Potential Transportation Technologies, Strategies, and Policies: Priority Issues

Innovations Unit

FY91 Final Report and Proposed FY92-93 Activities

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Submitted to:

Goals Subcommittee
Washington State Transportation Commission
Olympia, WA

April 17, 1991

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GLOSSARY

ACM	Association of Computing Machinery
AGT	Automated Guideway Transit
AT&T	American Telephone and Telegraph
ATIS	Advanced Traveler Information Systems (an IVHS technology)
ATMS	Advanced Traffic Management Systems (an IVHS technology)
AVCS	Advanced Vehicle Control Systems (an IVHS technology)
CAD	Computer-Aided Design
CAM	Computer-Aided Manufacturing
CAT Scan	Computerized Axial Tomography Scanning
CBD	Central Business District
CNG	Compressed Natural Gas
CVO	Commercial Vehicle Operations (an IVHS technology)
FAME	WSDOT Freeway Arterial Management Effort
FHWA	Federal Highway Administration
Flextime	Adjustable work hour options
GM	General Motors
GM Lean Machine	GM designed 1/2 width lightweight commuter vehicle
HCT	High Capacity Transit
HOV	High Occupancy Vehicle
HSCT	High Speed Commercial Transport (aircraft)
HSGT	High Speed Ground Transport
HSST	High Speed Surface Transport Corporation (MagLev venture)
ICE	InterCity Express (German high speed steel on steel train)
IVHS America	Organization which promotes IVHS research
IVHS	Intelligent Vehicle/Highway Systems
LTC	Legislative Transportation Committee
LID	Local Improvement District
LRT	Light Rail Transit
MagLev	Magnetic Levitation technology (rail and marine)
METRO	Municipality of Metropolitan Seattle (Metro Transit)
Mobility 2000	Ad Hoc Group to promote IVHS research (now IVHS America)
MPG	Miles Per Gallon
NASP	National Aerospace Plane

NEPA	National Environmental Policy Act of 1969
NIMBY	"Not In My Back Yard"
P&R	Park and Ride
Peirce Report	Seattle Times series on growth management and land use in Puget Sound
PRT	Personal Rapid Transit
PSCOG	Puget Sound Council of Governments
QSRA	Quiet Short-Haul Research Aircraft
SC&DI	Surveillance Control and Driver Information
SIGGRAPH 90	1990 Conference of ACM Special Interest Group on Computer Graphics
SOV	Single-Occupancy Vehicle
Steel-wheel	Conventional rail system (vs. MagLev); aka Steel-wheel-on-steel-rail
STPP	1990 Transportation Policy Plan of Washington State
Taxi 2000	Commercial venture to implement PRT
TDM	Transportation Demand Management
Telecommuting	Home-based or Work-center-based workplace using telecommunications
TGV	Trains a Grand Vitesse (French high speed steel on steel train)
Tilt-rotor	Aircraft propulsion technology employing swiveling rotor mechanism
Transportation 2000	Metro Transit Puget Sound Transit Development project
TRB	Transportation Research Board
TRO	Trip Reduction Ordinance
UMTA	Urban Mass Transportation Administration
U-PASS	TDM incentive program at UW
UW	University of Washington
V-22	Boeing tilt-rotor vehicle (Osprey) which uses V/STOL technology
VAL	European driverless automated guideway transit (AGT) system
Videotex	Interactive Text/Graphics communications using display screens
Vision 2020	PSCOG Puget Sound Growth Management study
V/STOL	Vertical/Short Take-Off and Landing
WSDOT	Washington State Department of Transportation
WSF	Washington State Ferries (WSDOT Marine Division)
WSTC	Washington State Transportation Commission
WSU	Washington State University

1. PROBLEM STATEMENT

There is a growing realization by the public and its decision-making representatives that traditional transportation solutions are not sufficient to address the significant and expanding needs of the State of Washington. Conventional approaches to transportation problems are only marginally effective in the face of steadily increasing transportation demands. As their effectiveness reaches the saturation point, traditional techniques must be supplemented by creative methods that more effectively address today's transportation challenges and that account for the important interrelationships between the transportation system and other public responsibilities such as land use and growth management, economic well-being, and environmental protection. Nationally, increasing attention is being paid to emerging and innovative transportation technologies, strategies, and policies that 1) offer the potential to significantly improve the personal mobility capability, cost effectiveness, and safety of our transportation system, and 2) are sensitive to the interactions between transportation system decisions and other aspects of our society.

The Washington State Transportation Commission (WSTC) has made a commitment to enhance its role as an active participant in molding the future direction of this state's transportation system. In order to meet that responsibility, Commission members must receive up-to-date information on newly emerging, promising transportation solutions and maintain a long-range focus on innovative options. To address the Commission's need for responsive analyses of technologies and policies, this report proposes that the Innovations Unit, a newly-formed advisory group to the Transportation Commission, undertake a program of exploratory monitoring, background research, and policy development activities. As proposed, the Innovations Unit, under the direction of the Commission's Goals Subcommittee, will address the analysis needs of the Commission by performing timely research of transportation technologies and policy options that have a high potential for long-term success in the state of Washington, and advise the Commission on emerging policy trends and strategies.

This report documents the Innovations Unit's research activities in FY91. It includes descriptions of study issues that the Innovations Unit and the Commission determined to be high-priority research interests, and describes the proposed budget and work plan for the Innovations Unit in the next biennium, including objectives, methodology, and implementation of FY92-93 research activities.

2. BACKGROUND AND STATUS

The 1990 Legislature appropriated $200,000 for the formation of a Transportation Innovations Unit. This unit was placed under the direction of the Washington State Transportation Commission's Goals Subcommittee and staffed in the summer of 1990. It began full-time operations in October 1990 as an advisory group to the Commission on long-range transportation developments and opportunities for Washington state. The initial study goals of the Innovations Unit were to

- provide long-range program development support to the Commission,
- generate unfiltered visions of a wide range of future short-term and long-term transportation technology/policy options, and
- establish a research methodology that fosters development of innovative transportation concepts.

The responsibilities of the Innovations Unit for FY91 were to identify and evaluate an array of innovative and emerging transportation technologies, strategies, and policies, and to prepare a proposal of FY92-93 activities. The following research activities were performed during FY91.

- Identification of an array of potential transportation technologies, strategies, and policies. This included a search of recent technical and popular literature and the development of a list of 150-200 topics.
- Preparation of brief top-level descriptions of 60 of these topics. These descriptions included the status of the technique's implementation, potential benefits and drawbacks, the degree of innovation risk, and possible study topics.
- Presentation of research results to the Legislative Transportation Committee (January 1991) and the Goals Subcommittee of the Transportation Commission (January 1991).
- Preparation and presentation to the Goals Subcommittee of a preliminary FY92-93 work plan (February 1991).
- Preparation and presentation to the Goals Subcommittee of seven high-priority research topic descriptions (March 1991).
- Initiation of research on the first of the seven high-priority topics (Land Use/Transportation Linkage). Results of this research will be presented to the Goals Subcommittee in July 1991.

- Ongoing monitoring of worldwide transportation technology and strategy developments.
- Attendance at national conferences focusing on state-of-the-art transportation technology and policy issues.
- Preparation of a final report documenting the FY91 activities and the FY92-93 proposal.

The FY91 research activities of the Innovations Unit were designed to support subsequent in-depth technology and policy research in FY92-93, as well as ongoing monitoring of worldwide transportation strategy and policy developments. In light of the exploratory research that the Innovations Unit will have completed by the end of FY91, the Innovations Unit staff concludes that the most efficient and effective way to successfully accomplish the desired follow-on research and monitoring activities is to continue developing the original strategy approach. In other words, the initial research results should be used as the starting point for an array of decision-support analysis activities conducted by an appropriate blend of permanent professional staff and contract researchers in relevant research specialties. The staffing and research topics of the proposed FY92-93 research are designed to build upon the initial FY91 research results and provide the Innovations Unit with the means to 1) explore, accumulate, and synthesize information that supports policy decision-making by the Commission, and 2) produce innovative and feasible transportation solutions that will enhance Washington's statewide transportation system and benefit its citizens.

3. OBJECTIVES

The technical objectives of the proposed FY92-93 research are designed to complement the FY91 study activities of the Innovations Unit. The proposed research has three levels of objectives that represent successively more detailed and focused studies:

Objective 1. Monitor emerging technologies and strategies.
Compile and synthesize up-to-date information about emerging and innovative transportation technologies, strategies, and policies. Produce an updated report and/or computer database of transportation technology and policy trends on an ongoing basis.

Objective 2. Research selected topics of Commission interest.
Conduct detailed background research of specific technology and policy issues under the direction of the Goals Subcommittee. Produce a series of white papers

outlining technology and policy implications germane to the Washington State transportation system.

Objective 3. Support in-depth technology and policy research. Conduct research of key enabling technologies, strategies, and policies that support the primary goals of the State Transportation Policy Plan (STPP) and/or supervise contract researchers to perform this research. Monitor research progress. Synthesize research results and produce recommendations that support the decision-making requirements of the Commission.

4. BENEFITS

This research is anticipated to produce long-term benefits for the Transportation Commission, the Washington State Department of Transportation, and the State of Washington. The activities of the Innovations Unit will

1. enhance the long-term transportation policy planning efforts of the Commission and strengthen its effectiveness in shaping the future direction of the state transportation system,
2. enhance transportation technology and strategy research efforts in Washington State, and
3. generate innovative, feasible solutions to the transportation needs of Washington's citizens, and enhance personal mobility throughout the state.

5. PRODUCTS

In addition to enhancing the ability of the Commission to maintain a long-term policy focus, the FY92-93 research activities of the Innovations Unit will generate the following products:

1. an updated database of ongoing worldwide transportation technology, strategy, and policy trends, accessible in written and computer-based form,
2. white papers of topics selected by the Goals Subcommittee,
3. an updated WSTC priority list of research topics and linkage to STPP goals,

4. synthesis reports and recommendations based upon in-depth research conducted by the Innovations Unit and/or contract researchers,
5. a draft report of research activities and results, and
6. a final report of research activities and results.

6. IMPLEMENTATION

The results of the Innovations Unit research activities will be applied in three ways. The Innovations Unit will

1. provide the Commission with timely technology and policy research results that can be used to support state transportation policy development and research directions,
2. provide an "early warning" monitoring capability that anticipates developing transportation trends and emerging solutions; this mechanism will be used to support the long-term transportation planning process of the Commission and the State Transportation Policy Steering Committee, and
3. provide the Commission with a rapid-response exploratory research capability.

7. WORK PLAN

The futures research methodology of the Innovations Unit employs a three-tiered approach that matches the three research objectives. It is intended to both maximize the exploration of creative and long-term solutions to transportation needs and efficiently utilize this state's public and private sector research personnel and facilities (see Figure 1). Within each tier or level, a distinct set of tasks will be performed as appropriate. The three levels are as follows.

Level 1	Maintain a long-range focus on potential transportation solutions.
Level 2	Filter potential concepts. Perform detailed background research.
Level 3	Support formal in-depth research and development efforts.

