Annual Summary Report

Research Project GC8286, Task 2
Freeway Management Coordination

FREEWAY AND ARTERIAL MANAGEMENT EFFORT (FAME) IN WASHINGTON STATE

by

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Traffic congestion and personal mobility preservation are the most challenging issues facing transportation professionals. From Phoenix to San Francisco to Washington, D.C., citizens are identifying transportation as their number one concern,[1] outweighing issues such as pollution, overpopulation, unemployment, and crime. In the state of Washington, particularly in the greater Seattle area, congestion is likewise a major concern.

In order to address the mobility problems facing the urban areas in the state of Washington, the state initiated a new transportation research and implementation program in October of 1987. The program is called FAME -- Freeway and Arterial Management Effort. The focus of the program is to find implementable solutions to immediate mobility problems.

SEATTLE'S TRAFFIC TROUBLES

The traffic congestion problem is a by-product of population and economic growth. Absolute population growth in Washington between 1980 and 2000 is projected to be the seventh largest in the United States. State population will increase by approximately 1,178,000 people (a 25 percent increase from 1980) by 2000.[2] During the same time period, population in the four county area surrounding Seattle will increase from about 2.2 million to about 3.1 million,[3] representing about 70 percent of the statewide increase.

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[1]Institute of Transportation Engineers. "Urban Traffic Congestion: What Does the Future Hold?" ITE Publication No. IR-040. 1986.

[2]Puget Sound Council of Governments.

[3]Puget Sound Council of Governments. Twenty Twenty Vision. August 1988.

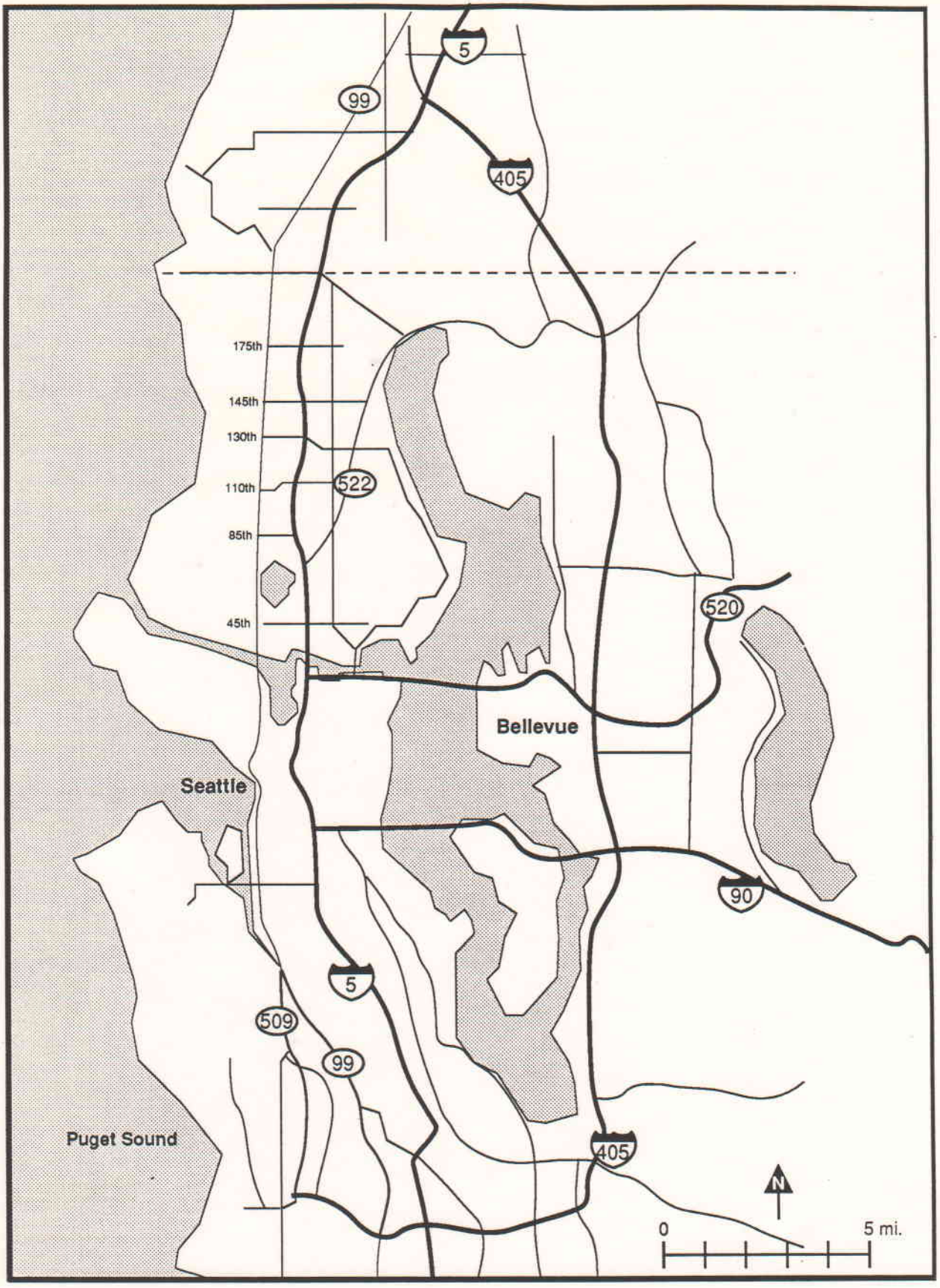

Figure 1. Seattle Vicinity Map

Growth in travel demand will accompany the increase in population. Total trips in the central Puget Sound area are predicted to increase by 42 percent from 1980 to 2000. Vehicle miles of travel (VMT) will increase even more. Freeway VMT will increase 73 percent and arterial VMT will increase 71 percent in the same time frame (see Figure 2).[4] Because of this increased travel demand, average speeds on the road system will decrease from 25 mph in 1988 to 15 mph by 2000.[5] To compound the problem, the increase in travel demand will take place on essentially the same freeway network that exists today.

The Washington State Department of Transportation (WSDOT) has been combatting the congestion problem for some time. A strong program emphasizing ridesharing and TSM measures has been in place since the early 1970s. The program includes park and ride lots; bus/carpool facilities (such as freeway HOV lanes and HOV bypasses at metered freeway ramps); and a surveillance, control, and driver information system.

