IVHS AND THE ENVIRONMENT

New Models for Federal, State and Local Cooperation in the Application of Advanced Transportation Systems for Environmental Improvements in Urban Areas

Executive Summary

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Lee W. Munnich, Jr, Senior Fellow
Candace Campbell, Fellow
Gary DeCramer, Fellow
Barbara Rohde, Research Fellow
Frank Douma, Research Assistant
David Van Hattum, Research Assistant

State and Local Policy Program
Hubert H. Humphrey Institute of Public Affairs

UNIVERSITY OF MINNESOTA

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EXECUTIVE SUMMARY

Intelligent Vehicle Highway Systems (IVHS) have the potential to substantially change transportation's impact on urban air quality and other environmental aspects. Whether this impact is positive depends on how these technologies are deployed. This study by the State and Local Policy Program of the University of Minnesota's Hubert H. Humphrey Institute has been funded through a cooperative agreement with the Federal Highway Administration (FHWA). The study focuses on finding new models for cooperation among federal, state, and local institutions that would ensure deployment of lVHS technologies in a manner that minimizes the negative impacts and maximizes the positive impacts on urban air quality and the broader environment.

Case Studies

The State and Local Policy Program used case studies to identify these new models of cooperation. Five criteria were adopted to select three case study areas.

Case Study Selection Criteria
1) A current operational test or early deployment study and various levels of maturity for IVHS technologies.
2) Significant air quality and environmental problems to be addressed by advanced transportation technology.
3) Willingness to participate by transportation policy makers and environmental leaders.
4) Technical and data support by transportation and environmental agencies.
5) Geographic and population diversity for selected cities.

The cities of Houston, Texas, Minneapolis-St. Paul, Minnesota and Portland, Oregon were selected. These cities vary in size, use of IVHS technologies, air quality problems and institutional and political approaches to addressing transportation and environmental issues. (see table 1 on the following page)

The research strategy consisted of site visits and interviews with transportation and environmental leaders, a local steering committee for each city, a day-long consultation in each city to identify key concerns, a conference in December 1993 to discuss the three case studies and cross-cutting issues, and follow-up interviews to clarify key issues and facts.

A broad definition of IVHS guided the research. First generation lVHS (e.g. ramp metering, signal timing, etc), the twenty-eight FHWA defined IVHS user services, and expanding notions of lVHS relating to the information highway, bicycling, and parking were all included.

IVHS. Each of the three case study cities approached IVHS differently. Minnesota has a well-developed IVHS program, Minnesota Guidestar, with several operational tests underway. In fact, Minnesota Guidestar indicates it is participating in 25 percent of the total number of national operational tests awarded by the U.S. Department of Transportation since 1992.

Table 1.
Comparisons of the Three Urban Areas

City	Houston, TX	Minneapolis-St. Paul, MN	Portland, OR
Population of Metropolitan Statistical Area (1990)	3,711,043	2,464,124	1,477,895
Percent Growth in Population 1980-1990	19.7%	15.3%	13.9%
Total Highway Miles	17,001	8,951	4,514
Congestion Ranking (Shrank et al, 1993)	10	33	15
Persons per Square Mile	1,806	2,063	2,875
Daily Vehicle Miles per Person	25.5	21.0	18.7
IVHS Activity	8 major projects	Over 20 projects.	Early deployment grant.
Air Quality	Severe Non-attainment (Ozone)	Moderate Non-attainment (CO)	Marginal Non-attainment (Ozone) Moderate Non-Attainment (CO)
State Environmental Laws	Texas Clean Air Act	Minnesota Environmental Policy Act	Oregon Clean Air Act, VMT Mandates
Land Use Controls	no local zoning laws	Metropolitan Urban Service Area	Urban Growth Boundary

Sources: U.S. Census; Federal Highway Administration (Federal-Aid Urbanized Area Estimated); U.S. Environmental Protection Agency

Houston is making extensive investments in transportation technology through the development of a major multi-jurisdictional traffic management center and the largest network of barrier-separated high occupancy vehicle (HOV) **lanes** in the nation. To support these projects, Houston draws from the full-range of federal funding sources. Portland does not have a formal IVHS program but has been on the cutting edge of transportation policy innovations, particularly demand management, land use and transit enhancement strategies. Accordingly, IVHS technologies in use or being planned in Portland are oriented to improved transit, congestion pricing and more efficient commercial vehicle operations.