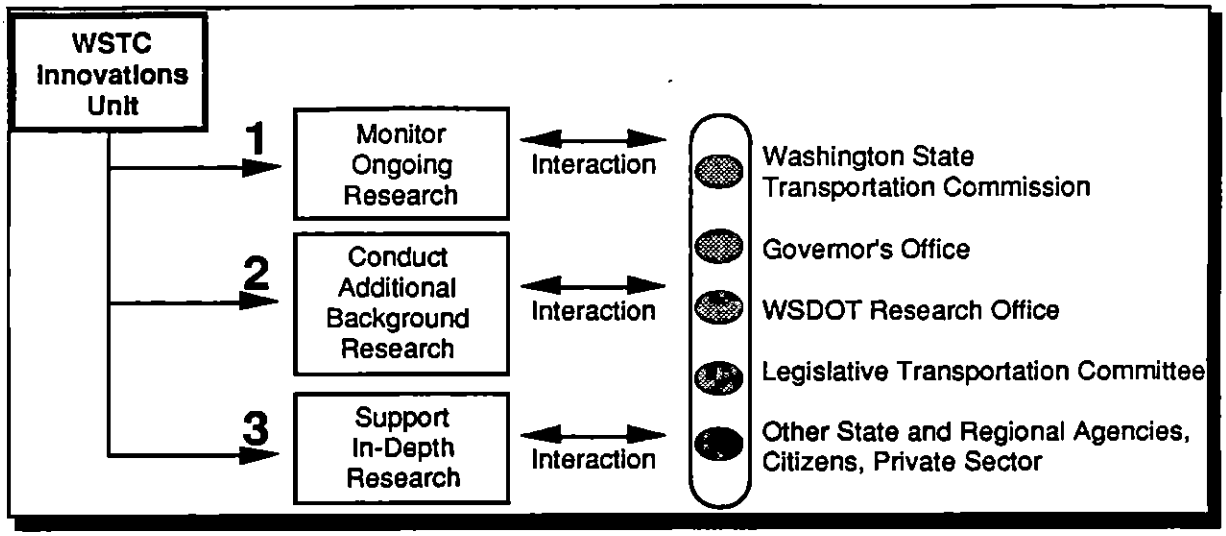


Figure 1. Innovations Unit Methodology

Level 1 research is conducted on an ongoing basis, while Level 2 and 3 research are conducted as needed with direction by the Commission. The tasks corresponding to each level are described in the following paragraphs.

Level 1 Research

Maintain a long-range focus on potential transportation solutions.

Task 1. ***Sustain an ongoing research effort to monitor creative research and development taking place both nationally and internationally.*** The scope of this monitoring activity will be deliberately broad and all-inclusive, encompassing not only emerging technologies but leveraging, incentive, and organizational strategies, as well. The tracking process will reflect this scope by considering subjects in the following three categories.

Emerging Technologies and Transportation Modes

This category includes transportation modes as well as multimodal transportation technologies.

Growth Management and Demand Management Strategies

This category includes leveraging techniques to manage growth and transportation demand.

Program Delivery and Institutional Policies

This category includes informational and organizational strategies, financial and partnership programs, and policy approaches.

The monitoring process will incorporate a flexible research perspective that encourages exploration of innovative solutions in a manner that is unconstrained by convention. Monitored topics will include approaches with both short and long development lead times; they will **not** be filtered on the basis of preconceived notions of technical feasibility, economic conditions, or political realities. This approach is intended to minimize the premature encroachment of bias or "conventional wisdom" into the study process and to maximize the potential for thought-provoking discussion, brainstorming, and innovative thought.

The monitoring system will obtain information via a continuous broad-based literature search, as well as through periodic information gathering from all government levels, discussions with other government agencies, and communications with the private sector. Data will also be collected via written correspondence, on-site visits, and professional technical meetings that focus on innovative, state-of-the-art transportation activities. In recognition of the often long-term and dynamic character of innovative development, this tracking activity will be sustained on a continuing basis during the entire biennium.

Task 2. ***Maintain and update a database of potential transportation technology, strategy, and policy options for reference and discussion.*** The database of Level 1 data collected in Task 1 will be compiled and organized in a centrally accessible form; information will be organized by source, category, and key word(s). As a minimum, this information will be available in written form and updated periodically. In addition, computer-based access to this information may be provided under the direction of the Commission's Goals Subcommittee.

Level 2 Research

Filter potential concepts. Perform detailed background research.

Task 3. ***Prioritize research efforts.*** Under the direction of the Goals Subcommittee, the Innovations Unit will solicit comments from government and private interests, including the Legislative Transportation Committee, the WSDOT Research

Office, and private engineering and planning firms, to help prioritize potential study topics generated by Level 1 research. A high priority list will be created and updated in consultation with the Commission. This list of long-term Commission research priorities will then be available to public and private organizations for reference or further comment. The initial high priority list consists of the following seven topics:

Leveraging Strategies:

1. Land Use/Transportation Linkage Strategies
2. Transportation Demand Management (TDM) Strategies
3. Marine System Strategies

Program Delivery:

4. WSDOT Organization/Human Resource Development
5. Corridor Preservation

Emerging Technologies (A Monitoring Activity):

6. High-Speed Rail (conventional and MagLev)
7. Automated People Movers

Summary descriptions of each topic are provided in Section 9 of this report.

While this list represents the initial working priority of the FY92-93 study effort, it is intended to be flexible. The composition of the list can be adjusted by the Commission's Goals Subcommittee as new trends emerge, additional technology or policy developments are identified, and potential opportunities arise. The list will also be updated as research of specific topics on the list has been completed by the Innovations Unit and the Washington State Department of Transportation. Given the staffing level of the Innovations Unit, the initial list of seven high-priority areas represents the typical number of topics that the Innovations Unit will be able to develop at one time during the biennium study period. The Innovations Unit is conducting advance research in support of this task during FY91, with particular focus on land use/transportation linkage issues (Topic #3).

The list of seven high-priority topics was developed from an initial study of approximately sixty topics. The following examples from that initial list may be considered as potential additions to the high-priority list in the future.

Intelligent Vehicle/Highway Systems (IVHS)
Special Needs Transportation
Smart Signs
Tilt-Rotor Air Transport
Aviation Infrastructure - Airport Design/Siting
Telecommuting
Alternative Fuel Strategies
Robotics Technologies
Commuter Information Network
Intermodal Research Strategies
Cross-State Transportation Network Strategies

Task 4. ***Develop periodic white papers of the highest priority transportation options on the priority list, under the direction of the Goals Subcommittee.*** Each white paper will expand upon the Level 1 background research and contain the following information.

Description	The description and background of the proposed technology, policy, or strategy.
Status	The status of selected research that is presently taking place in the field, and/or other relevant activities in the transportation field, with specific emphasis on Washington State examples.
Potential Benefits	• Potential benefits to the state's transportation system.
Potential Drawbacks	• Possible drawbacks or challenges to implementation.
Innovation Risk	An initial evaluation (e.g. Low, Medium, High) of the development risk in terms of technology, organizational, or attitudinal changes required.
Sample Study Topics	• Examples of research study topics.
Innov. Unit Focus	Initial study focus of the Innovations Unit

Task 5. ***Disseminate white paper results and determine which topics merit in-depth research.*** The Goals Subcommittee will direct the Innovations Unit to prepare research plans of topics that are of particular interest.

Level 3 Research

Support formal in-depth research and development efforts by the WSDOT Research Office, the Transportation Commission, and other contract research services.

Task 6. ***Perform or supervise in-depth (Level 3) research of the highest priority topics based upon Level 2 white paper results.*** The Innovations Unit will coordinate all Level 3 research activities under the direction of the Goals Subcommittee, including both Innovations Unit in-house research and contract research conducted by associated WSDOT, university, and private sector researchers. The use of contract services will be determined by the nature of the subject matter and the availability of outside researchers with the ability to perform the research cost-effectively. In all other cases, the Innovations Unit staff will perform the research directly. In cooperation with researchers, the Innovations Unit will develop research and development plans that describe the sequencing and timing of strategic goals and implementation phases, and define benchmarks of progress. Communications with the contract researchers regarding their ongoing research efforts will be maintained. The nature of in-depth studies will be topic-dependent; in general, a full-spectrum study approach will be used. A full-spectrum study will involve any or all of the following:

- technology evaluation and feasibility,
- economic benefits and costs,
- safety improvements or impediments,
- applicability to this state's needs,
- definition of prerequisites (e.g. technology, policy, legislative),
- policy implications (e.g. required WSDOT organizational skill mix), and
- recommendations regarding the next step in research and implementation.

In addition, an advocacy and implementation study will be performed when topics have a strategy and/or policy emphasis. An advocacy and implementation study will emphasize the following:

- recommended enabling strategies and legislation that support the proposed approach, and
- recommended advocacy strategies by the Commission to ensure successful implementation of the proposed approach.

Task 7. ***Summarize research results.*** The Innovations Unit will be responsible for the preparation of synthesis reports that summarize results of Level 3 research efforts and recommend policy and/or research directions to the Commission.

Report Preparation

Task 8. ***Document all Innovations Unit activities.*** In addition to preparing background research reports (Task 4) and synthesis reports (Task 7), the Innovations Unit will prepare a draft summary biennium report to be disseminated to the Commission and the WSDOT Research Office for comment. A final report will then be prepared to summarize all activities and accomplishments of the Innovations Unit during the FY92-93 biennium.

8. RESEARCH DOMAIN

The eight tasks of the Innovations Unit are associated with, and complement, other state research and planning activities of the WSDOT Research Office and the STPP Steering Committee. The Innovations Unit operates under a charter with the following elements.

1. Operate within an unfiltered scope of study. Maintain an impartial view of potential transportation solutions.
2. Emphasize long-term vision and ongoing monitoring. Provide broad-band information collection capabilities to the Commission.
3. Emphasize policy implications of research topics. Focus on research results that support policy-level decision-making.

While the interests of each group are similar, the Innovations Unit, WSDOT Research Office, and STPP Steering Committee do have distinct (though overlapping) research domains. The primary areas of interest are shown in Table 1.

Table 1. RESEARCH DOMAINS

Research Focus	Innovations Unit	Research Office	Steering Committee
Background study and monitor	●		
Policy Implications study	●	○	●
Technology Implications study	●	○	●
Research and Demonstration	○	●	
Full-scale Implementation		●	
Evaluation	○	●	

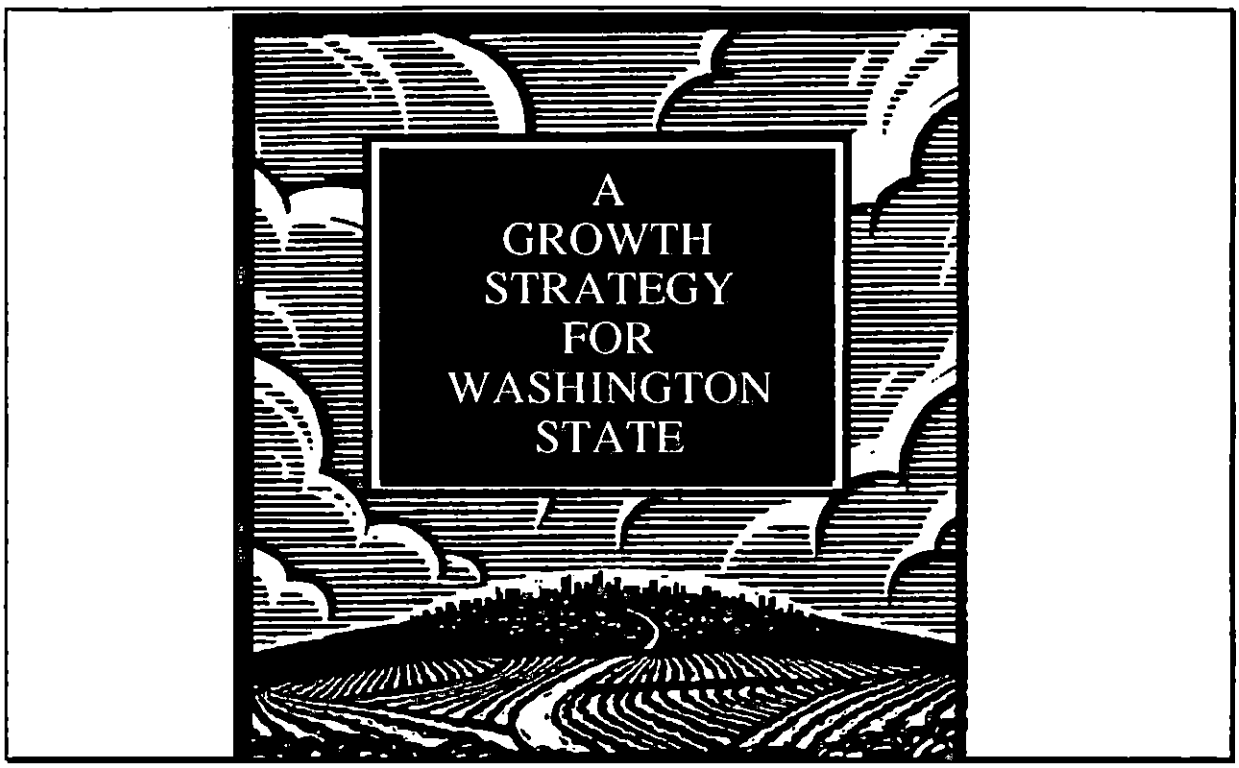
(● = concentrated emphasis)

In summary, the charter of the Innovations Unit emphasizes early, preparatory studies of emerging potential transportation solutions. Its activities are intended to complement and support subsequent in-depth applied research and implementation by the WSDOT through its Research Office, and reinforce ongoing STPP policy development.

