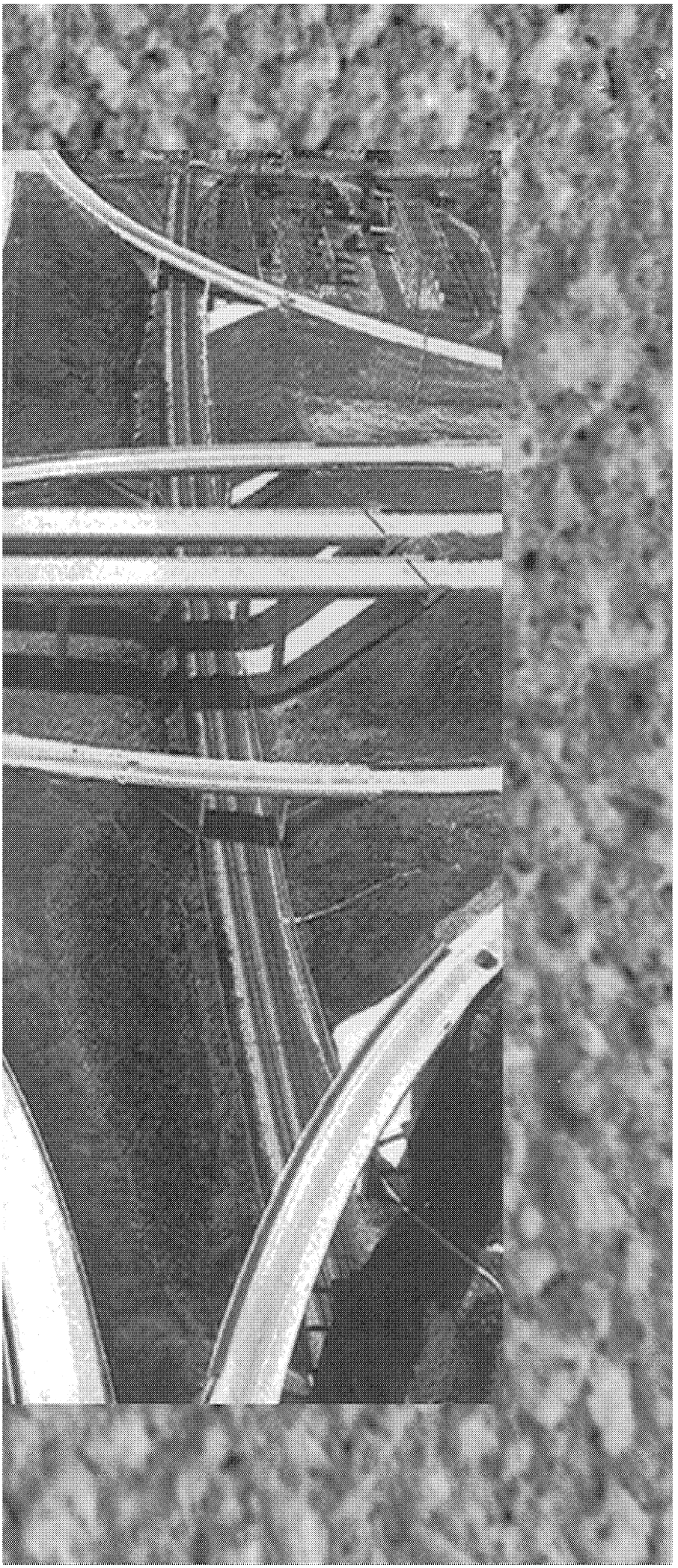

A Report to Congress

Nontechnical Constraints and Barriers to Implementation of Intelligent Vehicle-Highway Systems

Department of Transportation
June 1994

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

JUN 24 1994

The Honorable Albert Gore, Jr.
President of the Senate
Washington, DC 20510

Dear Mr. President:

I am pleased to forward to you a report called for in Section 6054(d) of the Intermodal Surface Transportation Efficiency Act of 1991, Public Law 102-240, which was prepared in cooperation with the Departments of Justice and Commerce. The report discusses whether nontechnical and institutional factors raise substantial barriers to the development and deployment of intelligent vehicle-highway systems (IVHS) in the United States.

The report is based upon the results of research studies and comments from members of the IVHS community, State and local governments, universities, private parties, and public interest groups.

The principal conclusion of the report is that none of the issues identified and examined is so formidable that it will seriously delay, much less prevent, the timely development and adoption of IVHS technologies. However, many of the nontechnical and institutional issues identified will require the Department and other parties, both in the private and public sectors, to take appropriate remedial action.

The Department of Transportation has formulated an institutional and legal issues research program to address these problems. This research program will help develop solutions to the problems we have identified in this report. We shall report further on these issues in 1996 in a follow-up report to this study.

I look forward to working with you to make the adoption of IVHS technologies in the United States a reality.

Sincerely,

Federico Peña

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

JUN 2 4 1994

The Honorable Thomas S. Foley
Speaker of the House of Representatives
Washington, DC 20515

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Department of Transportation
June 1994

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Introduction

Report Background

Intelligent vehicle-highway systems (IVHS) have the potential to improve the performance of the Nation's transportation system. These technologies apply to all transportation modes that use streets and highways including single-occupant automobiles, multi-occupant automobiles, heavy trucks, light trucks, and vans; they also apply to traditional fixed-route bus, innovative demand-responsive bus, and paratransit. There is, however, concern in the IVHS community and among public policymakers that a number of nontechnical and institutional issues could adversely affect the adoption of IVHS technologies.

Intermodal Surface Transportation Efficiency Act (1991) Report Requirements. Because of the importance of nontechnical and institutional issues to the Nation's IVHS program, Section 6054 (d) of the Intermodal Surface Transportation Efficiency Act of 199 1 required the Department of Transportation (DOT) to prepare, in cooperation with the Departments of Commerce and Justice, two special reports on IVHS nontechnical and institutional issues (see Appendix A). This document is the first of these reports. In 1996, DOT will prepare a follow-up report that describes the progress that has been made in resolving the issues identified in this report.

Source of Information for this Report. To gather information for this study, DOT opened Public Docket *No.* 48626 (58 *Federal Register* 7029, February 3, 1993) and solicited comments on nontechnical issues that could affect the development and adoption of IVHS technologies (see Appendix B). Other reports and sources used for the preparation of this document are noted where appropriate throughout the text and in the endnotes that follow each chapter.

Scope of IVHS Users Discussed in this Report. While DOT is engaged in a program to develop, test, and deploy new IVHS technologies, rarely, if ever, will the Federal Government (including DOT) be the principal customer for IVHS products and services. In some instances, IVHS products and services will be purchased directly by the traveling public and by fleet operators. In other instances, they will be purchased and deployed by state and local government agencies.

Public Sector Versus Private Sector Issues. The nontechnical factors discussed in this report cannot be categorized as either purely public sector or purely private sector issues. One of the essential elements of DOT's IVHS program is the recognition that IVHS technologies will not be adopted, much less achieve their potential benefits, unless there is close cooperation between the public sector and private sector. Specific distinctions between public sector and private sector perspectives are noted only as appropriate within a particular discussion.

No Recommended "Optimal" IVHS Operating Environment. This report does not recommend an optimal IVHS operating environment. The DOT's collective experience and knowledge of existing and planned IVHS technologies are not yet sufficient to specify the optimal set of institutional and organizational arrangements that would guarantee the widespread adoption of IVHS products and

services. Today, advanced highway technologies are being operated under many different institutional arrangements and operating environments. Any attempt to specify the "correct" institutional and operating environment would not only be purely speculative, but could also prove to be counterproductive.

Report Contents (Executive Summary)

The following is an executive summary of the contents of each of the report chapters:

Chapter 1, Barriers to Private Sector Participation in the Development and Deployment of IVHS Technologies

The technical expertise needed to deploy, operate, and maintain many IVHS technologies may be beyond the current capability of many state and local transportation departments. Therefore, the private sector's experience in developing, marketing, and commercializing new products and services is essential to the success of the national IVHS program.

If IVHS products are going to be widely adopted, the private sector may have to play a greater role in the provision of highway transportation services than it has in the past. While the private sector could help defray a large share of the potential public agency costs of providing IVHS products to the traveling public, to date state and local transportation agencies have had relatively little experience in designing cooperative arrangements between public agencies and private firms. Constraints that restrict or prohibit the sale of traffic data, limit the use of highway rights-of-way, and inhibit the ability of state and local agencies to delegate responsibilities for the control of specific highway operations to private firms may need to be changed. If these restrictions can be eliminated, it would make it easier for there to be greater cooperation between the public sector and the private sector.

Chapter 2, Institutional Impediments to Metropolitan Traffic Management Coordination

State and local government agencies will have to cooperate better if they are going to take advantage of IVHS technologies. The responsibility for managing highway traffic in most metropolitan areas has evolved over time in response to public needs, resources, and prevailing institutional and political arrangements. Within each political jurisdiction these managerial responsibilities are often dispersed among separate public agencies. If cooperation is not possible among public agencies, this fragmentation will inhibit chances for the successful implementation of certain elements of the national IVHS program.

A recent DOT-sponsored report concluded that public transportation agencies and political jurisdictions generally worked together effectively to introduce and operate traffic management systems. Some metropolitan areas have adopted coordination committees to deploy and operate these technologies. Many of the transportation officials interviewed believed that even greater coordination and cooperation could be achieved among agencies and political jurisdictions without far-reaching changes to established laws, regulations, or policies. Most transportation managers interviewed stated that at this time it would not be

necessary to form large, centralized agencies to operate new IVHS technologies. They also stated that over time there might be greater centralization of responsibility as more experience is gained in operating these systems. Local transportation managers also expressed the need for rigorous cost-benefit analyses that would allow them to generate the level of public and political support necessary to make large investments in these advanced technologies and to pay for these investments with taxes or user fees.

Chapter 3, Procurement of IVHS Products and Services

This chapter discusses the IVHS procurement issues that could be impediments to IVHS development and deployment. Public agencies traditionally rely on "arms-length" negotiations to ensure that all parties are treated fairly. These procedures, however, make it difficult to achieve the close interaction needed between public agencies and the private sector to develop new technologies.

Some members of the IVHS community have expressed concern that Federal, state, and local government acquisition requirements unduly delay or inhibit progress in developing and adopting IVHS technologies. These parties also maintain that government contracting and acquisition rules are not flexible enough to meet the needs of long-term developmental projects. In particular, organizational conflict of interest requirements may deter firms from participating in the early phases of the development of a new IVHS technology. Also, smaller firms may be at a distinct disadvantage in developing expertise in the area of Federal procurement regulations and procedures. The DOT has identified areas where the procurement process could be streamlined, and we have begun an outreach effort to inform small firms about Federal procurement procedures.

Chapter 4, The Role of Design and Performance Standards in the IVHS Program

This chapter discusses the ways in which industry design and performance standards could affect the development and adoption of IVHS products and services. Some private sector IVHS developers argue that they need assurances that any IVHS products they develop will be technically compatible with IVHS products developed by other firms. The adoption of industry design and performance standards, they believe, could promote the development and adoption of large and complex systems and technologies, such as IVHS. If properly designed and introduced, industry standards could reduce market uncertainty, promote acceptability among users, limit liability, improve safety performance, and promote technological development.

The premature adoption of industry standards or protocols, however, could also stifle competition and innovation among IVHS developers. Industry design and performance standards, to the maximum extent feasible, should accommodate the broadest possible range of interests and technological alternatives.

Most IVHS standards will be developed voluntarily by members of the IVHS community. The DOT's primary mission in this area will be to serve as a broker and facilitator, working as a partner with other interested parties. In other areas, however, DOT may be required to

take a more active role. The Federal Government, for instance, may have to establish standards for access to the radio spectrum, the transfer of spatial databases, and system security. The DOT will also foster the development of "systems architecture" for all IVHS products and services. In each of these critical areas, a greater Federal role may be essential to ensure public safety and to encourage the adoption of new technologies.

Chapter 5, Staffing and Education Needs

This chapter discusses whether a shortage of trained workers could adversely affect the Nation's ability to deploy, operate, and maintain IVHS products and services. A DOT-sponsored study concluded that it is unlikely that there will be a shortage of trained workers for the IVHS industry. It is, however, quite possible that under current budget constraints state and local transportation departments may not be able to hire enough workers with the professional and technical skills to operate and maintain IVHS because of low pay and/or staffing restrictions.

It is estimated that IVHS-related employment will rise from 21,000 in 1996 to 2 19,000 in 2011. By 2011, employment in the IVHS sector will account for a substantial share of the work force for certain highly skilled occupations. There should, however, be no major difficulty in meeting that demand. The Nation's declining defense sector could be an important source of scientific, professional, and technical expertise for the IVHS industry. However, IVHS products and services will be deployed, operated, and maintained under conditions that are quite different from traditional defense sector practices, such as building relatively few high-technology products for a single client.

Chapter 6, Antitrust Issues

This chapter reviews the relevant antitrust statutes and case law as they pertain to IVHS. The DOT has concluded that the antitrust laws, recent congressional action, court decisions, and the antitrust review procedures now being used by the Department of Justice and the Federal Trade Commission should not inhibit the formation of legitimate IVHS research and production joint ventures.

The courts have made it clear that the antitrust laws allow firms to form joint ventures for legitimate purposes, as long as the partners' conduct is reasonable and is not designed to thwart competition. While some firms may be reluctant to form joint ventures because of their uncertainty over how the antitrust laws will be applied, the National Cooperative Research and Production Act of 1993 (NCRPA) established guidelines to limit the potential antitrust liability for those firms that establish joint ventures for research and production activities. Further, IVHS America has adopted guidelines intended to preclude anticompetitive actions at its meetings.

Chapter 7, Liability Concerns

The DOT recognizes that the introduction of new technologies, such as IVHS, is not a risk-free venture. Several developers of IVHS products have noted that while drivers currently bear the general burden of liability for automobile crashes, the increased automation resulting from the adoption of certain IVHS technologies could shift liability to the developers and operators of automated systems. Many of the liability concerns that have been raised, however, are not unique to the deployment of new IVHS technologies. The tort liability system provides legal and financial incentives that encourage IVHS developers to design, manufacture, and operate IVHS products safely and with the appropriate degree of care.

The DOT does not believe that liability issues present significant barriers to the development and deployment of new highway technologies. No evidence has been presented to demonstrate that liability concerns have inhibited the development of IVHS products. Accordingly, it is too early to consider legislation or other actions to protect IVHS developers and operators from the risks of legal liability.

Chapter 8, Privacy Issues

There is a concern that some IVHS technologies will collect personal information on where one has been, is, or plans to be. The potential for collecting this type of information may reduce the public's willingness to support the development and adoption of various IVHS technologies. The far-reaching information capabilities of these technologies raise legitimate concerns about the invasion of privacy.

Recent surveys suggest that Americans have ambivalent feelings about personal privacy issues. Some care little about whether government or others obtain personal information, while others call for extensive protection against the potential loss of privacy. A solid majority appear to be privacy pragmatists -- individuals who are willing to cede some privacy when they understand the resulting benefits of the technology and how the information is used.

The DOT is sensitive to the privacy concerns that have been raised on behalf of individual motorists and commercial vehicle operators. Many of the concerns that have been raised can be resolved in the context of studies and outreach programs planned as part of the IVHS program. The DOT has a series of projects underway to develop information about the privacy implications of IVHS, to suggest strategies to enhance the compatibility of IVHS technologies with privacy concerns, and to promote public understanding of the privacy issue. In addition, IVHS America is developing "privacy principles" to help alleviate privacy concerns.

Chapter 9, Intellectual Property Considerations

Disputes over the retention of intellectual property rights by a government agency could deter IVHS developers from participating in Federal- or state-funded IVHS research or development agreements. Some private firms allege that the retention of intellectual property rights in the public sector will reduce the ability of IVHS developers to offset research and development costs.

The Federal Government's policy concerning rights to inventions created in the course of a funding agreement is intended to promote the utilization of inventions that arise from federally supported research and development, ensure that any inventions are used in a manner that promotes competition, promote the commercialization of inventions, and ensure that sufficient rights are retained to protect the public from the unreasonable use of inventions.

We believe existing Federal laws, regulations, and court decisions, as well as state policies regarding patents, copyrights, and rights to data, provide sufficient flexibility to protect the intellectual property interests of private IVHS developers and the public sector. Additional research on possible state and local problems in this area should continue. Frank and candid negotiations about the allocation of any future intellectual property among participants to funding agreements are essential to resolving potential misunderstandings and promoting the development of new IVHS technologies.

Chapter 10, IVHS and the Environment

The impact of IVHS on society and the environment will be determined by the particular IVHS technologies chosen for deployment. Deployment of selected combinations of IVHS can support attainment and maintenance of air quality standards in metropolitan areas. Air quality problems and excessive energy use associated with congestion, poor vehicle maintenance, and inefficient, circuitous travel in single-occupant private autos could be alleviated by the deployment of a balanced, multimodal program of transportation technologies integrated with other systems management programs. IVHS technologies that provide reliable information on a real-time basis to operators and customers of all elements of the transportation system can promote shifts in travel that favor more efficient modes, such as transit and ridesharing, while supplementing ongoing emission control programs. In addition, IVHS services can function as "enabling technologies" to support implementation of other approaches to improving environmental quality, such as congestion pricing and identifying high-polluting vehicles.

An extensive program of research on the potential environmental and societal implications of IVHS has been developed and is being implemented. Improved methods are needed for collecting relevant empirical data on IVHS-related environmental impacts, for assessing potential traveler response to the introduction of IVHS, and projecting future effects. Beyond this, future research must consider impacts on the community and social

environment, as well as the underlying forces and the potential supporting role of IVHS in enhancing mobility, promoting community cohesion, and enhancing the quality of life.

Conclusions

The DOT has initiated a comprehensive program to investigate institutional and legal issues that could affect the development and deployment of IVHS. This program will address many of the nontechnical issues facing both public sector and private sector participants involved in IVHS activities. Offices from several DOT operating administrations as well as the Office of the Secretary are conducting activities to reduce potential barriers to the adoption of IVHS technologies. The DOT is also working with the private sector and with state and local governments to resolve problems identified in this report.

In some cases, barriers to the adoption of IVHS technologies are created because participants have different constituencies, perspectives, and experiences. The DOT is conducting conferences, workshops, and training activities to familiarize potential partners in the IVHS program with the rules and processes that apply to federally funded transportation projects. We will also explore how various parties will need to work together to deploy and operate new IVHS products and services. Through workshops and conferences, DOT will be able to reach out to individuals and organizations that may be affected by IVHS so their perspectives can be incorporated in the national IVHS program.

Through research, DOT intends to find solutions to specific problems facing members of the IVHS community and transportation policymakers. The DOT is reviewing the experience to date with IVHS operational tests and related experiences in other developing technologies to provide models for future deployment of IVHS technologies. Analysis is also underway on the benefits IVHS deployment could have on air quality, privacy, and other areas of concern to society. When appropriate, DOT will adopt new ways of doing business and encourage other government entities to do the same. Innovative approaches to procurement, financing, and agreement formation are among the projects DOT will pursue.

Appendices

Appendix A

This appendix is a copy of the relevant statutory language that directed DOT to prepare this study.

Appendix B

This appendix is a copy of the notice that appeared in the *Federal Register* soliciting public comments on nontechnical issues that could affect the introduction and use of IVHS products and services.

Appendix C

This appendix is a summary of the comments that were filed in the Public Docket.

1 Barriers to Private Sector Participation in the Development and Deployment of IVHS Technologies

Introduction

The Department of Transportation (DOT) has never considered the IVHS program to be exclusively, or even primarily, a Federal program. The 1990 DOT *Report to Congress on Intelligent Vehicle-Highway Systems* concluded that the IVHS program should be a "... national cooperative effort [and not] primarily a Federal program... . "[1] The 1992 DOT *IVHS Strategic Plan* concluded that the private sector should have primary responsibility for developing IVHS technologies.[2] The importance of the private sector participation in the national IVHS program was underscored by IVHS America in its 1992 *Strategic Plan for Intelligent Vehicle Highway Systems in the United States.* That report pointed out that private firms may account for as much as 80 percent of total expenditures for IVHS products and services.[3]

This chapter discusses the following topics:

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

Reasons For Public Sector-Private Sector Partnerships In IVHS

This section discusses the main reasons for pursuing IVHS partnerships between the public sector and the private sector. Many of these issues were first raised at a DOT-sponsored workshop on how to take advantage of the private sector's capabilities.[4]

Private Sector Technical and Marketing Expertise. The private sector's experience in developing, marketing, and commercializing new technologies and products is essential to the success of the national IVHS program. Private sector participation is needed to provide technical expertise, market new products, and reduce public sector funding requirements. If deployment of IVHS technologies is left solely to the public sector, the potential for IVHS technologies to improve the performance of the highway transportation system may not be realized.

Lack of Expertise Within State and Local Transportation Departments. The technical expertise needed to operate and maintain certain IVHS technologies is beyond the current capability of many state and local transportation departments. Some of the technical and professional staff needed to deploy, operate, and maintain IVHS products will come from retraining current staff (refer to chapter 5, *Staffing and Education Needs,* for more information on training issues). In many cases, public agencies may find it more cost-effective to enter into a contractual arrangement with one or more private firms to provide specific IVHS products or services.

Private Sector's Ability to Establish and Dissolve Agreements. Private firms can more easily establish *ad hoc* business relationships with other firms. By contrast, public agencies generally require detailed, formal agreements in order to work with private firms or other government agencies. Private firms that have entered into agreements also find it easier to dissolve them once they have achieved their objectives.

Private Sector's Marketing and Distribution Capabilities. Private firms are generally better able to gauge the market'sresponse to a new product or service. Demands for IVHS products will vary depending upon such factors as geographic location, type of trip, and the willingness of users to pay for IVHS products and services. Many travelers may be willing to pay for additional levels of service; however, public agencies generally do not have a great deal of experience in providing separate products and/or services to different customers. Private firms are much more accustomed to tailoring products and services to different segments of the market.

Private Sector's Ability to Generate Revenue. It would be costly for state and local transportation agencies alone to fund the deployment of new IVHS technologies. Consequently, a greater financial role for the private sector in transportation may become necessary. Financial support from the private sector may take several forms, including direct investment and indirect support through advertising. The Intermodal Surface Transportation Efficiency Act of 199 1 encourages the creation of public sector-private sector partnerships to finance highway transportation projects. Currently there are considerable barriers to the formation of such partnerships, but the IVHS program may offer opportunities to generate revenues by allowing firms to advertise on highway advisory radio, variable message signs, and other traveler information services.[5]

Private Sector Collection of IVHS Data. Private firms usually are restricted from installing hardware that is physically connected to public roadways. Because some IVHS technologies do not require physical connection to roadways, there is less need to rely exclusively on public agencies to gather traffic data. Several firms, such as Metro Traffic, Shadow Traffic, and SmartRoute Systems, use probes and surveillance cameras to collect traffic information.

In other cases, it might be desirable for government agencies to collect data and have a private firm provide traffic information using that data. However, many state and local transportation agencies have either formal or informal policies against selling traffic data to private firms. A number of solutions have been proposed and adopted to address these policies.

For example, one approach has been developed in Westchester County, New York. The public agency (Westchester County) awards a contract, or franchise, to one or more firms to collect and analyze traffic data. The contractor provides traffic information and/or data to the County and is then permitted to sell specific traffic information/data, as determined by the County. Westchester County recently awarded an exclusive franchise to a firm to collect, assemble, and disseminate traffic information throughout the County. The franchise also allows the firm to provide certain services, such as incident management and operating variable message signs, based on the data it collects.

HELP, Inc., is another example of private sector participation in highway operations. This organization was formed following the completion of a DOT-sponsored operational test,

HELP/Cresent, which was a multistate, multinationalresearch effort involving the FHWA, Transport Canada, 13 states, and several motor carriers. An integrated large truck vehicle monitoring system using Automated Vehicle Identification (AVI), Automatic Vehicle Classification (AVC), and Weigh-in-Motion (WIM) technologies was tested. Following the success of this test, this not-for-profit corporation was established to assume operational responsibilities for various commercial vehicle operations.

Initially, HELP, Inc., will allow trucks to bypass mainline weigh stations and ports of entry. In the future, HELP will support the issuance of overweight and overdimension permits and provide a truck location and hazardous materials monitoring system. Ultimately, HELP may provide an integrated commercial vehicle information system.

Private Sector's Ability to Expand Markets. If IVHS products were bundled by the private sector with other consumer services, they would be likely to reach many more potential users than if they were provided on a stand-alone basis by public agencies. It will be important to discover financial opportunities that will help defray the costs of providing IVHS services. The revolution in personal communications may provide an opportunity to bundle IVHS services with other consumer information services. The extent to which such bundling could generate revenues to offset the cost of collecting information remains to be seen but, at a minimum, it appears that the cost of disseminating information could be defrayed. Bundling traveler information with other communications services almost certainly would result in more travelers gaining access to IVHS services. The development of the national information highway and new services provided by communications companies are some of the areas that need to be explored to allow the greatest amount of information to be provided to the public.

Potential Barriers to Public Sector-Private Sector Partnerships

This section discusses the potential barriers to public sector-private sector partnerships in the development of IVHS systems.

Traditional Attitudes About Public Sector Responsibility for Highways. Greater private sector participation in the IVHS program may be limited by the longstanding tradition in the United States that highway operations and maintenance are primarily the public sector's responsibility. Some public officials also maintain that traffic and travel information should be provided free of charge, or at a nominal fee, to all travelers. Such attitudes, if they prevail, could limit the extent to which IVHS products are offered by private firms.

Limited Experience in Public-Private Partnerships in IVHS. The public sector presently has limited experience in designing and implementing institutional arrangements between public agencies and private firms for the provision of IVHS products and services. If there is to be greater cooperation between the public and private sectors, existing policies regarding the private use of highway rights-of-way, fees for traffic information, and the role of private firms in collecting and disseminating traffic information will need to be modified.

Need for Long-Term Commitment. Before private firms will invest in IVHS technologies that require publicly supplied infrastructure, they must be sure of the public sector's long-term commitment to fund these systems. Current uncertainties about transportation budgets and the long-term commitment of state and local officials to IVHS may inhibit the formation of partnerships with private firms, especially where such partnerships depend on joint investment. If many public agencies are parties to the partnership, private firms may also be concerned about the stability of multijurisdictional funding agreements.

Initiatives Underway to Reduce Barriers

There are several initiatives now underway to explore how to reduce barriers to public-private IVHS partnerships, including:

- Identification and analysis of institutional issues related to partnership issues that have come up in operational tests;
- Development of guidelines for evaluating institutional issues in future tests;
- Funding of research projects to gain a better understanding of how public and private organizations could work together to deploy IVHS technologies;
- Preagreement conferences on operational tests; and
- Innovative financing of operational tests.

One project, which is scheduled to be completed by March 1995, will examine institutional issues that have arisen in the deployment of other new services, such as cable television, mobile communication, and weather forecasting. The DOT is particularly interested in understanding how franchise agreements, service contracts, or other contractual arrangements have been designed and implemented to provide these services.

A second DOT study will examine the institutional and public-private partnership problems that have been identified in previous IVHS operational tests. The goal of this exercise is to develop approaches to solving the most common problems. Another DOT study will examine potential markets for different highway/traffic services, as well as the public's willingness to pay for these services.

One of the most significant barriers to effective public-private partnerships is the lack of understanding of the goals and principles needed to guide these partnerships. Workshops to clarify these goals and the regulatory environment in which they must be conducted are a productive means of enhancing their likely success. For example, IVHS America recently held a workshop in Dallas that focused on legal barriers to IVHS partnerships.[6] The State of Colorado Department of Transportation has sponsored a workshop that discussed the organization of the IVHS program and how public sector-private sector partnerships could be encouraged through innovative contractual arrangements.

The DOT will continue to sponsor workshops and regional meetings to discuss opportunities for public sector-private sector partnerships and how to implement them. Many other outreach activities underway may address attitudes about IVHS and the respective roles of the public and

the private sectors. The sharing of information gained in other jurisdictions or lessons learned from other technologies will be extremely useful to the national IVHS program.

Conclusions

The IVHS program is well-suited to the formation of partnerships between public sector organizations and private firms. In this chapter, we have identified potential impediments to effective public sector-private sector partnerships. The DOT will continue to identify the legal and regulatory impediments that exist to greater private sector participation in the national IVHS program. Moreover, DOT will work with state and local governments, local transit authorities, and private firms to facilitate public sector-private sector cooperative ventures.

ENDNOTES

[1]U.S. Department of Transportation, Office of the Secretary, *Report to Congress on Intelligent Vehicle-Highway Systems,* March 1990, pp. 44-45.
[2]U.S. Department of Transportation, *IVHS Strategic Plan: Report to Congress,* December 18, 1992, p. 13.
[3]IVHS AMERICA, *Strategic Plan for Intelligent Vehicle-Highway Systems in the United States,* May 20, 1992, p. II-14.
[4]Federal Highway Administration, *Public and Private Sector Role In Intelligent Vehicle Highway Systems Workshop,* Rockville, MD. , April 1992.
[5]The use of right-of-way for anything other than highway purposes is generally forbidden. 23 CFR 1.23. Section 1 A- l of the MUTCD forbids the use of the signs on the right-of-way as an advertising medium. The Highway Beautification Act (codified at 23 U.S. C. § 13 1) limits the use of advertising signs outside Interstate or Federal-aid primary highway rights-of-way, although it does allow advertising on the right-of-way under the LOGO system and in rest areas, in limited fashion.
[6]*IVHS Public/Private Partnerships: Managing the Legal Issues Workshop, Dallas, Texas, January 25-26, 1993.*

2 Institutional Impediments to Metropolitan Traffic Management Coordination

Introduction

Responsibility for traffic management operations in most metropolitan areas has evolved over time in response to changing public needs, resources, and prevailing institutional and political arrangements. In many metropolitan areas, these responsibilities are dispersed across political jurisdictions; indeed, they are even dispersed among separate agencies within jurisdictions. If cooperation among public agencies is limited, for whatever reason, it will make it more difficult to implement certain elements of the national IVHS program.