Air Quality. The type and magnitude of air quality problems facing the three cities vary extensively. Houston is classified as in severe non-attainment **for ozone (0,).** Most of the ozone pollution in Houston is caused by stationary sources, particularly the petroleum industry. Consequently, Houston's achievement of Clean Air Act (CAA) mandates will require strategies that go beyond reducing transportation emissions. Portland's air quality has improved significantly during the past decade, although the city is in marginal non-attainment for ozone and in moderate non-attainment for carbon monoxide (CO). The Minneapolis-St. Paul metropolitan area has the least severe air quality problems of the three cities. This area is in moderate non-attainment for carbon monoxide (CO).

Air quality regulation varies in the three cities as well Of the three states, only Minnesota has a State Environmental Policy Act (SEPA), which extends environmental review requirements to actions not covered by the National Environmental Policy Act (NEPA).' However, Minnesota is also the only **one** of these three states without a Clean Air Act? Each state has auto emissions testing laws, but the Oregon Department of Environmental Quality dedicates the most resources and full-time equivalent employees to mobile source regulation? Sirnilarly, while growth of Vehicle Miles Traveled (VMT) is a concern in all three areas, Portland is the only urban area under a state-issued directive **to** reduce per capita VMT.

The case studies culminated in several key findings, plus local examples of interagency cooperation, which may be applied to other urban areas.

Case Study Findings
1) Constructive collaboration between transportation planners and environmental organizations is possible.
2) IVHS varies in its role in improving the environment.
3) Data collection and modeling techniques are inadequate for multi-modal planning.
4) Market-based strategies, including congestion pricing, are gaining support among transportation professionals and environmental advocates.
5) Public participation and **social** equity issues will become increasingly important to IVHS and the broader reformulation of transportation policy inspired by the Intermodal Surface Transportation Efficiency Act (ISTEA).

New Models for Cooperation:

Focusing on IVHS and the environment offers a unique opportunity for environmental and transportation interests to discuss a broad range of transportation and environmental policy issues.

Examples of new models for cooperation include:

Local Models for Cooperation		
Houston	**Minneapolis-St. Paul**	**Portland**
Houston's Bicycle Alliance, a grass roots organization which promotes bicycling as **a** travel option and led **to** the creation of Houston's mayoral task force **on** Bicycle Safety and Mobility.	**Minnesota Guidestar's Transit Innovations Committee which** has identified new IVHS projects that serve the needs of bicyclists, pedestrians, and transit users.	**Land Use, Transportation and Air Quality (LUTRAQ), which** represents an evolving partnership between transportation planners, environmental regulators, environmental interest groups, and land-use planners.
The Greater Houston Transportation and Emergency Management Center resulted from a formal agreement between METRO, Harris County, TxDOT, **and the City of** Houston.	**Downtown Minneapolis Transportation Management Organization** is a public-private partnership designed to manage travel demand to insure environmentally sound growth and prosperity in downtown Minneapolis.	**Governor's Task Force on Motor Vehicle Emissions,** made up of representatives from public, private and non-profit organizations, developed many effective measures to reduce mobile emissions.
Houston is developing the largest network of barrier-separated **HOV** lanes in the nation.	**Joint Air Quality Guidance Committee** includes staff from the Minnesota Pollution Control Agency, the MPO and MnDOT.	**Region 2040 Plan will guide** Portland's transportation and land use over the next 50 years.
The Metropolitan Transit Authority of Harris County (METRO) was created from fourteen agencies, and **is** responsible for transit, police, and street repair.	**Team Transit is** a region-wide interagency partnership making transit more attractive **and** easier to use.	**Transit Oriented Developments and MAX Light Rail continue** to receive support from Portland residents despite increasing anti-tax sentiment and state budgetary constraints.

