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ADVANCED TECHNOLOGY BRANCH

Status Report of Active Projects
Washington State Department of Transportation
JUNE 1995

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At the beginning of each project description, one or two names are listed to call for further information. The first name is the WSDOT TRAC person or the Metro person. When a second name is listed, it is usually the principal investigator (P.I.). The phone numbers for each person follow:

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Each of the following project descriptions includes recent changes in bold face type, usually at the end of each report, while previously reported information has been changed to unbold.

.c.HOV, TDM, and Related Projects

% .c.Travel Time Video Test.; (Eldon L. Jacobson) This project is studying the use of high resolution video cameras and computer software that subsequently analyzes the video tapes to compute vehicle travel

times using the matching license plate method. WSDOT has arranged for Transformation Systems, Inc., of Houston, Texas to perform the work. The field work will be done during June 19-22, 1995, with the analysis and the report received about a month later. We will be looking at travel times between HOV lanes and GP lanes.

% .c.I-90 Lane Conversion.; (Eldon L. Jacobson or Fred Mannering)
This project studied the impacts of converting a general purpose lane to an HOV lane on I-90 between Issaquah and Eastgate (sometimes called take-a-lane). The westbound conversion (and added lane) was fully operational on December 6, 1993. During January, 1994, the lane configuration was revised in the Mercer Slough area, creating a bottleneck section on westbound I-90 that has two general purpose lanes plus the HOV lane. After a couple of months the complaints quieted, and people appear to have become used to the situation. On June 27, 1994, westbound I-90 ramp metering was implemented. Some video tape for the RafterS data survey was collected the week before the ramp meter turn-on. The draft report was circulated for review late November, 1994. Comments have been incorporated into the final report by the P.I. The final report is complete and has been published. Project complete.

% .c.HOV Lane Evaluation and Monitoring.; (Eldon L. Jacobson or Cy Ulberg)
This project will produce the first annual (July, 1992 thru June, 1993) HOV system evaluation, on the basis of the methodology developed in the above project. It is important to periodically monitor and evaluate existing HOV lanes in order to make decisions about the operation of existing HOV lanes and about the best location to construct future HOV lanes. The evaluation will consider HOV lane usage, violations, safety, time savings, capacity improvements, modal shifts, route shifts, enforcement issues, cost effectiveness, and public opinion. The project will build on existing information to construct a database for evaluation of HOV lanes. Quarterly, annual, and biennial reports will be published. At the end of the research, recommendations will be made about the type of data necessary to do an HOV lane evaluation, the data collection methodology, what agencies should be involved in HOV lane evaluations, and the timing and format of HOV evaluation reports. Surveys for I-5 South of Seattle (the Southcenter hill area to Midway) were mailed out to motorists the week of February 10, 1992. Opinion surveys for Metro bus drivers in the I-5 South corridor were handed out in late, February, 1992, and returned in early March, 1992. All surveys have been tabulated and summarized. Data collection is now proceeding throughout the Seattle area. In addition to obtaining travel time and vehicle occupancy in the freeway mainline, vehicle occupancy is also being obtained at some ramps. Ramps are usually easier to monitor, and should reflect occupancy changes sooner than the higher volumes on the mainline. This project was supplemented to evaluate the change from a 3 person carpool definition to a 2 person carpool definition on I-5 north of the Seattle CBD. The draft report for the 2+ demo (prepared by TRAC and TTI) was received on January 27, 1992. The final report for the 2+ demo is now available. Contact Eldon if you want a copy. The results indicate that vehicle occupancy decreased, reliability decreased and travel time increased in the northbound direction, much of the driving public approves of 2+, and there was no evidence that the project affected accident rates. The steering committee made three recommendations. First, the results of the demonstration project do not support existing policies. Second, the 2+ should revert to 3+ after a minimum 60 day period. Third, future occupancy requirement decisions should be based on

a performance standard that measures speed and reliability. A second supplemental project to the original project was funded. This second project developed a performance standard that measures speed and reliability. The intention was to have an easily measured reliability standard for HOV lanes, which could be used when considering revising the carpool definition for a particular HOV corridor. During April and May, 1992, data collection was done on the I-5 North corridor that was used in developing the standard. A performance standard was adopted by the WSDOT HOV Policy Board on August 13, 1992. It reads: "HOV lane vehicles should maintain or exceed an average of 45 miles per hour or greater at least 90 percent of the times they use that lane during the peak hour (measured for a consecutive six-month period)."

Collection of data continues throughout the area during each Monday to Friday peak period at about 20 different sites. The draft report was distributed before the end of March, 1994. Review comments have been received and the report has been revised. The final report was shipped to the Research Office for printing in December, 1994. Eldon got the final report back to fix some page numbering problems and returned it to the Research Office on February 8, 1995. Final report complete. Project complete.

