PRIORITIZATION OF CAPACITY IMPROVEMENTS

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Planning and Programming Service Center
in cooperation with the U.S. Department of Transportation
Federal Highway Administration
This study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

This technical report summarizes the Prioritization of Capacity Improvements Study (PCIS), the purpose of which was to develop a new methodology for prioritizing mobility improvement projects to reflect State Transportation Policy Plan objectives. This report includes a discussion of the preexisting Category C prioritization formula, an overview of state-of-the-art prioritization methods for regional and statewide project programming elsewhere, a detailed discussion of the proposed ranking methodology for mobility improvements, and finally, a description of the implementation process for the 1995-97 biennial programming cycle at the Washington State Department of Transportation (WSDOT).

This study focused on the safe, cost-effective movement of people and goods; the encouragement of high occupancy vehicles and alternative modes; land use-transportation compatibility; environmental conservation; social and economic impacts; institutional coordination; and local support, all of which are explicit goals in the State Transportation Policy Plan.

The new prioritization framework has several advantages. It is flexible enough to accommodate future changes in state policy. Additionally, it represents a significant step toward the ability to evaluate and rank multimodal mobility projects in direct response to transportation policy and service objectives. WSDOT is clearly in the forefront of such planning efforts nationwide.

There are many opportunities for further study, and it is recommended that the Washington State Department of Transportation continue to push the known boundaries of economic analysis as innovative, multimodal solutions are considered increasingly frequently in the mobility improvement program. Such efforts will allow decision makers to make the best use of limited state resources.
Final Technical Report
Research Project T9233, Task 10
Prioritization of Capacity Improvements

PRIORITIZATION OF CAPACITY IMPROVEMENTS

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INTRODUCTION

RESEARCH OBJECTIVE & SCOPE

Summarized herein are the findings of the Prioritization of Capacity Improvements Study (PCIS). Since this study was initiated in 1990, policy guidelines and program structure at the Washington State Department of Transportation (WSDOT) have changed significantly. While the scope of the study was originally limited to a review of the prioritization methodology for Category C capacity improvements, the scope has been expanded. It now includes development of a prioritization methodology for both the urban and rural Mobility improvement programs. This new methodology is to reflect State Transportation Policy Plan objectives for the 1995-1997 programming cycle. The expanded study scope now encompasses the following elements:

- Development of a prioritization methodology for evaluating mobility project proposals to emphasize movement of people and goods rather than movement of vehicles. The methodology includes criteria to assess cost-efficiency; multimodal highway projects; non-monetized environmental, social, and land use impact costs.
- A full-scale test of the ranking methodology and sensitivity analysis between criteria.
- Coordination of criteria weight assignment.
- Implementation assistance to WSDOT.

PROBLEM STATEMENT

RCW 47.05, the Washington State Transportation Priority Programming for Highway Development Law, establishes a programming policy for the state highway system based on the "rational selection of projects according to factual need..." The scope of this law was expanded in 1993 to require "...an evaluation of life cycle costs and benefits systematically scheduled to carry out defined objectives within available revenue." RCW 47.05 further mandates that priority selection be applied to projects that are part of a comprehensive, six-year investment program, based on needs identified in
the state-owned highway component of the statewide multimodal transportation plan. The program must be adopted and periodically revised by the Washington State Transportation Commission (WSTC). The WSTC must specify state transportation policy objectives for each programmatic service objective (fig. 1). WSDOT has clearly distinguished between state-owned and state-interest facilities (fig. 2). State-owned facilities consist of state airports, the Washington State Ferries, and state highways. State-interest facilities consist of aviation (broadly defined), marine ports, bicycle/pedestrian access, freight and passenger rail, and public transportation. It is notable that PCIS is constrained to priority programming of mobility improvements in the State Highway Construction Program (shaded area in fig. 3). Specifically, this report recommends a revised prioritization method for evaluating Urban and Rural Mobility improvements that is responsive to II-Mobility program service objectives.

Prior to RCW 47.05 revision, highway improvements were categorized as A, B, C, or H. Category A provided funding for non-interstate preservation, safety, and minor operational improvements. Budget category B provided funding for interstate capacity, initial system completion, and preservation. Budget category C provided funding for non-interstate highway capacity improvements. Non-interstate bridge work was addressed separately in category H. Since the inception of this study, three things have been restructured. First, a State Transportation Policy Plan Steering Committee was set up in 1988 to identify goals and service objectives. Second, WSDOT's planning department drafted a 20-year Multimodal Transportation Systems Plan. Third, the Legislative Transportation Committee commissioned the program structure, monitoring, performance, and prioritization study (PAPS) in 1990-1992. As a result of this restructuring, the WSDOT highway construction program now more clearly differentiates system preservation from system improvement. The current program also minimizes facility type distinctions within the program.
Figure 1. Washington State Transportation Policy Implementation
Figure 2. Washington State Multimodal Transportation Plan Structure
Two independent budget categories, P and I, were created to align with the service objectives of the System Plan and to define all of the highway construction sub-programs. The elements of this programming transition are described in figure 4.

Category B ranking was based primarily on completion of the interstate system. In Washington state, the process included evaluation of quantitative factors, such as level of service, traffic volumes, accident rates, and volume-to-capacity ratios. The WSDOT also considered qualitative criteria, such as district priority, the balance of funding opportunities versus project costs, and degree of transit relatedness. Category B was not a focal point for the PCIS because its purposes were relatively limited. It was used only to program federal interstate completion funds. As the interstate system nears completion, the magnitude and diversity of this category are receding.

Category C encompasses more diverse project types, ranging from high occupancy vehicle improvements to interchange improvements. The Category C rating system consisted of a screening process against statutory criteria, followed by computation of a rating factor. The rating factor was a function of specific engineering criteria (level of service change, accident reduction, and traffic volumes) and the project's annualized costs and benefits. Another distinction between categories B and C is that Category C was more controversial because prioritization was done biennially, on a larger number of projects. Category B projects were prioritized on only one occasion.

As competition for funding increases, and as highway deficiencies continue to require complex, diverse solutions, a new rating system is needed. This rating system must also be capable of encompassing a greater range of social, environmental, and economic impacts, as well as system performance parameters. This rating system must be responsive to State Transportation Policy Plan objectives and to the 1990 Washington State Growth Management Act (GMA). Federal funding priorities expressed in the Intermodal Surface Transportation Efficiency Act (ISTEA) necessitate prioritization
Previously Existing Program Structure

System Preservation

A
Non- Interstate Preservation
Safety
Minor Capacity
Operational

B
Interstate Completion
Interstate 4R

C
Non- Interstate Capacity Improvement

H
Non- Interstate Bridge

Capacity Improvement

Interim Stage

A
Interstate Preservation (IM)
Non- Interstate Preservation
(STP, NHS, State)

B
Interstate Capacity (ICE)
Non- Interstate Capacity
(NHS, STP, State)

H
Interstate and Non- Interstate Bridge Preservation

C
Bridge Capacity

Revised Highway Construction Program

P
Roadway Structures
Other Facilities

I
Mobility
Safety
Economic Initiatives
Environment Retrofit

Figure 4. Transition from CATA-H to 1995 WSDOT Highway Program Structure
methods applicable to multimodal projects (e.g., HOV facilities, transit, and non-motorized access).

To meet these new challenges and to improve upon the pre-existing Category C prioritization methods, WSDOT initiated a three-phase project (table 1). Phase I focused on development of a new ranking formula and on selection of criteria to reflect the state policy goal of cost-effective movement of people and goods. Phase II expanded on Phase I by selecting criteria to reflect land use, social, and environmental policy goals. Finally, Phase III, which completed the study effort, consisted of selecting and testing criteria for evaluating multimodal highway mobility projects. Greater ease in understanding for the lay person regarding the project selection process was also a WSDOT goal for the new methodology. The following section describes the progression and products of each phase in more detail.

**PROJECT FRAMEWORK**

Phase I study efforts focused on the selection of evaluation criteria based on cost-effectiveness in moving people and goods, and the development of a ranking algorithm. Phase I results included an evaluation of the existing WSDOT prioritization methodology, a state-of-the-art assessment, a detailed review of three typical methods, three cost-effectiveness criteria, systems attribute index criteria, and a preferred ranking algorithm (TOPSIS). This phase of the project satisfied RCW 47.05, which requires an evaluation that includes life-cycle cost and benefit analysis.

The number of evaluation criteria was expanded in Phase II to reflect the breadth of policy objectives established by the WSTC. Five criteria categories were added to reflect the importance of community support, social concerns, land use, wetlands, water quality, and noise impacts, as well as expected permitting difficulty. Existing database capabilities were assessed to ensure that each criterion could be evaluated consistently statewide.
<table>
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<th>Phase</th>
<th>Prioritization Study Phases</th>
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| Phase I | 1. Develop ranking formula  
2. Select ranking criteria for cost-effective movement of people and goods |
| Phase II | 1. Select ranking criteria to reflect land use, social, and environmental state transportation policy goals as expressed in the state transportation policy plan  
2. Review literature and conduct state-of-the-art assessment for multi-modal evaluation criteria |
| Phase III | 1. Select multi-modal evaluation criteria  
2. Conduct final test of complete criteria set and formula  
3. Implement prioritization methodology |

During Phase III, which completed the study, the cost-effectiveness and Systems Attribute Index criteria developed in Phase I were revised; a final full-scale test of the ranking methodology was carried out; sensitivity analysis among criteria was carried out; final criteria weights were set; and the WSDOT was assisted with full implementation of the new methodology for the 1995-97 biennium. Phase III resulted in a more detailed definition of a benefit-cost ratio as the sole cost-efficiency criteria, and in refinement of the Systems Attribute Index into an explicitly multi-modal criteria category that encourages designs that incorporate public transportation, TSM, pedestrian, and bicycle improvements. Second, data were collected for the 1993-95 biennium project proposals for a final full-scale test of the ranking criteria and methodology. Finally, the sensitivity analysis was used to assist in the adoption of criteria weights among WSDOT representatives. UW TRAC investigators assisted WSDOT with full implementation of the methodology for the 1995-97 biennium program.

The following types of projects are considered typical mobility improvements in this prioritization study:
- passing lanes
- interchanges
- geometric intersection improvements
- general purpose widening
- additional high-occupancy vehicle lanes and facilities
- park-and-ride lots
- transportation system management (e.g., surveillance control and driver information technologies)
- arterial, frontage road, and ramp improvements
- bridge improvements associated with proposed projects

In the following section, a survey of current prioritization practice is presented (including detailed evaluation of methods used in agencies in three west coast urban areas). The WSDOT's Category C prioritization is also presented. This discussion identifies important components and concepts that should be incorporated into the new ranking methodology. A discussion of the proposed ranking system, including the proposed evaluation criteria and the mathematical algorithm, follows. The report concludes with comments on the results of the full-scale test, sensitivity analysis, and observations on the successful implementation of the PCIS in the 1995-97 biennial programming cycle. WSDOT continues to refine and develop the method and criteria, and views the PCIS as an evolving tool.
SURVEY OF CURRENT PRACTICE

The discussion of current practices entails (1) an in-depth evaluation of the pre-existing WSDOT formula, and (2) a review of the state-of-the-art.

This section describes and evaluates the WSDOT's category C prioritization formula for non-interstate capacity improvements. This material is followed by summaries of prioritization methods currently in use by several transportation agencies. The prioritization methods highlighted herein are unusual in that they begin to incorporate a broad range of issues, including environmental impacts, intermodal connections, and land use.

WSDOT CATEGORY C PRIORITIZATION FORMULA

The rating system for Category C projects consisted of screening project proposals against statutory criteria, followed by calculation of a rating factor. The screening criteria required (1) that project proposals address existing highway deficiencies, such as roadway congestion, and (2) that there be community support for the proposal addressing the deficiency. Projects meeting both statutory criteria were then evaluated and ranked.

The quantitative formula for Category C projects actually constituted one overarching relative rating calculation, which consisted of several levels of interim calculations. These calculations, as well as the input data required, are discussed in the following sections. Six sets of calculations were performed, with the results of the first five calculations defining the parameters for the remaining relative rating calculation.

Step 1

Three parameters must be derived for each project: (1) the accident reduction factor; (2) the level of service factor; and (3) the volume factor.

1. **The Accident Reduction Factor** (ARF) is calculated on the basis of the estimated reduction in accidents for the proposed project. The project(s) expected to cause the greatest reductions in accidents is awarded the
maximum 40 points; the project(s) expected to cause the least reduction are awarded one point. Remaining projects are awarded points between one and 40, standardized according to the highest- and lowest-scoring projects. The input data for this calculation are estimated with reference to the Information Guide for Highway Safety Improvements (1979).

2. The Level of Service Factor (LOS) is formulated in much the same manner as ARF. Projects are awarded points on the basis of the number of service levels they will improve. A change from LOS F to LOS E is awarded 20 points; a change from LOS E to LOS D, 15 points; LOS D to LOS C, 10 points; LOS C to LOS B, 5 points; and LOS B to LOS A, 0 points. The points for each successive improvement are cumulative; for example, a project that is expected to improve traffic from LOS F to LOS B is awarded 50 points. As with the ARF calculation, the project(s) with the largest number of points receives 40 points; the lowest gets 1 point. Remaining projects are pro-rated between the two extremes. Change in LOS is estimated on the basis of existing volumes and forecasted volumes (with and without the proposed improvement).

3. Volume Factor (VRF) The project that would serve the highest volume is awarded 20 points. The project serving the area with the lowest volume is awarded one point; the rest are pro-rated along a continuum defined by the two extremes. Note that this criterion is weighted less heavily than either ARF or LOS, for which the point maximum is 40, but that all three factors are scored on a normalized scale.

The next step in category C prioritization is the calculation of the engineering factor and the annualized costs.

**Step 2**

1. The Engineering Factor (EF) is calculated by adding together the points from Step 1. The only weight applied to these factors is the scale from which the factors are derived.

\[
EF = ARF + LOS + VRF
\]

Because the individual components of EF are in integer form (i.e., from 1 to 40), the EF itself does not range widely among projects. A large proportion of projects have an EF score between 15 and 35. Consequently, cost turns out to be a key determinant of final project ranking.

2. Cost Factor - The cost factor is calculated as follows:

\[
CA = (C+MC)K_{30} - Oc - ARC
\]

K_{30} is the capital recovery factor used to convert present project costs to an annualized value. C is project design and construction costs, and MC is maintenance costs. ARC is the estimated accident reduction savings and Oc is the operating cost savings. In essence, annualized benefits are subtracted from annualized costs, resulting in an overall cost factor.
Note that travel time savings are not calculated as a project benefit in the Category C formula. For this reason, very few projects would emerge as economically efficient, i.e., having greater benefits than costs without revision of Category C's life-cycle cost analysis. There are both advantages and disadvantages associated with calculating travel time savings into the formula. Leaving aside travel time savings means avoiding the thorny issue of assigning an appropriate monetary value to time. Alternatively, leaving travel time savings out of the formula makes it difficult to ascertain a project's true economic efficiency. By monetizing travel time savings, an economic analysis comes much closer to assessing all the benefits of any project, making it possible to demonstrate the return on the taxpayer's investment.

**Step 3**

The final step project prioritization combines the results from Step 2 as follows:

\[
Relative \text{ Rating } = \frac{EF}{\sqrt{\frac{CA}{10,000}}}
\]

The engineering factor is divided by the square root of the cost factor (10,000 is simply a scaling factor). Taking the square root of the cost factor decreases the disparity between projects for which costs are very high and projects for which costs are very low. In theory, more expensive projects are not penalized simply because of their high cost. However, because the calculated engineering factor does not vary greatly among projects (roughly 70 percent of the projects have an engineering factor between 15 and 35), cost does play a significant role in the final ranking. Nevertheless, not taking the cost factor's square root would exaggerate its effect to an even greater degree.

**General Comments**

The current formula is well-suited to evaluating highway-related projects that are similar in nature and whose primary purpose is to move vehicles. However, transportation policy and funding strategies are changing; as such, a new approach to
project prioritization is both needed and mandated by RCW 47.05. It is hoped that the foregoing review of the current formula has helped identify elements to consider in developing a new approach. For example, review of the current formula revealed that changes in the evaluation criteria would require substantive changes in the existing mathematical algorithm. Ideally, a mathematical formula should be flexible enough to accommodate any number or type of criteria. Such flexibility would enable WSDOT to respond to changes in state transportation policy without changing the basic prioritization framework. The prevailing emphasis on multi-modal planning and project evaluation also suggests that criteria should be applicable across a wide range of project types and costs.

The new approach should include criteria that capture the cost-effective movement of people and goods, community support and impact, environmental impact, multi-modal design attributes, and land-use transportation linkage factors. Although this study primarily addressed project evaluation for improvements within the Mobility program, the new methodology is flexible enough to allow future expansion to accommodate additional criteria, or for application to other improvement program areas.

STATE-OF-THE-ART ASSESSMENT

Three state-of-the-art methodologies for ranking transportation projects are discussed in this section: two from California and one from Washington state. While each is in some way unique, all address broad multi-modal and intermodal transportation objectives. These state-of-the-art methodologies are offered as case studies of regional priority programming efforts; as such, they provide a starting point for incorporating a broader range of system criteria into the new methodology.