9. HIGH-PRIORITY STUDY TOPIC DESCRIPTIONS

The following are summary descriptions of topics on the initial high-priority research list (see Task 3). The descriptions follow the Level 1 and 2 research format described in Task 4. These outlines are intended to provide an indication of the nature and potential of each topic, and are based upon a top-level sampling of the available literature.

Land Use/Transportation Linkage



Description

Develop an integrated procedure to link transportation decisions with land use decisions. Use the development or improvement of the transportation network as leverage to support desired growth management goals. Use both passive and active (dis)incentives. "Government takes the lead" as an active initiator and advocate of policy directions that synchronize the state's transportation system with its approach to land use and growth management; transportation becomes a partner and catalyst to encourage desired patterns of growth rather than an after-the-fact reaction to isolated or uncoordinated development patterns.

State government could strengthen this linkage and reinforce transportation's role in a land use partnership by actively promoting discussion of rural, intrastate, and freight needs as well as urban commuter desires, encouraging state-wide and community debate of "new urban development visions" and innovative solutions with

spokespersons of new growth approaches, and challenging traditional and incompatible tenets of the "American dream". Particular emphasis would be on the role of the transportation component. The state could promote and assist in the development of community consensus on desired land use guidelines and growth patterns, then actively support those desires with compatible state transportation planning and development.

Status

Linkage between transportation and land use may be used in a number of ways to enhance urban mobility. Transportation funding and project priorities could be linked to enlightened land use policies that support transportation goals and a regional outlook. Examples of such policies include the following:

Encouraging higher employment densities - Researchers have identified density as the most influential development factor in determining whether high-occupancy vehicles are used in commuting. Appropriate transportation development incentives could be used to encourage higher employment densities; these higher densities could in turn be supported by other transportation incentives to encourage greater use of high-occupancy vehicles in the commute. As an example, Bellevue's higher-than-average employment density is combined with a SOV disincentive (a cap on parking spaces) and an HOV incentive in the form of a regional transit center, to encourage city workers to use HOV (buses, carpools, vanpools).

Encouraging mixed-use developments - High capacity transportation funding could be linked to the use of zoning tools that encourage mixed use of office and non-office commercial and service activities, thereby reducing the number of extra trips needed to perform errands during the day and reducing the need of a vehicle to perform those trips.

Encouraging a balance of jobs and housing - High capacity transportation funding could be linked to the use of zoning tools to encourage closer proximity and clustering of jobs and housing, with resulting increases in HOV use and reductions of trips.

In other urban experiences worldwide there are indications of the potential of transportation leveraging, such as a rapid acceleration of economic and residential development in areas with increased mass transit service (e.g. Japan).

Recent discussions of Washington State's future have been given prominent attention. A week-long series on the Puget Sound region's future growth directions (the Peirce report) was presented in the Seattle Times and promoted on television; the Vision 2020 effort by the PSCOG sought to develop community consensus on desired patterns of growth. Other approaches to growth have been proposed by urban planners and architects (e.g. UW Architecture chairman Doug Kelbaugh proposes "pedestrian pockets" of small high-density villages, 1/2 mile in diameter, containing a combination of office/retail/residential/open space, with all pockets connected by high-capacity ground transit).

Other state government activity and public initiative efforts on the growth management issue indicate the interest and importance of the topic among state citizens. Regional agency planning concepts in Puget Sound are being reconsidered in a post-PSCOG, post-Metro Council era. Initiative 547 was brought before the voters in response to perceived inadequacies in the state approach toward growth management (but was voted down by the voters in the November 1990 election). The final report of the Growth Strategies Commission advocates an approach that uses state leadership and leveraging of transportation network funding and development to provide incentives toward progressive, coordinated, regional growth management. The Commission report outlines recommendations regarding the following:

- Coordinated growth planning
- Protection of the environment
- Protection of greenbelts/greenways and prevention of sprawl
- Protection of agricultural and forest lands
- Preserving significant lands and resources
- Sharing economic growth
- Developing urban growth areas and providing services
- Providing affordable housing
- Linking Land Use and Infrastructure (e.g. transportation)
- Resolving NIMBY issues
- Compliance

Proposals to develop accompanying legislation and administrative actions are now being considered. Policy consideration of land use issues is now a defined goal of the STPP.

Potential Benefits

- Promotes a holistic view of transportation as a key element of the state's economy, environment, and overall well-being
- Growth management and transportation network management are coordinated; superior comprehensive solutions to future transportation needs are developed
- Citizen participation in transportation issues is increased as discussions of growth issues are encouraged
- State growth goals are explicitly and comprehensively addressed
- Efficiency of state spending is increased

Potential Drawbacks

- Ongoing advocacy and coordination of the discussion process is needed
- "Point person" is needed to push the issues forward
- Sensitivity to city/county "autonomy" inhibits cooperation
- Individual rights issues, particularly land use, may inhibit cooperation
- Inter-agency and inter-governmental cooperation may be difficult
- Delays may increase as a result of additional coordination efforts

• Economic development could be affected

Innovation Risk

Medium: Attitudinal adjustments by individuals, governments, and agencies to an innovative and complex cooperative approach may be significant. Some risk-taking will be required on the part of organizations and/or individuals at all government and citizen involvement levels (e.g. Transportation Commission, follow-on to the Growth Strategies Commission, Governor, city/regional government officials, citizen organizations, etc.) to push this process forward and convert the discussion into actions.

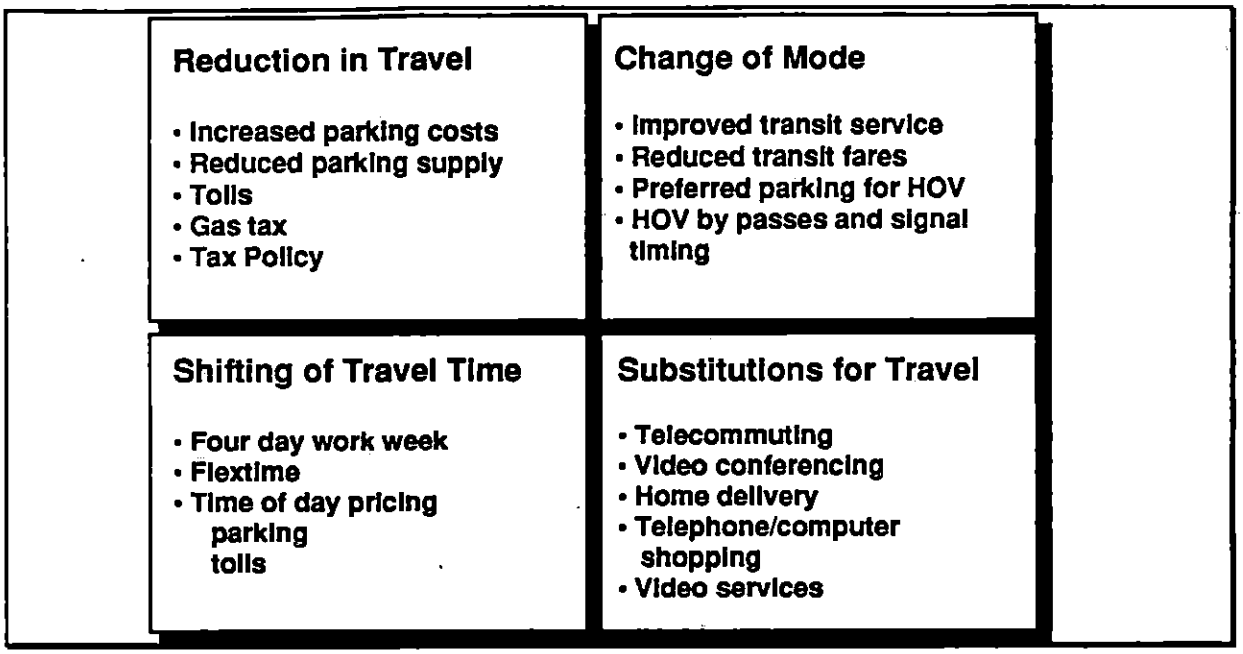
Sample Study Topics

- Design of overall growth management consensus and coordination effort
- Incentive strategies
- Zoning approaches
- Taxation approaches (disincentives)
- Subsidization strategies
- Costs and Economic Benefits
- Public/private partnership potential

Innov. Unit Focus

The Innovations Unit is planning to take an active role with preparatory research in this field during FY91. Activities will be coordinated with complementary studies by the WSDOT Planning Office as well as preparations by the Growth Management Division of the state Department of Community Development in support of the Growth Management Act. Future research by the Innovations Unit on this topic will emphasize enabling strategies to support transportation elements of growth management implementation legislation enacted during this session. The study would include a detailed literature review and policy status report. Potential issues to be studied include the use of incentive strategies, zoning approaches, taxation and other disincentives, subsidization policies, and associated economic costs and benefits. Particular attention would be paid to nationwide examples of successful linkage strategies, as well as joint public/private partnership potential.

Demand Management Incentives



Description

Amenities and incentives/disincentives designed to increase High-Occupancy Vehicle (HOV) ridership and mass transit use or reduce demand. HOV Demand Management programs are categorized as follows:

Reduction in Travel: Provide disincentives to travel by increasing its direct cost (e.g. tolls, parking fees, taxes) or decreasing associated supply (e.g. available parking spaces).

Change of Mode: Encourage a shift from single-occupancy vehicles to HOV (e.g. transit, pooling) by providing incentives in the form of increased service (e.g. better route coverage, express service) or reduced pricing (e.g. transit pass subsidies).

Shifting of Travel Time: Redistribute travel patterns to reduce congestion associated with peak commuting periods (e.g. reduced workweeks, using flextime, financial disincentives).

Substitutions for Travel: Provide alternative ways of performing activities that normally require transportation (e.g. shopping by phone or computer, telecommuting, video conferencing).

Status

Demand Management is one of the major areas of study and implementation in the WSDOT FAME (Freeway and Arterial Management Effort) program, and throughout the country. TDM is also a defined goal of the STPP. Nationally, expansion of incentives to develop HOV systems is being promoted by the HOV Coalition, a recently formed private group that has received support from the FHWA administrator, the Highway Users Federation, and UMTA.

Washington State is proposing a transportation demand management program as part of the 1991 Clean Air legislation (HB 1028) aimed at reducing automobile congestion and the pollution and accidents connected with it. In this program, major public and private employers (50+ employees) must implement programs to reduce SOV commuting by its employees, and cities are required to develop commute trip reduction plans and ordinances. Major employers with over 100 employees would be required to develop programs with the goal of reducing the number of single-occupant commuter vehicles by 15 percent by 1994, 25 percent by 1996, and 35 percent by 1998, while employers with over 50 employees have an additional two years to attempt to meet each goal (all percentages are relative to the company's area average). King County has already begun discussions of a trip reduction ordinance (TRO) to implement similar demand management concepts.

An innovative incentive program is about to be initiated on the University of Washington campus. The U-PASS program combines very low cost ($4-$8/month) unlimited-use bus passes to students, faculty, and staff, increased bus service to the campus, and flexible adjunct services including a guaranteed ride home

subsidy and low-cost occasional commuting privileges, with a 60% increase in on-campus permit parking fares, to encourage transit commuting.

Potential Benefits

- Increased use of HOV transportation modes
- Reduced congestion
- Reduced emissions
- Reduced fuel consumption
- Reduced number of incidents

Potential Drawbacks

- Potential startup/operating costs associated with amenities
- Costs associated with significant level of success (e.g. park and ride service expansion)
- Additional strain on existing mass transit system and service levels

Innovation Risk

Low. Techniques and technologies are well understood and previously implemented. Impacts of or on human behavior may require additional study.