POLICY RECOMMENDATIONS

I) BROADEN THE PARTNERSHIP

Change the Name. Although the name "Intelligent Vehicle Highway Systems" is perfectly good for many purposes, it immediately sends up red flags to environmental interests that IVHS is only about cars and roads. In fact, IVHS has already incorporated transit as a major component and has broadened its scope to include energy and environmental concerns. There is considerable momentum for a name change to "Intelligent Transportation Systems."+ This change should occur as soon as possible.

Build Coalitions of Key Stakeholders. One of the great successes of IVHS has been forging of new partnerships between the public and private sectors. Through FHWA's operational tests, state departments of transportation (DOTs) have been very creative in forming new partnerships with businesses for the development and deployment of new transportation technologies. Through these partnerships, public employees and business people are breaking down traditional barriers between the sectors, learning new skills in managing partnerships and forging long-term, realistic strategies for investment. For example, through the Minnesota Guidestar program, the Minnesota Department of Transportation and their business partners are learning how to identify and address legal, **institutional, cultural** and other barriers.

Key participants suggested that there are "insiders" (highway engineers, transportation professionals and transportation interest groups) and "outsiders" (environmental advocates, planners, bicycle riders) who have played an historic role in either building or challenging the current transportation system. The debate over new technologies-which to use, how much and where to invest, and when to use them-has helped to focus the concerns of these two groups. This insider/outsider tension has given way to identification of common ground and a broader policy dialogue at the national level.

To be successful, transportation policy coalitions must include three types of stakeholders, whose interests and perspectives have frequently led to conflicts in the past: 1) *Transportation policy* makers and planners, who are responsible for setting and implementing federal, state and local transportation policies; 2) Businesses, whose productivity and ability to create and sustain jobs depend on an efficient transportation system; and 3) ***Environmental and community interest*** groups, who represent societal and citizen concerns about the potential adverse effects of transportation policies on the environment and communities and about social equity and accessibility.

Such a broad-based coalition emerged in the San Francisco area to advocate congestion pricing, among other transportation policy improvements? The seeds for such broad-based coalitions exist in the three case study cities. In Houston, the business community is very involved in framing transportation policy and the role of IVHS, however, environmental and citizen interest groups are just beginning to play a significant role in transportation planning. In Minneapolis-St.Paul, there is a strong IVHS partnership between the Minnesota Department of Transportation (MnDOT), businesses, and the University of Minnesota's Center

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+Minnesota Guidestar now refers to ITS rather than IVHS.

for Transportation Studies; however, environmental interests have not been represented in this partnership until recently. On the other hand, Portland's environmental community has influenced the city's transportation priorities, but IVHS development is still at an early stage.

At the local level, there remains a need to educate and engage urban planners, community leaders, environmental organizations, and transportation professionals not directly involved with IVHS. The case studies revealed that key decision-makers need to learn about IVHS technologies and their environmental impacts. This study's policy consultations established a neutral turf for discussion of the issues related to IVHS and the environment. Participants found the dialogue to be an important educational and consensus-building activity. Such regionally based discussions should be encouraged.

The policy consultations as well as the national policy conference on Intelligent Transportation Systems and the Environment in June, 1994;5 demonstrate the willingness of environmental interests to enter into a constructive dialogue. However, there is a need to actively recruit these groups as evidenced by their lack of participation in FHWA's IVHS regional forums and Minnesota Guidestar's strategic planning process.

A key to involving these organizations and other key stakeholders is how the issue is framed. IVHS can be perceived as an abstract group of technologies, or as practical applications aimed directly at environmental organizations concerns about single occupancy vehicle (SOV) use, alternative fuels, land use, energy consumption etc. According to Lamont Hempel, a member of the study's steering committee, "The IVHS community simply cannot afford the present ignorance of environmental interest groups regarding these technologies." Broad agency announcements, to facilitate greater involvement of the environmental community in evaluating IVHS applications, is essential to the long term effective use of advanced transportation technologies.

Fund Public Education. The informational nature of IVHS technologies demands that users' needs and preferences be carefully addressed to maximize effectiveness. Thus, it is imperative that the public gain a greater understanding of the likely costs and benefits of such technologies, and help to shape their deployment.

