehicle miles traveled (VMT) per person, in the U.S. has been increased dramatically since 1970.' ITS has the potential to lessen the environmental impact of this travel, through a careful deployment of various ITS technologies and user services. Determination of the appropriate deployment of ITS technologies requires tools that can predict the environmental impact for a given setting and combination of ITS user services.

The 1994 Report to Congress

The 1994 Report discussed three environmental issues:

- ***The influence of ITS on air quality***
- ***The environmental impact and emission control implications of various ITS technologies***
- ***The need for additional research.***

The 1994 Report stated that impact of ITS on air quality was related to two factors: (1) the extent to which ITS affected total travel, and (2) the extent to which ITS affected the rate of emissions for a given amount of travel. The impact of ITS technologies on the volume of vehicle emissions could not be estimated accurately. However, the report went on to state that the potential for ITS to worsen air quality appeared minimal, while significant opportunities existed for ITS services to contribute to comprehensive state and local programs to improve environmental quality. If ITS technologies were used to reduce the number of vehicle accelerations and decelerations, reduce the number of single occupancy vehicle (SOV) trips, and shorten average trip lengths, they would reduce the volume of emissions.

The 1994 Report noted that there could be a general reduction in vehicle emissions through new engine and fuel technologies, such as heated exhaust catalysts and reformulated fuels. This could then reduce the sensitivity of overall vehicle emissions to the effects of ITS technologies. The 1994 Report also noted other ways in which ITS technologies could be used to reduce emissions, such as allowing the identification "gross-polluting" vehicles and facilitating the repair or removal of these vehicles. The 1994 Report also stated that ITS will contain the enabling technology for roadway pricing, which could allow the appropriate allocation of highway user fees among users to reflect the private and social costs of increased traffic.

The 1994 Report recommended areas for additional research. These areas include: (1) new analytical models to prepare quantitative estimates of the effects of ITS on vehicle emissions, (2) highway network models for transportation planners to predict the traffic effects of ITS, (3) traveler responses to ITS Data, and the effect of ITS on traveler behavior, and (4) analysis of environmental impact data from ITS operational tests.

Findings

As previously noted, predicting and understanding the environmental impact of ITS user services requires an understanding of several components (user services, travel behavior, traffic flows, and vehicle emission and fuel consumption characteristics), both individually and in interaction with the other components. In particular, it is necessary to understand the effects of user services on traveler behavior and on transportation system performance before the environmental impacts of ITS can be understood. The following represents the most recent research conducted to gain this understanding:

- ***Relationship Between ITS User Services and Travel Behavior***

  The FHWA sponsored several studies on the benefits and effects of ITS, including the effects of ITS user services on travel behavior.[2,3] There have also been studies on the relationship between specific ITS user services and travel behavior, such as the California DOT-sponsored report on the Pathfinder program, which determined that route guidance was a means of changing travelers' route choice.[4] Other studies established that there were relationships between travel demand management and VMT,[5] route planning and VMT,[6] traveler information and departure time, and traveler information and travel mode choice[7].

  Some research relevant to the topic of induced demand has been completed, which resulted in a quantitative estimate of the increase in trip-making due to increases in highway capacity.'

- ***Relationship Between ITS User Services and Transportation System Perfromance***

ITS user services can also be expected to affect the operation of a transportation network or to change the ***transportation system performance*** The Volpe Center prepared a FHWA-sponsored guidebook containing detailed qualitative descriptions of the interaction among ITS influences, travel behavior and transportation system performance.' The guidebook is intended to serve as an aid in designing environmental evaluations of ITS technologies. In another study, the Volpe Center linked travel behavior and traffic simulation tools in a feedback loop to arrive at quantitative estimates of the relationships between travel behavior and transportation system over a roadway network."

Other studies have established that specific ITS user services can be used to change transportation system performance. Examples include the use of route guidance to change freeway capacity" and travel time;12 the use of incident management to reduce congestion;13 and the use of traffic control, incident management, emergency vehicle management,14 ATIS, and ATMS l5 to improve overall transportation performance.