For a complete discussion of a similar literature review and the status prioritization methods throughout North America, see “Synthesis 201: Multimodal Evaluation in Passenger Transportation” (Rutherford, 1994). This document reports the
results of a survey conducted in 1991-92 for the National Cooperative Highway Research Program.

**San Francisco Bay Area Metropolitan Transportation Commission**

The San Francisco Bay area Metropolitan Transportation Commission (MTC) uses a ranking process to prioritize projects ranging from highway paving to child-care facilities at transit stations. The method consists of four tasks:

- Three independent sets of evaluation criteria are developed (or reviewed) to screen projects, to assign a score based on a project's merits, and to ensure overall program effectiveness.

- All proposed projects, regardless of mode, must pass the same initial screening.

- All proposed projects are scored based on technical merit and external impacts.

- A draft priority list is developed and evaluated against a third set of programming criteria/principles.

MTC continues to refine this process with every regional transportation improvement program (TIP) cycle, which allows the MTC to be flexible in responding to evolving transportation policy. Once evaluation criteria have been established, a committee screens and scores transit, highway, and multimodal projects. While the scoring criteria presently employed are qualitatively similar, multimodal performance measures are not quantified, and benefits are not monetized. Thus, the value of road, freight, mass transit, and bicycle/pedestrian projects are evaluated as separate subcategories, but they are scored similarly. The MTC's scoring procedure is interesting because it relies on impact measures that cut across modes wherever possible. The MTC method also applies weight differentially across modes by safety, congestion, and demand multipliers.

**Screening Criteria**

MTC planners first screen proposed projects for conformance criteria to ensure consistency among agencies and other interested parties (e.g., the regional transportation plan, land use plans, ISTEA, air quality plans, etc.). The committee also scrutinizes other
threshold requirements, including project definition and justification, completeness of
documentation, reasonableness of provided cost estimates, Americans with Disabilities
Act compliance, and support by an adequate financial plan. Although certified
environmental documentation is not required at this stage, projects must not show
significant adverse, unmitigated air quality impacts. Projects that pass the initial
screening are then scored and prioritized.

**Scoring Procedure**

Scoring is structured to handle multi-modal project evaluation. Projects that pass
the initial screening, are scored against four sets of criteria that quantify the following
Metropolitan Transportation System (MTS) issues:

1. maintaining/sustaining the MTS
2. improved efficiency and effectiveness
3. system expansion
4. external impacts

Each scoring category contains various sub-category measures of effectiveness, with a
maximum of 100-points possible. Multi-modal projects can be evaluated more than once
in each category, but the sum of a group of criteria must not exceed the sum allocated to
the scoring category of criteria. The components of each of the four categories are
summarized below (table 2).

**Maintaining/sustaining the MTS.** Contributions to maintenance are assessed on
the basis of management system evaluation and priority or normal replacement and
rehabilitation cycles. Seismic retrofitting is proportionately assessed. Existing
conditions constitute the scoring baseline.

**Improved efficiency and effectiveness** are scored based on the extent to which
the proposed project would improve safety and security, and reduce congestion.
Multipliers are applied according to the magnitude of the existing problem. The
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<td>Management System based rehabilitation/</td>
<td>magnitude of rehabilitation/replacement</td>
<td>urgency of replacement or degree of prolonged useful life of asset</td>
<td></td>
</tr>
<tr>
<td>replacements (0-30pts.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehabilitation/replacement NOT based on</td>
<td>magnitude of rehabilitation/replacement</td>
<td>determined largely by replacement cycles in transit finance plan</td>
<td>magnitude of rehabilitation/replacement</td>
</tr>
<tr>
<td>Management Systems (1-20pts.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seismic Retrofit (0-30pts.)</td>
<td>proportion of project for seismic retrofit and estimated degree of risk</td>
<td>not distinguished by type</td>
<td>not distinguished by type</td>
</tr>
<tr>
<td>Breakdown prevention (0-10)</td>
<td>degree that project will prevent unacceptable breakdowns in the MTS</td>
<td>not distinguished by type</td>
<td>not distinguished by type</td>
</tr>
<tr>
<td>Improved Efficiency &amp; Effectiveness of MTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Max. Score = 30)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety and Security* (0-20pts.)</td>
<td>extent project addresses generic problems -scored by improvement type</td>
<td>extent project addresses generic problems -scored by improvement type</td>
<td>extent project addresses generic problems -scored by improvement type</td>
</tr>
<tr>
<td>Congestion Relief* (0-20pts.)</td>
<td>degree of impact based on MTS, CMP deficiencies and improvement type</td>
<td>degree of impact based on MTS, CMP deficiencies, and emphasizes reliability over comfort.</td>
<td>degree of impact based on MTS, CMP, and emphasizes utilitarian facilities over recreational</td>
</tr>
<tr>
<td>Cost effectiveness (0-10pts.)</td>
<td>total project score divided total project cost normalized to ordinal scale</td>
<td>not distinguished by type</td>
<td>not distinguished by type</td>
</tr>
<tr>
<td>Freight Movement (0-30pts.)</td>
<td>based on heavy truck traffic % and scale of intermodal improvement on MTS</td>
<td>not distinguished by type</td>
<td>not distinguished by type</td>
</tr>
</tbody>
</table>

* Multiplier based on magnitude of existing conditions modifies the ordinal score assigned.
Table 2. Metropolitan Transportation Commission’s Criteria and Scoring Measures (San Francisco Bay Area)  
(Younger & Murray, 1994)

<table>
<thead>
<tr>
<th>Category</th>
<th>Roadway Elements</th>
<th>Mass Transit Elements</th>
<th>Pedestrian &amp; Bicycle Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Expansion</strong> (Max. Score = 15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of Demand** (0-15 pts.)</td>
<td>degree of benefit to MTS; HOV improvements favored over arterial capacity</td>
<td>degree of benefit to MTS</td>
<td>projects that primarily serve commuters are favored over recreational improvements and connections to MTS</td>
</tr>
<tr>
<td>Corridor Preservation (0-15 pts.)</td>
<td>significance of, and threat to transportation corridor</td>
<td><em>not distinguished by type</em></td>
<td><em>not distinguished by type</em></td>
</tr>
<tr>
<td><strong>External Impacts</strong> (Max. Score = 25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Quality Control (0-25 pts.)</td>
<td>effectiveness of Clean Air Plan Transportation Control Measures</td>
<td><em>not distinguished by type</em></td>
<td><em>not distinguished by type</em></td>
</tr>
<tr>
<td>Land Use Planning (0-10pts.)</td>
<td>degree to which project promotes increased density at transit station, more efficient I/u patterns, and reduces auto dependence</td>
<td><em>not distinguished by type</em></td>
<td><em>not distinguished by type</em></td>
</tr>
<tr>
<td>Energy Conservation/Modal Shift (0-10pts.)</td>
<td>degree project promotes modal shift, or by type of signal improvement</td>
<td><em>not distinguished by type</em></td>
<td><em>not distinguished by type</em></td>
</tr>
<tr>
<td>ADA Enhancements (0-20pts.)</td>
<td>degree to which project is for ADA requirements</td>
<td><em>not distinguished by type</em></td>
<td><em>not distinguished by type</em></td>
</tr>
<tr>
<td>ISTEA Enhancements (0-15 pts.)</td>
<td>degree to which project is a qualified enhancement</td>
<td><em>not distinguished by type</em></td>
<td><em>not distinguished by type</em></td>
</tr>
<tr>
<td>Negative Impacts*** (negative points)</td>
<td><em>not presently quantified</em></td>
<td><em>not presently quantified</em></td>
<td><em>not presently quantified</em></td>
</tr>
<tr>
<td><strong>100</strong></td>
<td><strong>TOTAL POINTS</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Intermodal freight facilities are scored based on significance of new access provided; and, Multiplier based on magnitude of existing conditions modifies the ordinal score assigned.

*** There is no consensus on how to measure such impacts and whether negative impacts were only significant of non-SOV projects. This is intended to be a future consideration.
maximum score for this category is 30 points. Improved freight movement and intermodal transfer facilities may account for zero to 20 or 30 points alone, while a proxy for lifecycle cost analysis may contribute no more than ten points. The MTS cost-effectiveness measure is a proxy because it is calculated by dividing the total project score in all four categories by total project cost, as opposed to calculating a detailed benefit value.

**System expansion.** System expansion project scores, are qualitatively assigned, but scaled with a multiplier, based on whether the project meets (1) current demand and (2) projected demand. The 15-point maximum in this subcategory may also be accrued if the project includes right-of-way acquisition for corridor preservation. Projects in this category are scored based on the primary mode served, rather than cumulatively across all modes served, as is the case in the other three categories.

**External impacts.** This category evaluates the degree to which a project is expected to (1) affect air quality in the Bay Area, (2) support land use plans and goals, (3) conserve energy, (4) promote alternative mode shifts, and (5) promote transportation enhancement activities as defined by ISTEA and the Americans with Disabilities Act. If a project has no significant impact on air quality, then it is awarded no more than one point. However, if a project scores well or moderately well in each of the other subcategories it may still accrue the desirable, maximum score of 25 points.

Air quality impacts are scored based on the effectiveness of the transportation control measures (TCMs) included. Assignment ranges from *non/marginal* to *most-effective*. Points are assigned qualitatively. For example, if a project is entirely a TCM, such as signal timing or a market-based TDM measure, it receives 20 points. Conversely, if arterial flow or transit service improvements are minor, then the project receives only five points. When multiple state and/or federal TCMs are included, the maximum contribution of the air quality subcategory is 20 points.
Interestingly, although projects that replace diesel buses with electric or clean-fueled buses are considered moderately effective TCMs for air quality purposes, they are not evaluated in terms of energy conservation. In fact, the only projects assessed in the energy impacts subcategory are those that encourage alternative mode shifts and improve arterial flow. Scores are assigned qualitatively in energy conservation, and the two other external impact subcategories: (1) land use and (2) enhancement activities. Negative impact on mobility across modes is slated for inclusion, but a means of measuring this impact are still being developed.

Programming Criteria/Principles

After projects have been scored, the MTC committee uses a final set of criteria to ensure that the overall program improves mobility, provides for air quality, leverages resources, and promotes equity. Ensuring overall compliance with the federal Clean Air Act is an important consideration at this stage.

The following criteria are used to arrive at the final program:

- Project merit. Based primarily on the project's score according to the procedure just described.
- Project readiness. The ability to program a project as soon as obligation authority is conferred.
- Cost-effectiveness: Based on points received in scoring process and total cost.
- Geographic equity: Based on county population over the duration of ISTEA.
- Funding. (1) 50 percent of ISTEA Surface Transportation Program funds programmed by counties and 50 percent by MTC; (2) all ISTEA Congestion Mitigation and Air Quality funds programmed by MTC with emphasis on addressing most serious air quality problems (Rutherford 1994)

Discussion

The MTC's prioritization process applies to capacity, facilities, and management-related improvements. The process stresses regional coordination, project justification, air quality improvements, ADA enhancements, and funding adequacy. The process is
simple, and participants can adjust points and evaluation criteria as to keep pace with policy shifts. However, the process has two drawbacks. First, the criteria and scoring measures entail significant subjectivity, particularly so in the case of cost-effectiveness and efficiency. Second, the methodology does not explicitly compare the movement of people and goods across modes. In fact, a full range of quantifiable criteria are not employed. The MTC process favors transit projects because the measures of effectiveness for roadway elements channel additional points to projects that encourage transit.

**Los Angeles County Transportation Commission**

The California Department of Transportation (Caltrans) uses another methodology in the Los Angeles region. Typical projects are lane additions, new roadways, new and modified interchanges, geometric improvements, traffic flow improvements, park-and-ride construction, and many combinations thereof. Each project is screened according to the criteria listed in Table 3. After screening, the remaining projects are ranked on the basis of several quantitative and qualitative criteria. The criteria used in the ranking procedure are outlined in Table 4.

The prioritization method stresses cost effectiveness, but it also includes community and environmental considerations. Like the MTC's procedure, the Los Angeles County prioritization method is designed to compare very different types of projects. The Los Angeles method's drawbacks are its dependence on subjective point assignment and its disproportionate emphasis on highways relative to other modes.

**Washington Transportation Improvement Board**

The Washington State Transportation Improvement Board (TIB) uses one of two evaluation methods, depending on whether the project is in an urban area or part of a small city program. Criteria from each of the programs are highlighted in tables 5 and 6.
Table 3. Los Angeles County Screening Criteria

<table>
<thead>
<tr>
<th>Current Congestion</th>
<th>Facility must be considered congested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Approval</td>
<td>Project must be consistent with the current regional plan</td>
</tr>
<tr>
<td>Ability to Maintain and Operate</td>
<td>Sponsoring agency must be able to operate the facility</td>
</tr>
<tr>
<td>Air Quality</td>
<td>The project is consistent with the most recent air quality plan in non-attainment areas</td>
</tr>
<tr>
<td>Project Study Report</td>
<td>A study is required for each project prior to submission. This study must encompass location, limits, scope, costs, and schedule. In addition, project reports must include a description of efforts to ensure that the project is coordinated with other rail/transit services.</td>
</tr>
</tbody>
</table>

Screening criteria are absent from the TIB prioritization process. Local financial support is weighted heavily. The TIB prioritization process rewards multi-agency cooperation and mode integration by assigning points based on the number of agencies or modes involved. However, the range of criteria employed is narrow, and point assignment is basically qualitative. In fact, land use impacts, environmental impacts, equity, accessibility, goods movement, cost, cost-effectiveness, and energy consumption are not even factored in. Still, this process is a good first step toward a more multi-modal selection process.

Conclusion

This report discussed the California and Washington methods for regional prioritization. In addition, another report, issued by NCHRP and authored by this study's principal investigator, covers other regional programming methods used in Denver, Calgary, and California (Rutherford 1994). While the results of Rutherford's study are too lengthy to reproduce herein, a combined summary of the state-of-the-art multimodal programming is provided here in table 7.
<table>
<thead>
<tr>
<th>QUALITATIVE CRITERIA</th>
<th>Modal Integration</th>
<th>The degree to which a project integrates alternative transportation modes. For example, bicycle travel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Linkage</td>
<td></td>
<td>The degree to which a project is part of an integrated program to solve congestion within a larger setting.</td>
</tr>
<tr>
<td>Trip Generators</td>
<td></td>
<td>The degree to which a project serves major trip generators (e.g., airports, industrial, and recreational centers).</td>
</tr>
<tr>
<td>Community, Environment, Energy</td>
<td></td>
<td>The degree to which a project fits into community plans, the relative benefit of the project as a trade-off against significant environmental impacts, and the projects energy efficiency of operating the project.</td>
</tr>
<tr>
<td>Freight Movement</td>
<td></td>
<td>The degree to which truck traffic is expedited or the degree to which congestion is reduced by modifying truck traffic.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QUANTITATIVE CRITERIA</th>
<th>Degree of Existing Congestion Problems</th>
<th>Based on duration of LOS E or worse, the peak hour volume on the existing route, the V/C ratio, and for transit, the peak load factor by direction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Effectiveness of the Improvement</td>
<td>Based on the cost to provide additional capacity (improvement cost divided by the change in vehicle trips per hour) and the cost to provide additional person trips per hour (cost of the improvement divided by change in vehicle flow rate).</td>
<td></td>
</tr>
<tr>
<td>Time Savings Index</td>
<td>The annual value of time saved divided by dollars spent.</td>
<td></td>
</tr>
<tr>
<td>Local Financial Contribution</td>
<td>The local or private investment relative to total project cost.</td>
<td></td>
</tr>
<tr>
<td>Marginal Cost for Peak Hour Improvement</td>
<td>Total project cost per additional peak-hour person-trip served, based on a ten-year horizon.</td>
<td></td>
</tr>
<tr>
<td>Estimated Level of Service</td>
<td>Estimated after project implementation, based on a ten year planning horizon.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5. Urban Program Scoring Criteria

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Agency</td>
<td>Points based on the number of agencies involved</td>
</tr>
<tr>
<td>Multi-Modal</td>
<td>Points based on additional modes served</td>
</tr>
<tr>
<td>Congestion/Safety</td>
<td>Points awarded in several categories based on the anticipated effect on current operations, i.e.,</td>
</tr>
<tr>
<td></td>
<td>• existing LOS</td>
</tr>
<tr>
<td></td>
<td>• existing V/C</td>
</tr>
<tr>
<td></td>
<td>• accident savings</td>
</tr>
<tr>
<td>Economic Development</td>
<td>Points based on the types of jobs created or retained, on the project's contribution to economic development, and on community support.</td>
</tr>
<tr>
<td>Local Match</td>
<td>Points based on the ratio of TIB support to community financial support.</td>
</tr>
</tbody>
</table>

### Table 6. Small City Program Scoring Criteria

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural and Geometric Factors</td>
<td>Points based on pavement condition or roadway width</td>
</tr>
<tr>
<td>Congestion/Safety</td>
<td>Points awarded in several categories based on the anticipated effect on current operations:</td>
</tr>
<tr>
<td></td>
<td>• existing LOS</td>
</tr>
<tr>
<td></td>
<td>• existing V/C</td>
</tr>
<tr>
<td></td>
<td>• accident savings</td>
</tr>
<tr>
<td>Other Factors</td>
<td>Allows up to 20 points for other factors</td>
</tr>
</tbody>
</table>
Table 7. Comparison of Criteria Used in Regional Programming Case Studies*

<table>
<thead>
<tr>
<th>General Criteria Category</th>
<th>Typical Criteria</th>
<th>CA Congestion Relief Program-MTC-</th>
<th>Bay Area MTC</th>
<th>Denver</th>
<th>Calgary</th>
<th>L.A. County</th>
<th>Washington TIB</th>
<th>Summation of Criteria Used Across Studies+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation System Performance</td>
<td>-No. of trips by mode</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
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<td>19</td>
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<td>-Vehicle miles traveled</td>
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<td>System Development,</td>
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<td>Freight</td>
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<td>-</td>
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</tbody>
</table>

* Table contents for the California Congestion Relief Program, Bay Area, Denver, and Calgary case studies were previously published in NCHRP Synthesis 201 (Rutherford, 1994), and the table formats of that report have been modified for this study.