* .c.HOV Lane Evaluation and Monitoring (Phase II).; (Eldon L. Jacobson or CyJULberg) This is the ongoing data collection and reporting project. Auto occupancy data are being collected every morning and evening peak period Monday through Friday. A 486 computer with a high capacity hard drive has been acquired to aid in the data analysis and storage. A two page legislative briefing report has been prepared. It will be distributed (probably in the Ex*Press) with changes and updates 2 or 3 times a year. Quarterly data updates are being prepared, which will update one of the appendices in the final report described in the previous project. The initial quarterly report is complete (this will actually add the 6 quarters that follow the 4 quarters in Appendix B of the report in the previous project).

* .c.I-5 South HOV Lane Accident Analysis; (Eldon L. Jacobson) This is an in-house project to analyze the before and after accident information for the HOV lane termination area at the top of the Southcenter hill. The accident data was provided by the Northwest Region. A draft report was circulated on June 1, 1994, and review comments are being received.

* .c.Intercounty Carpool Profile.; (Eldon L. Jacobson or Cy Ulberg) This project will provide knowledge of why people choose to ride share. The primary method to acquire information about a broad range of carpools in the two-county region (Snohomish and King counties) will rely on surveys of a random sample of people observed in carpools on selected freeways, arterials, and streets. A large number of surveys (on the order of 1000) will be conducted by mail, and they may include small incentives to encourage a high return rate. A follow-up survey will be conducted after one year. A smaller sample will be contacted for more intensive personal interviewing (focus groups). This project will be used to enhance the HOV 2+ evaluation. The project match will come from that project in order to direct questions toward the carpool definition change. We're waiting for the funds to be released by Metro to start the project. The funds have been released and a U.W. budget number assigned to the project. An initial literature review has been done. Carpool license plates have been collected and the public opinion survey is being finalized for printing. The survey was printed and mailed out in June,

1994. Surveys have been returned and have been coded for analysis. The project has been put on hold until early 1995, as the graduate student who is working on the project, Matt Benuska, is studying for three months in South Korea.

% .c.An Analysis of Factors Accounting for Successes and Failures in the Acceptance and Utilization of Employer-Based TDM Programs.; (Bill Legg or Cy Ulberg) This project will carefully investigate the processes that companies employ to implement TDM programs. It will develop a model of the factors that influence employee's attitudes and lead to actual changes in commuting behavior and will be useful to employers throughout the state in designing and implementing successful TDM programs. The project will be coordinated with the State Energy Office and to bolster the work currently being undertaken because of the commute trip reduction legislation. The scope of work was developed in cooperation with Metro and the Energy Office. A new element of the project will be the addition of a consultant to look at a proactive program for multi- site employers to shift personnel around so employees are working at the site nearest their home.

The draft final report has been completed and has been distributed for review and comment. This project has been given a \$95,000 supplement for a proximate commuting study. This study has been initiated and a detailed evaluation plan is now being developed. Proximate commuting is the concept of decentralizing work so that employees can work closer to their residence thereby reducing commuting time and distance.

.c.Incident Management Projects

% .c.Incident Response Data Base.; (Bill Legg or Fred Mannering) This project will develop and establish an incident response database. The database will be used to evaluate incident response measures developed and implemented in the Seattle area. This project was approved in February. The first project meeting with the researchers and the Data Annex in Olympia took place the middle of March. The Data Annex installed the CARS database at TRAC on May 27th. The project team is working with WSDOT's 3 western regions and the East Central region to establish a database format Incident report that could be used as a standard for the entire state. This format will be compatible with the States' MicroCars database. Work is also being done on a geographical representation of the MicroCars database by combining it with a GIS system. This project's completion date was extended to 6/31/94 from 12/31/93 to permit more testing of the database.

The draft database (the final level of effort for this project) is complete and now being used. We are looking at any additional needs for this project beyond the current completed work.

% .c.Evaluation and Application of Washington State's Incident Response Guide.; (Bill Legg or Fred Mannering) This project will evaluate the effectiveness, appropriateness, and format of the incident response guide currently used by WSDOT's North West Region's incident response teams. Based on this evaluation it will produce an updated electronic version of the guide for WSDOT's 3 western regions and the East Central region. Each region will be able to customize and update the documents as needed in the future. The project is now complete.

.c.Incident Management Training for WSDOT Personnel.; (Bill Legg) This project, through training sessions, will

% .c.Graphical Display of Real-Time Transit Coach Locations: Toward an APTS for the Puget Sound Region (BusView); (Morgan Balogh, Dan Dailey) The project will design and demonstrate a system that graphically displays real-time transit coach locations to the University of Washington campus community. The system will use Seattle Metro's existing automatic vehicle location system as its information source. This is a \$170,000 project sponsored by WSDOT (\$100,000) and TRANSNOW \$70,000. The completion date is February 1996. The design of the APTS architecture and interfaces is well underway and the evaluation of the accuracy of the AVL data is beginning. The system will be demonstrated at a Transit Conference in Spokane in late August.

% .c.Traffic Data Acquisition and Distribution (TDAD); (Morgan Balogh, Dan Dailey) The TDAD project will provide a system that will access available traffic databases and store it in a separate database for historical, research, and planning purposes. Agencies will then be able to request from the system specific records, and obtain these in formats meaningful and useful to them. The initial system will be demonstrated in the Puget Sound area, together with linkages to state level databases and applications. This project is coordinated with the North Seattle ATMS. This project supports regional Congestion Management Plans. The total project cost is \$210,000 and is fully funded by the FHWA. UW staff has interviewed the parties that will benefit by this project. They include planning representatives from PSRC, TRIP, FHWA, and the WSDOT N.W. Region. A working paper outlining the system desired by these representative has been prepared and reviewed. The project team is currently working with FSI and the North Seattle ATMS project on system integration requirements.

