# IVHS AND THE ENVIRONMENT

NEW MODELS

FOR FEDERAL

STATE AND LOCAL

THE APPLICATION

OF ADVANCED

TRANSPORTATION

SYSTEMS FOR

ENVIROMENTAL

IMPROVEMENTS

IN URBAN AREAS

# FINAL REPORT

STATE AND LOCAL POLICY PROGRAM

HUBERT H. HUMPHREY
INSTITUTE OF PUBLIC AFFAIRS

UNIVERSITY OF MINNESOTA

# 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

## FINAL REPORT

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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, however, depends on how these technologies are deployed. This report presents the findings of a study begun in 1993 to explore the public policy issues related to the environmental impacts of IVHS. The study was conducted by the State and Local Policy Program of the Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota and funded through a cooperative agreement with the Federal Highway Administration.

The study focused on finding new models for cooperation among federal, state and local institutions that would ensure deployment of IVHS technologies in a manner that minimizes the negative impacts and maximizes the positive impacts on urban air quality and the broader environment.' To identify these new models of cooperation, the State and Local Policy Program used three case studies and commissioned a series of papers for a national policy conference. The studies and the models of cooperation that were identified through them will be discussed later in the report.

Due to the fact that mobile source emissions are regulated by the Clean Air Act and the Intermodal Surface Transportation Efficiency Act, our study focused primariliy on the impacts of IVHS technologies on air quality. Through our consultation process, however, it quickly became apparent that participants perceived environment in a much broader sense. Concerns were raised regarding IVHS impacts on land use, energy consumption, neighborhood livability and social equity.

Intelligent Vehicle Highway Systems are a group of advanced transportation technologies designed to make surface travel easier. The most basic and recognizable applications of first generation IVHS technologies include ramp meters, coordinated traffic signals and, increasingly, traffic management centers. Before IVHS technologies are deployed on a large-scale basis, they undergo operational tests, funded by the Federal Highway Administration. Second generation applications currently being tested include real time travel information kiosks and personal pagers, nonstop toll booths and traffic signal preemption for buses. In the future, third generation IVHS technologies could include self-driving cars and self-monitoring emissions devices.

With the passage of the Intermodal Surface Transportation Efficiency Act in 1991, the Federal Highway Administration asserted itself as a leader in the development of IVHS technologies in the United States. Since then, the Highway Administration has been instrumental in shaping the direction of IVHS development and has provided funding for operational tests and for studies of the impacts of IVHS.

In 1993, the Federal Highway Administration developed a list of twenty-eight user services to guide the development of IVHS technologies. Subsequently, the services were grouped into six "bundles," based on the service supplied.'

| Federal Highway Administration Classification of IVHS Technologies | |
|---|---|
| **Bundle** | **User Services** |
| **Travel and Traffic Management** | Pre-Trip Travel Information<br>En-Route Driver Information<br>Route Guidance<br>Ride Matching and Reservation<br>Traveler Services Information<br>Traffic Control<br>Incident Management<br>Travel Demand Management |
| **Public Transportation Management** | Public Transportation Management<br>En-Route Transit Information<br>Personalized Public Transit<br>Public Travel Security |
| **Electronic Payment Services** | Electronic Payment Services |
| **Commercial Vehicle Operations** | Commercial Vehicle Electronic Clearance<br>Automated Roadside Safety Inspection<br>On-Board Safety Monitoring<br>Commercial Vehicle Administrative Processes<br>Hazardous Materials Incident Notification<br>Commercial Fleet Management |
| **Emergency Management** | Emergency Notification and Personal Security<br>Emergency Vehicle Management |
| **Advanced Vehicle Safety Systems** | Longitudinal Collision Avoidance<br>Lateral Collision Avoidance<br>Intersection Collision Avoidance<br>Vision Enhancement for Crash Avoidance<br>Safety Readiness<br>Pre-Crash Restraint Deployment<br>Automated Vehicle Operation |

As IVHS technologies have developed, their impact on air quality has become a contentious issue. In most major urban areas, IVHS technologies could either improve or exacerbate air quality problems. To effect a positive result, it will be necessary that federal, state and local institutions forge cooperative efforts similar to those presented in this report.

## IVHS and the Environment: Case Studies

The State and Local Policy Program used five criteria to select three case study areas.

| Case Study Selection Criteria |
|---|
| 1) A current operational test or early deployment study and various levels of sophistication 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. |

Based on these criteria, the cities of Houston, Texas, Minneapolis-St. Paul, Minnesota and Portland, Oregon were selected. These cities vary in size, use of IVHS technologies, type and severity of air quality problems, and types of institutional and political approaches to addressing transportation and environmental issues (see Table 1).

The research strategy consisted of site visits and interviews with transportation and environmental leaders, establishing a local steering committee for each city, day-long consultations in each city to identify key concerns, a case study 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 IVHS technologies such as ramp metering and signal timing, the twenty-eight user services, and expanding notions of IVHS 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 called Minnesota Guidestar that has several operational tests underway. In fact, Minnesota Guidestar staff indicate that they are participating in 25 percent of the total number of national operational tests that have been awarded by the U.S. Department of Transportation since 1992.

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 lanes in the nation. To support these

**Table 1**
**Comparisons of the Three Urban Areas**

| | Houston, Texas | Minneapolis-St. Paul, Minnesota | Portland, Oregon |
|---|---|---|---|
| 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 |
| People per Square Mile | 1,806 | 2,063 | 2,875 |
| Daily Vehicle Miles per Person | 25.5 | 21.0 | 18.7 |
| IVHS Activity | Eight major projects | Over twenty projects | Early deployment grant |
| Air Quality | Severe Nonattainment (Ozone) | Moderate Nonattainment (Carbon Monoxide) | Marginal Nonattainment (Ozone) Moderate Nonattainment (Carbon Monoxide) |
| State Environmental Laws | Texas Clean Air Act | Minnesota Environmental Policy Act | Oregon Clean Air Act; vehicle miles traveled reduction 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*

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 (charging higher tolls during rush hour) 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 nonattainment for ozone. Most of the ozone pollution in Houston is caused by stationary sources, particularly the petroleum industry. Consequently, Houston's achievement of Clean Air Act 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 nonattainment for ozone and in moderate nonattainment for carbon monoxide. The Minneapolis-St. Paul metropolitan area has the least severe air quality problems of the three cities. This area currently is in moderate nonattainment for carbon monoxide.

State environmental laws affecting the three cities vary as well. Of the three states, only Minnesota has a State Environmental Policy Act, which extends environmental review requirements to actions not covered by the National Environmental Policy Act.[3] However, Minnesota is also the only one of these three states without a Clean Air Act.[4] 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" Similarly, while the growth of vehicle miles traveled is a concern in all three areas, Portland is the only urban area under a state-issued directive to reduce per capita vehicle miles traveled.

The case studies culminated in several key findings and local examples of interagency cooperation that 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 multimodal 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. |

## 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** is a grass roots organization that promotes bicycling as a travel option and has led to the creation of Houston's mayoral task force on Bicycle Safety and Mobility. | **Minnesota Guidestar's Transit Innovations Committee** has identified new IVHS projects that serve the needs of bicyclists, pedestrians and transit users. | **Land Use, Transportation and Air Quality (LUTRAQ)** 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, Texas Department of Transportation, and the City of Houston. | **Downtown Minneapolis Transportation Management Organization** is a public-private partnership designed to manage travel demand to ensure environmentally sound growth and prosperity in downtown Minneapolis. | **Governor's Task Force on Motor Vehicle Emissions,** made up of representatives from public, private and nonprofit organizations, developed many effective measures to reduce mobile emissions. |
| Houston is developing the largest network of barrier-separated high occupancy vehicle lanes in the nation. | **Joint Air Quality Guidance Committee** includes staff from the Minnesota Pollution Control Agency, Metropolitan Council and Minnesota Department of Transportation. | **Region 2040 Plan** will guide Portland's transportation and land use decisions over the next fifty years. |
| **The Metropolitan Transit Authority of Harris County (METRO)** was created from fourteen agencies, and is responsible for transportation, 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 system) continue to receive support from Portland residents despite increasing antitax sentiment and state budgetary constraints. |

## Policy Recommendations

### I) Broaden the Partnership

**Change the Name.** The name "Intelligent Vehicle Highway Systems" is appropriate for many purposes. To environmental interests, however, the name raises red flags that IVHS is only about cars and roads, even though transit has been incorporated as a major component and the scope has been broadened to include energy and environmental concerns. To minimize this misconception, there is considerable momentum to change the name to "Intelligent Transportation Systems." (Minnesota Guidestar now refers to ITS rather than IVHS.) This change should occur as soon as possible.

**Build Coalitions of Key Stakeholders.** One of the great successes of IVHS has been the forging of new partnerships between the public and private sectors. Through the Federal Highway Administration's operational tests, state transportation departments 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.

During this study participants suggested that there are "insiders" (highway engineers, transportation professionals and transportation interest groups) and "outsiders" (environmental advocates, planners and bicyclists) who have played a 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 interests,* 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[6]

The seeds for such broad-based coalitions exist in the three case study cities. In Houston, the business community is very much involved in framing transportation policy and the role of IVHS, but 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, businesses and the

University of Minnesota's Center for Transportation Studies, but 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 and the national policy conference on Intelligent Transportation Systems and the Environment in June 1994 demonstrate the willingness of environmental interests to enter into a constructive dialogue. However, as evidenced by their lack of participation in the Federal Highway Administration's IVHS regional forums and Minnesota Guidestar's strategic planning process, there is a need to actively recruit participation by these groups .

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 that directly relate to the concerns of environmental organizations about such issues as single occupancy vehicle use, alternative fuels, land use and energy consumption. 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. As Lamont Hempel, a member of the study's steering committee, has emphasized, the IVHS community simply cannot afford to go forward without involving environmental interest groups regarding these technologies.

**Fund Public Education.** Users' needs and preferences must be carefully addressed to maximize the effectiveness of IVHS technologies, which are informational in nature. However, most of the public is unfamiliar with the term IVHS. Thus, it is imperative that the public gain a greater understanding of IVHS and the likely costs and benefits of such technologies, and help to shape their deployment.

Marketing alone will not provide for the "informed public comment" required under the Intermodal Surface Transportation Efficiency Act. A public education campaign is needed; one that could also serve the need for greater public understanding of air quality issues.' A good model for such a campaign is one developed by Los Angeles's metropolitan planning organization, which recently established public involvement guidelines requiring 10 percent of the total planning budget to go toward public outreach programs.'

**Involve Citizens in the Dialogue.** Transportation agencies have traditionally responded to the demands and expectations of their primary customers--road users. They have not been as successful, however, in involving citizens in the broader issues and implications of transportation policy. This is due to the complexity of transportation issues and their link 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.[9] 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 the Intermodal Surface Transportation Efficiency Act, co-sponsored by the Federal Highway Administration, the Surface Transportation Policy Projects 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 Ongoing 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 and environmental and community goals would strengthen the credibility of IVHS's mission among skeptical parties.

Links with initiatives such as growth management plans, alternative fuels development, intermodal 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 ensures broad stakeholder involvement, maximizes resources, and should have synergistic effects. An excellent example of this is Portland Metro's Region 2040 Plan. Metro is developing a fifty-year strategic plan. The first objective will be setting a land use policy; everything else, including IVHS, will be planned to fit the 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 project ranking and public participation process of metropolitan planning organizations.*

2) *Expand funding and other incentives for metropolitan planning organizations 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 packages.*

## II) Enhance the Capacity of Metropolitan Planning Organizations to Address Environmental and Public Participation Issues Related to New Transportation Technologies

The Intermodal Surface Transportation Efficiency Act expanded the role of metropolitan planning organizations in setting transportation priorities in urban areas. The 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 metropolitan planning organizations 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 fifty-year regional land use plan will provide the basis for choosing transportation priorities. In Minneapolis-St. Paul, the Metropolitan Council and the Minnesota Department of Transportation are currently conducting a joint study of the potential for road pricing, and the Metropolitan Council and other key regional policy makers are included on Minnesota Guidestar committees.

Nonetheless, the capacity of metropolitan planning organizations to conduct multimodal planning as mandated by the Intermodal Surface Transportation Efficiency Act 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 that has been in place in many cities for years." Also, few metropolitan planning organizations measure how congestion has changed over time.[12]

For metropolitan planning organizations to expand public understanding and dialogue, they must improve their analytical capabilities and better communicate their findings to the general public. Whenever possible, IVHS projects should be mainstreamed into the traditional metropolitan planning organization process for planning and evaluation of transportation investments. Presently, the metropolitan planning organization is not the lead agency for planning and evaluating IVHS projects in any of the three case study cities. Given limited resources, there is a need to enhance federal guidance on environmental evaluation of multimodal 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) *Give priority for Congestion Mitigation and Air Quality funding to IVHS projects that promote mode shift and market-based strategies.*

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

3) *Increase funding for development of metropolitan planning organizations' capacity to analyze environmental impacts.*

### III) Define a Prototype IVHS Bundle for Nonattainment Areas

During the course of the study, the Federal Highway Administration shifted its approach to classifying and explaining IVHS technologies. Originally, the Highway Administration identified six technology bundles, organized by major systems; now they list twenty-eight user services, based on specific applications for various users, and have grouped these user services into six new bundles based on the services or benefits that a user would receive (see page 4). The shift to a user services approach should help to make the discussion of transportation technologies more understandable to a wider audience and help determine how specific services might affect the environment. The next step will be to define a bundle of these user services appropriate to nonattainment areas.

**Develop Environmental Guidelines.** Any IVHS deployment must follow the investment guidance and planning factors described by the statewide and metropolitan planning rules of the Intermodal Surface Transportation Efficiency Act. As an articulation of this guidance, we present a set of guidelines for conducting IVHS operational tests and the work of the IVHS national systems architecture program to effect positive environmental results (see next page).

These guidelines are intentionally broad. The Federal Highway Administration and IVHS AMERICA's Energy and Environment Committee should translate these guidelines into more specific action items related to lVHS operational tests and deployment-related activities.

**Support Pricing Initiatives.** While difficult to implement, pricing strategies enabled through the use of automatic vehicle identification and smart card technology represent a premier lVHS strategy to reduce emissions in nonattainment areas. User charges based on congestion is a market-based approach that allows urban areas to manage congestion. Such charges also generate revenue for making infrastructure investments, reducing taxes, encouraging transit and reducing access inequities.

The Federal Highway Administration is promoting congestion pricing by funding demonstration projects. IVHS funds could support this initiative if they were invested in: 1) further refinement of technologies that ease implementation of these policies (such as electronic toll and traffic management and vehicle to roadside communication); 2) research on the likely impacts of pricing strategies on productivity, land use, equity and political/institutional strategies for implementation; and 3) better conveyance of the full costs of alternative travel choices. The Humphrey Institute of Public Affairs has just begun a national study of institutional and political issues in congestion pricing for the Federal Highway Administration.

**Explore New Applications.** Given the public's increasing awareness and concern for the environment, technologies that inform drivers of the adverse environmental impacts of driving behavior and offer information on transportation alternatives could have a significant impact on travel behavior. An emissions gauge that accounts for cold starts and 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 nonattainment areas.

## Environmental Guidelines for IVHS

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.

In order to maximize environmental benefits, more precise environmental guidelines for the transition of IVHS from research and development to deployment are needed.

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

- If investments are made in smoothing the flow of traffic, they should be bundled with demand management strategies that improve the time advantage for non-single occupancy vehicle travel. Ramp metering, signal preemption, preferential information, high occupancy vehicle lanes, and high occupancy toll lanes can provide incentives for people to shift their modes of travel. Incident management, commercial vehicle operations, and identification of super emitters (vehicles that pollute more than their share) through remote sensing technology should be coupled with projects oriented to traffic management.

- 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 nonattainment areas. Traffic smoothing is effective at addressing carbon monoxide hotspots, but at flows above 27.5 miles per hour, it may increase nitrogen oxides production.'

- IVHS projects should be competitively evaluated as part of the Transportation Improvement Program prioritization process to determine whether they represent the most cost-effective approach to issues such as emission reduction and system efficiency. IVHS projects should also be integrated into the State Implementation Plan 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, and so forth.

*(continues)*

Federal Highway Administration, *National IVHS* Program *Plan*, p. V-28.

- Representatives of key stakeholder groups, such as environmental protection advocates, should be included in project planning and program development. For example, representatives from nonprofit and public interest organizations could sit on advisory committees or take part in strategic planning exercises.
- Metropolitan planning organizations 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 the Federal Highway Administration's 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 planning process of metropolitan planning organizations offers potential. Environmental interest groups should be involved in the process to insure early consensus on research methodologies.

**Make Collection of Emissions and Travel Behavior Data a Key Output of an IVHS Nonattainment 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 assessing environmental impacts is essential to developing 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 vehicle miles traveled per capita in nonattainment 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, the Intermodal Surface Transportation Efficiency Act creates new goals, such as accessibility, energy and land conservation, and enhanced multimodal goods movement. While improving the environment is one of the three or four top IVHS priorities of federal policy leaders, no one has been able to demonstrate just how these new technologies will improve (or hurt) the environment. Some progress is being made, as evidenced by several papers presented at the June policy conference, but transportation planners still lack the tools to evaluate the environmental effects of new technologies and other system changes.

Effective analysis depends on 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 do not consider the impact of information on latent demand and choice of travel mode. The EPA Mobile 5 model for estimating emissions is based on average speeds, making it incapable of accurately assessing the impacts of smoothing the flow of traffic. There is a scarcity of good research regarding the social and environmental costs of transportation pollutants.

Investments need to be made in both better monitoring (i.e., empirical data collection) and better modeling of the environmental impacts of transportation projects. While these tools are being upgraded at the federal level, there is a need to ensure that new models and data collection address issues specific to IVHS technologies and that more detailed guidance on evaluation be delivered to states and metropolitan planning organizations. Two areas of increased attention should be consideration of latent demand impacts.[14] and the collection of data on nonwork trips, which are a significant and increasing portion of total trips.

The IVHS operational tests will certainly help to advance the science of transportation impacts on travel behavior and environmental impacts. The recent United States Department of Transportation 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 evaluations 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 the work by the Federal Highway Administration, Washington state and others on least-cost planning methodologies, are critical to evaluating IVHS investments relative to traditional capital investments. 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 environmental impacts and will demand comprehensive front-end evaluations of these impacts. For other projects, however, environmental impacts are likely to be minimal and the benefits should not be excessively delayed by attempts to precisely determine the impacts on the environment.

Due to national legislation, environmental objectives tend to focus on air quality. IVHS development, however, 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.

**Create an Emission Detection and Reduction User** Service. The draft *National IVHS* Program Plan recommends considering a twenty-ninth user service that would focus on IVHS technologies that 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 "super emitters." It is imperative that this user service be developed.

**Expand the Role of Traffic Management Centers.** One of the benefits of improved traffic management systems is the use of traffic management centers, which have the ability to effectively collect and use data on traffic behavior. Traffic management centers 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,[16] metropolitan planning organizations 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 Minnesota's light detection and ranging program (an operational test), only scratch the surface of the potential contribution of the national labs.

**Incorporate More Nontechnical Issues in Operational Tests.** Demonstration projects of "smart" or "livable" communities provide an opportunity for institutional cooperation in a high-tech situation. Michael Replogle of the Environmental Defense Fund has outlined the need to survey public attitudes toward pricing and automatic vehicle identification.*' Such studies will reveal important information about changes in driving habits and consumer preferences.

**Expand Research on Equity.** Operational tests should consider how IVHS investments affect various economic and social groups. The history of community dislocation resulting from the Interstate Highway System and the Environmental Protection Agency's recent attention to environmental justice demand that equity impacts be integrated into the operational tests in order to build consensus 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 Fund[18] 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 study 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 national conferences, held in Asilomar (1992), Diamond Bar (1993) and Arlington (1994), proved to be a valuable touchstone for those who are committed to resolving the relationship between IVHS and the environment. Organized through the leadership of George Mason University, the California Department of Transportation and the Federal Highway Administration to include a range of stakeholder organizations, these conferences 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 fund dedicated to improving transportation and environmental data.*

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

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

## December 12-14 Case Study Conference Participants

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**Endnotes**

1. In many cases positive impacts on air quality will also result in positive impacts on other environmental indicators, but this is not always the case. For example, rerouting traffic to less congested streets may lessen emission hotspots; however, that would have a negative effect on neighborhood livability.

2. Federal Highway Administration, *National IVHS Program Plan,* (draft), p. I-8.

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

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

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

6. Hank Ditmar, Karen Frick and David Tannehil, "Institutional and Political Challenges in Implementing Congestion Pricing: A Case-Study of the San Francisco Bay Area" (paper prepared for the Transportation Research Board Congestion Pricing Conference, Washington, D.C., June 23-24, 1993).

7. Dewitt John, in the recent book, *Civic Environmenfnlism* (Washington, D.C.: Congressional Quarterly Press, 1994) describes the increasing use of public education campaigns to address non-point source pollution.

8. Julie Hoover, "Post-ISTEA Public Involvement" (paper presented at the Transportation Research Board 73rd Annual Meeting, Washington, D.C., January 1994), p. 8.

9. Transportation planning in the San Francisco Bay Area offers a good model for consensus building. See Kristina E. Younger and David G. Murray, "Developing A Method of Multimodal Priority Setting for Transportation Projects in the San Francisco Bay Area in Response to the Opportunities in the ISTEA" (draft paper prepared for the Transportation Research Board, 10/5/92).

10. By "citizen juries" we mean a process similar to that developed by Ned Crosby and the Jefferson Center for New Democratic Process in Minneapolis.

11. Jack Faucett and Associates, "Qualitative Assessment of IVHS Emission and Air Quality Impacts" (paper prepared for the Federal Highway Administration, 7/93).

12. Michael D. Meyer, "Alternative Methods for Measuring Congestion Levels," in *Curbing Gridlock: Peak-Period Fees To Relieve Traffic Congestion,* Volume 2 (Washington, DC.: National Academy Press), p. 37.

13. IVHS AMERICA, Benefits, Evaluation and Costs Committee, proceedings from the meeting of the Energy and Environment Working Group, San Diego, Calif., December 1992. Also, see United States General Accounting Office, *Urban Transportation Control Measures,* p. 88.

14. Cheryl Little and Jean Wooster, "IVHS and Environmental Impacts: Implications of the Operational Tests" (paper presented at the 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. Booz-Allen and Hamilton, Inc., *Institutional Impediments to Metro Traffic Management Coordination* (Washington, D.C.: Volpe National Transportation Systems Center, 1993) part 3, p. 26.

17. Michael Replogle, "IVHS at Risk: A Review of Draft National Program Plan for Intelligent Vehicle Highway Systems (IVHS)," (paper prepared for the Environmental Defense Fund, November 25, 1993).

18. Michael W. Cameron, "Efficiency and Fairness on the Road: Strategies for Unsnarling Traffic in Southern California" (paper prepared for the Environmental Defense Fund, 1994).

# SUMMARY OF PAPERS FROM THE NATIONAL POLICY CONFERENCE ON INTELLIGENT TRANSPORTATION SYSTEMS AND THE ENVIRONMENT

The Humphrey Institute issued a call for papers in November 1993 on the topic of intelligent transportation systems and the environment.[1] Of the proposed research papers, twenty-three were selected for the National Policy Conference held in Arlington, Virginia, on June 6-7, 1994.

The papers were separated into three categories: New Strategies and Technologies, Energy and Environmental Impacts, and Socio-Economic and Institutional Issues. All of the papers relate research and planning for ITS/IVHS to other ongoing activities, whether they be traditional transportation and air quality research or broader political, socio-economic or cultural concerns. Many of the papers represent first or early explorations into important topic areas such as modeling induced demand impacts, considering equity impacts, linking IVHS to broader developments in environmental regulation and the environmental movement, or the appropriate structure for public participation in planning for ITS.

A compilation of the conference papers is available from the State and Local Policy Program. Two related papers are also available: Cost-Benefit *Analysis Applied to IVHS* (with special attention to congestion pricing) by Edward Foster, University of Minnesota Department of Economics, and New *Models for Federal, State and Local Cooperation in the Application of Advanced Transportation Systems for Environmental Improvement in Urban Areas,* a mid-project paper presented by the State and Local Policy Program at the 1994 IVHS AMERICA Annual Meeting.

## Summary of Conference Papers

### New Strategies and Technologies

In a solo paper and in a paper written with **Daniel Sperling, Michael Replogle** presents an alternative vision for ITS that emphasizes smart communities rather than smart cars and smart roads.

This vision emphasizes accessibility over mobility and prioritizes ITS applications of electronic road and parking pricing, transit and automatic speed limitation. In order to reach a cooperative vision in a presently contentious environment, Replogle argues for a broadening of public and metropolitan planning organization (MPO) participation and expertise.

The paper co-authored with Sperling suggests that a broader range of technologies, including smart tele-shopping, neighborhood electric vehicles and emissions monitoring devices, be considered part of ITS. Linking ITS with demand management strategies is

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1 The Humphrey Institute's State and Local Policy Program collaborated with George Mason University, CALTRANS, FHWA IVHS AMERICA, and the Environmental Defense Fund in developing the call for papers and in selecting and sponsoring the research papers.

also deemed critical. Such an approach appropriately addresses important goals of social equity, environmental quality and community livability.

Like Replogle and Sperling, **Lamont Hempel** is also in search of a sustainable transportation system. Design of such a system would recognize the interdependency of technology, politics and markets, and address critical institutional issues such as the cultural schism between the public and private sector and reconciling multiple government agencies to a common task.

Hempel believes that we cannot count on models to give us definitive answers to air quality concerns in the near future. Yet, important policy guidance relative to IVHS is known. For example, it will be more cost-effective to promote cleaner cars through the identification and removal of super emitters and further advancement of control equipment (e.g., preheated catalytic converters) than to promote HOV/transit options; pricing strategies need to be linked to the capacity expansion made possible by IVHS; funding should not cloud the instrumental nature of IVHS; and problems external to the transportation system, including new technical fixes, will heavily influence IVHS. If IVHS is to achieve multiple goals of clean air, energy security, mobility and access to transportation, it will have to be "employed in the service of DSM [demand side management], market-based pricing, and development of green vehicles."

Given ISTEA's new planning criteria, the introduction of IVHS highlights the need to develop techniques to compare results across modes and between supply- and demand-side strategies. **Patrick DeCorla-Souza** suggests a least-cost planning approach to compare IVHS with alternatives such as land use changes and multimodal infrastructure investments. This approach takes better account of the full costs of various alternatives, suggests a common measure of output and of incremental cost, ensures comparison to a real base case, and allows comparison of capital investment and policy changes.

**Ellen Williams** also considers how we might gain the greatest competitive advantage from our investments in high technology transportation infrastructure. Based on her experiences with Project California, which considered the potential of six major high-tech transportation industries, Williams advocates strategic investment in the information highway. Williams does not speak directly to ITS. However, her depiction of information technologies' potential to replace travel in a cost-competitive and environmentally superior manner, and her depiction of a massive, globally competitive, but extremely fragmented technology, offer important insights to the ITS arena. Public/private partnerships, leadership, and cultural considerations, such as decentralized organizing principles, are seen as critical to the advancement of high technology transportation.

The other authors in this section present strategies for specific uses of IVHS technologies.

**Robert Behnke** describes ATHENA, a concept for a smart community that is both an IVHS and a National Information Infrastructure (NII) project. ATHENA uses an interactive computer system to provide a variety of personalized transportation and public information services. It is also designed to connect new transportation services such as smart jitneys and taxi-like Carpools with existing transit, paratransit and ridesharing systems.

Plans are underway to test ATHENA in the city of Ontario, California, and to measure its impact on energy consumption, emissions and general quality of life.

**Sally Spadaro** believes ITS can create a more positive image for transit and thereby get more travelers out of their single occupancy vehicles. Marketing transit can be advanced through the use of geographical information systems (GIS) to personalize route information, cable TV broadcasts of congestion conditions and alternative travel modes, and improved information delivery at transit shelters.

One does not naturally associate ITS and bicycles, but **Allen Greenberg** of the American League of Bicyclists demonstrates the need to connect ITS funding to the needs of present and potential bicyclists. He also suggests specific applications of ITS that would promote bicycling as a realistic alternative to car travel.

ITS can play a similar role to bicyclists as it does to car travelers by providing computerized information about potential routes. At the same time, bicyclists can provide a unique perception on the importance of neighborhoods and local environments in discouraging traditional trip-making.

### Energy and Environmental Impacts

The paper by **Salvatore Bellomo and Andrew Sullivan** is based on workshops with transportation professionals from different levels of government. The authors contend that "none of the IVHS operational tests currently being conducted in the U.S. has as one of its primary goals the reduction of air emissions or the improvement of environmental quality."

Modeling and analytic tools need improvement, especially in their capacity to "evaluate the use of information (not just infrastructure) on a real time basis." Uncertain environmental impacts affect the planning process. Responsive multimodal planning, IVHS and ISTEA management systems, and enforcement of the Clean Air Act Amendments (CAAA) all depend on good data. Despite data shortcomings, ITS applications such as air quality alerts and port/airport intermodal facilities have obvious benefits.

Bellomo points out the need for modeling and data gathering improvements. The following authors present exciting advances in this realm relative to IVHS.

**Sergio Ostria, Michael Lawrence and Don Pickrell** offer clarification and response to the induced demand concern raised by IVHS detractors. In layperson terms, the authors make a distinction between demand increases resulting from induced demand (i.e., decreases in perceived user costs) and increases resulting from secular volume growth (i.e., demographic and economic growth factors). Mistakenly merging these two demand changes is understandable since "increases in supply often are undertaken in exactly the places where demand is growing most rapidly."

The authors contend that induced demand should be counted as a benefit, since consumers choose it based on perceived costs, rather than an unintended side effect.

Maximizing social welfare, in economic terms, requires avoiding restricting benefits and directly addressing any associated disamenity (in this case emissions) through a gas tax, road pricing, or other type of market-based strategy.

IVHS requires new emissions models that account for smoother flows and induced demand effects. **Matthew Barth** describes power-demand-based models, which calculate second-by-second modal emissions data and are an improvement over the driving-cycle-based emission inventory techniques presently used in the federal test procedure. Barth uses these models to predict emissions reductions from automated highway systems (AHS). AHS are predicted to reduce emissions by a factor of two simply as a result of the platooning of fleets at closer distances, which reduces the aerodynamic drag coefficient of the vehicle.