+ This column is the total of all the criteria used in the 6 case studies for each criteria category, and indicates which categories generally receive the most emphasis.
Table 7. Comparison of Criteria Used in Regional Programming Case Studies* (Cont’d.)

<table>
<thead>
<tr>
<th>General Criteria Category</th>
<th>Typical Criteria</th>
<th>CA Congestion Relief Program -MTC-</th>
<th>Bay Area MTC</th>
<th>Denver</th>
<th>Calgary L.A. County</th>
<th>Washington TIB</th>
<th>Summation of Criteria Used Across Studies+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economic</td>
<td>- Homes/businesses displaced</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
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<td></td>
<td>- Maximize economic benefit</td>
<td></td>
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<td></td>
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<td>- Historic impacts</td>
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<td>- Construction employment</td>
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<td>Environmental</td>
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<td>4</td>
</tr>
<tr>
<td></td>
<td>- Sensitive Areas</td>
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<td>- Natural Environment</td>
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<td>-</td>
<td>1</td>
<td>1</td>
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<td>Safety</td>
<td>- Annual accidents by mode</td>
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<td>1</td>
<td></td>
<td>1</td>
<td>3</td>
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<td>Equity</td>
<td>- Equity of benefit and burden</td>
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<td>Costs</td>
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<td></td>
<td>- Operating costs</td>
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<td>Cost Effectiveness</td>
<td>- Annualized costs per trip or mile</td>
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<td>1</td>
<td>-</td>
<td></td>
<td>4</td>
<td>10</td>
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<td></td>
<td>- FTA (UMTA) index</td>
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<td>Financial Arrangements</td>
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<td>-</td>
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<td>1</td>
<td>4</td>
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<td></td>
<td>- Funding feasibility to build/operate</td>
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* Table contents for the California Congestion Relief Program, Bay Area, Denver, and Calgary case studies were previously published in NCHRP Synthesis 201 (Rutherford, 1994), and the table formats of that report have been modified for this study.

+ This column is the total of all the criteria used in the 6 case studies for each criteria category, and indicates which categories generally receive the most emphasis.
Table 7. Comparison of Criteria Used in Regional Programming Case Studies* (Cont'd.)

<table>
<thead>
<tr>
<th>General Criteria Category</th>
<th>Typical Criteria</th>
<th>CA Congestion</th>
<th>Bay'Area</th>
<th>Denver</th>
<th>Calgary</th>
<th>L.A. County</th>
<th>Washington TIB</th>
<th>Summation of Criteria Used Across Studies*</th>
</tr>
</thead>
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<tr>
<td>Institutional Factors</td>
<td>- Ease of staging and expansion - Nonimplementing agency support</td>
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<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>- Fatal flaw - Right of way opportunities - Enforcement - Recreation</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

There are few good examples of multimodal planning and programming evaluation in state and regional programming because of the largely inflexible modal funding process, which pre-dates ISTEA. Transportation planning procedures seem to change slowly. Other reasons for the general lack of multimodal planning tools include the following:

- Truly multimodal evaluation is hindered by the lack of a commonly accepted multimodal measure of mobility.
- Mobility is measured infrequently; and accessibility is rarely, if ever, assessed.
- A full range of generally accepted, reasonable criteria are infrequently used.
- Criteria evaluating equity, cost, and institutional factors are left out more often than they are included in regional programming efforts.

* Table contents for the California Congestion Relief Program, Bay Area, Denver, and Calgary case studies were previously published in NCHRP Synthesis 201 (Rutherford, 1994), and the table formats of that report have been modified for this study.

+ This column is the total of all the criteria used in the 6 case studies for each criteria category, and indicates which categories generally receive the most emphasis.
PRIORITY RATING SYSTEM

This section overviews state transportation policies and identifies how these policies form the basis for the selection of evaluation criteria and a ranking methodology. A proposed rating system, including evaluation criteria and calculation of a priority index are also discussed.

STATE TRANSPORTATION POLICY

Since 1988, the Washington State Legislature has revised state transportation policy significantly. In fact, a new chapter was added to the Public Highways and Transportation Title, RCW 47.06. This chapter specifies the following functions as part of WSDOT's role in transportation planning:

- ongoing coordination and development of statewide transportation policies that guide all Washington transportation providers
- ongoing development of a statewide multimodal transportation plan that includes both state-owned and state-interest facilities and services
- coordination of state high-capacity transportation planning and regional transportation planning programs
- conducting special transportation planning studies that impact state transportation facilities or relate to those of statewide significance

Mobility project prioritization is to be related to state transportation goals directly. Policy documents associated with the first legislative task have directly informed this study in developing a new ranking methodology and in selecting evaluation criteria. The second task of developing the statewide multimodal transportation plan ultimately served as the project screening process for this study.

The State Transportation Policy Plan is an ongoing, joint effort on the parts of the WSTC and the state legislature. The policy plan sets forth a vision and statewide transportation goals consistent with state growth management mandates. Because this is an evolving document, the underlying planning and programming processes must be flexible enough to respond to legislative direction.
STATE TRANSPORTATION POLICY PLAN GOALS

PROTECTING OUR INVESTMENTS
1) Preserve and maintain transportation systems needed today and in the future.

PERSONAL MOBILITY
2) Provide personal mobility choices for urban, rural and intercity travel that are safe, reliable, affordable, and convenient.
3) Provide access to employment, commerce, education, health care, recreation, heritage resources, and social opportunities.
4) Provide facilities and services to make transfers between modes efficient and effective.
5) Reduce the impacts of congestion on personal mobility.
6) Reinforce a sense of Washington as a statewide community.

TRANSPORTATION SUPPORT FOR ECONOMIC OPPORTUNITY
7) Provide access that is safe, reliable, affordable, and convenient to industrial, commercial and intermodal sites for people, goods, and services.
8) Support domestic and international trade.
9) Support Washington’s business and industry.
10) Reduce the impacts of congestion on freight mobility.

ENVIRONMENTAL PROTECTION AND ENERGY CONSERVATION
11) Design new and improve existing transportation systems to avoid the disruption and degradation of the natural environment and heritage resources; work toward systems that are aesthetically pleasing and energy efficient.
12) Conserve scarce resources.
13) Reduce pollutants from transportation systems.

WORKING TOGETHER

Develop an institutional framework for transportation that:

14) Encourages opportunities for public-private partnerships.
15) Promotes greater sharing and coordination of technical expertise and services between state and local governments.
16) Promotes mutual understanding and public participation in transportation decision making.
17) Facilitates interjurisdictional and regional coordination.
18) Integrates land use planning and transportation planning.
19) Supports innovative research and development.

TRANSPORTATION FINANCE
20) Ensure funding to responsibly achieve the state’s transportation goals.

Exhibit 1. State Transportation Policy Plan Goals (WSTC, 1994)
Evaluation criteria presently recommended for the new methodology respond directly to overall goals and specific policies associated with delivery of the WSDOT's Urban and Rural Mobility program. Broadly defined, the program goal is to ensure mobility alternatives that afford safe, reliable, convenient access to employment, educational, recreational, cultural, and social opportunities in both urban and rural environments.

Specifically, state policy emphasizes regional coordination in the planning and delivery of transportation programs, in the safe and cost-effective movement of people and goods over vehicles in planning capacity improvements, and in promoting cost-effective alternatives to SOVs (including transportation demand management and transportation system management). As discussed, WSDOT's highway improvement program for state-owned facilities is sub-divided into four categories:

- Mobility
- Safety
- Economic initiatives
- Environmental retrofit

Many policy objectives in one sub-program may have implications for the program decisions in another. The complete list of general policy plan goals is provided in exhibit 1. This list is representative of the comprehensive documentation used in developing the evaluation criteria. In addition, Mobility sub-program policy objectives are detailed in exhibit 2.

To meet these policy objectives, the new prioritization ranking methodology and evaluation criteria must be flexible and must clearly prioritize projects that

- emphasize the movement of people and goods
- promote alternatives to SOVs
- facilitate smooth intermodal connections
- provide safe, reliable, efficient, convenient access
GOAL: PERSONAL MOBILITY

Urban Mobility Policies

Require regional coordination in the planning and delivery of transportation programs in urban areas.

Emphasize the movement of people and goods, rather than vehicles, in planning for capacity improvements to a regional transportation system.

Provide for cost-efficient alternatives to one-person vehicles, including transit and ridesharing, to ensure a high level of mobility.

Require land use planning and development to be coordinated with state, regional, and local transportation planning and investments.

Recognize demand management (parking fees, toll roads, flex-time, peak travel restrictions) as a major strategy to reduce congestion.

Require transportation improvements to be made reasonably concurrent with economic development, so economic growth does not contribute to the deterioration of existing transportation services.

Provide flexibility for different urban regions to adopt their own specific solutions to urban mobility problems.

Determine and provide the desirable levels of accessibility for the elderly and persons with disabilities.

Rural Mobility Policy

Provide effective and efficient rural transportation systems.

Coordinate the delivery and funding to federal, state, and local rural public transportation programs, integration social service, health care, and transportation objectives.

Establish and operate intermodal connection terminals at the community level.

Provide desirable levels of accessibility for the elderly and persons with disabilities.

Emphasize the movement of people and goods.

Exhibit 2. State Transportation Policy Plan Objectives Associated with Urban and Rural Mobility Sub-programs (WSTC, 1994)
• reinforce development patterns that reflect regional and local growth management objectives
• avoid or reduce disruption and degradation of the natural environment and heritage resources
• are energy efficient
• are consistent with state, regional, and local comprehensive plans
• are cost-effective

PRIORITIZATION METHODOLOGY

Any prioritization methodology contains several important components, the most basic of which are a formal ranking methodology (i.e., mathematical algorithm) and a set of evaluation criteria. In addition to being flexible enough to accommodate changing goals, the ranking methodology must operate independently of the evaluation criteria. Evaluation criteria should reflect state policy goals and objectives, should be measurable, and should have data requirements that are not unreasonable.

The first step in the prioritization process (figure 5) is the submission of project requests from WSDOT districts each of which is accompanied by a project description sheet (Appendix D). Project requests must address a need identified in the Statewide Systems Plan. As such, the financially constrained Systems Plan for Highway Improvements functions as the statutory screening criterion. Project requests that are not in the Systems Plan are not considered for prioritization in the current biennium. Evaluation criteria parameters are calculated for eligible proposals in five major categories: cost efficiency, community support, environmental impact, mode integration, and land use. Project requests are ultimately ranked by means of a mathematically derived priority index.

Each ensuing step (2) project screening, (3) application of project evaluation criteria, and (4) application of the ranking algorithm is discussed in the following sections.
Screening Criteria

There are two elements in the state-owned facilities component of the statewide multimodal transportation plan: a state highway system plan and a state ferry system plan. The state highway system plan identifies needs and recommends specific, financially feasible improvements to preserve the highway system's structural integrity, to ensure acceptable operating conditions, and to provide enhanced access to scenic, recreational, and cultural resources. The state highway system plan contains the following elements (RCW 47.06, 1994):

System Preservation – establishes structural preservation objectives, identifies current and future deficiencies, and recommends program funding levels and specific actions

Capacity and Operational – establishes operational objectives, identifies current and future deficiencies, and recommends program funding levels and specific improvements
Scenic and Recreational Highways – identifies and recommends designated routes, provides enhanced destination access, and recommends management strategies

Paths and Trails – identifies non-motorized needs

The Capacity and Operational element functions as the statutory screening criterion in the Urban and Rural Mobility categories. All proposals that provide recommended improvements from the financially constrained plan pass the initial screening. Because the state highway systems plan must meet air quality conformity requirements, any proposal that worsens air quality in non-attainment areas fails the initial screening. It is further expected that project submittals generated from the within the WSDOT for each biennium will focus on addressing existing deficiencies. However, if outside agencies, such as metropolitan planning organizations, wish to address anticipated, as opposed to existing, deficiencies, the WSDOT will consider those proposals nonetheless.

Evaluation Criteria

Evaluation criteria may be continuous (e.g., benefit-cost analysis), or categorical (e.g., yes/no questions or placement by type). Evaluation criteria and the statewide policy objectives served are overviewed in the following sections. Appendix E contains detailed worksheets and scoring guidelines. Evaluation criteria are grouped into five major categories: cost efficiency, community support, environmental impact, mode integration, and land use.

Cost-Efficiency

The State Transportation Policy Plan (hereafter referred to as the Policy Plan) clearly suggests that project selection be based on relative cost-efficiency in moving people and goods. Although there are many ways to measure cost efficiency, many would not be useful for the prioritization process or they would entail an excessive data collection burden and significant error accumulation. For this study, the following types
of measures were considered, but not selected, for use: sufficiency ratings, level of service standards, and traditional cost per unit of interest criteria. These measurements were not recommended because they capture capital costs but do not account for the monetary value of benefits. Thus, traditional prioritization methods systematically underestimate transportation investments' contribution to economic growth and productivity (Lewis, 1991). Another drawback of traditional prioritization criteria is that they cannot be uniformly applied to improvements that span multiple modes. Therefore, the PCIS pursued a single, continuous measure of project worth aimed at assessing progress toward state economic objectives. These objectives encompass provision of personal and commercial mobility that is safe, reliable, accessible, and efficient.

The research team selected the measurements of net present value, benefit-cost ratio, and net present value-cost ratio as potential criteria for several reasons. First, these measures can be related to the Policy Plan directly and easily. Second, these criteria can be quantified on the basis of data already available. Third, input data for the calculations can be refined incrementally as the management systems required under ISTEA are implemented. Furthermore, the criteria selected for consideration can be applied to all types of mobility projects.

Alternative investment-choice measures such as rate-of-return (the discount rate at which net present value (NPV) is zero) and annual cost to sufficiency rating comparisons were not selected because of their major flaws. First, the rate-of-return is subject to mathematical anomalies (White et. al, 1989). Second, it is an unnecessary measure because the minimum rate-of-return is assured by considering NPV to rank alternatives since it is noted that investments are only considered economically worthwhile when the NPV is positive. Third, these measures are not direct benefit assessments. Moreover, NCHRP Report #342 has concluded that "all the evidence, both theoretical and actual experience, indicates that sufficiency ratings, volume-to-capacity criteria and cost-
effectiveness tests do a poor job of helping decision makers find the most economically worthwhile transportation policies and projects. (Lewis, 1991)

In summary, net present value, the benefit-cost ratios, and net present value-cost ratios are the three most informative measures when prioritizing independent projects under financial constraints. Each of these criteria are defined below.

Defining the Criteria

1). Net Present Value (NPV)

NPV can be computed once the benefits and costs have been identified. In general, projects are considered economically efficient when the NPV is positive. Net present value is given by the following equation:

\[ \text{Net Present Value} = \text{Present Value of Benefits} - \text{Present Value of Costs} \]

Projects with higher NPV are assigned a greater value than those with lower NPV. In theory, projects with a high NPV return more to society than do similar projects with a low NPV. So, in calculating the final rankings, NPV would need to be maximized. The NPV criterion is limited by the implicit assumption that the program's capital resources are unlimited (Lewis, 1991). This limitation is due to the fact that the greatest combined NPV (per dollar invested) cannot be ascertained by linear NPV ranking alone.

2). Benefit-Cost Ratio (B/C)

Planners calculate B/C by simply dividing the present value of project benefits by the present value of project costs.

\[ \text{Benefit Cost Ratio} = \frac{\text{Present Value of Benefits}}{\text{Present Value of Project Costs}} \]

In general, projects are considered economically efficient when the B/C is equal to or greater than one. Like NPV, B/C can be computed for any project once benefits and costs have been identified. The B/C would also need to be maximized in the final ranking algorithm. However, unlike NPV, B/C is not a calculation of net worth and can be optimized by means of a descending linear ranking alone. As such, B/C is often limited by a narrow range of computed benefit-cost ratios, which makes it difficult to differentiate among projects.
3.) Net Present Value-Cost Ratio (NPV/C)

The NPV/C represents the net benefit expected per dollar of capital investment, given by the following equation,

$$NPV - Cost\ Ratio = \frac{（Present\ Value\ of\ Benefits - Present\ Value\ of\ Costs）}{Present\ Value\ of\ Costs}$$

NPV/C analysis has been characterized as a search for the biggest "bang for the buck" (Lewis, 1991). This criterion implies a prioritization method that would ration capital under financially constrained programming scenarios by a linearly descending NPV/C rank order. Like NPV and B/C, the NPV/C ratio would need to be maximized in the final ranking.