Most of the public is unfamiliar with the term IVHS. Marketing alone will not provide for the "informed public comment" required under ISTEA. A public education campaign could also serve the need for greater public understanding of air quality issues.6 A good model for IVHS is the Los Angeles Metropolitan Planning Organization (MPO) which recently established public involvement guidelines requiring ten percent of the total planning budget to go toward public outreach programs.'

Involve Citizens in the Dialogue. While transportation agencies have traditionally responded to the demands and expectations of their primary customers-road users-they have not been as successful in involving citizens in the broader issues and implications of transportation policy. This is due to the complexity of transportation issues and the linkage with so many other public policy concerns, such as environmental policy, economic development, housing, land use, and social equity. This is particularly true with advanced technology applications.

State and local transportation agencies should be encouraged and supplied with proper

guidance and resources to increase the involvement of citizens in the development of transportation policy and the application of new technologies. Local and state based processes for educating stakeholders and moving toward consensus on appropriate projects are needed? Possible models include: 1) the policy consultations employed in this study; 2) the joint planning and sponsorship of the Transportation Planning for Livable Communities regional conferences on ISTEA, co-sponsored by the FHWA, the Surface Transportation Policy Projects (STPP) and five other organizations; 3) citizen juries? and 4) the "informed consent" process currently being used by the Minnesota Department of Transportation **to** seek public involvement and consent before moving forward on potentially controversial projects.

Integrate IVHS Operational Tests With On-going Environmentally Oriented Initiatives. The breadth of IVHS technologies allows them to play an important role in many areas of transportation. Targeting funds to innovative programs that directly link transportation with environmental and community goals would strengthen the credibility of IVHS's mission among skeptical parties.

Linkages with initiatives such as state or local growth management plans, alternative fuels development, inter-modal planning, the Federal Transit Administration's Livable Communities Initiative (transit services and community development), and bicycle infrastructure planning and other environmentally sustainable technology packages should be pursued. This approach insures broad stakeholder involvement, maximizes resources, and should have synergistic effects. An excellent example of this is the Portland Metro (MPO) 2040 program. Metro is developing a 50-year strategic plan. The first objective will be setting a land use policy. Everything else, including IVHS, will be planned to fit the land-use policy. IVHS was discussed as part of the annual growth management conference held in Portland in the spring of 1993.

Recommended Federal Action:

1) *Require that all publicly-funded IVHS projects be explicitly considered as part of the MPO project ranking and public participation process.*

2) *Expand funding and other incentives for MPO's to include public participation in early stages of IVHS planning.*

3) *Explore innovative models of cooperation for engaging various environmental, academic and local agencies in the development of environmentally sustainable technology pack-ages.*

II) ENHANCE MPO CAPACITY TO ADDRESS ENVIRONMENTAL AND PUBLIC PARTICIPATION ISSUES RELATED TO NEW TRANSPORTATION TECHNOLOGIES

ISTEA expanded the role of metropolitan planning organizations (MPO's) in setting transportation priorities in urban areas. The 1991 law set the stage for a regional, intermodal approach to transportation decision-making, offering the opportunity to link transportation more closely with long-term comprehensive development plans. Projects by the MPO's in Portland and Minneapolis-St. Paul provide good models for how transportation planning

may be integrated into a broader regional policy. In Portland, Metro's 50-year regional land use plan will provide the basis for choosing transportation priorities. The Twin **Cities'** Metropolitan Council and MNDOT are currently conducting a joint study of the potential for road pricing; the Metropolitan Council and other key regional policy makers are included in Minnesota Guidestar committees.

Nonetheless, the capacity of MPOs to conduct multi-modal planning as mandated by ISTEA is uncertain and is exasperated by the introduction of new transportation systems. For example, there has been very little analysis of the impact of ramp metering-a first generation IVHS application which has been in place in many cities for years." Also, "few MPOs have any measure of how congestion has changed over time throughout their regions,"11 a critical base-line variable.

For MPOs to expand public understanding and dialogue they must improve their analytical capabilities and better communicate findings to the general public. Whenever possible IVHS projects should be mainstreamed into the traditional MPO process for planning and evaluation of transportation investments. Presently, the MPO is not the lead agency for planning and evaluating lVHS projects in any of the three case study cities. Given limited resources, there is a need to enhance federal guidance on environmental evaluation of multi-modal alternatives and to strategically link investments in IVHS to expanded data collection made possible by collection of real time traffic information.