This chapter examines whether the fragmentation in responsibility among public agencies makes it less likely that they will achieve the degree of cooperation necessary to take advantage of two principal areas of IVHS: Advanced Traffic Management Systems (ATMS) and Advanced Public Transit Systems (APTS).[1] Much of this chapter is based on a recent DOT study entitled *Institutional Impediments to Metro Traffic Management Coordination.*[2]

The chapter discusses the following issues:

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

Centralization Versus Decentralization

There are many scenarios as to how IVHS technologies could change the way local traffic management and transit services are provided. A common scenario is that traffic and transit managers will rely on a number of distinct technologies to gather information on traffic conditions.[3] This information would then be used to adjust traffic signals, ramp meters, and transit dispatching. Information on estimated trip times along alternative corridors would then be provided to travelers, thereby allowing them to change their itineraries if they so desired. Some experts have concluded that to achieve their maximum effectiveness, IVHS technologies will have to be adopted on a multijurisdictional, areawide basis. However, areawide traffic/transit management may be precluded if political jurisdictions or agencies fail to cooperate with one another or if they adopt incompatible technologies.

Centralization of Traffic Management. Some experts believe that traffic management operations in metropolitan areas should be organized under unified and centralized traffic management centers. There is a concern that the current fragmentation of responsibilities among agencies will either preclude the introduction of IVHS technologies or limit their effectiveness.

Need for Better Cooperation. Other experts theorize that the lack of formal cooperative arrangements among traffic management organizations in metropolitan areas is the result of the

fact that public officials have not conceded that greater centralization will result in substantial benefits. Relatively few of the traffic management systems in place today require substantial interagency or interjurisdictional cooperation. While inconvenient, fragmentation of responsibilities among agencies may not have had a major influence on how well traffic and transit operations have been managed in metropolitan areas.

New institutional arrangements often evolve in response to the emergence of new technologies. Indeed, the regional integration of various public utilities (e.g., water, sewer, electricity) often did not take place until it became clear that substantial benefits would arise from integration. This same pattern may occur in traffic and transit management operations. By providing substantial benefits to the traveling public, advanced highway and transit technologies may lead to closer cooperation among public agencies.

Review of Current Practices

A DOT-commissioned study, *Institutional Impediments to Metro Traffic Management Coordination*, investigated whether there are particular institutional and/or organizational impediments to greater metropolitan traffic management coordination and the adoption of ATMS and APTS technologies. The study focused on the experience of six metropolitan areas with varying demographic patterns, political arrangements, and traffic conditions.

For each metropolitan area selected, the study team interviewed state, city, and county transportation professionals involved in planning, traffic operations, traffic control, transit, and public safety. Each individual interviewed was asked his or her views on ten institutional issues related to social and administrative structures, laws, technical standards, and professional culture.[4]

The study team reached its conclusions based on:

- The results of quantitative and qualitative survey information;
- The study team's knowledge of organization theory; and
- The study team's knowledge of those elements of economic theory that relate to the design and effectiveness of organizations.

Characteristics of the metropolitan areas studied are shown in Table 2-1:

Table 2-1
Communities Participating in Metropolitan Cooperation Study

	Population (1990)	IVHS Technology Experience	Traffic Management Fragmentation
Atlanta	2,834,000	Low	Low
Austin	782,000	Moderate	Low
Baltimore	2,382,000	Moderate	Medium
Detroit	4,665,000	Substantial	High
Los Angeles	14,532,000	Substantial	High
Rochester	1,002,000	Low	Low

Source: Booz-Allen & Hamilton, *Institutional Impediments To Metro Traffic Management Coordination, September 13, 1993, 4-2.*

Study Findings

A major conclusion of the study is that public agencies have the ability to work together to introduce IVHS technologies. There is, for example, already considerable cooperation at the working level among state and local transportation agencies. In most of the communities surveyed, coordination committees composed of transportation professionals from various agencies and political jurisdictions have emerged, all operating with a clear sense of purpose. These committees could provide the basis for even greater cooperation among different organizational entities in a metropolitan area. It may be unrealistic to expect the formation of a "superagency" to manage and operate new IVHS products and services on a metropolitan or regional basis (assuming such an agency is desirable), at least in the near term. These committees, however, could form the basis for the adoption of IVHS technologies on a regional basis. This conclusion is supported by numerous comments to the Public Docket (No.48626, 58 Fed. Reg. 7029, February 3, 1993) that was opened to solicit comments on these issues.

Existing Attempts at Regional Cooperation. In metropolitan Atlanta, for example, a task force has been formed that includes representatives from local traffic, law enforcement, and emergency services organizations. This task force operates under the auspices of the Atlanta Regional Council (the local metropolitan planning organization). Often these committees embrace entire metropolitan areas with a large number of political entities. Los Angeles County, for example, has 89 different municipalities within its borders. Because of traffic congestion, Los Angeles has adopted a sophisticated traffic management system. The commitment to cooperative efforts among organizations in Los Angeles appears to be strong. By contrast, in Detroit there is little evidence of regional cooperation among agencies.

There are other examples of cooperation among public agencies. In the New York City metropolitan area, an organization, TRANSCOM, made up of representatives from 15 transportation and public agencies was established. Another organization in New York City, E-Z Pass Interagency Group, is composed of representatives from seven public agencies that collect tolls. In its comments to the Public Docket, E-Z Pass cited many instances where

cooperative activities among agencies had solved specific problems or provided valuable services to highway users.

Regional Cooperation Versus Regional Integration. Traffic managers recognize that regional approaches to traffic management could be desirable, since some ATMS and APTS technologies work better if they are operated across several communities and/or political jurisdictions. Table 2-2 illustrates the responses of the parties interviewed to various questions about the need for interagency cooperation and coordination. As the results indicate, there is strong support among traffic managers for interagency *cooperation,* but there is little support for the *integration* of traffic management operations.

Table 2-2
Response to Cooperative Efforts
All Respondents (Scale: 1 = Disagree to 7 = Agree)

My organization is supportive of cooperative efforts with other organizations.	6.5
My organization understands the importance of working with other agencies and jurisdictions and the public.	6.6
My agency has worked successfully with other agencies and jurisdictions in efforts that involve pooled funding and coordinated decision-making.	6
It would be relatively easy to establish a unified authority to deploy an ATMS.	3.9
It would be easy to maintain a consensus among a coalition of local authorities during the deployment, operation and maintenance of an ATMS.	3.9

Source: Booz-Allen & Hamilton, *Institutional Impediments To Metro Traffic Management Coordination, September 13, 1993, Appendix C.*

While the traffic managers interviewed agreed that regional cooperation was needed, there was much less support for the proposition that a single agency should be established to operate an ATMS technology throughout a large geographic region. Most of the individuals interviewed did not expect, at least initially,, that any agency would be willing to cede major areas of responsibility to an existing organization or to a new organization. When asked for their suggestions as to how coordination and cooperation among traffic management agencies could be improved at the local and/or regional level, traffic managers responded that either there could be a sharing (or even a trading) of responsibilities, or that certain individuals could work at their primary field offices but be electronically linked to other agencies.

The study also found strong opposition to suggestions that Federal aid be contingent on the adoption of formal joint responsibilities for traffic management operations in a metropolitan area. It was also clear that cooperation among (and within) jurisdictions is often driven by the desire or need for pooled funding and Federal sponsorship. Accordingly, there was support for the view that Federal funding could be structured in such a way as to encourage greater cooperation among public agencies and political jurisdictions.

Some of the individuals interviewed did state that a consensus may develop over time that the best way to manage IVHS technologies is through a large, centralized agency. (The type of organization that is best suited for the introduction of a new technology, of course, may not be

the best suited to operate it.) Most respondents, however, indicated that this would occur only ***after*** a new technology had been introduced and accepted by the traveling public. Much of the opposition to the formation of centralized traffic management agencies apparently stemmed from the belief that any attempt to impose such a "solution" would weaken support for the introduction of advanced highway technologies.

Regional Cooperation and Changes in Laws, Regulations, and/or Policies. The study concluded that significant changes in laws, regulations, and agency rules would not be required to achieve the interagency cooperation necessary to introduce ATMS. Most of the traffic managers interviewed believed that even greater cooperation among agencies and political jurisdictions could be achieved without major changes to existing laws, regulations, or policies.

Application to Local Conditions. There was a consensus that ATMS technologies will be deployed in various ways depending on local political arrangements and traffic conditions. However, the study revealed widely divergent views on the nature of the ATMS technologies being pursued at the national level, as well as how the national IVHS program relates to local traffic conditions and the concerns of local officials. In fact, many of the officials interviewed stated that ATMS technologies are only useful to communities with serious traffic congestion problems. They did not perceive ATMS as a modular system -- that is, a system that could be upgraded as traffic conditions change. The perception shared by most traffic managers about the limited usefulness of ATMS will have to be addressed in the outreach and education programs sponsored by DOT. The new definitions of user services should help to emphasize the incremental and modular nature of this technology.

Cost-Benefit Analyses and the Funding of IVHS. Virtually none of the people interviewed for the study was aware of any formal cost-benefit analyses that they could use to build political/public support for investments in IVHS technologies. While the respondents had considerable interest in IVHS technologies, many believed it would be difficult to get approval from policymakers (or the public) for investment in IVHS until there were professional studies that convincingly documented substantial net benefits from investments in nontraditional advanced traffic control technologies.

Many of the respondents were skeptical as to whether highway users (or state and local officials) would support new taxes or user fees to install and operate ATMS without more definitive information on the benefits of this technology. Further, many officials believed that the Federal Government would, and should, help finance the design and introduction of ATMS technologies. These officials also expected that after deployment, state and local governments would be financially responsible for their continued operation, a view consistent with the approach DOT has taken to date for funding ATMS.

*Desire **for** More Specific and Relevant Information.* Most traffic managers expressed a strong desire for more information about how IVHS could meet their specific needs. At the same time, many respondents stated that technical skills and knowledge of ATMS technologies at the local level are limited, even in those geographic regions where advanced technologies have been introduced.

Actions Underway

Many of the activities discussed in the previous chapter will also be useful in the efforts of local communities and public agencies to achieve greater interagency cooperation. Research studies, workshops, and operational tests are directly relevant to helping local agencies work more closely together. The DOT has a research program and outreach effort that relates to this issue. For example, DOT is sponsoring a study to explore alternative financing schemes such as pay-as-you-go financing and bond issuance for public sector IVHS technologies. The DOT will also consider how IVHS technologies could be integrated into the metropolitan planning requirements that are now being adopted to meet the mandates of the Intermodal Surface Transportation Efficiency Act of 1991.

The DOT already has underway several activities to improve cost-benefit analysis for local transportation officials. We have also been sponsoring research to improve the analytical models used to evaluate the benefits of IVHS technologies. A study is now underway to explore how to estimate the effect of different types of IVHS investments in a metropolitan area. We have also formalized a requirement for an independent assessment of the results of each operational test in order to gauge the impact of these new technologies.

Conclusions

The principal conclusion of our analysis is that the people who need to work together to manage highway traffic/transit operations are finding ways to achieve their common goal. The artificial barriers that have developed between agencies and political jurisdictions do not appear to be insurmountable. Moreover, the level of cooperation among public agencies is likely to improve over time. The national IVHS program will provide an impetus for more cooperative efforts. The operational test program for IVHS encourages the formation of partnerships across agency boundaries as well as public sector-private sector cooperation. The ISTEA requirements for regional transportation planning will further encourage greater capabilities of metropolitan planning organizations to foster regional cooperation.

The DOT's efforts to foster greater cooperation must be broadened to include police, fire and rescue departments, transit agencies, and metropolitan planning organizations. We will work to include these types of organizations in future community outreach programs. The DOT also will continue to pay attention to outreach efforts that help educate local traffic managers about the national IVHS program and how it relates to their concerns. To accomplish this goal, we will provide information, materials, and training to local traffic management officials.

The DOT will continue to find better ways to receive advice from state and local transportation professionals and policymakers. Unlike the national space program, where scientists and engineers can achieve their goals in relative isolation from the general public, new highway technologies must be closely linked to the needs of local communities.

The DOT will also continue to support the preparation of rigorous cost-benefit analyses for different IVHS technologies. The results of these analyses will be shared with local officials.

Without this critical information, it will be very difficult for state and local-officials to gain the public support necessary to fund new traffic management systems.

ENDNOTES

[1] Advanced Traffic Management Systems (ATMS) refer to new technologies and systems to monitor current traffic conditions and adjust lane usage, speed limits, traffic signals, and roadway ramp access based on actual traffic conditions rather than historical patterns. The National IVHS Program Plan includes such user services as traffic control, incident management, and travel demand management. Advanced PublicTransportation Systems (APTS) refer to the application of these technologies to public transit operations. APTS includes such user services as ride matching and reservation, enroute transit information, and personalized public transit services.

[2] Booz-Allen & Hamilton, *Institutional Impediments To Metro Traffic Management Coordination,* September 13, 1993. --

[3] Some examples of the possible IVHS-related technologies include: in-road detectors, television monitors/cameras, vehicle-based beacons, cellular phones, and individual driver and police reports. For additional information, see *IVHS Strategic Plan: Report to Congress,* U.S. Department of Transportation, December 18, 1992.

[4] The institutional areas addressed in the interviews were: benefits of ATMS; marketing, outreach and education; multiple jurisdictions and coordination mechanisms; ATMS expertise in metropolitan areas, organizational structures of stakeholders; funding of ATMS; public and private partnerships; legal and legislative considerations; and environmental impacts.

3 Procurement of IVHS Products and Services

Introduction

Some parties have argued that Federal, state, and local procurement policies will impede the development and deployment of IVHS technologies. Public agencies, according to these parties, are preoccupied with procuring goods and services at the lowest price without appreciating the problems, and additional costs, involved in developing new technologies. These parties also fear that a strict arms-length relationship between public agencies and IVHS vendors will inhibit the formation of mutually beneficial cooperative arrangements.

This chapter reviews IVHS procurement issues. Many of the concerns were raised in a recent report prepared by IVHS America, *Procurement Issues In IVHS Development and Deployment.*[1] Other concerns were suggested in the submissions we received to the Public Docket. This chapter discusses the following issues:

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

Impediments to Government High-Technology Procurements

Various impediments now exist in the procurement of high-technology products or services by public agencies.

Government Inexperience With High-Technology Procurements. Public agencies that want to establish contractual relationships with private firms for IVHS products and services may be inexperienced in high-technology procurements. Before a public agency can enter into a contractual relationship with a firm to provide a high-technology product, it must prepare a proposal that specifies, in detail, product specifications and performance requirements. These specifications and requirements must be developed without unduly favoring a particular vendor or technical solution.

The agency preparing the procurement, however, may not have the staff expertise to understand all of the relevant aspects of the technology or product it wants to acquire. Faced with such a situation, the agency may be forced to turn to specialized contractors and consultants, who will help prepare the procurement and evaluate final bids -- a process that increases cost and results in delay.

Cooperative Working Relationships With Vendors. One major difference between public sector and private sector procurements is that public agencies must maintain an impartial, arms-length relationship with private vendors. By contrast, private firms attempt to foster close working relationships with their suppliers. Such cooperation is particularly useful when a firm is uncertain as to whether it should acquire a new product or technology. Faced with this situation, a private firm can go to a potential vendor and discuss its needs without having to prespecify all relevant details and enter into a formal agreement. As its needs change, the firm can work with a vendor to develop or modify the product or technology.

Such cooperative working arrangements with private firms are unusual for public agencies. Under most circumstances, government contracts must be explicit and conform to established procedures and regulations. If a public agency seeks to revise product requirements before the terms of an existing contract are met, it often results in additional cost or delay. Contractors also recognize that future work with government agencies is more likely to be based on the competitiveness of their bids than on whether they have established a close working relationship with the public agency.

Training for Private Sector in Government Procurement Practices. Providing the private sector with more information on government procurement practices would improve the current procurement process. Many efforts are underway to achieve this goal. For example, the National Science Foundation sponsors training sessions on government contract regulations for small businesses, and the National Highway Institute provides training programs for state highway departments. Other sources of training include the National Contract Management Association, the American Bar Association Public Contracts Section, and the Transportation Research Board's Legal Resources Council.[2] IVHS America also has sponsored seminars on Federal and state procurement procedures. Further, DOT intends to provide specialized training in high-technology procurements for IVHS products and services.

Impediments Caused by Government Contracting Regulations

This section discusses regulations that may introduce additional delay and cost to government procurements.

Government Involvement in the Operation and Management of Private Firms. Private firms are not usually interested in their suppliers' operations and management practices. Moreover, the terms of contract between private parties are generally confidential. By contrast, public agencies often attempt to promote social goals through their business relationships with private firms, paying close attention to their suppliers' operations, expenditures, and employment practices.

Number and Complexity of Government Contract Laws and Regulations. Many small firms are challenged by the number and complexity of the laws and regulations that apply to government contracts. Complying with Federal cost accounting, cost certification, and auditing requirements can be a daunting task even for experienced contractors. To comply with these regulations, a firm may need to establish an entirely new accounting system and employ experts in government accounting practices, actions that may not be realistic for many small firms. The added cost of

complying with these regulations is no doubt reflected in additional administrative and overhead charges.

Compliance may become even more of a problem as the program moves toward deployment, since the contractor may then have to conform to state and local government accounting and procurement regulations. The vast majority of government IVHS purchases will be made by state and local governments. State and local procurements are subject to certain Federal regulations if they are financed with Federal funds. By and large, however, state and local governments are permitted to use their own procurement procedures. The flexibility that gives state and local governments the ability to meet local needs can also present problems for firms that have to comply with different procurement regulations and procedures in different political jurisdictions. This situation is not unique to IVHS procurements, although special problems may arise because of the complicated nature of acquiring high-technology products and services.

Other Financial and Administrative Burdens for Private Firms. There are other financial and administrative burdens private firms incur to meet Federal procurement requirements. These include the costs of complying with the requirements of the Drug-Free Workplace program and the Procurement Integrity Act. These costs, however, affect all government purchasing activities, not just those involving IVHS products and services.

New, start-up enterprises are expected to play a major role in developing and deploying IVHS products and services. While large firms may be in a position to establish separate subsidiaries (or profit centers) to serve government customers, such an option may be too costly for many small firms.

Organizational Conflict of Interest Limitations

As noted above, it is common for private firms to work closely with their suppliers. For public sector procurements, however, it is generally not considered good public policy for the same firm to be both the designer and the builder of a system. When seeking advice concerning the design of a system, a public agency does not want to create a situation where the developer enjoys an unfair competitive advantage if the system is subsequently built.

Some IVHS vendors have stated that the Organizational Conflict of Interest (OCI) rules may result in their being excluded from certain IVHS procurements.[3] They further contend that the OCI rules do not necessarily prevent the advice given by a private contractor to a public agency from being biased. These OCI rules may have adverse consequences from a public policy standpoint, since firms that have developed advanced highway systems and have the expertise to build them are precluded from doing so because of the rules. At the very least, government agencies need to find the correct balance between the need for unbiased information and the need to involve firms in all aspects (design, construction, and operation) of new IVHS technologies. In other instances, public agencies could adopt a “turn-key” approach, which would include designing, building, and deploying new systems.

Implementation of Fair and Reasonable Public Sector-Private Sector-Partnership Agreements

Although most members of the IVHS community contend that IVHS technologies will be developed and deployed through public sector-private sector partnerships, the meaning of the term "partnership" has not yet been fully defined. No established procurement model yet exists for the purpose of carrying out such partnerships. Further, all existing institutional arrangements (procurement, grants, and cooperative research and development agreements) fail to address one or more critical features of the partnership concept. These uncertainties virtually guarantee problems with future IVHS procurements. To illustrate this point, the following comments were provided to DOT during the course of this study:

- One respondent noted that "State and Federal laws were designed to make sure that transactions are conducted at arm's length. This principle is antithetical to a true partnership arrangement."[4]
- Many respondents commented that existing procurement regulations and procedures may impede public sector-private sector partnerships.[5]
- Some respondents commented that the partnership concept would help some firms avoid engaging in open competition, as required by the Competition in Contracting Act of 1984 and other statutes.[6]
- Several small firms expressed concern that they would be excluded from participating in some IVHS procurements, since only large firms have the financial resources necessary to "buy their way into" public sector-private sector IVHS partnerships through cost sharing or project financing.

Activities Underway

The DOT has several initiatives underway to better define many of the procurement issues discussed in this chapter. We are, for example, instituting an outreach program that will deal with many of the nuances of the Federal contracting process. The DOT is also investigating whether there are more flexible procurement procedures available to it. In the Automated Highway Program, for example, the Federal Highway Administration (FHWA) solicited proposals and awarded several contracts using the Broad Agency Announcement (BAA) procurement framework. Using this approach, FHWA did not specify the work to be performed in detail but, rather, described the project in general terms. Although the BAA is a contracting mechanism that had not been used by FHWA for some time, it will be considered for future procurements.

Through its Volpe National Transportation Systems Center, DOT has prepared a *Surface Transportation Research and Development Plan,* which includes a section on contracting and procurement issues. Table 3-1, which is based on that report, shows some of the activities underway at DOT on contracting and procurement issues.

Table 3-1
Other Contracting Studies and Initiatives

Program	Lead Office	Completion Date
1. Streamlined Procurement Practices -- Pilot Program	Office of the Secretary	To Be Determined
2. Study of Procurement Law Governing Acquisition of IVHS Research, Development, and Technology	FHWA Chief Counsel	July 1994
3. Study of Design/Build/Warranty Contracting on Highway Projects	FHWA Engineering	March 1993
4. Innovative Contracting Procedures - Special Experimental Project No. 14	FHWA Engineering	Ongoing
5. Transit Finance Program -- Innovative Finance Techniques and Public/Private Partnerships	FTA Technical Assistance & Safety	Ongoing
6. Program Review of R&D Contracting and Assistance Practices	FHWA Office of Program Review	June 1993
7. Quality Improvement - ISTEA Sec. 1043 Report	General Accounting Office	December 1993
8. Use of Warranties in Road Construction -- National Cooperative Highway Research Program, Project 20-5	Transportation Research Board	July 1993
9. Commission on Technology & Procurement -- Preliminary Report	Department of Commerce	To be Determined

Source: U.S. Department of Transportation, *Surface Transportation R&D Plan: A Report to Congress Pursuant to the ISTEA of 1991, Sec. 6009(b), July 1993, p. 160.*

Conclusions

Private vendors that provide products and services to public agencies incur additional costs compared to those vendors that deal exclusively with other private firms. Public agencies can help firms, particularly small firms, become familiar with their procurement regulations. Public agencies should review their procurement regulations to determine if they could be streamlined.

Problems with Federal procurement regulations were discussed in the recently completed *National Performance Review*.[7] The report proposed six major reforms that would streamline Federal procurement procedures. A companion report discussed procurement issues in more detail and suggested reforms to existing rules and procedures.[8] Any changes in Federal procurement regulations and procedures ultimately adopted as a result of this initiative could prove helpful to deploying IVHS technologies.

But even if Federal procurement reforms are adopted, there will still be a significant problem with state and local procurement requirements. This lack of uniformity among political jurisdictions presents problems not only for contractors but also for those jurisdictions that wish

to cooperate in their procurement activities (perhaps to ensure compatibility of technologies adopted). The desire to encourage public sector-private sector partnerships, moreover, is inhibited because many political jurisdictions are uncomfortable with the prospect and lack the authority to enter into partnership arrangements with private firms.

ENDNOTES

[1]IVHS America Legal Issue Committee, Procurement Task Force, *Procurement Issues in IVHS Development and Deployment*, April 23, 1993. Subsequently, a revised version of the report was approved by the IVHS America Board of Directors and the IVHS America Coordinating Council.
[2]*Ibid.* p. 12.
[3]There rules are codified in FAR 9.5. See also, OFPP Policy Letter 89-1, "Conflict of Interest Policies Applicable to Consultants."
[4]IVHS America Legal Issue Committee, Procurement Task Force, *Procurement Issues in IVHS Development and Deployment, op. cit.*, p. 25.
[5]In addition to IVHS America Legal Issue Committee, Procurement Task Force, *Procurement Issues in IVHS Development and Deployment,* see the comments in Public Docket No. 48626 of the American Public Works Association, the American Society of Civil Engineers, the California Trucking Association, and Public Technology, Inc.
[6]For example, see the comments of Donna L. Villers, Colorado Department of Transportation in Public Docket No. 48626.
[7]Gore, Albert, *From Red Tape to Results: Creating a Government That Works Better and Costs Less, Report of the National Performance Review*, Washington, D.C., September 7, 1993.
[8]*Accompanying Document to National Performance Review, Reinventing Federal Procurement,* September 1993.

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4 The Role of Design and Performance Standards In The IVHS Program

Introduction

Establishing design and performance standards for new IVHS products, services, and systems architecture is often cited as a critical policy issue.[1] Some members of the IVHS community are concerned that without such standards, IVHS vendors will be unwilling to make the investments necessary to develop new IVHS products. But before standards can be adopted for various IVHS technologies, several policy issues must first be resolved. For example, what specific IVHS technologies (or subtechnologies) would benefit if standards were adopted? Should certain standards be allowed to develop solely in response to market forces? Should the Federal Government or private industry assume the lead role in developing certain standards?

This chapter discusses the following standards issues:

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

The Benefits and Costs of Industry Standards

Three types of IVHS design and performance standards are likely to emerge:

- *De facto industry standards* that become accepted as a result of market forces and competition within the industry. In the personal computer industry, for instance, certain hardware platforms and software packages have become the industry standard; as a result, competing products must be compatible with them if they are going to be commercially successful. Vendors can attempt to make their products the industry standard but, ultimately, this power rests with consumers. Competition and market forces should ensure that the best product, service, or systems architecture becomes the industry standard.
- *Voluntary standards* that are established by industry organizations or professional trade associations. These standards are adopted voluntarily but in effect become mandatory throughout the industry.
- *Regulatory standards* that are established by government agencies through administrative procedures.

Benefits of Standardization. Those parties that wish to establish IVHS standards argue that they will encourage faster development and deployment of IVHS products and services. These parties also contend that industry standards will make it easier to draw upon public sector and private sector organizations to develop, finance, and operate new IVHS products.

Some analysts-believe that the adoption of standards may make it easier to market new IVHS products. These parties argue that potential customers (individuals, firms, and public agencies) will be less inclined to buy essential system components until they are certain that they will operate in a consistent, predictable way over wide geographic areas. Industry standards could also foster consumer confidence, since any new IVHS products introduced would be more likely to retain their value. Further, IVHS users would find it easier to upgrade their systems as new, add-on features become available.

Vendors of IVHS products would also benefit from the adoption of industry standards, since it would eliminate much of the risk that new products would embody "orphan" technologies. National standards would also make it easier for IVHS vendors to offer their products over wide geographic areas, thereby allowing them to reduce marketing and production costs. Many IVHS vendors, moreover, have stated that they need to perceive a "critical mass" of potential consumers before they are willing to develop new products. If industry standards were established this critical mass of potential consumers could, possibly, be realized sooner rather than later.

Problems Implementing Standards. By and large, the public sector and private sector have limited experience in cooperating with each other, making it more difficult to establish industry standards.[2] Despite the private and social benefits that result from industry standards, their adoption may inadvertently suppress new technologies. Moreover, it has been suggested that systems architecture and performance standards may have their desired effect for only a relatively short period of time -- a period when we have very little data to evaluate their beneficial effects and adverse consequences.[3]

Within the IVHS community a consensus exists that industry standards may be difficult to achieve. For instance, the design, development, and operation of advanced highway and travel information systems are not based on a single scientific or engineering discipline. Rather, IVHS technologies draw upon numerous disciplines: operations research, telecommunications, advanced electronics, automotive engineering, psychology, and human factors engineering. Each field has its own history, tradition, and interests, which will make it difficult for the various parties to reach agreement on industry standards.

Current Standardization Efforts. Some preliminary attempts to specify and adopt IVHS design and performance standards already have been made by several independent organizations:

- The American Association of State Highway and Transportation Officials;
- The American National Standards Institute;
- The Electronics Industry Association;
- The Institute of Electrical and Electronics Engineers;
- The Institute of Transportation Engineers;

avoidance systems, such as driver status monitors, side/rear object detection/warning systems, automatic braking systems, intelligent cruise control, or for vehicle controls and displays associated with other IVHS products (e.g., route guidance systems and traveler information systems). These latter standards would ensure that safety is not degraded as IVHS products are incorporated into motor vehicles.

Government Standards Agencies. In some instances, it will be useful for the IVHS program to draw upon existing Federal standards agencies, such as the Department of Commerce's National Institute for Standards and Technology (NIST), to help develop performance and technical standards for new IVHS products and services. These Federal agencies are responsible for developing performance standards and performance-measurement standards for advanced technology products and services that are procured and operated by public agencies and the military.

The DOT and Design and Performance Standards. In helping to establish design and performance standards, DOT will:

- Work with members of the IVHS community to identify those areas where it is crucial to establish standards;
- Assist standards-setting organizations;
- Ensure that obstacles to the standards-setting process are not inadvertently created as a result of legislation, regulation, or government procurement policies; and
- Promote the interests of the traveling public and U.S. firms engaged in IVHS research and development both at home and abroad.

Current and Planned DOT Activities

The DOT has several activities underway to identify and evaluate IVHS standards.

Development of an IVHS Systems Architecture. The DOT is sponsoring a coordinated research effort to define a standard systems architecture for various IVHS technologies. Scheduled for completion by 1996, this research program focuses on the following three areas:

- *Vehicle/infrastructure interface standards,* which will establish common "message sets" and protocol standards;
- *Safety standards,* which may require performance standards for collision avoidance technologies, such as longitudinal control devices, safety hazard warnings, and proximity detectors; and
- *Infrastructure standards,* which will establish communication and design specifications for IVHS products that interface with public infrastructure.