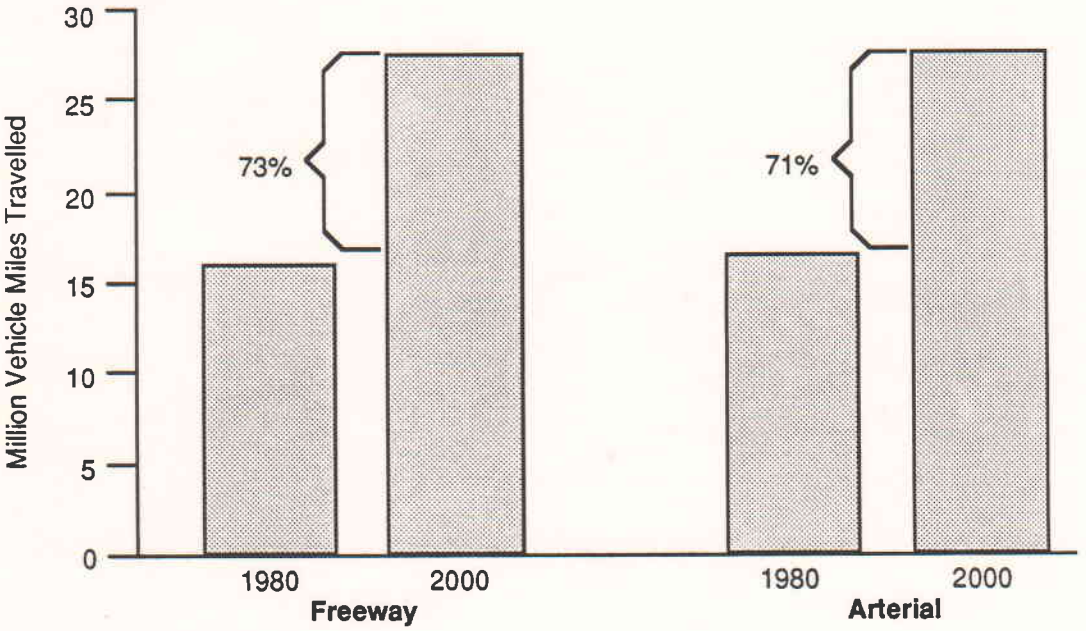

Figure 2. Four County Seattle Area VMT

[4]Puget Sound Council of Governments and Municipality of Metropolitan Seattle. Summary Report: Multi-Corridor Project. November 1986.

[5]Puget Sound Council of Governments. Twenty Twenty Vision. August 1988.

However, given that the current plan contains no major capacity improvements and that forecasters expect significant increases in growth and demand, the efforts mentioned above need to be strengthened. That is the reason the FAME program is aimed at supporting and expanding the existing programs.

In addition, FAME is addressing local agency problems, since all links in the transportation network, whether operated by the state or by a local agency, are interrelated. In order to give the FAME program a broad perspective, its Technical Advisory Committee includes 27 representatives of various agencies throughout the greater Seattle metropolitan area. Most individual research projects also have a smaller technical review committee to oversee the conduct of the research. Local agencies and the WSDOT are represented on the technical review committees.

THE FAME PROGRAM

The FAME program is aimed at developing and implementing strategies to address urban congestion and provide mobility. To facilitate an integrated approach to the mobility problem, the FAME work plan defines nine different task areas.

- **Freeway management**. The primary focus is on improved centralized ramp metering strategies, improved data collection from the electronic surveillance system, and design aspects of freeway HOV facilities.
- **Arterial management**. Advanced signal control strategies and arterial HOV facilities are the focus areas.
- **Freeway and arterial control system integration**. The two major efforts involve integrating the WSDOT freeway and arterial control systems and determining the best system design to integrate or coordinate arterial systems controlled by different jurisdictions.

- **Incident management**. The major focus is directed at evaluating potential techniques and providing a framework to help different urban areas develop an incident management system tailored to their needs.
- **Construction traffic management**. Testing and developing models to determine construction impacts on the transportation network and to evaluate alternative mitigation measures are the areas of interest.
- **HOV treatments**. This task area deals with encouraging people to use HOV facilities. Public/private partnership, marketing, education, and enforcement are critical areas.
- **Motorist information systems**. Getting clear and concise traffic information to the public is critical. This task area includes pre-trip and in-vehicle information delivery systems. A major effort has focused on determining the needs of the drivers; clustering them by audience; and determining what type of information they want, where they want it, and when they want it.
- **Advanced technology**. This task area follows advancements in technology and how they can be applied to any aspect of improving mobility.
- **Demand management**. The primary focus is on policy issues to help reduce vehicular demand on the transportation system. Parking strategies, development conditioning, and land use are three of the areas of interest.

Freeway Management

WSDOT's Seattle area freeway surveillance and control system is an element of the WSDOT's overall freeway management system, called the FLOW System. One of its principal means for managing freeway traffic is the use of ramp meters. The ramp metering system currently controls 23 ramps on Interstate 5 north of

downtown Seattle and on State Route 520 leading out of Seattle across Lake Washington (see Figure 3).

Seattle's freeway surveillance system includes closed circuit television monitoring to verify incidents and provide information to the system's operator (see Figure 4). Data from the electronic surveillance system are stored at the Traffic Systems Management Center (see Figure 5). They are used to control ramps, detect incidents, and provide information to the news media and the driving public.

The FAME program includes two projects in this area. One research project is seeking to improve the efficiency of the centrally controlled, real-time metering system. The project is examining techniques to forecast when a bottleneck will occur, so that the metering system will then be able to anticipate bottlenecks and take action before congestion sets in rather than as a reaction to congestion.

Another research project is exploring ways to improve the reliability and ease of using data collected through the electronic surveillance system. This project will improve the techniques used to detect errors in detector data, recommend an improved database structure, and flag erroneous data in the system's database.

Arterial Management

Many jurisdictions in the Seattle metropolitan area can communicate with or control arterial signal systems from a centrally located computer. Engineers develop timing plans for these systems using off-line computer packages or manual methods. These methods for developing timing plans, as well as the process of manually collecting the data needed for these methods, are labor intensive and costly. The City of Bellevue has taken steps to reduce these costs by installing a computerized system that automatically collects required traffic data, formats it to be used by a signal timing computer program (FORCAST), runs the timing program when requested by the operator, and outputs the plan in a computer file that can be directly implemented by the signal system's computer. (This system is essentially a UTCS 1.5 generation system.) The City of Seattle is investigating a similar system.