Selecting the Criteria

Selecting the appropriate criteria depends on budgetary constraints and on whether projects to be compared are independent or mutually exclusive (Wright, 1979). Because transportation funding is scarce, project prioritization is necessary to make the best choices amid difficult tradeoffs. WSDOT has required that proposals must be independent submittals. In other words, no project is an alternative "version" of another; each addresses a wholly separate need. This independence affects the criteria selection process by requiring evaluation measures that differentiate among projects enough to support program tradeoffs. Ideally, a group of related projects would be selected in coordinated fashion for maximum program value within given budget constraints.

NPV is the best single indicator of economic merit for guiding investment choices where the goals are to reduce congestion and delay, diminish vehicle operating costs, enhance safety and environmental conditions, and to increase business and industrial productivity (Lewis, 1991). To enable program building based on cost-efficiency using net present value, it is necessary to optimize NPV within the budget limits. However, WSDOT's objectives extend beyond superficial costs and encompass hidden costs and benefits insofar as they incorporate alternative mode promotion, intermodal design, growth management, non-monetizable environmental impacts, and community support. Therefore, the ranking algorithm developed in this study aims to include quantitative
measures of project impacts that cannot be assigned a consistent monetary value. While
cost-efficiency is a major WSDOT objective, the final prioritization is not based on
economic criteria alone. A cost-efficiency optimization routine would select a group of
projects within the budget limit in order to summarily provide the greatest NPV but it
would not rank the projects. Thus, NPV was eliminated from further consideration
because it isn't feasible to accommodate an optimization routine within the preferred ranking
algorithm.

Alternatively, NPV/C and B/C ratios may both serve as measures of worth that
can also allow linear ranking of projects which, unlike standard optimization routines
applied to project NPV, eliminate any possibility of discrimination against proposals with
unusually high project costs. As previously described, NPV is the most comprehensive
measure of productivity and economic merit. Of course, the NPV/C ratio retains these
advantages. However, B/C ratio has an advantage over the NPC/V ratio in that the B/C
ratio is more easily understood. The B/C ratio is a suitable approximation of the present
worth per dollar invested. For these reasons, the researchers selected B/C as the most
appropriate measure of cost efficiency for the PCIS. B/C provides adequate
differentiation between generally cost-efficient projects (B/C>1.0), despite the fact that
B/C is a gross measure of benefit per dollar invested, while NPV/C ratios more accurately
represent actual project worth (per dollar invested).

**Computing the Criteria**

Most important in calculating costs and benefits is first defining the project’s
costs and benefits. A discount rate and an analysis period must also be selected.
Accuracy depends on consistency in computations. To address the need for accuracy,
WSDOT appointed a Technical Advisory Committee (TAC) to determine appropriate
unit values and to ensure consistency in benefit computations (the role of the TAC is
detailed on pages 60-61 of this report).
WSDOT staff must compute standardized cost estimates for each proposal. It is not always clear in the existing WSDOT method whether all submitted cost estimates reflect consistent analytical methods. Addressing this concern by ensuring consistency is the purpose of the recommended project sheets, which clearly identify the costs that should be factored into the proposal. Costs are grouped into four major categories:

1. Construction (including right-of-way)
2. Environmental retrofit
3. Preliminary engineering
4. Annual operating and maintenance costs

Within the construction cost category, the researchers assume that environmental analysis, mitigation costs, and right-of-way expenditures are included. The WSDOT has singled out environmental retrofit costs to indicate proposals that must address pre-existing environmental impacts. There is a separate environmental retrofit program intended to fund this type of work; therefore, these costs should not be a part of the cost efficiency calculation. When possible, funds to pay for environmental retrofitting should be transferred to the Mobility program, so that project rank is not negatively affected.

In the previously existing Category C formula, annual operating and maintenance costs were calculated as 15 percent of project costs. In the future, these cost estimates should be provided by the district that submitting district, and they should be based on historical trends in the region.

Benefits must also be treated consistently across projects, in terms of both categorization and application. Benefit calculations should take into account the categories used in traditional benefit-cost analysis:

- accident savings
- user cost savings
- travel time savings

Travel time savings and accident savings together typically account for more than 80 percent of transportation benefits. This combination ultimately raises productivity and
economic output by reducing work time losses. Though accident savings and user cost savings were already included in the existing Category C prioritization process, the new, recommended process described herein builds on these calculations by including travel time savings and by estimating user cost savings on an hourly basis. Estimates of travel time savings and user cost savings were combined into a single procedure based on volume-to-capacity ratios over 20 years. This modification to the traditional method has the advantage of reducing the repetitious burden of calculating user cost savings per project. The traditional method does not differentiate one project proposal from another significantly, except by length.

Including travel time savings as a monetary benefit is complicated because it requires assigning a monetary value to time. It is further complicated by the need to distinguish between personal and commercial time expenditures. Vehicle occupancy for each project must be considered to account for time accurately, and to faithfully reflect the movement of people and goods. In the short-term, WSDOT has defined statewide estimates of average value of travel time differentiated by trip purpose (e.g., general vs. commercial travel) and average vehicle occupancy, by trip purpose, region, and facility type (e.g., non-commercial travel in HOV vs. general purpose lanes) where more accurate local counts are not available. In the long term, as traffic management systems become operational, the occupancy parameter could be computed on the basis of observed values.

Benefit-cost analysis also requires future volume estimates. Although future volumes have been calculated for many WSDOT projects in the past, they have not been used for prioritization.

Because of the debate over their value and appropriateness, other significant, non-quantifiable costs associated with transportation projects are not typically monetized. The following four recommended categories of criteria are included in the mobility prioritization framework to ensure that these important impact areas and benefits are taken into account: community support, environmental impact, mode integration, and
land use. As new methods become available, these presently non-monetized costs and benefits should be incorporated into the cost-efficiency calculation.

**Community Support**

Community support has always been central to the WSDOT's screening process for proposals. Accordingly, it was addressed specifically on previous WSDOT category C submittal forms. The statewide twenty year Systems Plan is subject to substantial public comment and participation throughout the planning process. As described in the previous section, the Systems Plan will be used a statutory screen for prioritization. However, strong community support for proposals cannot always be taken for granted in programming. Moreover, state transportation policy goals generally emphasize cooperation, economic development, and shared financial responsibility. This category of criteria is aimed at gauging community support and potential local impacts.

The community support criteria reflect the following state policy objectives: 1) public-private partnerships; 2) access to employment, commerce, education, health care, recreation, heritage resources, and social opportunities; and 3) transportation decision making characterized by mutual understanding and public participation. The community support category of criteria evaluates the magnitude of financial contributions and endorsements from other agencies. In so doing, extra emphasis is placed on interjurisdictional coordination otherwise assessed in the land use category. While assessing local government support in both categories could be considered "double counting", the WSDOT Program Management staff and the Washington State Transportation Commission deemed it critical to include each proposed measure.

Community support criteria consist primarily of categorical questions regarding public and private participation, endorsement (or opposition), disruption of cohesive neighborhoods, and physical displacement. These yes/no categorizations are supplemented and scaled by means of qualitative assessments. The criteria specifically promote:
• projects with minimal or no opposition
• official endorsements
• financial involvement of private sector, special programs, and local governments
• preservation of existing access within neighborhood and business areas
• communication with the public

Points are accrued by project proposals that displace homes, farms, or businesses, while points are withheld from proposals depending upon the percentage of contributed financing. Points are assigned categorically regarding formal endorsements and division of identifiable neighborhood, school, or business service areas. The total community support score is the sum of points accrued in this category and will be minimized in the final ranking algorithm. Thus, projects with the most community support and the least physical impact receive lower total scores than projects that are insensitive to local sentiment and conditions. Appendix D provides detailed worksheets and scoring guidelines.

**Environmental Impact**

Transportation policy objectives in Washington state aim to avoid or minimize damage to the natural environment and heritage resources, and to favor energy-conservative transportation strategies. Other state and federal guidelines such as ISTEA, state and federal clean air acts and amendments, the National and State Environmental Policy, and the 1990 Washington State Growth Management Act further support State Transportation Policy Plan goals. This legislation requires systemic consideration of environmental factors before committing to transportation improvement projects. However, historically, environmental impacts were not assessed until after prioritization and approval (Washington, 1992). Washington state law, RCW 47.01.280, now requires that WSDOT involve the relevant permitting agencies in the project scoping phase, a requirement intended to avoid cost overruns and delays due to unforeseen environmental
problems. Sketching potential environmental impacts at the outset of project development and getting preliminary permit approval should result in an impact assessment accurate enough to use for prioritization. Thus, environmental criteria are critical to programming proposals based on relative merit in a manner consistent with state policy.

The environmental criteria address wetland encroachment, water quality and resource related permitting, and noise impacts. The selection of only these topic areas does not reflect any oversight of other environmental concerns. Rather, the researchers focused on these three areas because they are generally the most controversial, the most closely regulated legislated, and most potentially expensive impacts of transportation projects that can be readily quantified.

Air quality and energy conservation criteria are obviously absent from this category of criteria, but not for lack of consideration. During Phase II of the prioritization study, researchers tried to develop air quality evaluation criteria applicable to mobility projects statewide. However, data requirements for air quality assessment are enormous, and exceed either (a) current database capabilities, or (b) programming budgets statewide. Manual estimation of air quality impacts were not comprehensive and were unreliable because air quality is sensitive to individual pollutant concentrations. Modeling must be based on projected vehicle type, speeds, volumes, and atmospheric conditions. Consequently, the programming process depends on the 1991 Washington State Clean Air Act “Conformity Rule,” which requires that WSDOT and the Washington State Department of Ecology ensure that transportation plans, programs, and projects conform to the State Implementation Plan. Because the conformity rule applies to the Systems Plan, the screening process will exclude any proposal expected to have negative air quality impacts from prioritization.

The cost efficiency and mode integration categories of criteria will serve as indirect measures of relative energy efficiency. Proposals that promote alternatives to
SOV travel, improve the operating efficiency of the transportation system, and decrease congestion will be favored in these categories. Energy efficiency will also be favored in the land use category. If concurrent land use and GMA goals are implemented, short auto trips may be reduced and replaced by nonmotorized access to local services in dense urban areas.

The environmental criteria in the new methodology serve the following WSDOT policy objectives: 1) to support federal and state “no net loss” policies by protecting, restoring, and enhancing natural wetlands adversely impacted by transportation related construction, maintenance, and operations; 2) to minimize and control levels of harmful pollutants generated by transportation activities from entering surface and ground water resources; 3) to protect, restore, and enhance, where feasible, fish and wildlife habitat and populations within transportation corridors; 4) to avoid, minimize, or mitigate impacts of transportation projects on heritage resources; and 5) to minimize noise impacts from transportation systems and facilities. The scoring process and proposed evaluation criteria for the environmental sub-categories (wetlands, water quality and permitting, and noise) are described below.

Wetlands

This category is designed to assess proposed projects’ likely encroachment on classified wetlands and associated buffers in accordance with federal, state, and local regulations. The wetlands evaluation criteria begin with a categorical question that requires further quantification of wetland acreage only if wetlands are identified within 300 feet of either side of the proposed project. The 300-foot distance is based on a statewide buffer zone requirement for Class I wetlands. Detailed definitions and scoring guidelines are provided in appendix D. The wetlands criteria favor the following:

- advance project planning
- avoidance of classified wetlands
- “no net loss” of state wetland area
Points accrue based on (1) the actual wetlands acreage likely to be affected by project construction, and (2) a multiplier that reflects Washington State Department of Ecology and GMA-mandated replacement ratios (EPM, 1993). The total score reflects calculations in each of four wetland categories and the associated buffers category. The final ranking algorithm minimizes the wetlands score so that projects with minimal or no net impacts (low scores) rank favorably.

**Water Quality and Permitting**

The criteria in this sub-category have two purposes: (1) to assess potential watershed impact, and (2) to measure the risk and staff time associated with the permitting requirements for proposed projects. The evaluation criteria consist primarily of categorical questions regarding the project's proximity to sensitive areas, resource lands, waterways and sources. The total impervious surface area of the project proposal within 2000 feet of any body of water is measured and scored. Point assignment is variable and depends on the relative risk per item or duration of associated permit review. Appendix D provides detailed definitions and scoring guidelines. The criteria favor

- advance project planning and environmental review
- interjurisdictional coordination
- avoidance of sensitive areas and water sources
- minimization of total impervious surface area

Points are accrued by all proposals slated to be built within sensitive areas, managed resource lands or heritage resources, and federally designated floodways or sole source aquifer areas. The measures are very conservative, for example, the impervious surface area score is based on maximum pollutant filtration estimates. However, the score may be split in half if all permitting agencies have been contacted, and if no foreseeable conflicts or disagreements are anticipated. If a required permit has already been obtained for the project's expected duration, then no points are assigned for that particular measure and the issuance date is recorded. Consequently, projects that avoid watershed impacts
and that have preliminary environmental agency approval receive lower scores than do roadway expansions in sensitive areas with uncertain permitting prognoses. Water quality and permitting scores are minimized in the final ranking algorithm.

**Noise**

This sub-category is aimed at assessing potential noise impact and the associated costs and risks for project implementation. Accordingly, the criteria favor

- transportation system management without lane expansion
- avoidance of significant traffic noise impacts
- mitigating retrofit of existing impacts

The proposed evaluation criteria begin with a categorical question that requires documentation of the feasibility, reasonableness, and cost of mitigation measures where there are existing noise impacts on-site. The number of receptors within a 200-400 foot perimeter of the proposed roadway are then detailed in the criteria. This variation in distance is based on whether the proposed roadway is new or existing. The difference is justified on the basis of ambient noise levels due to existing traffic and acoustics. The criteria quantify a noise level risk factor that grades potential noise impacts associated with a proposed project. The risk factor is based on the number and proximity of receptors per type of improvement (new or existing roadways). Geographic variability and specific decibel estimates are not factored into the noise criteria because the time and cost associated with such measurements would make this infeasible. Appendix D provides detailed definitions and scoring guidelines for the recommended criteria.

Points are assigned based on the calculated risk along the proposed project distance. The total score is the sum of scores for each receptor category, and is minimized in the final ranking algorithm. Urban or rural projects that propose significant road widening or lane additions near multiple receptors receive higher scores than projects that avoid roadway expansion and maintain existing setbacks from homes,
businesses, and schools. Consequently, most projects likely to result in increased traffic volumes and speed rank poorly in this sub-category.

**Mode Integration**

Washington state's transportation policy aims at development of a multi-modal transportation network that (1) facilitates smooth intermodal connections for people, goods, and (2) services and promotes alternatives to single occupancy vehicle (SOV) travel. It therefore follows that projects promoting SOV alternatives, such as park-and-ride lots, intermodal terminals and HOV lanes, should be prioritized over projects that add only SOV capacity. Moreover, ISTEA requires more multimodal planning on the part of state departments of transportation. The research team thus developed mode integration criteria (originally referred to as a systems attribute index) to encourage multimodal characteristics in every project.

These evaluation criteria consist of categorical (yes/no) questions designed to check for the existence of multimodal attributes. The criteria specifically favor

- more efficient use of existing capacity,
- connectivity between existing systems,
- integration of modes, and
- better packaged projects.

Points are withheld from proposals that encourage multimodal integration, support intermodal freight transfers, include non-motorized facilities, support or extend HOV system development, link or extend the network of SOV alternatives, and preserve existing roadway capacity by means of TSM or TDM. The total mode integration score equals the sum of points accrued on the worksheet for this category (see appendix D) and is minimized in the final ranking algorithm. Consequently, projects that optimize existing capacity and improve alternative mode integration are scored lower than projects aimed at SOV travel.
Land Use

State policy objectives for mobility reflect land use and growth management mandates. State policy clearly emphasizes that projects should reflect specified, long-term growth patterns, provide convenient, multimodal accessibility, and better integrate land use and transportation planning. To meet these objectives, evaluation criteria must assess the following factors:

(1) accessibility
(2) the degree to which proposals support local and regional growth management goals;
(3) consistency with state, regional, and local comprehensive plans; and
(4) sensitivity of roadside and adjacent land use design to SOV users.

Accordingly, a set of land use criteria was developed.

These land use criteria combine categorical (yes/no) questions regarding site location and transit routes with a required synthesis of associated regulations/standards dictated by local governments adjacent to the project limits. These land use criteria specifically encourage

• coordination between WSDOT engineers and local planners,
• convenient accessibility for transit,
• connectivity between urban activity centers, and
• consistent transportation planning.

Points are awarded for proposals designed for existing or planned transit thoroughfares, and/or to connect areas of mixed-use or high intensity commercial use. Points are also awarded for district completion of a land use checklist for every jurisdiction through which the proposal would pass. The screening criteria are quantified in this category such that points are assigned for projects consistent with local comprehensive plans. Proposals that address improvements not identified on state or regional transportation plans are, by definition, fatally flawed; as such, the screening criteria exclude them from prioritization as previously described.
The land use score equals the sum of points accrued on the worksheet for this category (see appendix D). The total score is maximized in the final ranking algorithm. Consequently, projects that better integrate land use and transportation improvements will receive higher scores than projects designed without regard to such goals.

