

**Transportation Northwest at the University of Washington**  
**Research Project Descriptions**  
**Year 12: September 1, 1999-August 31, 2000**

**DAILEY**

<b>Identifying Number</b>	62-2515
<b>Project Title</b>	The Use of Transit Vehicles for Speed and TTM in Support of Performance Monitoring
<b>Principle Investigator</b>	Dan Dailey
<b>Institution</b>	University of WA
<b>PI's telephone number</b>	206-543-2493
<b>PI's E-mail address</b>	dan@ee.washington.edu
<b>External project contact, address, telephone number</b>	Pete Briglia University of Washington Box 354802 Seattle, WA 98195-2700 206-543-3331
<b>Project objective</b>	The objectives of the TransNow component of this project are to: 1) develop a methodology to use transit coaches as probe vehicles to estimate freeway corridor speed and travel-time in support of performance monitoring, 2) describe a system to provide real travel-time and speed measures using this methodology, 3) demonstrate these capabilities by providing the travel-time speed information to researchers and planners when it is available.

**Abstract**

A previously funded joint TransNow/WSDOT project began the development of technology and software to use Metro's AVL-equipped fleet as a set of probe vehicles both on freeways and arterials. That project created the ability to capture AVL data on the fly and to measure individual transit vehicle travel-times. While travel-time is one measure for performance monitoring, the goal of this project is to extend the use of the AVL data stream to estimate both speed and travel-time. In past work, several techniques and technologies have been used to estimate travel-time, each of which have various strengths and limitations. For this reason, "data fusing," the principled integration of multiple data sources is seen as a desirable way to estimate travel conditions. The fusing of data from both WSDOT and Metro will allow the development of the techniques necessary to truly use transit vehicles as probes.

In the TransNow component of this project, we will expand the methodology for using transit coaches as probe vehicles to estimate travel-time and speed in support of performance monitoring. In the parallel WSDOT component of this project, freeway travel-times and speeds estimated using probe transit coaches will be compared to, and integrated with, travel-time and speed estimates obtained from both direct and derived speed measures using WSADOT freeway inductance loop sensors. In addition, we will explore expanding this work to include estimates from transit vehicles on arterial routes. The goal of the TransNow component of this project is to leverage an existing transit, automatic vehicle location (AVL) system (currently used primarily for command and control purposes) as an additional key data source in performance monitoring. The goals of the WSDOT component of this project are twofold. The first goal is to understand the relationship between speed and travel-time as estimated by both: 1) the AVL probe vehicles and 2) inductance loop sensors in the roadway. The second goal is to continue the exploration of using the AVL data stream to create a monitoring tool for arterial congestion.

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**Task Descriptions and Milestones**

1. Review Literature on travel-time estimation techniques and performance monitoring.
2. Develop algorithms to estimate speed and travel-time for freeway corridors using both AVL data and inductance loops.
3. Validate assumptions about observed data properties to ensure validity of algorithms developed.
4. Collect large numbers of days of AVL data from freeway and test speed/travel-time algorithms.
5. Collect loop data in parallel to the AVL information.
6. Explore methods for comparing speed and travel-time estimates from both transit probes and loop data.
7. Create a quantitative relationship between the AVL estimates and loop estimates.
8. Collect data from express transit routes on the arterials and apply speed/travel-time algorithms.
9. Validate assumptions about observed data properties to ensure validity of algorithms developed.
10. Collect on-the-ground information for selected arterial routes.
11. Develop prescriptions for the use of freeway algorithms on arterials based on the data statistics.
12. Explore quantitative relationship between AVL-derived speeds and traffic conditions/travel-times.
13. Develop recommendations for the use of speed/travel-time estimates from the identified methods.
14. Write the final report.
15. Respond to comments on the final report.

<b>Project Start and End Dates</b>	September 1, 1999- August 31, 2000
<b>Current year budget</b>	\$65,625
<b>For two-year project, total budget and start and end dates</b>	N/A
<b>Modal orientation of the project</b>	Transit
<b>Student involvement (thesis, assistantships, paid employment)</b>	1 student working on MSEE thesis

**Relationship to Other Research Projects**

A previously funded joint TransNow/WSDOT project began the development of technology and software to use Metro" AVL-equipped fleet as a set of probe vehicles both on freeways and arterials. That project created the ability to capture AVL data on the fly and to measure individual transit vehicle travel-times. While travel-time is one measure for performance monitoring, the goal of this project is to extend the use of the AVL data stream to estimate both speed and travel-time. In past work, several techniques and technologies have been used to estimate travel-time, each of which have various strengths and limitations. For this reason, "data fusion," the principled integration of multiple data sources is seen as a desirable way to estimate travel conditions. The fusing of data from both WSDOT and Metro will allow the development of the techniques necessary to truly use transit vehicles as probes.