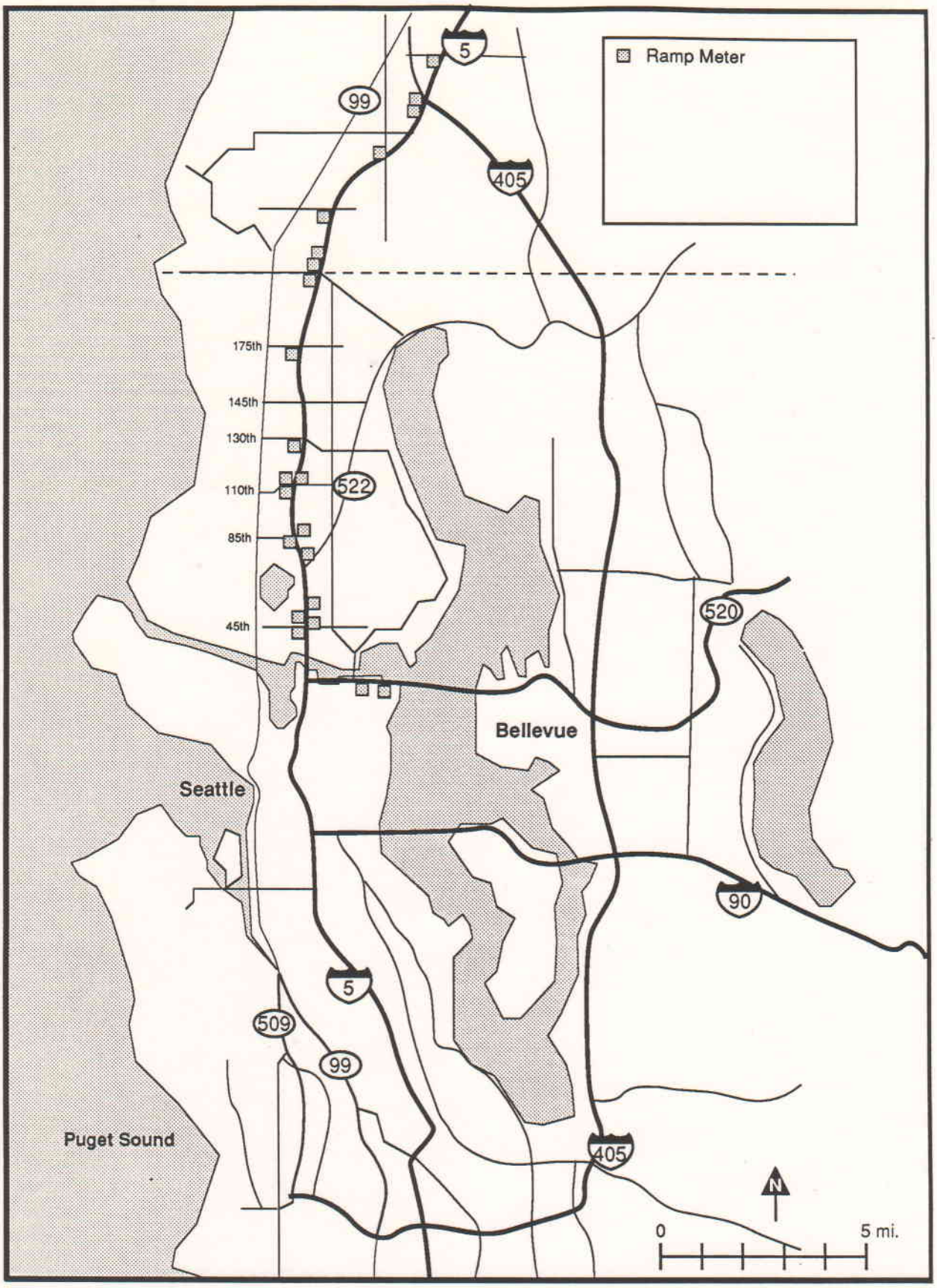

Figure 3. Ramp Meters

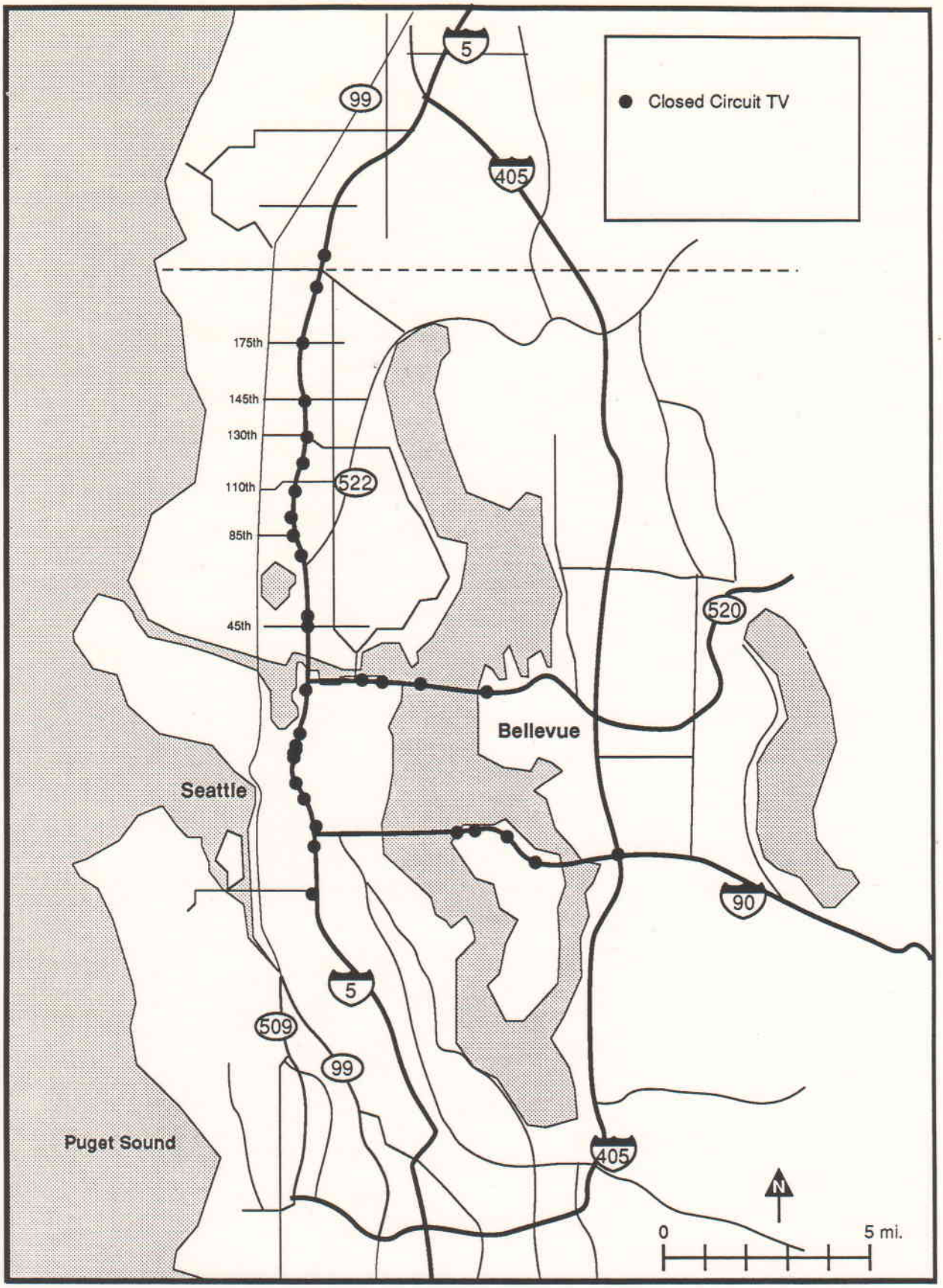

Figure 4. Closed Circuit TV System

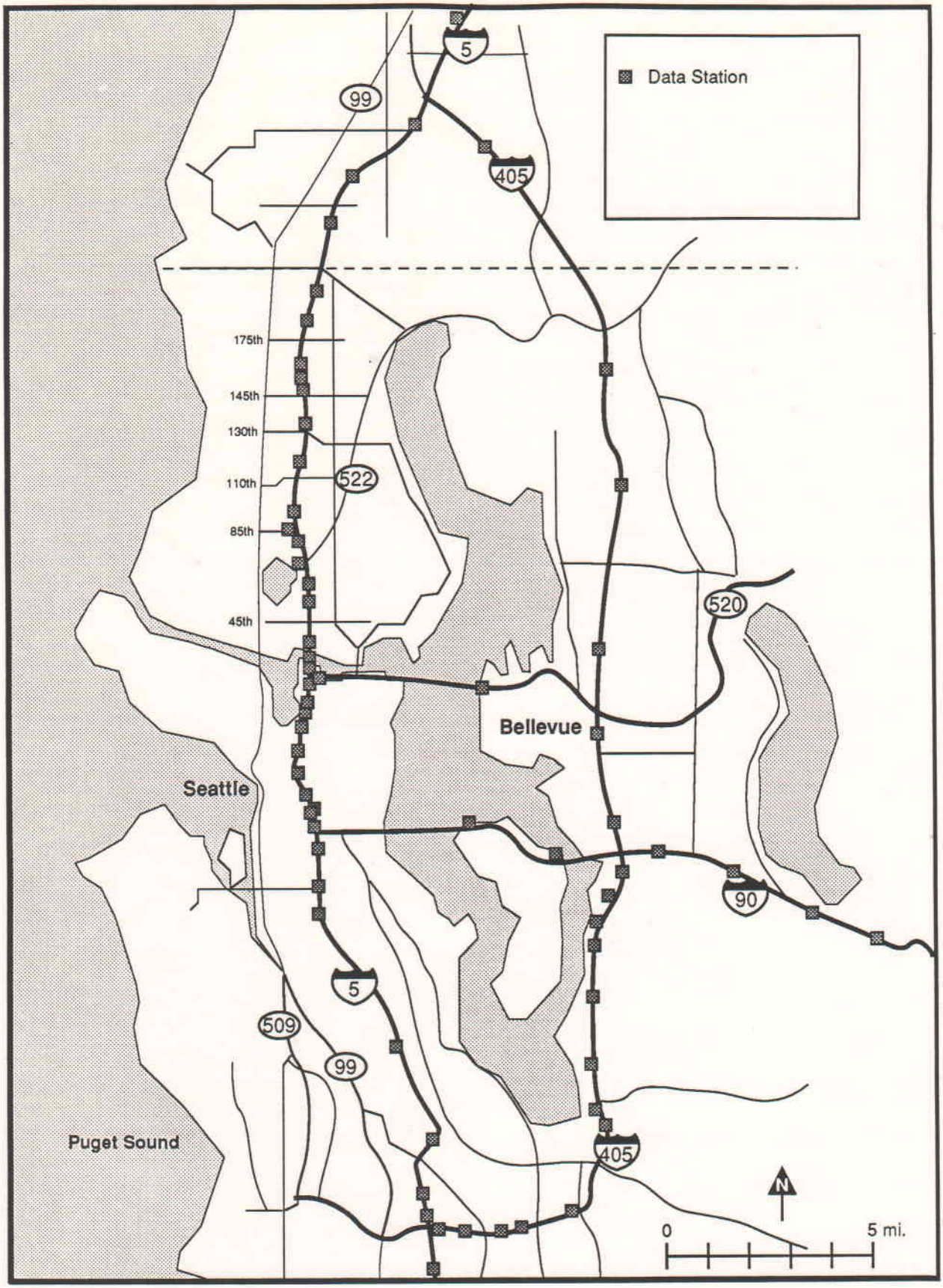

Figure 5. Data Stations

The Australians and the British have developed systems that greatly reduce or eliminate the need for off-line timing plan development. One of the FAME projects is examining the British SCOOT system, the Australian SCAT system, and the FHWA OPAC system and evaluating Bellevue's UTCS 1.5 system. The project will look at the costs of these systems, the benefits that have been reported, and the types of signal systems on which they have been successfully implemented. Project staff will determine the conditions under which these control systems may be implemented successfully in Washington State.

Control System Integration

Because of the level of Washington's current problems, regional transportation professionals need to work at coordinating or integrating freeway and arterial control systems. The first step is to explore the jurisdictional issues involved in integrating freeway and arterial control. The FAME program is focusing on control system communications that can pass data on traffic conditions and traffic patterns from the freeway control system to arterial control systems in the area and vice versa.

One of the current FAME projects is exploring the region's need for an integrated freeway and arterial control system. A primary thrust of the project is to determine the needs and desires of the various agencies and jurisdictions in the region regarding coordinating or integrating control systems. Researchers will poll each jurisdiction to find out its need for and interest in different levels of integration.

Results from this project will drive future efforts to design an integrated system in which each agency may operate at a different level of integration. The idea is to develop a plan to incrementally implement a system that will eventually meet the needs or desires of all the agencies.