Emissions reductions can also be expected to result from microscopic traffic flow adjustments (e.g., fewer accelerations and decelerations). **Simon Washington and Randall Guensler** address this research area in their analysis of the carbon monoxide impacts of automatic tolling operations. The authors use a modal model to estimate emissions reductions from automatic vehicle identification (AVI) in automatic tolling. By eliminating toll plaza delays, significant emissions reductions are possible since a single, sharp acceleration may cause as much emissions as a complete trip.

Washington and Guensler's model improves on previous models in its ability to explain variations in emissions for individual vehicles tested on different emissions testing cycles. The model also considers both aggressively and normally driven vehicles, and reinforces previous research on the high emissions associated with aggressive driving and dirty vehicles within the fleet. The authors are confident that some emissions reductions can be projected fairly safely from some ITS applications.

Both of the previous studies provide preliminary findings that need to be supplemented by trials with more representative fleets and research into induced demand effects, but nonetheless, they demonstrate real progress toward devising tools to accurately predict the emissions effects of ITS.

**Jin-Ru Yen, Hani Mahmassani and Robert Herman** use stated-preference data collected from employees and employers to predict the level of telecommuting adoption. They find that approximately 5.8 percent of workers (2.5 percent of total vehicle fuel use) in the city of Austin, Texas, could be expected to adopt telecommuting under a salary neutral program. They also find that while fuel savings may be meaningful, other factors such as greater productivity and time savings are more likely to influence telecommuting adoption.

Previous methods of estimating the energy impacts of telecommuting failed to consider networkwide effects. The authors' two-fluid model employed in this study "takes into account network attributes such as average speed, concentration, and directional factors." It also considers any increases in travel speed experienced by nontelecommuters using the network. Telecommuting, by reducing travel, increases system service levels. Thus, the authors suggest that energy savings may be partially offset by induced demand.

Using existing examples of radio frequency identification (RFID) technology, such as the Los Angeles International Airport curbside space and Lincoln Tunnel in New York, **Cathleen Santeiu** describes the efficiency and environmental benefits of electronic payment, real time information for commercial vehicle operations, and automatic equipment identification. Environmental benefits to be expected from RFID applications include minimization of environmental encroachment (e.g., additional paving), reduced emissions through congestion relief and smoother traffic flow, mode shift incentives, and improved safety.

While Yen, Mahmassani and Herman described some early indications of consumer acceptance of telecommuting, **Carol Zimmerman** believes that we have much to learn about consumer reaction to IVHS. Zimmerman summarizes existing research on individual travelers across four points of entry for IVHS in the travel decision-making process: 1) substitution of telecommunication alternatives, 2) demand management policies, 3) pretrip travel information, and 4) en-route travel information. Telecommunications is thought to have a persistent but modest impact, affecting a maximum of 5 percent of the work force in the near term. Demand management is facilitated by a combination of disincentives for SOV and incentives for ridesharing. Pretrip travel information is more likely to lead to route changes than to mode changes; to result in mode changes, some form of economic incentive will be required. En-route travel information appears to have market potential based on experiences with the Smartraveler in Boston and TravTek in Orlando, but reported benefits are related to time and safety and not environmental quality.

Despite these findings, IVHS may lead to substantial environmental benefits if applications are marketed to specific demographics or other characteristics of travelers.

**Cheryl Little and Jean Wooster** discuss the Volpe National Transportation Systems Center study of the status of environmental evaluations of the FHWA/IVHS operational tests. Nearly all of the tests were found to use different approaches for assessing air quality and emissions impacts. This is likely the result of federal guidance, which does not delineate precise methodologies.

The study also summarizes environmental evaluations of IVHS projects in Europe, Japan and Australia, and describes interesting developments such as new user services that communicate emissions information directly to the motorist and an attempt by the TravTek program to model latent demand impacts.

The Volpe Center is also developing a guidebook of best practices in assessing energy and environmental impacts of IVHS user services.

### Socio-Economic and Institutional Issues

Like the modeling of emissions and travel behavior, there is much work to be done in assessing the socio-economic impacts of IVHS. **Barbara Richardson** believes that considering the socio-economic impacts early in the planning process is a cost-effective strategy for both the public and private sector. The first step in considering the socio-economic impacts of IVHS is to locate the transportation system in the context of larger social systems. Richardson uses census demographic forecasts, symposia on the

likely critical issues of traffic safety in the year 2010, and a Delphi study of the future of factors related to the automotive industry.

Key findings include the planning ramifications of an aging population, the need for enhanced cooperation across organizational boundaries, and the use of IVHS in-vehicle technology in only 3 percent to 10 percent of new cars by the year 2003, despite expected increases in standards for energy efficiency, safety and emissions.

In regard to the issue of induced demand, the stabilizing societal force of VMT ceilings is also of interest.

**Barbara Kanninen** presents an economic case for where the public sector should and should not invest in smart cars, smart roads and smart transit. Kanninen also addresses the question of induced or latent demand and, like Ostria, Lawrence and Pickrell, argues that any increase in demand should be counted as an economic benefit. While she finds research on latent demand to be scarce, Kanninen suggests that latent demand is likely to be significant in areas of previously high congestion and its impact to be location specific.

Kanninen concludes that public investment should only be directed to smart streets and smart transit, and this investment should be linked to economic disincentives to automobile use.

**Peter Roudebush and Harry Mathews** use the Boston Transportation Planning Review (BTPR) process as a springboard for envisioning a participatory, cooperative process for IVHS planning. Like Richardson, the authors see the need to locate transportation in a broader context, in their case a cultural one. Keys to success of the BTPR were an intermodal approach and the combination of "open public participation and broad interdisciplinary professional expertise."

As Hempel discusses in his paper, Roudebush and Mathews also see the need to view intermodalism as an opportunity rather than an obstacle. The opportunity is to connect transportation to multiple social, economic and environmental values, thereby creating a sustainable system. A good example of seeing opportunities where others see obstacles is to view the environmental impact statement (EIS) as an important educational experience rather than a bureaucratic impediment. Roudebush and Mathews conclude that sustainable transportation planning is influenced by our best technologies and our best human capabilities--creativity, wonder and appreciation of diversity.

**David Van Hattum and Lee Munnich** consider challenges and opportunities for public involvement in IVHS planning at the national and metropolitan level. As part of their broader research on new models for cooperation in the application of advanced transportation technologies, they identify five components of new models for cooperation in regard to public involvement: 1) aggressive stakeholder involvement, 2) public outreach and education (the authors doubt whether IVHS AMERICA can sufficiently accomplish this task), 3) coalition building both within and across public and private sectors, 4) integrating new technologies with existing projects and policies, and 5) devising built-in cost-effectiveness analysis that considers least-cost/full-cost accounting and evaluation of strategic economic investments.

**Samuel Myers and Lisa Saunders** use census data for the three case study cities used in the Humphrey Institute's IVHS and the Environment study to compare racial and income differences in travel time to work, and to consider equity ramifications of IVHS-induced changes in travel times.

Myers and Saunders reveal interesting differences among the three cities regarding relationships between race/income stratification, commute times and earnings. They also find that inner city nonwhites will benefit slightly from across the board travel time reductions despite their isolation from good paying jobs. Furthermore, although they found that transportation may not be particularly effective in reducing racial earning inequality, Myers and Saunders believe that "transportation project development, finance and operation can and should be undertaken in a distribution-conscious way."

The final two papers address particular institutional concerns: the connection between IVHS and transportation demand management (TDM) activities, and between IVHS and ISTEA's five management areas.

**Philip Winters and Amy Polk** raise concerns about the lack of knowledge of and interest in IVHS among professionals in the TDM field. One might expect these sectors to be natural partners. The authors find, however, that TDM professionals, particularly those with government agencies, are skeptical about technology-based strategies.

Winters and Polk believe that IVHS practitioners could better market IVHS by reaching out to TDM professionals and learning from their rich experience in developing a customer orientation, their attempts to clearly define project benefits, and their timely information on travel behavior.

**Lane Swauger** argues for a stronger connection between IVHS and the five ISTEA management systems. For IVHS to accomplish its goals in the context of the ISTEA management systems, attention needs to be focused on human resource development, institutional frameworks, and connecting an integrated management system architecture with the national IVHS architecture.

IVHS, along with GIS, can play a critical role in monitoring and evaluating the performance of overall systems at different levels and in internal communications.

## Papers Selected for ITS Conference

### New Strategies and Technologies

Intelligent Transportation Systems for Sustainable Communities. Michael Replogle.

Intelligent and Environmentally-Sensible Transportation System: An Alternative Vision. Daniel Sperling, Michael Replogle.

The Greening of IVHS: Integrating the Goals of Air Quality, Energy Conservation, Mobility and Access in Intelligent Transportation Policy. Lamont C. Hempel.

A Least Cost Approach to Compare IVHS, Land Use, Management and Multi-Modal Infrastructure Alternatives. Patrick DeCorla-Souza.

High Technology Transportation and the Information Highway: A Global Market Strategy for the United States. Ellen Williams.

ATHENA, An Advanced Public Transportation / Public Information System. Robert W. Behnke.

Intelligent Transit Information Systems. Sally J. Spadaro.

Intelligent Vehicle-Highway Systems & Bicycling. Allen Greenberg.

### Energy and Environmental Impacts

How Responsive Multimodal Transportation Management Linked to IVHS Can Improve Environmental Quality. Salvatore J. Bellomo, P.E., Andrew Sullivan.

Capacity-Induced Increases in the Quantity of Travel with Special Reference to IVHS. Sergio J. Ostria, Michael F. Lawrence, Don H. Pickrell.

Evaluating the Impact of IVHS Technologies on Vehicle Emissions Using a Modal Emission Model. Matthew J. Barth.

Carbon Monoxide Impacts of Automatic Vehicle Tolling Operations. Simon Washington, Randall Guensler.

Energy Consumption Implications of Telecommuting Adoption. Jin-Ru Yen, Hani S. Mahmassani, Robert Herman.

Near-Term RFID Applications in Transportation Systems. Cathleen J. Santeiu.

User Acceptance of IVHS: An Unknown in the Environmental Equation. Carol A. Zimmerman, Ph.D.

IVHS and Environmental Impacts: Implications of the Operational Tests. Cheryl Little, Jean Wooster.

**Socio-Economic and Institutional Issues**

Socio-Economic Issues and Intelligent Transportation Systems. Barbara C. Richardson.

Intelligent Vehicle/Highway Systems (IVHS): Economics and Environmental Policy. Barbara J. Kanninen.

Intelligent Transportation Systems: Building Consent for Post-Cold-War Transportation Initiatives. Peter Roudebush and Harry Mathews.

IVHS and Public Participation: Challenges, Opportunities and New Models for Cooperation. David Van Hattum, Lee W. Munnich, Jr.

Transportation Demand Management and Intelligent Vehicle Highway Systems: The Need for Mutual Cooperation. Philip Winters, Amy Polk.

Tracking the Future: Integrating IVHS Technologies with the ISTEA Management Systems. Lane W. Swauger.

IVHS: Potential Impact on Disadvantaged Communities. Samuel L. Myers, Jr., Lisa Saunders.

# CASE STUDY REPORTS

# List of Acronyms Used in the Case Studies

**IVHS** **Intelligent Vehicle Highway Systems**

| | |
|---|---|
| APTS | Advance Public Transportation Systems |
| ATIS | Advanced Traveler Information Systems |
| ATMS | Advanced Traffic Management Systems |
| AVCS | Advanced Vehicle Control Systems |
| AVI | Automatic Vehicle Identification |
| AVL | Automatic Vehicle Location |
| CVO | Commercial Vehicle Operations |
| HOV | High Occupancy Vehicle |
| ITS | Intelligent Transportation Systems |
| MOV | Multiple Occupancy Vehicle |
| SOV | Single Occupancy Vehicle |
| WIM | Weigh In Motion |

**ISTEA** **Intermodal Surface Transportation Efficiency Act of 1991**

| | |
|---|---|
| CMAQ | Congestion Mitigation and Air Quality |
| DOT | Department of Transportation |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| LRTP | Long Range Transportation Plan |
| MPO | Metropolitan Planning Organization |
| NHS | National Highway System |
| NPTS | National Personal Travel Survey |
| STP | Surface Transportation Program |
| TCM | Transportation Control Measures |
| TDM | Transportation Demand Measures |
| TIP | Transportation Improvement Program |
| TSM | Transportation System Management |
| VMT | Vehicle Miles Traveled |

**CAAA** **Clean Air Act Amendments of 1990**

| | |
|---|---|
| **CO** | Carbon Monoxide |
| **$CO_2$** | Carbon Dioxide |
| ECO | Employee Commute Options |
| EIS | Environmental Impact Statement |
| EPA | Environmental Protection Agency |
| HC | Hydrocarbons |
| I&M | Inspection and Maintenance |
| NAAQS | National Ambient Air Quality Standards |
| NOx | Oxide of Nitrogen |
| PM | Particulate Matter |
| SIP | State Implementation Plan |
| VOC | Volatile Organic Compound |

**OTHER**

| | |
|---|---|
| CBD | Central Business District |
| GIS | Geographical Information System |
| LRT | Light Rail Transit |

**PORTLAND**

| | |
|---|---|
| FOCC | Flexible Operation Command and Control |
| HCT | High Capacity Transit |
| JPACT | Joint Policy Advisory Committee on Transportation |
| LCDC | Land Conservation and Development Commission |
| LUTRAQ | Land Use, Transportation and Air Quality |
| MAX | Metropolitan Area Express |
| ODEQ | Oregon Department of Environmental Quality |
| ODOT | Oregon Department of Transportation |
| TOD | Transit Oriented Development |
| UGB | Urban Growth Boundary |

**HOUSTON**

| | |
|---|---|
| ARCS | Advanced Radio Communications System |
| CART | Citizens Advocating Responsible Transportation |
| CTMS | Computerized Transportation Management System |
| FTM | Freeway Traffic Management |
| GHASP | Galveston/Houston Association for Smog Prevention |
| HGAC | Houston-Galveston Area Council |
| HITS | Houston Intelligent Transportation System |
| METRO | Metropolitan Transit Authority of Harris County |
| RCTSS | Regional Computerized Traffic Signal System |
| SC&C | Surveillance, Communications and Control |
| TAC | Technical Advisory Council |
| TBC | Texas Bicycle Coalition |
| TEMC | Transportation and Emergency Management Center |
| TNRCC | Texas Natural Resource Conservation Commission |
| TPC | Transportation Policy Council |
| TxDOT | Texas Department of Transportation |

**TWIN CITIES**

| | |
|---|---|
| CEE | Center for Energy and Environment |
| CTS | Center for Transportation Studies |
| DARTS | Dakota Area Resources and Transportation Services |
| DMTMO | Downtown Minneapolis Transportation Management Organization |
| ED1 | Electronic Data Interchange |
| F&PC | Funding and Programming Committee |

| | |
|---|---|
| GPS | Global Positioning System |
| ICTM | Integrated Corridor Traffic Management |
| ILSR | Institute for Local Self-Reliance |
| ITMS | Integrated Traffic Management Systems |
| LIDAR | Light Detection and Ranging |
| MAC | Metropolitan Airports Commission |
| MCTO | Metropolitan Council Transit Operations |
| MnDOT | Minnesota Department of Transportation |
| MPCA | Minnesota Pollution Control Agency |
| MTC | Metropolitan Transit Commission |
| MUSA | Metropolitan Urban Service Area |
| NTN | Neighborhood Transportation Network |
| PCD | Personal Communications Device |
| PDA | Personal Digital Assistant |
| RFPP | Request for Preliminary Proposal |
| RTB | Regional Transit Board |
| TAB | Transportation Advisory Board |
| TAC | Technical Advisory Committee |
| TAD | Third Avenue Distributor Traffic Management Project |
| TMC | Traffic Management Center |
| UEEC | Urban Environment Education Coalition |

# Case Study of Portland, Oregon

The information in this summary was compiled by State and Local Policy Program staff. We would like to thank those we interviewed and those who participated in the Humphrey Institute's consultation on October 27, 1993, in Portland and the Case Study Conference in December 1993 in Minneapolis for their assistance.

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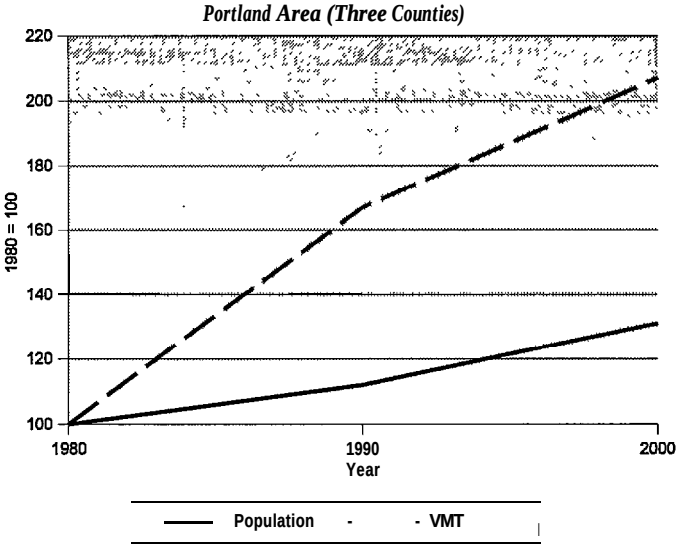
# Profile of the Portland Area

## Demographics

According to data from the U.S. Bureau of the Census, Portland was the thirtieth largest city in the nation in 1990. The Portland metropolitan area was home to 1.47 million people, 437,319 of whom resided within the city limits. Between 1980 and 1990, the metropolitan area grew by 13.9 percent, the least of the three cities studied. In the past several years, however, Portland has experienced accelerated population growth and this trend is projected to continue at the rate of 1.6 percent per year.' The anticipated population growth of the inner three counties of Portland is estimated at 500,000 over the next twenty years,' or 3 percent per year. Portland's Federal Aid Urbanized lnad area covers 416 square miles.[3]

**Figure 1**

**Population and VMT. Growth Rates, 1980-2000**




***Sources: Pop: ODOT;*** VMT ***ODEQ, (2000 projections: Pop. @ 1.6% ann. Rate, VMT 2.2% ann. rate***

A facts booklet published by the Portland Development Commission in June 1994 shows that there are 919,000 people in the Portland metropolitan area labor force. This economic area is made up of six counties: Clackamas, Columbia, Multnomah, Washington and Yamhill Counties in Oregon and Clark County in Washington. The leading sectors of the economy based on level of employment are services and miscellaneous (26.6 percent), wholesale and retail (24.9 percent), manufacturing (16.0 percent), government (14.0 percent), finance, insurance and real estate (8.3 percent), transportation, communications and utilities (5.6 percent), and construction and mining (4.5 percent). Durable goods and lumber and wood products are key elements in the manufacturing sector.

## Land Use

The state of Oregon is unique in its approach to land use and growth management. In 1973, the state adopted the Urban Growth Boundary (UGB), which separates urban and rural land uses. The UGB was drawn to accommodate twenty-year urban growth needs. The Oregon Land Conservation and Development Commission (LCDC) administers and periodically revises the UGB lines. In 1992, the LCDC adopted Chapter 660, Division 12 of the Oregon Administrative Rules, commonly referred to as the Transportation Planning Rule, or "Rule 12." Rule 12 calls for coordination and conformity of local transportation plans to state plans and specifically requires a 10 percent reduction in vehicle miles traveled (VMT) per capita over the next twenty years, and a 20 percent reduction in VMT per capita over the next thirty years.[4] Portland Metro, the nation's only directly elected regional government, together with the Joint Policy Advisory Committee Transportation (JPACT), serves as the metropolitan planning organization (MPO). Metro is now evaluating land use allocations as a potential means of meeting the goals set forth by Rule 12.

Rule 12 is one of nineteen rules that make up Oregon's land use program. Rule 10, the Metropolitan Housing Rule, has acted to ensure affordable housing within the UGB.[5] Rule 10 deviates from traditional "exclusionary zoning" by mandating that certain minimum densities be allowed in the city of Portland and its suburbs.[6] By encouraging the creation of smaller lots, houses in the Portland area have remained affordable relative to other metropolitan areas in the western United States.[7]

## Existing Transportation Systems

**Highway System.** Portland is situated along the banks of the Willamette River and is a major port city, the twenty-first in size nationally, shipping over thirty million tons to domestic and international destinations. Its transportation system links the port to major interstate highways running north to Seattle and beyond to British Columbia, south to California along I-5 and to the east along I-84.

According to 1990 U.S. Department of Transportation figures, Portland's system of 4,514 highway miles accommodated 22,416,000 VMT per day. This system consisted of 128 miles of freeways with 625 lane miles that handled 8,879 vehicle miles per day (or about 40 percent of the total). This works out to 14,206 vehicles per freeway lane per day, or 22.7 vehicles per mile of freeway lane per day. VMT is projected to grow by 2.2 percent per year in the Portland metropolitan area. USDOT also estimated that Portland's metropolitan population density in 1990 was 2,875 people per square mile with 3.7 miles of highway for every one thousand people.

Over the past decade, both VMT and single occupancy vehicle (SOV) trips have risen four times faster than Portland's population growth.[8] Metro's transportation models estimate that 70 percent of automobile trips are nonwork related. Transportation policy makers and planners in the region and the LCDC believe this number can be reduced with land use planning that would increase urban densities, allow mixed use developments, and accommodate alternative modes (pedestrian and bicycles).

There have not been significant expansions in the highway system in Portland over the past twenty years. In the mid-1980s, Portland tried making one existing lane in each direction on I-84 a high occupancy vehicle (HOV) lane. However, the Portland driving population did not like this change--as evidenced by the high violation rate--and the effort was abandoned. Subsequently, the Oregon Department of Transportation (ODOT), Metro and the city of Portland have emphasized transit, including light rail, as the primary solution to congestion.[9] Since the I-84 failure, the Federal Highway Administration has pressured Portland and ODOT to add HOV lanes when new highway lanes are added. Portland and ODOT, however, have resisted the option."

Proposed construction of a limited access, circumferential highway skirting the southwest quadrant of the metropolitan area (the Western Bypass) is among the most prominent transportation issues in the Portland area. The proposed route of the highway runs through agricultural land, outside of Portland's UGB." Environmentalists and others are concerned that inadequate access control of the facility will stimulate leapfrog development in rural portions of Washington County, thereby frustrating regional efforts to control expansion of the urban area. A lawsuit against the project led an environmental interest group, 1000 Friends of Oregon, to commission a study that was called Making the Land Use, Transportation, Air Quality Connection (LUTRAQ). This study models the impacts of a no-build scenario that enhances transit, transit oriented development, and bicycle and pedestrian ways. ODOT is now including a land use program as an alternative to the bypass in its current environmental impact statement (EIS) for the project.[12]

The basic thrust of LUTRAQ is to increase residential densities and livability and to influence the location of work and shopping centers within the city by encouraging transit oriented development (TOD). LUTRAQ's modeling work was directly responsible for Metro's allocation of $1 million in Congestion Mitigation and Air Quality (CMAQ) funds under the Intermodal Surface Transportation Efficiency Act (ISTEA) to the Oregon Department of Environmental Quality (ODEQ) to develop several TOD demonstration projects to stimulate public and developer interest in these design ideas.[13]

**Transit System.** Compared to many U.S. cities, Portland has achieved a number of significant advances in the development of its transit system. As part of its 1972 downtown plan, a $16 million transit mall consisting of two exclusive bus lanes over eleven blocks in downtown Portland was developed with an 80-to-20 percent ratio federal-local partnership. The Banfield Transitway--the first joint highway-transit project in the United States combining light rail and freeway (I-84) along the same corridor--was begun in 1982 and completed in 1986 for $214 million with a federal-local 83-to-17 percent match. The federal funds had been set aside to build a new highway to the east, but were used to develop the light rail instead.

The Tri-County Transportation District of Oregon (Tri-Met) operates the Metropolitan Area Express (MAX) light rail line. Currently, MAX extends fifteen and a half miles from downtown Portland to Gresham, an eastern suburb. Government leaders and transportation planners in the region have attempted to spread transit infrastructure investment among all three counties.[14] Multnomah County was first, receiving the Gresham MAX line after plans to build the Mount Hood freeway were scrapped. The freeway would have run east toward Mount Hood, along a slightly different route from MAX. Its path would have run straight through Ladd's Addition, a southeast

neighborhood near downtown rated "most liveable" by Portland residents in 1993. Construction of a second western light rail route (Westside) is just beginning and is scheduled for completion in 1997.[15] Environmentalists are concerned that this western extension could lose substantial ridership if the Western Bypass highway is built.[16]

The region is involved in the planning stage of a $2.3 billion north-south high capacity transit (HCT) line. The mode has not yet been decided. Light rail transit (LRT), busways, commuter rail and river transit are all being considered in a $10 million planning effort. A process of broad public involvement is being implemented, and a decision was made to proceed on the north-south lane.

Rail transportation on the MAX light rail line accounts for 113,000 passenger miles per day." Tri-Met reports transit ridership has more than doubled in the past twenty years-- up 188 percent. As of 1992, Tri-Met carries 37 percent of all work trips to downtown Portland and 4 percent of all daily trips in the region. Tri-Met provides 194,900 boardings per day, using 556 buses and 26 light rail vehicles." Thirty-one percent of Portland area residents use Tri-Met at least twice per month.[19]

The Gresham MAX line carries approximately 20,000 riders per day.20 Tri-Met forecasts 19,000 riders per day for the Westside MAX line when it opens in 1997 and 26,000 riders per day by 2005. [21]

**Environmental Quality**

Portland has made significant progress in addressing mobile as well as point source emissions during the last twenty years. In the early 1970s, one out of every three days exceeded National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO) and maximum ozone levels were about twice the NAAQS. Figures 2, 3 and 4 show the emissions inventories for CO in 1986, nitrogen oxide (NOx) in 1987 and volatile organic compounds (VOCs) in 1986. Estimates of contributors to Portland's ozone pollution as of 1993 include: point sources (industry) 5-10 percent and road vehicles (cars and small trucks) 50 percent.**

**Figure 2: CO Emissions Inventory**

***Portland Area - 1986***

**On-Road (75.0%)**

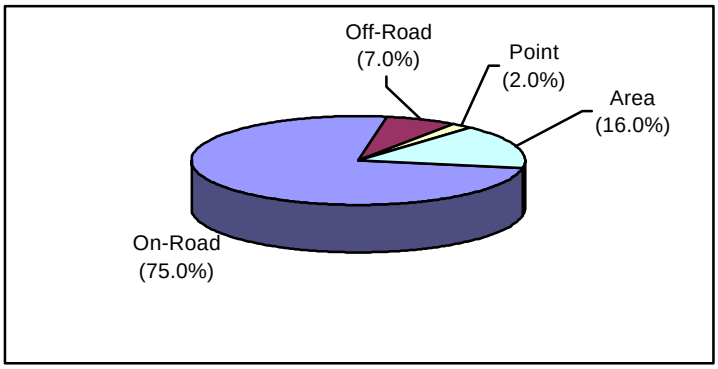
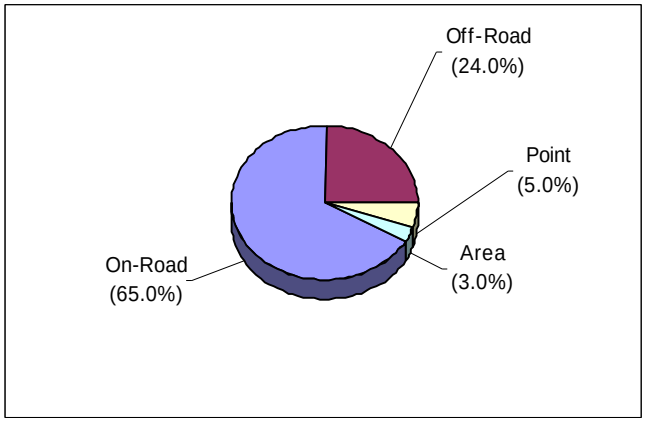


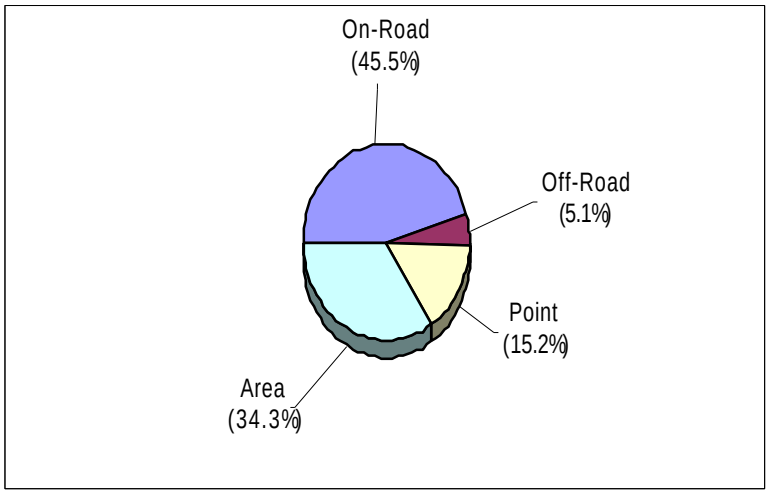
**Figure 3: NOx Emissions Inventory**

***Portland Area – 1987***




Portland is currently classified as in Marginal nonattainment for ozone and in moderate nonattainment for CO. For the last three years, Portland has had no violations of U.S. ozone standards partly due to "abnormal" summers. The summer of 1992 was a drought, leading to water restrictions and consequently less use of gasoline-powered lawn mowers, and the summer of 1993 was cool, making conditions less favorable for ozone creation.[23] Portland also has not violated U.S. CO standards, formerly a severe problem for the downtown area, for more than three years.[24]

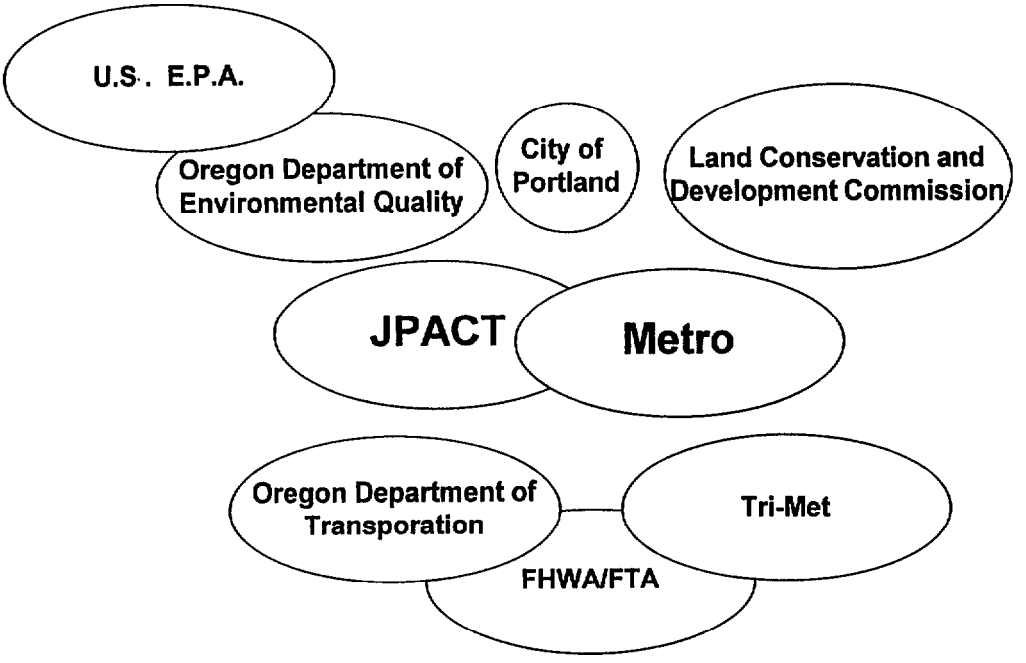
Applications for reclassification to achieve CO and ozone attainment status are being developed by ODEQ. The application includes demonstration of past attainment and a plan for maintaining attainment in the future.[25] Ozone emissions from on-road vehicles have been reduced from 75 percent to 50 percent during the past eight years. Major factors contributing to these improvements include point source remediation efforts, fleet turnover, reduced auto commuting to the central business district by increasing transit ridership, and implementing a parking control strategy.