% .c.Puget Sound Help Me (PuSHMe) Operational Test; (Morgan Balogh) The WSDOT has received USDOT operational test funding for a Puget Sound regional mayday system. This is a public-private partnership whose participants include the FHWA, WSDOT, WSP, David Evans and Associates, Inc. (DEA), Sentinel Communications (SenCom), Motorola, IBI Group Inc., and the University of Washington. Other firms involved in this project but not actually on contract are McCaw Cellular and Intergraph. This system will allow a traveler to send a signal indicating their location when they need assistance directly to a traffic operations center who will then dispatch the appropriate units (i.e. tow truck, assistance van, WSP, etc.)

The cooperative agreement between WSDOT and the FHWA signed on August 1, 1994. The project started February 3, 1995. A equipment purchase contract was signed between WSDOT and SenCom as of March 3, 1995. A equipment lease between WSDOT and Motorola was signed 4/4/95. The project Kick-Off meeting is scheduled for March 28, 1995. The evaluation plan is almost complete and should sent to the PuSHMe partners for review in late June. Motorola has installed their GPS Reference station at the TSMC on June 15, 1995 and plan to have their Dispatch running in Mid July. SenCom will begin producing their mayday devices in late June. Mayday testing should begin in late July or early August.

% .c.A Real Time Traveler Information System for Reducing Urban Freeway Congestion: Expansion, Implementation, and Evaluation.; (Larry Senn or Mark Haselkorn) This is a continuation of the earlier Real-Time Motorist information project. Several enhancements will be made to the "Traffic Reporter" information system including expanding coverage of the display to include all freeways in the Seattle area and to include separate information on the HOV lanes. Efforts will also be made to

introduce the basic language and protocol for the Incident Command System to the WSDOT IRT members,

summarize new and existing state and federal regulations that impact current incident management practices,

identify WSDOT IRT training material suitable for periodic "refresher" training, &

provide information to Maintenance Area Supervisors on the importance of effective incident management.

This project began the first of the year (1995) and training will begin this summer.

.c.The Use of Total Station Surveying Equipment for Accident Investigation: A National Perspective.; (Bill Legg) WSDOT took the national leadership role in the implementation of the use of total station surveying equipment by the State Patrol as a way to more quickly clear major accident scenes. This project will determine

how the use of total station surveying equipment for accident investigation has expanded to other parts of the nation,

what factors encourage the use of the technology,

what factors discourage the use of the technology, and

how the quantified and perceived benefits change depending on local conditions.

The survey of national law enforcement agencies has been completed.

.c.ITS Projects

% .c.North Seattle Advanced Traffic Management System; (Morgan Balogh) The primary objective of this project is to provide communications to the different traffic control system in the I-5 corridor from Seattle to Marysville. This will enable coordinated operations among the different jurisdictions traffic signal systems and the freeway ramp meter system, provide a regional monitoring and data sharing system, and receive real-time information on traffic and transit conditions. This project will be expandable to the east and south to include the entire Seattle Metropolitan area.

Many times political and jurisdictional issues prevent coordinating adjacent systems. These issues will be worked out over the course of the project.

This project will endeavor to obtain data from several signal systems in the I-5/SR 99 corridor in north King County and south Snohomish County. The data will be collected by a separate micro-computer through communications links with central traffic control systems (and master controllers if necessary) belonging to the various jurisdictions involved. The micro-computer will compile the volume, occupancy, and operations data and transmit it back out to the participating control systems. Each signal system will independently use the data to improve its traffic management capabilities. TIB funding for this project has been obtained. The City of Seattle was the lead agency for obtaining TIB funds. Oil rebate money is also being used on this project. The FHWA is contributing 3.5 million in state appropriated IVHS money.

Dave Berg of the WSDOT, NW Region is managing this project. Farradyne System Inc., is the lead consultant on the project. FSI started work on Nov. 29, 1994. This was the same date that a kickoff meeting was held. FSI has just completed the Control Strategy Report for the project (June 16, 1995). It is currently under review. There have been several user group meetings with the next scheduled for June 17, 1995. FSI is currently working on the system design.

improve the quality of travel time data and the quality of electronic data coming from the WSDOT system. This project will provide delivery of the system for use by the public and will evaluate the system under actual use.

Traffic Reporter has been expanded to cover the Puget Sound area. Testing is being done to compare "lap top" travel time data to those calculated by Traffic Reporter. Also, usability testing has been conducted on the expanded interface, and will continue once the system is on display. Traffic Reporter can now find multiple freeway routes from a given origin ramp to a given destination ramp. Added features include the ability to compare speed and trip time between these routes, including a comparison of general purpose versus HOV lanes.

A rough draft of the final report has been turned into TRAC for preliminary review and should be ready to go to the Research Office soon.

