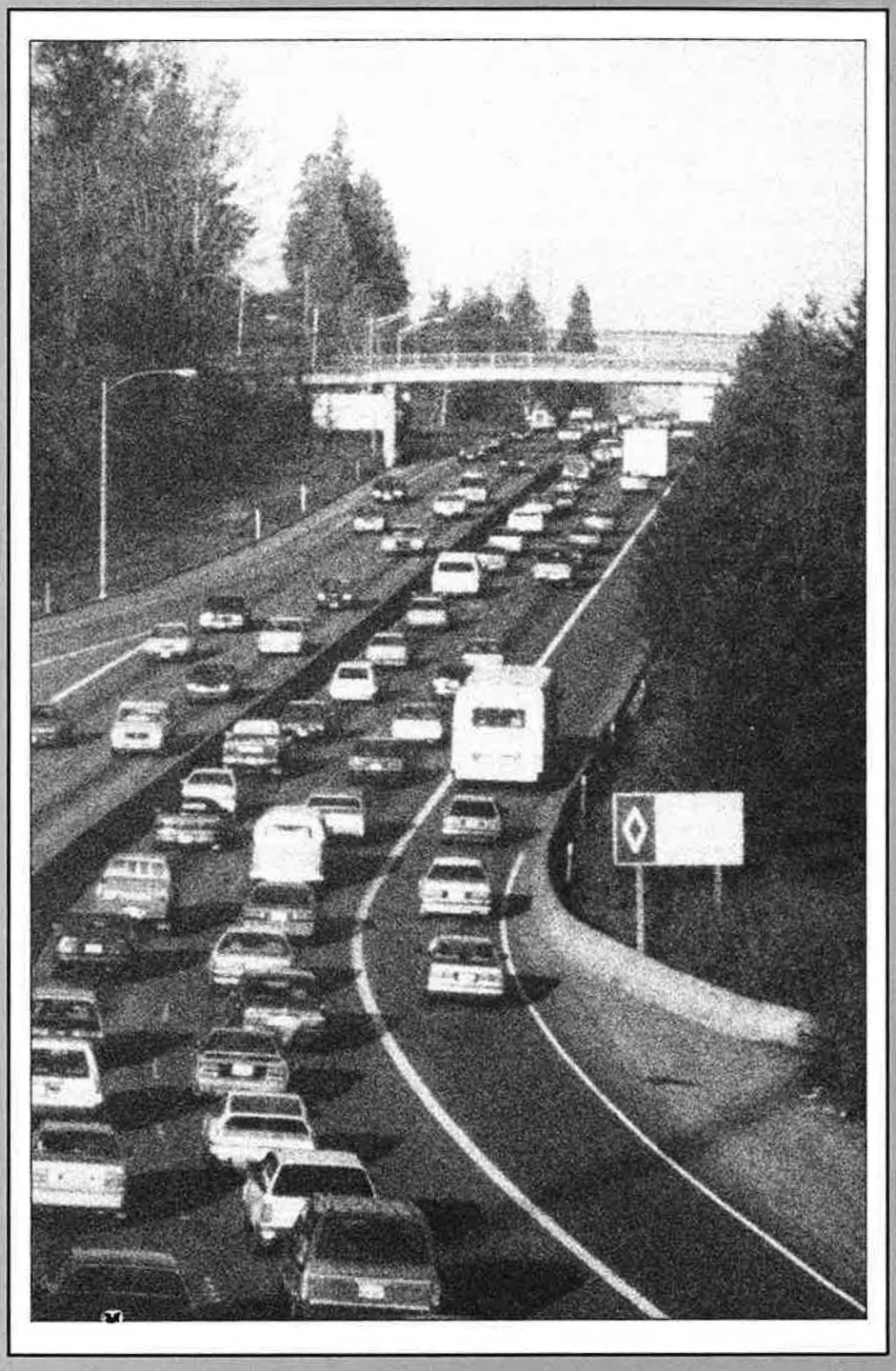
F A M E

AMY J. O'BRIEN and
LESLIE N. JACOBSON



Freeway and Arterial Management Effort

Addressing Traffic Congestion in Washington State

FAME ridesharing treatment projects seek to develop methods to increase number of HOVs on the highways and to provide incentives for using those travel modes.