**Calculation of Priority Index**

There are many mathematical methods for ranking projects. However, ranking groups of projects that are independent and exclusive of the previous set from biennium to biennium, and that may be composed of very different improvement types, presents a unique problem. In any given biennium the "best" and "worst" projects depend on the composition of the composition of that particular group, as well as on current policy objectives. Two methods for ranking projects are discussed below.

**Theoretical Comparisons of Ranking Algorithms**

The first ranking method considered is based on defining a standard by which any project can be measured for any given programming cycle. Such a standard does not vary from year to year; therefore, proposals submitted in any biennium are evaluated by the same standard. This approach is attractive because of its simplicity. However, determining a "standard" for projects that might be very different in composition would be difficult, if not impossible. In addition, policy changes would logically necessitate changes in the evaluation standards.

The second method considered and ultimately selected, for this prioritization study, is the assembly of a hypothetical "ideal" project made up of the best characteristics of all the proposals for each cycle. A "least desirable" project is similarly established. The "least desirable" project, for example, would be characterized by:

- the lowest cost-benefit ratio,
- the highest community support score,
- the highest wetlands score,
- the highest water quality and permitting risk score,
- the highest noise impacts risk score,
- the highest mode integration score, and
- the lowest land use score.

The ranking algorithm then ranks proposals according to their "distance" from the hypothetical ideal and negative-ideal projects for that biennium.

This method is appealing for several reasons. First, it is flexible. The ranking algorithm is independent of the criteria, in other words, any criteria can be used to rank projects. Criteria can be modified or expanded easily to reflect changes in transportation policy each biennium. Second, this methodology allows planners to more closely scrutinize projects with relatively similar total scores. This method eliminates the current formula's "integer" effect by relying on computed distance from the ideal project as the means of calculating priority. However, the project ranking is sensitive to changes in the input set. (See Appendix B for discussion of the mathematical basis for the prioritization calculation.)

Once the priority index has been computed, projects may be sorted in descending order. That is, proposals with a higher priority index value are ranked (sorted) higher than those with a lower priority index. Index calculation is described more fully below.

**Priority Index Calculation**

Priority index calculation is summarized in Figure 6. The first step is to derive the evaluation scores (e.g., B/C, community support score, etc.) for each proposal. The next step is to enter these values into a standard Excel spreadsheet. TOPSIS-6, the ranking algorithm, is then executed from the main menu. TOPSIS-6 is a macro that operates within Excel. TOPSIS-6 calculates the priority index and saves the project title and associated index in a file specified by the user. When the user opens this file, projects appear sorted in descending rank order. The program then prompts the user to input a budget limitation for the programming cycle. TOPSIS-6 responds by calculating,
the list of projects that may be funded according to that budgetary scenario in exact rank order.

The TOPSIS-6 macro is written to accommodate any number or type of criteria, which allows for easy expansion or modification. Both Macintosh and PC versions are available. Appendix A contains a more detailed discussion, along with an illustration of TOPSIS-6 macro execution. Appendix C contains a step-by-step explanation of the TOPSIS-6 code.

![Diagram of Mathematical Ranking Process]

Figure 6. Mathematical Ranking Process
IMPLEMENTATION

The second half of Phase III focused on assisting the WSDOT in implementing the new prioritization methodology for the 1995-97 biennium. This section describes the process of weighting the proposed evaluation criteria and overviews the trial application of the methodology to past category C projects. Results from the 1995-97 programming cycle are also described. Conclusions and recommendations based on Phase III observations follow.

SENSITIVITY ANALYSIS AND CATEGORICAL WEIGHT ASSIGNMENT

Evaluation criteria were weighted by means of a Delphi analysis conducted by the WSDOT Program Management Division. Participants were geographically balanced and selected from planning, project development, and local programs. Representatives included two WSDOT district administrators, three assistant secretaries, three WSTC Commissioners, and the Transportation Improvement Board executive director. The results of three rounds of discussion and weight assignment (informed by sensitivity analysis for each category), were later adopted by the WSTC, which was responsible for establishing the final weights. Table 8 summarizes the final weights for the 1995-97 biennium.

Sensitivity Analysis Results

Six weighting scenarios were analyzed prior to the delphi analysis session. The purpose of the sensitivity analysis was to demonstrate the significant range of category weights. The six weighting scenarios are summarized below:

(1) Cost-efficiency criteria receive 70 percent of the weight; the remaining 30 percent is equally divided among the other four categories.

(2) Community support criteria receive 70 percent of the weight and the remaining 30 percent is equally divided among the other four categories.
Table 8. Final Weight Assigned to Evaluation Criteria Categories (WSTC, 1993)

<table>
<thead>
<tr>
<th>CRITERION / POLICY GOAL</th>
<th>WEIGHT</th>
</tr>
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<tbody>
<tr>
<td>COST EFFICIENCY</td>
<td>0.65</td>
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<tr>
<td>SAFETY</td>
<td></td>
</tr>
<tr>
<td>FREIGHT/GOODS</td>
<td></td>
</tr>
<tr>
<td>ENERGY CONSERVATION</td>
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<tr>
<td>HIGH OCCUPANCY VEHICLES</td>
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<td>ENVIRONMENT</td>
<td>0.08</td>
</tr>
<tr>
<td>WETLANDS</td>
<td></td>
</tr>
<tr>
<td>WATER QUALITY/PERMITTING</td>
<td></td>
</tr>
<tr>
<td>NOISE</td>
<td></td>
</tr>
<tr>
<td>MODE INTEGRATION</td>
<td>0.07</td>
</tr>
<tr>
<td>LAND USE</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>1.00</strong></td>
</tr>
</tbody>
</table>

(3) 70 percent of the weight is divided equally among the three environmental criteria, and the remaining 30 percent is divided equally among the remaining four categories.

(4) Mode integration criteria receive 70 percent of the weight; the remaining 30 percent is equally divided among the other four categories.

(5) Land use criteria receive 70 percent of the weight; the remaining 30 percent is equally divided among the other four categories.

(6) Each category is assigned a weight representing the average compiled from a questionnaire distributed among WSDOT district program managers and staff as follows:

Cost efficiency=46%, Community support=18%, Environment=15%, Mode integration=11%, & Land use=10%.
The analysis was carried out on test data from category C submittals from the 1993-95 biennium. The researchers were able to track projects by type, district, and previously calculated rank (based on the category C cost-effectiveness and rating factor formula).

Results of the weighting scenarios applied to both urban and rural project lists showed that if ~50-70 percent of weight (with the balance of the weight divided equally) were applied to a single category, such as cost efficiency, the remaining four criteria categories would have minimal effect on the resulting rank order. However, further investigation showed that if the remaining criteria combined for a negative weight greater than 30 percent, then the effect on the ranking would be noticeable, but not dramatic. For example, it was fairly common under this type of scenario for projects to appear in locally reverse order (i.e., a project ranked #7 switching places with #8 while a project previously ranked #9 may appear as #6). In only one case did a score from a single category with less than 10 percent of the weight affect the final project ranking significantly (this outcome was due to a relatively extreme level of wetlands impact).

Following the Delphi analysis session, two additional weight scenarios from the second and final rounds of the session were analyzed in the fall of 1993. These additions produced no unusual deviations from the previous sensitivity analysis. Each transportation commissioner was provided the complete analysis package prior to public discussion and the motion to adopt the weights.

**Delphi Decision-making Technique**

Because the evaluation criteria assessed potentially conflicting objectives, it was important to structure the decision-making process such that the participants could deal with the weight assignment as a single unit. The Delphi technique is recognized as an effective means of building consensus within a single group of divergent interests. The technique provides for comparison of group judgment and individual contributions, for an opportunity for individuals to discuss and revise their views, and for a degree of anonymity. The Delphi process as utilized by WSDOT is outlined below.
The researchers first led a combination presentation-discussion on established WSTC goals and objectives for the Urban and Rural Mobility program. The proposed evaluation criteria were also discussed. Participants were instructed to assign category weights individually. Individual weight assignments were then summarized and redistributed to the participants. The mean, median, and standard deviation of the group responses were provided. Participants discussed desired policy direction and implementation as documented in appendix H. This feedback process was repeated twice—until a satisfactory standard deviation and degree of individual comfort were achieved. The Delphi technique itself was effective in moving the participants toward a fairly strong consensus. The final round of criteria weights from the Delphi session were later adopted by the full WSTC.

IMPLEMENTATION ASSISTANCE TO WSDOT

UW TRAC researchers assisted WSDOT in implementing the new prioritization methodology for the 1995-97 biennium. Their role entailed active participation in the technical advisory committee and a review of the final results. The researchers also assisted district staff in gathering the new data required for the methodology. The TRAC team conducted and attended several training sessions and criteria review sessions. Finally, the researchers reviewed the results of the first application of the methodology, (figures 7 and 8). Implementation of the methodology at WSDOT took one year. Implementation was preceded by a trial application on past category C projects. This trial, described below, was a full-scale test to verify that the criteria were reasonable and to assess the sufficiency of statewide databases. A presentation of the technical advisory committee's critical role and 1995-97 results follows.

Criteria and Database Assessment

As with any new set of evaluation criteria, it was important to determine that the prioritization criteria were feasible for application and assessment. Prior to all other
1995-97 Biennium Statewide Ranking Results: I1-Urban Mobility Program

Figure 7. Statewide Prioritization Urban Mobility Program, 1995-97
Figure 8. Statewide Prioritization Rural Mobility Program, 1995-97
aspects of implementation, a full-scale test of the recommended methodology was conducted on a complete set of category C 1993-95 biennium proposals provided by WSDOT. All additional data necessary for the new methodology was gathered for each project statewide. Ensuring that data collection for the criteria categories would not be unduly expensive or time-consuming was a primary concern. The trial application of the new prioritization criteria and methodology was a successful test of the ranking algorithm and criteria on traditional mobility projects, and this primary goal was ultimately achieved.

In the process, however, the researchers changed to the original criteria in the categories of water quality, air quality, wetlands, and land use substantially in order to reduce double counting and to improve the scoring framework. For example, the investigators eliminated the air quality criterion originally proposed in Phase II because it oversimplified mobile source analysis and was only sensitive to carbon monoxide pollution. Moreover, conformity rules of the 1991 Washington State Clean Air Act prevent construction of any project that would denigrate air quality in non-attainment areas. As such, the researchers determined that the statutory screening criteria already accounted for clean air policy objectives, and that the draft evaluation criteria would not contribute to the methodology in any meaningful way. Consequently, avoiding projects with negative air quality impacts became the focus and since the financially constrained systems plan document is required to comply with the Department of Ecology State Implementation Plan, WSDOT could be sure that no such projects would even be ranked.

Data collected in the full-scale test similarly strengthened the direct links between the remaining evaluation criteria and other state regulations. The investigators compiled an inventory of statewide resources intended for use by district staff and drafted scoring guidelines. Appendix F contains the resource inventory and Appendix E contains the scoring guidelines. The inventory provides contacts (names and addresses) at resource agencies that might assist WSDOT's data collection efforts and the scoring guidelines
define the legal parameters and terminology used in each criteria category. The full-scale test improved the prioritization methodology, and WSDOT benefited from the full-scale database assessment and revisions. Further, the test proved that the TOPSIS-6 ranking algorithm was in working order.

Beyond the full-scale test, TRAC investigators held several criteria review sessions with WSDOT programming and environmental engineers to further refine the criteria. For example, the debate over noise impact measurements became heated, but was resolved following circulation of several alternative approaches and a criteria review session with mediation. Noise impact evaluation ultimately evolved from a requirement of decibel change estimates per project to an assessment of increased noise level risk per project. Similarly, the focus of criteria refinements generally suggested by WSDOT staff was reduction in the time required to evaluate each proposal by means of simplifying assumptions. Minor numerical scoring revisions were also recommended, some of which were incorporated.

With regard to cost efficiency, the full-scale test in 1993 revealed that it would be feasible to assess travel time savings, and that such assessment would be supported by existing traffic counts, growth forecasts, and databases. However, the definition of proposed mobility improvements was significantly broadened from the old category C program between 1993 and 1995. The Mobility program now includes (to name a few) category B interstate, corridor-wide Intelligent Transportation Systems, and HOV-related improvements, as discussed previously. It was impossible for TRAC investigators to predict the full breadth of applications that would ultimately be required for implementation at the time of the test. To address this issue, WSDOT engineers convened a technical advisory committee (TAC) to assist in implementing the methodology for 1995-97.
Technical Advisory Committee

The technical advisory committee included representatives from three WSDOT districts, planning, programming and traffic engineers from WSDOT headquarters and the Transportation Data Office, the UW TRAC principal investigator, and a facilitator. The TAC was created to serve as a forum for technical debate, to establish consistent guidelines across project types, to improve communications, and to set all constant parameters for benefit-cost analysis (e.g., value of travel time). Many of the TAC deliberations during the implementation period were dedicated to benefit estimation methods for mobility improvements that were different from the old category B and C proposals. Examples of such projects included signalized intersection modifications, HOV lanes, park-n-ride lots, transportation system management, and driver information system improvements. The TAC produced a series of benefit calculation worksheets and directions (as well as explanations of the background discussion), for use in the districts.

Each worksheet pertains to a particular project type and represents travel time and operational savings in a manner appropriate for each improvement type. Benefit calculations for arterial highways and saturated conditions (LOS F) on freeways were among the most controversial topics. Appendix G includes a sample calculation.

The TAC’s primary goal was to assist the districts in applying technical guidelines consistently, but it was also called upon to recommend improvements in the cost efficiency criteria to program management staff. Examples of technical decisions with implications for policy setting included project staging and analysis periods, discount rate selection, regional modeling variations, volume or growth projection coordination, vehicle occupancy assumptions, and benefit evaluation based on weekday peak hour volumes. The need to define benefits to the state (as opposed to local jurisdiction) was also an intriguing example of how policy must lead technical analysis. However, the need for particular guiding policies was often impossible to predict prior to beginning the technical analysis. For instance, the cost efficiency analysis resulted in
benefit-cost ratios of less than 1.0 in some cases, indicating the need for WSDOT to confront the sufficiency of project screening policies and foreshadowing several TAC debates over the full capture of actual annual benefits. On this point, modifications were made to incorporate the residual value of facilities (with service life beyond the standard 20-year horizon) in the benefit cost analysis using cost reduction factors. Daily benefits in highly congested areas were also estimated using an input capacity factor wherein peak-hour spreading was expected between 6 a.m. and 6 p.m. In the past, such issues had not been a concern because travel time savings were not quantified, and because non-interstate and interstate deficiencies were analyzed separately.

The TAC proved to be a key component of the prioritization implementation. The committee was very thorough, and a review of the new process by an independent consultant revealed few unique recommendations. The TAC also played a critical role in improving district support for, and confidence in, the new methodology. The TAC continues to refine the benefit estimation techniques and to develop guidelines for monetizing the impacts of emerging highway deficiency solutions and other external impacts (e.g., TDM/TSM and fish barrier removal).

1995-97 Project Ranking Results

The effectiveness of the study methodology is most convincingly illustrated by the actual 1995-97 prioritization results. Figures 7 and 8 depict the relationship between the priority order output from the ranking algorithm and each project's benefit-cost ratio. The figures simultaneously show how the biennial Mobility program costs accumulate in the urban and rural sub-programs respectively. The accumulated program costs depicted are calculated using the total present value costs of the project over 20 years for each proposal. The TOPSIS-6 algorithm and all five categories of criteria were used to calculate the rank order assuming statewide competition. The criteria categories were:

- Cost-efficiency
- Community Support
• Environment
• Mode Integration
• Land Use

The cost-efficiency criterion (B/C) is illustrated to show the strong relationship between the final rank order and the most heavily weighted category of criteria. Figures 9 and 10 illustrate the relationship between monetary benefits (i.e., B/C) and total accumulated costs and the descending priority order using all five categories of criteria. [Note the difference in scale.]

The most compelling observation is that both the Urban and the Rural Mobility programs show an overall program cost effectiveness. However, each program's cost effectiveness reaches a plateau (or point) where continued investment in priority order does not increase the measurable monetary benefit more than the associated increase in costs (i.e., where the slope of the accumulated benefit curve is less than or equal to the slope of the accumulated cost curve, \( b_B \leq b_C \) or \( b_B = b_C \)). The Urban Mobility program does not reach the point of decreasing effectiveness (Z, fig. 9) until 94 projects are funded. The Rural Mobility program, on the other hand, reaches a plateau beginning with the project ranked 20th (X-Y, fig. 10) and reaches the point of decreasing effectiveness (Z, fig. 10) after 48 projects are funded. These curves might be utilized to program projects based only on measured cost effectiveness. For example, if the goal were to maximize the total accumulated benefit per dollar invested while still programming in priority order, it would not be advisable for WSDOT to invest beyond the point of equal slope or decreasing effectiveness in any biennium. Thus, WSDOT could respond to the greater need for mobility improvements in urban areas without sacrificing the comparative integrity of a statewide rural investment program.