While communication among different jurisdictions' control systems are being investigated, another project will develop an algorithm that will integrate the

control of WSDOT's arterial systems and freeway control systems. Congestion and incident conditions on Interstate 5 north of Seattle will affect pattern selection on two parallel WSDOT arterials in the corridor, one east and one west of the freeway.

Incident Management

Quick response to and efficient management of incidents can save a great deal of traffic congestion: as much as 60 percent of the congestion on urban freeways is caused by incidents.[6] Incident management techniques are used to minimize the time required to detect incidents, respond properly to them, clear the roadway, then clear the resulting congestion.

Incident management is receiving attention in the major urban areas in Washington state (see Figure 6). A multi-jurisdictional incident management task

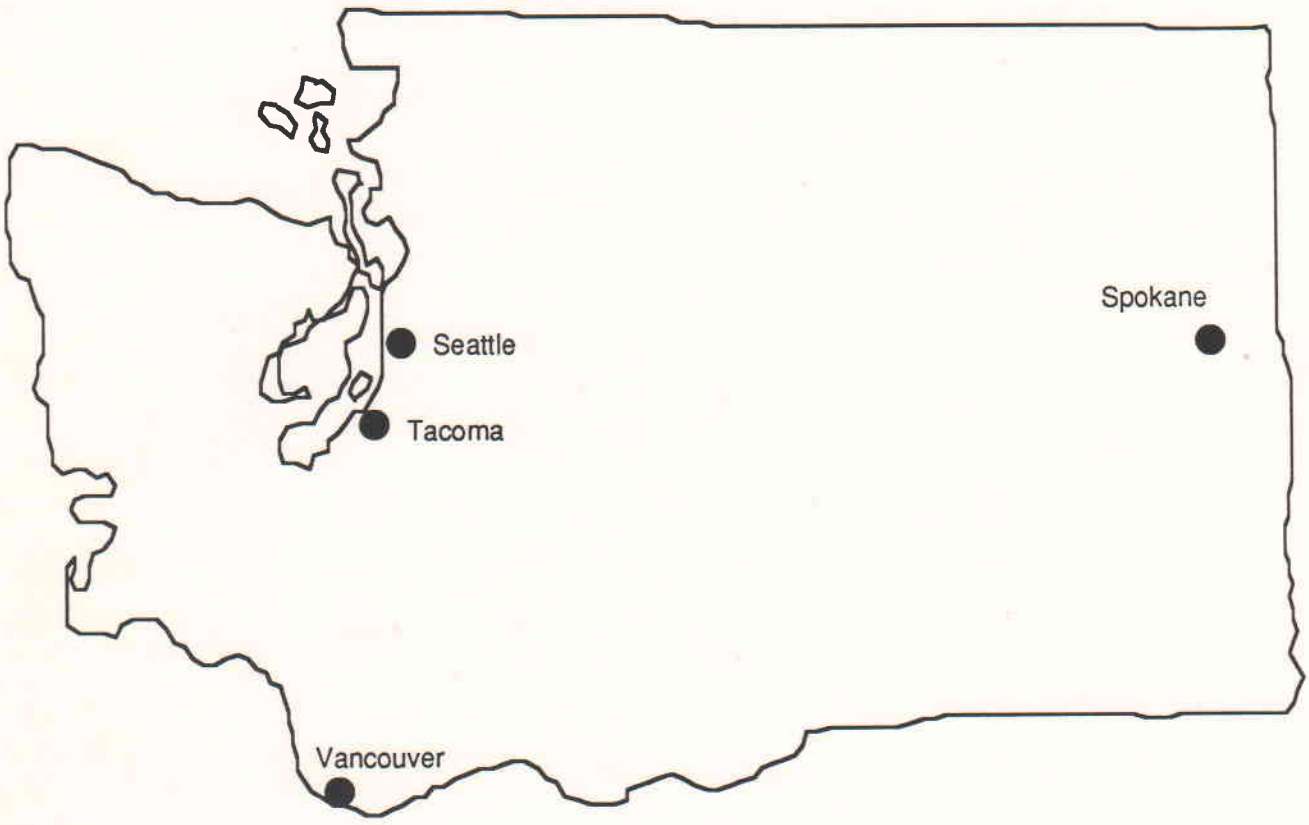

Figure 6. Urban Areas with Incident Management Activities

[6]"Urban and Suburban Highway Congestion." The Future National Highway Program -- 1991 and Beyond. Working Paper No. 10. Federal Highway Administration. December 1987.

force has been established for the Columbia River Gorge area. Specially equipped trucks are available for incident response in the Vancouver, Washington area. In Tacoma, a task force is working to improve incident management. In the Seattle area, incident management planning has been occurring for several years. Tow trucks operate on both Lake Washington floating bridges to clear disabled vehicles quickly. The Traffic Systems Management Center provides the focal point for incident detection, incident response, and driver information in the Seattle area.

FAME projects are under way in both the Seattle and Spokane areas to improve incident management. In Seattle, the project is investigating current practice nationwide and evaluating the effectiveness of incident management techniques in the Seattle area. The project will evaluate the effectiveness of actions such as accident investigation sites and remote equipment storage sites. Researchers will recommend additional actions to improve incident management in the Seattle area.

In Spokane, the FAME project is assessing incident management techniques in the Spokane area. Emphasis is being placed on clean up of major incidents. Researchers will recommend improvements to current incident management practices.

Construction Traffic Management

In 1984, WSDOT established an office in Seattle to coordinate traffic mitigation measures for construction projects throughout the area. This group is called the Construction Traffic Coordination Office (CTCO). The CTCO

- coordinates traffic control on all projects on state highways in the Seattle area,
- determines traffic impacts and develops mitigation measures for construction projects in the area,
- informs the public about closures and predicted impacts through the media and driver information systems, and

- monitors traffic conditions during construction projects to determine if modifications to mitigation plans are necessary.

The CTCO employs public information professionals as well as engineers to create a multi-disciplinary approach to construction traffic mitigation. This group coordinates construction traffic management among the design, construction, maintenance, and operations offices.

In addition to analyzing the impacts of each construction project, the CTCO also looks at project timing and interaction among projects. In essence, it integrates all projects into a single process to determine the most effective mitigation measures. On occasion, this may even include rescheduling a project to begin in a later year to prevent unreasonable impacts on a given corridor or in a given geographical area.