Urban congestion is an issue of national importance. Headlines lamenting slow, heavy traffic and its consequences on our freeways and arterials appear daily in newspapers across the country. Washington state is no exception.

As in other areas of the country, Washington's urban traffic problems are a result of the state's success. Puget Sound ports have expanded trade with Pacific Rim countries, and the aerospace and microcomputer industries have flourished and pushed the economy upward. The more successful the state has become, the more it has grown, both in the city cores and in the outlying suburbs.

For example, from 1980 to 2000, the state's population is expected to increase by approximately 1.2 million people (a 25 percent increase) (unpublished data, Puget Sound Council of Governments). During the same period, population in the four-county area surrounding Seattle will increase from about 2.2 million to 3.0 million, representing 70 percent of the statewide increase (*1*). This kind of growth means that aging freeway systems must accommodate swelling traffic volumes. Total trips in the central Puget Sound area are predicted to increase by 42 percent during this same period. Vehicle miles of travel (VMT) will increase even more; freeway VMT will increase 73 percent, and arterial VMT will increase 71 percent (see Figure 1) (*2*). Congestion is the inevitable result. Because of the increased travel demand, average roadway system speeds will decrease from 25 mph in 1988 to 15 mph by 2000 (see Figure 2) (*1*).

Despite the congestion problems, few new freeways will be built in the Puget Sound area because of the increased social, environmental, and economic impacts of new highway construction. Transportation agencies in Washington have therefore had to look at alternatives to combat congestion, including programs for ridesharing facilities and freeway surveillance and control. However, given that population and demand will continue to grow, even these efforts are not enough. Greater measures are needed to strengthen current efforts to preserve mobility.

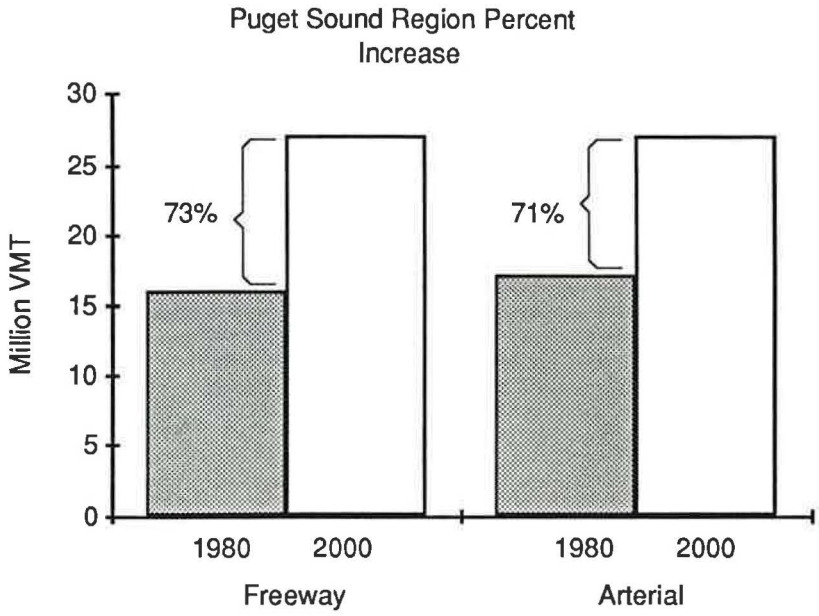


FIGURE 1 Central Puget Sound vehicle miles of travel.