## Government

Metro and JPACT jointly serve as the Portland area MPO, encompassing the urban portions of Washington, Multnomah and Clackamas counties in a complex relationship. Transportation plans require the approval of both entities and a process exits to resolve disagreements between Metro and JPACT.

## Interagency Configuration




JPACT, representing general purpose governments in the metropolitan region, is composed of representatives from each of the three counties, the city of Portland, a roving member from other cities in the metropolitan area, and a representative from Metro. Metro, a special purpose agency, is the only directly elected regional government in the U.S. It is governed by thirteen elected councilors and an elected executive officer who govern transportation and land use planning, waste disposal, parks, and regional tourist and convention facilities. The state legislature maintains veto, override and other powers.

This structure is changing, however. Metro voters approved a "Home Rule Charter" for Metro in 1992, providing power to levy some taxes, and making Metro the institution charged with growth management. The charter reduced the number of councilors (all of whom are directly elected) from thirteen to seven by 1995.

At the state level, numerous agencies work together to achieve goals set forth by the state's legislative and administrative branches. In addition to federal rules for conformity among State Implementation Plans (SIPs), Transportation Improvement Programs (TIPS) and twenty-year transportation plans, Oregon requires conformity of local transportation and land use plans to the state's transportation plan through the Transportation Planning Rule (Rule 12). ODEQ has recently been authorized by the state legislature to promulgate and enforce parking ratio limitations on new construction within the Portland metropolitan area.

## IVHS Technology In Place or Planned

Portland has not yet invested heavily in IVHS technologies. The major IVHS technologies in use or being considered include applications that come under the FHWA Travel and Traffic Management, Public Transportation Management, Electronic Payment Services and Commercial Vehicle Operations bundles. These existing and proposed IVHS user services are described below.

### Travel and Traffic Management

Travel and traffic management are seen as a way to stay ahead of Portland's anticipated growth in population and VMT.[26] Portland has historically had minimal problems with congestion, but congestion is on the rise and the city is experiencing congestion problems common in other major metropolitan areas.[27] A major cause of congestion is incident related. Incidents account for as much as 65 percent of congestion and approximately 20 percent of incidents are secondary accidents.*' Portland is considering advanced traffic management systems such as ramp metering for demand management, incident management and arterial improvement. The area's first ramp meters were installed in 1981. Current plans call for fully integrated meters on all freeways in Portland."

**Signal Preempts on MAX Trains.** This project allows MAX trains to preempt traffic signals when traveling city streets.[30]

**Signal Preempts on Buses.** This demonstration project, which will allow buses to preempt signals, is underway.[31]

**IVHS Early Deployment Study.** ODOT received an IVHS Early Deployment grant from the FHWA to commission a study of signal systems and detection, corridor assessments and incident management. **The study led** to a primer on an advanced traffic management system (ATMS) for the region.[32] The study also considered how to create and coordinate incident response teams in the Portland area and a range of other institutional issues.

### Public Transportation Management

**Transit Mall TVs and Kiosks.** Portland presently has TV screens that display bus information at stations on the downtown transit mall. Eight kiosks, soon to be installed, will offer interactive trip planning information. Maps of Portland and key commercial and tourist sites, transit schedules and ticket purchase information will be available. The TV screens are equipped with a changeable message scroll that could provide information about such things as major delays.

**Automatic Vehicle Location (AVL) System.** Tri-Met is testing a fleetwide AVL system in order to provide better service, reliability and safety, using global positioning technology. This is the precursor to a real time en-route travel information and public transportation management system.

**Portland Smart Bus.** The Portland Smart Bus is a Tri-Met project funded by the FTA. The project is designed to review the technical feasibility and cost-effectiveness of a flexible operation command and control (FOCC) transit system that integrates fixed route transit, dial-a-ride minibuses, and contract taxi service in Portland's growing suburbs. A second objective is to design an operational test for those components if an FOCC system is found suitable. The project's final report suggests that a demonstration be conducted in a low-density suburban area and be supplemented with a congestion pricing system.

### Electronic Payment Services

**Congestion Pricing Pilot Project.** Metro is seeking an FHWA grant for this project, which would develop new models to measure potential demand and test willingness to pay for use of roads with congestion pricing, trip reduction, and paratransit projects in order to determine the most efficient strategy. Electronic tolling, which would address privacy concerns through the use of debit cards, is envisioned. One barrier to testing congestion pricing is that Portland does not have authority to collect tolls.[33] Such authority was sought but not passed in the last legislative session and will be considered next session. Congestion pricing is listed in Portland's contingency plan for air quality attainment required by the Clean Air Act Amendments (CAAA).

### Commercial Vehicle Operations

The testing and deployment of commercial vehicle technologies by the state of Oregon has been a major component of IVHS technologies impacting the Portland area. In the mid-1980s, Oregon began testing technologies designed to improve the operation and regulation of commercial vehicles. In July 1993, Oregon adopted a strategic plan for IVHS/CVO. Goals of the plan are reduced traffic delays, safety enhancement, better enforcement in restricting overloaded trucks and catching those attempting to avoid paying taxes. These goals are to be accomplished by private and public sector investment in IVHS. Private industry has begun to invest in AVL technologies that promote speedier pickup and delivery, fuel-efficient routing and incident response.

**HELP (Heavy Vehicle Electronic License Plate) Crescent.** HELP Crescent is a demonstration project involving states from Washington to Texas that allows for mainline pre-clearance of trucks. Mainline pre-clearance refers to the ability to weigh and check trucks for proper safety inspections and other credentials without their stopping at weigh stations or ports of entry. Weigh-in-motion and automatic vehicle identification (AVI) are the enabling IVHS technologies for this system. It is believed that these systems will improve operating efficiency and promote environmental goals because the stopping and starting of trucks, which contribute a disproportionate share of emissions, are reduced. Oregon is presently operating three facilities for mainline pre-clearance in the HELP Crescent project.

The short-term impact of the HELP Crescent project on Portland's air quality is thought to be minimal, but there are some possible positive impacts. For instance, by improving the operating efficiency of the overall transportation system, additional public resources are freed up for urban goods movement issues. Also, the existence of an advanced CVO

system encourages additional private investment in technologies for AVI, which should have advantages in present and future urban transportation systems.

## IVHS Technologies In Use or Being Planned in Portland

| Name of Project | Project Status | Technology Bundle | User Service |
|---|---|---|---|
| **Signal Preempts on MAX Trains** | **Implemented** on 30 miles of LRT right of way. | Travel and Traffic Management | Travel Demand Management |
| **Signal Preempts on Buses** | Demonstration project. | Travel and Traffic Management | Travel Demand Management |
| **IVHS Early Deployment Study** | Completed October 1993. | Travel and Traffic Management | Traffic Control<br><br>Incident Management |
| **Transit Mall TVs and Kiosks** | In implementation phase. | Public Transportation Management | En-Route Transit Information |
| **Automatic Vehicle Location (AVL) System** | In test phase. | Public Transportation Management | Public Transportation Management |
| **Portland Smart Bus** | Technical feasibility review in process. | Public Transportation Management | Personalized Public Transit |
| **Congestion Pricing Pilot Project** | Applied for federal program grant. | Electronic Payment Services | Electronic Payment Services |
| **HELP Crescent** | In implementation phase. | Commercial Vehicle Operations | Commercial Vehicle Electronic Clearance<br><br>Commercial Vehicle Administrative Processes |

## Environmental Issues and Organizations

### Issues

Environmental considerations are present in nearly every major transportation policy in Portland. However, this does not mean that transportation and environmental interests are in agreement with one another and with all transportation policies. Some of the most prominent issues are presented below.

**Downtown Parking Lid.** An element of Portland's improved air quality has been the downtown parking lid, which was instituted in the mid 1970s. This lid, or limitation, allocates a maximum number of parking spaces allowable in the central business district. Interestingly, the lid has never been reached and is likely to be lifted in the near future in favor of a system of parking ratios (a maximum number of spaces per thousand square feet of commercial office and retail space) throughout the metro area within the UGB. Advocates of this alternative believe that these ratios should make parking rates in downtown Portland more equivalent to those in the suburbs.

When the cap was implemented in the 1970s, 90 percent of the multitenant businesses in Portland were located in the central business district.[34] By 1993, however, this rate had fallen to 50 percent.[35] Parking in suburban Portland is currently not limited and usually is free. It is also believed that while the parking lid served its purpose in successfully reducing CO concentrations in the downtown area, it may now be counterproductive.

**Recommendations of the Governor's Task Force on Motor Vehicle Emissions.** Despite marked improvements in air quality, Portland will need to achieve a reduction in hydrocarbon emissions of approximately 36 percent and a 20 percent reduction in NOx emissions from motor vehicles to stay in attainment over the next ten to twenty years.[36] In 1992, the governor appointed a task force on motor vehicle emissions to make recommendations to the legislature on achieving continued improvement of air quality.[37] These recommendations will also provide the basis for an air quality maintenance plan required by the CAAA if Portland is to be reclassified from nonattainment to attainment.

One of the recommendations was to achieve a 5 percent reduction in per capita VMT through a vehicle emission fee based on emissions and mileage driven. The fee would have averaged $50.00 in 1994 and increased to an average of $200.00 by 2000. The revenue would have partially funded Portland's LRT network. However, the legislature replaced this with a doubling of the proposed employee trip reduction requirements and a requirement for maximum parking ratios (parking spaces to newly constructed commercial and office square footage) in the entire Portland urbanized area to be enforced by ODEQ. The governor's task force also supported increased incident management programs, which are a natural area for IVHS application. An analysis is currently underway by ODEQ, but it has not yet been determined whether the legislature's proposed measures will meet emission reduction goals.[38]

Consideration of new emission control strategies has been met with opposition by the industry sector. Industry representatives feel that their sector has received a disproportionate burden in relation to their contribution to the air quality problem. Pointing to

policies such as offsets, the Tri-Met payroll tax, the parking lid, and mandated employee commute programs, industry representatives contend that any additional regulations should be imposed on private motorists. Motorists, however, have shouldered a significant burden to date. Pollution control equipment on cars, inspection and maintenance programs, oxygenated fuel requirements and vapor recovery nozzles have all led to increased operating costs for private motorists. Any future emission control strategy will have to consider the impact on both sectors. It is likely that this issue will become highly politicized given the concern over both jobs and personal attachment to driving.

**Carbon Dioxide ($CO_2$) Reduction.** $CO_2$ is the primary greenhouse gas thought to cause global warming. In addition to air quality concerns, CO, emissions from autos are an important environmental concern. In Portland, cars and trucks contribute approximately 70 percent of total CO, emissions.

**On November 10, 1993,** the Portland City Council passed a resolution to implement a citywide $CO_2$ reduction strategy policy. Included in this policy are several goals: reducing metropolitan VMT per capita by 10 percent by 2010 (five years ahead of the schedule under the state transportation rule); achieving a 10 percent bicycle modal share by 2012; optimizing traffic signal timing on all heavily traveled city streets and major county roads; establishing areawide, multijurisdictional incident management teams; and utilizing ATMS for both incident response and traveler information for congestion avoidance.[39]

This strategy will require cooperation between several transportation related agencies, such as Tri-Met, Metro, ODOT, ODEQ, 1000 Friends of Oregon and other environmental organizations, as well as local utilities, businesses, and citizens.

**Metro's 2040 Regional Plan.** Metro is finalizing the Region 2040 Plan, which will guide the growth in Portland over the next fifty years. If current growth patterns continue, the current UGB will accommodate only half of the projected population growth. In the 2040 plan, Metro will evaluate the degree to which the UGB may be expanded, and the degree to which new housing and density should be added in existing neighborhoods.

Metro has developed three distinct development alternatives as a framework for the plan. The plan will be a combination of the best elements of all three of these concepts. The first concept calls for expanding the UGB to accommodate the new growth, and providing additional transportation capacity through three new highways and a high capacity transit system radiating out from Portland.

The second concept retains the existing UGB by creating more compact development inside. This concept supports transit oriented developments, walking and biking. Rather than building new freeways, the concept emphasizes expansion of the transit system and improvements to existing streets. In addition, the concept provides public open space to complement the compact development pattern.

The third concept calls for about one-third of the growth to occur in currently existing, but expanded, "satellite" cities located outside the UGB. Similar to the first concept, this concept includes the three new freeways and a large transit system, but also provides for broad, stringently enforced "greenbelts" between the Metro UGB and the satellite cities.[40]

### Environmental Interest Organizations

While many Portland organizations, including neighborhood groups, actively participate in public forums, the following groups have been primarily responsible for the strong environmental presence in Portland's transportation planning.

**Oregon Environmental Council (OEC).** This nongovernmental organization is actively involved in Portland's transportation planning process. The group actively participated in the 1994-1996 TIP approval process to ensure that the plan conformed with the constraints of ISTEA and the CAAA as these laws pertain to nonattainment areas.

As for IVHS, OEC believes that technologies that get people out of their cars should receive priority. They feel that IVHS should be included in the formal MPO planning process as directed by ISTEA. However, since most environmental groups do not have adequate resources for the data collection required to fully participate in the process, OEC advocates that MPOs undertake the data collection, thereby allowing environmental groups to participate equally in analyzing and evaluating proposals.[41]

**1000 Friends of Oregon.** Founded in 1975, l000 Friends advocates sound land use planning, focusing on conserving farm and forest lands, protecting natural resources, and promoting compact and livable cities.

As a response to the Western Bypass proposal, 1000 Friends began a national demonstration project called Making the Land Use, Transportation, Air Quality Connection, or LUTRAQ. "The primary thrust of this [multiyear] project was to determine whether an alternative growth scenario that would help promote alternative transportation could be achieved, and if so, what benefits could be gained from such an alternative."[42] With the assistance of several public and private grants, 1000 Friends contracted with a number of major national consulting firms to develop LUTRAQ. In addition to development of the theoretical parameters for LUTRAQ, the concept is included as an alternative in the alternatives analysis for the Western Bypass freeway.

**Sensible Transportation Options for People (STOP).** STOP began as grassroots opposition to the Western Bypass in early 1989. Since then, this group has developed its grassroots network in support of the LUTRAQ alternative. They advocate mixed-use, transit-friendly developments that conform with the LUTRAQ model.

## Portland Key Findings

1) Portland has an integrated, long-term view of transportation and environmental goals and plans.

Portland has created a number of models to integrate its growth management and transportation policies through state and local governmental agencies. Models of cooperation are found in the state's establishment of a UGB for Portland and through the state's Transportation Planning Rule (Rule 12), which requires conformity of state and local transportation plans toward reduction of VMT per capita. The transportation planning

rule is leading to changes in city and county planning codes to better accommodate travel by transit, bicycling and walking.

Integration and involvement of a variety of state and local transportation, land use and environmental agencies and private sector interests, are found in the programs initiated as a result of the 1993 Governor's Task Force on Motor Vehicle Emissions. One of these programs authorizes ODEQ to evaluate, establish and enforce parking ratios (a maximum number of spaces per thousand square feet of new commercial real estate developed) within the UGB.

2) Portland has achieved significant environmental (air quality) improvement and transportation (mobility) goals through cooperation, creativity and flexibility of local, state and federal resources.

Examples of Portland's success in achieving its environmental and transportation goals include the development and construction of the MAX light rail system, the creative use of CMAQ funds by ODEQ to partially fund the construction of transit oriented designs to demonstrate their viability to developers, and the continued reliance on the potential of parking ratios to serve as a transportation control measure.

3) Portland expects to achieve continued environmental improvements primarily through land use planning, transit, pedestrian and bicycle facilities, parking management, transit-oriented development and other behavior-oriented measures, with limited reliance on IVHS applications.

Application of the fundamental elements of ATMS technology (e.g., ramp meters, signal coordinations, incident response) has been embraced in selected areas. The regional transit authority has adopted more advanced IVHS technologies such as geo-positioning, traveler information systems, and signal override capability on buses. Applications of highway-oriented IVHS technologies are being considered for congestion pricing, vehicle emissions regulation, and improved access and operation in the congested downtown core. These applications are designed to support land use planning and transit operations on urban arterials and to discourage reliance on SOV travel.

Non-IVHS programs have also been effective. Portland's environmental community and transit advocates have successfully supported alternatives to highway expansion. The most notable example is the LUTRAQ concept, which is one of the alternatives being reviewed as a part of the EIS for the proposed Western Bypass highway. Portland's citizens are supportive of transit, as evidenced by voter approval of property tax surcharges to pay for expansion of the MAX system at a time of waning fiscal support for government services in Oregon. In addition, a recent survey concluded that Portland residents would not oppose congestion pricing and vehicle emission fees in the region if the proposed revenue was earmarked to support transit.

## Models for Cooperation

Unique cooperation between planners, highway officials and environmentalists has a long history in Portland. The state land use plan required cooperation and encouraged policy makers to talk to one another. At the same time, Metro was given more authority for regional planning and Tri-Met, previously a private operation, became a public entity. Later, when a voter referendum elected that federal highway funds be directed to transit, a cooperative arrangement for determining how to spend these funds was needed. Oregon's constitution prohibits the expenditure of state or locally imposed vehicle-related fees or taxes for anything but purposes that benefit motorists or publicly owned roads.

**LUTRAQ.** LUTRAQ represents a cooperative response to controversy over the proposed Western Bypass that raised transportation and environmental issues. While this began as a law suit by a citizens group against the state and local agencies to stop highway construction, LUTRAQ is now seen as "key" to relieving pressure on the UGB and achieving Rule 12.[43] Bypass supporters claim that ODOT can still achieve these goals "systemwide" and build the bypass.[44] They cite, as examples, other controlled access highways in the region outside the UGB that have contained development. Environmental interests now sit face-to-face in evaluating the impacts of land use and transportation plans in the region.

**Region 2040 Plan.** Metro is developing a fifty-year Region 2040 strategic plan. The first objective will be setting a land use policy. Everything else, including IVHS investment, will be planned to fit the land use policy.

Under ISTEA, TIPS must be financially constrained. Since ODOT was unsuccessful in getting a gas tax increase passed, it is now in the process of determining how to reduce $400 million of planned expenditures from the state TIP. The Oregon Transportation Commission has given preliminary guidance to ODOT and the MPOs for making such cuts. The main criteria for retaining projects in the construction program are projects that emphasize preservation and maintenance of the existing system or safety. Regional equity in funding highways has been included in the past, and equity between highways and alternate modes will be considered in the next program update. In this round of programming, policy makers have shifted $34 million from highways to alternative modes in the Portland area, in addition to cutting $136 million from highway construction funding.

**Governor's Task Force on Motor Vehicle Emissions.** This is another example of a cooperative approach to transportation planning. The task force comprised representatives from a variety of public, private and nonprofit organizations. While some suggest that the level of cooperation deteriorated during the legislative session, six of the seven recommendations were endorsed. A key recommendation, imposition of an emissions fee, was defeated. The legislature did, however, direct further study of this policy by ODEQ. While the level of public participation generally has been high, there were significant issues regarding public involvement in this process and subsequent implementation decisions.

**Transit Oriented Development and MAX.** In addition to extensive land use planning activities, Portland also is known for aggressively promoting public transit and other

alternative transportation modes such as walking and bicycling. Oregon is concurrently experiencing voters' antitax sentiment and state budgetary constraints making it difficult to fund maintenance of old roads, let alone construct new ones. However, in referenda and opinion polls, Oregonians have been willing to pay to fund transit (MAX) with either bond issues or emissions fees.[45] Metro now plans development to ensure MAX's continued success.[46] ODEQ, using CMAQ funds, is working with local jurisdictions and private developers to demonstrate the viability of transit oriented development (TOD) and to assess the potential of such developments on a citywide basis.

## Challenges and Opportunities

Portland citizens are facing a number of transportation and environmental goals over the next twenty years that will require innovation and cooperation among governmental agencies and citizens. A Ninth Circuit Court case in San Francisco ruled that state transportation departments must take secondary land use impacts (i.e., additional trips created) into account when developing SIPs.[47] Environmental interest groups in Portland, fearing that IVHS will be used to avoid necessary changes in land use and transportation planning, take a similar position regarding the capacity expansion potential of IVHS.

The role of IVHS as an air quality strategy is unclear. Consensus in Portland, as reflected in Rule 12, is for reducing trips, not improving flow.[48] Still, given the projected increases in VMT, IVHS might play a complimentary role to land use planning by increasing the present system's effectiveness through rapid incident response and signal preemption for buses and LRT. In this case, it is important to differentiate between increases in VMT, which are certain to occur in Portland due to population increases, and increases in VMT per capita. Population increases will demand more from the present infrastructure. In order to avoid any new road building, IVHS may be an acceptable strategy so long as VMT per capita is controlled.

Opinions of agency representatives reflect this uncertainty. If M-IS is perceived simply as a way to move existing traffic faster, some believe that air quality impacts are likely to be marginal since most emissions in newer cars come from turning the vehicle on and off, not from their average speed.[49] Others feel that IVHS can play an important role, particularly in reducing CO emissions.

It is clear that land use planning is intended to drive Portland's transportation planning to meet long-term air quality goals. It is less clear how the VMT reduction goals set by Rule 12 will be met. Regulatory authority for enforcement exists--Metro's authority calls for local transportation plans to be consistent with Metro's regional plan--but the form that the actual implementation of policies will take is uncertain. Conclusion of the Region 2040 process and selection of a preferred land use pattern will clarify these questions somewhat. However, it remains to be seen whether Portland will succeed in bringing transportation planning to the service of enlightened lan use.

# Portland Consultation Small Group Discussion Summary

## Messages

Participants were asked to respond to the following question: *What message would you or your organization like to leave the Humphrey Institute regarding IVHS and the environment?*

The following summarizes their comments.

**A broadened notion of environmental quality.** A notion of environmental quality should include impacts not just on air quality but on energy consumption and quality of life--or livability considerations--which are affected by different land use patterns, accessibility and social concerns related to two-career families, child-care and disabled needs. The focus on environmental issues related to IVHS is timely and important.

**The efficacy of technological versus behavior approaches to addressing transportation environmental problems.** In attempting to reach environmental objectives, a blend of technological and behavioral strategies will be required. While many IVHS technologies show promise, we must be careful not to be caught up in the technological wizardry and miss the more simple approach. The concern with behavioral elements led many to focus on transportation demand measure (TDM) strategies and the use of pricing instruments in particular.

**Public investment in IVHS requires a cost-effectiveness assessment.** Related to the above issue, deployment of technologies should be sufficiently understood to ensure cost-effectiveness.

**Prioritize IVHS technologies to suit regional vision. IVHS** technologies that deserve prioritization include TDMs that can be demonstrated to reduce VMT and SOV use, and technologies that can track the impact of IVHS on vehicle spacing, speeds and so forth. The difficulty in prioritizing investments was best captured by the following message: "resolve the philosophical conflict between IVHS (ATMS) system efficiency objectives and the need to reduce VMT."

**Use of pricing instruments to control travel demand.** Congestion pricing or other schemes to assign the full social costs of driving on the user of the transportation infrastructure were suggested.

**Adopt an integrated approach to technology deployment.** Several messages referred to the importance of an integrated approach that facilitates communication and cooperation. There is a need to integrate planning between different modes and different political jurisdictions, for example, and between commercial and private vehicles. New technologies make it possible to do business in new ways; thus, it is important that IVHS technologies be looked at collectively and that the public be brought into this assessment. Finally, since IVHS is, in many ways, about advancing information technologies in the transportation sector, the use of telecommuting and other technologies that create information highways should not be overlooked.

**Take a balanced approach that allows for local flexibility and autonomy.** Since IVHS technology is at an early stage of development and deployment and there are many unknowns, an open-minded research agenda and a recognition of the need for flexibility and local autonomy in implementation is important.

### Cross-Cutting Issues

Participants in the small group discussions were asked to brainstorm and discuss answers to the following questions:

1) *What are the critical environmental challenges for new transportation technologies to address in the Portland area?*
2) *What IVHS technologies could improve environmental quality in Portland?*
3) *What suggestions do you have for federal legislation regarding the implementation of IVHS technologies for environmental improvements in urban areas--e.g., through amendments to either ISTEA or the Clean Air Act?*
4) *What models for cooperation among governmental agencies and others would you recommend to demonstrate this legislation in the Portland area?*

The following are their verbatim responses.

#### *Environmental Impacts*

- Impact on runoff, noise and visual pollution, open spaces, and energy consumption and CO, emissions are important
- Increasing VMT and stagnant or decreasing transit equals congestion and AQ problems. Latent demand effect of IVHS technologies needs further study.
- EIS should be required on all projects
- A federal criteria against funding of any IVHS that diminishes air quality.
- Land use, livability, and community development are intricately related to environmental impacts. Statutory land-use provisions should be included in ISTEA and CAA.
- Delete “traffic flow improvements” from CAA TCM list
- Apply advanced technology for all modes, for example to increase safety, accessibility and service for bicyclist and pedestrians.
- Suburban growth and non-work trip trends make VMT decrease a major challenge.

#### *Technology Issues*

- IVHS technologies should be implemented in a manner to decrease reliance on SOV.
- Technologies should facilitate multiple occupancy vehicles and transit ridership, for example, smart cards for transit, smart bus stops with real time information, home/ office computer based information access, AVL for transit systems.
- W-I-M for Commercial vehicles.
- Improved incident response is a logical arena for IVHS technologies.
- Successful deployment of new technologies requires public understanding and trust.

- Collision avoidance technology can promote many goals, safety decreased congestion, and improved air quality.
- IVHS can play important role in transportation planning data collection.
- Establish national performance standards requiring AVI devices and on-board emissions sensors on all new cars.

### *Equity Issues*

- Neighborhood cohesion/livability should not be jeopardized by redirected traffic.
- Impacts on accessibility and service of transportation system on disadvantaged and elderly of all new transportation technologies should be assessed.
- Federal funds should go to explore socio-political obstacles to pricing schemes enabled by IVHS.
- Opportunity costs are real, public money shouldn't go disproportionately to technologies that can't be widely used.
- Transportation planning should be more inclusive, including all stakeholders.

### *New Transportation Strategies*

- No supply-side investments without a way to control demand. TDMs include congestion pricing or emissions charges with federal incentives for local implementation. A national road pricing scheme that can improve efficiency of goods movement without increasing SOV travel should also be considered.
- The connection between land-use patterns and travel behavior should be addressed by more aggressive regional planning.
- IVHS should be renamed and reconfigured to promote intelligent transportation systems that enable greater modal choice, and use of information highway via telecommuting and other info technologies.
- Increase relative investment in transit and HOVs (for ex. 50 percent of IVHS money should go to APTS, 90 percent federal share to transit projects, and a federal requirement of HOV lanes) to improve their competitiveness with SOV travel.
- Increase public/private partnerships.
- A new measure of effectiveness should be utilized, not number of cars and trucks but movement of goods and people by whatever method.
- Allow gas tax to go toward transit, TDMs, etc.

### *Institutional Issues*

- Federal tax credits for AVI transponder installation.
- ISTEA money to MPOs should provide even greater flexibility and MPO role in regional transportation planning should be strengthened.
- All federally funded IVHS projects should have an environmental impact component.
- Increase public education and input (including consumer groups) to transportation and air quality issues.

- Broaden advisory board for IVHS development and deployment.
- Need greater interagency and inter-jurisdictional coordination and cooperation.
- There is a need to insure a net environmental gain from changes in transportation system, not just a shift to more industrial pollution.
- FHWA, FTA, and NHTSA should all be merged to form a single surface transportation agency.
- Clarify policy objectives clearly before implementation of new technology, for example, relationship between Oregon Transportation planning rule and possible IVHS deployment.
- Get environmental, technology, and economic development interest groups to the same table and then strive for consensus.
- IVHS national plan needs greater connection to local public decision-making process.
- Require TIPS and other state and local transportation planning to explicitly address IVHS so not just a top-down strategy.

# IVHS AND THE ENVIRONMENT:

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

### Portland Policy Consultation I

### October 27, 1993 -- Oregon Convention Center

### *AGENDA*

8:00 Coffee and rolls

8:30 Welcome and synopsis of the day's activities: Candace Campbell, Fellow, Humphrey Institute

8:40 Introductions by policy dialogue participants: What do you do? How is it related to transportation, technology, or the environment?