Recommended Federal Action:

1) *IVHS projects that promote mode shift and market-based strategies should receive priority for Congestion Mitigation and Air Quality (CMAQ) funding.*

2) *Encourage the transportation voting body of the MPO in communities above 200,000 to include a minimum of one state air quality representative for the region or a representativefrom an environmental organization.*

3) *Increase funding for development of* MPO *capacity to analyze environmental impacts.*

III) DEFINE A PROTOTYPE IVHS BUNDLE FOR NON-ATTAINMENT AREAS

During the course of the study, the Federal Highway Administration shifted its approach to classifying and explaining IVHS technologies from six technology bundles, organized by major systems, to 28 user services, based on specific applications for various users. FHWA has grouped these user services into six new bundles based upon the services or benefits that a user would receive." The shift to a user services approach should help to make the discussion of transportation technologies more understandable to a wider audience and to examine how specific services might affect the environment. We recommend that FHWA take the next step by defining a **bundle** of these user services appropriate to non-attainment areas.

Develop Environmental Guidelines. Environmental benefits are often cited as a likely outcome of investments in IVHS. However, many environmental interest groups have pointed out that IVHS can cause adverse impacts on air quality, increase energy consumption, and negatively affect the general quality of life in our communities.

Any IVHS deployment must follow the investment guidance and planning factors described by the statewide and metropolitan planning rules (Sections 134,135) of ISTEA. As an articulation of this guidance, we present a set of environmental guidelines to inform IVHS operational tests and the work of the IVHS national systems architecture program.

Environmental Guidelines for IVHS

- IVHS should be integrated with on-going traffic demand management programs, livable community initiatives, and the introduction of new information technologies. , Examples include: land-use/growth management-and sustainable development planning; telecommuting, bicycle and pedestrian/traffic calming projects; and parking charges and other market based incentives such as congestion and emission pricing.

- If investments are made in traffic smoothing, they should be bundled with demand management strategies that improve the time advantage for non-SOV travel. Ramp meter by-passes, signal preemptions preferential information, and high occupancy vehicle (HOV) lanes can provide incentives for mode shift. Incident management, commercial vehicle operations, and identification of superemittors through remote sensing technology should also be coupled with traffic management oriented projects.

- Transportation demand management projects that effectively promote mode shifts and emission detection strategies such as remote sensing should be given priority over traffic smoothing in ozone non-attainment areas. Traffic smoothing is effective at addressing carbon monoxide hotspots, but at flows above 27.5 MPH may increase NOx production (IVHS Program Plan, pg. V-28).

- IVHS projects should be competitively evaluated as part of the Transportation Improvement Program (TIP) prioritization process to determine whether they represent the most cost-effective approach to emission reduction, system efficiency, etc. IVHS projects should also be integrated into the State Implementation Plan (SIP) development and conformity determination processes.

- Increase outreach to inform the public about IVHS projects. Both the potential benefits and costs of IVHS projects should be conveyed. Outreach could take the form of policy consultations, newsletters, on-line databases, etc.

- Representatives of key stakeholder groups, such as environmental protection advocates, should be included in project planning and program development. For example, representatives from non-profit/public-interest organizations could sit on advisory committees or take part in strategic planning exercises.

- Metropolitan Planning Organizations (MPOs) should play a lead role in assuring that IVHS is integrated into a broader framework of land-use and growth management planning and assuring public participation.

- Data on emissions and travel behavior should be a key output of IVHS operational tests. Even though required by FHWA rules for operational tests, there is further need to expedite the completion of environmental analyses. Forming specific multi-agency task forces or Technical Advisory Committees focused on IVHS in the MPO planning process offers potential. Environmental interest groups should be involved in the process to insure early consensus on research methodologies.

These guidelines are intentionally broad. The FHWA and IVHS America's Energy and Environment Committee should translate these guidelines into more specific action items related to IVHS operational tests and deployment related activities.