Other DOT-sponsored Research. The DOT is also sponsoring research in the following areas:

- Standards for spatial information databases;

- Vehicle-roadside identification standards (which will focus on commercial vehicle operations);
- Cataloging ongoing IVHS standards-setting activities;
- Reviewing electromagnetic compatibility issues and how they could affect IVHS;
- Identifying areas that will require human factor standards (e.g., driver-vehicle interaction and traveler-transit system interaction); and
- Determining performance guidelines for future crash-avoidance systems. [6]

Radio Frequency Identification Activities. The DOT has been involved in assessing the radio frequency spectrum needs of various IVHS technologies including:

- Gaining approval from the National Telecommunications and Information Administration to dedicate five narrow-band channels to IVHS;
- Gaining the recognition of the Federal Communications Commission that IVHS is a priority area for the allocation of the radio spectrum;
- Sponsoring a study to identify communication technologies that could support IVHS;
- Gaining the support of the Department of Commerce in the area of electromagnetic compatibility; and
- Sponsoring a study to develop and test a standard for broadcasting digital traffic information over FM sub-carriers.

IVHS America. Although IVHS America does not establish industry standards, it has established a Standards and Protocols Committee and a Center for Standards and Protocols. The Committee is developing a plan that will identify areas where industry standards are needed. The Committee has also been working with the Federal Communications Commission on spectrum issues. To ensure that any standards ultimately adopted reflect the needs of the IVHS community, the Center will serve as a liaison with other organizations involved in establishing industry standards.

Council of Standards Activities. IVHS America and a number of organizations involved in setting industry standards recently formed a Council of Standards. The Council is chartered to facilitate cooperation among standards-setting organizations. One of the Council's goals is to reach a voluntary agreement as to which parties have the lead in establishing standards. The Council will work to eliminate duplication of effort and make sure that all key technical areas are considered.

Existing Standards-Setting Bodies. Private organizations will establish many IVHS industry standards. Two organizations, the Society of Automotive Engineers (SAE) and the Institute of Electrical and Electronic Engineers (IEEE), will play crucial roles in this effort. The SAE will almost certainly play a major role in setting standards that affect motor vehicle components and systems. Moreover, the SAE has established various committees and working groups to develop industry standards and to specify what constitutes recommended practice.[7] The IEEE has established a Standards Coordinating Committee, with three subcommittees working in the following areas:

- The National Electrical Manufacturers Association;
- The SAE International; and
- The Telecommunications Industry Association.

The National Institute of Standards and Technology and the National Highway Traffic and Safety Administration, as well as other Federal agencies, may also be involved in setting IVHS technical and regulatory standards.

Priority Areas for Technical Standards

The first priority is to establish standards for systems architecture. Such standards would provide a consistent framework for long-term IVHS development. Adopting standards will be important in other technical areas, too, including communication systems and information databases.

Systems Architecture. Systems architecture specifies how various subsystems communicate with each other as well as what information is shared. Some typical subsystems are roadside control and communication devices, onboard vehicle systems, and transportation information centers. Defining systems architecture will lay the framework for developing and deploying future IVHS products.

Communications Technologies and Radio Frequencies. Intelligent vehicle-highway systems will draw upon many communication technologies. The limited availability of radio frequency spectrum resources, however, could prevent new IVHS products and services from being introduced. Because of the large demand for frequencies, and the length of time it takes to get them allocated, the IVHS community needs to take action now to secure dedicated capacity, although a number of technical and policy issues still need to be resolved.

One IVHS technology that will require the introduction of technical standards is Automatic Vehicle Identification (AVI) -- a technology that will make motor carrier operations more efficient through the electronic tracking of vehicles and cargo. While desirable, it is not certain whether it will be possible to establish a single communication standard for various AVI technologies; indeed, competing technologies are commercially available. Moreover, various road and toll jurisdictions are now using incompatible technical specifications for the procurement of AVI-based electronic toll collection systems.[4] As a matter of public policy, it may be desirable to resolve technical issues involving the duplication of alternative AVI technologies sooner rather than later.

Spatial Information databases. Three types of standards for digital-map databases have been identified. Before spatial database technology will become operational, industry standards will need to be established in the following areas:

- *Performance standards* that set minimum requirements for completeness, content, and accuracy;

- *Transfer or interchange standards* that-specify a common for-mat for the exchange of spatial data, thereby simplifying the job of transmitting map information from one party to another[5]; and
- *Truth-in-labeling standards* that establish common definitions and metrics for the contents of various databases.

Hazard Analysis/System Safety. Estimating the likelihood and consequences of the failure of a new technology or system before it is deployed is called hazard analysis. Such analysis is commonly undertaken for those systems and product that could affect public safety. Hazard analysis for IVHS technologies would focus on those systems and products that could result in loss of life, injury, or property damage. Several safety standards for computer software already have been written. Before such standards can be established, however, it is necessary to specify acceptable levels of risk that the hardware or software should fail. Assessing levels of risk implies making judgments about the probability and consequences of a software and/or hardware failure.

Human Factors and Traveler Safety. Receiving too much information on traffic/travel conditions while operating a vehicle could distract the driver and impair highway safety. To ensure that IVHS users are not distracted or overloaded with travel information, human factor and traveler safety standards will need to be established. The DOT will take action to ensure that IVHS products do not adversely affect highway safety.

International Harmonization. European and Japanese firms have been engaged in IVHS research and development longer than have U.S. firms. As a result, members of the European and Japanese IVHS community exercise substantial influence through the International Standards Organization (ISO). Operating under the auspices of the American National Standards Institute (ANSI), the SAE International and IVHS America, among others, represent U.S. commercial interests before the ISO. The DOT will work to ensure that the economic interests of U.S. firms engaged in the development of IVHS technologies are considered by international regulatory and standards-setting organizations.

The Role of Government Agencies in Setting Standards

In some cases, especially in the area of public safety, the Federal Government, when appropriate, will establish design and performance standards for IVHS products. The rules and regulations promulgated by Federal regulatory agencies will no doubt influence how quickly IVHS products are commercialized.

National Highway Traffic Safety Administration (NHTSA) Standards. The primary mission of NHTSA is to reduce the frequency and severity of highway crashes. All motor vehicles and motor vehicle equipment manufactured domestically or imported for sale into the United States must comply with the Federal Motor Vehicle Safety Standards (as set forth in 49 CFR 571). If NHTSA determines that an IVHS product or service would promote motor vehicle safety, it could require it be adopted in new vehicles. Any safety standards established by NHTSA would establish minimum performance requirements for vehicle-based or cooperative-collision

- Developing practices and procedures for protecting IVHS products/services that could be affected by lightning;
- Defining IVHS nomenclature; and
- Developing protocols for communications linkages.

Several states also have taken action to set IVHS standards, especially for electronic toll collection systems. The State of California, for example, has adopted a standard. In metropolitan New York City several organizations are working to develop a common standard so that vehicles will be able to use one identification device for toll roads and bridges in the region.[8]

Conclusions

Establishing industry design and performance standards is important for the success of the IVHS program. The first step in this process is to establish a consensus on systems architecture. The premature adoption of industry standards, however, could be detrimental to the long-term success of the IVHS program. Faced with this dilemma, the most appropriate course of action is to rely primarily on private standards-setting organizations within the IVHS community. Except for technologies that affect public safety, the private sector is usually in a better position to develop design and performance standards for goods and services than is the Federal Government. Moreover, DOT should continue to ensure that the commercial interests of U.S. firms are represented when international standards are promulgated.

ENDNOTES

[1]The issue of IVHS technical and performance standards was frequently cited in comments submitted to Public Docket 48626. See the comments of the American Society of Civil Engineers, SAE International, State of California DOT, State of Colorado DOT, E-Z Pass Interagency Group Policy Commission, Indiana DOT, Kentucky Transportation Cabinet, Maryland DOT, Utah DOT, Ford Motor Company, George Mason University, and IVHS America.

[2]For more discussion of these considerations, see for example, Jonathan L. Gifford, "Standards for Intelligent Vehicle-Highway System Technologies," *Transportation Research Record,* Issue 1358, 1992, pp. 22-28.

[3]See Jonathan L. Gifford, op. *cit.* p. 23.

[4]See submission to Public Docket 48626 by Linda M. Spock, Chair, Interagency Policy Committee, E-Z Pass Interagency Group, April 15, 1993.

[5]Candidate standards have been developed in the United States and Europe. The draft standard in the United States is the Standard Data Transfer Standard (SDTS); in Europe it is the Geographic Data Format standard (GDF).

[6]For more information on this research see Department of Transportation's *Intelligent Vehicle Highway Systems Projects,* February 1993.

[7]For additional information on SAE IVHS activities, see the submission to Public Docket 48626 from Max Rumbaugh, Executive Vice President, SAE International, March 3 1, 1993.

[8]See submission to the Public Docket from E-Z PASS, *op. cit.* pp. 1-3; and Frank S. Zolin, Director, California Department of Motor Vehicles, April 9, 1993, p. 3.

5 Staffing And Education Needs

Introduction

Advanced traffic management and advanced public transportation technologies draw upon various technical, scientific, and policy disciplines.[1] Some traffic managers have reported that their staffs may not have the education, skills, and experience necessary to deploy and operate new IVHS technologies. Most state and local transportation planning organizations will have to augment the professional and technical capabilities of their staffs.

In order to gather more information on this subject, DOT commissioned the Urban Institute to conduct a study on IVHS staffing and education requirements.[2] This chapter, which is based primarily on that study, discusses the following issues:

- Skill requirements for IVHS;
- Staffing requirements for IVHS; and
- Private sector and public sector staffing challenges.

Skill Requirements for IVHS

The Urban Institute analyzed the job skills that will be required to deploy and operate IVHS technologies. As part of its study, the Urban Institute interviewed individuals from industry, academia, and the public sector about the skills and staffing requirements needed to implement the national IVHS program. The following subsections discuss the skills needed for the IVHS program as well as the current state of expertise in traffic and transit management operations.

Traffic Engineers and Technicians. The Urban Institute found a consensus that there is not now a large enough pool of qualified traffic engineers who can operate Advanced Traffic Management Systems (ATMS) and Advanced Public Transportation Systems (APTS). Many of those interviewed also thought that the IVHS program will suffer due to the lack of qualified electronic technicians, traffic signal technicians, and traveler information systems technicians, especially those with experience in field installation and repair.[3]

Traffic Management Center and Transit Management Center Operators. Some industry experts believe that there are not enough people in the work force who have the expertise needed to operate traffic management centers and transit management centers. Many of the traffic managers interviewed stated that on-the-job training under experienced supervisors would ensure that day-to-day operations would be handled successfully in the future.[4] The job skills needed to operate traffic management centers include the ability to:

- Override automated systems;
- Bring new sections of highway under the control of these centers;
- Manage emergency situations; and
- Remain alert for long periods of time.

While the experts interviewed acknowledged that relatively few individuals have the necessary skills to operate IVHS products and services today, they are generally confident that IVHS staffing problems will become less serious over time as training programs are established.

Advanced Public Transportation Systems. These systems involve the application of information technologies to mass transportation. Many of the skills needed in highway traffic management centers will also be needed by transit operators using APTS. Additional skill requirements include an understanding of transit equipment and operations, including buses, light rail, heavy rail, and paratransit. Finally, as job descriptions change, labor negotiating skills will be needed. Most of the experts interviewed did not expect major problems in providing the skills needed to operate and maintain APTS, although they did think that key labor markets should continue to be monitored.

Commercial Motor Vehicle Operators. Nearly all those interviewed believed that commercial motor vehicle operators will not have major problems finding employees with the skills needed to take advantage of commercial IVHS technologies. The adaptability and responsiveness of private firms to new economic opportunities will make it possible -- indeed imperative -- for them to hire the personnel they need to operate IVHS products.[5]

Training. The Urban Institute concluded that colleges and universities are not training enough people with the skills needed to operate advanced traveler information, advanced traffic management, and advanced public transportation systems. Although colleges and universities are training a sufficient number of people for database management and to construct digital maps for routing and navigation purposes, some respondents stated that not enough people are being trained with the skills needed to assemble and transmit information to homes, bus stops, work places, transit vehicles, and motor vehicles.[6] Many of the individuals questioned also thought that as an IVHS architecture became established, and as the work force became proficient in designing, operating, and maintaining these technologies, steps could be taken to guarantee that an adequate number of properly trained workers become available for the IVHS program.

Staffing Requirements for IVHS

As shown in Table 5-1, the Urban Institute projects that domestic employment in the IVHS sector will increase from 21,000 in 1996 to 219,000 in 2011. In a separate analysis, the California Council on Science and Technology projects IVHS-related employment growing from 20,000 in 1995 to 110,000 in 2010.[7]

Table 5-1
IVHS Employment Forecasts

	Urban Institute	Project California
1995/1996	21,000	20,000
2000/2001	95,000	64,000
2010/2011	219,000	110,000

Source: Urban Institute, *IVHS Staffing and Educational Needs, September 1993.*

As shown in Table 5-2, the Urban Institute estimates that between 1995 and 2000, employment in the IVHS sector will account for no more than 0.6 percent of total employment in any occupation, a figure too small to exert a major influence on market trends for each occupation. By 2011, however, employment in the IVHS sector is expected to account for 5.1 percent of jobs for precision assemblers, 4.4 percent of electrical/electronic engineers, 2.9 percent of engineering technicians, 2.7 percent of industrial engineers, and 2.1 percent of mechanical engineers. Even though employment in the IVHS industries may grow to more than 5.0 percent of employment in certain technical and professional occupations, the Urban Institute concluded that labor markets should be able to accommodate this growth in demand.[8]

Table 5-2
IVHS Employment Share of Total Occupation Employment

Occupation	1995-2000	2005-2010
Executive, Management, and Managerial	0.10%	0.82%
Aeronautical/Astronautcial Engineers	0.10	0.93
Civil (including Traffic) Engineers	0.21	1.84
Electrical/Electronic Engineers	0.52	4.41
Industrial (except Safety) Engineers	0.29	2.69
Mechanical Engineers	0.24	2.13
Computer, Math and Operations Research Engineers	0.14	1.24
Economists	0.14	1.23
Urban & Regional Planners	0.10	0.83
Lawyers	0.09	0.67
Engineering Technicians	0.33	2.93
Mechanics for Electrical, Electronic, and Communications Equipment	0.16	1.79
Precision Assemblers	0.60	5.10
Total	**0.14%**	**1.19%**

Source: Urban Institute, *IVHS Staffing and Educational Needs, September 1993.*

Private Versus Public Staffing. Staffing requirements for the national IVHS program will depend on which technologies are deployed. For example, if in-vehicle equipment, rather than

highway infrastructure, becomes the primary means by which IVHS products become available to highway users, the number of IVHS employees needed in the private sector would increase relative to the number required by public agencies.

In addition to manufacturing and marketing in-vehicle equipment, IVHS architecture will require private firms to develop databases, although the public sector could assume this responsibility in many urban areas. The private sector is also in the forefront of developing digital map databases for vehicle navigation, although public agencies will play an increasing role in this area as they install geographic information systems and become familiar with global positioning technology. By contrast, the public sector is likely to have a large role in operating ATMS, particularly those technologies that build upon existing signal control and freeway management systems. The public sector will also have responsibility for most public transportation systems.

IVHS Staffing and the Current Restructuring of the Economy. In response to domestic and international political and economic developments, many sectors of the Nation's economy are undergoing restructuring. Over the last several years, large numbers of workers have had to acquire new, marketable skills, either through training or formal education. Many individuals who will work in the IVHS sector are working today in related occupations.

IVHS Staffing and Academic Programs. The restructuring of the economy will compel professionals and technicians working today to augment their skills or learn new ones. Public and private vocational and training schools have an important role to play in making sure that there are enough workers qualified to install, operate, and maintain IVHS equipment.

Based on interviews with academics, the Urban Institute concluded that there should not be a specialized degree for those individuals who want to work with IVHS technologies, although many respondents stated that colleges and universities should offer a broader and more integrated multidisciplinary curricula so that students interested in technical and policy issues that affect IVHS could acquire the necessary knowledge and skills. Civil engineering programs, for instance, may need to be restructured so that students have a better understanding of general systems theory, advanced electronics, mechanical engineering, and telecommunications. Similarly, students specializing in certain engineering disciplines (other than civil engineering) probably will need to become more familiar with transportation systems and civil engineering if they are going to find jobs in the IVHS sector.[9] Community colleges will play a major rule in training technical staff for the IVHS program.

IVHS Staffing with Foreign Students. Individuals who have come to the United States for higher education are a major source of technical and professional talent for the IVHS program. Foreign students now represent over 40 percent of the full-time science and engineering graduate students in the United States as well as a substantial number of the full-time faculty in the engineering disciplines and computer science.[10]

IVHS Staffing with Women and Minorities. Relatively few women and minorities are employed as professionals in the engineering disciplines or in other professions closely related to transportation.[11] Many in the academic community already recognize the need to design

programs that encourage women and minorities to enter scientific and technical disciplines, including those that will be required for the IVHS program.

IVHS Staffing from the Defense Sector. The Nation's declining 'defense sector is another important source of professional and technical talent for the IVHS program. The Defense Conversion Commission has estimated that between 199 1 and 1997 about 960,000 defense-related jobs will be lost.[12] While employees in the defense sector could be an important source of talent for the IVHS program, the ability of private firms and public agencies engaged in IVHS research, development, and production to assimilate these workers could be more difficult than has been generally appreciated. For example, IVHS products will be manufactured and operated under competitive conditions, quite unlike those in the defense sector (e.g., where relatively few high-technology products are built for a single client). Nevertheless, there have been successes in reallocating workers from the defense sector to certain transportation industries, particularly engineers.[13]

Private Sector and Public Sector Staffing Challenges

This section discusses the major challenges that both the private sector and public sector face with IVHS staffing:

Challenges to the Private Sector. Many of the experts interviewed stated that private firms do not now have nor will they have a problem meeting needs for trained staffing to operate IVHS products and services.[14]

Challenges to DOT. Managing a large and rapidly growing IVHS program will be particularly challenging for DOT. Various DOT operating administrations are managing research and development projects for the IVHS program, as well as designing operational tests for new highway technologies. The Federal Government will continue to work with state and local officials and the private sector to deploy IVHS products and services. The DOT is employing various management strategies to accomplish its objectives, and we continue to receive assistance from national research laboratories, private contractors, and IVHS America.

Challenges to State and Local Governments. A number of state transportation departments and metropolitan planning agencies are engaged in IVHS activities. These organizations, however, tend to build upon existing staff expertise (which is rooted in civil engineering), not in those scientific and technical disciplines that are required for the deployment of many IVHS products. State and local agencies face financial and staffing constraints that will make it difficult for them to deploy, operate, and maintain new IVHS technologies. To overcome these obstacles, these agencies will have to rely on training programs, consultants, and cooperative arrangements between the public sector and private firms. Hiring, training, and retaining enough staff who have expertise in systems engineering may be especially difficult. It may also be difficult to hire and retain enough staff who have the education and experience necessary to assess the public and private benefits and costs of IVHS technologies relative to other transportation projects and strategies.

According to the Urban Institute, current strategies for meeting IVHS staffing requirements in the public sector should prove to be adequate. Some local agencies see a clear benefit to using IVHS technologies as part of their overall transportation program. Many of the public officials interviewed, especially those from smaller political jurisdictions, indicated that they and their staffs are so preoccupied with day-to-day operations that it is unrealistic to believe they could adopt sophisticated IVHS products and services at the local level.[15] Indeed, many smaller transportation departments have only one civil or traffic engineer. In sum, it may be difficult for many local transportation agencies to deploy new IVHS products or services given their current financial and staff resources.

Conclusions

It is very unlikely that there will be a major shortage of trained workers to deploy, operate, and maintain new IVHS products and services over the long term. It is quite possible, however, that state and local transportation departments and transit authorities may be unable to hire and retain enough workers with the technical and professional skills because of low pay or hiring restrictions. It is very unlikely that private firms will face shortages of trained workers because of hiring restrictions or limits on compensation.

The DOT is working with other organizations to explore ways to alleviate the problems that state and local governments have in hiring and retaining qualified staff. This effort will form the basis of a strategy to address the broader problems of education and training for the workforce needed to deploy and operate IVHS technologies.

The DOT will continue to monitor trends in labor markets. Other actions that could be undertaken in the area of IVHS staffing include forming national, regional, state, and local employee development and rotation programs and develop management training programs for government employees. Further DOT actions in training and education will be addressed in the IVHS National Program Plan, which is now being prepared.

ENDNOTES

[1]See, for example, *IVHS AMERICA Strategic Plan,* May 20, 1992, pp. 1-2.
[2]The Urban Institute, *IVHS Staffing and Educational Needs,* September 1993.
[3]*Ibid.* p. 98. See also the comments in Public Docket 48626 by Leon Goodman, Institute of Traffic Engineers.
[4]*Ibid.* p. 101.
[5]*Ibid.* p. 98.
[6]*Ibid.*
[7]California Council on Science and Technology, *Project California Update,* Volume 2, No. 1, February 1993. Project California is a state-sponsored effort to identify technology areas in which California might exert leadership over the next twenty years.
[8]The Urban Institute, op. *cit.* p. 84.
[9]*Ibid.* p. 141.
[10]*Ibid.* p. 65.
[11]*Ibid.* p. 56.
[12]*Ibid.* p. 69 (quoting Defense Conversion Commission, *Adjusting to the Drawdown,* Washington, D.C. December 31, 1992, p. 52).
[13]The Urban Institute, op. *cit.* p. 134.
[14]*Ibid.* p. 103.
[15]*Ibid.* p. 104.

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6 Antitrust Issues

Introduction

Antitrust issues are primarily of concern because of a perception in the business community that particular conduct, especially by joint ventures, could be found to violate the antitrust laws, subjecting parties to substantial damages. This chapter reviews the antitrust laws and assesses whether they will significantly delay the development, production, and deployment of IVHS technologies. After an analysis of the antitrust laws and the paper *IVHS and Antitrust: A Preliminary Assessment* (which was specifically commissioned for this report), [1] this chapter concludes that the antitrust laws will not have a negative impact on IVHS development and production. This opinion is supported by the findings of various researchers, who have concluded that the antitrust laws do not significantly impair research and development collaboration by private firms in the United States,[2] as well as the general view of the commenters to the Public Docket No. 48626 (58 Fed. Reg. 7029, February 3, 1993).[3]

This chapter discusses the following 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; and
- IVHS America's antitrust guidelines.

The Antitrust Laws

For IVHS, the most relevant antitrust statutes are the Sherman Act of 1890, codified at 15 U.S.C. § 1 *et seq.*, which prohibits monopolization and contracts in restraint of trade, and the National Cooperative Research and Production Act of 1993 (NCRPA), P.L. No. 103-42, 103d Cong., 1st Sess. (1993), amending P.L. 98-462, 98 Stat. 1815 (1984), codified at 15 U.S.C. 4301-4305, which allows certain joint ventures engaged in research and production to limit their potential antitrust liability.

The Sherman Act

The Sherman Act seeks to promote the public welfare by ensuring that the output and prices of goods and services are determined by competition. As the Supreme Court has pointed out:

> "The Sherman Act reflects a legislative judgment that ultimately competition will produce not only lower prices, but also better goods and services. The heart of our national economic policy long has been faith in

the value of competition." National Society of Professional Engineers v. United States, 435 U.S. 679, 695 (1978) (citation omitted).

Interpretation of the Sherman Act. Although the Sherman Act's prohibitions against contracts in restraint of trade and monopolization are phrased in general terms, the judicial cases interpreting the statutory language have established standards for determining whether a transaction is likely to violate the act. In addition, as explained below, respective enforcement agencies can issue policy statements and opinions interpreting the applicability of the antitrust laws.

Enforcement of the Sherman Act. The Sherman Act may be enforced by the Department of Justice (DOJ) and the Federal Trade Commission (FTC), injured private parties, and state governments (the DOJ and the FTC are referred to hereafter as the "enforcement agencies").[4] The DOJ can obtain criminal penalties for antitrust violations and, like the FTC, private parties, and the states, it can obtain injunctions to prevent antitrust violations. Private parties and the states can also obtain treble damages under the Sherman Act, except insofar as statutes like the NCRPA limit damages obtainable for antitrust violations.[5]

Sherman Act Standards on Joint Ventures

The development and deployment of IVHS technologies are activities that may sometimes involve the formation of joint ventures or partnerships by firms engaged in the effort. While the creation of a joint venture or partnership by actual or potential competitors can raise antitrust questions, the antitrust laws generally allow firms to form such joint ventures.[6] Further, there are a number of federally funded operational tests proposed or underway, as well as other business ventures in which companies are collaborating on the development of IVHS products and services. As far as we know, none of these collaborative ventures has required a review by the DOJ, nor have any lawsuits alleging antitrust violations resulted from these ventures.

Joint Ventures Rarely Seen as Violating Antitrust Laws. The United States' economy contains many joint ventures and partnerships involving actual or potential competitors, yet these cooperative arrangements frequently provide substantial efficiency benefits that could not be obtained otherwise. Cooperative arrangements are rarely challenged because neither the courts nor the enforcement agencies have viewed the legitimate use of cooperative arrangements as presenting inherent antitrust risks. Instead, the courts and the enforcement agencies usually find that such arrangements are likely to promote economic efficiency and further competition.

Use of the "Rule of Reason" in Determining Antitrust Violations. In considering whether a cooperative arrangement is in violation of the antitrust laws the enforcement agencies and the courts use the "rule of reason" analysis that gives weight to the arrangement's potential procompetitive benefits along with its potential anticompetitive effects (except for a few types of arrangements that are inherently anticompetitive and considered unlawful, per se). The enforcement agencies accordingly have not been hostile to joint ventures. The FTC, for example, approved the production joint venture between General Motors and Toyota setting up a plant for manufacturing automobiles in the United States.[7]

Joint Ventures that Result in a Merger or Acquisition. In reviewing the formation of a joint venture that has the effect of a merger or acquisition, the enforcement agencies (and the courts) employ the kind of analysis used in merger cases. However, a joint venture will likely have less of an effect on competition than a merger, since the joint venture is usually limited in scope.

In analyzing proposed mergers, the DOJ and the FTC follow their 1992 Merger Guidelines, 57 Fed. Reg. 41552 (September 10, 1992). The Guidelines' general theme is that proposed mergers should be blocked if they are likely to create or enhance market power, market power being defined as the ability to profitably maintain prices above competitive levels for a significant period of time (firms with market power can also harm customers by reducing product and service quality below competitive levels). To determine whether a proposed merger is likely to create or enhance market power, the DOJ and the FTC primarily consider whether the merger would significantly increase concentration in the relevant markets, whether the merger raises concern about potential competitive effects in light of concentration in the market and other factors, and whether entry into the market would be timely, likely, and sufficient either to deter or to counteract the merger's potential for harm.

Analysis of Joint Ventures. Even if a joint venture's overall operation is procompetitive, some aspects of its operation may raise antitrust concerns (for example, if the venture's rules limit the conduct in which its members may engage outside the venture). In analyzing such issues, the courts have recognized that many joint ventures provide important economic benefits -- benefits that substantially outweigh evidence that the ventures might possibly reduce competition and that restrictions on the members' conduct inside (or even outside) the venture may be reasonable in order to fulfill the venture's overall goal of promoting efficiency. See, e.g., Northwest Wholesale Stationers v. Pacific Stationary & Printing Co., 472 U.S. 284 (1985); and Broadcast Music, Inc. v. CBS, 441 U.S. 1 (1979).

For example, the Court stated that the buying cooperative at issue in Northwest Wholesale Stationers appeared likely to promote competition, 472 U.S. at 295.

> Wholesale purchasing cooperatives such as Northwest are not a form of concerted activity characteristically likely to result in predominantly anti-competitive effects. Rather, such cooperative arrangements would seem to be 'designed to increase economic efficiency and render markets more, rather than less, competitive.' [citation omitted] The arrangement permits the participating retailers to achieve economies of scale in both the purchasing and warehousing of wholesale supplies, and also ensures ready access to a stock of goods that might otherwise be unavailable on short notice. The cost savings and order-filling guarantees enable smaller retailers to reduce prices and maintain their retail stock so as to compete more efficiently with large retailers.

The courts accordingly analyze whether a joint venture's operation violates the antitrust laws under the "rule of reason" -- i.e., whether a joint venture provides procompetitive benefits and whether it actually harms competition.[8] In this analysis the courts consider whether practices followed by the joint venture (and rules imposed on its participants) are necessary for achieving the venture's procompetitive goals and whether they are likely to reduce competition in ways not offset by the benefits of those particular practices (or rules).

Standards-Setting Activities Under the Sherman Act

The antitrust laws may affect the development and use of IVHS technologies because the implementation of IVHS will involve establishing standards to make the technologies and/or systems compatible in actual operation (refer to chapter 4, *The Role of Design and Performance Standards in the IVHS Program* for more information). This is recognized by the IVHS enabling statute, which articulates a public policy in favor of setting standards to promote the development of the advanced technological systems.[9] The DOT intends to facilitate the development of standards through the systems architecture development process, and through its involvement in standards-setting activities at many organizations

Standards that are not in Violation of Antitrust Laws. The Federal Government or a state government, of course, may set standards without incurring any antitrust liability.[10] However, even private firms may engage in the establishment of standards without antitrust liability when their conduct is reasonable and undertaken for legitimate goals. The Supreme Court has found that standards-setting by private groups can promote the public welfare:

> When . . . private associations promulgate safety standards based on the merits of objective expert judgments and through procedures that prevent the standard-setting process from being biased by members with economic interests in stifling product competition, . . . those private standards can have significant pro-competitive advantages. Allied Tube & Conduit Corn. v. Indian Head. Inc., 486 U.S. 492, 501 (1988).

Standards that are in Violation of Antitrust Laws. The use of a standards-setting body by one or more firms to reduce or eliminate competition will constitute a violation of the antitrust laws, as the Court held in Allied Tube & Conduit Corp. v. Indian Head, Inc. In this respect, the antitrust laws would further IVHS development, because they should prevent abuses of the standards-setting process that would prevent the adoption of competitive technologies.