Sample Study Topics

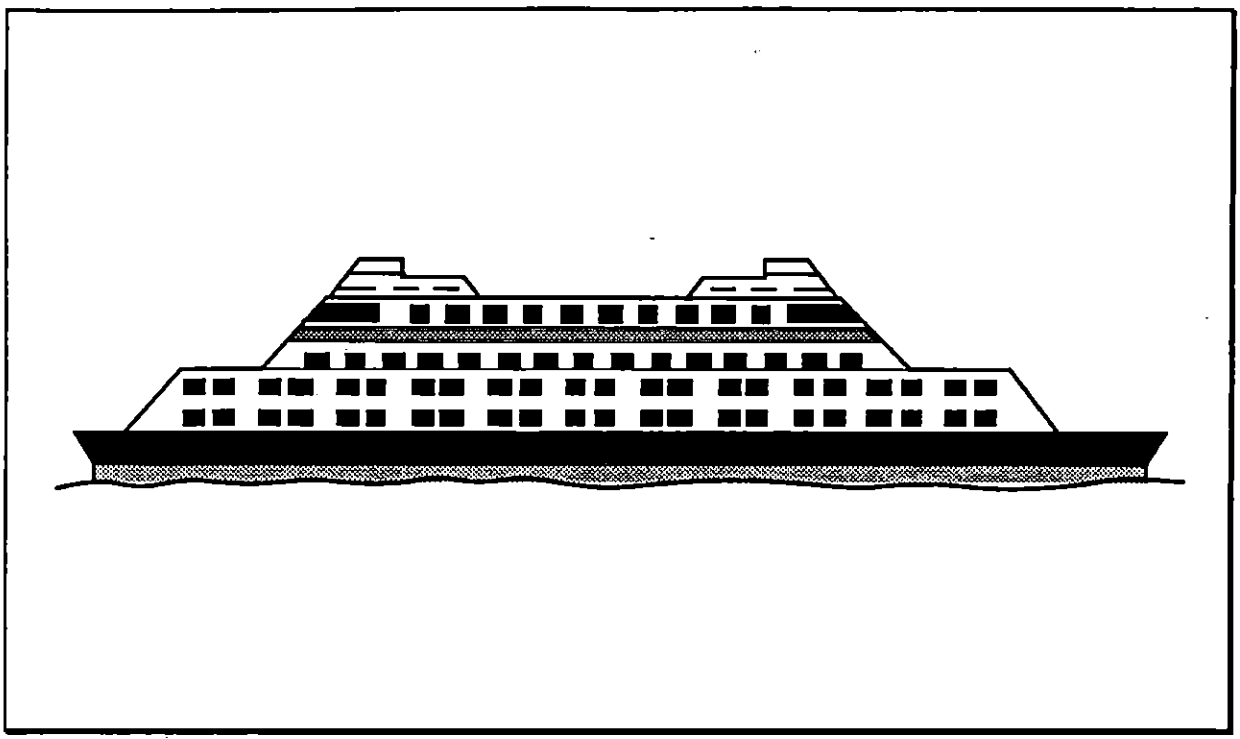
- Economic benefit
- Service impact on existing network of mass transit
- Issues associated with increased mass transit use (e.g. safety and security of passengers)

Innov. Unit Focus

Research by the Innovations Unit on this topic will involve monitoring of existing TDM programs statewide, as well as research into implementation and policy issues associated with pending legislation, particularly the proposed Clean Air Act and the Growth Management Act, each of which includes a TDM component that will affect both employers and individual commuters. The Innovations Unit will work with major players in TDM implementation, including Metro Transit, WSDOT, and major employers. The initial studies would produce a detailed literature review and strategy status report that describes major approaches and identifies advantages and disadvantages. Potential topics

include economics (capital and operating costs, funding mechanisms), private sector involvement (employer programs, incentives, disincentives, expenses), and TDM evaluation techniques.

Marine System Strategies



Description

Develop policies and implement strategies that enhance the role of the Washington State Ferry system in achieving state-wide transportation goals. Implement Transportation Demand Management approaches associated with marine travel in Puget Sound; provide both incentives and disincentives to encourage high-occupancy vehicle and foot passenger use of the ferries and efficient use of resources. Develop supporting technologies that enhance the ferry commute, such as real-time traveler information and automated fare collection. Determine state policy implications of, and coordinate with, the long-term planning activities of the WSDOT Marine Division. Fully integrate the planning and operation of the Marine Division into state growth management goals and strategies.

Status

Potential policies, strategies, and research issues include the following:

On-Board Service Amenities and Adjunct Services:

Encourage ferry use by providing enhanced ferry service to passengers with a full range of amenities, such as high-quality food and beverage service, televisions, stereo music, and premium seating in a modern vessel. Provide express service using fast vessels (e.g. hydrofoils) that provide high-speed passenger commutes or delivery services at a premium. Provide additional amenities and information services at the dock as well.

The WSF has provided some of these amenities on selected ferry routes. For example, the Vashon passenger-only ferry provides express service to downtown Seattle. Some food and information services are also provided at selected loading docks including the Colman and Anacortes locations. A new privately operated ferry system with a premium fare has been started to serve the Port Townsend-Kingston-Seattle commute as well as tourist runs during reverse commutes.

In the New York/New Jersey area, several passenger-only commuter ferry services offer amenities in the ferry terminal waiting area such as restaurant facilities, dry cleaning and florist shops, video rental services, box lunch sales, and a cocktail lounge. In addition, "nightlife" non-commute packages are available to provide theatre goers with "door-to-door" ferry and express bus service from the ferry terminal in NJ to New York events and back again.

HOV incentives:

In addition to in-vessel amenities, ferry service may be enhanced by mass transit circulator service to major employment centers. Such service would emphasize smooth intermodal transitions to and from transit service on both ends of the ferry trip, as well as integrated and discounted fare programs, to encourage use of the ferries and other HOVs such as buses and vanpools. Circulator service may be

enhanced by preferential HOV treatment in the form of dedicated circulator service, exclusive busways, and exclusive access ramps. An extension of this approach would involve the direct boarding of buses and vans onto ferries to further enhance the ease of using HOV service and facilitate transfers.

The WSF is presently participating in the "FerryPool" program that encourages the use of vanpooling by commuters. The system involves a set of "collector" vans that pick up patrons in North Kitsap county. The vans then board the Kingston-Edmonds ferry; once onboard, commuters may transfer between vans, each of which is then directed to a different work area in Snohomish and King County. As further incentive, the vans offer padded swiveled armchairs, reading lamps, and air conditioning. Vans are given guaranteed priority boarding status, and riders pay the discounted walk-on fare.

In the previously-mentioned New York/New Jersey ferry systems, a private ferry operator also provides NY bus service that enables commuters to transition from the ferry to a bus which takes them to their destinations. This combined service is encouraged via the use of an integrated fare program. On the NJ side, the ferry dock and adjacent rail station offer an integrated ferry/rail fare program.

Fare Policies:

Fare policies have been used in other transport modes to encourage efficient use of vehicles and infrastructure. Examples of possible ferry programs include fare discounts to enhance the attractiveness of off-peak and reverse commute usage, thereby increasing the efficient use of the ferry system throughout the day. Discounts could encourage ferry and HOV use, as in the WSF FerryPool system. In combination with service incentives and intermodal transfer programs, fare structures could be tuned to encourage desirable commuting patterns.

Long-Term Policy Planning:

The above-mentioned programs should be developed in coordination with long-term planning activities such as the Western Washington Inland Waters Transportation Study/WSDOT Marine Division Long-Range Plan which is presently being conducted by the LTC and the WSDOT. In addition, state policies that direct the development of future ferry system enhancements should be an integral part of the state's overall transportation policy planning activities, particularly as they pertain to land use and growth management decision-making.

Potential Benefits

- Attractive service compared to conventional SOV commuting
- Increased use of mass transit
- Efficient use of state transportation resources
- Improved service
- Reduced congestion and pollution
- Private adjunct services in the waiting area would reduce the amount of non-work travel to conduct errands
- Possible revenue generation from adjunct service contracts

Potential Drawbacks

- Initial capital costs (amenities and landside HOV support)
- Possible high operating costs
- Uncertain price and service elasticity depending upon the fare premium and degree of amenities

Innovation Risk

Low. All amenities noted are readily available, and have been offered in other transit systems (e.g. cruise ship service, commercial air service, other passenger ferry systems worldwide). Primary obstacles include institutional and economics-oriented issues.

Sample Study Topics

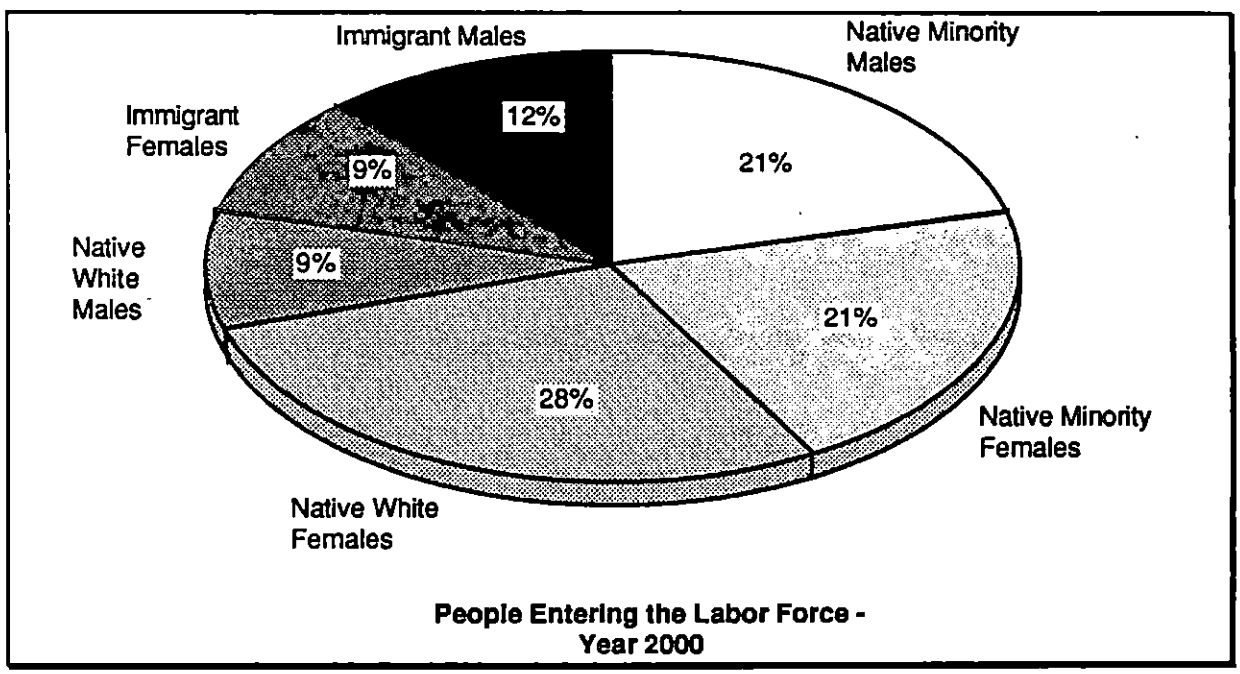
- Costs and economic benefits
- Desired level of fare and amenities by the public
- Public/private partnership potential

Innov. Unit Focus

Research by the Innovations Unit on this topic will be coordinated with the upcoming activities of the Western Washington Inland Waters Transportation Study (WWIWTS) and the development of the WSDOT Marine Division Long-Range Plan, to begin this year, as well as the results of the PSCOG's West Corridor Study and associated marine system studies. It is anticipated that Innovations Unit research in this field will be of a supporting nature, with particular emphasis on service issues, TDM strategies, and supporting technologies.

WSDOT Organization

Human Resource Development



People Entering the Labor Force - Year 2000

WSDOT Organization

Description

Examine the state's transportation organizational structure and its interrelationship with associated state issues. Develop or adapt new WSDOT organizational goals and structures to directly address growth management issues, emerging technologies, and customer-oriented service goals, as well as desired future interrelationships and cooperative efforts by the WSDOT with other state and regional agencies, the private sector, and regional/city/county governments. Emphasize consistency of planning at different government levels, highly responsive inter-agency interaction, and ongoing communication with the public.