The CTCO also works with other agencies to coordinate WSDOT and local construction projects. For some projects, the required mitigation measures are implemented on facilities under the jurisdiction of other agencies. The CTCO works with local agencies and transit agencies to implement these mitigation measures.

One weak point in the system is the inability to quickly and accurately determine the specific traffic impacts of construction projects and evaluate alternative mitigate measures. One of the FAME projects is investigating different models that might improve the CTCO's ability to analyze construction impacts on traffic and to evaluate alternative mitigation measures.

HOV Treatments

As mentioned earlier, WSDOT makes a concerted effort to encourage ridesharing. One aspect of this effort is the operation of a high occupancy vehicle (HOV) system in the Seattle metropolitan area. Park-and-ride lots constitute a major element of this HOV system. The park-and-ride system has approximately 16,000 spaces (see Figure 7).

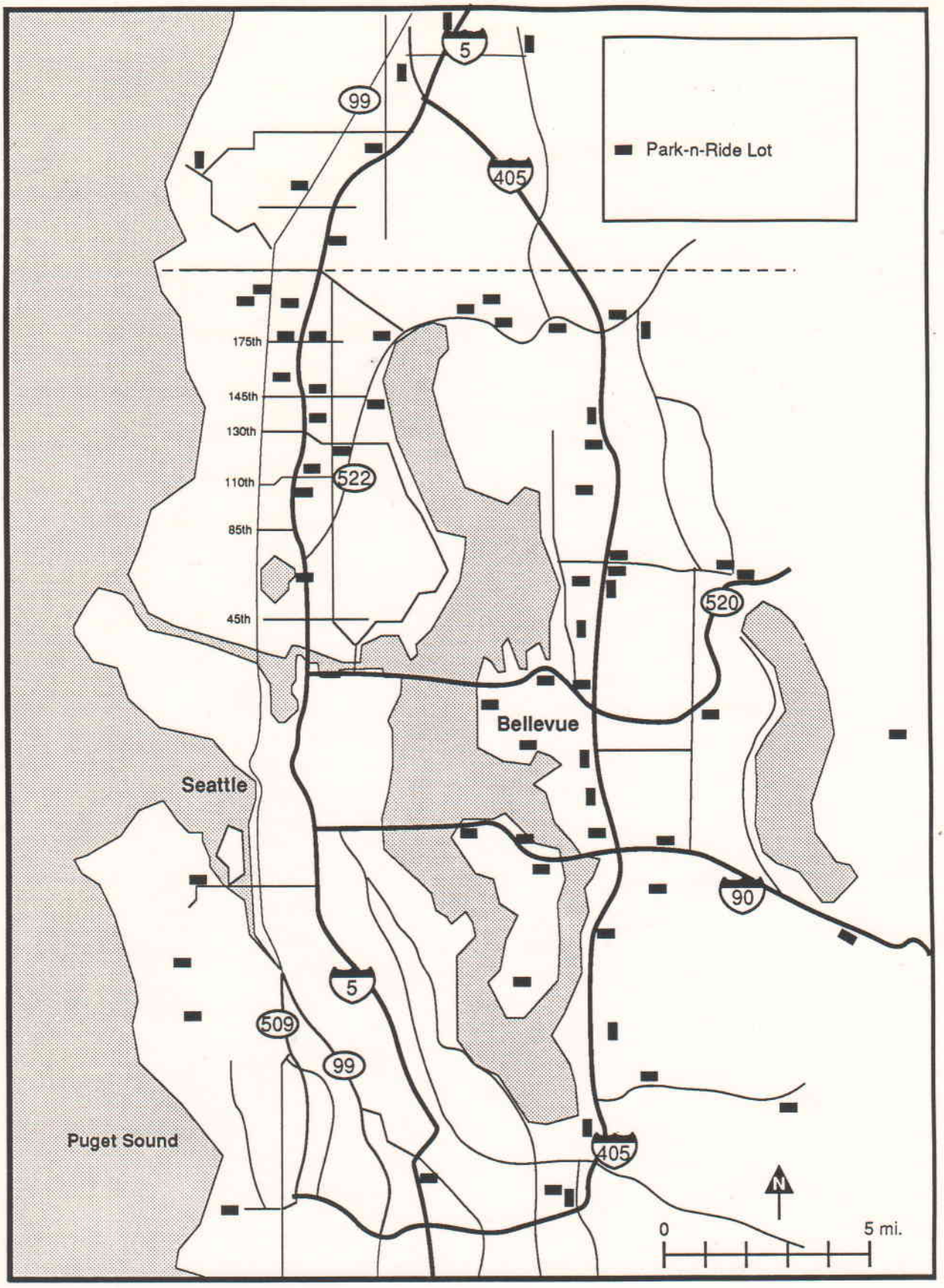

Figure 7. Park-and-Ride Lots

Another important aspect of the system is the HOV lane network (see Figure 8). The WSDOT has to date opened 36 miles of these lanes to traffic. In addition, local agencies, such as the City of Seattle, have opened or planned HOV lanes on surface streets.

Maintaining the integrity of the HOV lanes is dependent on education and lane compliance. An innovative technique used for these purposes is the HERO Program, developed in Seattle in a cooperative effort among the Washington State Patrol (WSP), Seattle Metro, and the WSDOT. This system allows motorists to make a phone call to report violators of the HOV lanes. The violators are sent informational brochures on the HOV lane system. The system works: not only have violation rates dropped, but about 94 percent of those reported have been first time violators.

A FAME project is under way to explore HOV compliance. The project is investigating techniques to effectively monitor HOV compliance, to improve the efficiency of the HERO program, and to survey the public's awareness and attitudes about the HOV system and the HERO program.

Another FAME project is exploring additional means of providing park-and-ride lots. In a cooperative venture with Seattle Metro and the Washington State Transportation Center, the WSDOT has received an Urban Mass Transit Administration (UMTA) grant to study the private development of park-and-ride lots. The project is exploring three approaches to public/private partnership in park-and-ride lot development. The first involves the development of private retail and service space on or adjacent to existing lots. In the second, private developers would participate in financing park-and-ride lots within their developments. In the third, private developers would provide off-site park-and-ride lots as mitigation for their development. The project is also investigating the jurisdictional and legal issues involved in these options.