% .c.Improved Congestion Prediction Algorithm.; (Improved Ramp Control Algorithm) (Larry Senn or Nancy L. Nihan) This project continues the search for an improved ramp control algorithm based on predictive techniques. The project objectives are to: (1) evaluate the existing data and the performance of the predictive ramp control algorithm used to operate the WSDOT traffic systems computer in Seattle, develop improvements to the existing predictive ramp control algorithm by looking at upstream volumes and lane occupancies and ways to improve pattern recognition, testing the new algorithms on more than one section of freeway.

Data collection computer modeling runs have been made and contrary to the proposal will likely need to be conducted periodically throughout the project. Preliminary analyses have been performed and strategies are being discussed to select the algorithm most likely to be productive. TSMC data is now available by modem for UW analysis. Researchers have found that the flow divided by the lane occupancy (F/O) provides a better indicator of congestion than indicators that are currently in use. A F/O of 90 indicates the onset of congestion and an F/O of 70 provides an excellent indicator of congestion. Storage, which is currently used by the freeway system as an indicator of congestion, does not appear to a very good indicator (a result also found in the neural network project). The final report is in review.

% .c.Improved Error Detection and Incident Detection Using Prediction Techniques and Video Imaging.; (Larry Senn or Nancy L. Nihan) This project seeks to improve knowledge of the relationship of volume and lane occupancy to the speed of traffic as a means of (1) determining invalid detector data and (2) detecting incidents. In addition the project will attempt to improve the ability to identify bad detector data. Video imaging will be used as an independent check of the volume/occupancy and speed relationships. The video imaging system will itself be evaluated as an incident detection tool and as a tool to obtain vehicle speeds.

Morgan Wong is the primary R.A. on this project. He has written a program to get 20 second data from Autoscope and is modeling the data to improve on the existing error and incident detection algorithms. TSMC data is now available by modem for UW analysis. The project team has been collecting additional video data for testing Autoscope. The overall opinion of the researchers is that Autoscope works well enough to be considered in future installations. The draft final report and draft technical report have been submitted for review.

% .c.Bellevue Smart Traveler: Using Traveler Information to Reduce Downtown SOV Commuting.; (Eldon L. Jacobson or Mark Haselkorn) This project produced and tested a prototype Traveler Information Center designed to increase the use of transit and paratransit (carpools and vanpools) by downtown Bellevue office workers. The goal was to locate in a downtown Bellevue office complex a prototype computer-based interactive Traveler Information Center that provided office workers with greater access to flexible, reliable, safe, and time efficient alternatives to single occupancy vehicle commuting. The prototype allowed us to gauge the impact of applying ATIS technology to enhancing transit and paratransit. It also allowed us to judge the viability of Traveler Information Centers as a way for downtown centers to meet trip reduction requirements set by the State of Washington.

The project was funded by WSDOT and FTA. Work was conducted as a partnership between the Bellevue TMA and the University of Washington. The project was originally scheduled to begin 7/1/92 and end 10/31/93. The FTA funding period ended up being for 15 months, starting 9/30/92, so no-cost time extensions were requested of both the FTA and WSDOT in order that both funding periods ended at the same time.

Most of the employee's in the office building (Bellevue Place) were surveyed. Since Microsoft doesn't do surveys, focus groups with Microsoft employees were done the last week in April, 1993. The project was expanded to cover more buildings in downtown Bellevue. Will also use a public-private partnership utilizing pagers donated by PacTel (now Air-Touch). The telephone equipment was purchased, the initial programming of it completed, and it was tested. A media event showcasing the project was done by the U.W. on September 28, 1993. 83 applications were received by the TMA as of November 2, 1993. The kiosk was opened for use in Bellevue Place on November 15, 1993.

Three ride groups were formed. Some of the interesting statistics as of the close of the project on April 15, 1994 are: 496 rides offered, 145 rides sought, 6 confirmed ride matches. Preliminary conclusions are that people were much more willing to offer rides than to accept a ride. The draft technical report has been written and was submitted to TRAC the end of August, 1994, for editing and processing. The initial editing generated substantial suggested improvements, so the report was sent back to the P.I. for modification in September, 1994. The draft report has been circulated and review comments received. The P.I. plans on incorporating review comments for the final report during the first week of July, 1995.

% .c.In-Vehicle Signing and Variable Speed Limit Demonstration.; (Larry Senn) The project is unique in that its objective is the enhancement of motorists safety on freeway facilities through the display of variable speed limits and other safety messages based on traffic and roadway conditions. These displays are presented using variable message signs and in-vehicle equipment. The proposed project includes the implementation of a variable speed limit and motorist alerting system featuring the use of low cost in-vehicle radio receivers with alphanumeric displays. The system is to be installed on a forty mile section of I-90 approximately 40 miles east of Seattle in the vicinity of the Snoqualmie Pass. The University of Washington will be responsible for the evaluation of the system and the experimental design. The installation of data stations for collection of "before" data is complete and data collection is underway. Farradyne has continued the systems development, and has found solutions to several issues concerning the radio communications system and integration of the weather stations.