**Technology Transfer Activities**

1. An algorithm that uses Metro AVL data received over the ITS backbone to estimate speed and travel-time of transit vehicles on the freeway system.
2. A report that: a) describes the AVL speed-travel-time algorithm, b) describes comparative analysis of various estimates and measurements, c) recommends guidelines for the use of these techniques in performance monitoring, d) recommends methodologies for data fusion of various estimates and measurements, 3) recommends future ITS development strategies to make travel-times and speeds more available, accurate, and useful.

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3. A paper to be submitted for presentation at the TRB '00 Annual Meeting and a manuscript to be submitted to a peer review journal.

#### **Potential Benefits of the Project**

1. Leveraging additional key benefits from Metro/WSDOT/TransNow's existing investment in both ITS backbone and AVL related research projects.
2. Increasing the effectiveness of performance monitoring efforts by: a) enhancing the accuracy of estimated travel-times and speeds, b) creating the technology for a new tool that can be used to do performance evaluation.
3. Making available better travel-time and speed estimates for a variety of ITS application by fusing two different travel-time data sources.
4. Making current travel-time and speed data available for archiving and manipulation.
5. Creating algorithms for travel-time and speed estimation that can be used with any methodology that collects sets of positions as a function of time (e.g., GPS-equipped vehicles).
6. Producing a report that describes the algorithms and statistics of travel-time and speed estimates when using probe transit vehicles for use in performance monitoring.

#### **TRB Keywords**

AVL, Kalman Filtering, Probe Vehicles, Speed Measurement, Travel-time

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**VERNEZ MOUDON**

<b>Identifying Number</b>	62-2517
<b>Project Title</b>	Prioritizing Pedestrian Infrastructure Improvements
<b>Principle Investigator</b>	Anne Vernez Moudon
<b>Institution</b>	University of Washington
<b>PI's telephone number</b>	206-685-9597
<b>PI's E-mail address</b>	moudon@u.washington.edu
<b>External project contact, address, telephone number</b>	Tom Hanson WSDOT Box 47300 Olympia, WA 98504
<b>Project objective</b>	To increase pedestrian travel and, indirectly, to increase transit use, in suburban locations other than the designated suburban employment centers, yet which already have the necessary land use characteristics necessary to foster walking.  To develop a methodology which will assist state and local jurisdictions in identifying suburban locations where investments in pedestrian infrastructure improvements will yield highest potential increases in pedestrian travel.

**Abstract**

This project is to develop a methodology enabling state and local providers to prioritize funding for pedestrian facilities improvements in suburban areas. It builds on previous research which shows that a significant amount of pedestrian travel takes place in suburban areas with appropriate population densities and land use mix, pedestrian travel increases significantly in sites with continuous sidewalks and small street blocks. Parallel research on metropolitan land use distribution and intensity patterns reveals that 20 percent of the Puget Sound suburban population live outside of the recognized suburban centers, yet in areas exhibiting land use conditions which are appropriate for pedestrian travel. Hence targeting pedestrian facilities improvements to these suburban areas offers great potential to increase pedestrian travel.

The project will contribute to local policies focused on reducing dependence on motor vehicles, as well as to theory and methods on the relationship between land use and transportation by enhancing measures of metropolitan population density distribution and land use mix. It will also advance methods of modeling pedestrian travel.

**Task Descriptions and Milestones**

Year 1:

1. Project preparation
2. Review of databases and related analytical methods
3. Automated approach
4. Manual approach
5. Selection of demonstration jurisdictions
6. Workshops
7. Paper preparation

Year 2:

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8. Demonstration Jurisdiction A
9. Demonstration Jurisdiction B
10. Draft final report
11. Final report
12. Training Manuals
13. Paper preparation
14. Workshops

<b>Project Start and End Dates</b>	September 1, 1999-August 31, 2001
<b>Current year budget</b>	\$17,827
<b>For two-year project, total budget and start and end dates</b>	\$35,654
<b>Modal orientation of the project</b>	Multi-modal
<b>Student involvement (thesis, assistantships, paid employment)</b>	Paul M. Hess, RA, other student to be announced (either RA or hourly undergraduate)

**Relationship to Other Research Projects**

This project fits into the context of the WSDOT policy to reduce the public's dependence on motor vehicles by providing travel alternatives. The state's pedestrian transportation policy recognizes walking as an important transportation option for many trips. It requires that pedestrian facilities be integrated into comprehensive transportation planning and development programs (WSDOT 1995).