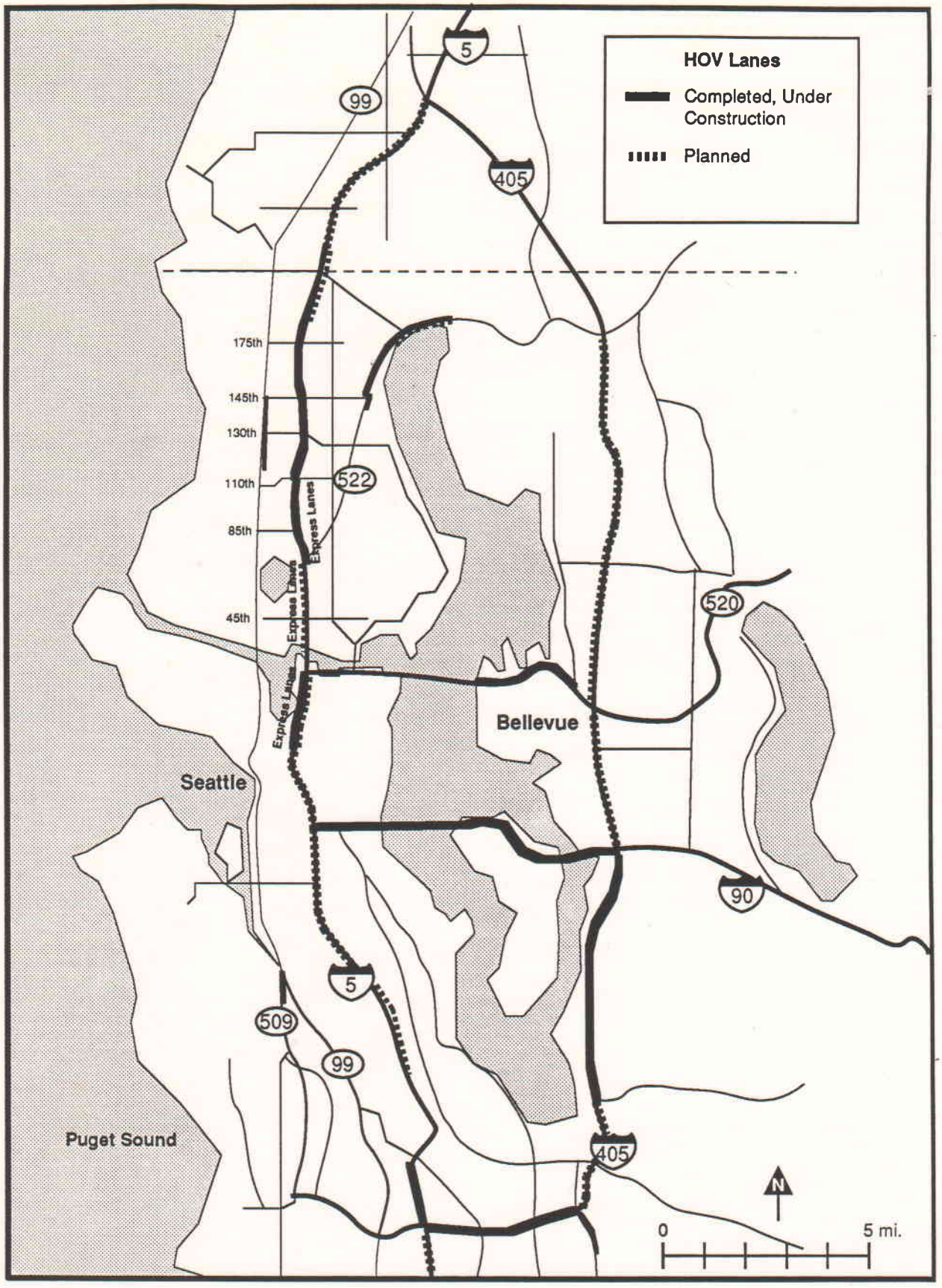

Figure 8. HOV Lanes

Finally, one FAME project is researching mode choice issues. The objectives of the project are to provide a richer understanding of how people make transportation mode choices and to quantify the psychological factors that affect these choices. The findings of this project will enhance planners' ability to explain and forecast mode choice.

Driver Information

Accurate and timely traffic information effectively delivered to motorists is a critical component of the management of transportation facilities. When drivers are informed of current traffic conditions, they can make rational decisions on route, mode, and time of travel.

Most motorists receive traffic information from commercial radio stations. The WSDOT provides traffic information to the radio stations, as well as directly to the public through the use of highway advisory radio (HAR) and variable message signs (VMS) (see Figure 9). The effectiveness of these dissemination methods needs improvement so that drivers receive the information they want most, when they want it, over the medium they most want to use. In particular, when traffic congestion reaches its most severe levels, motorists need information before they enter the system.

A FAME project is investigating these very issues. Researchers are exploring when motorists make decisions, where they make them, and how information might influence them. Specific media being investigated include telephone call-in systems, computer dial-up systems, and computer graphics televised on public access cable TV. The researchers will also recommend how to provide better information to the news media and how to make more effective use of the VMS and HAR systems.

Advanced Technology

In the future, even more innovative and advanced methods to deal with congestion problems will be needed. New technology may provide some methods to deal with congestion, such as in-vehicle route guidance. ETAK Navigators are