Congress' Reduction of Antitrust Liability for Joint Ventures

In the belief that potential antitrust liability had discouraged private firms from engaging in research joint ventures that may be procompetitive, Congress enacted the National Cooperative Research Act of 1984, P.L. 98-462, 98 Stat. 1815 (1984), to reduce the potential antitrust liability for certain research and development joint ventures. See S. Rep. No. 98-427, 98th Cong., 2d Sess. (1984), reprinted in 1984 U.S. Code Cong. & Admin. News, 3105, 3108. Nine years later, Congress extended the statute's coverage to production joint ventures. National Cooperative Production Amendments of 1993, P.L. No. 103-42, 103d Cong., 1st Sess. (1993).

National Cooperative Research and Production Act of 1993 (NCRPA). This statute reduces the antitrust risk under both Federal and state law for research and production joint ventures in two respects:

- It requires the courts to use the rule of reason in determining whether a joint venture covered by the statute has violated the antitrust laws; and

- It allows such joint ventures to limit their liability for antitrust violations to actual damages rather than treble damages if they comply with the statute's notification procedure.

The statute's benefits apply to "joint ventures," which are defined as activities undertaken by two or more persons for the purpose of research, testing, and production. 15 U.S.C. 4301(a)(6). The statute specifically excludes such activities as exchanging information on costs and prices if the information is not reasonably necessary for the joint venture's purpose, restricting other research or the production of other products and services by a party to the joint venture, and allocating markets. 15 U.S.C. 4301(b).

Use of the Rule of Reason in Determining Antitrust Violations. For joint ventures covered by the NCRPA, the statute provides that the courts must use the "rule of reason" in considering whether the joint venture has violated the Federal antitrust laws or any comparable state antitrust law.

Limitation on Damages. The NCRPA also creates a notification procedure whose use limits the damages recoverable against a joint venture under the Federal antitrust laws and comparable state antitrust laws. Within 90 days of entering into a written agreement to form a joint venture a party to the venture may file a notice with the Attorney General and the FTC identifying the venture's parties and its nature and objectives and, for production joint ventures, the nationality of each of the parties. If the joint venture's membership subsequently changes, the venture must notify the Attorney General and the FTC within 90 days. 15 U.S.C. 4305(a). Within 30 days after the notice is filed, the Attorney General or the FTC must publish a notice in the Federal Register generally describing the joint venture. 15 U.S.C. 4305(b).[11]

If a joint venture has complied with the notification procedure and the venture is later found to have violated the Federal antitrust laws or a state antitrust law, the plaintiffs may recover only their actual damages, interest, and attorney's fees, unless the conduct at issue violated a decree or order entered under the antitrust laws after October 11, 1984. 15 U.S.C. 4303. Thus, a joint venture using the notification procedure will not be liable for treble damages. And while the NCRPA entitles a plaintiff to attorney's fees if it prevails, the act also enables a defendant to recover attorney's fees if it prevails and the court finds that the plaintiffs suit (or conduct during the case) was unreasonable or in bad faith. 15 U.S.C. 4304(a). These limitations on liability, however, are available for production joint ventures only if the venture's principal facilities are located in the United States and if the venture's participants (and persons controlling the participants) are either United States persons or are persons from a country whose laws give U.S. persons antitrust treatment for production joint ventures that is at least as favorable as the treatment given persons of that country. 15 U.S.C. 4306.

NCRPA and IVHS Ventures By the Private Sector. The NCRPA should encourage firms to engage in joint ventures for the development and production of IVHS services and products, since it substantially limits the potential liability for ventures using its notification procedure. However, the NCRPA may not cover standards-setting conduct, so that agreements among private firms to establish standards for IVHS products might not be protected by the statute. Nonetheless, as discussed above, the judicial standards for determining whether standards-setting

groups have violated the antitrust laws are based on the rule of reason and should protect good-faith conduct in this area.

Some parties have argued that the rule of reason approach is inherently vague and that clearer guidelines are needed. These parties have called for a clear statement of a market share "safe harbor" and a more lenient approach to market definition.[12] The DOT and DOJ do not believe changes to the antitrust laws are warranted at this time, particularly in light of the recent enactment of the NCRPA. Further, DOT is evaluating any legal issues, including antitrust concerns, that may arise in IVHS operational tests as well as the anticipated Automated Highway System Program.[13] These efforts in addition to general experience with the NCRPA, should provide significant insight into the behavior of IVHS joint ventures. In light of the fact that past activities under the NCRPA were not considered anticompetitive, there is no evidence to suggest that legitimate joint ventures in the future will cause antitrust problems.

Enforcement Agencies' Guidance To Alleviate Fear of Liability

If the antitrust laws deter firms from engaging in economically efficient conduct in the IVHS area, the cause is likely to be the firms' fear of potential antitrust liability, not the likelihood that the conduct would be found unlawful. To alleviate that fear, the enforcement agencies have been willing to publish general guidelines and rulings in specific cases, even though such statements are not binding on private litigants or the courts.

The DOJ and the FTC have published guidelines defining the kinds of conduct likely to be challenged (or not challenged) by the government. The guidelines relevant to IVHS antitrust issues are the 1992 Merger Guidelines, which provide standards for determining whether the formation of a joint venture is likely to be challenged. In addition, DOJ issues "business review letters," which state that the agency does not intend to take enforcement action against a particular transaction. The FTC issues advisory opinions upon request.

IVHS America Antitrust Guidelines

IVHS America, the nonprofit organization that is promoting the development and use of IVHS, has adopted antitrust guidelines stating that its goal in issuing the guidelines is to assure full compliance with the antitrust laws. These guidelines outline the antitrust provisions likely to apply to its members' activities and list prohibited types of conduct. These guidelines appear to provide worthwhile guidance to firms in several primary areas of potential antitrust concern.[14]

The guidelines warn members not to do any of the following:

- Exchange price schedules or future notices of price or product promotions;
- Discuss any division or allocation of markets or customers;
- Discuss production volumes or limits on any member's production; or
- Discuss joint action in refusing to deal with suppliers or customers or obtaining a firm's agreement not to do business with a competitor.

The guidelines recognize that setting standards is frequently a procompetitive activity permitted by the antitrust laws. However, the guidelines also note that setting standards may present antitrust questions and that any association engaged in setting standards should not favor some competitors or discriminate against others. The guidelines accordingly provide that members engaged in setting standards should, among other things,

- Use legitimate engineering, social, and policy goals as the basis of any standard;
- Favor performance standards rather than construction or design standards;
- Ensure that affected persons have an opportunity to participate in the process; and
- Not discriminate in the interpretation or application of standards.

Conclusions

After considering the relevant antitrust principles, DOT has concluded that the antitrust laws should not hinder the development of IVHS and that no remedial legislation is needed at this time. Past judicial decisions have made it clear that the antitrust laws allow private firms to form joint ventures for legitimate purposes, as long as the venture's conduct is reasonable and not intended as a means of frustrating competition. While private firms might otherwise be reluctant to form joint ventures, since it is sometimes hard to predict how the courts will apply the antitrust laws to particular factual situations, Congress' enactment of the NCRPA has limited the potential liability for joint ventures that take advantage of its notification procedure.

The DOT will continue to monitor developments in this area. For example, DOT is exploring the legal issues (including antitrust concerns) connected with the Automated Highway System Program, as well as taking a lead role in determining what standards are appropriate. Specific antitrust concerns will be addressed as they are identified.

ENDNOTES

[1]Calkins, Stephen, *IVHS and Anitrust: A Preliminary Assessment,* prepared for the Federal Highway Administration, September 1993.

[2]Brodley, Joseph F., "Antitrust Law and Innovation Cooperation," *Journal of Economic Perspectives* (Summer 1990), p. 97; Shapiro, Carl, and Willig, Robert D., "On the Antitrust Treatment of Production Joint Ventures," *Journal of Economic Perspectives* (Summer 1990), p. 113. But see, Jorde, Thomas M. and Teece, David J., "Innovation and Cooperation: Implications for Competition and Antitrust," *Journal of Economic Perspectives* (Summer 1990), p. 75, which criticized the National Cooperative Research Act as not sufficiently permissive. Note, though, that the article was published before that Act's 1993 amendment, which gave the same protection to production joint ventures.

[3]See, e.g., comments by the State of Florida, Department of Highway Safety & Motor Vehicles (April 13, 1993); Oregon Department of Transportation (April 5, 1993), Ford Motor Company (April 22, 1993); and IVHS America Legal Issues Committee (April 23, 1993).

[4]The FTC's governing statute, the Federal Trade Commission Act, broadens its authority to stop anticompetitive practices by prohibiting unfair methods of competition and authorizes it to determine what constitutes an unfair method of competition. Section 5 of the Federal Trade Commission Act, 15 U.S.C. 45. The FTC may define conduct as an unfair method of competition if it violates the spirit of the antitrust laws, even if it does not violate the letter of those laws.

[5]While many states have antitrust laws of some kind, those laws should have little impact on IVHS development since the NCRPA limits on liability apply to suits filed under state laws as well as on suits filed under the Federal antitrust laws.

[6]Participants in joint ventures, however, must be careful regarding limitations on future competitive activity and on agreements regarding the venture's output or prices. In research and development ventures, there would be particular concern that technological progress not be impeded. See, for example, United States v. Automobile Manufacturers Ass'n, 307 F. Supp. 617 (C.D. Calif. 1969), aff'd per curiam, 397 U.S. 248 (court approved consent decree ending alleged conspiracy by automobile manufacturers to eliminate competition in the research and manufacture of motor vehicle pollution control equipment); and Brodley, Joseph, F., "Antitrust Law and Innovation Competition," *supra*, pp. 97-98. The Sherman Act's prohibition on monopolization does not pose a constraint unique to IVHS implementation. Firms should be aware, though, that monopolization requires proof of possession of monopoly power in the relevant market and the willful acquisition or maintenance of that power by improper conduct, as distinguished from growth as a consequence of a superior product or business acumen. Eastman Kodak Co. v. Image Technical Service. Inc. 112 St. Ct. 2072 (1992): Berkey Photo. Inc. v. Eastman Kodak Co. 603 F.2d 263 (2d Cir. 1979). See Aspen Skiing Co. v. Aspen Highlands Skiing Corp., 472 U.S. 585, 605 (1985) on standards for attempted monopolization.

[7]Brodley, "Antitrust Law and Innovation Competition," *supra,* p. 101.

[8]Of course, a joint venture established for illegitimate reasons, such as price-fixing or reducing output, is likely to be considered a "per se" violation -- i.e., the courts will hold it illegal without considering its actual competitive effects. See, e.g., Citizen Publishing Co. v. United States, 394 U.S. 131, 135-136 (1969).

[9]Section 6053(b) of ISTEA [23 U.S.C. 307, note] states: "The Secretary shall develop and implement standards and protocols to promote the widespread use and evaluation of intelligent vehicle-highway systems technology as a component of the Nation's surface transportation systems. To the extent practicable such standards and protocols shall promote compatibility among intelligent vehicle-highway systems technologies implemented throughout the States. In carrying out this subsection, the Secretary may use the services of such existing standards-setting organizations as the Secretary determines appropriate."

[10]See OMB Circular A-119, *Federal Participation in the Development and Use of Voluntary Standards.* Some local government action is also exempt from the antitrust law prohibitions if the action satisfies certain conditions. *Town of Hallie v. City of Eau Claire,* 47 1 U.S. 34 (1985). The Congress, moreover, has prohibited antitrust damages actions against local governments and their officials. 15 U.S.C. 34-36.

[11]Since the NCRPA promotes procompetitive collaborative activities, it is not surprising that the enforcement agencies have investigated less than five percent of the 388 joint ventures filed under the Act. Neither agency has challenged such a venture, thus reinforcing the conclusion that those ventures covered under the NCRPA are unlikely to be anticompetitive.

[12] Jordan and Teece, op.cit. See also Comments of State of California, Department of Transportation, Docket No. 48626 (April 14, 1993), suggesting the creation of a "safe harbor" under the antitrust laws.

[13] The AHS program is more fully described in the Department's *National Program Plan,* op. cit., III-27-1.

[14] While the IVHS America guidelines by their terms cover only IVHS America activities of the organization's members, the guidelines provide useful guidance for member firms in conducting their business outside the organization.

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7 Liability Concerns

Introduction

This chapter discusses tort and product liability issues that are related to the development of IVHS technologies. Several IVHS developers have expressed the view that while motor vehicle drivers presently bear the burden of the cost of automobile crashes, increased automation resulting from the deployment of IVHS may shift liability to developers and operators of these systems.[1] The perceived vulnerability to lawsuits has resulted in calls for more studies and for consideration of legislation to mitigate liability risks.[2]

For this report, DOT commissioned a review of liability law and state sovereign immunity as it relates to the development and deployment of IVHS.[3] This chapter also draws upon the findings and conclusions reached by Professor Kent Syverud of the University of Michigan Law School (in *Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States),*[4] and upon the comments received in the Public Docket No. 48626 (58 Fed. Reg. 7029, February 3, 1993).

This chapter discusses liability issues in the following areas:

- Advanced Traffic Management Systems;
- Advanced Traveler Information Systems;
- Advanced Public Transportation Systems;
- Collision Avoidance Systems; and
- Automated Highway Systems.

Advanced Traffic Management Systems

The implementation of advanced traffic signal and freeway control technologies should not alter the current apportionment of liability between drivers and other parties. Local and state traffic departments today set timing patterns for traffic signals that are intended to advance the flow of traffic; however, they often do not have current traffic data or adjust for real-time traffic conditions.[5] Advanced Traffic Management Systems (ATMS), on the other hand, involve the implementation of signals to optimize the flow of traffic based on real-time traffic information.

Liability Rests Mainly With the Automobile Driver. Liability for damages in the majority of automobile accidents rests with the automobile owner or driver.[6] The potential for a shift in liability from drivers to other parties has concerned IVHS developers as well as state and local highway officials.

With regard to the implementation of optimized signal timing and traffic flow control, however, the allocation of liability for accidents should not be altered significantly. For example, public agencies currently bear the potential risk of liability when maintenance crews fail to repair

broken traffic signals (or replace missing ones) and their negligence causes injury.[7] With the implementation of ATMS (and assuming the public sector retains responsibility for operations and maintenance), government liability should remain the same as it has been.[8] Indeed, since the shift to optimized traffic signal controls will not transfer control of the vehicle or decision-making functions from the driver, it should not change the current apportionment of liability between drivers and other parties.

Several state highway departments commenting in the Public Docket regarded the selection and implementation of an ATMS as actions for which the public agency should assume responsibility. Potential liability would not be considered a deterrent when implementing an ATMS technology. For example, the California Department of Transportation (CALTRANS) suggested that the public agency selecting advanced systems technology for traffic control management should take responsibility for its choice and for any negligence that results because it participated in the installation or maintenance of the technology:

> Public liability will occur from an alleged case of third party loss caused by a systems failure due to improper installation and maintenance if the responsibility is assumed by the public entity as the purchaser and operator of an IVHS system. This is similar to a traffic controller system for signal lights, though much more complex in its scope and integration. When the public purchases the system and installs it for operation, that judgment of the appropriateness of choice for the designated service purpose is truly a public entities [sic] choice of solutions. Subsequent negative impacts should be borne by the public as long as the IVHS system conforms to the publicized technical description of the supplier?

The private sector is expected to design, develop, and integrate ATMS technologies, including traffic surveillance and control.[10] Private firms may also operate and maintain traffic control systems under contract to public agencies. Given the fact that implementation of ATMS is not likely to shift responsibility from motor vehicle operators to IVHS developers, the private sector should not be deterred from taking part in these activities.

Failure to Adhere to Publicized Specifications. One potential liability, though, was discussed by CALTRANS in its comments to the Public Docket.[11] Hypothetically, a private IVHS manufacturer under contract to a public agency to design an automated traffic control system could fail to adhere to publicized specifications. In this instance, should the variance contribute materially to an automobile accident and injury, the manufacturer could be held liable for damages to the plaintiff. Depending upon the jurisdiction, the IVHS manufacturer could face liability under the traditional fault theory of negligence,[12] or under the theory of strict product liability.[13]

Legal principles under which plaintiffs could sue IVHS manufacturers include:

- Negligence (in design, inspection, or in failure to warn);
- Breach of warranty (express or implied); and
- Strict product liability (for design defects, manufacturing defects, or failure to warn).[14]

Legal defenses to liability include comparative negligence, lack of proximate cause, and compliance with industry standards.[15] Clear and conspicuous disclaimers of warranties may also form a defense against breach of warranty of merchantability. Courts may, however, regard certain damage limitations unconscionable within the meaning of the Uniform Commercial Code.[16]

An additional defense pertinent to a claim of strict product liability may be the assertion that the technological application at issue was a "service" not a "product" within the meaning of strict product liability. As a-general rule, in a mixed service/product transaction the applicable law depends upon which element (service or product) is dominant in the transaction. With IVHS hybrid product/service transactions, it is unclear whether IVHS manufacturers may be protected from strict liability theories, particularly if the consumer received or relied upon a defective IVHS product in the course of using an IVHS service.

CALTRANS suggested that should the public agency be sued in the hypothetical example of a manufacturer's negligent deviance from the public entity's specification, it should have a right of indemnification to the extent the variance in the design or performance standard can be shown to have caused or contributed to that loss. The allocation of these rights and responsibilities could be negotiated at the outset of the public/private development partnership and incorporated into the contractual provisions.

Advanced Traveler Information Systems

Advanced Traveler Information Systems (ATIS) encompass several technologies, such as enroute driver information, route guidance user services, and incidentmanagement services. These technologies will provide drivers of motor vehicles real-time information about traffic and highway conditions, including:

- Incidents, accidents, road construction and alternate routes;
- Traffic speeds along specific routes;
- Parking conditions;
- Event schedules; and
- Weather information.

These services should enable drivers to operate their vehicles more safely by avoiding dangerous conditions or driving in a more alert manner; they should also reduce travel delay, fuel consumption, and traveler stress.

The technologies involved with ATIS systems will focus on:

- Vehicle location data collection (such as the LORAN-C land-based radio navigation system, the satellite-based Global Positioning System, vehicle-based dead reckoning, or other vehicle location systems);
- Data communications (from source to central, and from central to user through cellular telephones, modems, pagers and radio frequency);

- Data processing; and
- Communication to users (through personal communications devices, touch screen displays, heads-up displays, voice instructions, video text, and other means).

The private sector will be instrumental in developing routing algorithms, route databases, computer hardware, and providing real-time information on traffic and road conditions. States and localities are expected, at least initially, to be responsible for deploying the infrastructure that is required to provide real-time communications between the developer of the IVHS product and the in-vehicle or other route guidance device. [17]

Potential Liability Does Not Deter Investment. Reservations have been expressed regarding the potential for liability resulting from the provision of these advanced products and services. State highway departments have concerns that information systems could provide incorrect routing information that may contribute to some accidents, thereby shifting liability to the provider of the inaccurate information (either to the ATIS manufacturer or to the public agency). [18] Public agencies may have accepted liability in the past for routing oversized vehicles, for example, over incompatible roadways. [19]

As discussed above, while liability for negligence or strict liability for supplying a defective product is possible as advanced highway technologies are deployed, it does not appear significant enough to deter investment.[20] Further, most of the commenters in the Public Docket suggested that the liability issue as it pertains to ATIS and ATMS was not unique to IVHS and that the application of sound engineering techniques could alleviate liability exposure by ensuring safe, well-constructed products and services.

Performance Information Should Alleviate Reservations over Liability. It was also suggested by comments in the Public Docket that a disciplined, incremental approach to the deployment of IVHS technologies will generate specific information about the performance of various products and services. This information would enable IVHS manufacturers to adjust the design or performance characteristics of particular technologies, enhance the instructional material available to drivers, and acclimate the motoring public to the benefits and limitations of IVHS.[21]

This type of approach should alleviate concerns voiced in a paper presented at a recent conference on applications of advanced technology in transportation engineering.[22] These concerns included the potential safety implications of a driver's attention being diverted from the road by a computer screen and of errors committed by drivers not skilled in interpreting computer-generated information.

Operational Tests from DOT's National Program Plan. A number of operational tests involving driver advisory technologies have been completed or are underway:

- *Pathfinder* which incorporates the transmission of traffic congestion information to vehicles via an in-vehicle screen or by digital voice;
- *Snoqualmie Pass* which provides information on hazardous driving conditions through the Pass using variable speed limit and message signs;

- *TravTek* which provided traffic congestion information through digital data radio to equipped vehicles; and
- *Genesis* which will allow personal portable communication devices to receive real-time traffic and transit information.

Route guidance operational tests include:

- ADVANCE which will transmit information provided by equipped vehicles to a traffic control center and then integrate this information with other data to transmit route guidance instructions to drivers;[23]
- FAST-TRAC which will integrate traffic messaging and route guidance technologies in an urban setting;[24] and
- TRANSCOM which will enhance emergency response capability and provide real-time traffic data to selected commercial vehicle operators.[25]

Analysis and Actions as a Result of Testing. The DOT now requires that both technical and nontechnical results of operationai IVHS tests be evaluated. In the nontechnical portion of the evaluation, DOT anticipates that liability issues may be examined by analyzing the following documents and sources:

- Cooperative agreements;
- Disclaimers, notices, or other such arrangements with participating vehicle operators;
- Opinions of counsel;
- Review of any claims and settlements; and
- Discussions with operational test participants, as well as with applicable insurance representatives.

The information provided from these tests will assist DOT in responding to concerns about tort and product liability. As the IVHS program evolves, DOT will be in a better position to identify areas where concerns about liability might hinder further progress.

Advanced Public Transportation Systems

There are possible liability issues concerned with the development of IVHS in public transportation also. Some of these issues relate to ride matching and personal security. Instant or dynamic ride-matching options are being considered in a number of locations throughout the country. Potential riders or drivers could use computers to attempt a match for a commute. The participants could come from an established database, which has already screened program participants. Alternatively, nondatabase participants could be eligible to participate in the program merely by entering origin-destination data.

To the extent to which these technologies encourage strangers to share rides, there may be at least the perception of greater liability. Personal security could be an issue where an individual carpools with an unknown driver and other unknown occupants. The DOT intends to evaluate the extent to which these concerns may constrain deployment of these systems and will examine potential solutions.

Collision Avoidance Systems

Collision avoidance systems include many types of automatic vehicle controls systems designed to enhance traveler safety such as automatic braking and automatic steering systems. These systems may transfer some of the liability from the driver of the motor vehicle to the manufacturer of the product. Liability concerns that relate to collision avoidance services arise as a result of the potential for manufacturers to be held:

- Strictly liable under a defective design liability claim;
- Strictly liable for a manufacturing defect;
- Negligent for inducing driver reliance on a system that fails to avoid accidents in all situations; and
- Negligent for failure to provide these devices in all cars.[26]

Many of these concerns, though, can be attributed to engineering problems that relate to the technical complexity and reliability of these services; accordingly, they can be resolved through engineering research, design, and development.[27] It appears that cruise control systems, also an advanced automobile technology, have resulted in very few product liability actions.[28]

Ongoing Activities. Several organizations are pursuing research and development activities related to control systems technology.[29] The National Highway Traffic Safety Administration (NHTSA), for example, has a comprehensive program to evaluate these technologies and to develop performance guidelines for the collision avoidance systems that include automatic vehicle control. Moreover, the agency has cooperative agreements with industry to encourage the development and early deployment of new products that embody this technology.

Automated Highway Systems

The Intelligent Vehicle Highway Systems Act of 1991 (Title VI, Part B of the Intermodal Surface Transportation Efficiency Act of 1991, 23 U.S.C. 307, note) requires DOT to develop an automated highway and vehicle prototype from which fully automated IVHS could be developed. The act requires a fully automated roadway or test track to be in operation by 1997 (§6053(b) of ISTEA).

Automated highway systems (AHS) will provide fully automated control (i.e., “hands-off” and “feet-off” operation) of suitably equipped vehicles that are traveling on instrumented highways. Drivers should be able to acquire either vehicles that are instrumented for AHS operation or retrofit existing vehicles. One possibility is that drivers will enter an AHS through a check-in area where the vehicle’s and driver’s capability to operate on the instrumented highway are verified. Vehicles would have on-board status systems sensing components, which are critical for AHS operation, and would be required to undergo periodic inspections. If the vehicle is not approved, it will be diverted back to noninstrumented lanes. If the vehicle is approved, it will proceed to a transition area where control is assumed by the AHS. The system then will move the vehicle onto one of the AHS lanes where it will merge with other traffic. Once in the AHS lane, the system will move the vehicle. When the destination exit is reached, the system will

move the vehicle to a buffered off-ramp where the driver's ability to resume control of the vehicle will be tested before control is returned to the driver.

DOT AHS Activities. The DOT, through the Federal Highway Administration (FHWA), intends to comply with the congressional directive to develop an automated highway and vehicle prototype. The DOT plans to work with a consortium of organizations that have the expertise to develop and deploy this technology. Members of the consortium should include those able to analyze and evaluate tort liability aspects of the AHS.[30] The preferred system will be tested at selected locations during the operational phase of the AHS program. Additionally, research and development projects now underway include:

- A FHWA human factors study on AHS;
- A program in California to develop technology to support high-speed vehicle "platooning" using electronic sensing and communications;[31] and
- A FHWA contract that is analyzing key issues and risks of the AHS program.

Liability Concerns. Concerns over potential liability appear to be based on the following factors:

- The control of a vehicle will be transferred from the driver to the AHS, operated by a public highway department or possibly by private firms under contract to a public agency;
- The increase in vehicle and roadway complexity;
- The increased component reliability that will be required with automated systems; and
- The possibility of severe damage caused by collisions of automobiles traveling at higher speeds and reduced spacings.

Although some parties have argued that investment decisions in AHS should be delayed pending legislation to address concerns over potential liability, the lack of such legislation has not deterred many members of the IVHS community from participating in the AHS program to this point.[32] Additionally DOT will soon sponsor a conference on product and tort liability as it applies to IVHS. This' conference will bring together experts on liability issues and IVHS technologies. It will help identify those areas of future IVHS deployment and operation that are most likely to have significant liability risks as well as to identify possible solutions.[33]

Several legislative proposals have been suggested to alleviate potential liability concerns including?

- Federal preemption of certain negligence or failure-to-warn suits (through promulgation of safety standards or regulations regarding contents of warning of known hazards, respectively);
- Modifications in liability laws (including a blanket preclusion of strict liability suits against IVHS manufacturers or sellers; a uniform statute of limitations; capping of damages and the modification of joint and several liability clauses; mandatory alternative dispute resolution); and
- Mandatory risk pooling or Federal indemnification.

Not all parties support the contention that there should be legislative changes. The Center for Auto Safety, for example, claimed that such tort reform would result in an undue shift in costs to consumers and will result in inefficient technology.[35] Based upon the information we have collected to date, DOT and DOJ do not believe that it has been demonstrated that the IVHS community requires legislation to address potential liability concerns for the reasons described in the following subsections:

Liability for Traffic Management and Information Systems Not Unique. With regard to the driver and traffic management information systems, the liability exposure of the ATMS and ATIS private participants does not appear to be unique. Liability exposure could be limited by the application of sound engineering principles. The advanced vehicle control systems carry the potential for enormous safety benefits that need to be evaluated.

Liability Laws Stimulate Safe Products. The liability laws are intended to ensure that IVHS developers are motivated to produce safe products. Limiting liability, such as transferring liability to the Federal Government by indemnifying IVHS manufacturers for a proportion of their liability costs, or for judgments that exceed available insurance coverage,[36] would tend to remove the incentive for even the best developers to control the design and manufacture of products. Such measures undermine the function of tort liability as a means of causing a manufacturer or designer to act with due care.[37]

The NHTSA is undertaking research and analysis in preparation of developing IVHS industry standards and/or Federal guidelines. Before NHTSA imposes mandatory safety standards, it will need substantial experience with various IVHS technologies. The agency's purpose in promulgating regulations is to promote and ensure safety, rather than to protect manufacturers from lawsuits involving questions of product negligence.

Conclusions

At this stage in the IVHS program, DOT does not believe that liability issues present significant barriers to the development and implementation of advanced highway technologies. No compelling evidence has been presented that demonstrates that concerns over potential liability have inhibited the development and deployment of IVHS technologies. It is, accordingly, too early to consider legislation or other actions to protect developers or operators of IVHS products from liability risks.

Sound engineering practices and rigorous testing of new IVHS products and services should reduce liability risks. As described above, these technologies are being tested through ongoing operational tests and other contracts being conducted by FHWA and by NHTSA. Liability implications, as well as other concerns, will be evaluated in context of these programs and procedures.

ENDNOTES

[1] *Sobey, A.,* "Business View of Smart Vehicle-Highway Control Systems," 116 *Journal of Transportation Engineering, No. 4 (July/August 1990).* The author claims that the "litigious society not only has stopped major construction projects but has increased the cost of new products by imposing a risk premium on their price."

[2] Virginia Transportation Research Council, *Tort Reform and "Smart" Highways: Are Liability Concerns Impeding the Development of Cost-Effective Intelligent Vehicle Highway Systems?* (July 1993) VTRC 94-R6; United States General Accounting Office, *Smart Highways: An Assessment of Their Potential To Improve Travel* (May 1991) GAO/PEMD-91-18; IVHS America, *Strategic Plan for IVHS in the United States* (April 1992).

[3] Nossaman, Guthner, Knox & Elliott, "Intelligent Vehicle Highway Systems and State Sovereign Immunity for Torts; Possible Impediments to Development of Advanced Traveler Information Systems: An Analysis of Potential Tort Liability"; "Advanced Traffic Management Systems Tort Liability Issues"; and "Advanced Vehicle Control Systems Potential Tort Liability for Developers," FHWA Contract DTFH61-93-C-0087 (1993).

[4] FHWA Purchase Order #DTFH61-92-P-01229, as amended November 5, 1992 (March 1993).

[5] Virginia Transportation Research Council, *Tort Reform* report, *supra.*

[6] Research has shown that driver error has been a significant causal factor in up to 90 percent of accidents. See U.S. Department of Transportation, *National Program Plan for Intelligent Vehicle-Highway Systems* (Draft October 15, 1993), at p. III-27-1; Saxton, L., "Automated Control -- Cornerstone of Future Highway Systems," *IVHS Review* (Summer 1993); IVHS America, *Strategic Plan for IVHS in the United States* (1992) at p. II-9.