FCC licenses for all sites have been obtained. The construction contract with Totem Electric is underway and at least three sign bases have been installed. The production of the Daktronics VMS is underway and the inspection of the first sign occurred on June first. We hope to test the in-vehicle devices in '94-'95 using a portable transmitter, however the fixed sites will not have communications until '95-'96 when the entire project will be operational. The UW team has conducted an in-depth accident analysis based on 5 years of accident data and has continued the development of the driving simulator that will be used to evaluate the in-vehicle signing equipment. A detailed evaluation plan has been submitted to NHTSA and has been tentatively approved pending some minor corrections.

% .c.Seattle to Portland Inter-city ITS Corridor Study and Communication Plan; (Morgan Balogh) We are in the initial stage of this project. There are three main objectives of the project. The first objective is to develop a plan to reduce congestion and improve safety along the Seattle to Portland I-5 corridor utilizing Intelligent Vehicle-Highway Systems (IVHS) technologies. The second objective is to identify the communications network needed to support the IVHS for the corridor. Additionally, evaluate alternatives and provide recommendations for this network to support WSDOTUs other, non-IVHS, intra-departmental communications requirements along this corridor. The third objective is to develop general recommendations for a statewide WSDOT communication network utilizing the corridor communications analysis.

State matching funds have been identified and approved. An Agreement between the FHWA and the WSDOT for the Seattle to Portland Inter-city ITS portion of this project has been made.

A request for a service contract to select/hire a consultant was developed and published September 13, 1993. The consultant proposals went through the first stage of the evaluation process. This stage chose the top 3 proposals. The representative of each team was asked to give an oral presentation on December 7, 1993. From these presentations David Evans and Associates was chosen to be the prime consultant. The consultant began work May 2, 1994. The consultant has completed Technical Memorandum #4, Draft ITS Corridor Plan in May and is developing a draft communications plan.

% .c.Portland to Boise ITS Corridor Study; (Eldon L. Jacobson) This project is to develop a plan to identify Intelligent Transportation System technologies that should improve some of the known transportation problems in the Portland to Boise corridor. One of the known problems is the poor weather conditions that can rapidly appear in the Columbia Gorge and the Blue Mountains. The corridor includes roads on both sides of the Columbia River, two railroads, and barge shipping. The planned \$400,000 consultant study is anticipated to be funded by FHWA, ITD, ODOT, and WSDOT. A draft agreement between the FHWA and the three state DOTs has been drafted by the FHWA Region office. The revised draft proposal was circulated for final comments and support letters. The proposal was submitted to the FHWA the day before the due date of August 1, 1994. Approval from D.C. was received the middle of January, 1995, provided the scope-of-work is approved by the FHWA region office. The draft scope-of-work was circulated for comments the end of February, 1995. The FHWA approval is expected mid-March, 1995, with the RFP planned late in March or April, 1995.

Kimley-Horn and Associates, Inc., is the consultant that was selected to do the study. The scope-of-work and cost estimate are being worked on

prior to signing the contract.

% .c.Seattle to Vancouver, B.C., and Seattle to Spokane ITS Corridor Study; (BillJLegg) This project is to develop a plan to identify Intelligent Transportation System (formally IVHS) technologies that should improve some of the known transportation problems in the two corridors. The two corridors may be studied separately, or together, depending on whether one or both are approved for funding by the FHWA. The planned consultant study is anticipated to be funded by FHWA and WSDOT.

Interviews for final consultant selection will be held on June 22nd. Work on this project will begin in the 3rd quarter of 1995.

% .c.Assessment of ATIS in Washington State.; (Morgan Balogh) This project is primarily funded by FHWA discretionary moneys. It will provide an early evaluation of 4 ATIS in Washington state (FLOW, Traffic Reporter, Bellevue Smart Traveler, and the proposed Canadian border crossing information system). The project will develop a matrix of ATIS so that appropriate criteria for judging success can be developed and applied. The project will also recommend direction for future ATIS development in the state. Start date for project was 10/01/92 and the completion date for the project is 4/30/94.

Tasks completed to date include: (1) Identified classifying system and definitions of success for this project. (2) Designed metrics and instruments for assessing Flow.

Delays in the installation of the Vax at TSMC have delayed the implementation of Traffic Reporter and consequently the evaluation of Traffic Reporter. That problem has been corrected and the evaluation continued. The final report was submitted to the Research Office in March, 1995.

% .c.IVHS Data and Information Structure.; (Morgan Balogh or Daniel Dailey) The overall objective of this project is to develop a framework in which to understand, select, and apply wireless data communications technology to IVHS development in Washington State. It will (1) review the state of the art of wireless data communications, (2) examine promising wireless communication alternatives, (3) perform a limited field test of selected wireless data communications, and (4) provide the basis for an overall plan to integrate wireless data communications into a regional IVHS network. The final report for this project is due December 31, 1994.

The final report was submitted to the Research Office in March, 1995.