9:00 Framing IVHS AND THE ENVIRONMENT

Panel: Barbara Rohde, Research Fellow, Humphrey Institute, Moderator
Technology Issues: Ed Fischer, Federal Highway Administration, Region 10
Environmental Regulation Issues: Mark Simons, EPA/national Vehicle and Fuel Emissions Laboratory, Ann Arbor, Michigan
Achieving Environmental Goals: Annette Liebe, Oregon Environmental Council

Discussion

10:00 Break

l0:15 Portland: An urban setting for a case study on the environmental impacts of the application of advanced technologies on a transportation system

Panel: Candace Campbell, Fellow, Humphrey Institute, Moderator
Environmental Challenges of the Portland Area: John Kowalczyk, Air quality Division, Oregon Department of Environmental Quality
IVHS operational tests: Goran Sparrman, Director, City of Portland Bureau of Traffic Management
Land Use in Portland: Keith Bartholomew, 1000 Friends of Oregon
Planning for Environmental Quality: Andy Cotugno, Planning Director, Metro

Discussion

11:45 Lunch

12:40 Announcements

12:45 "Applying Advanced Technologies in Seattle," Peter Briglia Jr., Urban Systems Engineer, Washington Department of Transportation

1:00 Case Study Preparation: lVHS and the Environment in Portland

Small Group Discussions on the following questions:

1) What are the critical environmental challenges for new transportation technologies to address in the Portland area?
2) What IVHS technologies could improve environmental quality in Portland?
3) What suggestions do you have for environmental improvements in urban areas e.g. through either amendments to either ISTEA or the Clean Air Act?
4) What models for cooperation among governmental agencies and others would you recommend to demonstrate this legislation in the Portland area?

2:30 Break

2:45 Reconvene to report group discussions: The making of a case study report, reaction and discussion

REACTION PANEL:

Loyd Henion, Manager, Future Technology, Oregon Department of Transportation
Duane Hofstetter, State Traffic Engineer, Oregon Department of Transportation
Bob Cortwright, Senior Policy Analyst, Department of Land Conservation and Development
Judy Wyers, Presiding Officer, Metro
Rod Monroe, District 9 Councilor, Metro (invited)
Terry Moore, District 13 Councilor, Metro (invited)

3:45 Quality check and wrap-up

4:00 Adjourn

## October 27, 1993 Consultation
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**Endnotes**

1. Metro modeling data from Terry Whisler, planner.

2. Metro, *Passport to Metro Regional Services: A Users'Guide 1993-94.*

*3.* U.S. DOT, *Our Nation's Highways: Selected Facts and Figures,* Publication No. FHWA-PL-*92-004.*

4. Oregon Administrative Rules 660-12-35(4).

5. Paul Ketcham and Scot Siegel, *Managing Growth to Promote Affordable Housing: Revisiting Oregon's Goal* 10, Executive Summary (Portland: 1000 Friends of Oregon and The Homebuilders Association of Metropolitan Portland, September 1991) pp. 5-9.

*6.* Ibid.

7. EC0 Northwest, *Portland Case Study: Urban Growth Management Study* (Portland: Oregon Department of Land Conservation and Development, November 1990) p. A-76, table 6-2. The 1989 average sale price in Portland was $116,296 and the average sale price per square foot was $52.86, both of which were lower than the average price and price per square foot in San Francisco, Sacramento, Seattle, Tucson, Tacoma, St. Louis and Salt Lake City.

8. Comments from meetings with ODOT, FHWA, and the city of Portland, August 30, 1993, and ODEQ, August 31, 1993.

9. Comments by Dr. Ken Dueker, Portland State University, during meeting with ODOT, FHWA and the city of Portland, August 30, 1993.

10. Comments from meeting with FHWA, ODOT and the city of Portland, August 30, 1993.

11. Comments from meeting with ODOT, FHWA and the city of Portland Traffic staff, August 30, 1993.

12. Comments from meetings with 1000 Friends of Oregon, August 31, 1993, and STOP, September 1,1993.

13. Comments from meeting with ODEQ, August 31, 1993.

14. Comments by Dr. Dueker, op. cit.

15. Tri-Met Strategic Plan, 1993-1998.

16. Comments from meeting with STOP, September 1, 1993.

17. USDOT, op. cit.

18. Tri-Met Fact Sheet, Fall 1992.

19. Tri-Met Attitude and Awareness Survey, March 1991.

20. Comments by Dr. Dueker, op. cit.
21. Tri-Met Strategic Plan, 1993-1998.

22. Comments from meeting with OEC, September 1, 1993.

23. Ibid.

24. Comments from meeting with ODOT, FHWA and the city of Portland, August *30,* 1993.

25. Comments from meetings with OEC, September 1, 1993, and ODOT, FHWA and the city of Portland, August 30, 1993.

26. Ibid.

27. Comments from meeting with ODOT, FHWA and the city of Portland, August 30, 1993.

28. Comments by Ed Fischer, FHWA, at the IVHS and the Environment Consultation, Portlaud, Oregon, October 27, 1993.

29. Comments from meeting with ODOT, FHWA and the city of Portland, August 30, 1993.

30. Comments by Dr. Kent Lall, Portland State University, during August 30, 1993, meeting.

31. Ibid.

32. Comments from meeting with ODOT, FHWA and the city of Portland, August 30, 1993.

33. Comments from meeting with 1000 Friends of Oregon, August 31, 1993.

*34.* Ibid.

*35.* Ibid.

36. Comments by John F. Kowalczyk, ODEQ, at the IVHS and the Environment Consultation, Portland, Oregon, October 27, 1993.

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40. The information on the Region 2040 plan comes from Mary Kyle McCurdy, "Region 2040 Plans for Region's Growth," *The Willamette County News,* Vol. 1, No. 3, May 1994. Published by 1000 Friends of Oregon.

41. The information presented is based on OEC's responses to written questions from the Humphrey Institute.

42. Keith A. Bartholomew, "Making the Land Use, Transportation, Air Quality Connection," *PAS Memo,* May 1993. Published by the American Planning Association.

43. Comments from meeting with ODOT, FHWA and the city of Portland, August 30, 1993.

44. Comments from meeting with STOP, September 1, 1993.

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47. Comments from meeting with ODEQ, August 31, 1993.

48. Ibid.

49. Ibid.

# Case Study of Houston, Texas

The information in this summary was compiled by State and Local Policy Program staff. We would like to thank those we interviewed and those who participated in the Humphrey Institute's consultation on November 5, 1993, in Houston and the Case Study Conference in December 1993 in Minneapolis for their assistance.

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# Profile of the Houston Area

## Demographics

The city of Houston has the fourth largest population in the United States and the largest population in the South and Southwest, with 1.6 million residents in 1990. The metropolitan (CMSA) population grew by 20 percent between 1980 and 1990.[1] By 1992, the metropolitan population was over 3.7 million. Roughly one-half of the residents (1.7 million) resided within the city limits.

The 1990 census revealed Houston's metropolitan area population to be 68 percent Caucasian, 18 percent African American, 0.3 percent American Indian/Eskimo, 4 percent Asian and Pacific Islander, and 11 percent other races. People of Hispanic heritage--who may be of any race--accounted for 21 percent of the region's population. The ethnic distribution within the city limits in 1990 was 27 percent African American, 28 percent Hispanic, 4 percent Asian, and 41 percent Caucasian. Approximately 13 percent were foreign born. Houstonians were almost equally divided by gender, with 50.19 percent female and 49.81 percent male. The largest age group in Houston in 1990 was the 25- to 44-year-olds, which made up nearly 37 percent of the population; the next largest group was the 5- to 17-year-olds at nearly 20 percent.[2]

Houston's Federal Aid Urbanized Land Area covers 1,549 square miles,[3] and under Texas' Municipal Annexation Act of 1963, Houston's Extraterritorial Jurisdiction contains about 1,900 square miles.[4] The city of Houston itself lies in three counties: Harris (572.73 square miles), Fort Bend (12.06 square miles), and Montgomery (2.07 square miles).[5] In addition to the central business district, there are three major activity centers--the Galleria/Uptown Houston Area, the Texas Medical Center, and Greenway Plaza--that have tens of thousands of daily commuters.[6]

After explosive growth that saw job gains average 7.2 percent annually between 1974 and 1981, Houston entered a recession in 1982 that cost 221,900 jobs, or one in seven, between March 1982 and January 1987. Because most of the jobs lost came from the petroleum industry, Houston decided to diversify its economy. The expansion that began in 1987 created over one hundred thousand new jobs in medical, business and professional services.[7]

Houston averages twenty-one days per year with temperatures under 32°F and ninety-six days with temperatures of 90°F or more. Houston's growing season averages three hundred days. Annual average rainfall is near forty-five inches per year.'

## Land Use

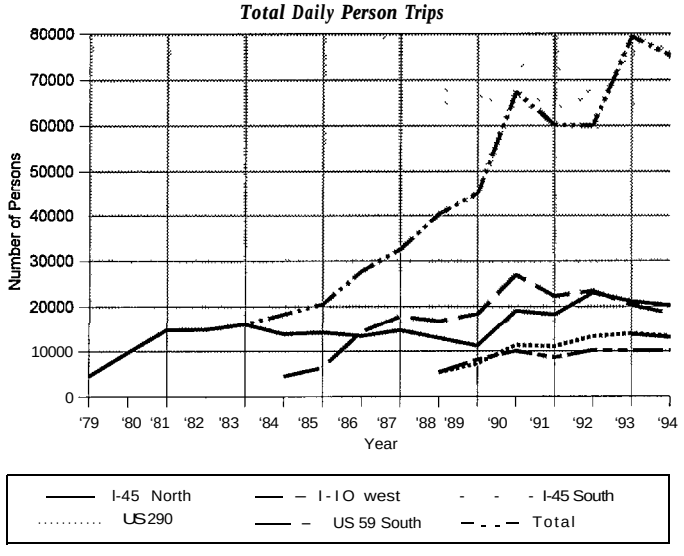
Land use controls in the Houston area are minimal and state law precludes Texas counties from adopting zoning ordinances. The city of Houston is the largest city in the United States without zoning. Houston residents have voted against controlling transportation through land use restrictions on several occasions, most recently in November 1993. Polls showed that voters turned against the most recent proposal after

television advertisements pointed out the lack of a comprehensive plan to be used in conjunction with the proposed ordinance. Efforts to address this perceived deficiency are underway. The first step is a "visioning" program being conducted by the city. Meanwhile, the city continues to rely on specific ordinances, such as parking, fire and building codes, and plotting, as its means of regulating development. Transportation planning through land development regulation is limited to the adoption of a major thoroughfare plan that includes the area inside the city limits and out into the unincorporated areas of Harris and surrounding counties.

## Existing Transportation Systems

**Highway System.** Houston has one of the nation's major freeway systems. According to 1990 U.S. Department of Transportation figures,[9] Houston had 17,001 highway miles with 71,613,000 vehicle miles traveled per day. There were 315 freeway miles consisting of 1,945 lane miles that handled up to 29,255,000 vehicle miles per day. This works out to 15,041 vehicles per freeway lane per day, and 25.5 vehicle miles per person per day. In addition, these statistics estimated that the population density was 1,806 people per square mile with six miles of highway for every one thousand people. The average daily trip to work was twelve miles and the average daily auto trip was eight miles.

**Harris County HOV Lane Utilization**




Source: TXDOT

Currently, eleven freeways/tollways exist in the Houston area: Katy (I-10 W), North (I-45 N), Northwest (U.S. 290), Southwest (U.S. 59 S), Eastex (U.S. 59 N), Gulf (I-45 S), South (SH 288), Loop 610, LaPorte (SH 225), the Hardy Toll Road, and East Fwy (l-10 E). Sam Houston Tollway (Beltway 8) and the Grand Parkway are partially completed.

Between 1979 and 1987, Houston/Harris County voters approved road and traffic bonds totaling $1.1 billion. Voters also passed a $900 million bond referendum in 1983 to create the Harris County Toll Road Authority to supervise construction of the 21.6-mile Hardy Toll Road, which was completed in 1988, and a 26-mile portion of the Sam Houston Tollway, which was completed in 1990. According to these figures, the state of Texas plans to spend $3.5 billion on Houston-area highways between September 1993 and August 2002. The Sam Houston Tollway has exceeded projections and the Hardy Toll Road has not yet met traffic projections."

Of the ten most congested cities in the United States, Houston has been the only one to achieve a net reduction in congestion since 1983. The Regional Mobility Plan, which state

and local agencies created in 1982, has been a coordinated effort to define Houston's transportation needs and outline the projects and funding requirements needed to improve mobility through 1997. The Greater Houston Partnership, which represents business interests, has been an active partner in this process. Between 1982 and 1989, $7 billion was spent on street, road and freeway improvements. Average evening peak period freeway speed improved from 38.3 mph in 1982 to 47.5 mph in 1991.[11]

Houston has planned the most extensive network of barrier separated high occupancy vehicle (HOV) lanes in the nation. As of 1993, plans call for expanding the amount of HOV lanes from the current 63.6 miles to 105 miles. Currently, 800 bus trips and 23,000 carpool and vanpool trips carry 78,000 people per day.[12] It is projected that HOV lanes will serve 200,000 people per day by 2018. The development and operation of the priority HOV facilities have been the result of a joint effort of the Metropolitan Transit Authority of Harris County and the Texas Department of Transportation.[13]

Transit System. The Texas state legislature authorized the creation of local transit authorities in 1973. That authorization allowed voters to dedicate a special local sales tax to subsidize public transit and provide long-range mobility improvements. In 1978, voters in the Houston area elected to create the Metropolitan Transit Authority of Harris County (METRO) while approving a one cent sales tax to partially support the construction and operation of a comprehensive regional transit system. Currently, the one-cent sales tax generates about $230 million per year. Most areas east of Houston in Harris County did not vote to be a part of the transit authority's service area; therefore, METRO only covers the western two-thirds of Harris County, an area of 1,279 square miles.[14]

METRO devotes at least 25 percent of the sales tax revenue to "mobility projects"--improvements that provide benefits to all transportation modes, including transit. In cooperation with local cities and Harris County, METRO has designated over two hundred general mobility capital projects. These include thoroughfare widening and extensions, hike and bike trails, sidewalks, left turn lanes, bus pullouts and the linking of gaps in disconnected streets. In recent years, METRO has shifted the emphasis of its mobility program to funding local government transportation maintenance activities, such as street repair and traffic signal maintenance.

Since METRO took over operation of a municipal bus system in 1979, transit service and ridership have increased significantly. From 1980 to 1990, when most major transit systems were losing market shares, Houston was able to increase the share of work trips taken by transit. Currently, METRO operates a fleet of 1,163 vehicles--seventh in size, nationally--and over one hundred local, express, and park-and-ride routes. Thirty METRO bus routes are fully accessible to the disabled and METRO operates the METROLift paratransit service to meet the requirements of the Americans with Disabilities Act. In 1993, total passenger boardings were 84,549,000, down 486,000 from 1992. On-time performance ran at 94.9 percent in 1993.

ln addition to its fleet of buses and paratransit vans, METRO runs and operates a variety of facilities integral to the transit operation. These include five bus operating garages, twelve neighborhood and regional transit centers (off-street transfer sites) and over 1,140 bus shelters located in street rights of way. METRO also operates twenty-two suburban

park-and-ride lots (25,000 spaces) that are used for both carpool staging and nonstop bus service to major activity centers, primarily the central business district (CBD).

The major capital program for future expansion of the METRO system is the $1 billion Regional Bus Plan, funded through an earmark in the Federal Transit Administration's Section 3 New Start Program. The Regional Bus Plan was selected in 1992 as the region's transit alternative after many years of debate about various rail technologies and assignments. The plan includes the addition of transit centers and park-and-ride lots (8,000 spaces), an increase in the bus fleet from 1,100 to 1,600 vehicles powered by liquefied natural gas, improved service to non-CBD activity centers, and a variety of enhancements to the freeway HOV network and major thoroughfares carrying heavy bus traffic. Several IVHS projects are also included in the plan, such as automatic vehicle locaters for the bus fleet, an upgraded ride matching computer system, the Regional Computerized Traffic Signal System, and the Greater Houston Transportation and Emergency Management Center.

METRO has taken a lead role in providing carpool and vanpool matching services in the Houston region. METRO will provide support to people and companies trying to put together a carpool or vanpool program. METRO also provides ride matching services to individuals who wish to carpool on a casual or permanent basis. All METRO park-and-ride lots can be used for rideshare staging. As a part of the rideshare matching services, METRO offers a Guaranteed Ride Home program to assure that users of this service can get home when unscheduled events occur. METRO's primary uses for these services will be in support of Houston's traffic management organizations.

As a result of Houston's designation as a severe ozone nonattainment area by the Clean Air Act Amendments (CAAA), employers with one hundred employees or more must make efforts to increase employee vehicle occupancy. Employers must put together employee trip reduction programs, many of which provide carpool and other mass transit incentives. METRO will continue to help employers succeed in this program.

## Environmental Quality

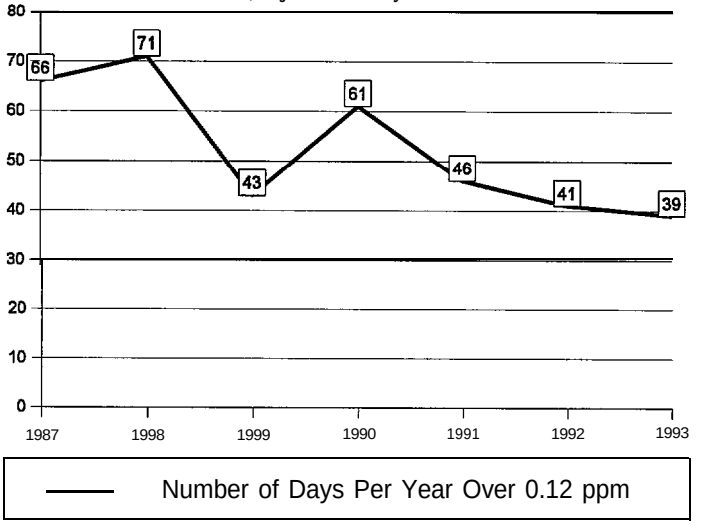
Houston meets the attainment requirements for all criteria air pollutants specified in the Clean Air Act except for ozone. Eight counties--Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller--are included in the Houston-Galveston severe ozone nonattainment area. The CAAA require a 15 percent reduction in volatile organic compound (VOC) emissions, adjusted for growth, between 1990 and 1996, and full compliance with the ozone standard by 2007.

Ozone is created through the reaction of VOCs and nitrogen oxide ($NO_x$) in the presence of sunlight. $NO_x$ is created as a by-product of high temperature, high pressure combustion processes, such as those that take place in automobile engines and power plants. VOC emissions enter the atmosphere via automobile exhaust and evaporative emissions, from petroleum refining and petrochemical processes, and from many other stationary and area sources. The mixture in Houston of VOCs and $NO_x$ is such that the ozone standard probably will not be achieved without reductions in VOCs and $NO_x$.[15]

The National Ambient Air Quality Standard requires that hourly ozone concentrations not exceed 0.12 parts per million (ppm) during more than one day per year over a three-year period. The number of days when the Houston area exceeded the ozone standard declined from seventy-one in 1988 to thirty-nine in 1993.[16] The fourth highest concentration recorded during the three-year 1987 to 1989 period was 0.22 ppm, which places Houston in the severe ozone nonattainment category by the CAAA.[17]

**Ozone Exceedence Days in Houston**

*State, Regional and City Monitors*




***Source: Houston and the 1990 Revisions to the Clean Air Act***

As a nonattainment area for ozone, the CAAA require the Houston area to implement the following transportation-related measures: 1) all transportation projects must conform with the State Implementation Plan (SIP) for air quality, 2) an inspection and maintenance program will become operational in 1995, 3) newly purchased fleet vehicles must be converted to alternative fuels, 4) reformulated gasoline is required in the area and transportation control measures must be implemented to offset growth in emissions due to growth of vehicle miles traveled (VMT), and 5) organizations with more than one hundred employees must implement an employee trip reduction program." In addition, the Intermodal Surface Transportation Efficiency Act (ISTEA) and the CAAA require that projects identified for federal funding in the Metropolitan Transportation Plan and the Transportation Improvement Program (TIP) be evaluated for consistency with regional and local transportation plans and meet tests for air quality conformity. The Metropolitan Plan outlines the region's proposed transportation improvements that will be implemented over a twenty-year period and TIP specifies which projects will be implemented during the first three years.

## Government

Houston has a strong mayor form of government in which the mayor and fourteen council members serve as the legislative body for the city. These fifteen officials and the city controller are elected for two-year terms that run concurrently. The mayor is also Houston's chief executive officer. Houston does not have a city manager.

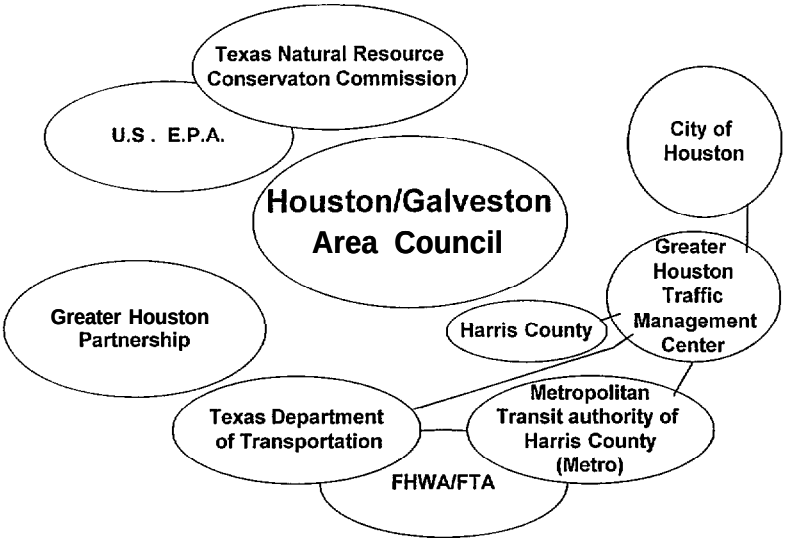
Although the city of Houston dominates the region in geographic size and population, there are approximately thirty smaller incorporated cities and towns within Harris County. The largest is Pasadena, with a population of 119,000. County governments also play a significant role, as hundreds of thousands of people live in unincorporated areas not subject to the direct control of city government.

Houston has no state or local personal income taxes. The sales tax rate is 8.25 percent (6.25 percent state, 1 percent city, 1 percent transit authority) with certain food and drug items exempt. Houston and areas outside the city had the option to vote on the 1 percent transit authority sales tax.

**Transportation and Environmental Planning.**[19] The Houston-Galveston Area Council (HGAC) has served as the metropolitan planning organization for the area since 1974. HGAC is governed by a board of directors composed of thirty-two local officials--fourteen officials represent county governments, sixteen represent cities, one represents school districts, and one represents conservation districts.

The Transportation Policy Council (TPC) is the transportation policy-making structure of HGAC. The TPC is composed of twenty-one locally elected officials and technical representatives from **HGAC, TxDOT, METRO,** cities with a population of at least fifty thousand, the eight urbanized counties, and other transportation agencies. The city of Houston has three representatives on the TPC, Harris County has two, and all other entities have one each.

**Interagency Configuration**




The Technical Advisory Council (TAC), which serves as the advisory committee to the TPC, is composed of representatives of governmental planning and regulatory agencies, and interested nongovernmental groups.

The TPC provides the policy guidance and overall coordination of multimodal transportation planning in the Houston area. Project selection for the TIP begins with a call for projects. HGAC staff, with the assistance of the TAC, evaluate the project according to four project selection criteria adopted by the TPC: current economic benefit-cost, future economic benefit-cost, air quality benefit-cost, and other qualitative factors.

The TPC, in consultation with TxDOT, makes a preliminary selection of projects according to the criteria scores from the above evaluation. Selections are evaluated within their respective funding categories (CMAQ, Transit Section 9, STP-MM, STP-UM, STP-RM, and NHS).[20] HGAC's transportation department staff conduct air quality conformity analyses to ensure that projects are within the mandates of the Clean Air Act.[21] After public comment is received (see below), the TPC makes the final project selection based on the recommendations of the TAC, project rankings, conformity analysis and public comments.

The TPC also approves the Metropolitan Transportation Plan, which identifies the strategies and programs the region will undertake to address its mobility needs and air quality issues. In addition to meeting air quality conformity tests, the projects in the plan must have identifiable funding sources. Therefore, the costs of all projects included in the plan must be matched with appropriate funding sources.

The TPC cooperates with TxDOT as the latter selects projects under the National Highway System and the Bridge and Interstate Maintenance programs. TxDOT's responsibilities also include selection of the surface transportation program statewide set-asides for safety and enhancements. State-funded mobility and rehabilitation projects do not require MPO approval, but are usually shown in the TIP for informational purposes.

**Public Participation.**[22] The call for projects is advertised in local newspapers and mailed to over four hundred groups. Another mailing follows, along with a TIP workshop that is open to the public. TPC and TAC meetings provide speaking opportunities for members of the public as well. Public meetings are also held on the draft project listing draft conformity analyses for both the Metropolitan Plan and the TIP.

## IVHS Technology In Place or Planned

Local agencies, TxDOT and USDOT are all involved in developing the Houston Intelligent Transportation System (HITS).[23] In 1993, to fully integrate IVHS plans across both street and public transportation systems, a consortium of local agencies created a multiagency partnership called the Greater Houston Transportation and Emergency Management Center (TEMC). The TEMC is a cooperative effort between Harris County, the city of Houston, METRO and TxDOT. An interim TEMC is currently in operation and will serve until the final TEMC becomes operational in 1995.[24]

The TEMC is the focal point for the planning, design, operations and maintenance of areawide traffic management activities and the coordination and management of IVHS programs in the Greater Houston area. Although both freeway and transit systems will utilize IVHS technology, many projects are in the initial planning and design stages. The proposed and existing technologies are described below.

## Travel and Traffic Management

(See Maps 1,2 and 3)

**Computerized Transportation Management System (CTMS).** CTMS is a planned 231-mile system that will form the backbone for IVHS in the Houston area. CTMS comprises "separate, yet integrated subsystems: mainline Freeway Traffic Management (FTM) and HOV Surveillance, Communications, and Control (SC&C)."[25] Specific technologies utilized by CTMS include:

- fiber optic communications links
- vehicle detection
- changeable message signs
  lane control signals
- closed circuit television
- ramp metering
- automated barrier gates
- intersection signal control
- intermediate processors
- central processors

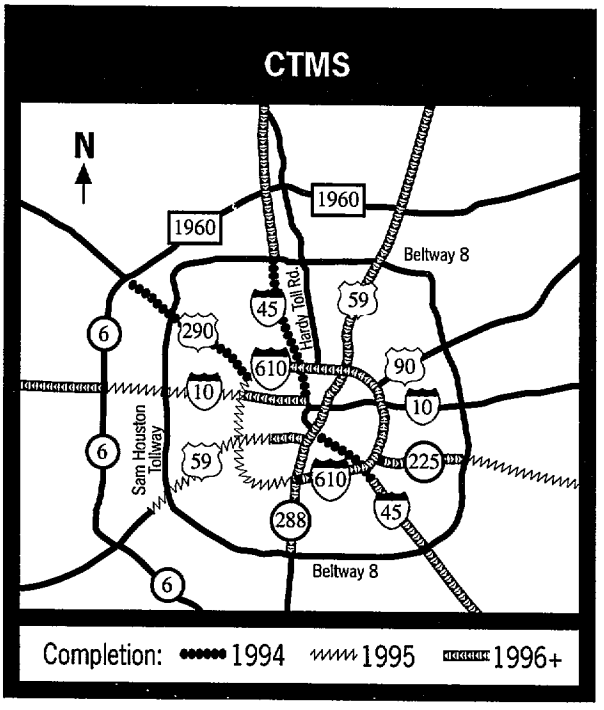
CTMS will utilize the TEMC as the clearinghouse for information received from these technologies in the Houston area. The schedule calls for implementing CTMS over thirty-five miles of corridor by the end of 1994.[26]

**Freeway Traffic Monitoring System.** TxDOT is installing an automatic vehicle identification (AVI) system on 227 miles of freeway and 70 miles of HOV lanes as a freeway traffic monitoring system. Information from these readers, such as average speeds and travel time, will be used in other IVHS applications and by other agencies for other applications, such as presentations to commuters in the home and work place.[27] Plans call for AVI technology in other applications. For example, AVI technology:

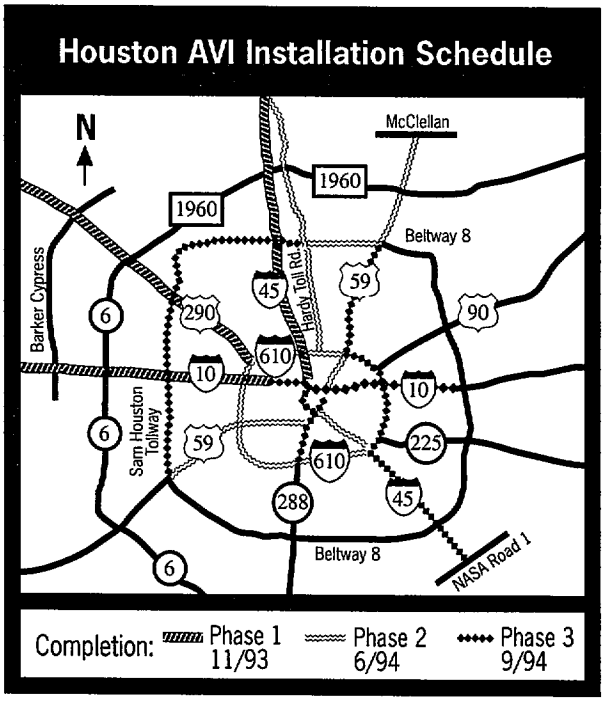
- has already been implemented on the existing tollways (Sam Houston and Hardy),
- will be tested for use in incident detection,
- will be used to monitor the arrival and departure of transit vehicles at park-and-ride facilities, and
- will be tested on one arterial facility for operation of arterial street signal systems.