[7] As a general rule, the doctrine of sovereign immunity has protected government officials from suit in matters considered to be an exercise of their discretionary powers. Decisions to construct roads or provide traffic aids are generally considered to be discretionary.

[8] The duty of care may be measured by compliance with accepted engineering practices. *See, e.g., Warda v. State,* 256 N.Y.S.2d 1007 (N.Y. App. 1965); *McKee v. Michigan Dept. of Transp.*, 349 N.W.2d 798 (Mich. App. 1984).

[9] State of California, Business, Transportation and Housing Agency, Department of Transportation, April 11, 1993, *Comments on Potential Nontechnical Constraints to the Implementation and Use of IVHS*, p. 3.

[10] Traffic surveillance is expected to be accomplished through such technologies and activities as inductive loop detectors, infrared sensors, microwave sensors, radar, magnetic, ultrasonic, machine vision, aerial surveillance, police and citizen reports, and environmental sensors. Traffic control information, which will include data and voice communications, may employ technologies such as landlines, microwave, wide-area radio frequencies, cellular radio, and satellite communications. The data processing technologies include real-time database processing, data fusion techniques, traffic prediction and assignment algorithms, and optimal control strategy algorithms.

[11] See State of California, *Comments on Potential Nontechnical Constraints, op cit.* p. 3.

[12] Under *Restatement Torts* 2d §282, liability for negligence is predicated on a failure to exercise due care to ensure that a product does not subject the user to unreasonable risk. In order to recover damages, the injured victim has the burden of proving the existence and breach of a duty of care, proximate cause, and damages. The duty of due care covers care in product design, selection of materials, production, testing and inspection, and warning of dangers. The duty of care requires use of at least the standard of care evidenced by industry custom and practice.

[13] Under the definition in *Restatement Torts* 2d, §402A, strict liability is imposed where a product is sold in a defective condition making it unreasonably dangerous, and, without having been substantially altered, it causes bodily injury to the user or consumer or damages the user or consumer's property. No privity with the defendant is required, subjecting all suppliers of a defective product in the chain of distribution to strict liability. This jurisprudence carries out the public policy of protecting consumers from unexpected injuries and anticipating that the manufacturers and distributors will treat the liability risks as a cost of production against which liability insurance can be obtained. *Brocklesby v. United States and Jeppesen and Company,* 767 F.2d 1288 (9th Cir. 1985).

[14] Virginia Transportation Research Council, *op cit.* pp. 10-11.

[15] Comparative negligence is the dominant modern standard under which plaintiffs recovery is reduced by the proportion to which his/her negligence contributed to the accident. This is in contrast to the older contributory negligence standard, under which any amount of plaintiffs negligence would defeat the plaintiffs claim entirely.

[16] UCC §2-719(3). The UCC is a model commercial law code that has been adopted, in some form, by all 50 states and by the District of Columbia. Comparative negligence is not, however, recognized as a defense in strict liability actions in *the Restatement Torts* 2d, §402A, Comment N.

[17]See, U.S. Department of Transportation, *National Program Plan for Intelligent Vehicle-Highway Systems (IVHS), op. cit.*

[18]Examples could include a route displayed on a map directing a vehicle wrongly down a one-way street or over a bridge being repaired.

[19]The Virginia Research Council *Tort Reform Study, op cit.,* p. 19, described a 1991 Virginia DOT misrouting of a tractor-trailer carrying a nuclear reactor pump motor under an overpass with insufficient clearance. Virginia DOT accepted responsibility after the pump clipped the overpass and was dislodged, spilling approximately 10 gallons of nuclear waste onto the highway.

[20]Syverud, K., *Legal Constraints,* FHWA Purchase Order #DTFH61-92-P-01229, *op cit.* pp. 24-5, stating: "Virtually all the ATMS and ATIS participants [in FHWA-financed operational tests] in both the public and private sectors had looked into tort liability, and virtually all have concluded it is not a serious problem in their particular context. . . . Makers of in vehicle map displays and navigation systems similarly reported no serious tort liability concerns, and no lawsuits or claims in connection with their products. ATMS participants reported no claims and no serious worries in connection with the special tort liability risks of ATMS systems. At least in the context of ATMS and ATIS, tort liability seems to be a phantom. . . . ".

[21]Ford Motor Company *Comments on Nontechnical Constraints to Implementation and Use of Intelligent Vehicle-Highway Systems (IVHS)* March 25, 1993.

[22]Johnston, R., *et al.,* "Automating Urban Freeways: Policy Research Agenda," *116 Journal of Transportation. Engineering,* No. 4 (July/August 1990), p.442, p. 449.

[23]ADVANCE is an acronym for Advanced Driver and Vehicle Advisory Navigation Concept. It is a cooperative effort among FHWA, the Illinois Department of Transportation, Motorola, Inc., and the Illinois Universities Transportation Research Consortium. The project involves up to 5,000 private and commercial vehicles in the suburbs of Chicago. *DOT Program Plan, op cit.* p. III-5-8; p. III-15-5.

[24]FAST-TRAC is a public/private cooperative effort in Oakland County, Michigan.

[25]TRANSCOM is an acronym for Transportation Operations Coordinating Committee. It is a consortium of 15 transportation and public safety agencies in the New York, New Jersey, and Connecticut area. *DOT Program Plan, op. cit.* p. III-15-6.

[26]Note, though, that many negligence suits that have been brought against automakers for failing to provide airbags in all cars, alleging that airbags were known to be a technologically feasible and cost-effective safety device that would lessen impacts of a collision, have been unsuccessful on the basis of Federal preemption (National Traffic Motor Vehicle Safety Act of 1966, as amended; 15 U.S.C. §1381 *et seq.). See, e.g., Taylor v. General Motors Corporation,* 875 F.2d 816 (11th Cir. 1989) holding that Florida's tort law doctrines of strict liability and negligence would recognize a claim against a manufacturer for its failure to equip an automobile with airbags, but that such a claim is preempted by Federal law. Compare, *Buzzard v. Roadrunner Trucking, Inc., et al,* 966 F2d. 777 (3rd Cir. 1992) holding that an action for defective design of the illumination system on a trailer involved in a fatal accident was not necessarily preempted by the Safety Act.

[27]It is assumed that maintenance of on-board collision avoidance devices would be the responsibility of the automobile owner, as it is now.

[28]Virginia Transportation Research Council, *Tort Reform, supra.* p. 23.

[29]Syverud, K. , *Legal Constraints, supra.,* pp. 25-6.

[30]See, e.g., United States Department of Transportation, Federal Highway Administration, "Request for Applications Number DT FH 61-94-X-00001 to establish a National Automated Highway System Consortium," (December 15, 1993) at 15.

[31]The Partners for Advanced Transit and Highways (PATH) Program was established in 1986 by CALTRANS and the Institute of Transportation Studies of the University of California at Berkeley.

[32]Over 180 organizations expressed interest in the FHWA automatic highway system program information document, published October 12, 1993.

[33]U.S. Department of Transportation's Intelligent Vehicle Highway Systems Institutional and Legal Issues Program, April 1,1994, at 9.

[34]See e.g., Virginia Transportation Research Council, *Tort Reform, op. cit.;* Svyerud, K., *Legal Constraints, op. cit.;* various comments to the Public Docket No. 48626 by engineeriing societies and IVHS America Legal Issues Committee and others.

[35]Center for Auto Safety, "Comments on Potential Nontechnical Constraints," Public Docket No. 48626.
[36]Federal indemnification procedures have been enacted in certain limited situations, involving ultra-hazardous activities or risks of catastrophic losses, upon documented showings of substantial need. See, 10 U.S.C. 2354, providing indemnification in certain military research and development programs; the Price-Anderson Act, at 42 U.S.C. 2210, relating to nuclear power facilities, and the Commercial Space Launch Act, at 49 U.S.C. App. 2601 *et seq.*, pertaining to satellite owners and launch companies.
[37]Indemnification of IVHS manufacturers by the Federal Government also would be an unwarranted expansion of Federal liability with negative fiscal implications. See, *e.g., Feres v. United States*, 340 U.S. 135 (1950). Additionally, subjecting the United States to unpredictable liability for IVHS developers and contractors would be in derogation of the Anti-Deficiency Act and the sound policies reflected in that act. (31 U.S.C. 1341.)

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8 Privacy Issues

Introduction

This chapter discusses whether concerns over privacy may restrict the development or deployment of IVHS technologies. Comments received by DOT on privacy issues reflect a range of opinions. Some members of the IVHS community allege that motorists would be willing to give up some privacy for increased highway operating efficiency and access to useful travel information. Others suggest that motorists may be reluctant to use IVHS products because of concerns over the potential loss of privacy.

To help us address these issues, DOT commissioned a review of privacy law pertinent to the IVHS program *(Privacy Implications Arising from Intelligent Vehicle-Highway Systems)*[1] The DOT also reviewed materials developed by the IVHS America Legal Issues Committee,[2] as well as comments received in the Public Docket No. 48626 (58 Fed. Reg. 7029, February 3, 1993).

This chapter discusses the following privacy issues:

- Privacy concerns over IVHS surveillance technologies;
- Privacy concerns over electronic payment services;
- Privacy concerns over ride sharing information;
- Privacy concerns over commercial vehicle operations services; and
- Research and related activities.

Privacy Concerns over IVHS Surveillance Technologies

Because they employ automated surveillance technologies, certain IVHS products and services raise concerns over privacy. Incident management services, for example, collect, relate, and evaluate data from many surveillance sources to identify possible incidents.[3] Conditions corresponding to an incident could be detected by fixed or mobile electronic sensors that monitor traffic and environmental conditions. Verification of incidents could be performed by video cameras and other technologies.

Travel demand management services employ IVHS technologies to facilitate alternatives to driving alone, manage the availability and price of parking spaces, control the pricing of highways, and identify gross-polluting vehicles.[4]

Vehicle monitoring technologies may be used in various ways to manage traffic. Automatic vehicle identification could also be used to track vehicles and record the number of miles driven. This information could also be utilized by local governments to decrease automobile pollutants through identification and enforcement of air quality regulations.

Traffic control and surveillance technologies would-manage the movement of traffic through control of signal systems and freeway control devices.[5] These technologies anticipate the use of enhanced surveillance techniques to provide real-time traffic information as well as to provide information on vehicle occupancy. Technologies for traffic surveillance include:

- Inductive loop detectors;
- Infrared sensors;
- Microwave sensors;
- Radar, magnetic, ultrasonic, machine vision (video cameras and video image processing systems);
- Aerial surveillance; and
- Vehicles as probes.

Privacy Concerns over Electronic Payment Services

Electronic payment services will allow travelers to pay for tolls, transit fares, and parking with electronic cards or tags.[6] Automated vehicle identification, a key component of certain proposed electronic payment technologies, typically involves radio frequency interrogation of an electronic memory located within a "tag" placed on or in a vehicle. Because they require that customer records be compiled, electronic payment services may raise privacy concerns.

Privacy Concerns over Ridesharing Options

Ride sharing programs may raise privacy concerns because they will require the development of databases that include information on place of residence and work, phone numbers, typical time of departure from residence and work, and normal travel mode as well as other travel characteristics, such as limitations on mobility or personal travel preferences.

Privacy Concerns over Commercial Vehicle Operations Services

Several IVHS products that affect commercial vehicle operations have raised privacy concerns. Commercial vehicle preclearance services, for example, use vehicle weight, safety status, and/or cargo data to permit vehicles to continue past checkpoints at high speeds without stopping. Vehicle preclearance might also include driver-specific information, such as past citations. This technology may be integrated with on-board safety monitoring devices, which rely on sensors and monitors to detect driver alertness and vehicle safety. The DOT anticipates that these services will be voluntary, with participation in the preclearance system optional for both commercial motor carriers and state highway departments.

Automated roadside safety inspection services provide real-time access by safety inspectors to the safety records of motor carriers, vehicles, or drivers. This technology may also provide for a communications link for updated inspection data to a national commercial vehicle operation information network.

Commercial vehicle administrative services allow motor carriers to file applications electronically for credentials such as registration, trip permits, oversize/overweight permits, and hazardous materials permits. This technology will automatically record vehicle trip miles and fuel purchased in each state for mileage and fuel tax reports.

General Views on Privacy Issues

Recent surveys suggest that Americans have ambivalent feelings concerning privacy issues.[7] Most people questioned want their privacy protected, but they also expect to obtain benefits that require their privacy to be compromised. Thus, while many respondents expressed concern regarding general threats to their privacy, they also expressed a desire to obtain credit cards based on their bill payment records. Moreover, while aware of the potential for abuse, most individuals do not believe they have ever been victims of an improper invasion of privacy.

While some of those surveyed seemed to care little about whether the government or others obtain personal information, and while others call for protections against any action or policy they perceive as an invasion of privacy, a solid majority of those surveyed appear not to have hard and fast views on privacy. The Harris-Equifax Survey identifies this group as "privacy pragmatists."

Privacy pragmatists are concerned about privacy while they also recognize that they can benefit when public agencies and private firms have access to certain personal information. For example, transactions involving credit, licenses, medical prescriptions, insurance, and welfare benefits can be completed more easily when personal records are already on file in accessible databases. Most of the individuals surveyed tended to assess the social purpose being served through access to some personal information, as well as what protections are being applied, before forming an opinion as to whether to support or oppose a particular activity.[8]

Based on these findings, DOT has concluded that IVHS technologies are less likely to be constrained because of concerns about the improper invasion of privacy when:

- The benefits of these technologies are clearly understood;
- The benefits are perceived as outweighing any adverse effects on privacy;
- It is perceived that the information will be properly protected; and
- Basic principles are followed to safeguard privacy.

Consumer Views on Surveillance and Privacy

Surveys have found that respondents' concerns over privacy, and their perceived tendency to hamper IVHS development, lie in two major areas: an interest in being free from surveillance in situations in which there is a reasonable expectation of privacy; and an interest in controlling, or at least participating in, decisions about the collection, quality, use, and dissemination of personal information.[9]

Some transportation officials argued that the threat of a loss of privacy due to new monitoring, sensing, and communications technologies could hamper the public's acceptance of IVHS technologies; [10] These officials suggested that agencies operating surveillance systems disclose the uses for which the data have been collected and the procedures they have adopted to protect the confidentiality of this information. [11]

Several commenters expressed concern about improving the potential ability of the police to track vehicles, and the resulting infringement on privacy because of that ability. These commenters, however, also realized that some consumers may welcome such an ability, especially for incidents involving stolen vehicles, hit-and-run accidents, or car-jackings. [12] Others commenters believe that IVHS technologies should be available for criminal justice purposes, such as tracking vehicles in the possession of "suspicious" persons, or for identifying alcohol-impaired drivers. [13]

Several commenters suggested that these concerns could be resolved through further study and the development of policy guidelines by Federal, state and local governments, law enforcement agencies, and the IVHS community. [14] Advanced traffic surveillance techniques are designed to monitor traffic and to facilitate incident detection and response. This technology is not intended to interfere with the privacy of the motorist or vehicle occupants. [15] Cameras are used to monitor traffic flow and to identify possible incidents, thereby facilitating emergency response. [16] (So-called "zoom" capabilities are designed to be used only in emergency situations.)

Individuals concerned about privacy issues are interested in determining what personal information should be known by others, when it may be released, and how it may be used. [17] Most IVHS records are likely to focus on vehicles rather than individuals, since this information will be used primarily for traffic management and transit management activities. Some records may be personal in nature, however.

Possible Solutions. There are possible solutions to the potential loss of privacy. Electronic toll tag manufacturers, for example, offer "anonymous" toll tags that provide privacy to users. This technology, however, does not necessarily afford protection against reported lost or stolen tags; it also makes auditing by the toll authority more difficult. [18] In another example, the toll agencies involved with the E-Z Pass Interagency Group have decided not to release, sell, or publish customer transaction data. The organization also intends to give customers the option of removing their electronic tag or to pay with cash. [19]

The commercial vehicle owners and operators involved in the Heavy Vehicle Electronic License Plate Program (HELP) were concerned that freedom of information laws would require that state highway departments make available computerized fleet management information to their competitors. This issue was resolved by contracting with a third party to act as a buffer between private and public agency participants for purposes of releasing pertinent information.[20]

Existing Laws on Personal Privacy

This section discusses the current laws and legal concepts that pertain to personal privacy and their impact on IVHS technologies.

Surveillance Activities and the Fourth Amendment (Expectation of Privacy). The Fourth Amendment to the United States Constitution establishes a fundamental protection from unreasonable searches- and seizures, which includes, in some cases, protection from electronic, aural, visual and other types of surveillance.[21] However, the Fourth Amendment applies generally to situations where individuals have a reasonable expectation of privacy.

The identification and even the surveillance of a vehicle traveling on public streets is not considered a search within the meaning of the Fourth Amendment.[22] People have less of an expectation of privacy in a motor vehicle than in a home because a motor vehicle travels on public highways where some of its contents, and its occupants, are in plain view. Motor vehicles have limited capacity for escaping public scrutiny; and they serve less frequently than a home does as the repository for personal effects. Consequently, one cannot reasonably expect as much privacy in one's motor vehicle as in one's home.

The expectation of privacy in motor vehicles is further diminished by the fact that automobiles, unlike homes, are subject to pervasive and continuing governmental regulation and controls, including periodic inspection and licensing requirements.[23] Police may routinely stop and examine vehicles when license plates or inspection stickers have expired, when emissions or pollution violations are noticed, when headlights or other safety equipment are not functioning properly, and when they observe erratic driving behavior.

Furthermore, the Supreme Court has held that the monitoring of beeper signals (emitted from beepers attached to vehicles) in areas open to visual surveillance is not a search or seizure subject to Fourth Amendment proscriptions, since it does not infringe on a legitimate expectation of privacy.[24] The Court reasoned that persons traveling in automobiles on public highways have no reasonable expectation of privacy in movements from one place to another. The fact that a beeper augments the ability of the police to monitor movements is irrelevant as long as the same results could have been achieved by unaided visual surveillance.[25]

Surveillance Activities and the First Amendment (Freedom of Speech and Association). The general rule regarding the use of government surveillance in relation to the First Amendment's protection of freedom of speech and association is that governmental programs or statutes that indirectly and adversely influence First Amendment rights are tolerable so long as the effect on speech is minor and the underlying governmental purpose is legitimate.[26] Accordingly, a First Amendment challenge to IVHS surveillance, arguing that this deters individuals from attending controversial or unpopular events and chills the ability to engage in dissident or unpopular speech, would likely be unsuccessful, assuming the IVHS-related information was being utilized for legitimate governmental needs and that its implications for freedom of speech were minor.

Federal Privacy Act and State Privacy Statutes. The Privacy Act of 1974 (5 U.S.C. 552a) regulates the Federal collection, maintenance, use, and dissemination of personal information.

Accordingly, the act serves as a useful starting point when discussing legal safeguards relating to informational privacy. In addition, about a dozen states have enacted their own statutes modeled after the Privacy Act. Other states have privacy statutes governing specific types of personal records, such as medical records and educational records, imposing on the private sector the same types of information responsibilities imposed by statute on Federal and state agencies.[27] These responsibilities typically include:

- Limits on-the collection of personal information;
- Standards regarding accuracy and completeness of information;
- Confidentiality and data security standards; and
- Data rights standards that provide individuals on whom data are collected with access and correction rights.

The Impact of the Privacy Act on IVHS. The Privacy Act itself would be implicated with regard to IVHS if a Federal agency would control a "group of records...from which information is retrieved by the name of the individual or by some identifying number, symbol, or other identifying particular assigned to the individual." 5 U.S.C. 552a(a)(5). Few, if any, IVHS technologies, products, or services will be owned or operated by the Federal Government. Nevertheless, DOT is sensitive to privacy concerns and will explore the potential access and control by Federal agencies of the data generated by IVHS during the course of the IVHS planning process and during operational tests.

Under the Privacy Act information is not to be gathered or maintained in an individually identifiable form unless doing so is necessary to carry out a lawful activity of the agency. Moreover, such information must be obtained from the record subject whenever possible, used only for authorized purposes, and protected from unauthorized persons. A notice must be published announcing the existence of the information, categories of persons and records covered, principal and other permitted uses made of the information, and how persons can learn whether they are covered by information, and, if so, how they can get access to the information and contest it if they disagree with it.

The Privacy Act places limits on the disclosures that can be made of information subject to its provisions. The act requires that agencies account for disclosures of information, keep records of such disclosures, and make that accounting available to the identified individual upon request.[28] Also of interest is the fact that no records may be maintained on "how any individual exercises rights guaranteed by the First Amendment unless expressly authorized by statute or by the individual about whom the record is maintained or unless pertinent to and within the scope of an authorized law enforcement activity."[29]

The Freedom of Information Act. The Freedom of Information Act (FOIA), 5 U.S.C. 552, is the other Federal statute that may be relevant if a Federal agency holds IVHS-generated data. The FOIA makes all federally held information available upon request to any person, for any purpose, unless one of the FOIA's nine exemptions applies. One of those exemptions covers information which, if disclosed, would be likely to result in a clearly unwarranted invasion of personal privacy. 5 U.S.C. 552(b)(6).[30] Each state has adopted its own open records or Freedom of Information Act, many of which are modeled after the Federal law. Each of these statutes

includes an exemption providing protection against disclosure of certain information that would be deemed to be an invasion of personal privacy.

Sale of Personal Information by State Agencies. The DOT recognizes that state departments of motor vehicles have, in many instances, made available for a charge personal identifying data relating to motor vehicle license and driver information. This practice has generated substantial privacy concerns about the potential loss of privacy. The Congress is currently considering legislation to limit the-public availability of such data.[31] Under such legislation, the states would be allowed to make the data available for marketing activities if the motor vehicle department has provided advance notice to the pertinent individual and allowed that individual to choose not to allow disclosure of that data for marketing purposes. These data also would be available for law enforcement functions and other specified purposes.

Research and Related Activities

Additional research and related activities are needed to resolve many of the privacy issues raised in this chapter.

IVHS America Recommendations for Privacy Policies. The Legal Issues Committee of IVHS America has suggested that the IVHS community take the lead in addressing privacy issues by adopting voluntary guidelines regarding the use of information obtained through IVHS technologies.[32] The Committee also has proposed that policies be established to protect individual identities and to restrict access to the commercial use of the information gathered with IVHS technologies[33]

Legislative Actions. Several respondents to the Public Docket suggested that DOT initiate legislative efforts to develop a privacy code to ensure industry codes of conduct. Many of these respondents refer to the following laws as models that IVHS can adapt: the statutory requirements that protect the privacy of individuals identified by national credit reporting agencies[34] or served by cable TV companies,[35] and pending legislation that would protect the privacy of driver registration and motor vehicle information held by the states.[36]

Studies and Outreach. Many of the privacy concerns expressed by individuals and groups will be addressed in the context of studies and outreach programs either ongoing or planned. Privacy issues will be further considered by DOT as a result of the written evaluations of DOT-funded operational tests.[37] Moreover, the Federal Highway Administration has awarded a grant to Santa Clara University College of Law to develop information about the privacy implications of IVHS. This research will suggest ways to make IVHS technologies more compatible with privacy concerns; it will also promote public understanding of the implications of IVHS for personal privacy by conducting a scholarly symposium, convening a public forum, and by publishing a special issue of the *Santa Clara Computer and High Technology Law Journal.*[38] Further, IVHS America has committees examining the privacy issue and will make recommendations to DOT.

Conclusions

As new IVHS technologies emerge, it is very important to adopt principles and safeguards to reduce the public's legitimate concerns over the potential loss of privacy. The DOT will be an active participant in discussions with members of the IVHS community on privacy issues. The DOT will consider public sensitivity to the use of personal IVHS information and insist upon appropriate conduct in the handling of personal information. The DOT will participate in the debate over IVHS privacy issues and will insist upon appropriate conduct in the handling of personal information.

ENDNOTES

[1]Belair, Robert, *et al., Privacy Implications Arising from Intelligent Vehicle-Highway Systems,* FHWA Contract DTFH61-93-C-00087 (December 8, 1993).

[2]IVHS AMERICA is a non-profit research and educational organization consisting of IVHS manufacturers, academic institutions, public interest groups, Federal, state and local government agencies, and others dedicated to the promotion of the development and use of IVHS technologies. IVHS AMERICA is also utilized as a Federal advisory committee by the Department of Transportation.

[3]U.S. Department of Transportation, *National IVHS Program Plan* (Draft, October 15, 1993), pp. III-7-1 *et seq.*

[4]This program is described in DOT's Draft *National IVHS Program Plan, supra,* p. III-8-1 *et seq.*

[5]This service is described in DOT's Draft *National IVHS Program Plan,* p. III-9-1 *et seq.*

[6]This user service is described in DOT's draft *National IVHS Program Plan, op cit.,* p. III-10-1 *et seq.*

[7]See, e.g., Harris-Equifax Consumer Privacy Survey (1991).

[8]Belair, *op. cit.,* p. 16.

[9]Belair, *op. cit.,* p. 4. A third interest, one of being free to engage in certain intimate or private activities free of governmental regulation, was also noted. However, any claim that foreseeable IVHS applications would violate this interest was deemed "unlikely to be taken seriously."

[10]State of New York Department of Transportation, Comments in Docket No. 48626 (April 14, 1993).

[11]March 15, 1993, letter of California PATH to IVHS AMERICA, received in Docket No. 48626.

[12]See, for example, IVHS AMERICA Institutional Issues Committee and Legal Issues Committee responses in Docket No. 48626 (April 21, 1993); the Institute of Transportation Engineers, Comments in Docket No. 48626 (April 26, 1993); and California Department of Motor Vehicles Response to Public Solicitation on IVHS Issues, Docket No. 48626 (April 13, 1993). Questions as to whether IVHS would be perceived as an invasion of privacy were raised in Sobey, A., "Business View of Smart Vehicle-Highway Control Systems," *116 Journal of Transportation Engineering,* No. 4 (July/August 1990) p. 471. Concerns over the collection and processing of vehicle-position data by roadway and network computers were discussed in Johnston, R., *et al.,* "Automating Urban Freeways: Policy Research Agenda," 116 *Journal of Transportation Engineering,* No. 4 (July/August 1990), pp. 452-454.

[13]Comments of Sigmund Silber, management consultant, in Docket No. 48626 (undated).

[14]Comments of the IVHS AMERICA Legal Issues Committee in Docket No. 48626, April 13, 1993.

[15]Nor is it intended to be used as a subtle "speed detector." Although "photo-radar" devices (radar detection combined with photographic equipment) are being used in cities in Utah, Arizona, and California to detect and immediately document speeding drivers, these programs are not funded as part of the IVHS program. Moreover, signs are posted along the roads to alert drivers that an area is patrolled by photo-radar.

[16]An IVHS traffic management center operating in Baltimore and Washington, D.C., was instrumental in clearing a tractor-trailer accident on the Capital Beltway "several hours faster" than would otherwise have been the case, according to state officials quoted in *The Washington Post* (August 20, 1992, "High-Tech Traffic Control Center Approved for Maryland," p. D6).

[17]*Belair at 4.*

[18]*Amtech Backscatter--Summer 1992* (Vo. I., No. 7), pp. 3-6.

[19]Comments of E-ZPass, an organization composed of representatives of seven major toll agencies in New York, New Jersey, and Pennsylvania, in Public Docket No. 48626, April 15, 1993.

[20]The HELP/Crescent project involves several states as well as British Columbia, in the integration of a heavy vehicle monitoring system to be used for regulatory weight enforcement, and fleet management purposes. See, *FHWA and FTA Intelligent Vehicle-Highway Projects in the United States* (May 1992), p. 25; *DOT National Program Plan* (Draft, October 15, 1993), p. III-1 1 *et seq.;* IVHS AMERICA, *Strategic Plan for IVHS in the United States* (May 20, 1992) p. III-44 *et seq.* and p. III-1 1 *et seq.* For a description of the concerns regarding data privacy on CVO movements, see, Midwest Transportation Center, Iowa State University, *Intelligent Vehicle Highway System, Institutional Barriers and Opportunities for I.V.H.S. in Commercial Vehicle Operations: An Iowa Case Study* (February, 1992), p. 82 *et seq.*

[21]See, *e.g., Duncan v. Louisiana,* 391 U.S. 145 (1968). Nearly all of the guarantees found within the Bill of Rights have been incorporated into the Fourteenth Amendment making them applicable to the states.

[22] *United States v. Knotts,* 460 U.S. 276, 28 1 (1983) holding that a "person traveling in an automobile on public thoroughfares has no reasonable expectation of privacy in his movements from one place to another." The Court explained the diminished expectation of privacy in an automobile: "One has a lesser expectation of privacy in a motor vehicle because its function is transportation and it seldom serves as one's residence or as the repository of personal effects. A car has little capacity for escaping public scrutiny. It travels public thoroughfares where both its occupants and its contents are in plain view." *Cardwell v. Lewis,* 417 U.S. 583 (1974).

[23] *South Dakota v. Opperman,* 428 U.S. 364, 368 (1976); *Cady v. Dombrowski,* 413 U.S. 433, 439 (1973).

[24] *United States v. Knotts,* op. cit. at 285 (1983).

[25] At least one state court has disagreed with the Supreme Court and has held that police use of a beeper to locate a suspect's automobile constituted a search under the state's constitution. *State v. Campbell,* 759 P.2d 1040, 1049 (Or. 1988).

[26] *Younger v. Harris,* 401 U.S. 37, 51 (1971).

[27] See, Smith, R., *Compilation of State and Federal Privacy* Laws, June 1991.

[28] 5 U.S.C. 552a(e)(1),(3).

[29] 5 U.S.C. 552a(e)(7).

[30] See, *Reporters Committee for Freedom of the Press v. United States Department of Justice,* 489 U.S. 749 (1989) holding that disclosure of any personal information is presumed to violate privacy interests; the government may consider disclosure if the public would obtain information on governmental conduct or misconduct.