This project builds on local and national research on the effects of land use on travel behavior (Rutherford et al. 1993; Federal Highway Administration 1994; Frank and Pivo 1994; Ewing 1994; Cervero and Kockelman 1996; Transportation Enhancements 1996). It is also part of a comprehensive research agenda to understand and control the relationships between land use, urban form, and transportation. The overall mission of the research program is to develop ways of designing and implementing human settlement patterns that decrease total vehicle trip making, reduce the length of the typical automobile trip, and that encourage the use of transportation means other than the single-occupant vehicle (Pivo and Moudon 1992). Please contact TransNow if more information is required.

**Technology Transfer Activities**

Tech Transfer Activities will take place during the two consecutive summers of the research project. The principal activities will include the preparation of two papers to be submitted for presentation at the Annual TRB conference and the organization of workshops to disseminate the products of the research. The first-year workshops will be designed for state and regional planning staff, while the second-year workshop will be directed at local jurisdictions. The last three months of the project have also been set aside to submit and review the final report.

**Potential Benefits of the Project**

Generally, the project will insure that limited funds for pedestrian infrastructure are targeted to suburban sites which hold the greatest promise of increased pedestrian travel.

At the policy level, the project will support local and national efforts to reduce dependence on motor vehicles (Downs 1994; Peirce 1997). Research has shown that a 10 percent reduction in VMT can be achieved by improving the pedestrian environment (Cambridge Systematics 1993). Increasing the incidence of pedestrian travel also contributes to reducing the number of trips by auto; improving air

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quality; improving travel conditions for the less-advantaged portions of the population; supporting public transit; and complementing current TDM methods (Replogle 1995). The project will specifically support our state's comprehensive planning under the Growth Management Acts and parallel implementation of Sound transit.

At the implementation level, the project will directly assist local jurisdictions in the allocation of their capital budgets, provide them with an objective and scientifically valid method for prioritizing locations which will yield the highest benefits in terms of increasing pedestrian volumes, improving pedestrian safety (Roth 1994), and supporting transit (Replogle 1992).

At the scientific level, the project will contribute to developing theory and methods for understanding the relationship between land use and transportation. Specifically, it will provide needed enhanced measures of metropolitan population density distribution and land use mix (Holtzclaw 1994; Replogle 1995; Cervero and Kockelman 1996). The proposed methodology will also contribute to parallel efforts in modeling pedestrian volume generation based on land use conditions (Cove 1993; Loevas 1994; Otis et al. 1995; Loutzenheiser 1997).

**TRB Keywords**

Pedestrians, Pedestrian Facilities, Land Use, GIS

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**DAILEY**

<b>Identifying Number</b>	62-2514
<b>Project Title</b>	The Use of Un-Calibrated CCTV Cameras as Quantitative Speed Sensors
<b>Principle Investigator</b>	Dan Dailey
<b>Institution</b>	University of Washington
<b>PI's telephone number</b>	206-543-2493
<b>PI's E-mail address</b>	dan@its.washington.edu
<b>External project contact, address, telephone number</b>	Pete Briglia University District Bldg., Ste. 535 1107 N.E. 45 <sup>th</sup> Street Seattle, WA 98105-4631
<b>Project objective</b>	In this project we propose to expand on a previous project that created a new algorithm to estimate speed using a sequence of video images from an un-calibrated camera. This algorithm uses frame differencing to isolate moving edges and track vehicles between frames. The algorithm uses a known vehicle length distribution with image information to estimate speed. The previous research demonstrated a proof of principle for the algorithm. This project will investigate the automation of the algorithm to create a new speed sensor from the existing CCTV cameras deployed by the WSDOT.

**Abstract**

In this project, we propose to expand on a previous project that created a new algorithm to estimate speed using a sequence of video images from an uncalibrated camera. This algorithm uses frame differencing to isolate moving edges and track vehicles between frames. The algorithm uses a known vehicle length distribution with image information to estimate speed. The previous development demonstrated a proof of principle for the algorithm. This project will investigate the automation of the algorithm to create a new speed sensor from the existing CCTV cameras deployed by any DOT using video surveillance. The development process will take place using WSDOT cameras in the Seattle metropolitan region.