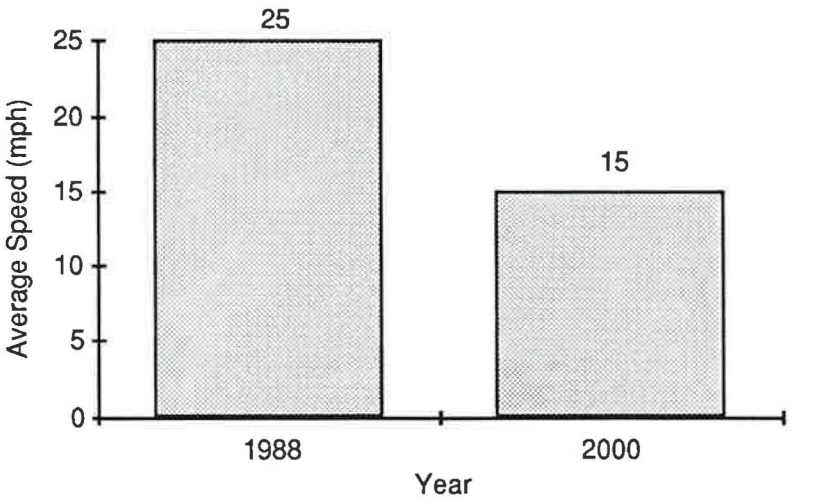


FIGURE 2 Central Puget Sound roadway system speeds.

One such measure is a transportation management program begun by the Washington State Department of Transportation (WSDOT) in 1987 in cooperation with the U.S. Department of Transportation's Federal Highway Administration and Urban Mass Transportation Administration. The Freeway and Arterial Management Effort, or FAME, is a research and implementation program intended to immediately address Washington state's urban congestion problem and help preserve urban and suburban mobility. The FAME program, its research objectives and projects, and a description of how it was set up are addressed in this article.

Amy J. O'Brien is editor, Washington State Transportation Center. Leslie N. Jacobson is urban systems engineer, Washington State Department of Transportation.

Overview

The FAME program is a broad umbrella that covers a wide range of traffic problems. Its primary goal is to preserve mobility in urban areas (Figure 3). To meet this goal, the program's objectives are to

- Improve freeway management techniques;
- Provide integrated traffic control systems;
- Improve traffic management during incidents and construction projects;
- Increase high-occupancy (HOV) vehicle use;
- Provide better information to the traveling public on routes, travel times, congestion levels, and transportation options;
- Develop, evaluate, and test advanced technology solutions to urban mobility problems; and
- Manage vehicular demand on the transportation network.

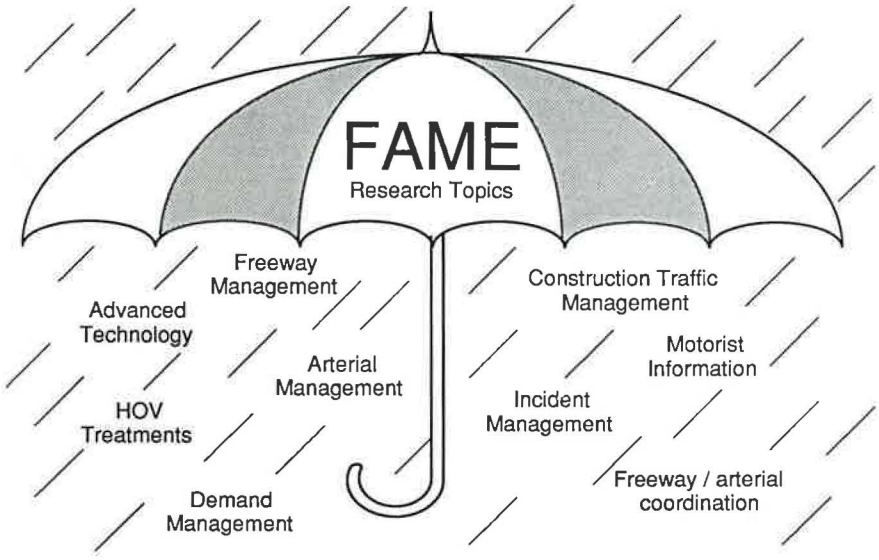


FIGURE 3 FAME supports numerous research topics in a wide range of areas.