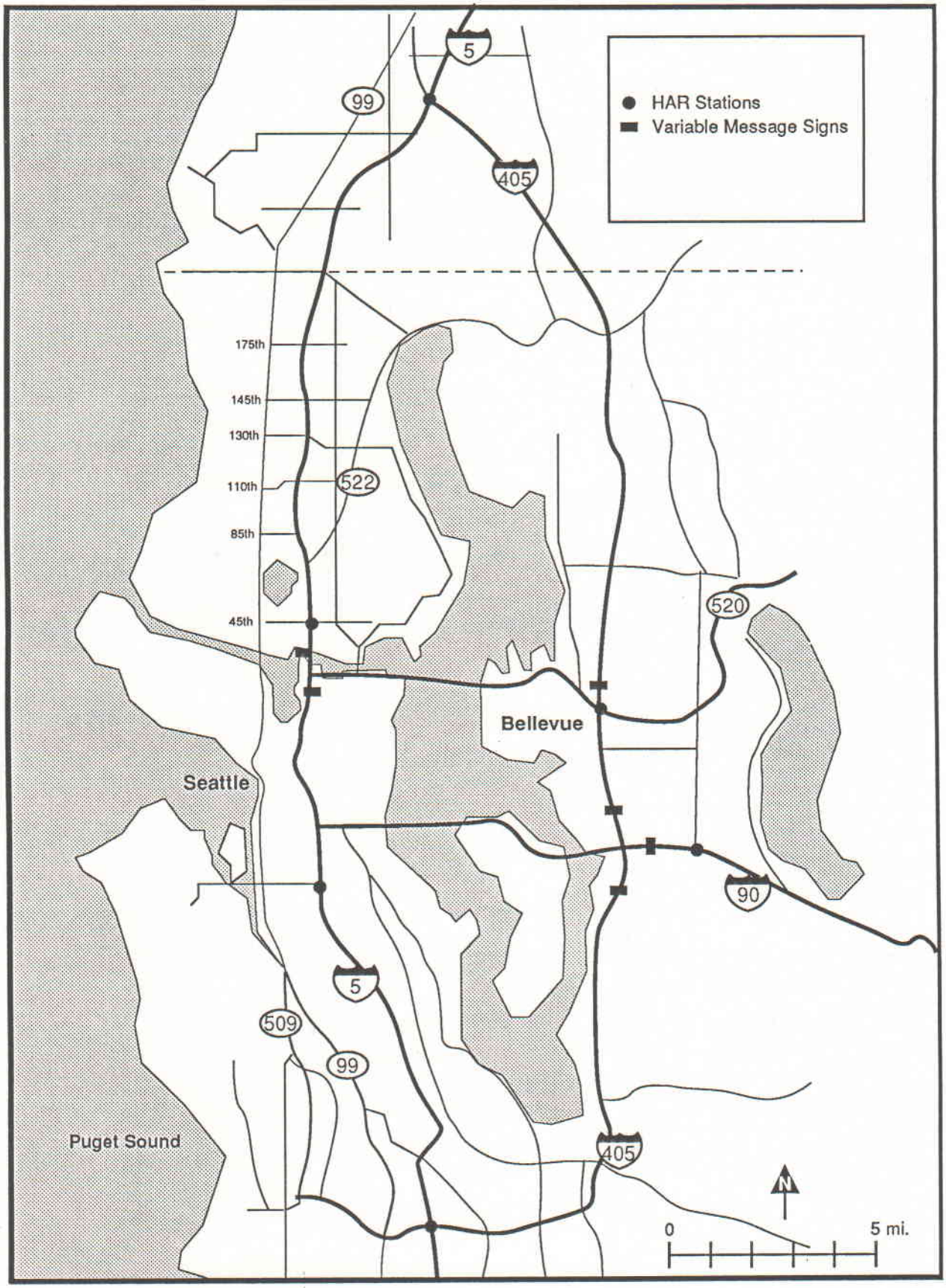

Figure 9. Highway Advisory Radio (HAR) Stations and Variable Message Signs

available in some urban areas in the United States to provide direction to motorists as they drive through urban areas, and the PATHFINDER project in Los Angeles is investigating ways to provide congestion related information on this type of device. Canadian and European researchers are working on ways to provide optimal routing to motorists through in-vehicle route guidance devices.

Other new technology approaches include automatic toll collection, automatic vehicle identification, automatic vehicle location, and automated highways. Through the Washington State Transportation Center's involvement in an NCHRP project on assessing advanced technologies, FAME is keeping abreast of new technology applications. FAME will keep the WSDOT informed of the most recent developments to determine how technology can be incorporated in the Department's planning for future improvements.

Demand Management

Demand on the transportation system is growing so rapidly that all of the efforts mentioned above still cannot solve the congestion problem. Construction of new facilities is too costly and too socially and environmentally disruptive to allow Washington to build its way out of the congestion problem. In order to provide acceptable levels of mobility to the public, Washington must explore to better manage the demand on its systems, as well as continue to implement the systems mentioned earlier. Demand management has the greatest potential to improve mobility, but it is also the most controversial.

In the Puget Sound area, several programs are working to improve demand management in the region. The most popular traditional method of demand management involves reducing vehicular demand by encouraging HOV use. Parking incentives are one means of encouraging carpools, and preferential parking and reduced parking fees for carpools and vanpools are being tried throughout the region. Less traditional are the Transportation Management Associations (TMAs) that have been established in Bellevue and the I-90 corridor. These associations

bring the private and the public sectors together to address transportation management. In Bellevue, the TMA has been instrumental in improving parking management in the downtown core. In another new kind of demand management effort, in parts of King County, residential developers are being required to establish transportation programs much like the programs required of commercial developers. The programs are aimed at reducing the impacts that these developments have on the transportation system. FAME will be involved in evaluating the effectiveness of these programs.

More is needed beyond these efforts. The effects of land use on the efficiency of the transportation system must be recognized. Steps must be taken to strengthen land use regulations on regionwide or even statewide levels to reflect transportation issues.

The design of new developments is also a critical issue that needs addressing. For example, often land use requirements force suburban developments to be set back a considerable distance from the roadway. Huge parking lots then separate bus stops and carpool drop-off locations from the buildings in the developments. People may be intimidated in crossing these expanses of parking lots with no pedestrian scale, especially during hours of darkness and inclement weather. Developments should be designed with the needs of pedestrians, carpoolers, vanpoolers, and bus-riders in mind.

Another example of the need to design developments differently is that retail space is often separated from work places, forcing people to drive alone to work so that they can accomplish personal business on lunch hours or after work. If workplace developments were encouraged to incorporate retail space and restaurants, the individual's need for a vehicle while at work would be reduced and more people could carpool, vanpool, or take a bus to the development. Researchers must begin to investigate these aspects of demand management, as well as discuss the more controversial methods, such as congestion pricing and auto-free zones.

CONCLUSION

The nine FAME task areas presented here are together under one umbrella to foster a coordinated approach to transportation management. The FAME structure ensures coordination and communication among researchers in the different task areas. Findings from one project feed into the work plan of future projects in other task areas. In addition, information on projects in other states and countries is used to determine solutions or continued research direction in the topic areas.

As mentioned before, the FAME program includes both research and implementation aspects. Its primary focus is on solving problems identified by professionals in the transportation field. Sometimes new research projects are introduced to address these problems. In other cases, experience in other states may point to a logical solution. In either case, the goal is to implement a solution to the problem identified. Solutions come from the broad perspective that is fostered by the FAME program's integrated approach.

The congestion problems Washington faces today will remain and will worsen. These problems must be addressed with a system of innovative solutions, and with the realization that there are no quick fixes to the congestion problem. Although some capacity improvements are necessary, construction alone is not the answer to congestion. Instead, any solution must involve a series of incremental improvements. FAME is providing the Washington State Department of Transportation some innovative solutions that can be incrementally implemented to address congestion and preserve mobility.