However, the 1995-97 results cannot be evaluated based on statewide cost-effectiveness alone. State transportation policy recognizes the value of presently non-
Figure 9. Overall Urban Mobility Program Cost Effectiveness, 1995-97
[Note difference in scale]
Rural Mobility Program (II) Cost-Effectiveness

Figure 10. Overall Rural Mobility Program Cost-Effectiveness, 1995-97
monetizable impacts and there are several policy and technical issues that require a broad perspective, and non-monetary criteria, as previously discussed. Two issues remain.

First and foremost is the fact that local financial contributions were subtracted from nearly half of all the urban project costs used for the cost-efficiency analysis. The total rural projects affected by this WSDOT policy to encourage local-state partnerships in this way is unknown to the research staff. This policy has greatly impacted the prioritization of mobility improvements because the relationship between the most heavily weighted criteria (cost efficiency) and the priority order is very direct. In nearly half of the urban proposals, the prioritization reflects a higher benefit-cost ratio than would otherwise be calculated if the local contribution were not subtracted. Nonetheless, internal consistency on this and other points was carefully maintained by WSDOT program management among both sub-programs of the 11-Mobility program, and the results are comparable within this biennium and policy context.

Geographic equity is another policy issue with a significant effect on the prioritization results. Projects in heavily congested regions generate greater benefits than projects in uncongested regions. This is because the most heavily weighted criterion dominates the priority array of projects, and because travel time savings are the most significant proportion of the monetized benefits in the cost efficiency analysis. However, WSDOT executives established a policy of programming on a regional (or district) basis rather than opting for statewide competition for Mobility program funds in the 1995-97 biennium. Consequently, the funds are optimized regionally, not statewide. One reason the ranked results are not equivalent (statewide vs. district) is that funding allocations to districts are based on different criteria than those used for prioritization. In other words, many proposals with low priority statewide will be programmed for preliminary engineering and construction in relatively uncongested districts before higher priority projects are programmed in the most heavily congested districts. This policy, disrupts the optimal statewide investment scenario calculated by the new prioritization methodology.
Geographic equity may be served but the economic implications of this measured disruption may be significant, and as such, warrant further study.

**GENERAL COMMENTS**

Finally, the first biennium worth of proposals included significantly more diverse projects than ever before. The TAC identified several technical policy agenda items that should be carefully evaluated. WSDOT has suggested various circumstances that warrant project programming out of the rank order produced by this prioritization methodology. It should be noted that where the priority index of two competing proposals is nearly identical and there is no significant cost difference, either proposal may be selected based on irreducibles, regional priority, and professional judgment. Furthermore, WSDOT advised program managers to continue the logical pairing of construction work between separate improvement programs as necessary. As a result, it is possible that project work may commence out of the strict priority order. Executive oversight is required where the proposed jump in priority is extreme.

The new prioritization methodology does not replace professional management of the biennial mobility improvement programs. Rather, it is a tool that reflects WSDOT policy guidelines. The new methodology assumes that coordinated planning and major investment study precede the programming effort. The methodology is designed to inform program management of the inter-relationships of five specific quantified criteria categories. Program Management will benefit from increased knowledge of investment trade-offs.
CONCLUSIONS AND RECOMMENDATIONS

This report summarizes all phases of the Prioritization of Capacity Improvements Study (PCIS). Included herein are a discussion of the previously existing Category C prioritization formula, an overview of existing state-of-the-art prioritization methods for regional and statewide project programming, a detailed discussion of the proposed ranking methodology for mobility improvements, and finally, a description of the implementation process for the 1995-97 biennial programming cycle at the Washington State Department of Transportation. The new methodology, and more specifically the evaluation criteria, have been developed to respond directly to transportation policy goals for the state of Washington.

Phase I resulted in a preferred ranking algorithm, state-of-the-art assessment, and development of cost-efficiency evaluation criteria. Phase II expanded the number of evaluation criteria to reflect the breadth of state transportation policy objectives and established screening criteria. New categories of prioritization criteria include the following: cost-efficiency (benefit-cost ratios), community support, environment (wetlands, water quality and permitting, noise), mode integration, and land use. Phase III concluded the study with a full-scale test of the new methodology, criteria revisions, sensitivity analysis, weight assignment, and implementation assistance to the WSDOT.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and state transportation policy mandate the encouragement of multimodal projects. The new prioritization methodology for mobility improvements constitutes a flexible, inclusive framework for assessing projects related to all highway modes. The recommended criteria involve monetizing safety and user benefits, as well as the costs of all project proposals. Indeed, one of the prioritization study’s long-range goals is to encourage the monetization of quantifiable impacts, particularly in the environmental category. This would allow accounting for environmental costs in the cost-efficiency evaluation.
Based on their experience in the first year of implementation, researchers concluded that setting up a technical advisory committee is essential. WSDOT used a technical advisory committee to maintain consistency in the application of cost-efficiency theory and to push the boundaries of economic analysis.

The needs for further study are many. Remaining technical issues associated with monetizing user benefit and external impacts include the following:

- full capture of annual and 24-hour benefits
- sensitivity of results to simplifying assumptions and cost parameters
- regional model compatibility
- consecutive intersection analysis on arterials
- refined benefit analysis for Intelligent Transportation Systems and HOV facilities
- an approach to scale environmental impacts by project length
- an approach for analyzing Transportation Demand Management, access management, and on-time freight delivery
- monetizing more social and environmental costs, such as water quality, wetlands banking, energy efficiency, and land use
- expanding the breadth or better quantifying mode integration and developing multimodal evaluation criteria.

Policy issues in need of further study include the following:

- geographic and taxpayer equity, or statewide vs. regional budget prioritization, and the associated need for additional equity criteria
- planning study coordination with the new methodology
- systems plan deficiency evaluation formula vs. priority programming formula
- calculation of all system benefits vs. proportionate analysis of state or local benefit and the policy to discount the project cost where other agencies/locals have contributed financially
- determination of "commitment" to a prioritized project
- Level of Service (LOS) standard variation among regions
- division of mobility projects into rural and urban sub-programs.
It is also recommended that WSDOT expand the scope of priority programming in other highway sub-programs, and in the public transportation, ferries, and aviation programs to include a similar prioritization methodology based on lifecycle cost analysis. This type of analysis would greatly enhance the budget trade-off process. WSDOT should also provide additional documentation and training for program management, planning, and environmental staff and pursue a dynamic programming process for the mobility program that links the criteria worksheets to the TOPSIS-6 algorithm.

Although many issues will require additional study, the proposed methodology represents a significant step toward the ability to evaluate and rank projects in a manner that directly reflects transportation policy and service objectives. WSDOT is clearly in the forefront of such efforts nationwide. Through continued effort, optimal utilization of limited state transportation funds will be made possible.
ACKNOWLEDGMENTS

The authors gratefully acknowledge the support of the Washington State Department of Transportation, and the many people and organizations in the public and private sectors who provided us with information. Particular thanks go to the State Transportation Committee and WSDOT program management staff who, in persevering, enabled successful implementation of the methodology. Valuable contributions to the final preparation of this report were made by the staff of the Washington State Transportation Center (TRAC) at the University of Washington.
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APPENDIX A

DETAILS OF PRIORITY INDEX CALCULATION
PROGRAM INSTRUCTIONS
(Refer to Figure A-1 and Table A-1)

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open TOPSIS-6⁠¹ macro file from the directory.</td>
</tr>
<tr>
<td>2</td>
<td>Open the data file containing projects and evaluation criteria values. This data file must be formatted as shown in Table A-1. Column 1 is used for the project identification (project identification can be any alpha-numeric combination). Columns 2 through 2+y are reserved for the evaluation criteria, where y=x-1 and x=Project Cost Column. Row 2 of the data sheet must include a weight for each evaluation criteria. The sum of the weights must equal 1.00. Row 3 is used to denote whether the criteria should be maximized or minimized. A &quot;1&quot; is used when high values are favored over low values, e.g., B/C and Land Use scores. A &quot;0&quot; is used when low values are favored over high values, e.g., environmental impact criteria.</td>
</tr>
<tr>
<td>3</td>
<td>Highlight (select) the entire data set area exactly with the mouse.</td>
</tr>
<tr>
<td>4</td>
<td>Go to &quot;Macro&quot; on the main menu and select TOPSIS-6. The program will display interim calculations to the right of the selected worksheet area. Be sure that you have saved the input worksheet prior to running the program. At the prompt, enter the name of a new file to which the output should be written. At the second prompt in the new worksheet, enter the program budget as indicated. Use the same units as were input for project costs previously. TOPSIS-6 will figure the project list that can be funded given the budget scenario in exact rank order and display the remaining funds in the third column, row five. When the program is complete, a window will display a notice as an indicator. Enter “OK”.</td>
</tr>
<tr>
<td>5</td>
<td>After the macro has completed execution, close the input data file and the TOPSIS-6 macro file; do NOT save any changes. Next, save the output file including changes and proceed to view the project priority indices in rank order. In order to format the output file, it must be saved under a different name before customizing the document.</td>
</tr>
</tbody>
</table>

⁠¹ A detailed listing of the TOPSIS-6 program is included in Appendix C.
1 Open file TOPSIS-6

2 Create a new worksheet
   1) Data entry. Refer to Table A-1.
   2) Select entire data area with mouse.
   3) Go to "Macro", click "run”, then select "TOPSIS-6". Click "OK".
   4) At "enter new file name", provide a name for your new priority index output file. Click "OK".

A new file is created with the above name and contains the following:

<table>
<thead>
<tr>
<th>Priority Index</th>
<th>Project I.D.</th>
<th>Project Cost</th>
<th>Budget</th>
<th>Project I.D.</th>
<th>Project Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.893</td>
<td>1-01</td>
<td>28,000</td>
<td>75,000</td>
<td>1-01</td>
<td>28,000</td>
</tr>
<tr>
<td>0.767</td>
<td>1-02</td>
<td>18,500</td>
<td>Remainings</td>
<td>1-02</td>
<td>18,500</td>
</tr>
<tr>
<td>0.725</td>
<td>1-03</td>
<td>24,200</td>
<td>4,300</td>
<td>1-03</td>
<td>24,200</td>
</tr>
<tr>
<td>0.642</td>
<td>1-04</td>
<td>32,100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.509</td>
<td>1-05</td>
<td>5,480</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...  ...  ...

*Figure A-1. Application Procedure*

*Table A-1. Data Input Format*

<table>
<thead>
<tr>
<th>Project</th>
<th>B/C</th>
<th>Community Support</th>
<th>Wetlands</th>
<th>Water Quality</th>
<th>Noise</th>
<th>Modal Integration</th>
<th>Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.65</td>
<td>0.14</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Max/Min</td>
<td>1</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1-01</td>
<td>11.31</td>
<td>2</td>
<td>0.5</td>
<td>21</td>
<td>36</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>1-02</td>
<td>10.2</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>20</td>
<td>5</td>
<td>15</td>
</tr>
</tbody>
</table>

...  ...  ...

...  ...  ...
APPENDIX B

MATHEMATICAL SUMMARY OF TOPSIS
MATHEMATICAL SUMMARY OF TOPSIS

One of the most frequently used methods for prioritizing elements (i.e., projects) with disparate units is called technique for order preference by similarity to ideal solution (TOPSIS), which was developed by Hwang and Yoon based on the concept of Euclidean distance.\(^1\) The algorithm uses one project that has the weighted minimum Euclidean distance as the ideal solution and assumes that each criterion has a monotonically increasing (or decreasing) utility. The "ideal project" is composed of all of the best criteria values, and the "negative-ideal project" has all of the worst criteria values. The method compares the Euclidean distance of each criterion to both the ideal and the negative-ideal solutions simultaneously by taking the relative closeness to this ideal solution, thus, the priority of each project is obtained.

Figure B-1 shows an example of the Euclidean distances to the ideal and negative-ideal solutions in two dimensional space. A\(^*\) is the ideal project, A\(^-\) is the negative-ideal project. In the figure, project A\(_1\) has shorter distances both to the ideal project A\(^*\) and to the negative-ideal project A\(^-\), than the other project A\(_2\). To justify the selection of projects, TOPSIS compares the relative closeness to the ideal solution by considering the two distances at the same time.

---

**Figure B-1.** Euclidean Distance to the Ideal and Negative-ideal Solutions in Two Dimensional Space

**DETAILED ALGORITHM**

The TOPSIS method evaluates m projects through n criteria, which make up the following decision matrix:

\[
D = \begin{bmatrix}
X_1 & D_{11} & D_{12} & \cdots & D_{1j} & \cdots & D_{1n} \\
X_2 & D_{21} & D_{22} & \cdots & D_{2j} & \cdots & D_{2n} \\
\vdots & \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\
X_i & D_{i1} & D_{i2} & \cdots & D_{ij} & \cdots & D_{in} \\
\vdots & \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\
X_m & D_{m1} & D_{m2} & \cdots & D_{mj} & \cdots & D_{mn}
\end{bmatrix}
\]
where \( X_i \) = the ith project considered, 
\( B_j \) = the jth criteria considered in the decision, and 
\( D_{ij} \) = the numerical outcome of the ith project with respect to jth criteria.

TOPSIS uses a set of weights obtained from decision makers to describe the importance of each criterion. It assumes the larger the attribute outcomes, the greater the benefit criteria and the less preferable the cost criteria. It consists of the following steps:

**Step 1** Construct the normalized decision matrix (R). This process transforms the various criteria dimensions into non-dimensional criteria, which allows comparison across the different criteria. An element \( r_{ij} \) of the normalized decision matrix R can be calculated as:

\[
  r_{ij} = \frac{D_{ij}}{\sum_{i=1}^{m} D_{ij}^2}
\]  

**Step 2** Construct the weighted normalized decision matrix (V). A set of weights \( W = (W_1, W_2, \ldots, W_j, \ldots, W_m) \) are accommodated into the decision matrix. The weights should sum to one, that is \( \sum_{j=1}^{n} W_j \).

The updated weighted matrix can be calculated by multiplying each column by its associated weight:

\[
  v_{ij} = r_{ij} \cdot W_j
\]

**Step 3** Determine ideal and negative-ideal solutions: Let the ideal solution \( A^* \) and the negative \( A^- \) be defined as:

\[
  A^* = \{ (\max v_{ij} \mid j \in J), (\min v_{ij} \mid j \in J') \mid i = 1, 2, \ldots, m \}
\]

\[
  = \{ v_1^*, v_2^*, \ldots, v_i^*, \ldots, v_n^* \}
\]

\[
  A^- = \{ (\min v_{ij} \mid j \in J), (\max v_{ij} \mid j \in J') \mid i = 1, 2, \ldots, m \}
\]

\[
  = \{ v_1^-, v_2^-, \ldots, v_i^-, \ldots, v_n^- \}
\]
where \( J = \{ j = 1,2, \ldots, n \mid j \text{ associated with benefit criteria} \} \)

\( J' = \{ j = 1,2, \ldots, n \mid j \text{ associated with benefit criteria} \}. \)

**Step 4** Calculate the separation measure. The separation between each project can be measured by the n-dimensional Euclidean distance. The distance of each project from the ideal one is then given by

\[
S_i^* = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{j}^*)^2}, \quad i = 1, 2, \ldots, m \tag{B.5}
\]

Similarly, the distance from the negative-ideal one is given by

\[
S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{j}^-)^2}, \quad i = 1, 2, \ldots, m \tag{B.6}
\]

**Step 5** Calculate the relative closeness to the ideal solution. The relative closeness of \( A_i \) with respect to \( A^* \) is the priority of each project, which is defined as:

\[
p_i^* = S_i^- / (S_i^* + S_i^-), \quad 0 < p_i^* < 1, \quad i = 1, 2, \ldots, m \tag{B.7}
\]

**Step 6** Rank the priority order. A set of projects can now be priority ranked according to the descending order of \( p_i^* \).
APPENDIX C

DETAILED LISTING OF TOPSIS-6
A1. Topsis (t)
Start of the macro

A2. =SET.NAME("range",SELECTION())
Give the highlighted data area a name as "range"

A3. =ROWS(range)
Return the number of rows in "range"

A4. =COLUMNS(range)
Return the number of columns in "range"

A5. =SET.NAME("temp",OFFSET(range,0,A4+1))
Return a reference of the same size and shape as "range", with its upper-left corner shifted horizontally by the number of column of "range" (A4) plus 1. And give this shifted reference a name as "temp"

A6. =SET.NAME("workspace",INDEX(temp,4,2):INDEX(temp,A3,A4-1))
Give the area from row4-col2 in "temp" to rowA3-colA4 in "temp" a name as "workspace"

A7. =SET.NAME("origin",INDEX(range,4,2):INDEX(range,A3,A4-1))
Give the area from row4-col3 in "range" to row A3-colA4-1 in "range" a name as "origin"

A8. =SET.NAME("weight",INDEX(range,2,2):INDEX(range,2,A4-1))
Give the area from row2-col2 in "range" to row2-colA4-1 in "range" a name as "weight"

A9. =SET.NAME("logic",INDEX(range,3,2):INDEX(RANGE,3,A4-1))
Give the area from row3-col2 in "range" to row3-colA4-1 in "range" a name as logic