[31] The Driver's Privacy Protection Act , reported in *Cong. Rec.* S. 15761, Nov. 16, 1993.

[32] Minutes of the Legal Issues Committee of IVHS AMERICA; April 13, 1993.

[33] See, *Minutes of IVHS AMERICA, supra. See* also, *Strawman Intelligent Vehicle-Highway Systems Information Privacy Principles,* (Draft October 14, 1993).

[34] *See* the Fair Credit Reporting Act, 15 U.S.C. 1681, *et seq.* and see pending revisions to the FCRA in H.R. 1015 and S. 783.

[35] See the Cable Communication Policy Act of 1984, as amended, 47 U.S.C. 521 and 551.

[36] The Driver's Privacy Protection Act, *supra,* passed by the Senate on November 16, 1993.

[37] These evaluations are required by the Intermodal Surface Transportation Efficiency Act of 199 1, §§6055(d) and 6053(c); codified at 23 U.S.C. 307, note.

[38] Federal Highway Administration Grant No. DTFH61-93-X-00020.

9 Intellectual Property Considerations

Introduction

This chapter discusses the laws and regulations that govern the retention of intellectual property rights in government grants, cooperative agreements, and contracts. It also discusses the concerns of IVHS developers and state and local governments regarding the allocation of intellectual property rights. The private sector is concerned that the retention of intellectual property rights by DOT or a state agency may be too broad, reducing the ability of IVHS developers to recover predevelopment and research costs and limiting profits from future sales. State and local governments are concerned that an IVHS developer may limit access to computer software codes or other intellectual property needed by one or more public agencies to manage and operate an IVHS technology.[1]

For this report, DOT commissioned a review of intellectual property law as it pertains to the IVHS program, entitled *Intellectual Property Rights and the National IVHS Program.*[2] Additionally, DOT considered the comments received in Public Docket No. 48626 (58 Fed. Reg. 7029, February 3, 1993).

The chapter discusses the following intellectual property issues and their impact on IVHS development:

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

Laws and Concepts Regulating Intellectual Property

This section discusses the general laws and concepts that regulate the retention of intellectual property rights.

Subject Matter. An invention may be patented only if it fits within one of the statutory classes of eligible subject matter, which include ...“any new and useful process, machine, article of manufacture or composition of matter, or any new and useful improvement thereof.[3] Theoretical or abstract discoveries are excluded from protection. Patent protection may be available for a process performed by a computer, assuming that it meets the conditions for patentability, rather than the expression of that process in computer source codes or on screen displays.
Novelty. One statutory condition for patentability is based upon the concept of “novelty.” An inventor is not entitled to a patent if the invention was known or used by others in the United

States, or patented or described in a printed publication in the United States or any foreign country prior to its invention by the applicant.[4] An inventor is also barred from obtaining a patent if the invention was in public use or on sale in the United States more than one year prior to the date of the inventor's application.[5]

Obviousness. Another statutory condition for patentability is that the invention must not be obvious in light of the prior art-- i.e., that which has already been invented. That is, if a person has invented the combination of A plus B to get C, this may be patentable even if A and B already exist. The invention is not A alone or B alone but A *plus* B; if the combination is not shown or suggested in the prior art, then it is patentable.

Right to Practice Patents. The holder of a patent has the exclusive right to make, use, or sell the claimed subject matter for a limited number of years.[6] The holder of a patent may assign his or her patent rights to another person or corporate entity. Provisions of Federal law and regulations set forth the requirements for such assignments.[7] State law governs the issues related to the property of the assignment, per se. Licenses to use or "practice" patents or patented inventions are governed by state-based law governing contracts for the sale and disposition of personal property. A patent license may be exclusive or nonexclusive; it may also limit the licensee to practice the invention in a particular "field of use" or in a particular geographical area. In a typical commercial transaction, royalty payments are paid by a licensee for the right to practice an invention.

Federal Government Patent Rights In Inventions Developed with Federal Funding

This section discusses the applicability of patent right laws to the Federal Government and how these laws could affect the development and deployment of IVHS.

Federal Policy Concerning Patent Rights. The Bayh-Dole Act, codified at chapter 18 of Title 35 of the United States Code *(Patent Rights in Inventions Made with Federal Assistance),*[8] sets forth the Federal Government's policy concerning rights to inventions made in the course of a funding agreement' that calls for experimental, developmental, or research work wholly or partially funded by the Federal Government. As a matter of policy, the Federal Government seeks to:

- Promote the utilization of inventions arising from federally supported research or development;
- Ensure that the inventions are used in a manner to promote competition and enterprise;
- Promote the commercialization of domestic inventions; and
- Ensure that the Government obtains sufficient rights in federally supported inventions to meet the Government's needs and to protect the public against nonuse or unreasonable use of inventions.[10]

Scope of the Federal Government's Patent Rights. The Bayh-Dole Act generally applies to federally funded grants, contracts, and cooperative agreements for research, development, or

experimental work. It therefore applies to IVHS funding agreements. Under the Bayh-Dole Act, the Federal Government retains certain rights to inventions made under Federal funding agreements (such as a contract, grant, or cooperative agreement). Where the developer of the invention produced under the funding agreement elects to retain ownership of the "subject invention," the Federal agency shall have a "non-exclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world."[11] This license permits the Federal Government to practice or have practiced any subject-invention "for or on behalf of the United States." It does not allow the Federal Government to sell the licensed technology for profit.

Limits to Federal Government's License to Practice Patents. The term "for or on behalf of the United States," while not yet judicially construed, covers a license to use the technology both by the Federal agency funding the technology as well as by other Federal agencies. A patented IVHS application arising from a Federal Highway Administration (FHWA) funding agreement could be used on roads at Government installations. Federal agencies also would have a paid-up license to use the invention for or on behalf of the United States for non-IVHS purposes, such as military applications or air traffic control. The FHWA has heretofore not construed the retained license as permitting sublicensing of the subject invention to a state or local government, to a turnpike, bridge, transit, or similar authority, or to a private entity. Nothing suggests a change in this *de facto* policy.

Separation of Federal and Non-Federal Accounts and Limit on Government's Patent Rights. It has been suggested that the Federal Government's reservation of rights may be avoided in a particular funding agreement by segregating the work performed with Federal funds from that performed with non-Federal funds. According to some commenters, this accounting practice may enable participants to use non-Federal funds for activities leading to the development of new, patentable intellectual property, while allowing Federal funds to be used for activities not expected to produce patentable inventions.

The implementing regulations, however, explain that the maintenance of separate accounts in a Government-sponsored project cannot shield inventions from the requirement of being licensed for Government use. As stated in 37 CFR 401.1:

> Notwithstanding the right of research organizations to accept supplemental funding from other [i.e., non-Governmental] sources for the purpose of expediting or more comprehensively accomplishing the research objectives of the government-sponsored project, it is clear that the ownership provisions of these regulations would remain applicable in any invention 'conceived or first actually reduced to practice in performance' of the project. Separate accounting for the two funds used to support the project in this case is not a determining factor.

While separate accounting for a project sponsored by the Federal Government does not protect a patent from the Government's right to use the invention, the regulations provide that an invention will not be subject to a Government-purpose license if the invention is made in the performance of a "non-Government sponsored project," which "although closely related, falls outside the planned and committed activities of a Government-funded project and does not diminish or distract from the performance of such activities."[12] Further, the "time relationship" between the

two projects and the "use of new fundamental knowledge from one in the performance of the other are not important determinants" in deciding whether an invention was made "in the performance -of the federally-supported project."[13]

Federal Government March-In Rights and Exceptional Circumstances. The Federal Government also retains "march-in rights" with respect to any invention title to which is retained by the recipient of the Federal funding agreement.[14] These rights allow the funding agency to require the owner of the subject invention to grant a responsible applicant a license in any field of use upon reasonable terms if certain public policy conditions are present. These conditions include:

- The owner's failure to achieve practical application of the invention;
- The necessity of the action to alleviate health or safety needs;
- The necessity of the action to meet specified requirements for public use; and
- The failure of the owner or exclusive licensee to manufacture the patented item in the United States.[15]

In addition, Chapter 18 of Title 35 of the United States Code allows the Federal Government to obtain title to subject inventions or to direct that title be vested in other entities in "exceptional circumstances" -- i.e., "when it is determined by the public agency that restriction or elimination of the right to retain title to any subject invention will better promote the policy and objectives of this chapter."[16 17]

Application of the Standard Patent Rights Clause. The standard patent rights clause applies only to "subject inventions" that are "conceived" or "first actually reduced to practice" in the "performance of work under" a federally supported project.[18] Private IVHS developers that participate in DOT-funded agreements or contracts may be concerned about the possible inadvertent attribution of a pre-existing invention to a federally funded project. To protect their rights, private developers should consider establishing an in-house program to document the conception and reduction to practice of their inventions.

While each IVHS developer should develop its patent protection program to meet its individual needs using the assistance of professional legal counsel, it is generally recognized that such a program should include a system for documenting the testing or other "actual reduction to practice" of its patentable inventions. The policy contained in the Bayh-Dole Act prescribes that a government-purpose license attaches to inventions that are either conceived or first actually reduced to practice under Federal funding agreements.[19] Thus the Federal Government is entitled to obtain a license for government use if an invention conceived outside of Federal funding is "first actually reduced to practice" under a government funding agreement. A "first actual reduction to practice" generally occurs when an invention is first tested under actual operating conditions. After the first actual reduction to practice, the utility of the invention is no longer speculative. If Federal funds have been involved in this effort, the Federal Government would be entitled to a license.

A recent FHWA project shows how the standard patent rights clause can be used. The agency recently published its Request for Applications for a national consortium to manage the systems design phase of the Automated Highway System Program.[20] Rights to inventions made under

the proposed cooperative agreement will be determined in accordance with 37 CFR Part 401. The standard patent rights clause contained in 37 CFR 401.14, as modified, was attached to the Request for Applications.[21]

Copyrights and Rights in Data

This section discusses the laws and regulations governing copyrights and rights in data, their applicability to Government funding agreements, and the implication of these laws and regulations to the development and deployment of IVHS.

Definition of Copyrights. The owner of a copyright has the exclusive right to reproduce the copyrighted work, to prepare derivative works based on it, and to distribute copies of it to the public by sales or transfer.[22] Copyright protection extends for a period of 50 years after the death of the author.[23] A copyright may be obtained for "original works of authorship fixed in any tangible medium of expression."[24] Works of authorship include, among other things, technical papers and computer programs.[25] Copyright protection does not extend to the ideas, procedures, methods of operation, systems, processes, concepts, principles, or discoveries expressed in a work of authorship, but only to the expression itself.[26]

DOT Copyright Regulations for Grants. The DOT's regulations governing grants and cooperative agreements to state and local governments provide that DOT reserves:

> a royalty-free, non-exclusive, and irrevocable license to reproduce, publish or otherwise use, and to authorize others to use, for Federal Government purposes: (a) The copyright in any work developed under a grant, subgrant, or contract under a grant or subgrant; and (b) Any rights of copyright to which a grantee, subgrantee or a contractor purchases ownership with grant support.[27]

Government Rights in Data. Government rights in data[28] (whether or not copyrighted) developed under Federal procurement contracts are governed by Subpart 27.4 of the Federal Acquisition Regulations (FARs). The basic rights in data clause provide that the Government acquires unlimited rights in data that is first produced in the performance of a contract.[29] A contractor may, under certain conditions, claim a copyright in data first produced under the contract by obtaining the prior written approval of the agency's contracting officer.[30] For computer software first produced in the performance of the contract, the contractor agrees to grant to the Government "and others acting in its behalf" a paid-up, nonexclusive, irrevocable, worldwide license in the copyrighted software to reproduce, prepare derivative works, and perform publicly and display publicly "on behalf of the Government."[31]

Modified Rights in Data. The uniform administrative guidelines for grants and cooperative agreements do not contain data rights provisions. Presumably, provisions may be negotiated on a case-by-case basis, depending on specific program or project considerations. Additionally, the FARs allow contracting officers to modify the standard data rights clause, in accordance with Federal policy. That policy notes that:

> the Government recognizes that its contractors may have a legitimate proprietary interest...in data resulting from private investment [and that] protection of such data from unauthorized use and disclosure is necessary in order to prevent the compromise of such property right or economic interest.[32]

The policy also recognizes that protection of contractors' rights to data is "necessary to encourage qualified contractors to participate in government programs and apply innovative concepts to such programs."[33]

The funding agency may-protect the legitimate proprietary interests of the participants in data resulting from private investment by adopting the Rights in Data-General clause at 48 CFR 52.227-14. Under this provision, the funding participants may withhold from delivery to the government data that qualify as "limited rights" data or "restricted computer software," and deliver form, fit and function data in lieu thereof.[34] The Request for Applications for the Automated Highway System Program is an example of the use of this provision of the Rights in Data clause.[35]

Application of Standard Data Rights Clause. A private party may avoid losing rights to pre-existing or independently developed works eligible for copyright protection by taking similar precautions as those for the protection of patents for pre-existing inventions. A private party, for instance, may register copyrights in pre-existing works before participating in a federally funded project.

Assuming certain data can be shown to have been produced "at private expense," the producer will be entitled to identify the subject works as limited rights data or restricted computer software, according to the FAR's standard data rights clause.[36] The funding agency may require participants to either state that none of the data qualify as limited rights data or as restricted computer software (or to identify which of the data so qualify). The FAR for the Automated Highway System (AHS) Program is an example of a proposed funding agreement that provides for participants to withhold limited rights data or restricted computer software. However, the Federal Government's retained rights for data produced by the AHS consortium must, at a minimum, assure use of the data for agreed-to purposes.[37]

Private Sector Concerns Regarding Intellectual Property

This section discusses some of the major concerns the private sector has regarding the retention of intellectual property rights for IVHS products.

Public Sector Retention of Intellectual Property Rights. Some members of the IVHS community contend that if a public sector agency demands a greater share of intellectual property rights to an IVHS technology relative to the funding provided, it will reduce the ability of private developers to offset research and development costs through future sales, as well as prevent firms from recouping funds expended on predevelopment research and development. Some firms are also concerned over the potential loss of control over proprietary information and/or technologies, especially if the retention of intellectual property rights by the public agency will result in their release into the public domain.

Need for Sharing of Ideas Between Private and Public Sector. Some commenters to the Public Docket attributed concerns about the allocation of intellectual property rights to the lack of communication between private sector and public sector participants, the uncertainties surrounding the introduction of new IVHS technologies, and the private sector's general unfamiliarity with state and DOT procedures.[38]

Balancing Intellectual Property Interests of State and Local Agencies with the Private Sector

State and local agencies have expressed concern over the extent to which they are entitled to intellectual property rights under Federal law, because many state statutes and regulations may not specifically address the issue of retaining title or licenses to intellectual property developed under projects financed with state funds. This section presents ways in which state agencies and IVHS developers can reach agreement regarding the retention of title and licenses for intellectual property in a mutually beneficial way that accounts for all the rights each sector is entitled to under the law.

Retention of Title. If an IVHS developer desires to retain title to an invention, that developer can negotiate a royalty arrangement, license agreement, or comparable arrangement whereby the state receives compensation for its contributions toward the creation of the invention. The agreement can provide for the appropriate level of compensation should the funding agency desire to share its license with a sister agency.

Limited Rights Data. Some public agencies have expressed a need to use the intellectual property developed under a funding agreement for purposes of maintaining, operating, and expanding the funded IVHS technology. These agencies are concerned that if the data at issue were limited rights data, they would have to make additional, and costly, arrangements if the IVHS product needed to be repaired. Issues pertaining to the usage of limited rights data are appropriate topics for negotiation at the commencement of a funding agreement.

Alternatively, a software escrow arrangement may be used. Under this arrangement, the software code is deposited with an escrow agent who is bound to release the code to the licensee in the event of default by the software owner. This procedure would protect a funding agency from the risk of holding software that it could not maintain or improve if the developer goes out of business.[39]

Protection of Trade Secrets. Developers of IVHS technologies may also be concerned with the prospect that trade secrets (or other privileged information) disclosed to public agencies may become accessible to the public through freedom of information acts. The Trade Secrets Act makes it a criminal offense for U.S. Government employees to release trade secrets and other confidential information to any extent not authorized by law. At least 37 states provide for injunctive relief and award of damages for unauthorized disclosure of trade secrets.[40] Common law provisions may also be available to preserve confidentiality.

Many state "freedom of information" or "public records" acts governing public access to state and municipal government records exempt trade secret information from mandatory

disclosure.[41] These acts may be modeled after the Federal Freedom of Information Act, which exempts from disclosure matters that are trade secrets and/or privileged or confidential commercial and financial information.[42] This exemption must be read together with any contractual agreements for documents to be delivered to the Federal agency for agreed upon purposes.

Implication of Standards on Patentable Inventions. Some commenters to the Public Docket expressed concern that the systems architecture procurement and development of standards for IVHS products may discourage patentable inventions. The DOT does not believe this will be the case. Through its systems architecture procurement, DOT is fostering the development of an open architecture as the technological framework for IVHS. As suggested by the draft *National Program Plan,*[43] an "open architecture [should] cover interoperable products that will compete on their merits in price and performance." Additionally, the development of standards for IVHS products is important for promoting compatibility, improving safety, and accelerating system development and implementation. Since the standards themselves are not patentable,[44] all interested persons will be able to manufacture products to meet these standards and seek appropriate patent protection for the hardware or software they develop.

Conclusions

Federal patent policy affords sufficient protection for private developers of intellectual property that arise as a result of federally funded IVHS research, development, and deployment projects. Concerns that the Federal Government may "crowd out" IVHS developers are not justified. The DOT suggests that public sector and private sector participants to the funding agreements discuss their expectations regarding intellectual property rights in order to protect these rights in accordance with applicable laws, regulations, and policies.

The DOT will monitor the disposition of intellectual property rights in IVHS operational tests, deployments, and other IVHS activities, such as the Automated Highway System Program. Participants at a January 1994 workshop on intellectual property sponsored by DOT recommended several actions to reduce intellectual property concerns for both public and private participants, including issuance of detailed guidance on Federal intellectual property policies and encouraging IVHS partners to focus on intellectual property considerations early in the process of agreement formation. 'The DOT has distributed the proceedings of the recent workshop, and we will carefully review the recommendations that were developed by workshop participants.

ENDNOTES

[1]These comments were described in an April 13, 1993, White Paper of the IVHS AMERICA Legal Issues Committee, submitted in response to the Department of Transportation's request for comments on nontechnical issues, Public Docket No. 48626 (58 Fed. Reg. 7029, February 3, 1993).

[2]Nossaman, Guthner, Knox & Elliott, *Intellectual Property Rights and the National IVHS Program* (December 1, 1993) prepared under FHWA Contract DTFH6 1-93-C-00087.

[3]35 U.S.C 101.

[4]35 U.S.C. 102(a).

[5]35 U.S.C. 102(b).

"'Utility patents" are granted for a term of 17 years, subject to the payment of specified fees (35 U.S.C. 154); "design patents" are granted for a term of 14 years. (35 U.S.C. 173).

[7]35 U.S.C. 261.

[8]35 U.S.C. 200 *et seq.*

[9]The term "funding agreement" encompasses any "contract, grant or cooperative agreement" for the performance of experimental, developmental, or research work and "any assignment, substitution of parties, or subcontract" for such work. 35 U.S.C. 201(b).

[10]35 USC 200. The scope of Chapter 18 was expanded by the February 18, 1983, Presidential Memorandum on Government Patent Policy which provided that, to the extent permitted by law, all Federal agencies should adopt policies with respect to the disposition of inventions made with Federal assistance that are "the same or substantially the same" as applied to small business firms and non-profit organizations under Chapter 18. This is to allow private industry to retain title to inventions made with Federal support as an incentive to obtain the risk capital necessary to develop technological innovations.

[11]35 U.S.C. 202(c)(4).

[12]37 CFR 401.1(a)(1).

[13]*Ibid.*

[14]35 U.S.C. 203.

[15]Upon petition filed in the United States Court of Federal Claims by a contractor inventor, assignee or exclusive licensee adversely affected by an agency determination to exercise march-in rights, the court has jurisdiction to modify or reverse an agency determination. 35 U.S.C. 203(2).

[16]35 U.S.C. 202(a)(ii), 37 CRR 401.3, 401.4.

[17]The right to direct that title be vested in certain entities has been used recently by the U.S. Department of Energy to assure that title to certain subject inventions is vested in the sector of the industry most able to commercialize and utilize the technology in the manner contemplated by the government, including achieving the goal of benefiting and protecting the pertinent domestic industries. In the U.S. Advanced Battery Consortium, DOE allowed the Big Three auto makers under the "exceptional circumstances" determination, and with specified conditions, to control and license the advanced battery program technology to domestic industries. This action was consistent with the goal of developing successful commercialization of 'electric vehicles in the mid- to late 1990s. The participating small businesses, universities, and nonprofit subcontractors obtained exclusive rights in fields of use of the inventions other than automotive applications. (Cooperative Agreement No. DE-FC02-91CE50336). The DOE has also relied on the "exceptional circumstances" determination essentially to vest title to Steel Initiative projects in the U.S. steel industry, so as to permit the domestic steel industry to compete on a more even basis with the nondomestic steel industry.

[18]35 USC 201.

[19]35 USC 201(e)

[20]U.S. Department of Transportation, Federal Highway Administration, "Request for Applications to Establish a National Automated Highway System Consortium" (December 15, 1993) RFA Number DTFH6 1-94-X-0000 1.

[21]*Ibid.* p. 30. The standard patent rights clause contains the operative terms "subject invention" and "conceived or first actually reduced to practice in the performance of work under this contract." It also allocates principal rights between the contractor and the government; has requirements pertaining to invention disclosure, election of title and filing of patent applications by the contractor; sets forth conditions when the government may obtain title; describes minimum rights to the contractor and protection of the contractor's right to file; requires the contractor to take certain actions to protect the government's interest; requires the clause to be included in subcontracts; requires reporting on

utilization of subject inventions; describes the preference for U.S. industry requirement and the funding agency's march-in rights; and contains special provisions for contracts with nonprofit organizations.

[22] 17 USC 101-118, et seq.

[23] 17 USC 302(a).

[24] 17 USC 102(a).

[25] 17 USC 101.

[26] 17 USC 102(b).

[27] OMB Circular A-102, the Uniform Administrative Guidelines for Grants and Cooperative Agreements to State and Local Governments (codified at 49 CFR, Part 18; §1834). Similar provisions are contained in the Uniform Administrative Guidelines for Grants and Cooperative Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations (OMB circular A-l 10, revised 58 fed. reg. 62992, Nov. 29, 1993).

[28] Under 49 CFR Subpart 27.4, the term "data" encompasses all recorded information, including technical data, computer software programs, computer databases, and documentation relating thereto.

[29] 48 CFR 52.227-14; 48 CFR 27.404(a).

[30] 48 CFR 52.227-14(c)(1).

[31] *Ibid.*

[32] 48 CFR 27.402.

[33] *Ibid.*

[34] "Limited rights" data include "data developed at private expense that embody trade secrets or are commercial or financial and confidential or privileged." 48 CFR 27.401. "Computer software" means computer programs, computer databases, and documentation thereof." *Id.*

[35] RFA Number DTFH61-94-X-00001, op. *cit.* at 29.

[36] A "limited rights notice" states in pertinent part: "These data may be reproduced and used by the government with the express limitation that they will not, without written permission of the contractor, be used for purposes of manufacture nor disclosed outside the Government; except that the Government may disclose these data outside the Government for the following purposes, if any, provided that the Government makes such disclosure subject to prohibition against further use or disclosure. . . ." 48 CFR 52.227-14(g)(2)(a).

[37] *Ibid.*

[38] See, e.g., Syverud, K., "Legal Constraints to the Research, Development, and Deployment of IVHS Technology in the United States," March 31, 1993, prepared pursuant to FHWA Purchase Order #DTFH61-92-P-01229. The author conducted extensive interviews with participants in IVHS research, development, testing, and deployment.

[39] See Ostrer, M., "Contract Issues in Toll Road Agency Procurement of Intelligent Vehicle and Highway Systems," presented at the 3rd Annual Meeting, IVHS AMERICA, April 15, 1993. The paper also discussed contractual provisions placing full responsibility on the IVHS seller to avoid patent infringement.

[40] See, e.g. Cal. Civ. Code, 3426 *et seq.*

[41] See, e.g., Cal. Gov. Code 6254; Colo. Rev. Stat. 24-72-204; Mich. Stat. Ann. 4.1801(13)(1)(g); Minn. Stat. 13.37; N.Y. Pub. Off. Law 87(2)(d); Wis. Stat. 19.36.

[42] 5 U.S.C. 552(b)(4)

[43] *Op. cit.* p. V-l-l et seq.

[44] 35 USC 101.

10 IVHS and Related Environmental Impacts

Introduction

When deployed in strategic combinations, IVHS projects and programs can go far to advance energy conservation, environmental quality, and societal quality-of-life objectives. Discussion of potential IVHS impacts on society and the environment must recognize the different applications and potential impacts within the broad range of technology-based user services, the broad array of natural and community environments that need to be considered, and the prerogative of state and local governments in implementing IVHS programs that respond to their special needs.

The term IVHS encompasses a wide range of technology applications capable of improving the efficiency of system usage and operations, across modes and travel markets -- with individually unique implications for environmental quality and social conditions. Deployment of selected combinations of IVHS strategies can support attainment and maintenance of air quality standards in metropolitan areas.

It is important also to recognize that environmental features exist in a regional context and at the community level, and encompass both natural features and human aspects. Recent legislation has directed much of the environmental focus of IVHS assessment and research toward impacts on regionwide ambient air quality. Therefore, this report focuses on air quality.

For this report, DOT commissioned a review of the potential air quality effects of different IVHS technologies, entitled *Qualitative Assessment of IVHS Emission and Air Quality Impacts*.[1] This report reviewed relevant academic and government studies, evaluated the results of a recent video conference on IVHS and air quality,[2] and incorporated the results of a *National IVHS/Air Quality Workshop*.[3]

This chapter discusses the following environmental issues:

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

Influence of IVHS on Air Quality

This section discusses the potential impact of IVHS technologies. Each set of IVHS services affects air quality uniquely. The overall effect of IVHS deployment in an area will depend upon the IVHS technologies and services that decisionmakers choose to implement. Certain mixes of services may be mutually reinforcing, maximizing the potential air quality gains. For instance,

combining strategies to improve transit services with travel reduction strategies for high-emission vehicles effectively leverages the value of each.

Impacts of IVHS on air quality are related to two general factors, (1) the extent to which IVHS affects total travel, and (2) the extent to which IVHS reduces the rate of emissions generated for a given amount of travel.

Impacts of IVHS on total travel will depend on several factors including (1) reductions in the share of total travel that is in single-occupant vehicles (SOVs), (2) reductions in circuity and excess driving resulting from drivers not knowing the best route to their destination, and (3) changes in average trip length resulting from reduced congestion, better information about potential destinations, and other factors.

Traffic Flow Patterns. Unlike changes in travel patterns, which influence the volume of emissions, changes in the flow of traffic influence the *rate* of emissions. Under stop-and-go conditions vehicles emit substantial amounts of pollutants. Improved highway operations will result in reductions in hydrocarbons, one of the precursors of ground-level ozone formation. At speeds above about 30 miles per hour, however, additional speed brings about very gradual increases in another ozone precursor -- nitrogen oxides.

Motor vehicle acceleration often creates high levels of unburned hydrocarbons and carbon monoxide.[4] Recent laboratory tests indicate that frequent vehicle accelerations contribute significantly to total trip emissions; indeed, one sharp acceleration during a trip may cause as much pollution as the entire remaining trip.[5] During vehicle deceleration, emissions of unburned hydrocarbons and carbon monoxide increase because the efficiency of the combustion process is poor. While most vehicles with fuel-injected engines stop adding fuel during vehicle deceleration, rapid deceleration may still cause a “spike” of unburned hydrocarbons and carbon monoxide.

Effect of IVHS on the Volume of Single-Occupancy Automobile Trips. There is a concern that the principal impact of IVHS will be to encourage SOV trips. However, several IVHS services focus on improving information about alternatives to SOV trips. Better information about transit schedules, delays, routes, fares, etc., should attract riders from SOVs, especially if combined with demand management strategies designed to reduce the demand for travel in SOVs. Better information about carpools and other potential ride sharing strategies should also contribute to reducing the share of total travel by solo drivers. In addition, improved traveler information and route guidance services could reduce total travel significantly by reducing excess travel. New IVHS technologies could motivate travelers to make shorter and fewer SOV trips by:

- Increasing the attractiveness of mass transit and ride sharing;
- Discouraging SOV trips at times and locations targeted by demand management;
- Providing more accurate travel information, which could convince potential travelers to delay or forgo trips during adverse weather or air quality conditions or when congestion makes highway travel difficult; and
- Improving route guidance systems which could also result in shorter trips and more direct routings.[6]

On balance, the potential for IVHS to worsen environmental quality appears minimal, while significant opportunities exist for IVHS services to contribute to comprehensive state and local programs to improve environmental quality. Recent research suggests that even IVHS strategies that focus exclusively on improving highway operations and system speed will not lead to significant increases in induced traffic and emissions. Furthermore, communities with mandates to improve air quality will implement IVHS in ways that reduce, rather than increase, SOV use and emissions.

Improved Cold Start Operations and Emission Air Quality Levels. The number of times a vehicle's engine is started has a major effect on the volume of emissions it emits. Under cold start conditions (i.e., when a vehicle has been turned off for some time and the catalytic converter is cold) hydrocarbon and carbon monoxide emissions are greater than after the vehicle has been operating for some time. This occurs because catalytic emission control systems are not fully effective until they reach a given temperature. Under cold operating conditions a richer fuel-air mixture must be provided to the cylinders to ensure proper engine performance; moreover, excess fuel is not burned completely and a richer fuel-air mixture must be provided to ensure proper engine performance[7] For a typical trip cold start conditions have been estimated to account for approximately 50 to 70 percent of total trip emissions (for 198 1 and later model years).[8] As described above, however we believe there is considerable potential for IVHS to decrease the number of total trips and, therefore, cold starts.