Support Pricing Initiatives. While difficult to implement, pricing strategies enabled through the use of automatic vehicle identification (AVI) and smart card technology represents a premier IVHS strategy to reduce emissions in non-attainment areas. User charges based on congestion are a market-based approach which allow urban areas to manage congestion. Such charges also generate revenue for infrastructure investments, reducing taxes, encouraging transit and reducing inequities in access.

The FHWA is promoting congestion pricing by funding demonstration projects. IVHS funds could support this initiative if they were invested in: 1) further refining technologies, (AVI, ETTM) that ease implementation of these policies, 2) research on the likely impacts of pricing strategies on productivity, land-use, equity, and political/institutional strategies for implementation, and 3) the better conveyance of the full costs of alternative travel choices regardless of the imposition of direct user charges. The Humphrey Institute of Public Affairs has just begun a national study for the FHWA of the institutional and political issues in implementing congestion pricing.

Explore New Applications: Given the public's increasing awareness and concern for the environment, technologies which inform drivers of the adverse environmental impacts of driving behavior as well as offer information on transportation alternatives could have a significant impact on travel behavior. An emissions counter that accounts for cold starts, rapid accelerations, as well as the emissions effects of various travel speeds might induce drivers to go on "emissions diets" by adjusting their travel behavior.

Remote sensing, which was promoted by the most recent solicitation for IVHS operational tests, should also be strongly encouraged in non-attainment areas.

Make Collection on Emissions and Travel Behavior Data a Key Output of an IVHS Non-attainment Bundle. Given the scarcity of good data on the environmental impacts of IVHS and transportation control measures in general,13 this outcome is critical to the future deployment of IVHS. Progress toward agreement on methodologies of environmental impacts is essential to the development of a common vision for IVHS development.

Recommended Federal Action:

1) *Specify the environmental goals of IVHS and consider adoption of environmental guidelines for program management.*

2) *Set aside funds for IVHS operational tests that are specifically developed for reducing VMT per capita in non-attainment areas.*

IV) INVEST IN IMPROVED TRAVEL BEHAVIOR AND ENVIRONMENTAL MONITORING AND MODELING RESEARCH

Address Existing Shortcomings in Travel Behavior and Air Quality Data. In addition to traditional concerns about mobility, ISTEA creates new goals, such as accessibility, energy **and** land conservation, and **enhanced** multi-modal goods movement. While improving the environment is one of the three or four top priorities of federal policy leaders for IVHS, no one has been able to demonstrate just how these new technologies will improve (or hurt) the environment. While some **progress** is being made, as evidenced by several papers presented at the June policy conference, transportation planners still lack the tools to evaluate the environmental effects of new technologies and other system changes.

Effective analysis depends upon reliable data on 1) travel behavior, 2) the air quality impacts of changes in rate and flow of traffic, and 3) the estimated health and environmental **costs of** different pollution levels. Unfortunately, serious shortcomings exist in all three of these areas: Travel models don't consider the impact of information on activity generation and mode choice; the EPA Mobile model for estimating emissions is based on average speeds, making it incapable of accurately assessing impacts of traffic smoothing; and there is a general dearth of good research in attaching social and environmental costs to transportation pollutants.

Investments need to be made both in better monitoring (i.e. empirical data collection) and modeling of the environmental impacts of transportation projects. While these tools are being upgraded at the federal level, there is a need to insure that new models and data collection address issues specific to IVHS technologies and that more detailed guidance on evaluation be delivered to states and MPOs. Two areas of increased attention should be consideration of latent demand impacts14 and the collection of data on non-work **trips** as these are a significant and increasing portion of total trips.

The IVHS operational tests will certainly help to advance the science of travel behavior and the environmental impacts of different transportation systems. The recent USDOT guidance on environmental evaluation of the operational tests reflects the importance of assessing societal and environmental impacts in addition to technological viability. To maximize the goals of improved environmental data collection, a consistent methodology of evaluation

should be promoted and findings from these evaluation and other related studies should be made readily available to transportation and environmental professionals.15

Expand use of Cost-benefit Analysis and Least-cost Planning Methodologies. Efforts underway, such as the Volpe Center's work on cost-benefit analysis of IVHS, and by the FHWA, Washington State and others on least-cost planning methodologies are critical to evaluating IVHS investments relative to traditional capital investments.16 Such efforts should be expanded and should include greater research on secondary benefits, such as the productivity enhancing potential of IVHS.