**Task Descriptions and Milestones**

1. Create a methodology and software to obtain images from WSDOT CCTV cameras.
2. Obtain example images from roadways under a variety of conditions to be used with the algorithm development.
3. Create software framework to implement existing algorithm.
4. Investigate "block matching" algorithms from the video literature.
5. Develop tracking algorithm once individual vehicles can be automatically matched in sequential frames.
6. Implement tracking algorithm as an outer loop to the existing algorithm.
7. Obtain probe vehicle images from WSDOT by deploying probes and recording series of images from DOT cameras.
8. Obtain loop sensor data and video image sequences for comparison.
9. Statistically quantify the effectiveness of the automated algorithm against on-road data.
10. Prepare manuscript for peer reviewed publication.
11. Prepare draft final report.
12. Respond to comments on draft final report.

**Project Start and End Dates**    September 1, 1999 – August 31, 2000

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<b>Current year budget</b>	\$31,500
<b>For two-year project, total budget and start and end dates</b>	\$71,875
<b>Modal orientation of the project</b>	Highway
<b>Student involvement (thesis, assistantships, paid employment)</b>	1 student working on MSE thesis

#### **Relationship to Other Research Projects**

This project builds on a previous project funded by TransNow and WSDOT. The previous project developed an algorithm that can estimate vehicle speed using un-calibrated CCTV cameras. This project expands the algorithm in an attempt to automate it and make it suitable for deployment in traffic management activities.

#### **Technology Transfer Activities**

1. Creating an algorithm that can automatically estimate speed on a freeway using un-calibrated CCTV cameras.
2. Demonstrating this experimental speed sensor to WSDOT using freeway cameras.
3. Submitting a paper for presentation at the TRB '00 Annual Meeting and submitting a manuscript to a peer review journal.

#### **Potential Benefits of the Project**

The presently installed set of cameras represents a large financial investment to all DOTs nationally. This research allows quantitative speed estimates from the existing camera pool and eliminates the need for additional, specially calibrated cameras and associated infrastructure. Further, as cameras are deployed on arterial routes, this technology will allow quantitative traffic speed measurement from the cameras that would only be available by installing additional, expensive traffic sensors (e.g., loops, radar). If the research is successful, it will create prototype software and algorithms capable of producing speed estimates from cameras producing 3 image frames per second. The technology to produce such image streams is becoming cheaper year by year, and many DOTs have video cameras online capable of delivering such a stream. Initially the work will benefit both WSDOT operations and other ongoing research projects that require quantitative information from the roadways where loops do not exist. Long-term, this work will benefit any DOT operations that use un-calibrated cameras for surveillance. The number of DOTs using this technology is growing daily and the potential to use the technology developed here exists in nearly every state.

#### **TRB Keywords**

Video Imaging Detectors, Speed Detectors, Speed Data, Image Processing, Closed Circuit Television

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**STRATHMAN**

<b>Identifying Number</b>	922910-2
<b>Project Title</b>	Use of Bus Dispatching and TM Systems Data in Transit Services Planning
<b>Principle Investigator</b>	James G. Strathman
<b>Institution</b>	Portland State University
<b>PI's telephone number</b>	503-725-4069
<b>PI's E-mail address</b>	strathmanj@pdx.edu
<b>External project contact, address, telephone number</b>	Ken Turner Tri-Met 4012 SE 17 <sup>th</sup> Avenue Portland, OR 97202 503-238-4918
<b>Project objective</b>	Tri-Met's computer-aided bus dispatch system (BDS), which uses a global positioning system (GPS)-based automatic vehicle location (AVL) technology to relate bus location to route, bus stop and schedule databases, is now fully deployed and is generating operating data for all bus routes. The first objective of the proposed project is to estimate route level performance and reliability models, focusing on delay, running time variation, and service regularity, from archived BDS data supplemented by traffic and signalization data from the Traffic Management System (TMS) overseen by the City of Portland and the Oregon DOT (Region 1). The performance/reliability models would have the capability of assessing route-specific changes in signalization, stop placement and route design. The second objective is to explore the use of archived BDS data to develop standards that can be employed by schedulers in setting running and layover times, determining stops and in routing service.