At this time, the impact of IVHS technologies on the volume of vehicle emissions cannot be estimated accurately. To the extent IVHS technologies reduce the number of vehicle accelerations and decelerations, result in fewer SOV trips, and shorten average trip lengths, they will reduce the volume of emissions. If IVHS technologies result in more SOV trips and longer average trips, they will increase total emissions. However, because IVHS deployment, like all transportation programs, is the responsibility of individual communities and regions, areas with air quality problems will necessarily promote IVHS strategies that lead to reductions in emissions. To the extent that improved highway operations result in increased average travel speeds, the net effect on emissions is mixed.

IVHS Environmental Impacts and Emission Control Technologies

It is important to view the impact of IVHS on vehicle emissions in light of future advances in emission control technologies.

Engine and Fuel Technologies. The eventual adoption of electrically heated catalysts and more advanced combustion control processes will reduce vehicle emissions significantly. Reformulated fuels and alternatively fueled vehicles will generate important environmental benefits. Over the long term, the impact of IVHS technologies on emission levels may be relatively small compared to new engine and fuel combustion technologies.

Products That Identify Polluting Vehicles. IVHS technologies could also help improve air quality by identifying polluting vehicles. The EPA's regulations requiring on-board diagnostics

that monitor a vehicle's emissions and remote-sensing devices that measure exhaust pollutants from moving vehicles could help identify gross-polluting vehicles or ensure that malfunctioning emission control systems are repaired. These technologies would supplement conventional control strategies such as periodic vehicle inspection. According to the National Research Council, fewer than ten percent of motor vehicles account for approximately 60 percent of the ozone-forming and carbon monoxide emissions attributable to mobile sources. Vehicles that are major polluters in one category (e.g., volatile organic compounds) are not necessarily responsible for high emissions in another (e.g., carbon monoxide).[9] Identifying, repairing, or removing gross-polluting vehicles in each category would improve air quality dramatically in many metropolitan areas.[10]

IVHS Technologies and User Fees. In the United States, motorists pay to construct and maintain highways through various taxes and fees. However, the total cost of using a highway also includes, among other things, the private and social costs of congestion and pollution. These costs are not accurately reflected in today's highway taxes and fees. ***New*** information technologies will make it more feasible to consider imposing highway user fees that better reflect the additional private and social costs that result from increased traffic. These technologies could also be used to allocate costs more appropriately among highway users. Automatic vehicle identification systems, for example, could be used to establish fees that vary over time and distance. The role of IVHS as an enabling technology for the implementation of road pricing is likely to be extremely important.

Additional Research

This section discusses ongoing research and what additional research is needed to answer questions about the environmental effects of adopting IVHS technologies.

Research on IVHS and Increased Traffic. Motor vehicle emissions will be reduced if IVHS technologies reduce vehicle accelerations, decelerations, SOV trips, and average trip length. Moreover, if IVHS technologies improve the speed and reliability of public transit and multi-occupant vehicle trips, environmental benefits will result. But some public policymakers are concerned that IVHS technologies will improve the efficiency of the highway system to such an extent that more trips will be taken and more vehicle miles will be driven. If this were to occur, IVHS would have a detrimental effect on air quality. A recent study indicates that even large expansions in highway capacity/efficiency may not result in substantial volumes of induced traffic.[11] More research is needed on this important question. Research is also needed to evaluate the best approaches to improving the balance among public and private transportation modes.

Need for New Analytical Models. Preparing quantitative estimates of the effect of various IVHS technologies on vehicle emissions will require new analytical models and better data. Changes in the speed profiles of vehicle trips cannot be estimated accurately with current traffic models. For example, the baseline exhaust emissions data contained in the MOBILE and EMFAC models are based on a standardized driving cycle that was originally developed to duplicate the speed and time profile of a typical highway trip in the Los Angeles metropolitan area in the late 1960s.

To estimate the effects of IVHS on emissions will require improved models of trip generation, trip distribution, and modal choice.

Need for Highway Network Models. Transportation planners also need to develop highway network models. Analytical models that simulate the flow of traffic on an integrated systemwide basis, rather than the current models that simulate traffic at the corridor level, are needed. Such models should be able to accept and interpret real-time traffic data received from surveillance points along the highway network.

Need for Understanding Traveler Responses to IVHS Data. The effectiveness of advanced highway and transit technologies for reducing congestion, promoting high occupancy vehicle travel, improving safety, and increasing the efficiency of the highway system will depend on whether travelers change their behavior. While it is evident that imperfect information on traffic conditions contributes to urban congestion, the degree to which travelers will use better information to adjust their travel plans, either route or transport mode selected, is not well understood.

Assessment of the Environmental Impacts of IVHS Operational Tests. Field tests are now underway to determine the effect of IVHS technologies on highway operations. However, these operational tests do not consider the environmental consequences of adopting various IVHS technologies. One reason why DOT has not measured the environmental impacts of IVHS technologies more accurately is because we have not conducted a large enough field test. The biggest test to date included only 100 vehicles, a number that is too small to make a measurable difference to air quality in a metropolitan area. To the extent possible, future IVHS field tests should take into account the air quality effects of adopting new technologies.

Conclusions

Advanced highway technologies need to be adopted in ways that allow users to better balance their transportation choices. An extensive program of research on the potential environmental and societal implications of IVHS is being implemented. Improved methods are needed for collecting relevant empirical data on IVHS environmental impacts, for assessing potential traveler response to the introduction of IVHS, and projecting future effects. Beyond this, future research will consider impacts on the community and social environment -- the underlying forces and the potential supporting role of IVHS in enhancing mobility, promoting community cohesion and enhancing the quality of life. Investigation of these issues is at an early stage and will be described more fully in future publications. On balance, IVHS technologies have the potential to reduce vehicle emissions and to contribute to the goals of the Clean Air Act. The DOT will work to make sure this potential is realized.

ENDNOTES

[1] Jack Faucett Associates, *Qualitative Assessment of IVHS Emission and Air Quality Impacts,* Bethesda, Maryland, July 1993.

[2] Ibid. Appendix C.

[3] Institute of Public Policy, George Mason University, *National IVHS and Air Quality Workshop,* South Coast Air Quality Management District, Diamond Bar, California, March 29-30, 1993.

[4] Oxides of nitrogen, NO, are inherently low during this type of engine operation, although increases may be seen in vehicles with highly efficient NO, control.

[5] Daniel Sperling, Randall Guensler, Dorriah Page and Simon Washington, Transportation, Information, Technology and Public Policy, proceedings of the Asilomar IVHS Policy Conference, 1992.

[6] Steven E. Shladover, "Potential Contributions of IVHS to Reducing Transportation's Greenhouse Gas Production," *Transportation Research,* May 1993.

[7] Sierra Research, Inc., *Evaluation of "MOBILE" Vehicle Emissions Model,* prepared for the Volpe National Transportation Systems Center, April 1993.

[8] The Environmental Protection Agency considers a cold start for a catalyst-equipped vehicle to occur after the engine has been off for one hour. For non-catalyst vehicles, a four-hour period when the engine is off distinguishes a cold start. In between these periods, engine-on events are considered hot starts. Moreover, the duration of cold start operating conditions under the Federal test procedure (FTP) is by definition 505 seconds *(i.e.,* the "Bag 1" portion), after which the vehicle is operating under stabilized conditions.

[9] National Research Council, *Rethinking the Ozone Problem in Urban and Regional Air Pollution,* Washington, D.C., 1991.

[10] National IVHS and Air Quality Workshop.

[11] Institute of Transportation Studies, University of California at Berkeley, *The Air Quality Impacts of Urban Highway Expansion: Traffic Generation and Lund-Use Impacts,* UCB-ITS-RR-93-5, April 1993.

INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT OF 1991

PART B--INTELLIGENT VEHICLE-HIGHWAY SYSTEMS ACT

SEC'. 6054. STRATEGIC PLAN, IMPLEMENTATION, AND REPORT TO CONGRESS

(d) NONTECHNICAL CONSTRAINTS.—

(1) REPORT TO CONGRESS.—In cooperation with the Attorney General and the Secretary of Commerce, the Secretary shall prepate and submit, not later than 2 years after the date of the enactment of this Act, a report to Congress addressing the nontechnical constraints and barriers to implementation of the intelligent vehicle-highway systems program.

(2) SCOPE OF REPORT.—The report shall-

(A) address antitrust, privacy, educational and staffing needs, patent, liability, standards, and other constraints, barriers, or concerns relating to the intelligent vehicle-highway systems program;

(B) recommend legislative and administrative actions necessary to further the program; and

(C) address ways to further promote industry and State and local government involvement in the program.

(3) UPDATE OF REPORT.-Not later than 5 years after the date of the enactment of this Act, the Secretary shall prepare and submit to Congress an update of the report under this subsection.

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Federal Register/Vol.58, No. 21 / Wednesday, February 3, 1993, (7029-7030)

DEPARTMENT OF TRANSPORTATION

Office of the Secretary

[Docket No. 48626; Notice 93 - 6]

Request for Public Comments on Potential Nontechnical Constraints to the Implementation and Use of Intelligent Vehicle-Highway Systems (IVHS)

AGENCY: Office of the Secretary, DOT.

ACTION: Notification of open docket for public comments.

SUMMARY: Intelligent vehicle-highway systems (IVHS) are intended to improve safety, reduce congestion, and help promote other important national transportation goals. The Department's IVHS program was formally established by the Intermodal Surface Transportation Efficiency Act of 199 1 (ISTEA) (23 U.S.C. 307 note). This program is described in a report prepared for Congress by the Department of Transportation, IVHS Strategic Plan: Report to Congress, December 18, 1992.

A number of nontechnical constraints have been identified as potential deterrents to the successful adoption of IVHS technologies. Section 6054(d) of the ISTEA requires the Department of Transportation, in consultation with the Departments of Commerce and Justice, to prepare a report to Congress that identifies and evaluates nontechnical constraints and barriers to the adoption of IVHS technologies (section 6054(d)(1)). The purpose of this notice is to solicit comments from state and local officials, academics, industry, and private individuals on the various nontechnical constraints to IVHS deployment we have identified, as well as others we may not have identified.

According to the relevant statute, the report should consider the following issues: Antitrust, privacy, educational and staffing needs, patent, liability, and architectural/technical standards. The report should also recommend legislative and administrative actions to further the Department's IVHS program, as well as to suggest ways to encourage industry and state and local governments to become more actively involved in the national IVHS program.

In addition, the Senate Appropriations Committee Report to the Fiscal Year 1993 DOT Appropriations Act requested the Department to consider whether the deployment of IVHS projects will affect the ability of a state or region to meet the requirements of the Clean Air Act. Finally, the Strategic Plan for Intelligent Vehicle Highway Systems in the United States, 1992, prepared by IVHS America, discusses additional nontechnical issues that may have a major impact on the success of the national IVHS program.

Acting on these recommendations, our report will, in addition to the issues listed above, discuss contracting and acquisition issues, local government coordination issues, and barriers that may prevent private firms from providing IVHS services.

INFORMATION REQUESTED: In each of the following subject areas, we are interested in having information submitted. that will help us understand how the nontechnical constraints we have identified may inhibit the adoption of IVHS technologies. We are also interested in identifying potential actions the Department of Transportation or the Federal government could take to reduce these constraints, as well

as obtaining suggestions as to how we can promote industry and state and local government involvement in the IVHS program.

I. Antitrust: The development of IVHS technologies may require businesses to pool their technical skills, capital, and facilities. Concern about antitrust prosecution and liability, however, may inhibit the formation of joint ventures. By providing that certain joint ventures are to be evaluated under a rule of reason standard for antitrust purposes (rather than under the more restrictive per se test) and limiting liability to actual damages, the National Cooperative Research Act of 1984 (NCRA), (15 U.S.C. 4301 - 4305) provides limited protection for private firms from antitrust prosecution. We seek information as to whether the antitrust laws unduly inhibit the ability of U.S. companies to work together to develop IVHS products and services, as well as to participate in public/private partnerships.

II. Patents: Developers and manufacturers of IVHS products must work cooperatively to ensure that components properly interface with established IVHS technologies; they must also work cooperatively with state and local governments to install and operate these technologies. Some IVHS development and deployment, moreover, will be funded by Federal and state governments. The cooperative nature of IVHS development, as well as government involvement in funding and operating IVHS technologies, may affect the patent, copyright, and other intellectual property rights of the developers of these technologies. At this time, it is not clear how the cooperative development nature of many IVHS technologies will be influenced by existing patent and copyright provisions. The full implications of government rights to IVHS-related intellectual property developed at government expense, or partially at government expense, may also need to be further addressed.

III Liability: Large court damage awards in product liability suits may inhibit private firms from developing and marketing certain products and services. In the IVHS area, this potential liability concern may escalate more rapidly as emerging IVHS technologies assume more of the functions now performed by individuals. In these circumstances, liability claims could be raised against the public agency owning or operating the highway, as well as against the manufacturer or distributor of the allegedly defective technology. Moreover, because the financial risks involved in introducing new technologies could be substantial and are uncertain it may be difficult, or very costly, for private firms to insure against these risks. We would like to solicit views on various approaches to managing the IVHS product liability issue, including insurance, indemnification, and immunity.

IV. Standards: Because of the limited market for many IVHS technologies, private firms may need assurances that their product development plans will not only meet the needs of their customers but will also technically conform with other IVHS products and services. Thus it has been suggested that one critical action that will be needed to promote the adoption and diffusion of IVHS technologies is for all parties to reach an agreement on appropriate industry standards and protocols. We need to determine what industry standards and protocols are necessary and/or desirable. We also need to evaluate the additional social benefits and costs of greater industry standardization.

It is expected that such standards and protocols will be developed and promulgated by existing standard-setting organizations, like the American Society for Testing and Materials (ASTM) the Institute of Electrical and Electronics Engineers (IEEE), and the Society of Automotive Engineers (SAE). We would like comments on the adequacy of this approach.

V. Acquisition: Industry spokesmen concerned with promoting IVHS technologies often allege that Federal, state, and local acquisition requirements unduly delay or inhibit progress in developing and

adopting IVHS technologies. Federal procurements are governed by the Federal Acquisition Regulations (FAR). Government contracting and acquisition rules, it is alleged, are not sufficiently flexible with regard to long-term developmental requirements; in particular, organizational conflict of interest requirements may have the effect of deterring companies from participating in the early phases of developing IVHS technologies.

There is also a concern that existing acquisition rules inhibit the ability of government agencies to work with private sector companies to develop, test, and adopt various IVHS technologies. Some argue that government agencies should be granted greater latitude to establish contractual relationships with private firms, particularly& areas where the work is being undertaken in a collaborative manner. Views on this issue are requested.

VI. Privacy: Some motorists may consider their privacy jeopardized if certain IVHS technologies, such as automatic vehicle identification devices or other traffic surveillance systems, were widely adopted. It has also been suggested that these privacy concerns could precipitate consumer backlash against various IVHS technologies. We are interested in views on whether the possible loss of privacy could reduce the willingness of consumers to accept and purchase IVHS products and services.

VII. Education and Staffing: The successful introduction of new IVHS technologies may require employee and managerial skills that are different from those that were previously in demand. We need to understand if colleges, universities, and technical institutes are preparing students with the training and skills they need to pursue potential high technology jobs in the IVHS sector. We also need to determine if government employees have the skills necessary to meet the demands that will be placed upon them if new IVHS technologies are widely adopted. Finally, we need to assess what types of IVHS-related training and retraining programs for transportation employees may be appropriate in the future.

VIII. Local Government Coordination: Responsibility for traffic management operations has evolved in response to various institutional, political, and funding arrangements.

In many metropolitan areas such responsibilities are often dispersed among distinct political jurisdictions; moreover, within jurisdictions there are likely to be a number of separate agencies involved in traffic management operations.

Various IVHS technologies will improve the efficiency of metropolitan traffic management services. Some experts have suggested that these technologies must be adopted on an areawide basis to achieve maximum efficiency. Some parties also have suggested that the deployment and operations of these technologies are a natural extension of current services provided by the public sector; others have suggested that new traffic management services will be provided by the private sector. We are particularly concerned as to what measures may be needed to facilitate adequate cooperation by local governments for the provision of certain IVHS services in an efficient manner.

IX. Private Sector Access: In many cases, new IVHS services will be offered by the private sector. For example, while governments are responsible for road signs and traffic signals, in-vehicle information on traffic conditions and other traffic information could be offered by public agencies or private firms on a subscription basis. There are, however, a variety of statutory or regulatory constraints that could prevent private companies from offering such services. This is particularly the case if there needs to be access to the highway system by private companies, or if the radio spectrum allocated to the public sector

is to be used for these services. We are particularly interested in views on institutional and regulatory changes that need to be made to enhance the private sectors' ability to offer IVHS services.

X. Environment: Some parties are concerned that reduced traffic congestion could have negative implications for the environment. Under one scenario, any short-term successes achieved in alleviating traffic congestion will merely encourage higher levels of automotive traffic, thus leading to more air pollution. On the other hand, some IVHS supporters argue that these traffic management technologies will lead to smoother traffic flows, decreasing much of the air pollution now caused by stop-and-go traffic patterns. Also, some IVHS supporters believe these technologies could result in a higher level of transit use and carpool and vanpool use, as well as facilitate road pricing. Views on how IVHS technologies can contribute to a positive environmental impact are requested.

DATE: Comments should be received by April 15, 1993. Comments that are received after that date will be considered to the extent possible.

ADDRESSES: Comments should be sent (four copies) to: Docket Clerk, Docket No. 48626, room 4107, United States Department of Transportation, 400 7th Street, SW., Washington DC 20590.

FOR FURTHER INFORMATION CONTACT: Laurence T. Phillips or Thomas E. Marchessault, Office of Economics, P - 37, Office of the Secretary, U.S. Department of Transportation, Washington, DC, 20590. Phone (202) 366 - 5412, Fax (202) 366 - 3393.

Joseph F. Canny,

Deputy Assistant Secretary for Policy and Regulatory Affairs.

[FR Doc. 93 - 2497 Filed 2 - 2 - 93; 8:45 am]

BILLING CODE 4910 - 62 - M

ASSOCIATIONS

AMERICAN PUBLIC WORKS ASSOCIATION, INSTITUTE FOR TRANSPORTATION, 106 West 11 Street, Kansas City, MO 64105 (R. Marshall Elizer, Jr., Institute for Transportation Policy Chair, dated 4/14/93)

- In view of the vital importance of public acceptance of IVHS technology, further consideration -of liability limitations should only be considered in the context of all transportation and public work services.
- RFP and sole-source procedures should be changed. Low-bid approaches by Federal, state, and local governments are often too restrictive.
- IVHS implementation will require a "build and cooperate" operations and maintenance approach between state and local governments. Local expertise will be required to ensure compatible traffic management systems.
- Achieving local traffic management system compatibility and integration with IVHS technology cannot be expected to occur through a phased-in approach. IVHS implementation must include funds for replacing and/or integrating current signal systems.
- TMA's and MPO's need to establish institutional methods to address traffic control issues.

AMERICAN SOCIETY OF CIVIL ENGINEERS, 345 East 47 Street, New York, NY 10017 (Edward Jones, Director, Codes & Standards, dated 4/8/93)

- A great reliance must be placed on the use of private sector voluntary consensus standards.
- Procurements must be prescriptive- and performance-based
- Voluntary standards should be developed with industry input.
- Private firms or government agencies should have adequate protection from liability if they conform to consensus developed standards.
- Inasmuch as programs are already too full to accommodate additional educational courses, the continuing education of practicing engineers (as provided by professional societies that would also be developing pertinent standards) is the obvious solution.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 1828 L Street, N.W., Washington, DC 20036 (Nelson L. Milder, Assistant Director, Policy Development & Technical Support, dated 2/8/93)

- Submitted a previously issued statement on IVHS
- New staff members will need to have educational backgrounds that include much more electrical, mechanical, electronic, and software engineering training than their predecessors.

- Some limitations of tort and liability exposure are likely to be needed before public agencies and private companies will be comfortable deploying IVHS.
- The most effective way to achieve both operational testing and deployment of IVHS is through partnerships of public and private sector organizations.
- The Federal investments at the early stages should be targeted toward answering the following questions. How should humans best interface with the technology? How will travelers respond to the availability of more comprehensive travel information? What effects will IVHS have on land use patterns, the environment, and energy consumption?
- The tremendous technological resources represented by the people, the facilities of the defense industry, and national laboratories can be applied to IVHS in order to help ensure U.S. leadership in the international competition for IVHS development.
- It is essential to recognize that IVHS is a very broad subject. Some of its elements are ready for deployment today, while others will require a decade or more of development.

CALIFORNIA TRUCKING ASSOCIATION, 1900 West Garvey Avenue, South., West Covina, CA 91790 (Walter Keeney, President, Flour Transportation & CTA Representative, HELP Project. Joel D. Andersen, Executive Vice President, dated 3/24/93)

- Some exceptions may have to be made in any antitrust law provisions that might inhibit cooperation between manufacturers of various types of equipment to be used in the highway system.
- It is questionable whether equipment developed to meet a generic specification should be patentable.
- As multiple systems for Automatic Vehicle Identification (AVI) are developed, there is concern that many non-compatible systems will be used around the country and that truckers will be forced to hang a variety of transponders on their vehicles in order to operate in a nationwide market.
- The acquisition and purchasing processes of both the Federal and state governments are far too slow and need to be streamlined.
- Users must be educated in the advantages of AVI usage in nonstop toll facilities, ports of entry, and highway scale facilities for commercial vehicles.

CENTER FOR AUTO SAFETY, 2001 S Street, NW., Washington, DC 20009 (Alpa Patel, Staff Attorney and Lisa J. Danetz, Technical Policy Analyst, dated 7/12/93)

- There is a disturbing trend by IVHS America to forego public participation in its role as a Federal Advisory Committee. The FHWA must reassert oversight and encourage public participation.
- There is concern that tort reform, which is aimed at reducing or eliminating liability on the part of the manufacturer, will unduly result in shifting the cost to the consumer and inefficient technology.

- IVHS technology is too oriented towards crash avoidance; there should be more attention to crashworthiness technologies
- For IVHS to have a long-term positive environmental impact, it is necessary to maximize the utilization of mass transit.

INSTITUTE OF TRANSPORTATION ENGINEERS, 525 School St., S.W., Washington, DC 20024 (Leon Goodman, P.E., President, dated 4/26/93)

- Submitted a report: *Advanced Vehicle & Highway Technologies*
- Written rules should be developed and made available to provide specific guidance to businesses interested in pursuing joint ventures in IVHS.
- Legislation and regulations should be developed to apply innovative concepts that will provide a return on investments for both public and private investors.
- Early limitations on liability should be considered for new products and services. As more experience is gained and safety benefits are demonstrated, these limits can be removed gradually.
- Standards and protocols should be fostered through existing standards-making organizations such as ITE, SAE, and IEEE.
- Competitive procurement should be promoted with prequalifications and other innovative options for acquisition.
- Accurate information and safeguards should be provided to earn the public trust. IVHS must be market driven.
- IVHS should be a catalyst to attract new personnel into the transportation industry through education and training. Fellowships and scholarships should be available.
- Federal funding and rules should provide incentives for jurisdictions to overcome past inertia and other barriers to change.
- Services should be provided for public agencies to be able to apply IVHS technologies and/or to license the private sector to do so directly.
- A national research program should be coordinated to develop better quantitative relationships between environmental impacts and the entire range of transportation improvements.

NATIONAL RESEARCH COUNCIL - TRANSPORTATION RESEARCH BOARD, 2101 Constitution Avenue, Washington, DC 20418 (Thomas B. Dean, Executive Director, dated 4/12/93)

- Create formal government-private sector partnerships for limited purposes — in particular for long-range, high-risk research and development.
- Tort liability concerns are a major institutional obstacle. The government and the private sector should find an acceptable strategy for containing exposure of firms and government agencies.
- Coordination of the IVHS system architecture development process should be the joint responsibility of DOT and IVHS America.
- The government should devise new institutional arrangements that improve its ability to manage advanced systems regarding testing alternatives. This should

include the operation of traffic management facilities by contractors and new intergovernmental arrangements for metropolitan traffic management.

- The committee emphasized the potential importance of privately provided IVHS services.

PUBLIC TECHNOLOGY, INC., 1301 Pennsylvania Avenue, N.W., Washington, DC 20004 (Costis Toregas, President, dated 4/14/93)

- DOT is urged to reach out more aggressively to involve the local government community in the DOT IVHS programs.
- The following is a list of constraints that have been identified:
  - failure to incorporate local government transportation needs,
  - extensive regional coordination requirements of fully deployed IVHS,
  - procurement processes that are not well suited for complex technology,
  - restrictive or limited financing options,
  - conflicting local government priorities amid scarce resources,
  - lack of experience with effective models for public-private partnerships,
  - lack of information among local government elected and appointed officials,
  - confused public policy regarding ownership and control of public assets,
  - technical and managerial skills training for employees,
  - complete re-engineering of functions to make optimum use of system, and
  - integration of diverse existing local government databases.
- Finance the creation of a local government IVHS/Transportation Task Force under the umbrella of PTI's Urban Consortium, which represents the large metropolitan areas already targeted for early deployment planned studies.
- Fund planning, research and demonstration studies that address local government roles, constraints, and contributions in a systematic way.
- Immediately develop a strong information dissemination program.

SAE INTERNATIONAL, 400 Commonwealth Drive, Warrendale, PA 15096 (Max E. Rumbaugh, Jr., Executive Vice President, dated 3/31/93)

- IVHS should make use of existing voluntary standards processes, coordinate and encourage existing standards writing organizations to develop standards, and encourage the Federal Government to participate in standards writings activities.
- Appropriate standards and procedures should be established prior to IVHS implementation to guard against the possible loss of privacy.
- The public sector will be the principal driving force for implementation.
- The Federal Government should pursue a policy of reducing congestion and improving safety.

GOVERNMENT

STATE OF CALIFORNIA, DEPARTMENT OF MOTOR VEHICLES, Box 932328, Sacramento, CA 94232 (Frank S. Zolin, Director, dated 4/9/93)

- The development of IVHS technologies provides an opportunity for public-private sector coordination and cooperation at a level unprecedented in the United States outside of wartime.
- IVHS technology offers the opportunity to dramatically change the basic practices of meeting air quality goals.
- IVHS technology could be designed to reduce traffic congestion, to control security and access within an area.
- If the United States is to be successful in harnessing the potential of IVHS technology, the effort must be nationally coordinated, grounded in a clear strategy for development, based on nationally accepted standards, and developed in an atmosphere of cooperation at all levels of government and business.

STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION, Box 942873, Sacramento, CA 942273 (James Van Loben Sels, Director, dated 4/14/93)

- To ensure the development of new technologies in the United States, some changes to antitrust laws are needed. These changes can include protections such as the "safe harbor," a share of the market that does not discourage competition.
- Innovators should be allowed to competitively seek follow-on work leading to the implementation and use of products developed in research projects.
- The government should limit its share of intellectual property rights to those needed for the public portion of IVHS deployment.
- The mix of deployment and operational liability, combined with product liability, is volatile and should be resolved.
- The approach to standards outlined in the Federal Register (navigable map databases, transportation system/user databases, incident command nomenclature, GIS layer definitions, and frequency allocation and usage) is a sound solution.
- The IVHS community must make it clear that the privacy issues will be resolved as the technologies and systems are implemented.
- State transportation departments, academia, and the research community should develop "hands on" training.

STATE OF CALIFORNIA, DEPARTMENT OF CALIFORNIA HIGHWAY PATROL, Box 942898, Sacramento, CA 94298 (M.J. Hannigan, Commissioner, dated 5/3/93)

- A national Automatic Vehicle Identification (AVI) specification should be created to ensure compatibility between vehicle transponders and toll facilities where AVI technology is used.

- In order to create a true multimodal and intermodal transportation management system, a concerted effort should be made to provide multijurisdictional IVHS coordination.
- Any proposed application should consider and mitigate potential legal or operational impacts.
- The Federal Government should coordinate and initiate IVHS efforts of strategic planning and development that include the active participation of federal, state, regional, and local agencies, in addition to the private sector.

STATE OF COLORADO, DEPARTMENT OF TRANSPORTATION, 4201 East Arkansas Avenue, Denver, CO 80222 (Johan J. Bemelen, Staff Traffic Engineer, dated 4/8/93)

- Antitrust concerns are: What problems exist if signals are changed or eliminated? Do we create a liability on the public agency's part to the user to continue to supply the information?
- Unless we reinstate "immunity laws" for the public agencies and include those private industries working with the public agencies, we **will** never be claim free.
- Standards and protocols need to be agreed upon immediately.
- Contracting and acquisition rules should be changed for areas in research and development.
- The private sector should not manage traffic directly. It should always work through public agencies.
- Since the private sector will be providing services and collecting fees, it should share in the earnings.

STATE OF COLORADO, DEPARTMENT OF TRANSPORTATION, 4201 East Arkansas Avenue, Denver, CO 80222 (Donna L. Villers, CPPB, Purchasing Agent, dated 4/22/93)

- Existing acquisition rules do not seriously limit negotiating positions nor are they especially detrimental to the public in areas of new technology.
- Competition should be brought to a higher level -- not be eliminated. This must be accomplished through accepting proposals for moderately different products and evaluating the potential benefit to the public.

E-Z PASS INTERAGENCY GROUP POLICY COMMISSION - no address listed (Linda M. Spock, Chair, dated 4/15/93)

- A key issue regarding patents is the extensive claims of intellectual property rights made by the Federal Government in connection with grants of Federal funds. The group believes that the scope of such claims may constrain the procurement of IVHS and/or increase costs.
- The interagency group is trying to select and install common electronic toll collection technology in the absence of any national standard.

- It is still too early in the development of IVHS technologies to promulgate standards that will cut off promising areas of research.
- The group has made a policy decision that customers' records will receive the greatest degree of confidentiality.
- An educated staff is critical in both the private and public sectors. The New York/ New Jersey metropolitan areas have interagency groups that were organized for the purpose of improving the coordination of transportation agencies within the region. TRANSCOM is an example of such a group.
- The environmental assessment of the New York State Thruway Authority suggests that the new technology will have a beneficial impact on air quality.