The scale of environmental impacts is also relevant to cost-benefit assessments. Clearly such proposed projects as the automated highway system will have major impacts and demand comprehensive front-end evaluations of environmental impacts. For other projects, environmental impacts are likely to be minimal and the benefits should not be excessively delayed by attempts to precisely determine environmental impacts.

While, due to national legislation, environmental objectives tend to focus on air quality, IVHS development should look to the future and address emerging goals such as reducing energy consumption and urban sprawl, and improving community livability. As IVHS refines its mission in the coming years, it should do so in light of the recent movement toward incorporating notions of sustainability, both resource and financial, in transportation investments.17

Create an Emission Detection and Reduction User Service. The draft National IVHS Program Plan recommends considering a 29th user service focussing on IVHS technologies which support emissions detection and reduction. Emission detection applications have the potential to vastly improve data collection **on** environmental impacts of IVHS and to advance policies that focus resources in the most cost-effective areas such as the removal/repair of "superemittors." It is imperative that this user service be developed.

Expand the Role of Traffic Management Centers (TMC). One of the benefits of improved traffic management systems is the ability to collect and use data on traffic behavior more effectively. TMC's could also direct traffic, particularly heavy vehicles, away from emission hotspots. While integration of traffic management activities is likely to be advanced by the benefits of new technologies,18 MPOs should be encouraged to promote such an integration and where applicable oversee traffic management operations. Houston's interagency Transportation and Emergency Management Center is an exciting new development in this regard.

Encourage Partnerships with National Labs. The technical **expertise** of the national labs should be exploited in evaluating the impacts of IVHS. Initial partnerships with national labs, such as the involvement of Los Alamos in the LIDAR program in Minnesota, only scratch the surface **of** the potential contribution of the national labs.

Incorporate More Non-technical Issues in Operational Tests. "Smart or livable communities" demonstration projects provide an opportunity for institution testing. Michael Replogle of the Environmental Defense Fund promoted the notion of "smart communities" and has outlined the need to survey public attitudes toward pricing and AVI.19 Such studies will reveal important information about changes in driving habits and consumer preferences.

Expand Research on Equity. Operational tests should consider the equity impacts of IVHS investments. The history of community dislocation resulting from the Interstate System and the Environmental Protection Agency's recent attention to environmental justice demand that equity concerns be integrated into the operational tests in order to build legitimacy for deployment.

Work by the Urban Habitat Program in San Francisco, the Surface Transportation Policy Project's Roundtable on Transportation and Social Equity and the Environmental Defense Fund20 represent early stages of new models for cooperation in this area.

Continue an Ongoing Objective Forum for the Exchange of **Information and Evaluation Results.** The consultations and policy conferences conducted during this project brought together key transportation, environmental and academic leaders to exchange information, discuss research and explore policy options. While these forums raised more issues than they resolved, they served an extremely **useful** purpose in increasing understanding and trust, elements necessary for long-term cooperation.

The three annual national conferences, held in Asilomar, Diamond **Bar** and Arlington, have proved to be a valuable touchstone for those who are committed to resolving the relationship between IVHS and the environment. These conferences, organized through the leadership of George Mason University, CALTRANS, and the FHWA to include a range of stakeholder organizations, support and stimulate the work being conducted through the U.S. Department of Transportation, IVHS AMERICA, the Transportation Research Board and other organizations.

Recommended Federal Action:

1) *Provide a dedicated fund for improving transportation and environmental data.*

2) *Encourage regional environmental analyses that include consideration of induced demand and land-use impacts.*

3) *Insure adequate staffing for environmental analysis of transportation plans within the Federal Highway Administration and the U.S. Environmental Protection Agency.*

Endnotes

1. Sigford, Kristin, *Paperwork or Protection? A Comparative Assessment* of *State Environmental Policy Acts,* Minnesota Center for Environmental Advocacy, December, 1993 p. 3.