Status

Land use and growth management discussions at the state level (e.g. the state Growth Management Act, the Growth Strategies Commission), interest in regional transportation/land use interactions (e.g. PSCOG Vision 2020, Metro Transportation 2000 Proposals), and public comments indicate growing interest in the interdependencies of the transportation system with many other state and regional concerns. The 1991 STPP reflects this interest with recommendations to coordinate transportation programming in urban regions and among all levels of government statewide, and to implement consistent procedures and data requirements. The final report of the Growth Strategies Commission also emphasizes the linkage between transportation and other growth management issues. An important issue associated with these discussions is the degree to which the present WSDOT organizational structure is prepared to accommodate these diverse relationships in the future.

Recent public discussions of the WSDOT's administrative and financial oversight processes have also focused upon issues such as budget accountability, lines of communication with other components of state government as well as the public, efficiency of operations, and cultivation of a high-quality engineering staff.

Potential Benefits

- State transportation planning and development will be more efficient and responsive to public needs
- Inter-agency coordination will be more efficient, and resulting plans more consistent

Potential Drawbacks

- Possible re-organization costs
- Difficulties of establishing new lines of communication
- Difficulties of overcoming established ways of thinking

Innovation Risk

Medium to High. Government inertia may be significant.

Sample Study Topics

- Definition of new organizational structure and desired lines of communication
- Role of private sector and citizens in a new organizational structure
- Public/private and national/interstate partnership potential

Human Resource Development

Description

Anticipate future staffing needs in light of anticipated projects, future technologies and innovative strategies, and the size and nature of the projected employee supply. Develop specific programs to promote development and retention of transportation professionals based upon the skills and activities that are forecast in the WSDOT of the future. Use indirect approaches that encourage general interest in the transportation profession (e.g. touring informational displays), active support of Civil Engineering and Transportation Systems degree programs at the undergraduate and graduate levels via scholarships and internships, and attractive compensation packages that, in addition to improving the salary structure, also enhance training and other educational benefits. Provide comprehensive low-cost or no-cost continuing education both on hours and after hours, extensive cross-training opportunities, and participation in professional seminar functions; enhance the image and desirability of the transportation profession via teaching fellowships to promote transfer of knowledge. Establish state "research fellow" positions

with broad flexibility and independence to pursue innovative programs and long-term objectives. Actively support minority education and hiring programs at all levels, and develop an organization that recognizes, and operates productively with, a diverse work force.

Status

Studies indicate a developing gap between professional needs and the number of graduates available to fill them, resulting from significant numbers of retirements among experienced transportation professionals as well as a reduced entry level supply. A recent survey of trends in the U.S. workforce notes that the number of new workers being added to the labor supply is declining; by the year 2000, approximately 1.6 million entry level workers will be added to the workplace per year, down from nearly 3 million workers per year in the 1970's. The composition of that entry level workforce is also changing significantly from the existing workforce. By the year 2000, the entry level labor force will be predominantly minorities and women; only 9% of entry level candidates will represent the traditional employment pool of white males, while nearly 58% will be women and 63% will be native or immigrant minorities. Competition to maintain a high-quality workforce may also be increasingly difficult, as evidenced by a 1989 State Efficiency Commission study which noted that state transportation engineering salaries are not keeping pace with market rates. In addition, greater linkage between transportation issues and other disciplines such as urban planning and environmental engineering, coupled with the increasing use of advanced technologies, warrant re-definition of the skill mix that will be needed by the Department of Transportation in the 21st century.

Potential Benefits

- Innovation, competence, and productivity will be enhanced by superior worker skills
- The transportation needs of the public are ultimately better served by trained and motivated state employees
- The transportation profession is strengthened

- Active support of women and minority training and hiring is consistent with the composition of the labor force
- A diverse workplace will be more productive within a system that recognizes and is sensitive to that diversity, and which develops approaches to management and training that are appropriate to a diverse employee group
- Strong training programs encourage employees to develop new skills, and indicate responsiveness to the employees' professional well-being
- Future managerial needs are anticipated by developing appropriate hiring and training strategies

Potential Drawbacks

- Initial investment
- Possible change of attitudes and managerial styles

Innovation Risk

Low. Investment in education is generally cost-effective.

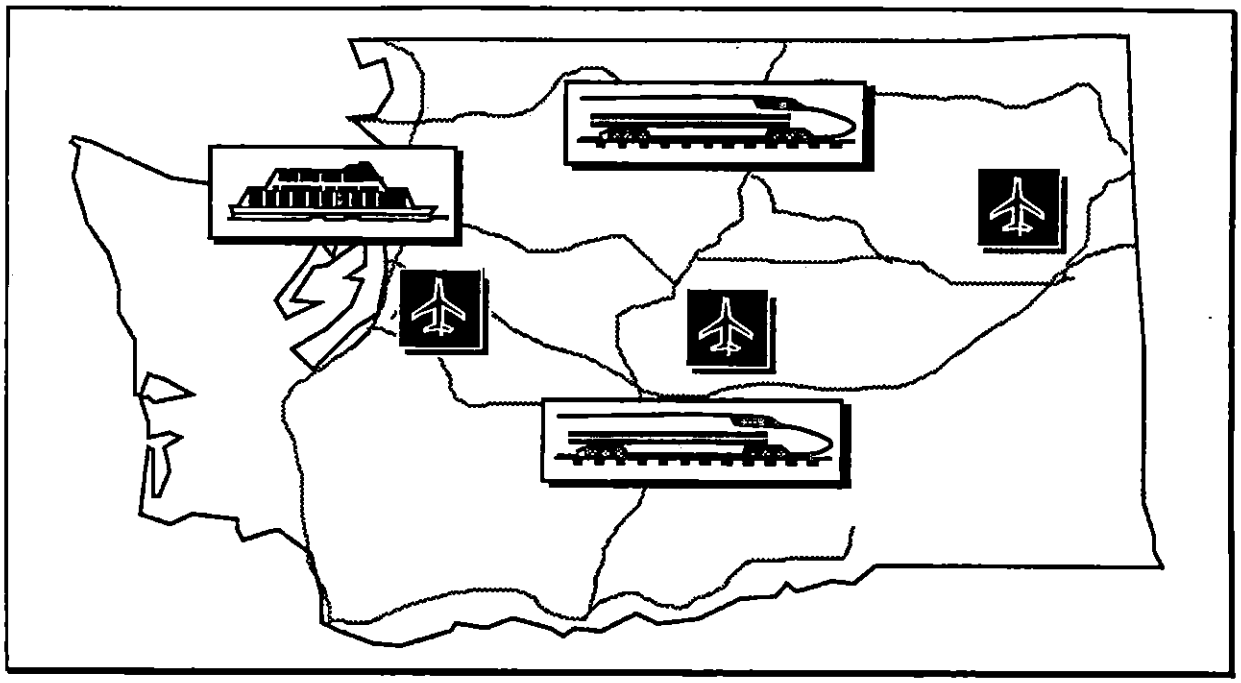
Sample Study Topics

- Design of educational programs and cross-training
- Study of management in a diverse workplace

Innov. Unit Focus

Research by the Innovations Unit on this topic will emphasize organizational strategies to best accommodate expected skill needs by the WSDOT in the 21st century, with special emphasis on needed expertise in non-traditional areas. The Innovations Unit will be working with the WSDOT and appropriate Human Resource departments in this regard, as well as monitoring approaches in other state DOTs and in other fields. The research emphasis will be on a comprehensive descriptive analysis of the WSDOT organizational structure, as well as an analysis of areas of improvement.

Corridor Preservation Strategies



Description

Develop policies and advocate approaches to protect and enhance urban and rural corridors throughout the state. Preserve rail and utility right-of-ways for future use. Preserve corridors/sites to accommodate future marine ports, ferry terminals, and airports. Develop or enhance a systematic methodology that incorporates planning procedures, environmental impact studies, funding, intergovernmental coordination, and public information.

Status

A primary focus of corridor preservation in Washington State involves potential future commuter and high-speed rail usage. Rail preservation is a defined goal of the STPP. In the past two decades, nearly 35% of the state's rail network has been abandoned, despite constant freight traffic levels. Washington state has developed an ongoing program to identify key rail segments. Recent state actions have addressed the rail abandonment issue, including cataloging of rail links in the state and establishment of the Essential Rail Banking Account (ERBA) to fund purchases of rail rights-of-way and

preserve existing links. Other states are also using rail banking to reserve inactive lines for future rail freight use or urban transit use. The U.S. Local Rail Service Assistance Program provides limited funds to plan preservation efforts.

In addition to corridors associated with ground transportation and utility right-of-ways, preservation activities also take into consideration other transportation modes. In Washington State, two such areas of particular importance and interest are 1) preservation of strategic marine transportation corridors and sites, including future port and ferry terminal locations, and 2) protection of strategic air transportation sites to accommodate future airport or heliport needs.

Another aspect of preservation involves appropriate design and engineering of corridor development to support flexible future usage. The multimodal potential built into the I-90 corridor design to support bicyclists, pedestrians, SOVs, HOVs, and rail transit is one such example.

A number of state research studies involving corridor preservation and utilization are in progress. Examples include the Stampede Pass corridor studies (Air Transportation Commission), remote airport studies (Puget Sound Air Transportation Committee), rail abandonments (Ag 2000 Transportation Subcommittee), long-term rail planning (Three-Year Freight Rail Study), high speed ground transportation (HSGT Study), King County commuter rail (Metro Commuter Rail project), high-capacity mass transit (joint Metro and WSDOT study in the Puget Sound area), and Portland/Vancouver mobility (Portland/Vancouver HCT Study).

Potential Benefits

- Increased mobility options
- Protection of rural economies
- Development of corridor protection policies that encourage long-term planning

Potential Drawbacks

- Initial investment costs
- Need to develop long-term preparatory programs that anticipate corridor availability and desirability
- NEPA requirements which prevent advance acquisition of corridors prior to environmental impact processes

Innovation Risk

Low to Medium. Potential uses of corridors may be limited by technology, politics, or the environment. For example, the proposed use by Metro Transit of a Burlington Northern (BN) right-of-way north of Bellevue for high-capacity transit resulted in neighborhood concerns regarding noise and safety, and the subsequent modification of the plan to remove the BN track from consideration.

Sample Study Topics

- Comprehensive survey and prioritization of intermodal corridors
- Intermodal passenger and freight network studies and design
- Private partnership potential

Innov. Unit Focus

Research by the Innovations Unit on this topic will emphasize the development of a corridor preservation methodology that will encourage the systematic, comprehensive, and efficient processing of preservation opportunities statewide. Included will be recommendations on legislative and policy changes to facilitate preservation actions. Such preservation research activities would coordinate with existing corridor studies.

Automated Guideway Transit (AGT)

Description

Driverless automated rail vehicle systems that operate at short intervals and minimal wait times. Also referred to as people movers. A variation known as personal rapid transit (PRT) uses small automated vehicles operating on a guideway to provide on-demand, non-stop, personal transportation.

Status

Examples are in commercial operation in Europe and North America (notably the Lille VAL system in France and the Sky Train in Vancouver B.C.). Additional AGTs are implemented in 57 other areas throughout the world serving 1.3 million people daily. The majority of that ridership is served on 14 true mass transit systems; of the remainder, 11 systems are airport people movers (e.g. the Sea-Tac Airport underground system), while 21 systems operate in recreational environments. Seattle's Metro Transit recently began a study of a people mover or PRT concept connecting Sea-Tac airport to future regional transit, nearby commercial developments, and the

city of SeaTac; Metro is also considering the people mover concept in Bellevue and the University District as part of a future regional high capacity transit system. Chicago Regional Transit Authority has begun two $1.5 million prototype design and development projects to implement 1 to 2 miles of PRT service in the Chicago area. The initiative is being developed without UMTA funds.

Potential Benefits

- Reduced fuel consumption and polluting emissions
- Improved mobility, safety, and reliability
- Short-interval service competes with private auto advantages
- Personal, private transportation (PRT)
- Provides individual on-demand mobility (PRT)
- Potentially smaller visual scale than conventional rail systems

Potential Drawbacks

- Possible high capital costs
- Possible high operating costs
- Dependence upon high ridership/population density
- Untested technology (PRT)
- Infrastructure costs

Innovation Risk

Low to Medium. Commercial and circulator (e.g. airport) operations have been successful and are expanding. A definition of the conditions favorable to successful operation of such a system is needed. PRT system technology has not yet been tested in commercial service; research may remain on safety mechanisms, control systems, performance improvements, and total system testing.