**Priority Corridor Program.** USDOT designated the Houston Corridor as one of four IVHS priority corridors in the United States. TxDOT and the Texas Transportation Institute plan to expand the AVI system, dynamic lane assignment controls for freeway frontage roads and major arterials, closed circuit television monitoring for special events traffic management, testing programs for high technology equipment, deployment of monitoring/warning systems for freeway-to-freeway connectors, and general public information programs.[28]

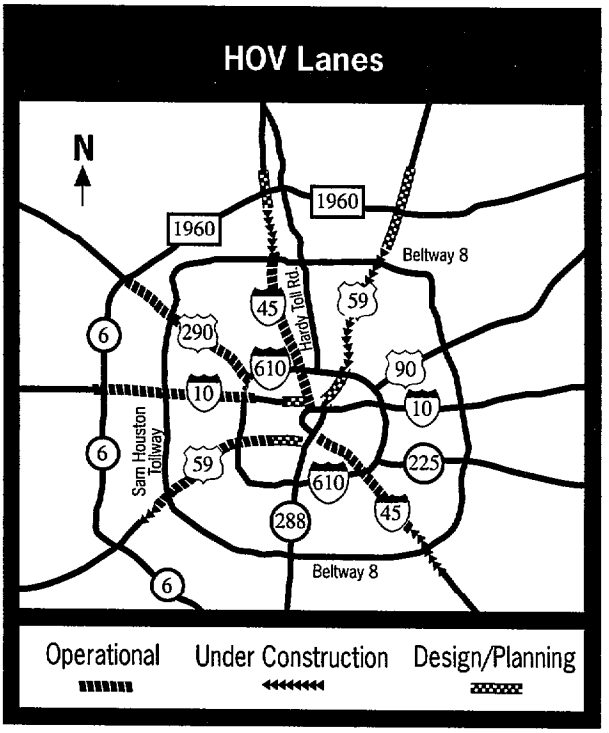
## Map 1



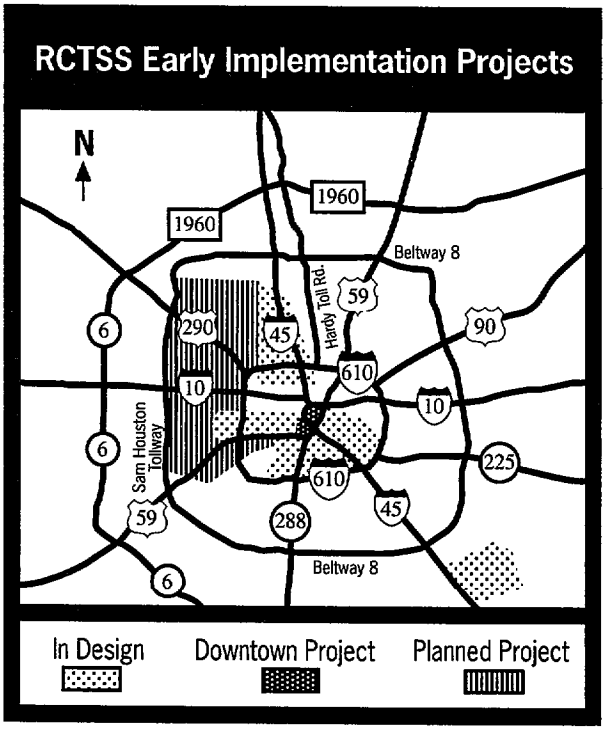

## Map 2




## Map 3




## Map 4



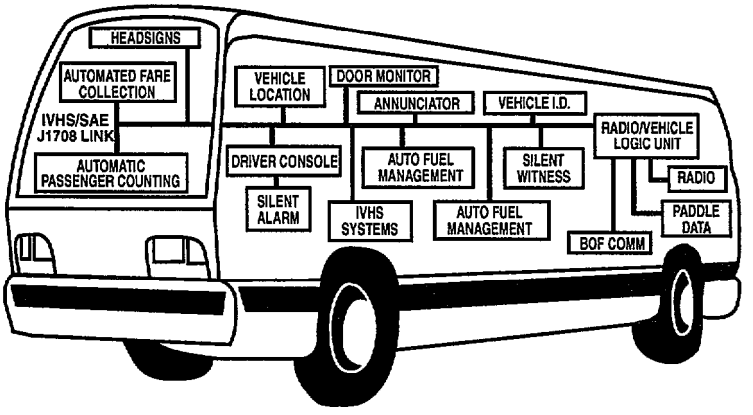
**Regional Computerized Traffic Signal System (RCTSS).** RCTSS is a project jointly funded by METRO and the Federal Transit Administration (FTA). The project will provide a modern communications system and will accommodate future integration of IVHS in the Houston region. The communications link will modernize and coordinate control of 2,800 traffic signals in the Houston area for immediate traffic management control at local intersections for nonrecurring incidents. The link will also facilitate an integrated RCTSS/METRO transit communications network to connect bus operating facilities, park-and-ride lots, transit centers, and major bus stops via a high-speed optical network, for a totally intermodal communication network. RCTSS will also permit emergency vehicle preemption and transit priority handling at individual intersections. System management and control will occur at the TEMC by Houston and Harris County traffic engineers. Two hundred to three hundred intersections will be upgraded in 1994, and full implementation is planned over the next six to eight years[29] (see Map 4).

**Smart Commuter.** Smart Commuter is an operational test that will examine the potential for increasing utilization of high occupancy commute modes, shifts in travel routes, and changes in trip departure times. This program will provide quick and easy access to up-to-date information concerning traffic conditions, bus routes, schedules, instant carpool matching and so forth. The program will also provide information to drivers regarding traffic flow and potential congestion, and ultimately, this information will be provided in automobiles and buses for traveler decisions. The Smart Commuter operational test will examine whether a traveler will be more likely to use high occupancy modes of transportation as a result of having quick and easy access to this information.[30]

The Smart Commuter project includes two different components. The I-45 North bus component focuses on the suburban-to-downtown travel market. Commuters will receive traffic and transit information in their home or workplace to facilitate their choice of travel modes, routes or trip departure times. This component will be in operation in late 1994, with seven hundred participants.

The second component focuses on the suburban-to-suburban travel market in the I-10 West corridor. A real time carpool matching system will be used to encourage a mode shift from driving alone to carpooling. This component will begin operation in 1995.[31]

**Public Transportation Management**




*Source: Metropolitan Transit Authority of Harris County*

**Smart Bus.** METRO, in conjunction with the FTA, is undertaking an array of IVHS projects known as the Smart Bus projects. Two of these projects are an advanced radio communications system (ARCS) and an automatic vehicle location (AVL) system. Both of these systems, along with RCTSS, will provide a robust communications foundation for all Smart Bus projects.

These systems will connect METRO buses with METRO's fixed facilities.[32] Another Smart Bus project will provide electronic fareboxes to accurately count passengers and method of payment.[33]

Another building-block project that METRO is working on with other regional transportation agencies is the geographic information system (GIS). This, in conjunction with the AVL system, will allow METRO to track transit vehicles geographically, allowing dissemination of schedule adherence information at bus stops, transit centers, and park-and-ride lots. The projects will also assist bus stop communication inside and outside the bus.

Finally, special transit vehicle priority controls will permit RCTSS to recognize a unique transit vehicle preemption request. GIS will evaluate the vehicle's position relative to its target schedule. RCTSS will evaluate the request relative to congestion and performance measure criteria in the surrounding area, and then issue a priority override to the traffic signal equipment to expedite the transit vehicle's movement, if necessary.

**Transitway System.** HOV lanes form the basis for a one-hundred-mile transitway system. The HOV lanes were started in the 1970s when it was determined that, with an average of 1.2 people per vehicle, it would not be desirable or feasible for the city to continue to provide enough streets to handle the increasing volume of traffic.[34] As of April 1994, priority facilities were in operation in five corridors, accounting for a total of 63.6 miles of HOV lanes, with an additional 21 miles under construction. Operation of the HOV lanes will be monitored in the TEMC with the same systems that are being installed on the freeway lanes:[35]

- closed circuit TV,
- vehicle detectors,
- automatic vehicle identification systems,
- wrong-way movement detectors, and
- lane control signals.

### Emergency Management

**Motorist Assistance Program (MAP).** MAP currently operates a nine-vehicle fleet, sixteen hours per weekday and services 2,200 incidents during the average month, 80 percent of which are detected by moving patrols. As the various computerized traffic monitoring projects become operational, more incidents will be detected by the TEMC and the patrols will be dispatched to the incident scenes. Currently, AVL systems have been installed on all MAP patrol vehicles. The program will be expanded in 1994 to provide twenty-four-hour coverage, using twelve vehicles during the primary patrol periods and two vehicles during the eight-hour night shift. The benefit-cost ratios in reduced traffic congestion have been estimated at approximately twenty.[36]

**IVHS Technologies In Use or Being Planned in Houston**

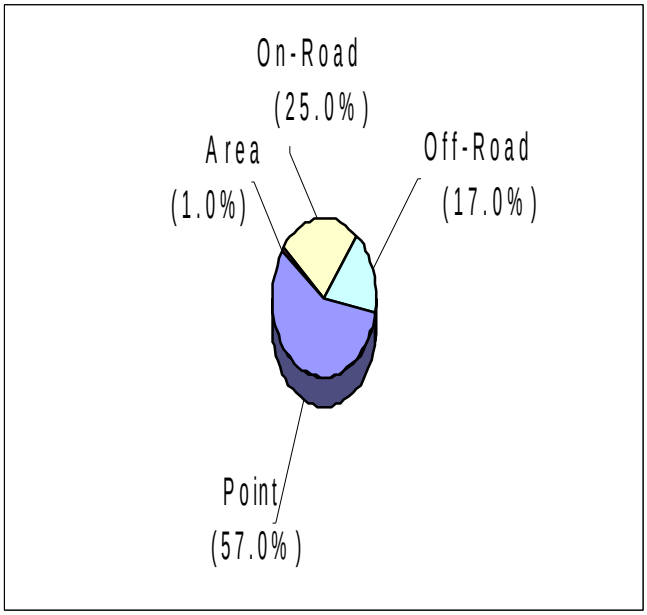
| Name of Project | Project Status | FHWA/IVHS Bundle | FHWA/IVHS User Service |
|---|---|---|---|
| **Computerized Transportation Management** System (CTMS) | 35 miles by 1995; 231 miles planned. | Travel and Traffic Management | Traffic Control |
| **Freeway Traffic Monitoring System** | Implemented on existing tollways. TxDOT is installing on 227 miles of freeways and 70 miles of HOV lanes. | Travel and Traffic Management<br><br>Electronic Payment Services | Pre-Trip Travel Information<br><br>Incident Management<br><br>Electronic Payment Services |
| **Priority Corridor Program** | In progress. | Travel and Traffic Management | Traffic Control<br><br>Pre-Trip Travel Information |
| **Regional Computerized Traffic Signal System (RCTSS)** | 200-300 intersections in 1994; 2,800 intersections by 2002 | Travel and Traffic Management | Traffic Control |
| **Smart Commuter** | Component I: operational in late 1994.<br><br>Component II: begin operation in 1995. | Travel and Traffic Management<br><br>Public Transportation Management | Pre-Trip Travel Information<br><br>Ride Matching and Reservation<br><br>En-Route Transit Information |

| | | | |
|---|---|---|---|
| **Smart Bus** | In progress; due for completion in late 1996. | Public Transportation Management | En-Route Transit Information<br><br>Public Transportation Management<br><br>Public Travel Security |
| **Transitway System** | 63.6 miles of HOV lanes as of April 1994. 100 miles planned. | Public Transportation Management | Public Transportation Management |
| **Motorist Assistance Program (MAP)** | 24-hour coverage by the end of 1994. | Emergency Management | Emergency Notification and Personal Security<br><br>Emergency Vehicle Management |

## Environmental Issues and Organizations

**Issues**

Before ISTEA was passed, transportation planning in Houston largely existed independent of environmental constraints. Consequently, nongovernmental environmental organizations have been the strongest advocates for environmental interests. The transportation and air quality links required by ISTEA and the CAAA called for modest changes. As a result, a limited consideration of air quality issues was introduced into the transportation planning process.

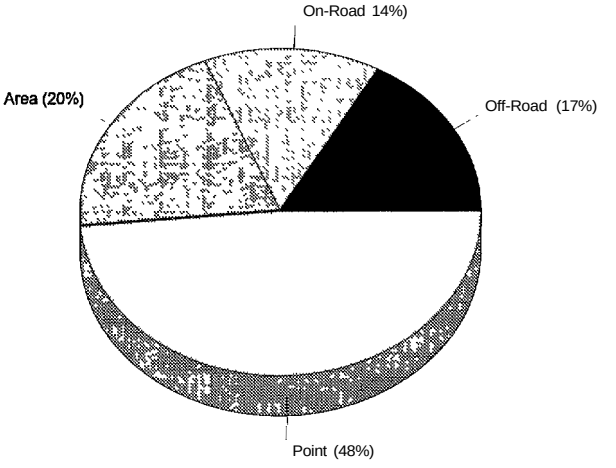



The Texas Natural Resource Conservation Commission (TNRCC) estimates that on-road transportation accounts for 14.1 percent of the VOC emissions in Houston, compared to 48.5 percent from point sources, 20.2 percent from area sources and 17.2 percent from off-road mobile sources. The TNRCC also estimates that on-road transportation accounts for 25 percent of NO, emissions, compared to 57 percent from point sources, 17 percent from off-road mobile sources and 1 percent from area sources. To meet the emission reduction requirements in the Houston area, including growth factors, the SIP calls for a 15 percent reduction in VOCs by November 1996. Transportation-related emission reductions, including reformulated gasoline, contribute 23 percent of the needed reduction.[37]

Various entities have taken steps to meet the 1996 requirements. METRO will replace its entire fleet by the year 2000 with vehicles powered by liquefied natural gas.[38] The TNRCC is requiring that employers with one hundred employees or more implement employee trip reduction programs. The programs must result in an employee average vehicle occupancy of 1.47 in Harris County and 1.41 in adjacent counties between 6:00 a.m. and 10:00 a.m.[39] Houston is also promoting the use of bicycles through a bicycle and pedestrian program that includes three hundred miles of bikeways.[40]

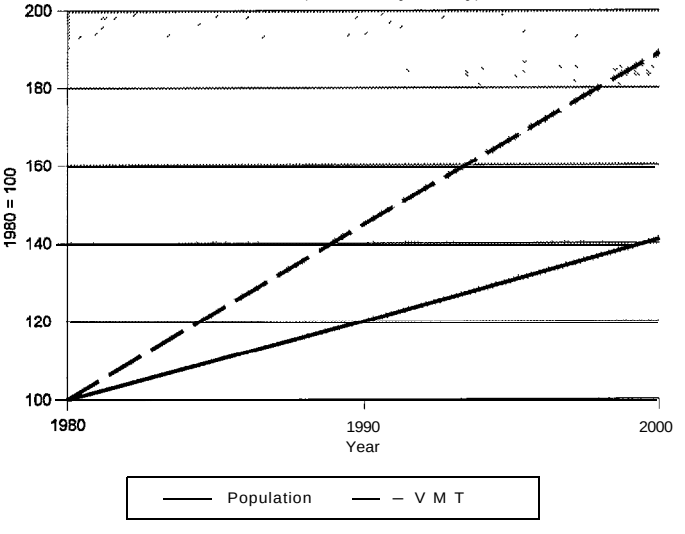
**VOC Emissions Inventory**

***Houston Area - 1993***




**Population and VMT Growth Rates, 1980-2000**

***Houston MSA (Less Liberty County)***




***Source: HGAC***

The greatest challenge, however, is controlling the increase in VMT. Even with slowed population and employment growth, VMT in Houston has increased an average of 3 percent per year since 1982.[41] Projections indicate that VMT will continue to grow along with population growth and efforts to maintain a strong economy in the area.[42] Yet, to meet the targeted reduction in VOCs in the Houston-Galveston nonattainment area, emissions from all sources must be reduced by 262 tons per day (tpd) by 1996, down from an estimated 1,091 tpd in 1990. According to best estimates in the 1993 SIP, transportation control measures only reduce emissions by 0.1 tpd. Further, it is unlikely that significant VOC or No, benefits can be gained from traffic smoothing or congestion reduction, considering that speeds on Houston freeways during the evening peak hour averaged 47.5 mph in 1988.[43]

As previously discussed, Houston has chosen not to control transportation through land use restrictions. Voter rejection of the 1993 referendum to implement zoning measures,[44] combined with the requirement of zero growth in mobile source emissions, creates a formidable task for the area, especially in achieving the 15 percent reduction in VOCs by 1996 and the CAAA attainment standard by 2007.

### Environmental Interest Organizations

**The Sierra Club.** This group focuses on the air quality impacts of transportation and land use. Largely made up of volunteers, the Sierra Club has established itself as an eloquent critic of Houston's transportation planning and development process. Members of the Sierra Club sit on HGAC's Regional Air Quality Planning Committee and TAC. Until recently, Sierra Club members were not familiar with the region's IVHS plans. While they have since learned quite a bit about IVHS, they question whether these systems are the most cost-effective way to minimize transportation's contribution to Houston's ozone problem.

**GHASP (Galveston/Houston Association for Smog Prevention). This grass** roots organization is one of the strongest critics of transportation policies in the Houston area. The Grand Parkway freeway project is a major issue for this group, but GHASP criticizes many transportation projects as being too friendly to single occupancy vehicles (SOVs) and not paying enough attention to transit needs. This skepticism includes opposition to IVHS projects.

**CART (Citizens Advocating Responsible Transportation).** This organization is similar to GHASP in that it comprises mostly grassroots citizen representation. CART has been frustrated in many of its efforts to impact transportation planning in Houston. Consequently, this group takes a very skeptical view of new transportation proposals from HGAC or TxDOT, including IVHS.

**Texas Bicycle Coalition (TBC).** This is an active statewide group of bicycle advocates centered in Austin. They are lobbying MPO's throughout Texas to incorporate bicycle projects into their TIPs. The Houston chapter has pursued this goal along with the Houston Area Bicycle Alliance (see below). The TBC is aware of IVHS technologies and advocates the eventual creation of a system for IVHS bicycles.

**Houston Area Bicycle Alliance.** This group is arguably the most successful new transportation interest group in the Houston area. With over two thousand members, the Alliance lobbied the mayor and city council to create a comprehensive bikeway plan for Houston. The mayor was supportive of this idea and in August 1993, the Mayor's Task Force on Bicycle Safety and Mobility developed a plan that calls for a one-thousand-mile bikeway network. The Alliance is working with the city council and HGAC to secure CMAQ funds for construction of this network. Currently, $37.5 million in CMAQ and enhancement funds have been approved for the first phase of the project.

# Houston Key Findings

## General Findings

1) Advanced transportation technologies are being used to remedy congestion problems resulting from urban sprawl.

Houston's historical patterns in the area of transportation and land use planning form a basis for our key findings. As previously discussed, Houston has no zoning laws, it has low density development, and the city boundaries spread over three counties. Since point source pollution from the petrochemical industry contributes an unusually large portion of the region's air pollution, the Environmental Protection Agency's stringent mobile source requirements may have a relatively minor affect on air quality. This situation is creating a policy problem because the petrochemical industry is also the major economic force in the region.

Until 1988, citizens rated traffic congestion as the worst problem in Houston. Since then, Houston has achieved a net reduction in congestion, accomplished by adding nearly $7 billion worth of highways, making street and road improvements, providing the most miles of HOV lanes in the nation, and increasing bus service in various areas.

2) Creative partnerships have been established between public agencies in Houston to advance IVHS plans.

The TEMC and HITS are planned systems that are both intergovernmental and intermodal. The TEMC is based on a legal agreement between the city of Houston, METRO, **TxDOT** and Harris County to build and operate a center that will monitor and report the actual flow of traffic in the Houston region. It is scheduled to begin operation in late 1995. HITS is a project consisting of major IVHS plans for both transit and freeway operations.

3) Strong mayor form of city government affects most major transportation decisions for the region through its appointment power.

The structure of Houston's strong form of mayoral government provides the mayor with the majority of appointments to the METRO Board. The mayor's chief of staff currently serves as chairman of the TPC, HGAC's voting body for transportation decisions.

## IVHS Findings

1) Houston is aggressively seeking funding to implement IVHS.

Houston is the only city in the nation eligible to receive money for IVHS projects from three main federal sources: congressional funds earmarked for IVHS operational tests, IVHS Priority Corridor funds and CMAQ.

2) HITS decisions respond to demand for congestion relief rather than environmental improvements.

Though many of the extensive plans for HITS are not operational at this time, most of the decisions were made jointly by TxDOT and METRO. CMAQ funding decisions were made through a joint process with HGAC. IVHS operational test guidelines require the inclusion of environmental data; however, this study found varying degrees of testing being done in the three case study cities.

**3)** HITS is planned for extensive multimodal travel, which would be coordinated under several agencies.

Houston leads the nation in miles of barrier separated HOV lanes, which are used extensively by the transit system. This and many other facts brought forward in this case study show the extent of transit and freeway IVHS projects. In Houston, each agency will be responsible for its own projects, although these will ultimately be coordinated by the Greater Houston TEMC.

**4)** IVHS projects paid with CMAQ funding are controversial.

Texas receives 9.9 percent of all CMAQ funding and ranks behind only New York and California in funding through this program. Environmental groups have focused attention on the correct use of this money for freeway projects. At this time, however, the law does provide for flexibility with few constraints.

**Environmental Findings**

1) Efforts to involve citizen and environmental interests in transportation planning are expanding modestly as a result of ISTEA mandates.

Active public participation in transportation planning has not been a strong tradition in the Houston area. Most groups representing environmental interests have felt that their input has not resulted in decisions being changed. ISTEA is forcing more citizen input into the decision-making process. The appointment of the TAC for the TPC is an example. However, many organizations representing environmental interests feel this provides only limited input. On the other hand, Houston was the only case study city with a full-time environmental advisor position in the mayor's office.[45]

2) Citizen organizations working through the system can successfully influence transportation projects.

The Houston Area Bicyclist Alliance demonstrates that organized citizen groups can make a difference in Houston if they pursue their goals through regular channels. By directly approaching the mayor's office with a proposed plan to create bicycle paths throughout Houston, the Alliance received a grant from the city council for a consultant to help them write a comprehensive plan. The result is that several projects have been approved by HGAC for bike paths in the city.

3) Most environmental groups in Houston are volunteer-based, spread thin, and have varying agendas.

Environmental volunteers in Houston are a rather small group of dedicated individuals who are involved in the environmental aspects of transportation for a variety of reasons. No formal network exists to represent their interests, and they have problems attending meetings scheduled during working hours or at distant locations. The new recognition that ISTEA has given them has at least brought their views into consideration, but has not included them in the final decision-making process.

4) HITS currently does not include state or city environmental officials on its executive committee.

Although air quality factors are one of four considerations for funding projects through HGAC, environmental officials are not currently involved in the overall leadership of HITS projects. The mayor's environmental advisor, however, does have an opportunity to contribute an environmental point of view.

## Models for Cooperation

**Public/Public and Public/Private Partnerships.** METRO, HGAC, Harris County, TxDOT and the city of Houston work together to further transportation goals for the city and surrounding area. These groups have received the active support of the Greater Houston Partnership for business support of advanced transportation systems in the area.

**Greater Houston Transportation and Emergency Management Center (TEMC).** The TEMC is an excellent model of transportation organizations providing both funding and support for a cooperative transportation information facility. Governmental units have shown their desire to cooperate in supporting this multijurisdictional, multimodal center.

**Metropolitan Transit Authority (METRO).** METRO is another example of governmental structures working together. METRO has responsibility for a complex network of transportation, police and street repair services. Created from fourteen governmental agencies, it comprises a nine-member operating board. Five of the members are appointed by the Houston City Council and four are appointed by the Harris County Commissioners Court.[46]

**Houston Area Bicycle Alliance.** With over two thousand members in the Houston area, the Houston Area Bicycle Alliance successfully lobbied the mayor to appoint a task force on bicycle safety and mobility. The city council allocated $230,000 for a consultant to help the group write a comprehensive plan. The plan was completed and approved by the city council in August 1993 and calls for a one-thousand-mile bikeway network to be built over a ten-year period at an estimated cost of $94 million.

# Challenges and Opportunities

## Challenges

The essence of Houston is its independent spirit and this spirit might be the greatest challenge it will face in meeting the CAAA requirements.

The CAAA of 1990 requires Houston to meet air quality attainment levels that will be both difficult and expensive to accomplish. Due to the independence of the populace, transit is not considered a reasonable alternative at this time by a majority of Houstonians. The population continues to grow quickly in surrounding areas and VMT also continue to grow. In addition, as previously outlined, mobile sources are not the greatest contributors to the ozone pollution in the area. With the petrochemical industry located in this area, changes might not be quick. However, if attainment levels are not met, the possibility of losing federal funding exists.

The continued question of land use is also a problem in meeting both the air quality mandates and the planning requirements for the city. Four major centers of activity exist within the city of Houston: the Galleria, Medical Center, Greenway Plaza and central business district. Meeting the transportation needs for these areas will require enormous capital during the next decade.

Another challenge will be to make the transit system areawide. At the present time, METRO, through a referendum vote, covers only the western two-thirds of Harris County, which eliminates several eastern cities and the Port of Houston from transit service for residents.

The environmental community in the Houston area, though small, has begun to receive greater attention for their efforts to be heard on air quality issues for transportation planning. Since these groups are not convinced that IVHS will be the panacea for the area's future transportation and air quality needs, a challenge for them will be to work through systems that provide reasonable alternatives to the current transportation and political climate in the Houston area. The Bicycle Alliance is an example of what can be achieved. A challenge to the transportation community will be to make environmental groups a more integral part of the decision-making process for infrastructure planning.

## Opportunities

The same independent spirit that will be a challenge for Houston is also likely to provide its best opportunity. The "can do" spirit of this community has made the motto "We're not Los Angeles yet" a slogan that marks their commitment to improving their environment, transportation problems, and the city in general.

The greatest opportunity may actually stem from Houston's greatest problem: traffic congestion and the high use of single passenger vehicles. Because of the city's desire to improve the actual and perceived image of the city, there is a willingness to test many various alternatives. If HITS is successful, it could become a model for intermodal IVHS

transportation planning in the nation. With its HOV lanes, toll roads and other IVHS systems that are planned, the area could serve as an example of successful alternatives.

Since the 1982 recession, Houston has begun to successfully diversify the economy of the city, reducing its reliance on the oil industry. Because of the involvement of government, business and other organizations in trying to change the image of Houston as a congested traffic community, more risks are being taken than in most other areas and more money is being spent. The desire of the business community to assist governmental efforts in changing transportation patterns will be an extremely helpful element in achieving success.

A challenge for Houston during the next decade, however, will be to address air quality problems. The city has decided to use IVHS technologies as a major element in solving their congestion and air quality problems. If successful, Houston could become a major voice in shaping national policy on effective transportation measures to meet environmental mandates.

# Houston Consultation Small Group Discussion Summary

## Messages

Participants were asked to respond to the following question: What message *would you or your organization like to leave the Humphrey Institute regarding IVHS and the environment?*

The following summarizes their comments.

**IVHS is not a panacea for air quality problems.** Since mobile sources account for less than one-fourth of total VOC emissions, and since IVHS technologies have a broad range of potential environmental impacts, IVHS should only be considered as one aspect of addressing Houston's air quality problems. In planning, implementing and evaluating IVHS projects and programs, we need to focus on those technologies that will have the most positive impact on the environment, and document the impacts of these IVHS tests.

**IVHS provides benefits other than air quality, which should not be overlooked.** IVHS addresses many issues, including air quality. Although the focus of the consultation was environmental/transportation, it should be remembered that IVHS also has the potential to save lives, time and money. The foundation elements of IVHS (e.g., traffic management) have been in place for over twenty years. Given the mix of travel modes in Houston (less than 5 percent transit), IVHS is a great opportunity to address the changes that will occur in the use of SOVs, the mode used by so many.

**IVHS technology development should be structured to improve air quality.** IVHS is akin to rearranging the deck chairs on the Titanic. The focus should be on moving *people* efficiently, not on moving cars. IVHS can help mitigate mobile source emissions, if we consider environmental concerns in the development process. M-IS projects should **be** targeted to those that facilitate and encourage the use of HOVs rather than those that merely move SOVs. Laws need to be enacted to force people out of their cars.

**More communication is needed to assess the impact of IVHS in Houston--the consultation was a good start.** The environment is more than air quality. It is unwise to discuss IVHS independent of the social needs of the target community. There is a need to better define and measure the environmental effects and assess whether the actual results will justify the cost of development, implementation and maintenance of the system. Since a lot is unknown about environmental impacts, the federal government must move slowly and with caution. Public officials need to become more conversant on environmental issues as they relate to IVHS.

The consultation identified some of the IVHS/air quality issues. It was a crisp program on a timely topic with all stakeholders represented. The consultation is a model for expanding communications locally with good coverage of specific Houston issues. Getting a diverse group together was a great idea; now the messages and ideas need to be heard, aiming at solutions that will work in real time and be cost-effective.

## Cross-Cutting Issues

Participants in the small group discussions were asked to brainstorm and discuss answers to the following questions:

1) *What are the critical environmental challenges for new transportation technologies for the Houston area?*
2) *How could IVHS technologies improve environmental quality in Houston? Or Not?*
3) *What improvements would you suggest for federal legislation to implement IVHS technologies affecting either Federal Highway Administration, Federal Transit Administration, or the Clean Air Act?*
4) *What models for cooperation among agencies and organizations would you recommend to demonstrate this legislation in the Houston area?*

The following are their verbatim responses.

### *Environmental Impacts*

- Improve operational efficiency without encouraging latent demand.
- Emission/congestion benefits must be modeled in order to justify project development. This will necessitate the development of new models of data gathering technologies, etc.
- The presence of large industrial plants, the weather and topology of Houston create non-mobile source, background ozone that cannot be controlled through IVHS.
- IVHS could also have negative impacts by increasing speeds and VMT, and consequently increasing pollutant emissions.
- An environmental task force should be established to advise various agencies implementing IVHS, so that IVHS technologies not only improve transportation accessibility and efficiency, but are also environmentally friendly at the same time.
- Transportation planners and the transportation community must accept that there is a new and equal mandate to reduce VOC and NO, emissions to low enough levels to prevent an ozone exceedence day, as well as to move people from point A to point B.
- IVHS is all about communications and giving the public enough information to make intelligent decisions. If people realize consequences of their actions, they could positively effect the air quality in the area.
- Effects of IVHS should include the prevention of further negative impacts on urban land use patterns and the natural environment from further road and highway construction, reduced SOV use, and eliminate super emitters.
- Many IVHS strategies such as driver information systems, and automated vehicle control systems and others tend to perpetuate and encourage auto dependency, a negative when considering transit alternatives. These and other IVHS strategies serve to increase capacity of the given roadway and have only ephemeral reductions of VOC which disappear when latent demand again crowds the freeways.
- CMAQ funds must not be used to increase capacity in projects lacking long term air quality benefits. Long range demand reduction with permanent air quality benefits is the environmental goal. IVHS strategies could be linked with complementary TCMs.