FAME is meeting these objectives in two ways. First, WSDOT's Urban Systems Branch addresses them operationally. It acts as a resource for problem solving, information dispersal, applied analysis, and activity and funding promotion. Second, FAME supports a large number of research projects in a wide range of areas related to its objectives. Because FAME is a broad program, it requires a number of people and agencies for guidance and input. Key FAME positions at WSDOT include the Urban Systems Branch of the Traffic Office, which administers the program; the state traffic engineer, who directs the program; the Research Office, which provides administrative and financial management for research projects; the Public Transportation Office; and WSDOT district representatives.

Because of its scope, FAME research is attracting the involvement of state and local agencies. These agencies, including the Municipality of Metropolitan Seattle, the Washington State Patrol, the Washington State Energy Office, and several local city governments, are either cooperating with, participating in, or funding FAME research projects.

Much of the FAME research is being conducted through two transportation research centers. The first is the Washington State Transportation Center (TRAC), which helps coordinate interaction between WSDOT and the research faculty at the University of Washington and Washington State University. The second is Transportation Northwest (TransNow), one of ten nationwide U.S. DOT research centers authorized by Congress, which is providing matching funds for many of the research projects.

Project Summary

The FAME projects are grouped into two major focus areas: congestion management and intelligent vehicle-highway systems, which comprise nine task areas. Congestion management includes the topics of incident management, construction traffic management, ridesharing treatments, and demand management. The research within each area is described in the following sections.

Congestion Management

Incident Management Systems

Incidents account for as much as 60 percent of all traffic congestion on urban facilities. The intent of this task area is to more effectively manage these incidents. Projects within this area will provide information and guidance to WSDOT's districts by developing better procedures for improving incident management.

One project assessed current impacts of incidents on Seattle area traffic and investigated possible improvements to WSDOT's incident management techniques. The researchers developed a computer model to simulate incidents or lane closures caused by construction to assess the impacts of different types of incidents and possible actions that would minimize disruption. They also recommended actions for improving incident response. A follow-up effort will develop a framework to guide agencies through the process of developing and implementing incident management plans.

On the other side of the state, another project was instituted to study major freeway accidents in the Spokane area and develop a data base of incident-related information. The researchers recommended actions to improve incident management. A second project will create an incident management team, to be formed in cooperation with agencies such as WSDOT, local fire departments, and the state patrol, to provide additional information for implementing and coordinating incident response action. The investigators will also prepare an incident response manual and

format available data for possible use in an expert system.

The object of other projects will be to deliver proven incident management tools to WSDOT districts that have not used them, evaluate their effectiveness, determine the need for increasing their number in each district, and develop guidelines for their use. As a result of one study, five portable message signs, which are trailer mounted and programmable to display any message, were purchased. Typically, a district places one upstream of a major incident so that motorists are able to choose a route around the incident. WSDOT also purchased one portable highway advisory radio (HAR) system. The trailer-mounted HAR station allows district personnel to provide more information than is possible with a portable variable message sign.

In conjunction with FAME, the Washington State Patrol is evaluating the effectiveness of special electronic surveying equipment in decreasing the time required for incident investigation. Two electronic surveying systems will be purchased. Called infrared total stations, these systems permit automatic distance measuring. The measurements are then fed directly into a computer for analysis.

Construction Traffic Management

This task is designed to improve the mitigation of traffic congestion caused by planned construction projects as opposed to unexpected incidents. Research within this task focuses on a process for routinely developing and analyzing traffic mitigation measures within urban areas. Specifically, researchers have investigated FHWA's CORFLO traffic simulation model, with and without its traffic assignment model, and are now studying FHWA's FRESIM model for use in assessing complex traffic patterns on freeways.

Ridesharing Treatments

The primary goals of the projects in this area are to develop methods for increasing the number of HOVs using the urban highway system and to provide cost-effective incentives for using those modes of travel. Toward those ends, researchers surveyed the public about its awareness and acceptance of HOV lanes and WSDOT's HERO (HOV lane violation reporting) program and found that 85 percent of the population favors HOV lanes. Ways were also investigated to monitor compliance with HOV lane requirements, and the researchers recommended that the FAME program coordinate its efforts with a demonstration project on monitoring automobile occupancy to establish HOV compliance rates.