Sample Study Topics

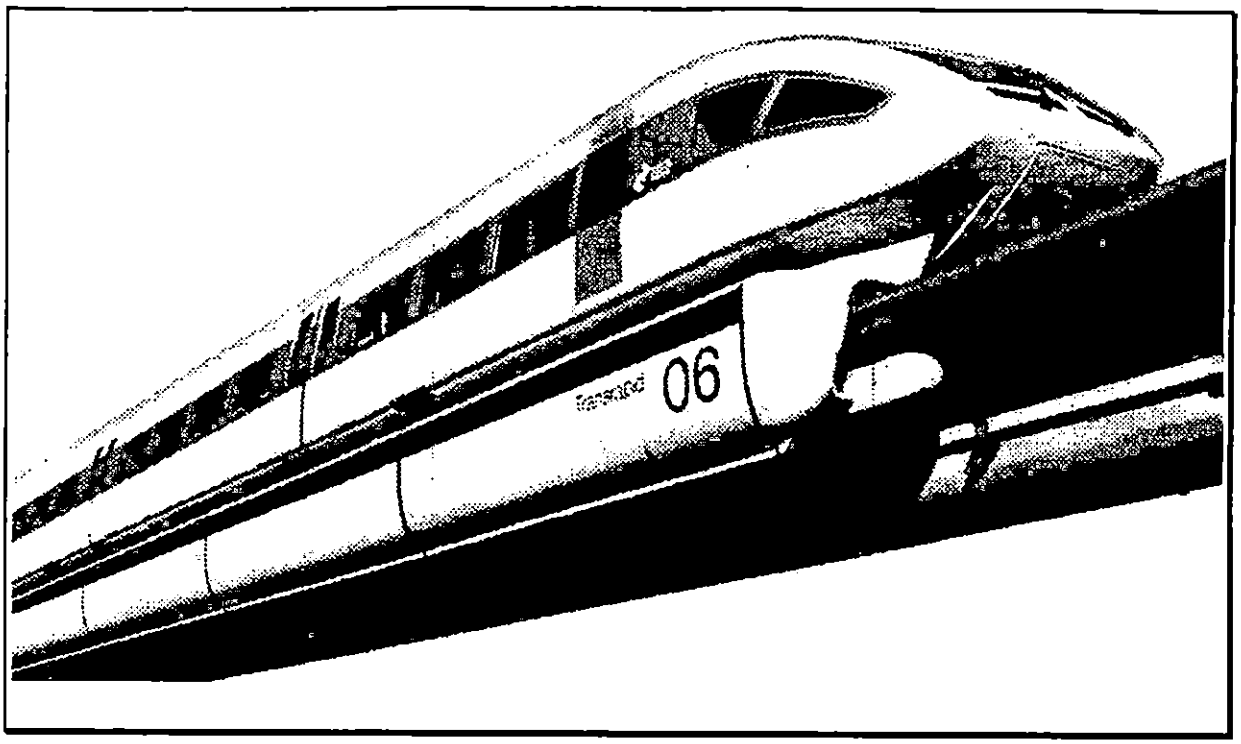
- Costs and economic benefits
- Technology status
- Public/private and national/interstate partnership potential

Innov. Unit Focus

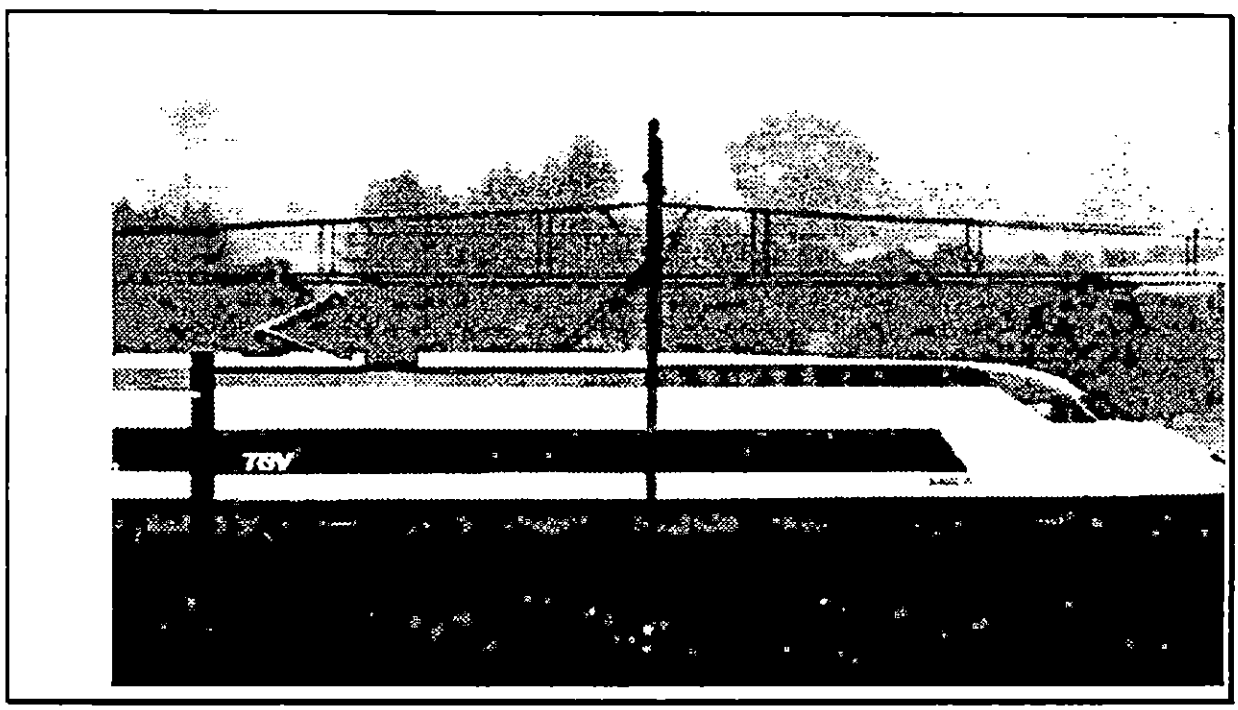
Background research by the Innovations Unit on this topic will be coordinated with ongoing activities by Metro and others into the potential of people movers in Bellevue, the University District, and

SeaTac to support a future regional high capacity transit system. While it is anticipated that the role of Innovations Unit research in this field will be a supporting one including technology monitoring and background research, there is a potential for detailed formal research in the future if people mover options and personal rapid transit system implementation are seriously considered. Initial research could include a detailed literature review and technology status of infrastructure and train set designs, operational variations, environmental impacts, safety, and economic considerations. Because of the large number of APMs in commercial operation (59 systems identified worldwide in a recent survey), and the potential of near-term implementation by Metro, the report would emphasize advanced prototype and operating programs, as well as the status of ongoing technology research and major technology or implementation risk areas.

Magnetic Levitation (MagLev) Rail



High-Speed Steel Rail



Magnetic Levitation (MagLev) Rail

Description

High-Speed passenger/freight tracked vehicle that is levitated and propelled along a guideway using attractive or repulsive magnetic fields.

Status

Magnetic levitation and propulsion technologies have been in development over a 25-year period, beginning with early U.S. research that was stopped in the mid-1970's. Since then, West German (magnetic attraction) and Japanese (magnetic repulsion) research have led to two different working technologies that are presently being tested in prototypes. German industry is conducting advanced testing of its TransRapid prototypes and is promoting development of commercial systems in both Germany and the United States. A Japanese consortium is beginning construction of a $2.3 billion, 26.6 mile long commercial test line supporting MagLev trains operating at up to 342 mph, to be completed by March 1995. In the U.S., the National MagLev Initiative, a two-year public-private study of the technological and economic aspects of MagLev, was begun this year with joint cooperation of the U.S. Departments of Transportation and Energy, the Army Corps of Engineers, and the Federal Railroad Administration. Study goals include the development of recommendations for future U.S. maglev technology research; a Request For Proposals was recently distributed to develop a "System Concept Definition". Meanwhile, U.S. implementation of existing MagLev technologies is in the study/proposal stage, with studies underway in several states/regions, and TransRapid developments tentatively planned in Florida and Nevada. Washington State was the only state to receive 1990-91 federal funding ($500,000) to support high-speed rail studies.

Potential Benefits

- High speed (300+ mph) supplement to auto and aircraft
- Reduced fuel consumption, noise, and polluting emissions vs.

other modes (including conventional steel-rail trains)
- Improved mobility, safety, and reliability vs. other modes (including conventional steel-wheel-on-steel-rail trains)
- Lower maintenance costs (reduced wear on guideway infrastructure)
- Development of second-generation technology based in the U.S. could support a potential new domestic industry and export market

Potential Drawbacks

- Possible high capital and operating costs
- Potential operations limitations (e.g. terrain)
- Magnetic field safety issues
- High-speed operation safety issues
- Dependence upon high ridership/population density
- Dedicated infrastructure

Innovation Risk

Medium to High. Although prototype demonstration systems and low speed commercial systems are in operation, further development of safe and cost-effective new technologies may be needed prior to full-scale use, particularly depending upon the type of MagLev technology used (e.g. attraction vs. repulsion, type of linear propulsion system).

Sample Study Topics

- Costs and economic benefits
- Safety issues
- Public/private and national/interstate partnership potential

Innov. Unit Focus

Research by the Innovations Unit will be coordinated with, and support, any upcoming activities of the proposed Washington State High Speed Ground Transportation Steering Committee and associated WSDOT HSGT studies. It is anticipated that the role of the Innovations Unit in this research will be a supporting one that will include monitoring of worldwide activities and development efforts, with special emphasis on MagLev technology development, safety, and implementation issues.

High-Speed Steel Rail

Description

High-Speed tracked passenger/freight vehicle using conventional steel wheel and steel rail guidance in combination with advanced train design, power supply, and rail construction techniques.

Status

High-speed steel-on-steel systems (also known as High-Speed Rail or HSR) have been in commercial use in Europe and Japan since the 1960's. Examples include the French TGV (Trains a Grande Vitesse) and Japanese Shinkansen ("bullet train") systems, among others. Commercial TGV service now operates at approximately 180 mph, while Shinkansen service operates at 150 mph. The second-generation TGV was recently timed at a world speed record of 320 mph (test only), while a second-generation bullet train is about to go into operation, increasing commercial service speeds to 168 mph. The Swedish Railways system has just begun operation of a tilting train (the X 2000) that provides up to 40% faster speeds in turns without the need of specially-built track structures like those often required of other high-speed rail systems (e.g. TGV). Existing U.S. service typically does not exceed 100 mph, except in the major northeast corridor where speeds may reach 125 mph.

Potential Benefits

- High speed (150-300 mph) supplement to auto and aircraft
- Reduced fuel consumption and polluting emissions
- Improved mobility, safety, and reliability vs. other modes
- Existing technology
- Use of existing infrastructure (in some cases)

Potential Drawbacks

- Possible high capital costs
- Possible high operating costs
- High speed operation safety issues
- Dedicated infrastructure (in some cases)
- Operational limitations (e.g. terrain)
- Dependence upon high ridership/population density

Innovation Risk Low to Medium. Advanced steel-wheel technologies have been operating successfully over a 25-year period. New high-speed technologies such as those employed by TGV, ICE (German InterCity Express), and ETR (Italy) are in service or will soon be operating. Operational restrictions (e.g. track curvature, terrain) depend on the technology.

Sample Study Topics

- Costs and economic benefits
- Impact on existing transportation network
- Public/private and national/interstate partnership potential

Innov. Unit Focus As with the MagLev study, research by the Innovations Unit will be coordinated with any activities of the proposed High Speed Ground Transportation Steering Committee and associated WSDOT studies. It is anticipated that the Innovations Unit research in this field will emphasize background studies that monitor the status of major relevant technologies. Potential areas of technology monitoring include infrastructure (guideways, right-of-ways, control structures), train set design (capacity, materials), environmental impacts (noise, air pollution, visual pollution), and safety (passenger protection, collateral damage), as well as economics (capital and operating costs, funding mechanisms, fare structure).