- ***Influence of User Services***

A variety of research efforts are attempting to develop tools for the prediction and measurement of the influence of ITS user services on emissions, fuel consumption, and local and regional air quality. A report completed in 1995 by the Volpe Center assessed the needs and requirements for modeling changes in automobile emissions due to changes in vehicle driving patterns. The Volpe Center report concluded that the considerable progress was required in the state of the practice before such emission effects could be accurately modeled.16

Development of Emissions Impact Models

In progress are a number of promising efforts to develop models sensitive enough to estimate the emissions impact of ITS technologies. The Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) is sponsoring the University of California, Riverside, in the development of a drive-pattern-sensitive vehicle emission model integrated with a traffic simulation.17

Travel Model Improvement Program

The U.S. DOT, Department of Energy (DOE), and Environmental Protection Agency (EPA) have initiated

the Travel Model Improvement Program, which is providing funding for the development of the TRANSIMS model at Los Alamos National Laboratory.[18] TRANSIMS is a large-scale, microscopic traffic model which accounts for travel behavior while simulating traffic flows. The model will also estimate vehicle emissions and fuel consumption.[19]

Other Relevant Emissions Modeling Efforts

The FHWA is sponsoring a Georgia Tech effort to develop a large-scale stochastic emissions model that is integrated with a large-scale traffic simulation and a geographic information system (GIS) database.[20]

Changes in Automotive Emissions Baseline

It must be noted that changes in fuels and automobiles will change the emissions baseline in multi-year emissions studies. The DOE has published a comprehensive and quantitative assessment of alternative fueled vehicles, traditional fuels and replacement fuels.[21]

Conclusions

The ITS environmental issues addressed in the 1994 Report to Congress are currently being addressed. However, work remains to be completed in addressing these issues, and several additional environmental issues have since become apparent.

Current modeling efforts should be directed towards a goal of integrated or at least compatible modeling of travel behavior and traffic. Integrated models should be able to model the influence of a number of ITS technologies and user services, rather than the effect of a single service, as this ITS will most likely be implemented in "bundles" of services.[22]

While efforts are in progress to develop detailed models of vehicle emissions as a function of vehicle driving pattern, there is also a need for compatible traffic simulations that can predict how ITS will change vehicle driving patterns. Similarly, models which can predict changes in air quality (local/airshed/regional) as a function of vehicle emissions must be compatible with these integrated traffic-air quality models.

Qualitative assessment of energy savings from the implementation of ITS[23] have been completed, but more detailed analyses will require the development of more sophisticated traffic simulations that can better model the effects of ITS technologies.

Recommendations

There are a number of concurrent and follow-on tasks which must occur before the current research and tools in development can be used to model and evaluate the air quality impact of the full-scale deployment of ITS technologies.

- Integrate new emissions and traffic models. If the current research efforts result in reliable vehicle emissions and traffic models that are sensitive to the effects of ITS user services, there must still be an effort required to integrate these various new models with each other, with regulatory requirements, and in some cases, with existing modeling practices.
- Validate and maintain models. Extensive data gathering and analysis will also be required for the validation of emissions, traffic, and integrated emissions-traffic models. There will also be ongoing requirements for collecting large amounts of vehicle data if emissions models are to be kept current and represent the on-road fleet. Even fairly recent travel behavior models are considered to be out of date and will require extensive data gathering if they are to allow realistic assessment of ITS impacts.[24] However, several ITS technologies, such as smart call boxes, on-board global positioning systems (GPS) and cellular data links may offer access to vast amounts of traffic and driver behavior data, which could be used to update models.[25]
- Apply new modeling tools in planning, designing, and implementing ITS programs. Most importantly, the resulting "suite" of modeling tools must be used to iteratively "design" ITS programs such that they meet environmental goals when they are eventually deployed, rather than simply being used as a tool to assess environmental impact after the fact.