Researchers also investigated the cultural and psychological reasons people choose to carpool and vanpool so that transportation officials could better market their services and planners better predict how effective HOV improvements would be. A follow-up project is incorporating the best of previous transportation models with new information on psychological and demographic determinants of mode choice into a data collection method and a model that will forecast vehicle occupancy for specific highway facilities. This forecasting ability will allow transportation agencies to plan and rank HOV improvements more effectively.

In another study, a coordinated HOV plan for the I-405 corridor is being developed. The objectives are to

- Facilitate intercounty travel by providing the optimum level of service for transit in the corridor,
- Provide HOV facilities that will attract single-occupant vehicle drivers to higher-occupancy modes, and
- Ensure that the HOV facilities work together smoothly and that transitions from one type of facility to another occur when they are warranted.

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

▲ **With ability to assess complex freeway traffic patterns, engineers will be better able to plan for and mitigate traffic congestion caused by construction projects.**

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

◀ **Incident management is an important study area in the FAME program because incidents account for as much as 60 percent of all traffic congestion in urban facilities.**

Ridesharing on arterials is also being addressed. Researchers are investigating state-of-the-art techniques for providing HOV incentives on arterial routes, generating HOV alternatives for use on arterials in Washington's urban areas, and simulating and evaluating the operation of selected HOV improvements in three or four arterial case study locations.

Park-and-ride lots are another important aspect of ridesharing. Researchers studied how the private sector can help provide park-and-ride services to the central Puget Sound area, with the objectives of making these facilities more attractive to commuters and increasing parking capacity by including private enterprise in the development of the lots, as well as providing commercial services at or near them. The researchers reviewed joint-development experiences across the United States, investigated institutional constraints to private development in the Puget Sound area, and completed a market analysis of retail services suitable for park-and-ride lots. They also assessed local park-and-ride lots and identified five sites with high potential for joint development, prepared cost/benefit and feasibility analyses, and created concept plans for their development.

FAME is also coordinating its efforts with two related studies the Washington State Transportation Center is conducting in cooperation with the Municipality of Metropolitan Seattle (Metro), Seattle's transit agency. In one study, information will be collected about those who carpool between two Puget Sound counties. Such information will help agencies create public policy to encourage carpooling and better promote this mode of ridesharing. The second project is developing a tool to analyze ridesharing and transit use on Interstate 5 between the same two counties. The aim is to predict future use of HOV facilities and thus test the effectiveness of various policy and construction options in the corridor.

Demand Management

The goal of this task area is to improve the understanding of the current and potential impacts of innovative travel demand management strategies. This task differs from the task area on ridesharing in that it is oriented toward public agencies that do not provide transportation services. It is intended to develop guidelines and procedures for helping cities, counties, and other government and private agencies to improve the movement of people and goods by better managing growth and development.

To meet these objectives, one study documented the implementation of home-end transportation management programs (TMPs) and evaluated their effectiveness in managing the traffic impacts of residential developments. Local jurisdictions and transportation agencies, which have traditionally used TMPs as a means of managing the traffic impacts of new office and retail developments, have begun to apply the TMP concept to residential developments by promoting HOV use among residents. However, as yet, the few home-end TMPs that have been implemented have not been evaluated.

Another project, being conducted with Seattle Metro, is evaluating the legal and administrative issues involved in various ways to collect, estimate the potential yield from, and evaluate public reaction to a parking tax, both in terms of acceptability and changes in travel patterns.

In a third project with the Washington State Energy Office, researchers are investigating the impacts of telecommuting, or replacing work trips with electronic transmission of information. Employees work at home and connect to the office with telephones and computers. Telecommuting is a fairly new means of reducing traffic demand, and researchers are seeking to better understand its effects on traffic patterns, fuel consumption, and air pollution, as well as the individuals and organizations who make use of it.

Intelligent Vehicle-Highway Systems

Advanced Technologies

The goal of this task is to examine the potential impacts of emerging technologies on WSDOT's ability to manage traffic. Recently the Washington State Transportation Center was involved in identifying and assessing the advanced technologies and systems that show the most promise for significantly increasing capacity and traffic flow. Technologies under consideration include driver information systems, advanced traffic signal systems, and automated vehicle control.