10. STAFFING PLAN

All Innovations Unit activities will be performed by the permanent staff as well as public and private sector contract researchers and university graduate student assistants as appropriate. Research support, both individual and organizational, will include the following:

Permanent Staff

1. **G. Scott Rutherford (Director, Innovations Unit)**
   Dr. Rutherford will coordinate all activities of the Innovations Unit under the direction of the Commission. Responsibilities will include the development of long-range policy studies and work programs, development of recommendations to the Commission on long-range transportation policy implications, and inter-agency coordination of Innovations Unit activities.

2. **John M. Ishimaru (Senior Staff Member, Innovations Unit)**
   Dr. Ishimaru will develop and manage the Level 1 monitoring capability of the Innovations Unit (Tasks 1 and 2), supervise background studies and research activities associated with Level 2 and Level 3 research (Tasks 4, 6, and 7), and oversee preparation of the biennial reports (Task 8).

3. **Additional Senior Staff Member**
   An additional senior staff person will be hired to participate in the support of Level 1 monitoring capability (Tasks 1 and 2), background studies and research activities associated with Level 2 and Level 3 research (Tasks 4, 6, and 7), and preparation of the biennial reports (Task 8).

4. **Administrative Assistant**
   An administrative assistant will be hired to coordinate all administrative activities within the Innovations Unit, including information monitoring operations and database maintenance (Tasks 1 and 2), project coordination associated with Level 2 and Level 3 research (Tasks 4, 6, and 7), and information synthesis and dissemination (Task 8).

WSDOT, Contract, and Other Services

Washington State Transportation Center (TRAC)

If the Commission and the Innovations Unit determine that specific Level 2 and 3 research studies would be most effectively performed by contract researchers, TRAC will coordinate the activities of researchers from the University of Washington, Washington State University, and private sector firms, with graduate student assistance as appropriate.

Research Office, Planning, Research and Public Transportation Division (PR&PT), WSDOT

If the Commission and the Innovations Unit determine that specific Level 2 and 3 research studies would be most effectively performed by WSDOT staff researchers, the Innovations Unit will coordinate those research projects through the WSDOT Research Office, PR&PT.

Graduate Student Support

A graduate student or students will be used as needed to assist in the monitoring process (Tasks 1 and 2), as well as background research studies (Tasks 4 and 6) and reports (Tasks 7 and 8).

Ad hoc Advisory Groups

Because potential transportation solutions will have a variety of impacts on the public and on all levels of government, interdisciplinary and specialized advisory groups will be formed as needed to assist in the successful completion of research and policy analyses.

11. WORK TIME SCHEDULE

The eight tasks will be performed over the next biennium as shown in Figure 2.

12. BUDGET ESTIMATE

The budget estimate for the FY92-93 biennium is shown in Table 2.

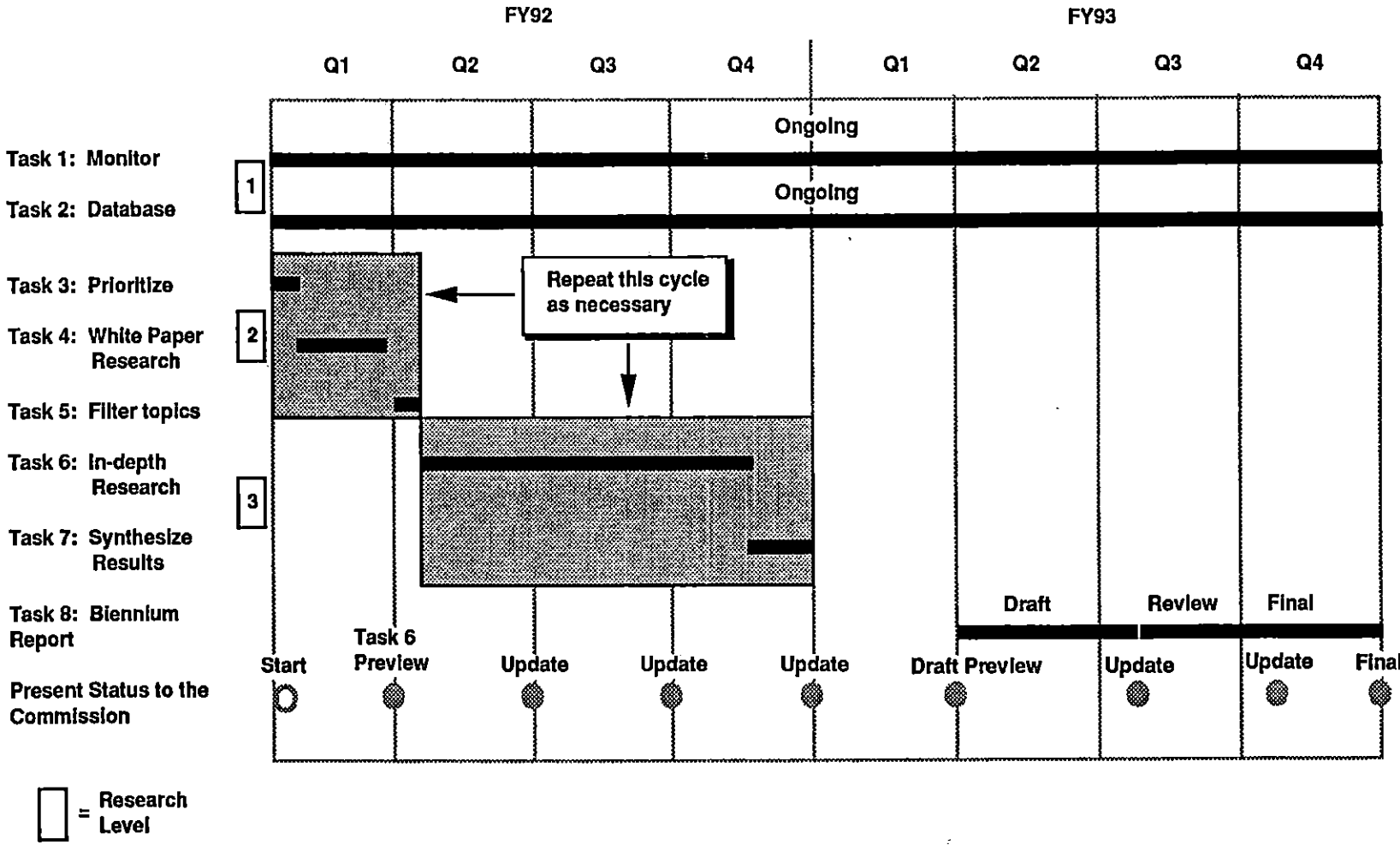


Figure 2. Innovations Unit Time Schedule: FY92-93

Table 2. Estimated Budget and Funding Sources FY92-93

Budget Item	FY 1992	FY 1993
a. TOTAL COST	$453,154	$461,470
b. Staffing	4.0 FTE's	4.0 FTE's
c. Objects of Expenditure		
A Salaries	$196,932	$196,932
B Benefits	44,222	44,538
C Contracts	165,000	170,000
E Goods/Services	36,500	38,500
G Travel	10,500	11,500
FY TOTAL	**$453,154**	**$461,470**
BIENNIAL TOTAL		**$914,624**
d. Source of Funds		
001-1 General Fund - State	$1,872	$1,907
039-1 Aeronautics Acct. - State	906	923
099-1 Puget Sound Cap Const. Acct.	29,340	29,878
108-1 Motor Vehicle Acct. - State	366,096	372,814
109-1 Puget Sound Ferry Ops. Acct.	54,940	55,948

APPENDICES

APPENDIX A. GOALS OF TECHNOLOGY OPTIONS, STRATEGIES, AND POLICIES

The following state and Commission goals provide the overall focus toward which individual transportation options are directed. This outline uses the structure described in the 1990 Transportation Policy Plan of Washington State, and is supplemented by the 1990 Long and Short Term Goals of the Washington State Transportation Commission's Committee on Transportation Planning. Additional goals suggested by research literature are also included. The source of each goal is coded by an accompanying symbol.

Coding of Goals

- • - Based on 1990 Washington State Transportation Policy Plan (STPP) Goals, pg. 7
- [#] - Based on goal # of 1990 Washington State Transportation Commission Committee on Transportation Planning: Long and Short Term Goals († is public information implementation action item)
- ° - Goals suggested by specific technology, strategy, or policy options or research literature

PROMOTE POSITIVE QUALITY OF LIFE

- Ensure the personal mobility of all citizens: provide safe, reliable, and convenient access to employment, educational, recreational, cultural, and social opportunities in both urban and rural environments
  - Support accelerated completion of the Central Puget Sound HOV system [5]
  - Support the concept of demand management processes to maximize efficiency [15]
  - Support growth management processes to reduce transportation needs [16]
  - Support cost-effective programs that increase access for the aged and persons of disability [9]
- Reinforce a sense of community statewide
- ° Reduce urban stress
- ° Increase individual productivity
- ° Influence and reflect changing demographics/lifestyles and their effects on:
  - residential patterns/densities
  - trip patterns
  - work/leisure activities

ENHANCE ECONOMIC VITALITY

- Promote cost-effective accessibility of goods and people to employment and commerce centers
- Support international trade
- Encourage revitalization of blighted urban and economically isolated rural areas
- ° Increase business productivity
- ° Increase stability of employment base - anticipate shifts to a non-defense-based economy
- ° Support economic development and expansion as appropriate

PROTECT THE NATURAL ENVIRONMENT/ENHANCE THE BUILT ENVIRONMENT

- Conserve scarce natural/energy resources

  Establish environmental policies for the WSDOT [12]
- Reduce air, water, noise, and visual pollutants and other waste by-products from transportation systems
- Avoid disruption and degradation of historically/environmentally significant locations
- Incorporate effective urban design in transportation facilities

ENCOURAGE COOPERATIVE EFFORTS AND EFFICIENT USE OF RESOURCES

- Ensure an adequate financing base that is inflation-sensitive, protected, and multi-modal [3]
- Encourage public/private partnerships [1]

  Support the concept of private development fees to finance improvements [14]
- Promote greater sharing between state and local governments

  Promote sharing of WSDOT expertise in development of high capacity transit [2]
- Promote sensitivity to public interest and participation

  Periodically measure public opinion of existing/new services (part of the STPP Process) [17]

  † Develop a pro-active Commission strategy toward public information [24]

  † Establish high visibility by the Commission on selected major issues [25]

  † Increase statewide access to Transportation Commission meetings [27]
- Facilitate interjurisdictional and regional partnerships [6]

† Strengthen the Commission's interaction, accessibility, and relationships with

Governor's office and policy staff [18,19]

Legislative leadership [20]

Transportation constituencies [21]

Transportation community [22]

WSDOT employees and departments [23]

† Establish an active role by the Transportation Commission in the STPP Process [26]

- Promote linkage between transportation planning and growth management /land use planning

  Support development of policies on land use and transportation needs [7]

  Ensure that regional transportation planning is consistent with the STPP Process [8]

  Establish state policies for managing land assets [4]

- Preserve transportation investments and develop cost-efficient new facilities

  Preserve rights-of-way in high density areas for recognized future needs [11]

- Sponsor innovative research and development in cooperation with academia, the private sector, and others, to identify new, more cost-effective transportation solutions [10, 13]

° Train present and future transportation professionals

APPENDIX B. ORIGINAL MATRIX OF STUDY TOPICS

The following matrix of topics and illustrative examples comprise the initial unfiltered list of study areas that was generated by research and brainstorming during the first phase of FY91 research, and provided the structure for ongoing monitoring activities. The organization of this list reflects an earlier study structure and has since been modified. The study structure in FY92-93 will evolve as future topics are developed and new trends are studied. This list is presented primarily to indicate the breadth of future monitoring activities.