A10. =SET.NAME("sum1",INDEX(workspace,1,1):INDEX(workspace,1,A4-2))
Give the area from row1-col1 in "workspace" to row1=colA4-2 in "workspace" a name as "sum1"

A11. =SET.NAME("sum",OFFSET(sum1,A3-2,0))
Return a reference of the same size and shape as "sum1", with its upper-left corner shifted vertically by the number of A3 minus 2. And give this shifted reference a name as "sum"
A12. =SET.NAME("positive",OFFSET(sum,1,0))

Return a reference of the same size and shape as "sum", with its upper-left corner shifted vertically by one row. And give this shifted reference a name as "positive"

A13. =SET.NAME("negative",OFFSET(positive,1,0))

Return a reference of the same size and shape as "positive", with its upper-left corner shifted by one row. And give this shifted reference a name as "negative"

A14. =SET.VALUE(A22,1)

Start outer loop. Initialize the counter at cell A22 to 1

A15. =SET.VALUE(A17,0)

Intitalize the value of A17 to 0

A16. =SET.VALUE(A18,1)

Start inner loop. Intitalize the counter at cell A18 to 1

A17. =A17+INDEX(origin,A18,A22)^2

Calculate the sum of squares of each cell in the first column of "origin", and repeat for all the columns

A18. =A18+1

Increment the inner loop counter A18

A19. =IF(A18<(A3-2),GOTO(A17))

The inner loop ends when all the rows in each column of "origin" are reached

A20. =SELECT(INDEX(sum,1,A22))

Select the cell of row1-colA22 in "sum"

A21. =FORMULA(A17)

Write the result of A17 to the above selected cell

A22. =A22 + 1

Increment the outer loop counter A22

A23. =IF(A22<A4-1,GOTO(A15))

The outer loop terminates when all the columns in "origin" are reached
A24. =SET.NAME("ido",INDEX(range,4,1):INDEX(range,A3,1))
Give the area from row4-col1 to row A3-col1 in "range" a name as "ido"
A25. =SET.NAME("costo",INDEX(range,4,A4):INDEX(range,A3,A4))
Give the area from row4-colA4 to row A3-colA4 in "range" a name as "costo"
A26. =SET.NAME("dummy",INDEX(workspace,1,1):INDEX(workspace, A3-3,1))
Give the area from row1-col1 to rowA3-3-col1 in "workspace" a name as "dummy"
A27. =SET.NAME("sep",OFFSET(dummy,0,A4))
Return a reference of the same size and shape as "dummy", with its upper-left corner shifted horizontally by the number of A4. And give this shifted reference a name as "sep"
A28. =SET.NAME("sepn",OFFSET(dummy,0,A4+1))
Return a reference of the same size and shape as "dummy", with its upper-left corner shifted horizontally by the number of A4 plus 1. And give this shifted reference a name as sepn"
A29. =SET.NAME("ci",OFFSET(dummy,0,A4+2))
Return a reference of the same size and shape as "dummy", with its upper-left corner shifted horizontally by the number of A4 plus 2. And give this shifted reference a name as "ci"
A30. =SET.NAME("id",OFFSET(ci,0,1))
Return a reference of the same size and shape as "ci", with its upper-left corner shifted horizontally by one row. And give this shifted reference a name as "id"
A31. =SET.NAME("cost",OFFSET(ci,0,2))
Return a reference of the same size and shape as "ci", with its upper-left corner shifted horizontally by two rows. And give this shifted reference a name as "cost"
A32. =SET.VALUE(A51,1)
Start outer loop. Initialize the counter at cell A51 to 1
A33. =SET.VALUE(A37,1)
Start inner loop. Initialize the counter at cell A37 to 1
A34. \( =\text{SELECT} (\text{INDEX}(\text{workspace}, A37, A51)) \)

Select the cell of row A37-colA51 in "workspace"

A35. \( =\text{INDEX} (\text{origin}, A37, A51) / \text{SQRT} (\text{INDEX}(\text{sum}, 1, A51)) * \text{INDEX}(\text{weight}, 1, A51) \)

Construct the weighted normalized matrix. (see Steps 1&2 of TOPSIS)

A36. \( =\text{FORMULA} (A35) \)

Write the result of A35 to the above selected cell

A37. \( =A37 + 1 \)

Increment the inner loop counter A37

A38. \( =\text{IF} (A37 < A3-2, \text{GOTO} (A34)) \)

Repeat the above calculations until all the rows in "workspace" are reached. End of Steps 1&2 of TOPSIS

A39. \( =\text{MAX} (\text{INDEX}(\text{workspace}, 1, A51):\text{INDEX}(\text{workspace}, A3-3, A51)) \)

Return the largest number in the list from row1-colA51 to row A3-3-colA51 in "workspace"

A40. \( =\text{MIN} (\text{INDEX}(\text{workspace}, 1, A51):\text{INDEX}(\text{workspace}, A3-3, A51)) \)

Return the smallest number in the list from row1-colA51 to row A3-3-colA51 in "workspace"

A41. \( =\text{IF} (\text{INDEX}(\text{logic}, 1, A51) = 0, \text{GOTO} (A47)) \)

If the value of cell row1-colA51 in "logic" is 0, goto A47. This corresponds to the case of minimization in TOPSIS Step 3. When its value is 1, goto next step A42. This corresponds to the case of maximization in TOPSIS Step 3

A42. \( =\text{SELECT} (\text{INDEX}(\text{positive}, 1, A51)) \)

Select the cell of row1-colA51 in "positive"

A43. \( =\text{FORMULA} (A39) \)

Write the value of A39 to the above selected cell

A44. \( =\text{SELECT} (\text{INDEX}(\text{negative}, 1, A51)) \)

Select the cell of row1-colA51 in "negative"
A45. =FORMULA(A40)
Write the value of A40 to the above selected cell

A46. =GOTO(A51)
End of maximization case

A47. =SELECT(INDEX(positive,1,A51))
Select the cell of row 1-colA51 in "positive"

A48. =FORMULA(A40)
Write the value of A40 to the above selected cell

A49. =SELECT(INDEX(negative,1,A51))
Select the cell of row1-colA51 in "negative"

A50. =FORMULA(A39)
Write the value of A39 to the above selected cell. End of minimization case

A51. =A51+1
Increment the outer loop counter of A51

A52. =IF(A51<A4-1,GOTO(A33))
End of Step 3 of TOPSIS

A53. =SET.VALUE(A84,1)
Start of outer loop, initialize the counter A84 to 1

A54. =SET.VALUE(A63,0)
Initialize A63 to 0

A55. =SET.VALUE(A65,0)
Initialize A65 to 0

A56. =SET.VALUE(A68,0)
Initialize A68 to 0

A57. =SET.VALUE(A70,0)
Initialize A70 to 0
A58. \( =\text{SET.VALUE}(A71,0) \)

Start of inner loop, initialize the counter A59 to 0

A59. \( =\text{SET.VALUE}(A74,0) \)

Initialize A74 to 0

A60. \( =\text{SET.VALUE}(A75,0) \)

Initialize A75 to 0

A61. \( \text{IF}((\text{AND}(\text{INDEX(positive,1,A71)}>0,\text{INDEX(workspace,A84,A71)}>0)),\text{goto A65}) \)

Determines whether the workspace value and ideal criteria value share the same sign

A62. \( \text{IF}((\text{AND}(\text{INDEX(workspace,A84,A71})<0,\text{INDEX(positive,1,A71}<0)), \text{goto A65}) \)

Same as A61

A63. \( =A63+(\text{INDEX(workspace,A84,A71})+(0-\text{INDEX(positive,1,A71}))^2 \)

Calculates the separation measure, Step 4 of TOPSIS, when criteria values of the workspace & ideal share the same sign

A64. \( =\text{goto A66} \)

Skips the alternate case calculation (see A65).

A65. \( =A65+\text{INDEX(workspace,A84,A71})-\text{INDEX(positive,1,A71}))^2 \)

Calculates the separation measure, Step 4 of TOPSIS, when criteria value of the workspace is negative and the ideal criteria value is positive.

A66. \( =\text{IF}((\text{AND}(\text{INDEX(workspace,A84,A71})>0,\text{INDEX(negative,1,A71}>0)),\text{goto A70}) \)

Determines whether the workspace value and negative-ideal criteria value share the same sign.

A67. \( =\text{IF}((\text{AND}(\text{INDEX(workspace,A84,A71})<0,\text{INDEX(negative,1,A71}<0)), \text{goto A70} \)

Determines whether the workspace value and negative-ideal criteria value share the same sign.
A68. \( =A68 + ((\text{INDEX}(\text{workspace},A84,A71) - \text{INDEX}(0-\text{INDEX}(\text{negative},1,A71)))^2 \)

Calculates the separation measure, Step 4 of TOPSIS, when criteria values of the workspace and negative-ideal share the same sign

A69. \( =\text{goto A71} \)

Skips the alternate case calculation(A70).

A70. \( =A70+((\text{INDEX}(\text{workspace},A84,A71) - \text{INDEX}(\text{negative},1,A71)))^2 \)

Calculate the separation measure, Step 4 of TOPSIS, when value in workspace is positive and the negative-ideal criteria value is negative.

A71. \( =A71 + 1 \)

Increment counter of inner loop A71

A72. \( =\text{IF}(A72<A4-1,\text{GOTO}(A61)) \)

Inner loop terminates when all the columns in row A84 of "workspace" are reached

A73. \( =\text{SELECT}(\text{INDEX}(\text{sep},A84,1)) \)

Select row A84-col1 of "sep"

A74. \( =A63 + A65 \)

Sum all possible separation measures to the ideal

A75. \( =A68 + A70 \)

Sum all possible separation measures to the negative-ideal

A76. \( =\text{SQRT}(A74) \)

Take the square root of the result in A74. This is the separation to ideal-solution for each project

A77. \( =\text{FORMULA}(A76) \)

Write the above result in the selected cell (See A61)

A78. \( =\text{SELECT}(\text{INDEX}(\text{sep},A84,1)) \)

Select row A84-col1 of "sepn"
A79. \[ =\text{SQRT}(A75) \]

Take the square root of the result in A75. This is the separation to negative-ideal solution for each project.

A80. \[ =\text{FORMULA}(A79) \]

Write the above result in the selected cell (See A64)

A81. \[ =\text{SELECT}((\text{INDEX}(ci,A84,1))) \]

Select row A84-col1 of "ci"

A82. \[ =\text{INDEX}(\text{sepn},A84,1)/(\text{INDEX}(\text{sepn},A84,1)+\text{INDEX}(\text{sep},A84,1)) \]

Calculate relative closeness, i.e., priority index. This is Step 5 of TOPSIS

A83. \[ =\text{FORMULA}(A82) \]

Write the above result to the selected cell (see A81)

A84. \[ =A84+1 \]

Increment the outer loop counter A84

A85. \[ =\text{IF}(A84<(A3-2),\text{GOTO}(A54)) \]

The outer loop terminates when all the rows in "workspace" are reached

A86. \[ =\text{SELECT}(\text{id}) \]

Select "ido", which contains the ID numbers of all the projects

A87. \[ =\text{COPY}() \]

Copy the selected region, i.e., "ido"

A88. \[ =\text{SELECT}(\text{id}) \]

Select "id"

A89. \[ =\text{PASTE}() \]

Paste the selected data, i.e., the ID numbers, to "id"

A90. \[ =\text{SELECT}(\text{costo}) \]

Select "costco", which contains the cost of all the projects

A91. \[ =\text{COPY}() \]

Copy the selected region
A92. =SELECT(cost)

Select "cost"

A93. =PASTE()

Paste the copied content, i.e., the costs, to "cost"

A94. =SELECT(INDEX(workspace,1,1):INDEX(negative,1,A4-2))

Select the area from the first cell in "workspace" to the last cell in "negative"

A95. =EDIT.DELETE()

Delete the selected area. Notice: steps A94 and A95 clear all the intermediate results on the worksheet

A96. =SELECT(INDEX(sep,1,1):INDEX(sepn,A3-3,1))

Select the area from row1-coll in "sep" to rowA3-3-coll in "sepn", which contains the final results of Topsis. We are going to write these results in a new file (see the following a few steps)

A97. =EDIT.DELETE()

Delete the selected area

A98. =INPUT("Enter a new file name (non-existing):",2)

Display a dialog box into which the user can enter information in text, i.e., the filename in which the user wants to store the final results

A99. =FOPEN(A98,3)

Create the file named by the user in A98, with read/write access

A100. =FCLOSE(A99)

Close the file specified in A99

A101. =SELECT(INDEX(ci,1,1):INDEX(cost,A3-3,1))

Select the area from row1-coll in "ci" to rowA3-3-coll in "cost"

A102. =SORT(1,2)

Sort priority indices by rows in descending order. This is Step 6 of TOPSIS

A103. =CUT()

Cut the selected area, i.e., the sorted results
A104. =OPEN(A98)
Open the file created in step A98 as a window

A105. =SELECT("r[1]c")
Select the first row and column "r[1]c"

A106. =PASTE()
Paste the cut content (i.e., the sorted results) in the new file

A107. =SET.NAME("b_range",SELECTION())
Give the selected area a name as "b_range"

A108. =ROWS(b_range)
Return the number of rows in "b_range"

A109. =COLUMNS(b_range)
Return the number of columns in "b_range"

A110. =SELECT("r[-1]c")
Select (an inserted) row above the sorted results in the new file, "r[-1]c"

A111. =FORMULA("Priority Index")
Write the heading "Priority Index" in the first above selected cell

A112. =SELECT("rc[1]")
Select the first cell in the next column over (to the right), "rc[1]"

A113. =FORMULA("Rank Order")
Write the heading "Rank Order" in the above selected cell

A114. =SELECT("rc[1]")
Select the first cell in the next column over (to the right), "rc[1]"

A115. =FORMULA("Project cost")
Write the heading "Project cost" in the above selected cell

A116. =SELECT("rc[1]")
Select the first cell in the next column over, "rc[1]"
A117. =FORMULA("Total Budget")
Write the heading "Total Budget" in the above selected cell

A118. =SELECT("r[2]c")
Select the cell two rows beneath the previous cell (in the fourth column), "r[2]c"

A119. =FORMULA("Remainings")
Write the heading "Remainings" in the above selected cell

A120. =SELECT("r[-2]c[1]")
Select two rows above and the next cell over (top row, fifth column), "r[-2]c[1]"

A121. =FORMULA("Funded Proj's")
Write the heading "Funded Proj's" in the above selected cell

A122. =SELECT("r[1]c[-1]")
Select the cell one row beneath and one column to the left of the previous (second row, fourth column), "r[1]c[-1]"

A123. =INPUT("Enter the total budget (unit should be consistent with the raw data!)",1)
Display a dialog box for user to enter information as text; i.e., the total available budget

A124. =FORMULA(A123)
Write the value A123 to the above selected cell (under "Total Budget") in new file

A125. =IF(A123>=INDEX(b_range,1,3),GOTO(A128))
Determine whether the top priority project is funded under the input budget scenario. Begins the outer loop if there is enough funding.

A126. =ALERT("No projects can be funded under this ranking order! Please check your total budget.")
Display a dialog box notifying user that the total budget entered will not cover the project cost of the top ranked item

A127. =RETURN()
Stop the macro
A128.  =SET.VALUE(A131,0)
Start inner loop. Initializes the counter at cell A131 to zero.

A129.  =SET.VALUE(A130,0)
Start outer loop. Initializes the counter at cell A130 to zero

A130.  =A130+1
Increment the outer loop counter A130

A131.  =A131+INDEX(b_range,A130,3)
Calculate the accumulated project cost in descending priority order

A132.  =IF(A131>A123,GOTO(A139))
Determine if accumulated project cost exceeds the total budget input

A133.  =IF(A130=A108,ALERT("all projects can be funded!"),GOTO(A138))
Determine if the project is from the last row in "b_range"

A134.  =SELECT("r[2]c")
Select cell two rows beneath previous cell in new file under "Remainings" (fourth row, fourth column), "r[2]c"

A135.  =A123-SUM(INDEX(b_range,1,3):INDEX(b_range,A108,3))
Calculate the remaining budget if any

A136.  =FORMULA(A135)
Write the value of A135 to the above selected cell

A137.  =RETURN()
Increment the inner loop

A138.  =GOTO(A130)
End of outer loop

A139.  =A123-(A131-INDEX(b_range,A130,3))
Calculate remaining budget; i.e., subtracts partially funded project from accumulated project costs of A131
A140.  =SELECT("r[2]c")

Select cell two rows beneath previous cell in new file under heading
"Remainings" (fourth row, fourth column).  "r[2]c"

A141.  =FORMULA(A139)

Write the value A139 to above selected cell

A142.  =SELECT(INDEX(b_range,1,2):INDEX(b_range,A130-1,2))

Select the cells of row1-col2 in "b_range" through row A130-1 (outer loop
counter)-col2

A143.  =COPY()

Copy selected cells

A144.  =SELECT("rc[3]")

Select cell three columns over previous selection, "rc[3]";  i.e., under heading
"Funded Proj's"

A145.  =PASTE()

Paste copied cells from above in selected cells;  i.e., paste names of projects
funded by total budget input under the heading "Funded Proj's"

A146.  =ALERT("This is the end!",3)

Display dialog box notifying user that the algorithm is finished

A147.  =RETURN()

Stop the macro.
PCIS MOBILITY PROJECT DESCRIPTION SHEET

PROPOSED IMPROVEMENTS

DISTRICT: ____________________________
LOCAL JURISDICTION(S): ____________________________

SR: __________
PROJECT TITLE: __________________________________
SR MILEPOST: _______ to SR MILEPOST _________
LENGTH: _______ (miles)

The purpose of the following descriptions is to identify the existing geometric characteristics of the project area, to detail the proposed improvements, and to describe the proposed future facility.