WSDOT's Urban Systems Branch will investigate the ability of automatic vehicle identification (AVI) equipment on trucks to detect incidents and reduce processing time at ports of entry and weigh stations. WSDOT will install six AVI readers, three at one-mile spacings on Interstate 5 in Tacoma for incident detection, two at ports of entry, and one at a weigh station.

Freeway Management

The goal of the projects in this task area is to improve the freeway management system by providing better real-time management of freeway ramp controls and improving the reliability of the data collected from the system. In one project, techniques were explored to predict congestion on the freeways one to two minutes before it occurs. The researchers developed a predictive algorithm that is based on pattern recognition. With these predictions, the freeway control computer can begin to modify ramp metering rates before congestion sets in, postponing its onset and reducing delay and fuel consumption.

In another project, researchers investigated methods to improve the reliability of traffic data collected through WSDOT's electronic surveillance system, and ways to make these data more accessible through a data base program. Part of the project entailed an informal survey of potential data users to determine how the data base should be formatted and operated. The researchers developed an algorithm to detect data errors and recommended the structure for an improved and expanded traffic data base.

A related study currently under way will investigate methods to accurately predict short-term traffic data, select the most promising method, and test the predictions on Interstate 5, north of Seattle. The ability to accurately predict short-term traffic data will help engineers if a detector fails or malfunctions by enabling them to estimate the detector's output from short-term predictions that are based on data from neighboring detectors.

Arterial Management/Integrated Traffic Management Systems

Within the task area of arterial management, FAME's goals are to investigate and implement advanced strategies for arterial control that are based on real-time changes in traffic conditions and to determine their applicability in Washington state. The integration of the freeway and arterial control systems will provide the benefit of coordinating control plans for a whole corridor or even the entire region to best use the facilities available. Arterial systems may use information from the freeway system to predict future traffic demand on signalized intersections and choose appropriate control plans. Likewise, the freeway system may use information from the arterial systems to predict future traffic demands on the freeway and modify control strategies.

To these ends, researchers investigated four advanced traffic control systems, as well as ways to integrate the Puget Sound area's systems. The researchers recommended one system for further investigation and regional demonstration. They also recommended that system integration consist primarily of computer-to-computer communication and that it be coordinated with local agencies.

In a follow-up demonstration project on the technical integration of freeway and arterial control systems, researchers will develop a control algorithm that will modify signal timings on two major arterials north of the Seattle city limits on the basis of freeway traffic. The project will also explore algorithms to modify freeway metering strategies on the basis of arterial traffic. The system will operate automatically, without the need for operator intervention.

Traveler Information Systems

The goal of this task area is to improve information dissemination to travelers, who will use the information to make more informed decisions about their choice of routes, modes, and time of travel. The result of their decisions should be trips spread more efficiently throughout the day, across parallel routes, and across all modes. This spread should decrease traffic delays and fuel consumption and increase the total vehicle and person-carrying capacity of the road network.

In a preliminary study, researchers surveyed 10,000 commuters to downtown Seattle and received 4,000 responses concerning commuter decisions and information needs. A follow-up survey interviewed almost 100 volunteers from the original respondents. The resulting information was used to develop preliminary recommendations about information delivery systems and ways to improve delivery of information to motorists throughout the area.

The objectives of a follow-up project are to

1. Apply enhanced knowledge of commuter behavior and decision making to the design of advanced driver information systems; and

2. Develop microcomputer software capable of receiving real-time traffic data; converting those data into information designed to affect commuters' choices of route, mode, and time of commute; and displaying that information through an interface designed to meet motorists' needs.

Summary

Because FAME's wide variety of projects could potentially affect so many jurisdictions, interagency coordination has been very important. Besides working directly with agencies such as Metro and the Washington State Patrol to conduct projects,

continued on page 56

O'BRIEN

One of FAME's goals is to help integrate freeway and arterial control systems so that one system can predict traffic demand by using data from the other and both can operate more efficiently within a corridor or region.