### *Technology Issues*

- IVHS can help obtain real-time environmental data in a standard form, incorporate that data into operational decision, and still provide additional mobility.
- IVHS technologies can activate/implement special programs/provide special information on travel alternatives on days when weather conditions are conducive to ozone exceedence.
- Several IVHS technologies may need to work together to create a positive effect on the environment, and need to be selected according to ability to deal with the circumstances of Houston: sprawl, transitways, HOV lanes, etc.
- The goal of IVHS is to improve utilization and sources of real time information to allow commuters to make appropriate choices on mode and route.
- Decreasing congestion in traffic so air pollution can be reduced through seamless traffic patterns. If accidents occur, IVHS can aid in rerouting traffic and warning the surrounding area.
- IVHS also is an integral part of implementing congestion pricing.

### *Equity Issues*

- Some IVHS technologies could intensify the disparity between transportation means available to high and low income "users." If many resources absorb so much capital that transit for less affluent is neglected, then it does not help.
- IVHS planning should include neighborhood associations, and incorporate public and media education to improve the perception of air quality improvement efforts by providing direct personal benefits.
- IVHS technologies should increase everyone's free time, ability to reach "play" areas, and make them happier. The critical environment in the Houston area is making transportation compatible with quality of life.
- Planners should balance environmental benefits with economic benefits, consider the opportunity costs, and allow for public assistance in creating competitive travel choices.
- The tax-paying public should understand the full cost of programs so they can assess the true cost-benefit ratios.
- The city government reached out to the bicycle community to develop the bike plan. Similar politics of inclusion should be used when developing IVHS.

### *New Transportation Strategies*

- IVHS should alter travel behavior by providing competitive, user-friendly, seamless HOV and transit use, without negative economic impact.
- Since Houston has a lack of capacity on alternate routes, new transportation strategies need to address better land use--transportation integration.
- IVHS should provide better, more timely travel information, and even substitute trips with communication advances.
- IVHS should improve traffic demand management measures, and make SOV costs perceptible to the public though VMT pricing, congestion pricing and parking pricing.
- Implement IVHS technologies without inducing greater SOV demand.

- IVHS should improve information and increase mode choices for suburban commuters and nonbusiness trips.
- IVHS should contribute to CAAA mandated ETR programs.

### *Institutional Issues*

- IVHS needs to be sold to the public.
- FHWA and FTA need to work together, and improve communication with local governments.
- Federal legislation should encourage experimentation with new technologies and provide clear incentives for VMT and air pollution reduction, rather than sanctions for failure.
- More coordination is needed between private, industrial and public sectors, perhaps to the point of having the private sector implement IVHS.

# *IVHS and the Environment*

## Houston Consultation, November 5, 1993

### *Agenda*

8:00 **Continental Breakfast**

8:30 **Welcome.** Lee W. Munnich, Jr., Senior Fellow and Director, State and Local Policy Program, Humphrey Institute of Public Affairs.

8:35 **Role of Houston, Texas in IVHS and the Environment Study at the Humphrey Institute.** Barbara Rohde, Research Fellow, State and Local Policy Program, Humphrey Institute of Public Affairs.

8:45 **Introduction by policy dialogue participants.** What do you do? How is it related to transportation, technology, or the environment?

9:00 **IVHS in the United States and Houston - Current Technologies and Planned Technologies**

Moderator: Lee Munnich, Senior Fellow, Humphrey Institute

Overview of IVHS in the United States Today: Videotape Presentation

IVHS and Relationship to Environmental Factors: D. A. Savitt, Vice-President, IVHS Business Development, Hughes Transportation Management Systems, Los Angeles, California.

IVHS and Houston Freeway System: Steve Levine, District Traffic Operations Engineer, State Department of Highways and Public Transportation, Houston, Texas.

Implementing IVHS in Houston METRO: Jerry King, Deputy General Manager, Capital Projects & Traffic Management, Metropolitan Transit Authority, Houston, Texas.

Coordination of Planned and Implemented IVHS Technologies in the Houston Area: Douglas Wiersig, Executive Director, Greater Houston Traffic Management Center.

Discussion

10:15 **Break**

10:30 **Environmental Impacts to the Nation and Houston from IVHS Technologies**

Moderator: Candace Campbell, Fellow, Humphrey Institute

National Impacts to the Environment from IVHS Technologies. Mark Simons, Emissions Control Strategies Branch, Transportation Section, Environmental Protection Agency, Ann Arbor, Michigan.

Impacts of IVHS for Texas Air Quality: Dr. Richard Flannery, Assistant to the Chairman, Texas Natural Resource Conservation Commission, Houston, Texas.

Challenges to the City of Houston for Air Quality due to IVHS: Mary Ellen Whitworth, P.E., Environmental Advisor to the Mayor, Houston, Texas.
Environmental Perspective to IVHS Implementation for Air Quality: Dr. George Smith, Texas State Air Quality Chairman, Sierra Club, Houston, Texas.

Discussion

11:45 **Lunch**

12:15 **"Transportation and Environmental Challenges for Houston."** Holcombe Crosswell, Member of the Board, Metropolitan Transit Authority, Houston, Texas. Introduced by Roger H. Hord, Vice President, Chamber of Commerce Division, Greater Houston Partnership.

12:50 **Announcements for Break Out Groups.** Barbara Rohde

1:00 **Case Study Preparation: IVHS and the Environment in the Houston area.**

Small Group Discussions on the following questions:

1) What are the critical environmental challenges for new transportation technologies for the Houston area?
2) How could IVHS technologies improve environmental quality in Houston? Or not?
3) What improvements would you suggest for federal legislation to implement IVHS technologies affecting either Federal Highway Administration, Federal Transit Administration or the Clean Air Act?
4) What models for cooperation among agencies and organizations would you recommend to demonstrate this legislation in the Houston area?

2:30 **Break**

2:45 **Reconvene, each group reports**

3:15 **IVHS and Houston, Texas: What Determinations Have Been Made from Today's Discussion and the Future of IVHS in Houston?**

Moderator: Barbara Rohde, Research Fellow, Humphrey Institute

Dr. Gregory Weiher, Director and Associate Professor, Center for Public Policy, University of Houston.
Mary Van Kerrebrook, Sierra Club, Houston, Texas.
Alan Clark, MPO Director, Houston-Galveston Area Council, Houston, Texas.
Leila Yim Surratt, Environmental Protection Specialist, Environmental Protection Agency, Dallas, Texas.
William R. McCasland, Research Engineer, Texas Transportation Institute, Houston, Texas.
David Hitchcock, Senior Research Associate, Houston Advanced Research Center, The Woodlands, Texas

4:30 **Wrap Up and Adjourn**

**November 3rd IVHS Meeting**
**Houston**

Russ Baier, Section Manager
Mobile Sources TNRCC

John Behnam
Environmental Protection Agency
Air Pesticides and Toxics Division

Marilyn Browning
Greater Houston Partnership

Judson Bryant
Citizens Advocating Responsible Transportation

Glenda Callaway
Ekistics

Alan Clark
Houston-Galveston Area Council

Mark Conway
Texas Department of Transportation

Holcombe Crosswell
Metropolitan Transit Authority

Norman Duncan
Center for Public Policy
University of Houston

Ernie Dunham
BHP Petroleum (Americas) Inc.

Jane Elioseff
Galveston-Houston Association for Smog Prevention

Steve Green
Galveston-Houston Association for Smog Prevention

Larry Feldcamp
Baker and Botts

Richard E. Flannery, Ph.D.
Texas Natural Resource Conservation Commission

Lance Freeman
Metropolitan Transit Authority

Kari Hackett
Houston - Galveston Area Council

David Hitchcock
Houston Advanced Research Center

Roger H. Hord
Chamber Division
Greater Houston Partnership

Dewayne Huckabay
City of Houston

Jerry L. King
METRO

Dr. Janet Kohlhase, Professor
University of Houston

Alfred Kosik
Texas Department of Transportation

Dr. Raymond A. Krammes
Texas Transportation Institute

William Kuykendall
Texas Medical Center

Thomas C. Lambert
Metropolitan Transit Authority

Mike Leary
Federal Highway Administration

Dr. Naomi W. Lede
Texas Southern University

Jacquie Lentz
Houston-Galveston Area Council

Steven Z. Levine, P.E.
JHK & Associates

Carol A. Lewis
Texas Southern University

John R. Mack
Federal Highway Administration

William R. McCasland
Texas Transportation Institute

Sandra McMurtry
Baylor College of Medicine

Charla Beth Mobley
Houston Galveston Area Council

Mark D. Olson
Federal Highway Administration

Stephen Payne
Houston-Galveston Area Council

Raul Pena
Texas Bicycle Coalition

Henry Reitz
St. Lukes Episcopal Hospital

Beverly Russell
Federal Highway Administration

Donald A. Savitt
Hughes Transportation Management Systems

Carroll Scherer
Sysco Corporation

Bill Schuessler
Common Cause

Dr. Robert Silverman
CART

Mark Simons
Environmental Protection Agency

Frances Smith
League of Women Voters

George Smith
Sierra Club

Loyd Smith
Metropolitan Transit Authority

Gloria R. Stoppenhagen
Metropolitan Transit Authority

Leila Yim Surratt
Environmental Protection Agency

Wade Thomason
American Lung Association of Texas

Gary Trietsch
Texas Department of Transportation

Katherine F. Turnbull
Texas A & M University

Mary Van Kerrebrook
Sierra Club

Dr. Gregory Weiher
University of Houston

Mary Ellen Whitworth, P.E.
Environmental Advisor to the Mayor

Douglas Wiersig
Greater Houston Traffic Management Center

## Endnotes

1. Greater Houston Partnership, Facts 1993, p. 3.

2. Ibid.

3. U.S. Department of Transportation, Our *Nation's Highways: Selected Facts and Figures*, Publication No. FHWA-PL-92-004, pp. 38-39.

4. Greater Houston Partnership, op. cit., p. 1.

5. Ibid.

6. Comments by 0. Holcombe Crosswell, Member of the Board, METRO, at the IVHS and the Environment Consultation, Houston, Texas, November 5, 1993.

7. Greater Houston Partnership, op. cit., p. 4.

8. Greater Houston Partnership, op. cit., p. 1.

9. U.S. Department of Transportation, op. cit.

10. Ibid.

11. Ibid.

12. Greater Houston Transportation and Emergency Management Center (hereafter cited as TEMC), *The Houston Intelligent Transportation System: Program Update--April 1994.*

13. Remarks by Jerry King, Deputy General Manager, METRO, at the IVHS and the Environment Consultation, Houston, Texas, November 5, 1993.

14. Metropolitan Transit Authority of Harris County (hereafter cited as METRO), *METRO* Facts 1993, p. 1.

15. Correspondence from METRO Chairman William Burge to Mayor Lanier, February 15, 1993.

16. Norman E. Duncan, *Houston and the 1990 Revisions to the Clean Air Act*, Publication 93-09 (Houston: University of Houston, Center for Public Policy, March 1993) p. 5.

17. Remarks by Richard Flannery, Texas Natural Resources Conservation Commission, at the IVHS and the Environment Consultation, Houston, Texas, November 5, 1993.

18. Remarks made by Mark Simons, Environmental Protection Agency, Office of Mobile Sources, at the IVHS and the Environment Consultation, Houston, Texas, November 5, 1993.

19. The information presented can be found in the 1994 TIP (HGAC Transportation Improvement Program, July 1993) Appendix C, pp. C-l and C-2.

20. According to the 1994 TIP, the TPC, in consultation with TxDOT, selects projects for funding under the following categories: Congestion Mitigation / Air Quality (CMAQ); Transit Section 9; and Surface Transportation Programs for Metropolitan Mobility (STP-MM), Urban Mobility (STP-UM) and Rural Mobility (STP-RM). In cooperation with the TPC, TxDOT selects projects to be undertaken on the National Highway System (NHS). (see pages C-l and C-2 of the 1994 TIP).

21. HGAC follows the EPA's and U.S. DOT's *Guidance for Determining Conformity of Transportation Plans, Programs and Projects with Clean Air Act Implementation Plans During Phase 1 of the Interim Period. (see* page C-2 of the 1994 TIP).

*22. 1994* TIP, p- C-2.

23. TEMC, op. cit.

*24.* Ibid.

*25.* Ibid.

*26.* Ibid.

*27.* Ibid.

28. Summarized from the Texas Transportation Institute IVHS Planning Notes, 1993.

29. TEMC, op. cit.

30. METRO, *Houston Intelligent Transportation* System and TEMC, op. cit.

31. TEMC, op. cit.

*32.* Ibid.

33. METRO, *Houston Intelligent Transportation System.*

34. Texas Transportation Institute, *The High-Occupancy Vehicle* Facility *System, Houston,* Texas (Research Report 1146-3, 2/91).

35. TEMC, op. cit.

*36.* Ibid.

37. Remarks by Richard Flannery, op. cit.

38. METRO, *Metropolitan Transit Authority of Harris County, Texas, 1992 Annual Report.*

39. Texas Air Control Board, "Employer Trip Reduction Program," *Texans Working for Clean Air,* Austin, Texas.

40. Sandra McMurtry, Houston Area Bicycle Alliance, interview with Barbara Rohde and Frank Douma, August 18, 1993; and remarks by Mary Ellen Whitworth, city of Houston,

at the IVHS and the Environment Consultation, Houston, Texas, November 5, 1993.

41. Remarks by Mark Simons, op. cit.

42. Remarks by Richard Flannery, op. cit.

43. METRO, *Background Information for Evaluating Cost-Effectiveness in Terms of Air Quality*, quoting Travel Time Speed Survey Report, Houston-Galveston Regional Transportation Study Newsletter, Spring 1990. (Attached to correspondence from William Burge, op. cit.)

44. "Haves, Have-nots Joined Same Side to Defeat Zoning," *Houston Chronicle,* November *4, 1993,* p. 25A.

45. While the environmental advisor position in the Houston mayor's office was unique, this configuration seems most appropriate for the strong mayor system. Since the mayors of the Twin Cities and Portland have relatively less power, the location of environmental activities in the MPOs and state environmental agencies may be more appropriate for these areas.

46. METRO, *1992 Annual Report,* op. cit.

# CASE STUDY OF MINNEAPOLIS-ST. PAUL, MINNESOTA

The information in this summary was compiled by State and Local Policy Program staff. We would like to thank those we interviewed and those who participated in the Humphrey Institute's consultation on September 23, 1993, in Minneapolis and the Case Study Conference in December 1993, also in Minneapolis, for their assistance.

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Fred Corrigan
Minnesota Transportation Alliance

Dennis Foderberg
Center for Transportation Studies
University of Minnesota

Barbara Hughes
American Lung Association of Minnesota

Carl Ohrn
Metropolitan Council

Tim Springer
Renewable Energy Society

David Thornton
Minnesota Pollution Control Agency

Jim Wright
Minnesota Guidestar

# Profile of the Twin Cities Area

## Demographics

Data from the U.S. Bureau of the Census shows that, in 1990, the population within the city limits of Minneapolis and St. Paul was just over 0.6 million, accounting for one-fourth of the Twin Cities metropolitan population. Based on April 1992 figures from the Metropolitan Council (the metropolitan planning organization for the Twin Cities), the population for the seven county metropolitan area was 2.4 million. Between 1980 and 1990, the metropolitan population increased by 15 percent, growing from 2.0 million to 2.3 million. Although the region's growth is expected to slow in future years, its population is expected to increase to over 2.8 million by 2015.[1]

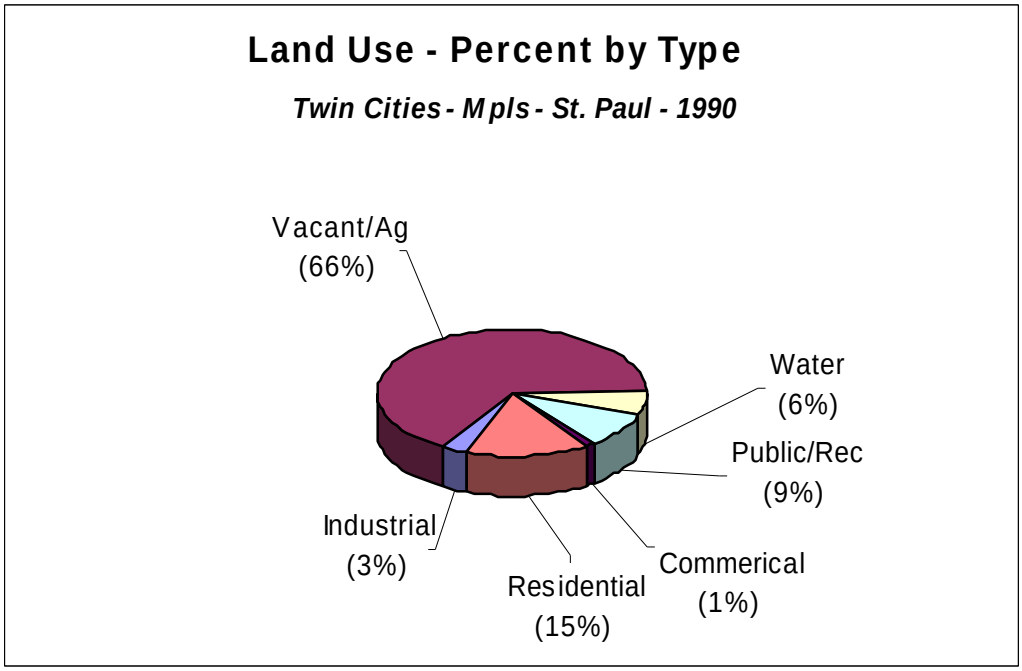
The 1990 census also showed that the population of the Twin Cities metropolitan area was 92 percent Caucasian, 4 percent African American, 3 percent Asian American and 1 percent Native American.

The Twin Cities 'Federal Aid Urbanized Land Area covers 996 square miles.* The metropolitan area encompasses seven counties--Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington. Minneapolis lies within Hem-repin County and St. Paul lies within Ramsey County.

The Metropolitan Council measures the economy of the seven county metropolitan area by a jobs available indicator. In 1990, 1,293,121 jobs were available. Projections show there will be 1,499,000 jobs by the year 2000; 1,603,000 by 2010, and 1,647,000 by 2020.

## Land Use

The Twin Cites ranked twenty-third among the nation's twenty-five largest metropolitan areas based on 1990 urban population density.[3] The Twin Cities growth management boundary or Metropolitan Urban Service Area (MUSA) was adopted by the Metropolitan Council in 1975 as a tool to assist in the orderly and economic planning for metropolitan systems. By Council policy, the MUSA is "designed to accommodate all forecasted regional growth and no effort is made to constrain development in any area of the region." The amount of vacant land within the MUSA boundary has declined approximately 11 percent between 1970 and 1990.[4] Members of the Twin Cities environmental community are concerned that enhanced IVHS/SOV (single occupancy vehicle) applications will lead to additional open spaces becoming consumed by sprawl both within and beyond the MUSA boundary.




In the USDOT/Volpe Center's 1993 *Review of the Transportation Planning Process in the Minneapolis-St. Paul Metropolitan Area,* the reviewers offer this suggestion:

> **Because ISTEA requires the effects of transportation decisions on land use to be considered, the Council might consider enhancing the travel models** to provide the capability to estimate the travel impacts of a wide range of transportation and land use policies. Although there are no major capacity expansion projects currently being planned for the Twin Cities area, introducing access sensitivity in the land use allocation process should be considered. . . . The Council and MnDOT [the Minnesota Department of Transportation] should consider utilizing these data opportunities. The Council could prepare and evaluate **alternative land use/transportation improvement scenarios** for their areawide mobility impacts prior to adoption of the next round of small area growth forecasts.[5]

Environmental advocates are urging Twin Cities transportation decision makers to use the application of advanced transportation technologies as an opportunity to "prepare and evaluate alternative land use/transportation improvement scenarios."

## Existing Transportation Systems

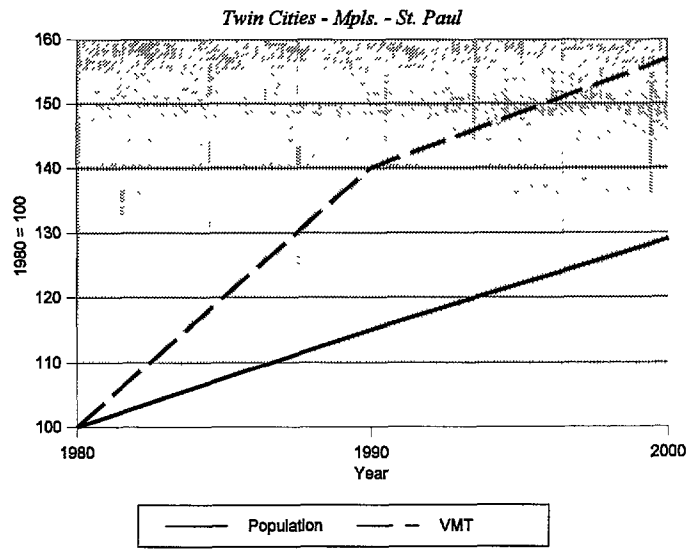
**Highway System.** According to 1990 U.S. Department of Transportation figures,[6] the Twin Cities metropolitan area had 8,951 highway miles, with 43,185,000 vehicle miles traveled (VMT) per day. There were 294 miles of freeways consisting of 1,452 lane miles that handled 17,790,000 vehicle miles per day (or just over 41 percent of the total). This works out to 12,252 vehicles per freeway lane per day, or 8.4 vehicles per mile of freeway lane per day. The past and projected growth of VMT is:

| | |
|---|---|
| 1980 | 36,100,000 |
| 1985 | 41,482,000 |
| 1990 | 50,700,000 |
| 1995 | 54,052,000 (projected) |
| 2000 | 56,652,000 (projected)[7] |

USDOT also estimated that the metropolitan population density in 1990 was 2,063 people per square mile with 4.3 miles of highway for every one thousand people. Cars occupy over 90 percent of the road space in the Twin Cities, even though 22 percent of Minneapolis households do not own cars.[8] The average daily work trip in 1990 was 9.8 miles and took 20.7 minutes. The average daily automobile trip was 6.6 miles and took 15.5 minutes.[9]

**Transit System.** Public transit accounted for 2.5 percent of all vehicle trips (225,000) in 1990, down from 3.2 percent in 1970.[10] Until recently, the Metropolitan Transit Commission (MTC) operated most of the buses in the Twin Cities and the Regional Transit Board (RTB) governed all metropolitan transit services. In May 1994, however, the Minnesota legislature passed a law abolishing the MTC and RTB and transferring their "duties, functions, property, and obligations" to the Metropolitan Council. The MTC became the Metropolitan Council Transit Operations (MCTO) on July 1, 1994. The RTB was subsumed by the Metropolitan Council on October 1, 1994, and will cease operations in January 1995. The former directors of the MTC and RTB continue to run the daily operations, but now report to new Metropolitan Council committees.[11] Under this new arrangement, the Metropolitan Council becomes the chief planning agency for both highway transportation and transit in the Twin Cites, although private transit operators will continue operations.

**Population and VMT Growth Rates, 1980-2000**




Light rail transit (LRT) continues to be a transit option for the metropolitan area. Approximately $100 million has been spent over the last twenty-five years studying fixed-

guideway transit systems in the Twin Cities, including purchase of options on old rail rights of way.[12] Current plans by MnDOT call for LRT as part of the I-35W reconstruction, as an alternate in the I-94 corridor, and as a part of the preferred alternative for reconstruction of TH 55 in Minneapolis.[13] IVHS technologies are under consideration on the I-35W project to monitor high occupancy vehicles (HOV), meter ramps, and assist in the operation of a proposed "smart bus"/express bus system.

HOV lanes and busways are in operation or under consideration throughout the Twin Cities area. There are eleven miles of reversible HOV lanes on the I-394 corridor and 38 of the 370 ramp meters have HOV bypasses. HOV lanes are preferred over LRT by Twin Cites suburbs due to lower start-up costs, availability to a wider variety of transportation modes, and greater flexibility.

**Travel Behavior.** Twin Cities area households own 1.8 million vehicles--an average of two vehicles per household--up from 0.8 million in 1970.[14] Trips per person have also expanded and now average four trips per person per day, up from two trips per person in the 1950s.[15] Vehicle occupancy during the morning peak period has declined from 1.4 people per vehicle to less than 1.2 people per vehicle in 1990.[16] When traveling to work, 80 percent of Twin Citians drive alone,[17] 10 percent use car pools and 4 percent use public transit." Fifty-three percent of all car trips are made by people who are driving alone.[19]

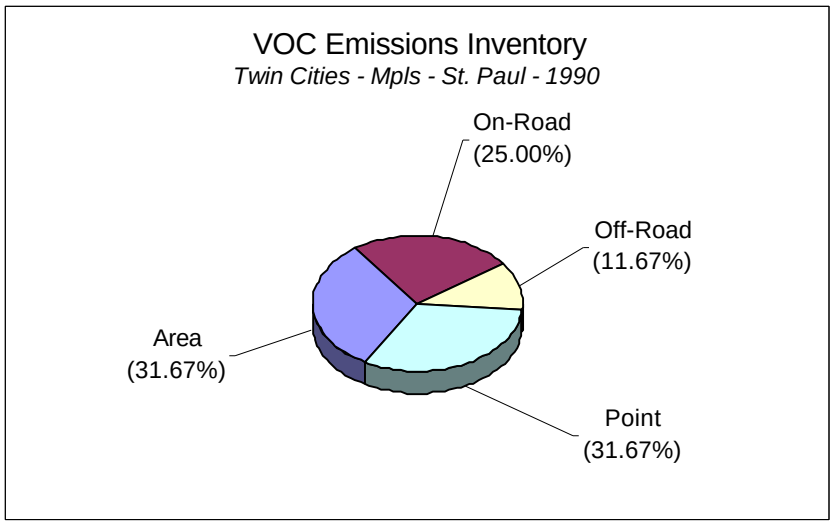
Regional travel demand is growing at a much faster pace than the growth in population. Vehicle trips per day in the region increased by approximately 74 percent between 1970 and 1990, while population increased by 19 percent.[20] The region experienced an increase of approximately 3,140,000 vehicle trips per day, and the average trip length increased from 5.1 miles in 1970 to 6.7 miles in 1990. The Metropolitan Council projects that, if current trends continue, VMT will increase 250 percent, growing from 24 million miles in 1970 to 62 million miles in 2010.[21]

## Environmental Quality

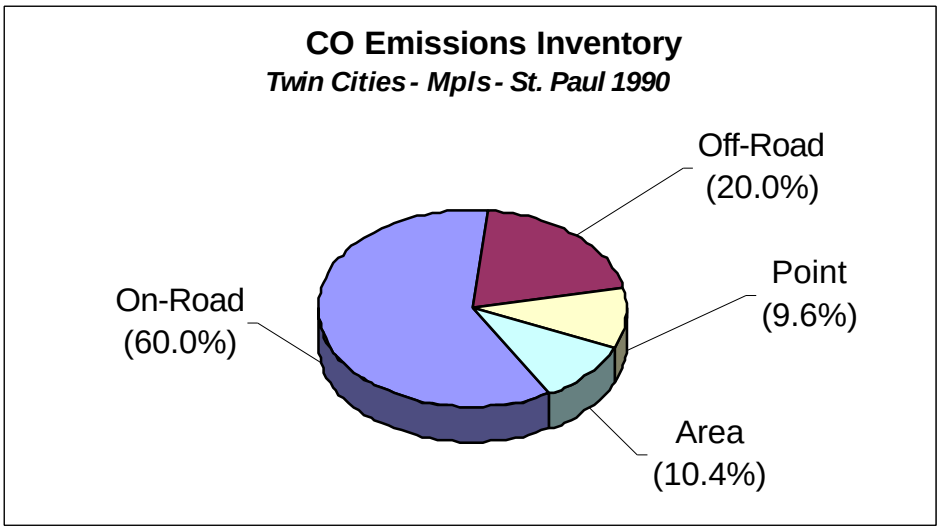
The Clean Air Act Amendments (CAAA) of 1990 set attainment standards for a number of pollutants. Of these pollutants, the Twin Cities metropolitan area is in attainment for ozone and in moderate nonattainment for carbon monoxide (CO).[22] St. Paul is in nonattainment for particulate matter. Carbon dioxide emissions are also a concern due to President Clinton's recent adoption of a climate change action plan to achieve greenhouse gas reductions as part of the International Framework Convention on Climate Change.

A major reason why the area currently meets the federal requirements for ozone is the absence of major industrial facilities upwind of the area. On-road sources contribute only 25 percent of all volatile organic compound (VOC) emissions in the Twin Cities.[23] However, should the EPA set more stringent attainment standards, which are now being considered, the area would fall into nonattainment.

An enhanced inspection and maintenance (I&M) program, the use of reformulated gas, and the possible use of oxygenated fuels year-round are being explored to ensure continued ozone attainment status. Minnesota is also waiting to see what the impact will be from federal regulation of area sources (e.g., dry cleaners) under the CAAA Stage II.[24]




The Twin Cities area is currently designated as being in moderate nonattainment for CO. Approximately 66 percent of CO emissions in the Twin Cities come from on-road sources.[25] The Minnesota winter contributes to the CO problem. Winter temperature inversions trap pollutants, and cold weather and snow exacerbate congestion and slow traffic, aggravating CO hotspots. The federal health standard for CO concentration has not been violated in the area since November 1991; thus, the area has been in attainment for more than eight consecutive quarters and is eligible to submit a request for redesignation.[26] Redesignation would require a twelve-year prevention plan and a contingency plan to respond immediately to violations. Remaining in attainment may be difficult to achieve since transportation models predict that increases in VMT will overwhelm the fleet turnover benefits of vehicle emission control systems by the year 2005. [27]



As a result of CO nonattainment, the Minnesota Pollution Control Agency (MPCA) conducted an emissions inventory that included cars, snowmobiles and lawn mowers. A vehicle emissions I&M program was also instituted and transportation control measures are being implemented at specific intersections.[28] In addition, recent legislation will require that oxygenated fuels, which have been required for four months of the year, be used year-round.