There are also advocates for expanding the definition of environmental impact to include a number of factors beyond air quality and fuel use. These other "environmental" issues include the influence of ITS on land use, the social equity of the benefits and burden of ITS, and the role of ITS in building sustainable communities.

- Consider the relationship between ITS and land use. Urban sprawl increases distance between home and workplace and the reliance on automobiles and finite petroleum supplies. There is a concern among the environmental community that ITS technologies may encourage or even accelerate the trend towards urban sprawl by making longer commutes convenient.[26]
- Consider social equity in the implementation of ITS. Concerns exist over unequal distribution of costs and benefits of ITS user services among different socio-economic groups.[27] For example, will some travelers be "priced-out" of ITS services such as en-route guidance because of the high cost of the necessary on-board equipment?
- Support the goal of sustainable communities in the implementation of ITS. Sustainable communities can be defined as "humanly-scaled and spatially defined communities that meet the needs of the present without compromising the ability of future generations to meet their own needs."[28] ITS technologies can impact community sustainability in a number of ways, including land use, air quality, fuel use and traffic.[29] For example ITS technologies can work counter to the goal of building sustainable communities if they increase the convenience of long work commutes, and thereby affect land use by increasing urban sprawl.

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APPENDIX A
ACRONYMS AND ABBREVIATIONS

3C	cooperative, comprehensive, and coordinated
AASHTO	American Association of State Highway and Transportation Officials
ADVANCE	Advanced Driver and Vehicle Advisory Concept
APTS	advanced public transportation system
ASTM	American Society for Testing and Materials
ATIS	advanced traveler information system
ATM	automated teller machine
ATMS	advanced traffic management system
AVCS	advanced vehicle control system
CVISN	Commercial Vehicle Information Systems and Networks
CVO	commercial vehicle operations
DOE	Department of Energy
DOJ	Department of Justice
DOT	Department of Transportation
DSRC	dedicated short-range communications
EDP	early deployment planning
EPA	Environmental Protection Agency
FAST-TRACY	Faster and Safer Travel through Traffic Routing and Advanced Controls
FHWA	U.S. Department of Transportation Federal Highway Administration
FOIA	Freedom of Information Act
FTA	U.S. Department of Transportation Federal Transit Administration
GIS	geographic information system
GPS	global positioning system
HELP	Heavy Vehicle Electronic License Plate
HOV	high-occupancy vehicle
IEEE	Institute of Electrical and Electronics Engineers
IM	incident management

IRM	information resource management
ISP	information service provider
ISTEA	Inter-modal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
IT1	Intelligent Transportation Infrastructure
ITS	intelligent transportation system
IUTRC	Illinois Universities Transportation Research Consortium
MnDOT	Minnesota Department of Transportation
MPO	metropolitan planning organization
NCHRP	National Cooperative Highway Research Program
NEMA	National Electrical Manufacturers Association
NH1	U.S. Department of Transportation Federal Highway Administration National Highway Institute
NTCIP	National Transportation Communications for ITS Protocol
OCI	organizational conflict of interest
R&D	research and development
RFPI	request for partnership information
RFPP	request for proposed partners
ROW	right of way
SAE	Society of Automotive Engineers
SaFIRES	Smart Flexible Integrated Real-Time Enhancement System
SDO	standards development organizations
SOV	single-occupant vehicle
SWIFT	Seattle Wide-Area Information For Travelers
TCIP	Transit Communications ITS Protocol
TM	technical manager
TRANSCOM	Transportation Operations Coordinating Committee
TRANSMIT	TRANSCOM's System for Managing Incidents and Traffic
TRANSIMS	Transportation Analysis and Simulation System
TravTek	Travel Technologies
TRB	Transportation Research Board
U.S.	United States

U.S. DOT	United States Department of Transportation
VMT	vehicle miles of travel
Volpe Center	U.S. Department of Transportation John A. Volpe National Transportation Systems Center
WSDOT	Washington State Department of Transportation