% .c.Investigation of Video Image Tracking.; (Morgan Balogh or Nancy Nihan) First generation video imaging systems provide Rtrip-wires type detection, that is they mimic the performance of inductance loops. The newer video imaging tracking system not only gathers loop type data but RfingerprintsS vehicles to provide tracking capabilities. Vehicle tracking provides travel time and origin destination information which has been historically difficult to obtain.

The proposed video imaging system for this project is the MOBILIZER, which is provided by Condition Monitoring Systems (CMS) and is in the prototype stages of development.

This project will test collected data for reliability and range of usefulness, compare cost effectiveness and total life-cycle cost of the CMS system to that of traditional loop detector systems, and if cost effective, incorporate the system in the WSDOT Traffic Systems Management Center. The final report for this project is due August 31, 1995.

Most of the technical problems with the MOBILIZER have been worked out and testing is continuing.

% .c.IVHS Backbone Design and Demonstration.; (Larry Senn or Dan Dailey) This project will (1) design a demonstration architecture for a regional IVHS backbone for the Puget Sound area and (2) construct this backbone in order to demonstrate how different types of data gathered from distinct agencies can be integrated in a single application. The backbone will be designed to (a) improve interagency and multi-jurisdictional sharing of data without disrupting existing operations, (b) support existing investment in IVHS technology and system development, (c) encourage expansion and innovation, and (d) be compatible with federal efforts to develop a national IVHS architecture. "The backbone will support traffic data from a multitude of sources while making data accessible in a clearly defined manner on a geographically distributed network. This all will be done in an open systems model that supports a distributed computing environment, is extensible to larger areas, and easily allows new agencies to participate. The T1 link to the TSMC and all hardware elements to set up the communication have been installed. Software to extract the data is operational. Loop data has been interfaced to the GIS application. Software is being developed to make use of the loop data for future research. The final report is being written.

% .c.Demonstration of ATIS/ATMS Data Fusion in a Regional IVHS.; (Larry Senn or Dan Dailey) This project proposes to design, construct, and demonstrate a data fusion system for use in a regional IVHS system. The fusion system will combine data for multi-agency and multi-jurisdictional sources to provide a more accurate, real-time picture of the transportation system. This fusion system will operate in a distributed computing environment that encourages interagency cooperation. The computer has been ordered and WSDOT and Metro have been contacted. An IVHS application has been written which displays both congestion data from loops and real time position of transit vehicles on a GIS based map. King County Metro is being contacted for an improved map database. A report is being written in conjunction with an IEEE Intelligent Vehicles Conference '95.

% .c.IVHS - Network and Data Fusion.; (Larry Senn or Dan Dailey) This Federally funded project will progress from specific regional issues investigated in other related projects and generalize by creating key network and fusion components that are transferable to other regions and countries. The project will (1) investigate, design, and document an encoding scheme, including ways to include temporal information with spatial information, for standardization of traffic and traveler information, (2) use this encoding scheme to demonstrate a layer between application and transport layers, and (3) work with another related IVHS research center to use the encoding scheme in a demonstration of its use in inter-regional IVHS communication. The investigator has started investigation of FIPS spatial data standard in detail and determined that the full standard is unwieldy for the design of our data encoding system. Adopting an object oriented paradigm to construct self defining data streams. The methodology for constructing the self defined data streams is the encoding stream promised for this project.

% .c.Investigation of Automatic Vehicle Location Systems for

Traveler Information.; (Larry Senn or Mark Haselkorn) This project will use Metro AVL information to improve information available to travelers and transportation managers.

Metro AVL data can now be displayed on any X-terminal connected to the Internet and has been demonstrated many times. This concludes the research portion of the project and a draft final is being formatted for preparation for review.

% .c.Ramp Control via Neural Network Control.; (Larry Senn or Deirdre Meldrum) This project will develop and test a new ramp metering algorithm by using an artificial neural network congestion predictor and a multi-variable control system.

Artificial neural networks have been constructed and tested. Promising results have been obtained with 1 minute data being used to predict volumes and occupancies 1 minute ahead, and somewhat less promising results have been obtained with 5 minute data. The draft technical report has been sent to the Research Office for review.

% .c.Fuzzy Logic Ramp metering.; This project will move toward developing the neural network forecasting and fuzzy logic control system including in depth testing using models and on the existing SC&DI system. If budget and time allows the system will be implemented within this project. This project is just starting.

% .c.SWIFT - Seattle Wide-area Information For Travelers.; (Larry Senn, Mark Haselkorn, Dan Dailey) This project is a \$7.4 million IVHS Operational test of an FM sideband data system which will be used to deliver traffic and transit information. Data will be extracted from WSDOT's freeway ramp control computer, Metro Transit's vehicle location system, and augmented with information from Metro Traffic Control. The information will be formatted and sent to Seiko Telecommunication System for transmission to devices. The devices include a watch (or pager) based on Seiko's Message Watch, Delco Electronics' Telepath car radio that includes a GPS to give distance and bearing to a destination, and a palm top computer that will be supplied by IBM which will provide bus locations and graphic displays of traffic conditions. Etak will supply geo-coding, mapping, and data entry interfaces. The test will occur in 1996 after the devices are programmed and developed. The contract With the SWIFT project team was signed on January 10, 1995 and work has commenced. An evaluation plan from SAIC was submitted at the March 14 Steering Committee meeting and was accepted by the team with minor changes. The UW team is working extensively on the network required to deliver SWIFT information. This project is proceeding on schedule.