**Abstract**

This project will develop and estimate route level models of bus delay, regularity and running time variation using data that is being archived from Tri-Met's recently-implemented Bus Dispatch System (BDS) and selected Traffic Management System (TMS) data recovered by the City of Portland and the Oregon DOT (Region 1) on signal prioritization, incidents, and traffic volume. The specific purposes of the analyses are two-fold and related: 1) to estimate the effects of various factors on service reliability and running times; 2) to simulate the consequences of changes in the operating environment, including signal prioritization, stop consolidation, and introduction of pull-outs at stops and other right-of way features. The more general objective is to better link the newly-available operating data to the development of standards that can guide scheduling practices.

**Task Descriptions and Milestones**

1. Review literature on determinants of service performance and reliability.
2. Develop and estimate run time, regularity and delay models from archived BDS and TMS data.
3. Simulate effects of changes in signalization, stop spacing and pull-outs on performance and utilization.
4. Construct and analyze run time and regularity distributions from archived BDS data.
5. Report preparation.
6. Implement/disseminate results.

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<b>Project Start and End Dates</b>	January 1, 2000 – August 31, 2000
<b>Current year budget</b>	\$37,801
<b>For two-year project, total budget and start and end dates</b>	N/A
<b>Modal orientation of the project</b>	Transit
<b>Student involvement (thesis, assistantships, paid employment)</b>	To be named

**Relationship to Other Research Projects**

With the implementation of Tri-Met's BDS system, the researchers have been recovering and analyzing service data. This includes a sequence of research projects supported by Tri-Met and TransNow:

1. Development of an internet-based system to provide real-time schedule information to passengers, termed "Transit Time Internet Access" – TTIA (BDS Evaluation, Phase 1).
2. Determination of baseline, pre-BDS implementation benchmarks on selected routes for on-time performance, running time variation, and service regularity, against which post-implementation performance can be compared (BDS Evaluation, Phase 2).
3. Evaluation of service reliability changes achieved by the BDS in "passive" (i.e., in the absence of systematic application of operations control measures) operation, and the establishment of a second set of route and time point level performance benchmarks (BDS Evaluation, Phase 3).
4. Beginning in January 1999, the researchers have been engaged in BDS Evaluation, Phase 4. The objective in this phase is to evaluate service reliability changes at the route and time point level in relation to the passive benchmarks. In addition, the researchers are employing GIS to estimate a time point level bus patronage model. In the context of the ongoing effort to evaluate the impacts of the BDS, an important feature of the patronage model will be to estimate the effect of service reliability on transit demand.

**Technology Transfer Activities**

The primary objective of this project is to evaluate bus operating performance and reliability in support of service planning and scheduling activities. Consequently, technology transfer activities will consist of research reports and recommendations that could be used by Tri-Met in updating its "Scheduling Practices" manual. It is hoped that the research will contribute to the development of planning and scheduling standards that would be transferred to these activities through the "Practices" manual or some like means.

**Potential Benefits of the Project**

The project will benefit Tri-Met and the transit industry by systematically documenting transit service performance and reliability, providing an improved basis for scheduling practice. Incorporating TMS data in the performance modeling and simulations will provide stronger support for service planning.

**TRB Keywords**

Computer-Aided Dispatch, Automatic Vehicle Location, Transit Service Reliability, Scheduling

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NIHAN

**Identifying Number** 62-2513  
**Project Title** Beyond Congestion Points: Freight Infrastructure System Investment Evaluation, Year 2  
**Principle Investigator** Nancy L. Nihan  
**Institution** University of Washington  
**PI's telephone number** 206-543-5965  
**PI's E-mail address** nihan@u.washington.edu  
**External project contact, address, telephone number** Martine Micozzi  
Staff Assistant to Deputy Federal Highway Administrator  
400 Seventh St. SW Room 4218  
Washington, DC 20590  
202-366-9249

**Project objective** This is a demonstration project to quantify the importance of coordinated freight mobility infrastructure improvements. The project premise is: spot transportation system improvements that are not coordinated as part of a larger intermodal system will simply result in relocation of congestion points, not elimination. A study of both local and regional container transportation in Seattle, WA will be conducted to demonstrate the point specific and system benefits associated with construction investment projects. Operational analysis will be conducted on all aspects of the transportation chain between container ship and warehouse or other external destination to quantify operational problems and the real impacts of construction investments.

**Abstract**

This continuing proposal is for a demonstration project to quantify the importance of coordinated freight mobility infrastructure improvements. The project premise is: Spot transportation system improvements that are not coordinated as part of a larger intermodal system will simply result in relocation of congestion points, not elimination. A study of both local and regional container transportation in Seattle, WA will be conducted to demonstrate the point specific and system benefits associated with construction investment projects. Operational analysis will be conducted on all aspects of the transportation chain between container ship and warehouse or other external destination to quantify operational problems and the real impacts of construction investments.