STATE OF FLORIDA, DEPARTMENT OF HIGHWAY SAFETY & MOTOR VEHICLES, Neil Kirkman Building, Tallahassee, FL 32399 (Fred O. Dickinson, III, Executive Director, dated 4/13/93)

- Companies are already collaborating on development of IVHS. For example, Lockheed IMS and ATT are jointly working on toll road technology and smart cards.
- Patents should be made clear in RFP's and should continue as the IVHS programs are contracted to vendors.
- Current areas of liability include IRP and IFTA software, fee modules, and magnetic strips on drivers' licenses.
- Privacy is an especially sensitive area. Florida is experiencing a problem in passing state legislation for photo monitoring of vehicles at toll facilities.
- Because of its authority on any public roadway in the State, the Florida Highway Patrol must be an active partner in any traffic management center or similar group. It must be kept informed of the progress in each group.
- Stop-and-go traffic must be improved if there is any chance of reducing air pollution and traffic congestion.

INDIANA DEPARTMENT OF TRANSPORTATION, 100 North Senate Avenue, Indianapolis, IN 46204 (Katherine Davis, Deputy Commissioner, Highway Operations, dated 4/13/93)

- Liability issues are of great concern. State legislatures may need to consider legislation that limits or eliminates liability claims. Fail-safe mechanisms need to be built into the electronic part of the IVHS system.
- IVHS America, ITS, FHWA, AASHTO and other technical groups need to share information to ensure that standards are developed. Industrywide standards will need to be developed as early as possible.
- The privacy issue could become a concern if the public is not educated on the benefits of IVHS technology. Public campaigns need to be developed to allow motorists to "buy into" the program.
- IVHS funding should be available to local governments.

- IVHS will be used to regain capacity lost through uneven overflow.
- IVHS projects will not add capacity to the point of attracting new traffic.

KENTUCKY TRANSPORTATION CABINET, **Frankfort, KY 40622 (Don C. Kelly, Secretary of Transportation, dated 3/24/93)**

- Public funds on a project should provide other public agencies with the use of software that has been enhanced with public funds. These agencies should not have to pay for this enhancement the second time.
- Standards, such as the foot pedal arrangement in automobiles, need to be set by the government.
- Most public agencies operate under strict acquisition procedures which have been strengthened over the years. Much more flexibility is needed.
- Privacy will not be an issue if customers perceive IVHS as a benefit.
- The ADVANTAGE I-75 project has clearly shown that government employees have the skills necessary to implement IVHS projects.
- There are so many areas where IVHS technologies will lead to improved air quality.

MARYLAND DEPARTMENT OF TRANSPORTATION, STATE HIGHWAY ADMINISTRATION, **707 North Calvert Street, Baltimore, MD 21203 (Hal Kassoff, Administrator, dated 4/15/93)**

- Standards are developed at a slow rate while technology enhancements are developed and implemented at a fast rate, resulting in decisionmaking dilemmas.
- The acquisitions issue can be expedited by purchasing equipment/software with existing contracts.
- Legal precedents should be explored regarding the public-private partnership and the potential sole-source liability encountered through such an arrangement.
- If a private interest collects traffic information for a public agency under the Freedom of Information Act, that public agency must share this information with anyone. This can discourage a private interest to the point where they do not want to participate.
- The IVHS industry should consider a public education campaign to avoid "customer backlash."
- Academia should assist in educating our future engineers and traffic professionals. This requires not only a diverse technical background in traffic and electronics, but strength in human factors and motorist behavior, and a clear understanding of the institutional hurdles such as funding, legislation, and liability.
- Maryland's regional groups and counties work well with the MDOT and its administrators and sees no need for another layer of coordination.
- IVHS technology can ultimately reduce emissions from vehicles and reduce the amount of fuel used for individual trips.

MONTANA DEPARTMENT OF TRANSPORTATION, 2701 Prospect Avenue, Helena, MT 59620 (Richard A. Howell, Special Projects Planning & Programming, dated 5/4/93)

- Perhaps some mechanism should be developed to compensate private firms for involvement in the government partnership venture. This mechanism may provide the private partner with some form of payments in lieu of patent rights.
- In the early stages of IVHS technology development and implementation, it may be necessary for the Federal Government to provide some form of liability protection to private firms that are involved.
- Perhaps the timing for standards may be more beneficial after a certain amount of experimental time and testing has elapsed.
- Existing governmental acquisition rules definitely have an inhibiting influence on the ability of agencies to work with private sector companies. Greater flexibility is needed.
- The loss of privacy relative to consumer willingness to accept and purchase IVHS products and services may have little or no effect in comparison to the benefits that may be obtained from CVO technologies.
- The Federal Government can soften the training impact through special training programs sponsored by the U. S. DOT and/or special programs arranged through universities.
- The Federal Government might consider establishing a public/private partnership with some transportation improvement districts for the objective of providing a turnkey demonstration project.
- Traffic management technologies can lead to a smoother traffic flow, thereby decreasing much of the air pollution caused by stop-and-go traffic.

STATE OF NEW YORK, DEPARTMENT OF TRANSPORTATION, OFFICE OF TRANSPORTATION POLICY & PUBLIC TRANSPORTATION, Albany, NY 12232 (Henry L. Peyrebrune, Assistant Commissioner, dated 4/14/93)

- Whenever possible, “open” architecture should form the technological framework for IVHS systems. Licensing agreements with patent holders would be acceptable in this regard.
- No indemnification of liability should be provided for private enterprises or public officials in instances of negligence, fraud, or malfeasance.
- The IVHS program should establish standards only after system owners and operators know what kinds of data are wanted from the monitoring systems, what the data transfer communications needs are, and what kind of information is required to be sent to system users. Basic standards should be national in scope.
  The U. S. DOT should cooperate with U.S. Department of Commerce to develop an educational program that would sensitize public and private agencies to the business needs, practices, and expectations of the other.
  Early enactment of uniform privacy regulations and guidelines is important where private enterprises are expected to be participants in IVHS operations.

- The nation's schools and colleges must examine their faculties,-facilities, and curricula to see of they are producing graduates who are adequately trained to meet the challenges of the IVHS program.
- Public/private and interagency coordination should use existing forums (especially the Metropolitan Planning Organizations and Transportation Management Organizations) and current mechanisms whenever possible.
- The Department should examine its own regulations for impediments to public-private partnerships and revenue-producing opportunities.
- The U.S. DOT should initiate research that entails an examination into the potential impacts of IVHS on both the natural environment and human society, including the examination of the potential effects of IVHS on the safety and economics of personal and commercial transportation.
- Proponents of IVHS must build and strengthen their relationships with their constituencies in the executive and legislative branches at all levels of government.
- Market research is needed to better gauge the needs of private motorists and commercial users.

OHIO DEPARTMENT OF PUBLIC SAFETY, 240 Parsons Avenue, Columbus, OH 43266 (Charles D. Shipley, Director, dated 4/15/93)

- Developers of IVHS products should interface with those governmental groups that are involved in highway safety/traffic management planning.
- It is highly likely that motorists will support the development of IVHS if they are correctly informed of its benefits.

OREGON DEPARTMENT OF TRANSPORTATION, 325 13th Street, NE., Salem, OR 97310 (Milan Krukar, Future Technology Research, and Ken Evert, Motor Carrier Services, dated 4/5/93)

- ODOT believes that present antitrust laws should not inhibit the formation of joint ventures.
- Federal and state governments should share in the patents, copyrights, licenses, and intellectual rights they have financed with developers.
- Changes are needed in laws to limit the amount of damages to curb the "deep pockets" concept in product liability suits. The solution will require a variety of approaches.
- There is a need to develop standards as soon as possible, and the U.S. DOT should take a more active role in "pushing" standards.
- Government agencies should be given sufficient flexibility to enter into agreements with private sector companies to develop, test, and adopt various IVHS technologies to meet long-term commitments.
- Privacy is a moot point because vehicle license plates are similar to automatic vehicle identification devices.

- Any training or retraining programs could be handled through special seminars, short courses, and local community colleges. It is not necessary for universities to get involved.
- There definitely is a need for local government coordination to prevent the use of many mixes of incompatible IVHS technology.
- Many trucking firms would like to have the private sector handle IVHS databases due to the privacy issue.
- IVHS technologies will contribute to a positive environmental impact by improved and smoother traffic flows resulting in gas savings and less air emissions.

TEXAS DEPARTMENT OF TRANSPORTATION, Dewitt C. Greer State Highway Building, 125 llth Street, Austin, TX 78701 (Arnold W. Oliver, P.E., Executive Director, dated 4/2/93)

- If government funding is used, no patents should be allowed.
- Current delays may be avoided if a coordinator is appointed to consolidate information and publish standards. The sooner standards are developed, the sooner private companies will be able to participate.
- Educational literature and media exposure will make the public less apprehensive.
- In order to attract and keep competent employees, government salary schedules must be competitive with those in the private sector.
- It would be in the best interests for everyone, for the public sector to operate IVHS. Private companies could support research, development, construction, installation, maintenance, and improvements.

UTAH DEPARTMENT OF TRANSPORTATION, 4501 South 2700 West, Salt Lake City, UT 84119 (Norman H. Lindgren, Director, Office of Motor Carrier Safety, dated 4/14/93)

- The standards setting organizations should involve private industry because of the large investment that will be required of private industry.
- Utah is experiencing controversy on the use of the "photocop" in West Valley City. There have been attempts to legislate against it because of the privacy issue.
- Emphasis needs to be put on additional resources required such as incident management, control centers, HOV lanes, ramp metering and AVIS systems.
- Local government coordination can be accomplished through the existing metropolitan organization committees and council of governments.

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION, Transportation Building, Box 47300, Olympia, WA 98504 (Duane Berentson, Secretary of Transportation, dated 4/12/93)

- Acquisition problems encountered at the Washington State DOT (WDOT) are:

- WDOT worked with a company to prepare a proposal for operational test funding. It is now faced with having to justify the sole-source purchase of the system from the private partner who participated in the development of the proposal.
- When a Federal audit agency was asked to review the financial information of a major defense contractor, a response was not forthcoming until four months later. Then the actual audit took less than one working day.

Funds for operational tests were awarded to a local transit agency, and the process resulted in additional paperwork, costs, and delays. This was due to the necessity of routing funds via two Federal agencies and the state DOT.

- Specialized traffic engineering training for electrical engineers is suggested.

PRIVATE SECTOR

FORD MOTOR COMPANY, The American Road, Dearborn, MI 48121 (M. D. Thomas, Manager, Product Strategy & Planning, dated 4/22/93)

- Given the current legal environment and the Administration's support for IVHS, it does not appear that there are significant antitrust impediments that will inhibit cooperative development of IVHS products or services.
  While IVHS standards adopted for general use should be available on a royalty-free basis, participants should be free to protect their own implementations of open systems through their own patents.
- An IVHS technology that reflects careful, prudent, and sound engineering, indexed to a clear and reasonable benefit, will enhance any manufacturer's ability to defend its products.
- There is concern about pressures for early standards. It is important to strike a balance between meeting the needs for product compatibility and insuring freedom of product design and development.
- Given the fact that drivers are licensed and vehicles are registered, it is unlikely that IVHS will erode privacy.
- Some of the goals of IVHS are to improve mobility, safety, energy efficiency, and air quality. This could be obtained because IVHS technology will minimize accidents due to driver carelessness. This technology will also reduce wasteful fuel burning due to traffic jams, congestion, rapid or frequent acceleration/deceleration, or aimless driving.

SAMARITANIA, INC., 12-d John Road, Sutton, MA 01590 (Rick Morgan-O'Connor, President, dated 4/23/93)

- For the past 15 years, Samaritania, Inc. has been providing high-level, patrol-oriented incident management services to urban highways.
- After reading ISTEA, they expected that cooperative private/public sector programs would be customary and that urban congestion would be effectively dealt with. This has not happened.
- Unless the barriers to legitimate efforts on the part of the private sector to contribute to the solutions are reduced and the resources that are being put into such programs are leveraged to their maximum, this country will continue to suffer "gridlock" with all its ramifications for reduced productivity, poor air quality, wasted fuel, higher levels of property damage, and personal injury.

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APPENDIX C

UNIVERSITIES & RESEARCH INSTITUTES

GEORGE MASON UNIVERSITY, 4400 University Drive, Fairfax, VA 22030, (Roger R. Stough, Northern Virginia Endowed Chair in Local Government. dated 6/3/93)

- The Federal Government may be in a poor position to assess what standards will ultimately maximize social welfare because it cannot predict exactly which IVHS products and services will meet the tests of consumers willing to pay for privately funded services.
- Although privacy is a confusing and complicated value, it is one for which public opinion surveys indicate increasing concern.
- DOT should emphasize an interdisciplinary approach to the study of nontechnical issues, such as legal analysis, some public administration concepts, and some survey research methods.
- Some of the most impressive potential benefits of IVHS technology lie in the ability of emerging information technologies to build traffic information and control networks spanning an entire metropolitan area.
- IVHS needs to recognize the new context created by the Clean Air Act Amendments of 1990.
- The IVHS community has paid inadequate attention to the demand factors that will affect deployment of ATIS.
- It would be extremely useful to conduct comparative analyses of institutional issues facing IVHS in the other industrially developed parts of the world.

UNIVERSITY OF KENTUCKY, KENTUCKY TRANSPORTATION CENTER, 108 Transportation Research Building, Lexington, KY 40506 (Calvin G. Grayson, Director, 3/18/93)

The current list does not identify the special problems involved in multistate IVHS systems and projects. Of particular concern is whether multistate actions imply the assumption of interstate regulations and legal authority. Multistate projects and IVHS systems will involve the development of new compacts and consortiums. Issues regarding interstate commerce emerge as consortiums impose reporting and information transmission requirements to third-party contractors. These issues may pose constraints when several states are involved in specific projects.

- Attention has been focused on the privatization of IVHS services for I-75. The multistate coordination problem again emerges. Without a clear understanding of the legal authority of several states to engage in "consortium like" IVHS systems, states will have difficulty contracting with third parties to carry out and coordinate information gathering and regulatory processes.

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PRIVATE INDIVIDUALS

SIGMUND SILBER, 143 Hoyt Street, Stamford, CT 06905 (dated 3/26/93)

- The biggest barrier to the adoption of IVHS would be the limited participation of the private sector. Private sector participation would have the benefit of providing capital, providing a focal point for the coordination of many distinct political jurisdictions, and making the effort to market IVHS.
- IVHS technology has the potential to improve public safety. It can monitor every vehicle at every point in time, thus creating the ability to prevent crime and trace it after the fact. In Japan, where IVHS is progressing rapidly, the police and the transportation authorities are in the same organization.
- Due to the concern about privacy, there are measures forthcoming to prevent IVHS from making this potential contribution to improved public safety.
- It makes no sense for private enterprise to offer free services. It is only by putting a price on a service that it is possible to determine if the willingness to pay by the purchaser is sufficient to cover the cost plus profit required for a private enterprise to offer this service.

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IVHS AMERICA

IVHS AMERICA, 1776 Massachusetts Ave., NW, Washington, DC 20036
(D. Craig Roberts, Director, Institutional and Legal Issues)

- DOT is encouraged to view the legal constraints associated with the development and deployment of IVHS technologies as an unfolding set of issues that will require continuingattention by Federal and state regulators and the IVHS community.
- IVHS policymaking should focus on the adoption of open architectures to encourage competition.
- DOT should view intellectual property rights generated from joint public/private development as a contractual matter to be negotiated between the parties to the development. Several commentators have expressed uncertainty over the scope of Federal intellectual property rights arising out of Federal participation in IVHS projects.
- As a short-term course of action, the IVHS community should be informed of educational efforts concerning product liability issues. As a long-term course of action, full studies must delve into alternative approaches to product liability, particularly in the context of AVCS.
- The IVHS industry should take the lead in the privacy area by developing voluntary guidelines regarding the issue of information obtained through IVHS technology.
- To the extent that economies of scale in an IVHS system architecture would permit only a closed set of facilities-based service providers, the committee encourages the adoption of policies that would provide competition through the establishment of resale and aggregator markets.
- There is a need for cooperation between public and private sector IVHS interests to ensure the timely deployment of IVHS services.
- IVHS can provide the means for policy makers to limit or redirect travelers' demands to serve environmental ends.

IVHS AMERICA, 1776 Massachusetts Ave., NW, Washington, DC 20036 (Sadler Bridges, Chair, Institutional Issues Committee, and Cynthia Moreland, Chair, Legal Issues Committee, dated 4/23/93)

- Products sold directly to consumers that require little or no involvement by governmental entities will not require significant public/private cooperation.
- The private sector will have to perform extensive market research to determine whether or not IVHS is a viable market.
- Because IVHS will be deployed at the state and local levels, extensive intergovernmental cooperation and coordination will be required.

- Many customers perceive IVHS technology as a "Big Brother" type of intrusion. If IVHS is an option rather than a requirement, consumers will be able to weigh the pros and cons.
- While the absence of standards may inhibit mass deployment of IVHS, their promulgation may preclude the use of new and better technologies. This must be carefully balanced.
- DOT should use IVHS operational tests and demonstration products to study the effects of IVHS on air quality.
- On the issue of education, it may be helpful to retrain workers from the defense industry, to retrain additional traffic employees, and to encourage universities to initiate specialized, multidisciplinary programs.
- DOT should use IVHS operational tests and demonstration projects as models for the study of the effects of IVHS on air quality.

IVHS AMERICA, LEGAL ISSUES COMMITTEE PROCUREMENT TASK FORCE, 1776 Massachusetts Ave., NW, Washington, DC 20036 (Gena Cadieux, Chair, dated 4/23/93)

- Intellectual Property Rights
  - Governments should seek only those intellectual property rights that are necessary for their own portion of an IVHS system.
  - Governments should create a uniform-specific policy about what property rights will be sought. They should develop specific,, publicized methods for seeking waivers of the usual public-private allocation and be willing to negotiate these issues before a contract is awarded.
  - Governments should utilize the experiences of other IVHS procurements and other Federal agencies to address this issue.

- MultiJurisdictional Issues
  - The Federal Government should spearhead efforts to coordinate requirements to allow interstate compacts so that regional requirements can conform. This can be accomplished by seeking revisions to ISTEA authority.

- Inexperience With High Technology Procurements
  - Training sessions should be expanded on high technology procurement issues for state and local procurement personnel and for businesses.

- Cost Accounting, Cost Certification, and Auditing Requirements
  - The procurements in which these requirements are applied should be minimized.
  - Training sessions on government requirements to potential IVHS vendors should be sponsored and subsidized.
  - The decision making in the Federal Government about whether cost and pricing information is required in order to obtain certainty and consistency should be centralized.

- Uniformity of cost accounting rules applicable to procurements to reduce administrative expense should be increased.

- Liability Between the Government and the Private Vendors
  - The government can seek statutory authority to indemnify contractors. It can take actions necessary to enable contractors to invoke the government contractor immunity doctrine. It can also assist in ensuring that reasonably priced insurance is available to reduce the uncertainties of potential product liability exposure.

- Procurement Compliance Cost
  - Every administrative requirement that differs from traditional commercial practices should be evaluated to determine whether it is worth the added cost.

- Organizational Conflict of Interest Limitations
  - The applicability of OCI rules and preempt application of unreasonable OCI rules by state and local governments should be clarified.

- Project Uncertainties Due to the Procurement Process
  - Aggressive information exchanges should be entertained in order to reduce delays caused by unrealistic scheduling and lack of planning.

- Fair and Reasonable Public-Private Partnership Implementation
  - DOT should consult with the IVHS community and promulgate specific regulations addressing the use of public-private partnerships in IVHS development and deployment.

VIRGINIA DEPARTMENT OF TRANSPORTATION - no address listed (Brian L. Smith, dated 3/11/93)

- IVHS development that is funded by the public sector should remain in the public domain.
- The IVHS community, through IVHS America, should play an active role in the standards setting process.
- Privacy is not an issue. Consumers have demonstrated in other industries that they are willing to give up some level of privacy for gains in efficiency.
- Transportation professionals do have the fundamental skills necessary to meet the demands of IVHS.
- Reasonable agreements should be reached between the public and private sectors.
- The public sector should be cautious in granting “exclusive” rights to one private company.

APPENDIX C

CITY OF COLUMBUS, OHIO, PUBLIC SERVICES DEPARTMENT, 90 W. Broad Street, Columbus, OH 433215 (Richard McGuinness, Freeway Engineer, not dated)

- Any governmental agency that has paid for the development of intellectual property has the right to that property.
- It is the responsibility of the designer, manufacturer, installer, and operator of the technology to see that it functions as intended. The present tort system guarantees that this will continue to be the case. However, awards going for far more than actual damages put a damper on new developments, developments that will be necessary for the continuation of our standard of living in the future. Perhaps the fairest solution would be to limit awards to actual damages.
- Standards are absolutely necessary. Any in-vehicle communications must be able to communicate with the local data source no matter where it is or what type of equipment it is using.
- In the Freeway Management System, we often hear about the "Big Brother" factor. Privacy is an issue that concerns most people.
- The required skills will have to come from the engineering and business schools and from the product developers and their respective trade associations.
- Regarding local government coordination, cooperation cannot be dictated. It must be developed through working relationships and proper performance by all agencies.
- The City currently allows radio traffic reporters to operate out of the Traffic Management Center. For wide-area information, the agency collecting it should also be responsible for it to the point of distribution.

MOTOROLA - no address listed (Randy Doi, dated 3/16/93)

- The issue of liability might be helped through liability caps in AVCS. From an ATMS/ATIS perspective, careful evaluation and testing must be done to insure driver's capability to use the information provided in a safe manner.
- Acquisition will most likely require legislation to streamline the process.
- Regarding education and staffing, the focus should be on the level of privatization.
- Local governments and public safety organizations need to coordinate their efforts.

COMMONWEALTH OF KENTUCKY, TRANSPORTATION CABINET, Frankfort, KY 40622 (Don C. Kelly, P.E., Secretary of Transportation)

- Some type of standards and/or modifications to patent laws should be developed whereby both the patent holder and the public agencies are protected.
- Certain standards, such as foot pedal arrangements, need to be set by the government.

- Most public agencies operate under strict acquisition procedures, This is an area where much flexibility is needed.
- Privacy will not be an issue if customers perceive IVHS as a benefit or economic advantage.
- The ADVANTAGE I-75 project has clearly shown that government employees have the skills necessary to implement IVHS projects. The main constraints are management's attitude toward change, lack of personnel to take up the slack left by those switching to IVHS activities, etc.
- It is difficult to perceive a situation in which IVHS technologies would have a negative effect on the environment.

UNIVERSITY OF KENTUCKY, KENTUCKY TRANSPORTATION CENTER, 108 Transportation Research Building, Lexington, KY 40506 (Calvin Grayson, dated 3/17/93)

- State governments, as sovereigns, conduct and carry out regulatory functions which are state specific and need to be held within a state's jurisdiction. Therefore, the multistate projects may impose constraints to the implementation of IVHS systems.
- Without a clear understanding of the legal authority of several states to engage in "consortium like" IVHS systems, states will have a difficult time contracting with third parties to carry out and coordinate information gathering and regulatory processes.

IVHS AMERICA LEGAL ISSUES COMMITTEE, SUBCOMMITTEE ON STATUTORY AND REGULATORY BARRIERS AND OPPORTUNITIES
(dated 3/17/93)

- The development and implementation of IVHS technologies require partnerships between the private and public sectors. An analysis should be conducted to determine whether current laws create an inappropriate barrier to IVHS and/or place the U.S. at a competitive disadvantage to its foreign competitors.
- The issue of intellectual property could significantly affect overall IVHS development and implementation, since it affects the incentives for private sector parties to participate in IVHS projects.
- The privacy issue with respect to IVHS is no different from privacy with respect to other issues.

  IVHS policy should be set to encourage the adoption of non-proprietary system architects with open interfaces to permit and encourage competition in the provision of IVHS commercial services.

  The committee suggests that trial IVHS projects allow the private sector to participate in public-sector decisionmaking processes.

  One of the paramount institutional obstacles to the timely deployment of a nationwide compatible IVHS infrastructure may be the multiplicity of state and local government authorities with jurisdiction over elements of that infrastructure.

To this end, the committee believes that the deployment of an IVHS infrastructure must be coordinated with thousands of state and local governmental agencies.

- The immediate impact of IVHS technologies will have a positive effect on the environment. The long-term impact, however, will remain unclear until more research and tests can be completed.

CALIFORNIA PATH, 1301 S. 46th Street, Richmond, CA 84804 (Donald E. Orne, PATH Director, dated- 3/15/93)

- AVI technologies should be implemented to protect individual privacy. Data on travel patterns of individuals should be protected by the recording agency and used only for billing purposes.
- There is a considerable opportunity to improve traffic operations through enhanced local government coordination, much of which is not specific to IVHS. For example, it is important to develop ways to coordinate traffic systems in real time.
- Institutional arrangements should be developed which will enable the private sector to develop new products to meet the needs of the public.
- Automated toll collection is perhaps the one technology that can reduce congestion and pollution.

ILLINOIS DEPARTMENT OF TRANSPORTATION, OFFICE OF PLANNING AND PROGRAMMING, 120 Center Court, Schaumburg, IL 60195 (Joe Ligas, dated 3/19/93)

- It is extremely important to work towards the development of national and international standards.
- It is important to continue with operational tests using a variety of products and concepts with open architecture and protocols whenever possible.
- The early initiatives in the area of acquisitions should concentrate on interpretation rather than changes in practice.
- Procedures ensuring privacy must be developed.
- Most state and local government employees are not trained sufficiently in high tech areas. It is important that a long-range university component be established.
- In Illinois, there are many areas in which the private sector has led in the development of travel information and traffic services. However, that does not mean that a carte blanche approach should be supported.
- IVHS will do little to improve or denigrate air quality.

JET PROPULSION LABORATORY, 4800 Oak Grove Drive, Pasadena, CA 91109 (Robert W. Easter, dated 3/23/93)

- The views of IVHS America's Institutional Issues Committee regarding patents and liability should be consistent with those offered in the area of intellectual

property rights protection in the Procurement Issues White Paper-being developed by the Legal Issues Committee.

- The arguments for standards are "unimpeachable." However, haste can lead to uncoordinated and/or competing standards.
- Correctly done government purchases can be a useful stimulus.
- Education and staffing challenges rest with academia, the government, and industry.
- The impact on the environment is one of the most fundamental issues facing IVHS. Care must be taken that responsible advocates not "sign up" the rosiest estimates too quickly.

FORD MOTOR COMPANY, The American Road, Dearborn, MI 48121 (G. D. Conover, Manager, IVHS Strategy and Planning, dated 3/25/93)

- Given the current legal environment and the Administration's support for IVHS, it does not appear as if there are any significant antitrust impediments.
- Any IVHS standards developed and adopted for general use should be made available to manufacturers and users on a royalty-free basis.
- Although it is expected that IVHS will be deployed in a disciplined manner, sound engineering and operational testing can minimize product liability lawsuits involving IVHS.
- There is a concern about the pressure for early standards. It is premature to press for vehicle IVHS product standards.
- Because operating a motor vehicle is a public event, it is difficult to believe that motorists reasonably expect privacy in driving.
- There is a clear need to have government support for IVHS to maximize utilization and minimize confusion.
- There are concerns that the success of IVHS will lead to an increase in highway demand, with a net growth in pollution and energy consumption. These concerns should be addressed in other ways.

STATE OF NEW JERSEY, DEPARTMENT OF TRANSPORTATION, 1035 Parkway Avenue, Trenton, NJ 08625 (Christine M. Johnson, Assistant Commissioner, Policy and Planning, dated 3/25/93)

- The procurement process makes it difficult to work with the industry or to develop a long-term partnership for both product development and long-term implementation and operation.
- Procurement rules impede wise decisionmaking.
- The experience of New Jersey is that privacy is an important issue.
- Trained personnel and training facilities are currently lacking.

SIGMUND SILBER, 143 Hoyt Street, Stamford, CT 06905 (dated 3/26/93)

(Refer to the summary under the section entitled "Private Individuals.")

APPENDIX C

FLORIDA DEPARTMENT OF TRANSPORTATION, 605 Suwannee, Street, Tallahassee, FL 32399 (K. N. Morefield, P.E., State Highway Engineer,, dated 3/22/93)

- The U.S. and foreign patent laws and multinational agreements on patents need to be examined closely to identify and develop strategies to deal with provisions that would adversely impact the development and use of IVHS technologies.
- Congress should adopt an umbrella liability limiting laws covering the utilization of IVHS technology.
- It is necessary to have early adoption of a number of simplified, nationwide standards.
- Federal and state procurement laws and rules need to be amended to recognize the unique benefits that can result from joint public/private utilization of IVHS technology.
- Substantial efforts are needed to educate the public that any loss in privacy 'represents the small price that must be paid to enjoy the new benefits IVHS will afford.
- Management-level courses could provide a positive exposure to executives on a quick-study basis.
- Special efforts are needed to assure that local governments are provided with educational materials.
- Long- and short-term studies are needed to show the potential impact of IVHS on the environment.
- Restrictions on private-sector access must have a basis of need, not just "turf' protection.

IVHS FUNCTIONALITY FOR SUTTER BAY: AN ENVIRONMENTAL POSITIVE - no address listed (Robert D. Ervin, University of Michigan, no date)

- The IVHS installation at Sutter Bay requires simultaneous deployment of a broad set of items with four subsystems. These subsystems will be installed within the street network, on-board transit vehicles, at the TOC, and at all points of access to the Transit-Friend. The elements of this system will grow in their physical extent as the community is developed. Because the community will be all new, installation costs will be much lower than retrofit systems, and the baseline for surface transportation data will be remarkably clean. Moreover, this system concept should present a unique opportunity for developing and evaluating interactive technology when specifically applied as a transportation advisor.

Office of the Secretary