% .c.SWIFT Smart Traveler: (Larry Senn, Dan Dailey) This project is a companion to the SWIFT project and will allow ad hoc ridesharing amongst UW employees. The large employer base combined with the availability of desktop computers and the campus network should allow for greater number of ride matches than found in previous projects. Web pages have been created, the server is being set up, and geocoding has started to establish rideshare locations.

% .c.NEXRAD: NEXT Generation Weather RADar.; (Larry Senn, Tom Seliga) This project is investigating potential applications for the new doppler weather radar in transportation. The potential uses of accurate short term weather predictions include better maintenance scheduling and transit operation improvements from early snow warnings, wind warnings

for ferries, and for research into the traffic impacts of inclement weather.

The investigators have obtained a disdrometer to assess the distribution of drop sizes in the region, are developing an algorithm for tracking storms, have arranged for data access from the weather radar, and have obtained a SUN workstation for use in the project. Phase 2 of this project has been funded and will continue the work. There will be no report for Phase 1 as it was a preliminary investigation.

* .c.Increasing Awareness of Transportation Options Through Riderlink.; (EldonJL.JJacobson) This FHWA/FTA Operation Action Program project intends to develop a Metro database infrastructure that can be used to make transit information (and other information) available at selected work sites. Originally the intent was to team up with US. West Community Link's planned videotext service (The original project was titled: Increasing Public Awareness of Transportation Options Through Videotext). Since the videotext service has been delayed or abandoned, the use of videotext was replaced by planning on using existing computer networks of some of the employers in the Overlake area between Redmond and Bellevue.

Metro assigned Catherine Bradshaw to coordinate the project. Initial planning and coordination work began in March, 1994. A detailed evaluation plan dated June 21, 1994, has been submitted. Quarterly reports are being submitted. The following three documents are available: Concept Document, Requirements Document, and Evaluation Plan. I have been able to access the Riderlink initial data pages from my office over the Internet. During January, 1995, Metro publicized the project and made Riderlink available on a World Wide Web site on the Internet to disseminate the information to existing networks at employer sites. All the Overlake TMA sites have connections to Riderlink. As of the end of February, 1995, nearly 4,000 people from all over the world have accessed Riderlink. Metro has continued to include more bus schedules and route maps in the Riderlink system.

* .c.Community Transit Arterial System Area-Wide Priority (CT ASAP); (EldonJL.JJacobson) This is the IVHS operational test project that was earmarked by congress for Snohomish County (Community Transit). A proposal was submitted in February, 1994, to DC. requesting \$1,500,000 in Federal funds (75%) which will be matched with \$375,000 in Community Transit funds (25%). This project plans to implement the most cost effective portion of the Community Transit Arterial HOV study, which was completed in March, 1993. That means installing a bus priority system at about 100 traffic signals in Snohomish County. The North Seattle ATMS project will utilize the data and METRO will install the same signal priority system on SR 99. This will be the first large scale area-wide test of a signal priority system (Pierce Transit has jumped into the forefront of testing signal priority, and may have a different signal priority system operational in Tacoma around March, 1995). The proposal was approved and an agreement between FHWA and WSDOT has been drafted by FHWA. At a coordination meeting on May 10, 1994, it was decided to combine this project with part of the SR 99 signal project, so as to only have one signal priority project within Snohomish County (Metro does not have authority to do any work outside King County). The WSDOT-FHWA Cooperative Agreement was approved on June 17, 1994. WSDOT Northwest Region is preparing the Local Agency Agreement between WSDOT and Community Transit. The Local Agency Agreement has been sent to Community Transit. The project may be revised in how it is coordinated with two other related projects in the area (the SR 99 project and the

Metro AVI purchase project).

As of March, 1995, the Local Agency Agreement is close to being finalized. Larry Ingalls of CT is developing a work plan for the project. Installation of hardware on the buses is dependent on the Metro region wide AVI purchase project.

.c.Additional ITS Projects

% .c.Regional Automated Trip Planning.; (Wayne Watanabe) King County Metro is participating with Community Transit and Pierce Transit in the development of a regional transit trip planning system. The system will allow any information operator at any of the three agencies to enter origins and destinations within the region. The system will automatically produce a trip itinerary including travel times, fares, and transfers. Current effort is focused on developing geographic information system (GIS) hardware and software capability in Pierce and Snohomish counties. King County is nearly done with its GIS component. This project is scheduled to be complete in 1997.

% .c.Regional Ridematch.; (Roland Bradley) King County Metro is participating with Community Transit and Pierce Transit in the development of regional ridematching software. The system will allow ridematch staff at any of the three agencies to enter ridematch requests into a regional database. This system will replace an existing regional ridematch system that limits the ability of agencies to offer geographic information system based matches, match maps for customers, and on-line ridematching. The project is scheduled to be complete in 1997.