**Task Descriptions and Milestones**

Data collection, road infrastructure, traffic volumes, port infrastructure, port container volumes, rail infrastructure, train operations and volumes, complete data collection, model development, FreeSim, NetSim, port operations, rail operations, complete model development, scenario analysis, economic analysis, report development, completion and final report.

**Project Start and End Dates** September 1, 1999 – August 31, 2000  
**Current year budget** \$35,215  
**For two-year project, total budget and start and end dates** \$110,215  
**Modal orientation of the project** Multi-Modal

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**Student involvement (thesis, assistantships, paid employment)** Karl Westby, PhD, RA  
Kevin Chang, PhD, Paid Employment  
Matthew Patrick Ensor, BA, Paid Employment

**Relationship to Other Research Projects**

This research is a continuation of work by TransNow researchers Robert Jaeger and Nancy Nihan

**Technology Transfer Activities**

Once the models have been developed, scenario analysis runs will be conducted. Operational improvements as well as infrastructure improvements in the rail, road, port and intermodal connections will be modeled. These will be modeled individually and with each other to demonstrate the impacts of individual, multiple, and coordinated improvements. The benefits in travel time savings will be measured for each of the improvements scenarios.

**Potential Benefits of the Project**

The benefits of travel time reductions calculated in the scenario analysis will be converted to a dollar value. A single value (dollars per hour) will be placed on each container in the transportation system. This information coupled with cost estimates of the proposed improvements allows for development of a benefit/cost model. With this, the transportation improvements can be measured in terms of real benefits.

**TRB Keywords**

Intermodal, Freight, Infrastructure, Congestion Points

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**HALLENBECK**

<b>Identifying Number</b>	62-2516
<b>Project Title</b>	Intelligent Transportation Systems Courses
<b>Principle Investigator</b>	Mark Hallenbeck
<b>Institution</b>	University of Washington
<b>PI's telephone number</b>	206-685-0767
<b>PI's E-mail address</b>	tracmark@u.washington.edu
<b>External project contact, address, telephone number</b>	Bill Legg WSDOT ATB 1107 NE 45 <sup>th</sup> Street, Ste. 535 Seattle, WA 98105 206-543-3332

**Project objective** This project's major objective is to assist in the development of ITS training opportunities for both students and practicing professionals. The project is intended to provide funding for the set-up and provision of courses and the development of course materials that would be used to conduct these courses.

**Abstract**

This project proposes to generate new Intelligent Transportation System course material by combining the resources and talents of the University of Washington transportation faculty, the Washington State Transportation Center staff, the Washington State Department of Transportation's staff, and the members of the Washington State Chapter of the Intelligent Transportation Society of America. The courses would be sponsored by the Intelligent Transportation Systems Society of Washington and TransNow. They would be offered through both the Engineering Professional Education Program of the University of Washington (EPP) and through the existing UW course structure (or that University structure selected by the TransNow Board of Directors), given the nature of the course and the desires of the University. Finally, it is expected that other TransNow universities would be able to offer their students and the professional communities they serve access to these courses through the distance learning capabilities being developed by TransNow.

**Task Descriptions and Milestones**

1. Develop course ideas.
2. Develop course material.
3. Schedule course.
4. Present course.
5. Write Final Report.

<b>Project Start and End Dates</b>	September 1, 1999 – August 31, 2000
<b>Current year budget</b>	\$10,000
<b>For two-year project, total budget and start and end dates</b>	N/A
<b>Modal orientation of the project</b>	Multi-Modal
<b>Student involvement (thesis, assistantships, paid employment)</b>	N/A

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**Relationship to Other Research Projects**

The intent of this effort is to provide the support needed to translate the knowledge learned in previous ITS research into practical course material, and then offer that course material to those who can benefit most from it. WSDOT staff have learned a great deal about the selection, operation, and maintenance of Intelligent Transportation Systems. This project is designed to help transfer that knowledge to others.

**Technology Transfer Activities**

This project is a technology transfer effort. Subject areas that will be covered by the course material developed under this effort will be selected based on the needs expressed by the transportation community.

**Potential Benefits of the Project**

ITS is proving to be successful, but a considerable amount of training is need to “mainstream” these technologies. This project will result in a major improvement in the availability of training opportunities.

**TRB Keywords**

ITS, Course Material, Training