2. Chapter 382, Texas Statutes Annotated and Chapter 486A, Oregon Statutes Annotated.

3. Hoffman, Steven and Sigford, *Kristin, State Air Quality Control Programs: A Comparative Assessment,* Project Environment Foundation and the University of St. Thomas, October 1991, p. 9. As of 1990, Oregon had 60 full-time equivalent employees, while Minnesota had 6 and Texas 4.

4. Dittmar, Hank, Frick, Karen and Tannehill, David, Metropolitan Transportation Commission, San Francisco Bay Area "Institutional and Political Challenges in Implementing Congestion Pricing: A Case-Study of the San Francisco Bay Area." Prepared for TRB Congestion Pricing Conference, June 23-24,1993, Washington, D.C.

5. This conference, held on June 6 and 7, 1994, in Arlington, Virginia was cosponsored by the United States Department of Transportation, IVHS AMERICA, George Mason University, the University of Minnesota, Environmental Defense Fund, Surface Transportation Policy Project, California Department of Transportation (CALTRANS), and the United States Environmental Protection Agency.

6. John, Dewitt, in the recent book *Civic Environmentalism* (Congressional Quarterly Press, 1994) describes the increasing use of public education campaigns to address non-point source pollution.

7. Hoover, Julie (Parsons Brinkerhoff, New York), "Post-ISTEA Public Involvement," Transportation Research Board 73rd Annual Meeting, January 1994, Washington, DC., p. 8.

8. Transportation planning in the San Francisco Bay Area offers a good model for consensus building. See Younger, Kristina, E. and Murray, David G., "Developing A Method of Multimodal Priority Setting for Transportation Projects in the San Francisco Bay Area in Response to the Opportunities in the ISTEA," TRB DRAFT, 10/5/92.

9. By citizen juries we envision a process similar to that developed by Ned Crosby and the Jefferson Center for New Democratic Process in Minneapolis, MN.

10. Jack Faucett and Associates. *Qualitative Assessment of IVHS Emission and Air Quality Impacts, 7/93.*

11. Transportation Research Board Committee for Study on Urban Transportation Congestion Pricing, *Curbing Gridlock: Peak Period Fees to Relieve Traffic Congestion,* Vol. I, National Academy of Sciences, Washington, DC. 1994 p. 93. Citing Meyer, Michael D., "Alternative Methods for Measuring Congestion Levels," pp. 32-61 of Vol. II of the same study.

12. U.S. Department of Transportation, IVHS National Program Plan: Implementation Report to Congress, Draft. Washington D.C. January 28, 1994

13. IVHS America, Benefits, Evaluation and Costs Committee, Energy and Environment Working Group, Proceedings, San Diego, CA, December, 1992. Also, see U.S. General Accounting Office, "Urban Transportation Control Measures," p. 88.

14. Little, Cheryl and Wooster, Jean, U.S. Department of Transportation, "IVHS and Environmental Impacts: Implications of the Operational Tests," National Policy Conference on Intelligent Transportation Systems and the Environment, Arlington, VA, June 6-7, 1994.

15. Little and Wooster, 1994, found that the IVHS operational tests are "employing diverse techniques to evaluate travel behavior, traffic operations, emissions and fuel consumption." In order to properly assess the relative merits of different IVHS projects and to assist state and local analytical capacity, we believe there is a need to develop consistent evaluation methodologies.

16. See Nelson, Dick and Shakow, Don *(1994), "Applying Least Cost Planning to Puget Sound Regional Transportation,* Phase I Report Seattle: Institute for Transportation and the Environment.

17. See Johnson, Elmer *Avoiding the Collision of Cities and Cars: Urban Transportation Policy for the Twenty-first Century* (Chicago: Academy of Arts and Sciences, 1993) or the Bulletin of The Surface Transportation Policy Project, Vol. III, No. 7, September 1993.

18. Booz-Allen and Hamilton, *Inc. Institutional Impediments to Metro Traffic Management Coordination,* Volpe National Transportation Systems Center, September 13, 1993 pp. 3-26.

19. Replogle, Michael, *IVHS at Risk: A Review of Draft National Program Plan for Intelligent VehicIe Highway Systems* (IVHS), Environmental Defense Fund, November 25, 1993.

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