A November 23, 1993, news story indicates the region's progress in reducing CO emissions:

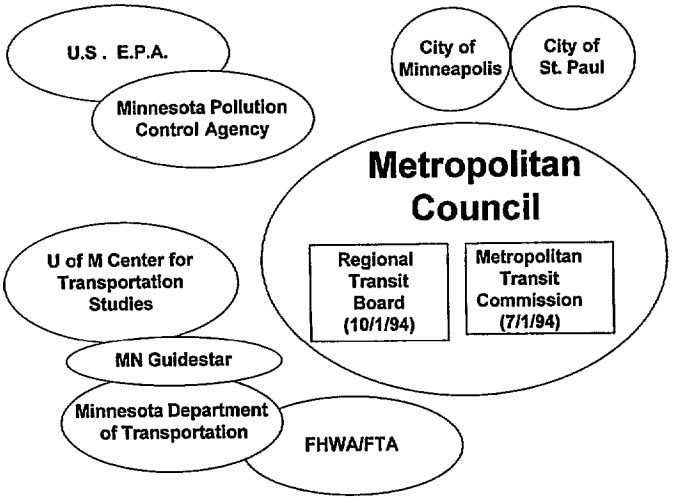
> As recently as 1989, the metro area was violating the standard 16 times a year. But a combination of adding ethanol to gasoline in the winter, timing traffic lights and metering freeway ramps, turning downtown streets into oneways, cleaner cars required under federal law and the vehicle inspection program have all cut carbon monoxide pollution. (from "Twin Cities Air Vastly Improved," *Saint Paul Pioneer Press*)

### Government

The Metropolitan Council represents seven counties in the Twin Cities urban area. There are 140 cities and 50 townships located within these seven counties. The Council is composed of seventeen members appointed by the governor.

**Transportation and Environmental Planning.** The Metropolitan Council's Transportation Development Guide/Policy Plan, developed in October 1993, was developed by those agencies responsible for transportation planning in the region. The document serves as a guide to transportation investments between now and the year 2015.[29] It also serves as the interim congestion management plan and the long-range transportation plan (LRTP) required by the Intermodal Surface Transportation Efficiency Act (ISTEA), and conforms to the requirements of the CAAA.

**Interagency Configuration**



The guide recommends expanding the region's transit systems and coordinating land use with transportation capacity planning. Reorganization of the bus system, development of LRT, and the addition of HOV lanes are also suggested. The guide emphasizes that "transit supports the environment by helping reduce trips and resultant automobile emissions."[30]

According to the 1994-1996 Transportation Improvement Program (TIE), the Twin Cities transportation planning process is administered and coordinated by the Metropolitan Council (which now includes the former RTB and MTC--see page 117) and involves municipal and county governments, the Metropolitan Airports Commission (MAC), MnDOT, and the MPCA. Locally elected officials participate through the Metropolitan Council's Transportation Advisory Board (TAB), which provides a forum for the collective deliberation of state, regional and local officials, and private citizens.[31]

In response to ISTEA, the Metropolitan Council convened a multiagency ISTEA working group to review and develop recommendations for issue areas.[32] The inclusion of the RTB and MTC functions within the Metropolitan Council represents a shift toward stronger regional governance on transportation issues.[33]

The TIP process in the Twin Cities begins with Metropolitan Council staff notifying the relevant agencies to submit TIP projects. The agencies develop and approve projects, which the Council staff incorporate into a draft TIP. The Council's Funding and Programming Committee (F&PC) reviews and comments on the draft TIP, and Council staff revise the draft based on these comments. Meanwhile, the MPCA receives and reviews the air conformancy analysis of the draft. The TAB's Technical Advisory Committee (TAC) reviews the draft TIP prior to TAB adoption. Finally, the Council's Committee of the Whole reviews the TIP and, unless the TIP is inconsistent with Council policy, adds its approval.[34]

Environmental impacts of transportation projects are addressed by MnDOT's Office of Environmental Services. This office includes an air quality unit that "provides technical expertise to MnDOT and other clients in the areas of policy development, procedures, modeling, analysis, and prediction for project and system level air quality, as well as energy analysis."[35] In addition, the MPCA coordinates an interagency air quality/transportation task force to address ongoing air quality regulatory concerns.

## IVHS Technology in Place or Planned

IVHS has been characterized as a linking of technological advances between the communications and computer infrastructure and the transportation infrastructure.[36] In Minnesota, planning and implementation of IVHS projects is overseen by Minnesota Guidestar, which recently became an office within MnDOT.[37]

Minnesota Guidestar represents an integrated approach to creating a statewide intelligent transportation system. Projects selected reflect an attempt to provide benefits to all the state's transportation needs. Rather than a single focus, Minnesota Guidestar employs a range of technologies: a communication and navigation project (Genesis), a transit

innovations project (Travlink), a freeway and arterial management project (Integrated Corridor Traffic Management System), an air quality monitoring project (LIDAR), two commercial vehicle operations (CVO) projects, and a project focused on rural users (ARTIC / Trilogy).

Minnesota Guidestar's Executive and Steering Committees provide the leadership for IVHS activities in the state. The committees comprise representatives from the major state, regional, county and city governmental agencies; staff members from Guidestar and the University of Minnesota Center for Transportation Studies (CTS); and consultants. There is also a private sector advisory panel and a Guidestar Forum, both of which are in the early stages of development, that give input to the executive and steering committees, respectively.

The executive committee, which is responsible for overall policy guidance, includes representatives from the MPCA the Metropolitan Council (including the MCTO and RTB), the Department of Public Safety (responsible for energy planning), the Federal Highway Administration (FHWA), and three citizen members. The executive committee has four standing committees:

- Communications
- Institutional Issues
- Legal Issues
- Funding Issues

The steering committee provides the day-to-day guidance for six working committees:

- Rural IVHS Applications
- Freeway and Arterial Management
- Architecture, Standards and Protocols
- IVHS Research and Development
- Transit Innovations
- Planning and Program Management

Members of the steering committee and the planning and program management working committee have undertaken a Guidestar management initiative to ensure proper coordination of the project teams. This structure provides specific roles and responsibilities. It has led to the completion of strategic planning documents as well as procedures for project selection, project evaluation and the formation of partnerships.

**Minnesota Guidestar Strategic Plan.** Minnesota Guidestar staff developed a strategic plan to define long-term goals, objectives and action steps for the next two years.[38] The purpose of the plan is to "articulate milestones" and help "establish processes to allow Minnesota to selectively engage in ITS[39] research, demonstrations and deployment.[40] The strategic plan will be updated every two years. The first plan was adopted in May 1992. The second plan, adopted in spring 1994, reflects the important changes that occurred as Guidestar evolved "from a concept into a multi-million-dollar program."[41]

The 1994 strategic plan reflects the input of various groups. Participants included national, state, county and local transportation planners and policy makers; university

participants from the CTS, Humphrey Institute and other departments; state patrol members; representatives from the Metropolitan Council and other metropolitan planning organizations in the state; a representative from the Minnesota Chamber of Commerce; and representatives from state and national legislators' offices. Notably absent from this group were representatives from the EPA, MPCA and environmental and community interest groups.

The strategic plan defines Guidestar's mission as "transforming the current transportation system into one with increased accessibility, greater productivity, enhanced safety, **reduced environmental impacts** and broader private sector investments."[42] (emphasis added). Guidestar's vision includes "environmental enhancement," and the plan states that "early efforts will be conducted in air quality evaluations of field tests. Strategies that promote alternative fuel use will be researched along with telecommuting and other demand management measures."[43]

The plan further states that "public input will be gained through the Guidestar Working Committees and greater agencies' involvement." Public acceptance for Minnesota Guidestar projects will be sought through the development of an effective public education program that keeps the population well-informed of the benefits and opportunities of ITS. Actions toward this end include de-emphasizing smart cars and highways and, instead, emphasizing smarter and safer travelers.[44]

**Minnesota Guidestar Projects.** Project selection is guided by development of the annual workplan. The budget for the 1994 workplan is $40 million. During the summer, the workplan is submitted to interested parties in the private sector and to the working committees. In August, a request for preliminary proposal (RFPP) is issued. Project proposals are submitted by mid-September. Project evaluation occurs in late September and early October. Projects are ranked according to mission criteria and sent on to the steering and executive committees for review and approval in November and December.

Currently, there are eight FI-IWA-sponsored **IVHS** operational tests, eight state-based federally funded MnDOT field trials, and nine miscellaneous research, emerging and related projects. These twenty-five projects are described below. They have been grouped according to the most recent FHWA technology "bundles," which are listed on page 4 of the Executive Summary. While federal guidelines require that all operational tests include an evaluation of environmental impacts, none has been completed to date.[45]

### Travel and Traffic Management

**IVHS Deployment Activities.** Deployment activities include installation of new ramp meters, HOV bypass ramp surveillance cameras, and expansion of the communications network.[46]

**Genesis.** Genesis will evaluate the impacts of using personal communications devices (PCDs) to deliver traffic and transit information. Genesis will use a data gathering and distribution function similar to Travlink (described on page 125) through two PCDs: 1) an alphanumeric pager with a 4 line x 20 character screen minimum, and 2) a hand held personal digital assistant (PDA).[47] The pager is currently envisioned as providing specific

zone information to the user on demand, with notification of late or broken-down buses, incidents and freeway congestion, weather hazards, lane closures and other prescheduled special event information. The PDA is envisioned to include the above functions, plus primary and alternate route planning capability that will suggest a time to wake up and a time to leave so the traveler reaches his or her destination on time. The PDA will also provide transit itinerary information from Travlink.

**ARTIC/Trilogy.** This is a project of MnDOT's Traffic Management Center (TMC), described on page 125, that will assess the potential for utilizing FM sideband to relay traffic information to travelers. ARTIC/Trilogy builds on an existing metro area traffic information broadcasting service provided by the TMC over KBEM 88.5 FM. The Human Factors Lab at the University of Minnesota will evaluate various receiver types.[48]

The purpose of the ARTIC/Trilogy pilot project is to demonstrate wide area digital broadcast of traffic data, assess safety and legal concerns, improve information formats and structure, refine the system components and processes, and eventually evaluate the impact of the in-vehicle devices on the driver.

The traffic information consists of incident, congestion, construction, weather and maintenance messages that are compiled at the TMC. The in-vehicle devices display the traffic messages via three different media (text, graphics or voice). The pilot project involves the evaluation of three devices totaling twenty-four units, most of which are either installed in MnDOT fleet vehicles or are being used for lab-testing and demonstration purposes.

**Herald.** Herald is an en-route driver advisory system that will disseminate information on road conditions and accidents over AM radio stations to remote areas of Iowa and Colorado.

**Autoscope.** Autoscope is an advanced wide area vehicle detection and automatic vehicle surveillance system invented at the University of Minnesota. This technology looks for changes in vehicle speeds, volumes and other parameters. Computer software automatically analyzes the video imagery and generates traffic flow information needed for incident detection and traffic and intersection control.[49] Autoscope is currently in operation at over two hundred intersections in Oakland County, Michigan, and is under consideration for application by the Guidestar Transit Innovations Committee on the transitway used by buses and bicycles linking the St. Paul and Minneapolis campuses of the University of Minnesota.

**Cruise.** Cruise is a video-image-based traffic detection and analysis device developed by 3M. The project will field test the application of machine vision to IVHS needs in traffic management and control.[50]

**ITMS Operations and Maintenance Program Study.** This is a study to develop an operations and maintenance program for the Twin Cities' Integrated Traffic Management Systems (ITMS). The study will prepare an inventory of ITMS program plans and schedules and review existing maintenance practices. Project partners include MnDOT; the cities of Minneapolis, St. Paul and Bloomington; and four metropolitan counties.[51]

**Integrated Corridor Traffic Management (ICTM) Project.** This project attempts to demonstrate that more efficient corridor transportation movement can be achieved through cooperative jurisdictional efforts, freeway and arterial integration, real time adaptive control strategies, advanced technologies and a comprehensive motorist information system.

Strategies will be developed that integrate freeway and arterial control systems; develop partnerships between key agencies; install vehicle detection and surveillance systems on arterials parallel to and intersecting the freeway; apply strategies for traffic management from a corridor perspective; implement, integrate and coordinate arterial traffic signal systems on intersecting and parallel arterials; and provide automatic data collection capabilities. Partners in the project include MnDOT; Minnesota Guidestar; the cities of Edina, Richfield and Bloomington; Hennepin County; and the CTS.[52] AWA Traffic System America, Inc. is the private consultant to the project.

**Portable Traffic Management System.** This project will demonstrate and evaluate a fully portable traffic management and control system. Traffic will be monitored using video cameras. Information will be compiled and evaluated at a fully portable traffic control center located on site. Real time traffic information will then be presented to travelers via changeable message signs. The National Sports Center in Blaine will be the first test site.

Project participants include MnDOT, the Minnesota Amateur Sports Commission, the city of Blaine, Anoka County, BRW, Inc., and Castle Rock Consultants.[53]

**Odyssey.** This project will provide traveler information and emergency alerts.

**Rosedale Project.** This project will use advanced traffic management and traveler information to relieve congestion at a major activity and retail center.

**Third Avenue Distributor Traffic Management Project (TAD).** TAD uses improved traffic signal control software and detectors to better coordinate traffic signals and ramp meters in a specific heavily used downtown corridor.

**MnDOT Traffic Management Center (TMC).** The TMC is a communications and computer center for managing traffic in the Twin Cities metropolitan area. The TMC operates 354 ramp meters: 322 are centrally controlled; 142 have closed circuit TV cameras; and 46 have changeable message signs, live traffic reports on an FM station, a highway helper program and specific links to four Minnesota Guidestar projects.

### Public Transportation Management

**Travlink.** Travlink will test the extent to which improvements in the quality and availability of transit information can positively influence an individual's selection of alternatives to SOV travel.[54] The Travlink system will consist of two parts. The first part will collect data, such as transit schedules and status, traffic flow, highway construction and detours, and traffic incidents, from the MCTO and TMC. An automatic vehicle location (AVL) system will help in this effort by providing real time bus location and time information from a network of global positioning systems (GPS).[55]

The second part of Travlink is the distribution of transit information, based on the above data, at various display devices. Traveler information will be available on display monitors, electronic signs, smart kiosks and videotext terminals. Smart kiosks and videotext terminals will provide interactive service regarding transit information and will provide transit data in major activity centers, selected residences and workplaces. Meanwhile electronic signs and display monitors, which are noninteractive, will display schedule and real time status at park-and-ride lots and transit transfer centers.[56]

Travlink traveler information fits into three categories: transit, traffic and mode comparisons. Each park-and-ride and transit station will have the schedule applicable to that location, including expected times of arrival for buses. Additional information includes special informational messages, park-and-ride lot and downtown parking locations, and transit itinerary planning. Transit itinerary planning will provide the traveler with the originating bus stop; route information, including transfers, fares and travel time; and the final bus stop. Mode comparison information will provide time and cost comparisons between transit, HOV and SOV along the I-394 corridor, which will allow the traveler to make an informed decision regarding his or her mode of travel.[57]

The pilot test for Travlink began in 1994. It consists of eighty buses equipped with AVL running along the I-394 corridor.

The Downtown Minneapolis Transportation Management Organization (DMTMO) will serve as a Minnesota Guidestar Travlink demonstration site for providing alternative transportation solutions to commuters and visitors, and for employers' new employee orientation and travel demand management (TDM) efforts.[58] The DMTMO is a public/private partnership between the city of Minneapolis, Minnesota Rideshare, the Metropolitan Council and its RTB and MCTO, MnDOT and downtown businesses. DMTMO's purpose is to maintain and improve safe, efficient and environmentally sound movement of people and goods to, in and through downtown Minneapolis.

**Smart DARTS.** Smart DARTS (Dakota Area Resources and Transportation Services) involves the application of computer-automated scheduling and dispatching, and the use of smart cards and AVL systems in various paratransit operations in Dakota County. The project is a partnership between MnDOT, the Metropolitan Council RTB, DARTS, Dakota County and 3M, and involves a community participation process.[59]

### Electronic Payment Services

**Smart Traveler.** Smart Traveler refers to a study commissioned by the former RTB to consider how smart cards might be used in fare payment, electronic billing and contractor performance monitoring.[60]

### Commercial Vehicle Operations

**Automated Mileage and Stateline Crossing Operations Test.** This project will test GPS and on-board mileage recorders for gathering location and mileage information from commercial vehicles for the purpose of apportioning fuel taxes and mileage. The Iowa

Department of Transportation provides the leadership for this project, with assistance from Minnesota and Wisconsin.

The test consists of two phases. Phase I will concentrate on the data accuracy and reliability of the technology. Phase II will test the technology on thirty commercial vehicles in their operating environments, and study the costs and benefits of the technology.[61]

**MnDOT Commercial Vehicle Operations (CVO) Study.** This study looks at the institutional barriers in adopting electronic data collection and interchange by commercial vehicles. This study found that CVOs are capable of exchanging information with the state electronically. Formal electronic data interchange (EDI) programs are not immediately feasible, however, if for no other reason than transactions are not yet uniform among states and software is not readily available. Commercial vehicle operators are prepared to adopt the basic IVHS technologies that would allow trucks to bypass weigh stations.[62]

**Minnesota/Wisconsin Out-of-Service Verification.** This project will use real time technology to improve state patrol enforcement of out-of-service commercial vehicles or drivers.

**Multi-State One-Stop Shopping.** This is a multi-state effort to create a one-stop electronic system for purchasing motor carrier credentials.

### Emergency Management

**St. Paul Incident Management Project.** The objective of this project is to manage incidents in the I-94/I-35E commons area using comprehensive data communication between MnDOT's TMC and the city of St. Paul. Safetran Traffic Systems is providing financial and evaluation support.

In order to minimize incident-related congestion and secondary incidents, traffic will be directed along alternate routes using specially designed traffic signal coordination plans. Surveillance cameras will be installed at key intersections along alternate routes to provide real time information to systems operators. Information will then be passed along to travelers via changeable message signs.[63]

### Research Projects

Minnesota Guidestar comprises a broad and advanced research element conducted through MnDOT and the CTS. Federally funded research projects address former FHWA-IVHS bundles--Advanced Traveler Information Systems, Advanced Traffic Management Systems, Advanced Vehicle Control Systems--and human factors. Scoping studies include a Rural IVHS Scoping Study, an Integrated Traffic Management Systems (ITMS) Scoping Study, an ITMS Operations and Maintenance Program Study, and an IVHS/Commercial Vehicle Operations (CVO) Study.

Under ISTEA, $1 million was allocated to CTS in 1991 for IVHS research. In fiscal year 1994, CTS received $2.75 million for thirteen research projects.[64]

**Planned or Emerging Projects**

**High Speed Bus System.** A number of Twin Cities' communities are exploring the possibility of implementing a smart bus system. These systems are designed to combine the latest in technology with comfortable, accessible, cleaner-fueled buses; dedicated highway lanes; express hub-to-hub links; neighborhood circulator buses with timed transfers to express buses; and comfortable and modern stations.[65]

IVHS technology would be used to coordinate neighborhood feeder services and a mainline express vehicle system moving passengers to major destination points using dedicated HOV lanes, HOV metered bypasses and signal preemption.[66] AVL systems would provide real time information as a fleet management tool that would be provided to the commuter through a variety of methods, including computer terminals at bus kiosks, personal computers, telephones and local cable TV.

The high speed bus demonstration project includes service in the I-35W and I-494 corridor areas. An important feature of the project will be a circulator service running east-west in the I-494 area, picking up and dropping off people from employment sites and intersecting with other existing north-south routes and transfer facilities. This service will be coordinated with MnDOT's TMC project along I-494, which is already being implemented.[67]

The existing bus systems may also be reoriented. There are four components that make up a system to automatically detour buses off their normal route: 1) a sensor that detects the speed of traffic on the normal route, 2) a sensor that detects the speed of traffic on the detour route, 3) a computer that collects the data from the two sites and determines which route is fastest, and 4) a sign or signal that tells the bus driver to alter the normal course.

Because of the expenses of running power and communication lines to sites along highways, all components of the system must be completely self-contained. The flexibility to fine tune the system by repositioning any or all of the elements is also made possible by using self-contained components. Power will be generated through solar panels and the communication between the components will be accomplished by means of two-way data radios and data modems. This type of data collection and evaluation technique is available "off the shelf" and is thought to be a very cost-effective and reliable system for transit detouring.@

**Transitway Crossing Project.** Guidestar's Transit Innovations Committee has recommended the University of Minnesota transitway crossing plan to the executive committee for implementation. The plan proposes an innovative method to alert traffic on streets crossing the university's transitway that bus/bike traffic is approaching. Currently, many motorists "run" or make "rolling stops" at these intersections, due to infrequent bus or bicycle traffic. The proposal calls for bicycle sensitive detectors on the transitway that would activate a specially designed flashing sign indicating "vehicle

approaching," or "bus/bike approaching" or a flashing symbol for each. The main purpose would be to protect bicyclists who could easily be overlooked by crossing motorists.

### Air Quality Measurements

**Light Detection and Ranging (LIDAR).** The LIDAR project is evaluating the environmental impacts of IVHS technology. It uses an optical scanning device that takes 3-D laser scans of the atmosphere to determine particulate and aerosol levels. Sante Fe Technologies is the prime contractor and technology provider. IBM, which is a subcontractor to Sante Fe Technologies, will develop imaging software to display the range of particulate concentration on a geographic information system overlay.

The LIDAR device can scan a 12 km radius; however, it can only detect particulate levels, not distinct pollutants such as CO or nitrogen oxide (NO,). LIDAR is a portable technology used specifically to monitor the air quality impacts of the portable traffic management system being tested at the National Sports Center in Blaine, Minnesota. Using LIDAR in conjunction with the present EPA monitoring devices will allow MnDOT to do real time evaluation of air quality impacts resulting from changing traffic patterns.[69]

### Other IVHS-Related Projects

**Advanced Parking Information System.** This project will examine the feasibility of an automated, real time parking information and guidance system. Using changeable message signs, parking information would be provided by parking lot operators. Partners in this project include MnDOT, the city of St. Paul, parking lot operators, and Edwards and Kelcey, Inc.

**Telecommuting.** MnDOT is exploring a joint effort with Tele-commuter Resources, Inc., a nonprofit telecommuting firm in the metro area, to expand the link between telecommunications and transportation as a way of reducing travel. Tele-commuter Resources, Inc. is a partnership between individuals, corporations and agencies committed to developing "grass roots strategic policies for evolution of communities in the electronic age. . . . Access to telecommunications will become the element which binds increasingly dispersed communities together."[70]

## IVHS Technologies In Use or Being Planned in the Twin Cities

| Name of Project | Project Classification | FHWA/IVHS Bundle | FHWA/IVHS User Service |
|---|---|---|---|
| Minnesota/ Wisconsin Out-of-Service Verification | 1994 FHWA Operational Test | **Commercial** Vehicle Operations | Automated Roadside Safety Inspection |
| Multi-State One-Stop Shopping | 1994 FHWA Operational Test | Commercial Vehicle Operations | Commercial Vehicle Electronic Clearance |
| Light Detection and Ranging (LIDAR) | 1994 FHWA Operational Test | | Emissions Detection" |
| ARTIC/Trilogy | 1994 FHWA Operational Test | Travel and Traffic Management | En-Route Driver Information |
| Herald | 1994 FHWA Operational Test | Travel and Traffic Management | En-Route Driver Information |
| Genesis | 1992 FHWA Operational Test | Travel and Traffic Management | Pre-Trip Travel Information |
| Travlink | 1992 FHWA Operational Test | Public Transportation Management | Public Transportation Management |
| Automated Mileage and Stateline Crossing Operations Test | 1992 FHWA Operational Test | Commercial Vehicle Operations | Commercial Vehicle Administrative Processes |
| ITMS Operations and Maintenance Program Study | MnDOT Field Trial | Travel and Traffic Management | Traffic Control |
| Portable Traffic Management System | MnDOT Field Trial | Travel and Traffic Management | Traffic Control<br>En-Route Driver Information |
| Rosedale Project | MnDOT Field Trial | Travel and Traffic Management | Traffic Control<br>Pre-Trip Travel Information<br>En-Route Driver Information |
| Third Avenue Distributor Traffic Management Project (TAD) | MnDOT Field Trial | Travel and Traffic Management | Traffic Control |
| Smart DARTS | MnDOT Field Trial | Public Transportation Management | Public Transportation Management |

| Name of Project | Project Classification | FHWA/IVHS Bundle | FHWA/IVHS User Service |
|---|---|---|---|
| St. Paul Incident Management Project | MnDOT Field Trial | Travel and Traffic Management | Traffic Control<br>En-Route Driver Information |
| Advanced Parking Information System | MnDOT Field Trial | Travel and Traffic Management | Traffic Control<br>En-Route Driver Information |
| Integrated Corridor Traffic Management (ICTM) Project | MnDOT Field Trial | Travel and Traffic Management | Traffic Control<br>En-Route Driver Information |
| Smart Traveler*+ | RTB Research Study Precursor to Smart DARTS | Electronic Payment Services | Electronic Payment Services |
| Cruise | *1992* MnDOT Research Project | Travel and Traffic Management | Traffic Control |
| Autoscope | *1989* MnDOT Research Project Product now being sold | Travel and Traffic Management | Incident Management<br>Traffic Control |
| MnDOT Commercial Vehicle Operations (CVO) Study | MnDOT Research Project | Commercial Vehicle Operations | |
| MnDOT Traffic Management Center (TMC) | MnDOT first generation IVHS - ramp metering, etc. | Travel and Traffic Management | Incident Management<br>Traffic Control |
| Odyssey | Emerging Project | Travel and Traffic Management<br>Emergency Management | En-Route Driver Information<br>Emergency Notification and Personal Security |
| Telecommuting | Emerging Project | | |
| Transitway Crossing Project | Emerging Project | | |
| High Speed Bus System*+ | Related Project | | |

* Emissions detection is under consideration as a twenty-ninth user service.
** High Speed Bus System and Smart Traveler are projects that relate closely to Guidestar's activities but were undertaken outside of Guidestar's operations.

## Environmental Issues and Organizations

### Issues

**Air Quality.** A critical part of remaining in attainment for CO and ozone is reducing the projected increases in VMT. The Metropolitan Council projects that construction of new highway lane-miles will not increase fast enough to meet the projected increase in VMT and will result in increased congestion. The Twin Cities long-range transportation plan (LRTP), therefore, stresses VMT reduction as a means to improve air quality and mobility. In the past, air quality improvements resulted primarily from improvements in auto and truck engines and cleaner fuels.

To reduce emissions of carbon dioxide ($CO_2$), which is a major global greenhouse gas, Minneapolis-St. Paul has undertaken an urban CO, reduction project. The objectives of the project are: 1) to reduce the Minneapolis-St. Paul VMT to 10 percent below 1990 levels, 2) to reduce transportation energy use of nonpassenger vehicles (nearly half of transportation-related emissions originate from nonpassenger vehicles), 3) to increase the use of alternative fuels, and 4) to achieve higher fuel efficiency standards for vehicles.[71]

### Land Use

Land use is an important transportation-related environmental issue that is receiving increasing scrutiny in the Twin Cities. Public concern about land use patterns is reflected in increasingly lively debate over LRT, analysis by the Minnesota Environmental Quality Board of growth management strategies employed by counties and localities, and legislation proposed by a state representative to overhaul present taxation boundaries.[72]

The public is generally unaware of the potential impact of IVHS technologies on land use and community livability. Moreover, community leaders remain suspicious of transportation projects, particularly those that would put communities that are often without a voice in transportation decisions at a greater disadvantage. Like most major urban centers, the Twin Cities has seen its share of community disruption brought about by transportation projects.

The Rondo neighborhood of St. Paul is an example of an entire community being displaced by a highway. In The Days *of Rondo,* Evelyn Fairbanks concludes her account of St. Paul's "thriving black community" by stating: "The community that I wrote about is gone. It was erased by the highway department and 'progress'--other people's money. U.S. Interstate 94 was built through the old Rondo neighborhood in the 1960's."[73] The Saint Paul Pioneer Press recently ran a series of articles regarding the old Rondo neighborhood, providing further information about the transportation project's impact:

> By 1956, the Minnesota Highway Department's plans for I-94 were ready. Community groups had persuaded the designers to depress the road and highway workers excavated a ravine nicknamed "the hole," where kids

> played baseball. But the road design was one thing. Relocating the people whose houses had to come down for it was something else.
>
> By 1958,435 displaced families had been moved. Most of them couldn't get homes anywhere outside the immediate neighborhood and many had to move to substandard structures.[74]

As the Twin Cities considers reconstruction of I-35W in Minneapolis, neighborhood community leaders are recalling the destruction of St. Paul's Rondo community. In the future, it is likely that these leaders will question whether IVHS applications will further increase the demand to expand I-35W or become a means of reducing SOV usage.

**Environmental Interest Organizations**

The environmental advocacy community in the Twin Cities is well established and plays an important role in policy formation on a range of issues, including waste management, energy resource planning, habitat preservation, and water and air quality.

Environmental interest groups directly involved in urban transportation issues include the American Lung Association, which has been active in transportation emissions and air toxics issues, and a rapidly growing bicycle advocacy network. Aside from these two groups, however, most environmental organizations in the Twin Cities have not demonstrated a primary concern about air quality, which is the most significant transportation-related environmental issue addressed by federal legislation. For the most part, environmental organizations have not been active in proceedings of the Metropolitan Council Transportation Advisory Board (TAB) and their involvement in a limited number of MnDOT project-specific public hearings has tended to be motivated by concerns other than air quality.

The lack of activity by environmental interest groups on air quality issues stems from a variety of factors. First, the area has relatively minor air quality problems. Second, limited resources have prevented environmental organizations from extensive activity in the transportation planning process. Third, given Minnesota's history of proactive environmental legislation and policies, the MPCA and Metropolitan Council are generally perceived as environmentally motivated and capable of enforcing the provisions of the CAAA.

The Twin Cities environmental community approaches transportation-related environmental issues from a number of angles, which may serve as a proxy for air quality.

**American Lung Association of Minnesota.** The American Lung Association provides information to the public regarding the health effects of mobile source air pollutants, monitors and suggests ways to minimize emissions (such as inspection and maintenance programs and car/van pooling), cosponsors the annual BBOP (bike, bus or car pool) Day with MnDOT and the Metropolitan Council, monitors the transportation section of the MPCA, and is involved in rule hearings on air toxics emissions.