% .c.Regional Ridematch Hotline.; (Roland Bradley) This project will provide one 1-800 telephone number for anyone in King, Snohomish, and Pierce counties to use for ridematch assistance. This project is scheduled to be complete in 1996.

% .c.Regional Fare Integration Project.; (Candace Carlson) King County Metro is participating with Community Transit, Pierce Transit, Everett Transit, Kitsap Transit, Washington State Ferries, the RTA, PSRC, and the Cascadia Project to provide seamless regional fare media that makes it easier to make inter-county trips within the Puget Sound region. The project team is currently evaluating several technologies including smart cards and magnetically encoded cards. The analysis phase will conclude in 1995 and a demonstration of the selected technology will be in place by the end of 1996.

% .c.Smart Bus.; (David Cantey) King County Metro is beginning the implementation of a smart bus strategy that will integrate electronic information systems on-board buses. The current order for 360 buses includes J-1708 wiring which will provide the backbone of the "vehicle area network." J-1708 is an SAE standard developed and adopted by ITS America. A contractor has been hired to integrate the automatic passenger counting systems and automatic vehicle location systems on board the 10% of the current fleet that have APC systems installed.

.c.other Projects

% .c.Traffic Congestion Monitoring-Urban Areas.; (Bill Legg or Mark Hallenbeck) There are three basic objectives for this study. (1) Develop a comprehensive understanding of the congestion monitoring needs and expectations of local, state, and federal governments and agencies.

(2) Define the alternative methods for performing that monitoring function. (3) Develop cost and staffing estimates that can be provided to state officials in decision package form, so that a monitoring system based on one of these alternatives can be implemented. This project will provide a resource document that lists the potential methods for monitoring congestion in the state's urban areas. It will describe the types of data that need to be collected, the strengths and limitations of each of the methods or combinations of methods that can be used for collecting those data, and preliminary costs for implementation of those data collection procedures. The project will provide descriptions of both systems that can be implemented using currently available technologies, and those systems that rely on technologies that are currently experimental but may provide greater levels of information gathering at a lower cost than traditional methods, if the new methods are implemented on an urban scale. The Phase 2 draft report is being revised to reflect comments received from review.

% .c. ENTERPRISE.; (Bill Legg) The ENTERPRISE Program represents an international forum for collaborative research, development, and deployment ventures. This forum will facilitate the sharing of technological and institutional experiences gained from the IVHS programs conceived and initiated by each participating entity. The cooperative and collaborative objectives of the ENTERPRISE Program provide for a more efficient use of resources than a series of independent initiatives. The synergistic effect of this forum is an accelerated implementation of IVHS programs. Current members of ENTERPRISE aside from WSDOT include; CDOT, AzDOT, MinnDOT, IDOT, MichDOT, NCDOT, Maricopa County DOT in AZ. FHWA, Ministry of Transportation of Ontario, Transport Canada, and Rijkswaterstaat (Netherlands DOT). Others considering joining are NYDOT, and the Federal DOT of Mexico. ENTERPRISE holds quarterly meetings, in 1994 that will be changed to 3 times a year. The last meeting of ENTERPRISE was held in April 1994. The next meeting will be in September, 1994 followed by a December 1994 meeting to be held in Seattle. I have notes as well as minutes of previous meetings. In conjunction with the September meeting ENTERPRISE will cosponsor the 2nd annual Rural IVHS conference with IVHS America. The first Rural IVHS conference was held in February, 1993, it was sponsored by ENTERPRISE. ENTERPRISE is the major backer of ITIS, which is the development of an international standard for communications between the roadside and vehicles. ENTERPRISE is also working on joint funding of several project proposals submitted by member organizations. One project that is currently underway is HERALD, which is investigating using an AM sub-carrier to deliver road and construction information to motorists in rural areas. ENTERPRISE submitted two proposals to FHWA as demonstration projects; the first is a second phase of the HERALD project, the second is a wide scale MAYDAY project. FHWA accepted both of these projects for funding, they are now just getting underway; the interagency agreements and contracts are being developed and signed by the involved parties. Since WSDOT is a partner in a second funded MAYDAY operational test we will be working closely with ENTERPRISE to avoid duplication in effort and to share information. I will use this report to provide updates on the ENTERPRISE operational tests. The latest meeting for this group was held in Phoenix in April. The next meeting will be in Minnesota in September in conjunction with the 1995 Rural ITS conference. The 1996 rural ITS conference will be held in Spokane, WSDOT will be the host agency.

% .c.Accident Risks Using Roadway Geometrics.; (Eldon L. Jacobson, Fred L. Mannering) The work is being done by John Milton, a WSDOT graduate student. The primary objective of this project is to test the statistical validity of the accident prediction method WSDOT is developing and utilizing. The findings of this research will be used to develop a weighted equation for use in the Department's safety program. The data has been collected and most of the literature review has been completed. Development and testing of accident frequency models began at the end of December, 1994.

% .c.Advanced Transportation Technology Application Policy Plan.; (Bill Legg) This effort is looking at establishing ITS, or in this case Advanced Transportation Technology, as a new policy area in the Transportation Policy Plan for Washington State. The first subcommittee meeting on this effort will be held on July 11th. A second meeting will be held in August.