TRANSPORTATION TECHNOLOGIES (by type of basic research or application)

- Artificial Intelligence Technologies
  - Expert Systems - e.g. analysis of incident/congestion cause, commute time estimates , route guidance
- New Materials Development
  - Buildings
  - Vehicle skins - e.g. composite materials or plastics to reduce cost of transit cars
  - Vehicle power plants - e.g. ceramic engines
  - Bus Stop designs
  - Bicycles
  - Roadway Materials
    - bridges/overpasses - e.g. long endurance materials
    - guideways/elevated rail
      - monorail
      - support columns
      - rail materials
    - high speed underground tunnels
    - high speed underwater tunnels
    - jersey barriers
    - light standards
    - shoulder surfacing
    - illumination materials/systems
      - vehicle
      - signs

roadway

reflector materials

vehicle

signs

roadway

- Human Factors/Design Research

Signage Design

Shape

Brightness

Wording

Vehicle design - e.g. IVHS America's projections of a large human factors investment

Roadway and shoulder design

CAD Technologies - e.g. support technical design, provide public information

Computer simulations/animations

"Virtual" Realism/3-D environments - e.g. UW Human Interface Technology laboratory

- Alternative Fuels Development

Ethanol/Gasohol

Methanol

CNG

Propane

Gaseous (hydrogen, ethane, propane) and Liquid (alcohol, methanol, hydrocarbons)

- Alternative Propulsion Systems

Electricity

batteries

fuel cells

Solar

Hydraulic Capsule Pipelines (HCP)

Pneumatic Capsule Pipelines (PCP)

MagLev (Magnetic Levitation)

attraction system

repulsion system

AirLev (Air Cushion Levitation over water)

High Speed Steel Wheel on Steel Rail

TGV: welded track

- Environmental Protection Technologies

Direct protection

air pollution reduction (e.g. advanced engine technologies)

water pollution reduction (e.g. runoff mitigation, wetlands protection)

noise pollution reduction (e.g. mode and facility-related mitigation)

Indirect protection

lightweight materials (i.e. reduce fuel consumption)

materials with reduced pollutant by-products during their manufacture

- Infrastructure Maintenance and Management Technologies

CAT Scan roadways

Retrofit technologies (seismic, materials rehabilitation)

Roadway reflection modeling/simulation (e.g. SIGGRAPH 90)

- Robotics/Automation Technologies

Maintenance and Vehicle Repair - e.g. facilities cleaning, incident clearing

Vision Systems:

heads up displays: "instrument driving" in poor weather or night conditions

Fire extinguishing systems

Directional Airbags with automatic refill

Automated tunnel evacuation

Automated ferry evacuation

Ferry bow wave energy dissipation systems (onboard ferry or on dock facility)

- Information Sensing/Gathering Technologies

Remote Monitoring (e.g. variable speed limit monitors or Videotex info systems)

weather conditions

wind

rain

snow

road conditions

snow/water accumulation

friction coefficient

environmental conditions

sun glare/reflection

visibility: fog, water, light

Object detection/avoidance

Incident detection

Congestion detection

- Information Dissemination Technologies

Smart Signs

electronic "berma shave"

downloading to automobile map displays

Interactive Ticket, Schedule, Information Dispensing Systems

- IVHS (Intelligent Vehicle/Highway Systems) Technologies

ADIS (Advanced Driver Information Systems)

ATMS (Advanced Transportation Management Systems)

AVCS (Advanced Vehicle Control Systems)

CVO (Commercial Vehicle Operations)

Intelligent Incident Management

High-Efficiency Platooning

- Alternative Motorized Vehicle Designs and Guideway Approaches

Urban Commuter Vehicles

e.g. GM Lean Machine: narrow, 100-200 mpg commute vehicle

Superbus and exclusive busways

amenities: food, drink, TV, stereo, user-friendly seating

dedicated service/HOV use/access ramps

Rail

Personal Rapid Transit (PRT): e.g. City of SeaTac, Taxi 2000

High Speed Ground Transportation (HSGT): MagLev, TGV, ICE

Light Rail Transit (LRT)

AGT (Automated Guideway Transit)

Urban people movers

Circulator systems (within airport, airport to city)

Ferries

passenger-only service

passenger-only fleet and automobile-only fleet (trade off amenities/speed vs. separation of passenger and vehicle)

Hydrofoils

High-speed elevated systems

Hybrid systems (hydrofoil/catamaran) to provide better passenger comfort

Aircraft

HSCT, NASP

QSRA

Intelligent cockpit

Air Traffic Control

Satellite airports with high-speed ground transportation support

Helicopter

tilt-rotor (V-22)

cross-lake or cross-sound commuter service

Freight-Haul Systems

tanker truck technology

trailer rig design

Special Needs Transportation Technology

elderly/disabled assist systems with mass transit

motorized short-distance transport systems

in-vehicle vision and detection systems

- Telecommuting/"Virtual" Transit

Distributed work centers or home-based

Home services via telecommunications/Videotex

reduce transportation demand via extensive online shopping/services

reduce transportation cost and increase attractiveness of mass transit by providing up-to-date information to efficiently schedule trips

Provide support services, e.g. shuttles between telecommute centers

- Non-Motorized Vehicle Technologies

Pedestrian

pedestrian open spaces

exclusive above-grade/covered walkways

people mover circulators

Bicycle

exclusive bicycle lanes (e.g. I-90)

covered bicycle lanes

- Multiple Technology Systems (hybrid systems)

Combine complementary systems that by themselves are inefficient or incomplete

intra-mode: e.g. dual-powered buses (diesel/electric)

inter-mode: e.g. smooth transfer from bus to rail to hydrofoil, etc.

- Demonstration projects
  - Puget Sound area
  - North-South (Western Washington)
  - North-South (Eastern Washington)
  - Center-to-center (e.g. Bellingham-Vancouver corridor, Spokane-Pullman corridor, SeaTac-Olympia, Vancouver-Vancouver, etc.)

PUBLIC INFORMATION STRATEGIES

- Distribution of timely transportation-related information (enhance the attractiveness of mass transit by reducing uncertainty associated with scheduling/transfers)

  Information Types:
  - weather
  - traffic
  - advisories
  - contour maps of travel times
  - schedules

  Information Modes:
  - displays at stations/transit centers (electronic readerboards as well as audio)
    - display next bus/train number and time of arrival
    - display next few arrivals after that
    - display location of all nearby buses
  - interactive user displays
    - provide routing advice, e.g. pick start/stop/time and get choice of routes, then generate printout of schedule info
  - hot line of service information
    - phone access
    - modem access
    - cable TV display
  - Electronic message systems
    - Help messaging
    - Cellular-phone-like Paging systems linked to information network
      - 2-way messaging capabilities
  - Public information updates, e.g.statewide commute time contour maps

Parking Guidance Displays

Information systems/displays showing occupancy of parking facilities

- Set up touring display of transportation-related information

Ongoing update of displays:

e.g. tour of solar car, maglev demo, innovations showcase

Feedback opportunities at every location

questionnaires coupled with incentives, like prizes, ride in solar car, etc.

design the questionnaires to support ongoing update of information database

Technology incorporated into the display

computer-based questionnaire

visual and tactile information display

School Tours

Motivate children and adults (enhance the image of the transportation field)

- Annual Mobility Assessment

Views of providers and customers on

costs

how well systems are working

what needs to be improved

- Sponsorships

Competitions

Presentations

Inter-company competitions to reduce energy use/increase HOV (with prizes)

(e.g. linkage with TROs)

Student Research

Student Events

Campaigns

attitudinal awareness

- Interactive video/CD-ROM training courses
- Knowledge Bases

Data collection

measure new data or collate existing data

Transportation Data (service, commute times, wait times, etc.)

Opinion Surveys

Commute Contour Lines

State/County/Local/Regional Agendas and Ongoing Plans

e.g. "institutional memory" concept (Bluechel)

Study socioeconomic impacts of new technologies/strategies

IVHS

telecommuting

new workplace (reduced personal contact)

Develop background information on unique regional situations or issues

marine transportation

E. Washington corridors and economic issues

urban and rural

LAND USE/DEMAND MANAGEMENT INCENTIVE STRATEGIES

- Leverage Transportation Systems with Land Use via passive/active (dis)incentives

Passive: don't provide service line

don't provide station

don't provide parking

use all of the above to encourage "natural" (i.e. private sector) growth to occur on its own (e.g. Van. B.C. Skytrain: Metrotown area)

Active: "Government Takes the Lead" as an active initiator and advocate of policy directions that coordinate the state's transportation system with its approach to land use and growth management

Develop zoning policy surrounding new service routes

Provide incentives to encourage growth in desired areas (e.g. development rights)

Develop partnership with private developers and major employers (e.g. Boeing) to support cost of transportation infrastructure in their vicinity develop in concert with both expected patterns of growth and **desired** patterns of growth (e.g. Metro's Transportation 2000 w/ PSCOG Vision 2020)

- Provide Individual Incentives

Provide monetary/in-kind inducements

Pay people to use transit (or free)

Prizes

Merchandise

shower (bicyclists)

shoes (bus, pedestrians)

Fleet of vehicles provided to employees (reduce maintenance costs of individual cars)

Provide regulatory req't and tax breaks to encourage retool of existing fleets

Make fuel efficient fleets available to public (e.g. extension of van pool concept to automobiles: raise occupancy, save energy, and reduce pollution)

Finance via government subsidies, employer incentive w/ tax break, or user fees

Demand-responsive systems

- fleet mix of fixed-stop and on-demand vehicles
- similar to taxis except cheaper/subsidized; taxis could queue up at "on-demand stations" just like any other trip generating location (airport, bus terminal, etc.), and provide joint public/private, inexpensive circulator service in / between CBDs

HOV Expansion

- Provide Corporate Incentives

Solicit private funding; in exchange, give/sell development rights to adjacent property or related industrial spinoffs

Tax Breaks

Shared Technology Partnerships

Encourage and provide benefits to support "**strategic alliances**"

e.g. Joint venture of auto/rail/bus industry and aerospace industry in:

aerodynamics
materials
electronics
CAD
CAM

Private Park&Ride (or sell the development rights)

- Coordinated Travel Demand with Employers by Shifting Travel Times

4-day weeks

Flex time

Time of Day pricing or Flextime pricing

- Use Amenities as incentives to attract ridership

Superbus and exclusive busways

amenities: food, drink, TV, stereo, user-friendly seating

dedicated service/HOV use/access ramps

amenities at

P&R

ferries

rest stops (e.g. MacStop)

child care

recreation center

guaranteed ride home (need not be expensive, just security blanket)

preferential treatment to HOV

preferred parking

reduced fare

exclusive lanes

Transit station amenities

Special needs service

elderly/disabled services via technology assistance

- User Fees as disincentives to reduce congestion

user fees at congested locations on non-HOV lanes during peak hours

Toll Roads

- Freight Service

dedicated rail lines/highway network; FOV (Freight Occupancy Vehicle) links

- Water Transportation Service

Super Service Ferries

expanded service

onboard and waiting area amenities

passenger-only service linked with circulator service at destinations

Hydrofoils

e.g. establish S. Lake Union as a major transit location serving downtown; provide connecting service from the Eastside with circulator shuttle to CBD

Mosquito fleet on Lake Washington and Puget Sound

- Rural Network Service

state feeder system to support and link rural communities throughout the state

rural communities tied to metropolitan areas

E. Washington network

- Cross-State Network Service

enhance East-West linkage with state high-speed ground system

enhance North-South linkage (both east and west sides) with state high-speed ground or toll system

- Establish HOV design guidelines and criteria
  - provide criteria of conversion of HOV to exclusive right of way
  - coordinate with METRO, other related agencies
  - create the necessary supporting database
    - e.g. HOV violation statistics

PROGRAM DELIVERY STRATEGIES

- Examine and modify organization structures
  - re-evaluate organizational goals
    - operate with the same goals as that of an outstanding customer-oriented private business; elevate good service to a goal on par with the efficient movement of people (e.g. ferries)
  - redefine the cooperative nature of agencies that should be related
    - state agencies (e.g. Transportation, Ecology, Energy, Trade and Economic Development, Community Development, etc.)
    - government units (State, County, City)
    - public and private sector
  - establish a formal organizational structure that provides clear financial rewards and visible public relations benefits for the concept of public/private
    - transportation partnerships, i.e. private sector supporting the public good
  - redefine organizational objectives
    - preservation vs. capacity improvements
    - Impact of Canadian free trade
    - Airport siting and ground support
    - All-weather network
- Financing Policy
  - stable financing sources
  - anticipatory financing and associated planning
  - defined financing distribution to each agency/governmental unit
- Establish state goals regarding desired transportation service in non-urban areas