**Neighborhood Transportation Network (NTN).** This is a grass roots organization that was recently formed to oppose expansion of I-35W and encourage investment in LRT. NTN filed suit with MnDOT over plans to begin to add lanes to a portion of the I-35W corridor prior to completion of a final environmental impact statement.

**Minnesotans for Light Rail Transit.** The mission of this recently formed nonprofit group includes communicating the benefits of LRT, building public support for the immediate construction of a portion of a proposed LRT system in the Twin Cities metropolitan area, and securing the necessary funding to make LRT a reality in the Twin Cities.

**The Bicycle Advocacy Movement.** This is a strong and growing network of bicycle advocacy groups in the Twin Cities, including the Minnesota Coalition of Bicyclists, Midtown Greenway Coalition, Save Cedar Lake Park, Loring Bicycle Task Force, and the Uptown Association Bicycle Task Force. There are also bike task force / advisory committees at the state, county, city and regional levels. The chair of the State Bicycle Advisory Board is one of the citizen members of TAB, and the bicycling community was consulted in developing the new scoring criteria for pedestrian and bicycling projects as part of the TIP process.

**The Transportation Alliance.** This advocacy group for transportation issues is composed of contractors, engineers, county board representatives, transit operators, and representatives of various municipalities. Although not technically an environmental organization, this group is worth noting due to its work around the state to define transportation needs and build consensus on how to meet those needs.

**The Institute for Local Self-Reliance (ILSR).** ILSR has addressed least-cost planning for transportation infrastructure through full pricing of roads. Least-cost planning is presented as an emerging strategy to ensure equity and efficient resource allocation transportation infrastructure investment. Recent studies by ILSR include *Making* the Cur *Pay its* Way The Case of Minneapolis Roads by John Bailey, and *Getting From Here to There: Building a Rational Transportation System* by Dr. David Morris.

**Center for Energy and Environment (CEE).** CEE conducted some demand-management-related activities to advance its CO, reduction project and conducted research on an alternative fuels project.

**Neighborhood Groups.** Neighborhood groups have a rich history of public involvement in the Twin Cities. These groups have addressed transportation issues on a project-specific basis in the past and can be expected to continue doing so. A recent survey of neighborhood organizations conducted by the Urban Environment Education Coalition (UEEC) found transportation issues, such as traffic noise, vehicle emissions, mass transit and bike trails, to be a primary concern.

**Citizen Members of the Guidestar Executive Committee.** Environmental interests related to IVHS development are represented, to some degree, by the three citizen members of the Guidestar Executive Committee. These members have advocated for consideration of congestion pricing and full-cost pricing of roads, a strong transit component, coordination of IVHS with development of alternative fuels, multimodal planning, and outreach to more stakeholders. None of these members, however, is from

an environmental organization or sees environmental groups as their main constituency. A bicycling advocate has recently been added to the Minnesota Guidestar Transit Innovations Committee.

## Key Findings and Challenges

1) The Twin Cities metropolitan area has a strong tradition of public participation in transportation decision-making, but greater citizen participation is needed.

### Finding

In its 1993 report, *Review of the Trunsporfufion Planning Process in the Minneapolis-St. Paul Metropolitan Area,* the USDOT/Volpe Center found that the Metropolitan Council was to be "commended for its commitment to citizen participation in the 3-C (continuing, cooperative and comprehensive) planning process.[75]

While Minnesota Guidestar has made a strong effort to expand public involvement in its decision-making process, there is no specific provision for environmental interest group representation in Guidestar's planning process. Efforts to broaden participation, especially from the environmental community, are underway in Minnesota Guidestar's newly formed Transit Innovations Committee. The committee is composed of representatives from various agencies including the Metropolitan Council, transit organizations, county and city governments, the university research community, and the business and environmental communities.

Citizen involvement in the application of advanced transportation systems is being considered as part of an effort to establish a Minnesota regional chapter of IVHS-AMERICA. Its purpose is to provide a grassroots outlet for public education, outreach and systems architecture building; encourage greater participation in IVHS activities in state, city and local areas; and create a more extensive network of relationships in both public and private areas.[76]

### Challenge

There is a need to increase outreach to key stakeholders in IVHS planning. For example, in response to over nine thousand solicitations to an informational forum sponsored by IVHS-AMERICA, USDOT, Minnesota Guidestar and CTS, more than three hundred transportation stakeholders from across FHWA Region V attended, but there were no representatives from the environmental or neighborhood interest groups. A panelist from the Humphrey Institute challenged the forum sponsors to make a greater effort to include representation from the environmental community in future forums.

At the Humphrey Institute's December Case Study Conference, Brian Ketcham, a member of this study's steering committee, remarked that he had conducted extensive interviews with numerous people from Minnesota's environmental interest groups and found that they felt they had not been invited to participate in Minnesota's IVHS transportation planning process. In a written response to Ketcham's claim, MnDOT Assistant Commissioner Eugene Ofstead stated that "Guidestar has made a strong statewide effort to involve all interested parties . . . [and] transit representatives and the Commissioner of the Minnesota Pollution Control Agency are members of the Guidestar Executive Committee."[77]

The USDOT/Volpe Center report cited above also observes that while minorities make up 3.5 percent of the metro area population, "they have not participated extensively in public hearings and other forums for public comment."[78] The report does not explore the reasons for nonparticipation by minorities. Given the likely equity impacts of IVHS projects, there is a need to expand outreach to community groups, especially minority and low-income, that are not presently involved in IVHS project planning.

Bundling IVHS applications to fit desired benefits identified at the regional level presents a major challenge. It may be possible to translate key issues to the regional level by having a dialogue with the people who live there rather than expecting appropriate bundling of applications to occur at the national level.[79]

Additionally, the current configuration of TAB does not involve environmental representatives. Consideration should be given to correcting this situation.

2) Creative partnerships have been formed between public agencies and between the public and private sectors.

Finding

Minnesota Guidestar projects have received input from various agencies involved in transportation planning and have strong private sector participation. Guidestar has conducted a limited number of focus groups and is making great strides in building partnerships with the business and investment community. For example, U S WEST and Westinghouse see themselves not as contractors in Minnesota Guidestar, but as partners.[80]

The Twin Cities area has a wide range of IVHS activities that have resulted from these creative partnerships. One excellent example is TMC, a partnership that includes representatives from MnDOT, an FM radio station, four Minnesota Guidestar projects, and communities affected by ramp meter installations.

Another example is the Air Quality Guidance Team. Staff of the MPCA, Metropolitan Council and MnDOT, together with consultants in the private sector, jointly created guidelines for the air quality analysis of transportation projects in the Twin Cities to ensure consistency in agency response to requirements of the Clean Air Amendments, National Environmental Policy Act, Congestion Mitigation and Air Quality applications,

and state laws. The guidelines are an attempt to describe the best practices in air quality analysis and modeling, and to set thresholds of analysis for different classes of projects.

The impetus for this project was frustration with inconsistent expectations experienced by the consultants hired to perform various analytical functions for these agencies. As evidence of their frustration, the consultants took part in drafting the guidelines on a pro bono basis.

Another outstanding partnership is DMTMO. Linked to MnDOT's TMC, this transportation management organization promotes awareness of existing and future traffic congestion problems and possible solutions among downtown employers, developers, parking facilities managers, commuters and visitors. DMTMO's objective is "to promote parking incentives and disincentives that favor multiple occupant vehicle (MOV) use, in the form of parking placement and pricing, and to promote conversion of a significant portion of private and public parking to MOV use."[81]

Other partnerships include the CTS Executive Committee and its councils, which serve as partnership forums for critical discourse between the public, private and academic community, and the Metropolitan Council, MnDOT, CTS and Humphrey Institute, which are partners in developing a congestion/road pricing study.

## Challenge

Although representatives from environmental regulatory and interest groups have been invited to participate in Guidestar's strategic planning process, they have not attended. There is a need to better understand why these groups do not view attendance as important to the achievement of their mission.

Another challenge is to make greater use of the data generated by the TMC. This data is a rich resource for traffic information that could extend beyond current applications. TMC could serve as a model for coordination and collection of traffic data, and for environmental action based on such data. TMC's partnership with DMTMO is an opportunity to bring about real change in the transportation habits of commuters and accomplish a coordinated effort at achieving environmental benefits.

3) Transit is an important component of Minnesota Guidestar

**Finding**

Genesis, Travlink, ARTIC/Trilogy and Smart DARTS operational tests are all considered transit sensitive. Travlink and Smart DARTS are exclusively transit projects. In fact, the Travlink project is one of the most watched transit IVHS projects currently underway.[82] In addition, Minnesota Guidestar's Transit Innovation Committee incorporates community-based transit design.

Team Transit, an interagency partnership between the Metropolitan Council and its MCTO and RTB, MnDOT, the cities of Minneapolis and St. Paul, transit providers, and metro area counties and other municipalities, also impacts Guidestar activities. Team Transit has provided a forum to name transit problems and to find solutions. Results to date include:

- more than thirty miles of exclusive bus lanes on state highways,
- exclusive bus lanes in downtown St. Paul and Minneapolis,
- more than thirty ramp meter bypass lanes,
- new park-and-ride lots,
- reorientation of existing bus routes, and
- transit advantage tests, such as intelligent signals at ramp meters to allow accelerated metering when a bus is present (speed light) and Opticom, which allows buses to use the technology now available to emergency vehicles.[83]

**Challenge**

Reorienting existing bus routes and improving route information is an area where IVHS can play a larger role. There are many instances where fixed route express service can save time on congested roadways simply by detouring around the core of congestion. The basic idea is to find locations where buses can be rerouted on a predetermined detour when the speed of the normal route decreases to a certain extent and to provide this information to bus drivers, thus providing a time advantage for transit. The Minnesota Transportation Alliance suggests that IVHS applications could make transfers easier and reduce travel time.[84] Also, to assure mobility for the elderly, IVHS applications can make transit more accessible to this growing population segment.

Another challenge is the need to determine the relative cost-effectiveness of transit in addressing air quality problems. Travlink and Genesis are proposed as demand-side solutions to congestion in the Twin Cities that would likely have positive effects on air quality. These projects provide information that makes transit and HOV modes more attractive, but it is unclear to what extent they will impact mode shift. For example, the effect of Travlink may be limited since most participants in the focus groups reported that they are not "regularly agitated" about commuting on I-394.[85]

Yet another challenge is the fact that the present capability of emissions models to accurately predict IVHS and other transportation projects is in question. The recent

Scherrer/Kittelson (University of Minnesota) report assessing the effectiveness of the Twin Cities I&M program raises questions not only about the effectiveness of I&M programs but also about the reliability of widely used emissions models in general.[86] The MPCA disputes Scherrer and Kittelson's findings, and claims that "the inspection program is needed to force people to maintain those cars so they will keep running clean."[87]

4) Minnesota Guidestar is moving toward an integrated approach to addressing environmental impacts.

**Finding**

Transportation planners and environmental interest groups are concerned about transportation demand management strategies and land use changes that will impact not only air quality, but a wide range of environmental concerns, including energy consumption, water quality, habitat preservation and community quality of life. As Minnesota Guidestar proceeds in developing its IVHS operational tests, it is likely that the evaluation of environmental impacts will include more than simply air quality. The congestion/road pricing study cited earlier reflects a more integrated approach to addressing environmental impacts.

Also, Minnesota Guidestar's adoption of the term "intelligent transportation systems" rather than "intelligent vehicle highway systems" reflects a more wholistic approach to integrating a variety of new technologies into the transportation infrastructure.

**Challenge**

The broadening conception of environmental impacts demands a more elaborate strategy for linking IVHS to transportation demand management strategies and to the development of alternative fuel technologies. IVHS could also play a key role in directing travelers away from emissions hot spots or in designing more environmentally sensitive land use alternatives.

Guidestar strives to "better meet the transportation needs of citizens and businesses . . . in a way that enhances the state's quality of life--environmentally, socially, and economically."[88] Included in Guidestar's vision are traffic flow adjustment; rapid incident detection and response; real time travel/traffic/transit information through either in-vehicle devices, changeable message signs, personal communications devices or radio data systems; safety enhancements through communication; and weigh-in-motion systems for commercial vehicles.

While Guidestar's strategic plan is an impressive depiction of the potential of these technologies, demand management is handled primarily by providing route information rather than by providing a time advantage over SOV travel. Demand management is not easily accomplished by an implementing agency. Nevertheless, given that demand management is stressed in the region's long-range plan, and given the multiagency structure of Guidestar's management committee, the failure of Guidestar to more fully

connect various projects to demand management goals raises questions about potential long-term environmental impacts.[89] A related challenge is the development of sufficient political will to implement aggressive demand management strategies.

The distinction between R&D and deployment is another issue highlighted by the Twin Cities experience with IVHS. It may be that an IVHS project is at the deployment stage before evaluation indicates whether its actual operation will create an SOV advantage or disadvantage. Approximately 31 percent of Guidestar's budget is allocated to deployment activities.[90] In addition, while many Guidestar projects, such as Genesis and Travlink, are clearly research and development, other projects, such as the Integrated Corridor Traffic Management (ICTM) project, might be characterized as deployment. As a result, questions arise as to whether such projects should operate under different requirements for estimating air quality and other environmental impacts, and for involvement of the public in planning activities. The split between R&D and deployment also highlights the need to ensure coordination and flow of information between various projects.

5) In light of the uncertainty regarding the environmental impacts of ITS applications, there is a need to expand the Metropolitan Council's planning capacity.

**Finding**

USDOT has recommended increasing the Metropolitan Council's planning capacity and role in evaluating the environmental impacts of transportation investments." In response to the changing requirements and policies of new laws--in particular the CAAA and ISTEA--the USDOT/Volpe Center's *Review of the Transportation Planning Process in fhe Minneapolis-St. Paul Metropolitan Area* calls for strengthening the Council's planning and evaluation process to produce the next Long-Range Transportation Plan (LRTP), Transportation Improvement Plan (TIP), and State Implementation Plan (SIP).[92]

The report goes on to state "The region is commended for its proactive stance on air quality. . . . Since the region's ambient air quality is so closely tied to auto usage and developing land use patterns, the council could include scenarios in its long-range plan that examine the interaction of land use development and the investment in transportation infrastructure."[93]

In order to meet these requirements and suggestions, particularly as they relate to the introduction of advanced transportation technologies such as IVHS, the Metropolitan Council's planning and evaluation capacity will have to be strengthened.

**Challenge**

Budget and resource constraints need to be overcome to allow the Metropolitan Council to play an expanded role in evaluating the environmental impacts of IVHS. If IVHS technologies are to be implemented, and federal funding suggests that Congress is serious about implementation, then the Council ought to be more visible in the planning and evaluation process. At present, MnDOT is the primary force behind evaluation of IVHS projects.

## Models for Cooperation

**Guidestar Transit Innovations Committee.** This committee includes representatives from the Metropolitan Council, transit organizations, county and city governments, the university research community, and the business and environmental communities. The committee seeks out new applications of IVHS in transit and other nonautomobile travel options.

**Team Transit.** Team Transit is a regionwide interagency partnership seeking to make transit more attractive and easier to use. IVHS applications could further this goal by finding locations where buses can be rerouted to a predetermined detour when the speed of a normal route decreases to a predetermined level.

**Joint Air Quality Guidance Committee.** This committee includes staff from the MPCA, Metropolitan Council and MnDOT, plus consultants from the private sector. The committee drafted guidelines for air quality analysis to ensure consistent responses to requirements of the CAAA, NEPA, CMAQ applications and state laws. This is important given the national debate over CMAQ requirements.

**Guidestar Forum.** The Guidestar Forum is an attempt to include new players in transportation planning. Outreach activities include coordinating an FHWA Region V forum, undertaking scoping studies and focus groups, and planning a fall 1994 forum targeted to rural Minnesota and private sector partners.

**Downtown Minneapolis Transportation Management Organization (DMTMO).** The DMTMO is a public/private partnership initiated by downtown Minneapolis businesses. DMTMO is designed to manage travel demand in order to ensure the environmentally sound growth and prosperity of downtown Minneapolis. The organization received CMAQ funding to assist the Minnesota Guidestar Travlink project in marketing smart information kiosks.

**MnDOT Traffic Management Center (TMC).** The TMC is a partnership that includes representatives from MnDOT, four Guidestar projects, an FM radio station, private towing firms, state patrol and other law enforcement agencies involved in incident response, and local communities affected by ramp metering.

## Twin Cities Consultation Small Group Discussion Summary

### Messages

Participants were asked to respond to the following question: *What message would you or your organization like to leave the Humphrey Institute regarding IVHS and the environment?*

The following summarizes their comments:

**Public education is essential for implementing environmentally acceptable IVHS systems.** This Humphrey Institute project should translate implications of IVHS into publicly (politically) acceptable policy proposals and provide analysis of potential consequences of various policy alternatives. The Institute needs to identify the emerging environmental issues just as it identified a vision for IVHS. Even though this is a metropolitan study, don't forget about "Greater" Minnesota and the environmental impacts.

**IVHS is a set of tools, not the total solution,** to transportation-related environmental problems. Transportation agencies, however, should make use of the advances in technology that have proven useful elsewhere.

**Environmental issues must be integrated into a "system" infrastructure so** that IVHS can deal with these issues in a sensible way. Also, the term "environment" should be defined within the context of this project.

**IVHS should be driven by the benefits of reducing congestion,** increasing vehicle occupancy and improving the environment, not by available technology. Also, a "family of benefits" will be needed. Dick Braun's luncheon address referred to the need for a "family of solutions."[94] There is a need to look at the near-term technologies and not just the longer-term "high-cost" solutions.

**Make sure the environmental issues considered are broader than simply "air quality."** Land use and the implications of continued urban sprawl and growth also must be drawn into the discussion.

**Be careful in referring to subsidies.** Comment this morning by one speaker was that highway users don't pay for the roads--i.e., they're subsidized. To say the highway user is "subsidized" is misleading and inflammatory. Highway users do, in fact, pay for their roads via fuel taxes. There are a number of roads that are "land service" and other taxes properly pay for these.

**Travel demand reduction should be at the top of the transportation planning hierarchy**--just as waste reduction is the first priority in solid waste management and energy efficiency is the first step to addressing energy supply and demand--then we can better meet travel needs with bicycles, mass transit, intelligent transportation systems, and so forth. Also, less travel creates stronger communities, which is an important social goal.

Providing infrastructure for bicycle transportation that is fast, safe and pleasant should also be a priority over large IVHS investments.

**Health concerns are being missed.** We, as public policy makers, seem to focus on specific policy questions in regard to IVHS and the environment. In considering the ramifications of our decisions on mobility, environmental quality, economics, social equity and cost-effectiveness, let us not forget that there is also a public health component that must be taken into account. IVHS must lead to a cleaner environment to yield better health and better quality of life in a strong economy.

**Congestion pricing is the solution we are waiting for.** Make current transportation more efficient without inducing more driving in the future. Implement congestion pricing so that driving costs reflect the total economic, social and ecological costs of auto use. IVHS provides an opportunity for behavior and social change. For example, travel demand could be reduced via road pricing, congestion pricing and emissions pricing.

**Transit is the answer.** To best serve the environment, transit/HOV options should be given the highest priority.

**The movement of goods needs a sound environmental approach.** We need to provide for safe and efficient movement of goods in an environmentally sound way.

### Cross-Cutting Issues

Participants in small group discussions were asked to discuss the issues suggested in the following questions:

1. *What are the critical environmental challenges for new transportation technologies?*
2. *How could IVHS technologies improve environmental qualify?*
3. *How can changes in transportation technologies be brought info the metropolitan planning organization (MPO) planning process? Environmental planning process?*
4. *What institutional processes, outside of MPO's, exist today to address transportation and technological concerns?*

The following are their verbatim responses.

#### *Environmental Impacts*

- It is difficult to predict all environmental impacts. There is a concern that we not move the environmental problems to someone else's backyard (NIMBY).

- Protection of habitat for plants and wildlife that may be threatened or endangered.

- Concern that air quality does not become the only environmental challenge. However smog-ozone increases do come with more miles traveled. There are impacts on people and crops. Electric cars may cause smog, may be precursors:

NO,, acid rain potential SO,. We must avoid worsening traffic congestion and VMT in the long run.

- There is a need for long-term planning, for reevaluating zoning and land use regulations to promote reductions in VMT, for control by regulations rather than market-based management. Incorporate and coordinate transportation planning with other planning efforts at all levels.

- We will be dealing with dispersed congestion. Sprawl is worsened if travel becomes safer / easier with smart cars and smart roads. Development pressures along smart road corridors through environmentally sensitive areas. There will be business sprawl with smart roads.

***Technology Issues***

- We will continue to improve car emissions. But we need to change oil dependent vehicles toward renewable (domestic and alternative) fuels.

- We must fix "smoke stack" emissions so electric cars can "work." Retool and recycle, not create obsolescence.

- EIS processes must include analysis of cost-benefit of technology solutions.

- Should the technologies drive the environmental planning process? Shouldn't the environmental concerns drive the process?

***Equity Issues***

- There is a need for provisions for low income transportation models, for equity issues. Avoid ameliorating ECORACISM. There is a need to "strike a balance" between increased transportation supply and transportation demand management, to make transit relatively more attractive than it is today, to make sure all residents benefit from new technology, to maintain the freedom of mobility that the people in this country cherish while respecting environmental and social issues, to help meet our transportation needs and goals while respecting and improving the environment and society, and to balance costs and benefits.

- How do *we implement* road pricing? Have we seriously asked this question? No perceived *individual* benefit should impede public acceptance.

- Environmental benefit is not enough to create new products / technologies. Development will come if there is a profit to be made or to respond to market-demand.

- There is further need to recognize and acknowledge the impact our desire for mobility and the improvement of our environment has on our economy, to recognize that investments made to enhance our mobility and the environment may mean a decline in other areas of society, and to identify technologies that are

cost-effective, i.e. have big payoffs. To look for those that can apply to Third World or impoverished areas.

***New Transportation Strategies***

- To change driver/traveler behavior, we must decrease SOV usage.
- We need to make bicycling a safer alternative travel mode.
- We need to use IVHS to identify Super Emitters, hence reduce emission. Convey wasteful/polluting driving habits graphically/visually to drivers. We must have remote sensing with pricing scheme (user/emitter fee) and we need to add AVI/HOV lanes and congesting pricing.
- Increase ramp metering. It smooths out traffic by 1/3 in peak hour periods--lessens stops and starts.
- We need to route trucks away from "hot spots" and we must implement commercial systems to decrease environmental impact and institute transparent borders.
- Genesis (hand-held PCD) can tell us where there are congested roads, and give us detours that will lessen amount of wasted time on the road.
- We must use PVT (signal pre-emption) for buses and other IVHS technology in van-pools.
- "Smart Buses" or bus automated systems are needed to tell passengers where they are on the route voice or readout. Travelink: AVL on buses and APTS--dynamic reporting to riders at station.
- We need integrated service to make public transit system more feasible, more convenient.

***Institutional Issues***

- There is a need to devise public education strategy so people all over Minnesota understand costs and benefits, to maintain freedom of choice, to fully understand the consequences of new transportation technologies and to communicate understanding before hysteria develops.
- There is a need for public buy-in before there will be the behavior changes needed.
- We have little experience and inadequate models, these are risky projections.
- Research needed on ways to more accurately predict changes in travel due to technology--such as telecommuting and IVHS.

- As planners attempt to anticipate future needs, vehicle changes can alter modeling results.
- MPOs should be involved in regional decisions regarding priorities, use, applications of technologies.
- Funding seems to drive transportation and the newly funded technologies already seem to be part of the process.
- MPOs should be proactive in courting partnerships with private nonprofit funders-- Metropolitan Council and RTB should be proactive in funding community based technology demonstration projects.

# 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**

**Twin Cities Policy Consultation I**

**September 23, 1993 -- Hubert H. Humphrey Center, Room 180B**

***AGENDA***

**8:00 Continental Breakfast**

**8:30 Welcome: Robert Kudrle, Associate Dean for Research, Humphrey Institute**

**8:40 Synopsis of the day's activities:** Gary DeCramer

**8:45 Introductions by policy dialogue participants:** What do you do? How is your work related to transportation, technology, or the environment?

**9:20 Framing IVHS and the Environment**

Panel: Project description: Lee Munnich, Senior Fellow, Humphrey Institute, Moderator
Overview of IVHS Technology: Donald A. Savitt, Vice President, IVHS Business Development, Hughes Transportation Management Systems
Relationship between IVHS and the Environment: Carol Zimmerman, IVHS Marketing Manager, AT&T
Environmental Issues and Regulations: David Van Hattum, Research Assistant, Humphrey Institute

Discussion

**l0:15 Break**

**l0:30 Twin Cities: An urban setting for a case study on the environmental impacts of the application of advanced technologies on a transportation system**

Panel: Candace Campbell, Fellow, Humphrey Institute, Moderator
Environmental Challenges of the Twin Cities: David Thornton, Program Director Air Quality Division, Minnesota Pollution Control Agency
Guidestar: IVHS operational tests: James L. Wright, Director, Minnesota Guidestar Program
Metropolitan Council: Planning for Environmental Quality: Carl Ohm, Principle Planner, Metropolitan Council

Discussion

**11:45** **Lunch.** Humphrey Dining Room

**12:40** **Speaker:** Dick Braun, Director, Center for Transportation Studies, University of Minnesota, and Chair, Metropolitan Airports Commission

**12:55** **Announcements and Introduction of Facilitators Linda Dolan, Melanie Brown, Merry Daher, Georgie Peterson**

**1:00** **Case Study Preparation: IVHS and the Environment in the Twin Cities**

Break out discussions on the development of environmental analysis of advanced transportation applications.

Topics:

1) What are the critical environmental challenges for new transportation technologies? (Linda Dolan. Room 180B, Blue)
2) How could IVHS technologies improve environmental quality? (Melanie Brown. Room 188, Green)
3) How can changes in transportation technologies be brought into the MPO transportation planning process? Environmental planning process? (Merry Daher. Room 215, Red)
4) What institutional processes, outside of MPO's, exist today to address transportation technological and environmental concerns? (Georgie Peterson. Room 170, Yellow)

**2:45** **Break.** Refreshments in Room 180B.

**3:00** **Reconvene. Each group reports.** Room 180B.

**3:20** **Panel Reaction and Discussion.** Panel includes

Panel: Gary DeCramer, Fellow, Humphrey Institute, Moderator
James Denn, Commissioner, Minnesota Department of Transportation
Dottie Rietow, Chair, Metropolitan Council
Mark Simons, Emissions Control Strategies Branch, Transportation Section, Environmental Protection Agency
Charles Williams, Commissioner, Minnesota Pollution Control Agency

**3:45** **Quality Check and Wrap-up**

**4:00** **Tour Humphrey Forum:** Steve Sandell, Director, Humphrey Forum

**4:20** **Adjourn**

## September 23, 1993 Consultation
### Twin Cities Participants

Steve Bahler
Federal Highway Administration

Jim Barton
Metropolitan Council

John Bergford
Minneapolis Chamber of Commerce

Harold Bottleson
Minnesota Department of Transportation

David Braslau
David Braslau Associates, Inc

Richard Braun
Center for Transportation Studies
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Melanie Brown
Minnesota Department of Transportation

Pat Bursaw
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Richard Cady
Minnesota Department of Transportation

Merry Daher
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Linda Dolan
Minnesota Department of Transportation

Larry Foote
Minnesota Department of Transportation

Charles Foslien
Federal Highway Adminsitration

Edward Foster
University of Minnesota

Cheryl Heide
Minnesota Department of Natural Resources

Judy Hollander
Regional Transit Board

Barbara Hughes
American Lung Association of Minnesota

Elaine Kienitz
Office of Congressman Martin Sabo

Greg Knopff
Senate Research

Karen Lyons
Metropolitan Council

David May
The 3M Company

Norm Mellem
Minnesota Department of Transportation

Tim Michaels
Senate Transportation Committee

Herbert Mohring
University of Minnesota

David Morris
Institute for Local Self-Reliance

William Morrish
University of Minnesota

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Minnesota Chamber of Commerce

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Michael Pearson
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James L. Wright
IVHS Development Engineer

Bob Zauner
Hughes Transportation Management Systems

Charleen Zimmer
Strgar-Roscoe-Fausch

Carol A. Zimmerman
AT&T

## Endnotes

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*30.* Ibid., p. 8.

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67. Jill Schultz, JMS Communications, memo to Gary DeCramer, March 7, 1994.

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69. Mike Manore, LIDAR project manager, interviewed by David Van Hattum, April 20, 1994.

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71. Center for Energy and Environment, *Recommendations to the Twin Cities of Minneapolis and Saint Paul for Strategies to Reduce CO, Emissions,* CO, Urban Reduction Project, August 1993.

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73. Evelyn Fairbanks, *The Days of Rondo* (St. Paul: Minnesota Historical Society Press, 1990) p. 181.

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77. Eugene Ofstead, MnDOT, memo to Gary DeCramer, March 1994.

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79. These remarks are a summary of comments from a Center for Transportation Studies morning round table discussion on IVHS and the environment with Dr. Thomas Horan, (previously cited) and invitees from the Metropolitan Council, MnDOT, rural county engineers, University of Minnesota transportation researchers, and transportation representatives from the private sector, held on November 18, 1993, at the Radisson Hotel Metrodome.

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81. Attachment to DMTMO's 1994 application for CMAQ funds, p. 3.

82. Ofstead memo.

83. Team Transit materials handed out at the Minnesota Transportation Alliance Expo in Minneapolis, October 17-18, 1993.

84. Fred Corrigan, Executive Director, Minnesota Transportation Alliance, phone conversation with Gary DeCramer.

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87. Barbara Jackson of the Minnesota Pollution Control Agency forwarded to the Humphrey Institute the EPA response (April 6, 1994) to the paper, "I/M Effectiveness as Directly Measured by Ambient CO Data."

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89. Concerns over appropriate attention to demand management in IVHS development at the national level have been raised by Michael Replogle of the Environmental Defense Fund in "IVHS at Risk: A Review of Draft National Program Plan for Intelligent Vehicle Highway Systems (IVHS)," Environmental Defense Fund, November 25, 1993.

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94. Richard Braun, Director of the University of Minnesota's Center for Transportation Studies was the luncheon speaker at the September 23 policy consultation.

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