In each case, *descriptions must address the following conditions:* number, width, and type of lanes; shoulder, sidewalk, and bike lane width/existence; median width and type; interchange/intersection specifications; midpoint of expansion; safety measures (e.g. signalization, lighting, etc.); functional class; design speed; alignment changes; and right-of-way needs.

A *map must be attached* that highlights the project area and describes the section-township-range coordinates, distance from the nearest intersection, and names of roadways in the vicinity. Where the project proposal entails a new roadway/alignment or major intersection improvements, attach a secondary map &/or cross section at a larger scale.

Description of Existing Facility:

Description of Proposed Improvements and Future Facility:

Ranking relative to other proposed district project submittals? _____ of _____. 
WSDOT CATEGORY C PROJECT DESCRIPTION SHEET

PROPOSED CATEGORY C IMPROVEMENTS

DISTRICT: ________

SR: ________ Project Title: __________________________
SR Milepost: ________ to SR Milepost ________ Length ________ (miles)
Functional Class: ________ Level of Development ________

Description of existing facility:

Description of proposed improvement (include staging):
{map usually attached}

Can the problem be solved by a Category A improvement or any other program than Category C?
Yes ________ No ________

Ranking relative to other proposed district Category C improvements: ________ of ________.

Local or TIB participation anticipated: Yes ________ No ________
If yes, to what extent?

Cost Data:
Total Estimated Cost ________ (19 ______ dollars)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Start Date</th>
<th>FY 9</th>
<th>FY9</th>
<th>FY9</th>
<th>FY9</th>
<th>FY9</th>
<th>...</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R/W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WSDOT CATEGORY C PROJECT CHECKLIST

CHECKLIST OF NON-ENGINEERING STATUTORY REQUIREMENTS
CATEGORY C PROJECTS

DISTRICT__________ Date_____
SR__________ Name________________________ SR Milepost ____to____

1. Is this project included in the existing local or regional plan? Yes____ No____
   If the project is not included in the applicable comprehensive plan, has action been taken by appropriate planning agencies to approve the project?
   Yes____ No____ Not Applicable____

2. Have the local legislative bodies requested or approved this project:
   County (ies)________________________ City(ies)________________________

3. Have local organizations (e.g., Chamber of Commerce, League of Women Voters, Good Roads Association) endorsed this project? Yes____ No____
   Comment:

4. Have local agencies or private groups indicated opposition? If so, who?

5. Will additional right-of-way be required? Yes____ No____

6. Will this project require coordination with other Transportation modes? Yes____ No____
   If so, what are they?

7. Will the project divide identifiable neighborhoods or the service areas of any school or business area? Yes____ No____

8. Will there be any significant adverse economic impacts on the community (such as increased business activity creating a barrier between businesses & customers)?
   Yes____ No____

9. Will the project have any impact on minority interests? Yes____ No____
   If so, what are they?

10. Will there be any significant impact on the natural environment? Yes____ No____
    If so, what impact?

11. Will any environmentally related construction permits or other approvals be required (e.g., shorelines, wetlands, 4F, prime farmland)? Yes____ No____

12. Will it be necessary to prepare an EIS? Yes____ No____ Maybe____

Form Completed by__________________________ (checklist is NOT scored)
APPENDIX E
CRITERIA WORKSHEETS AND SCORING GUIDELINES
MOBILITY PRIORITIZATION

CRITERIA

• COST EFFICIENCY- Benefit-Cost Analysis for Safe Movement of People and Goods

• COMMUNITY SUPPORT

• ENVIRONMENT
  - Wetland Assessment
  - Water Quality and Permitting
  - Noise Assessment

• MODAL INTEGRATION

• LAND USE
COST EFFICIENCY WORKSHEET -
BENEFIT-COST ANALYSIS FOR SAFE MOVEMENT OF PEOPLE AND GOODS

The purpose of this worksheet is to summarize project costs and benefits. Detailed calculations should be included for each project and attached on a separate page. Benefits and costs should be expressed as present values using the following parameters:

Discount Rate \( (i) = 0.04 \)
Study Period \( (n) = 20 \) years

(may vary on some projects, yet MUST be consistent with the time period used to calculate Project Benefits in any case. See accompanying outlines as detailed below.)

<table>
<thead>
<tr>
<th>Project Cost Estimate:</th>
<th>199 $'s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>( (C) )</td>
</tr>
</tbody>
</table>
| (Sum ALL relevant line items including: environmental mitigation and right-of-way; and excepting the following:)

Environmental Retrofit
\( (E_R) \)
(costs incurred due to a pre-existing condition, e.g. noise barriers, water quality treatment, and fish barrier removal. Some may be exempt.)

Preliminary Engineering
\( (S_P) \)

Annual Operating and Maintenance
\( (O_{PM_A}) \)
(based on historical rates in similar area with proposed geometrics, except the following: Snow and Ice Removal, Structures & Ferries, Rest Area Management, and Public Damage Repair)

Calculate the Present Value of Project Costs \( (PV_C) \):

\[
PV_C = (C) + (E_R) + (S_P) + \left\{OpM_A \left[ \frac{(1+i)^n - 1}{i(1+i)^n} \right] \right\}
\]

Total Est. Costs \( (PV_C) = \)

Project Benefit Estimate:

Present Value of User Benefits
(includes both Travel Time Savings & User Operating Savings. Calculate as outlined in accompanying "User Benefits Worksheets")

Present Value of Safety Benefits
(Calculate as outlined in accompanying "Safety Benefits Worksheets")

Total Est. Benefits \( (PV_B) = \)

Calculate the BENEFIT-COST RATIO of Proposed Project:

\[
B/C = \frac{(PV_B)}{(PV_C)} = \]
COMMUNITY SUPPORT WORKSHEET

The purpose of this worksheet is to assess the community support and potential impact from the proposed project. For each question, check the appropriate answer and log score in the blank to the right.

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is local, regional, or TIB financial participation anticipated?</td>
<td></td>
</tr>
<tr>
<td>If yes, identify and indicate scale by percentage of total project costs:</td>
<td></td>
</tr>
<tr>
<td>&lt; 10%</td>
<td>2</td>
</tr>
<tr>
<td>10-25%</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 25%</td>
<td>0</td>
</tr>
<tr>
<td>2. a. Have any local governments endorsed this project?</td>
<td></td>
</tr>
<tr>
<td>(Identify):</td>
<td></td>
</tr>
<tr>
<td>Yes=0 No=3</td>
<td></td>
</tr>
<tr>
<td>2. b. Have any local organizations endorsed this project?</td>
<td></td>
</tr>
<tr>
<td>(Identify):</td>
<td></td>
</tr>
<tr>
<td>Yes=0 No=1</td>
<td></td>
</tr>
<tr>
<td>3. a. Have any local governments indicated opposition?</td>
<td></td>
</tr>
<tr>
<td>(Indicate scale):</td>
<td></td>
</tr>
<tr>
<td>If Yes, minimal =1, moderate =2, significant =3</td>
<td></td>
</tr>
<tr>
<td>3. b. Have any private groups or individuals indicated opposition?</td>
<td></td>
</tr>
<tr>
<td>(Indicate scale):</td>
<td></td>
</tr>
<tr>
<td>If Yes, minimal =1, moderate =2, significant =3</td>
<td></td>
</tr>
<tr>
<td>4. Will the project divide identifiable neighborhoods, school or business service areas?</td>
<td>Yes=1 No=0</td>
</tr>
<tr>
<td>5. Will this project displace homes, cultivated farmlands, or businesses?</td>
<td></td>
</tr>
<tr>
<td>If yes, indicate scale of displacement:</td>
<td></td>
</tr>
<tr>
<td>No. Homes/Farms/Businesses: Estimated Acreage:</td>
<td></td>
</tr>
<tr>
<td>&lt; 6</td>
<td>1</td>
</tr>
<tr>
<td>6-20</td>
<td>2</td>
</tr>
<tr>
<td>&gt; 20</td>
<td>3</td>
</tr>
<tr>
<td>5. a. Has an evaluation of the potential opposition of the displaced been conducted?</td>
<td>Yes No</td>
</tr>
</tbody>
</table>

TOTAL SCORE: __________
WETLAND WORKSHEET:

The purpose of this worksheet is to assess the potential impact from the proposed project. For each question, check the appropriate answer or enter the appropriate acreage, and log score in the blank to the right.

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are there any wetlands within 300' from the edge of the present roadway?</td>
<td>Yes No=0</td>
</tr>
<tr>
<td>If yes, identify the Class and required buffer for each wetland. Note the total acreage that may be affected as a result of the proposed project below:</td>
<td></td>
</tr>
<tr>
<td>Category 1</td>
<td>No. of acres (x6)=</td>
</tr>
<tr>
<td>Category 2 or Category 3</td>
<td>No. of acres (x3)=</td>
</tr>
<tr>
<td>Forested</td>
<td>No. of acres (x2)=</td>
</tr>
<tr>
<td>Scrub-Shrub</td>
<td>No. of acres (x1.5)=</td>
</tr>
<tr>
<td>Emergent</td>
<td>No. of acres (x1.25)=</td>
</tr>
<tr>
<td>Category 4</td>
<td>No.of acres (x1)=</td>
</tr>
<tr>
<td>All Buffers</td>
<td>No.of acres (x1)=</td>
</tr>
</tbody>
</table>

**TOTAL SCORE:**

(if yes, minimum=0.5, if no, score=0)
WATER QUALITY AND PERMITTING WORKSHEET:

The purpose of this worksheet is to assess the potential watershed impact and permitting requirements associated with the proposed project. For each question, check the appropriate answer or enter the appropriate acreage, and log score in the blank to the right. If a required permit has already been obtained for the expected duration of the need, enter 0 pts and the date issued in the corresponding blank to the right.

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Will the project be located within 2000 feet of any body of water?</td>
<td></td>
</tr>
<tr>
<td>If yes, then address the following:</td>
<td></td>
</tr>
<tr>
<td>What will the total impervious surface area be upon completion of the</td>
<td></td>
</tr>
<tr>
<td>proposed project (within 2000' of any water body)?</td>
<td></td>
</tr>
<tr>
<td>&lt; 6 acres = 1</td>
<td></td>
</tr>
<tr>
<td>6-20 acres = 2</td>
<td></td>
</tr>
<tr>
<td>&gt; 20 acres = 3</td>
<td></td>
</tr>
<tr>
<td>Will the project require hydraulic permits (HPA's)?</td>
<td></td>
</tr>
<tr>
<td>Is there a known fish passage problem?</td>
<td></td>
</tr>
<tr>
<td>Yes = 4 No = 0</td>
<td></td>
</tr>
<tr>
<td>Will the project require COE Section 10, 404, or Coast Guard Section 9</td>
<td></td>
</tr>
<tr>
<td>permit?</td>
<td></td>
</tr>
<tr>
<td>Yes = 5 No = 0</td>
<td></td>
</tr>
<tr>
<td>Will the project require Shoreline Development permits?</td>
<td></td>
</tr>
<tr>
<td>Is the project located within a Shoreline of Statewide Significance?</td>
<td></td>
</tr>
<tr>
<td>Yes = 1 No = 0</td>
<td></td>
</tr>
<tr>
<td>Will any water quality permits be required (ie., NPEDS, Short-Term</td>
<td></td>
</tr>
<tr>
<td>Modification of Water Quality Standards)?</td>
<td></td>
</tr>
<tr>
<td>Yes = 4 No = 0</td>
<td></td>
</tr>
<tr>
<td>Is the project a new roadway?</td>
<td></td>
</tr>
<tr>
<td>Yes = 1 No = 0</td>
<td></td>
</tr>
<tr>
<td>2. Have any adjacent areas been identified as sensitive/critical by one</td>
<td></td>
</tr>
<tr>
<td>or more governing jurisdictions?</td>
<td></td>
</tr>
<tr>
<td>(Identify:)</td>
<td></td>
</tr>
<tr>
<td>Yes = 5 No = 0</td>
<td></td>
</tr>
<tr>
<td>3. Is the project located within a regulatory floodway?</td>
<td></td>
</tr>
<tr>
<td>Yes = 4 No = 0</td>
<td></td>
</tr>
<tr>
<td>4. Will the project increase impervious surface area within an EPA</td>
<td></td>
</tr>
<tr>
<td>designated sole source aquifer area?</td>
<td></td>
</tr>
<tr>
<td>(Identify:)</td>
<td></td>
</tr>
<tr>
<td>Yes = 2 No = 0</td>
<td></td>
</tr>
<tr>
<td>5. Will this project require the purchase of additional right-of-way, or</td>
<td></td>
</tr>
<tr>
<td>use of existing right-of-way?</td>
<td></td>
</tr>
<tr>
<td>If yes, is the project located within:</td>
<td></td>
</tr>
<tr>
<td>Forest Lands as defined by Dept. of Natural Resources?</td>
<td></td>
</tr>
<tr>
<td>U.S. Forest Service National Forest jurisdiction?</td>
<td></td>
</tr>
<tr>
<td>Other jurisdiction/resource lands of regional significance?</td>
<td></td>
</tr>
<tr>
<td>(Identify:)</td>
<td></td>
</tr>
<tr>
<td>Yes = 4 No = 0</td>
<td></td>
</tr>
<tr>
<td>Yes = 1 No = 0</td>
<td></td>
</tr>
<tr>
<td>Yes = 2 No = 0</td>
<td></td>
</tr>
<tr>
<td><strong>SUBTOTAL:</strong></td>
<td></td>
</tr>
</tbody>
</table>

If permitting agencies have been contacted, are there any foreseeable conflicts or disagreements?  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL SCORE: __________
NOISE WORKSHEET:

The purpose of this worksheet is to assess the potential noise impact and associated costs due to the proposed project. For each question, check the appropriate answer or enter the appropriate number of residences, and log score in the blank to the right.

**Question** | **Score**
--- | ---
1. Have existing noise impacts been identified along the proposed project distance?  
   **If yes,** include the cost of feasible and reasonable mitigation measures in the project cost estimate, or cite determination otherwise:  
   **___Yes ___No**

2. Is this project a **new** or existing alignment?  
   **___new ___existing**
   **If new,** evaluate the number of receptors within 400' of the edge of the proposed roadway. Go to question #4.
   **If existing,** go to question #3.

3. Does the proposed project include widening of an existing roadway?  
   **___Yes ___No**
   **If yes,** evaluate the number of receptors within 200' of the edge of the proposed roadway. Go to question #4.
   **If no,** go to question #5, enter 0 in the blank to the right.

4. Refer to the chart below, and compute the project score as follows: Divide the number of lanes that will be added/constructed by 2. Multiply the result by the number of receptors in each distance category and by the appropriate risk factor (for New or Existing alignment per question #2) for each receptor category as indicated below.

   | No. of lanes added or constructed / 2 | Receptor Category | Number of Receptors | Noise level risk factor (r.f.): NEW | EXISTING | SUBTOTAL = (No. lanes/2) * (No. receptors) * (r.f.) |
--- | --- | --- | --- | --- | --- | --- |
| < 100' | 4 | 2 | | | |
| 101-200' | 2 | 1 | | | |
| 201-400' | 1 | | | | |

5. Sum the results (Subtotals) for each category and enter the total project score in the blank to the right.  
   **TOTAL SCORE: ___**
MODE INTEGRATION WORKSHEET

The purpose of this worksheet is to assess the level of modal integration supported by the proposed project. For each question, check the appropriate answers and log score in the blank to the right.

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does the proposed project increase mobility using existing capacity (e.g., access control, TDM/TSM, GP=&gt;HOV conversion, frontage road improvement)? Yes=0 No=1</td>
<td></td>
</tr>
<tr>
<td>2. Does the project improve or facilitate linkage for movement of goods through port or terminal facilities (i.e., multimodal land-based, rail/trucking; waterborne; airborne)? Yes=0 No=1</td>
<td></td>
</tr>
<tr>
<td>3. Is the project, or does the project include, a designated HOV transfer area (e.g., park and ride lots, sheltered turnouts, flyer stop)? Yes=0 No=1</td>
<td></td>
</tr>
<tr>
<td>4. Does the proposed project improve integration between existing HOV facilities and connecting arterials (e.g., improved on or off ramp transitions, improvements to HOV termini)? Yes=0 No=2</td>
<td></td>
</tr>
<tr>
<td>5. Does the proposed project link or extend to existing HOV lanes? Yes=0 No=2</td>
<td></td>
</tr>
<tr>
<td>6. Is the project, or does it include, facilities designed to encourage use of bicycles with other modes or encourage bicycle use (e.g., bike carriers on buses, loop detectors or lane designations at intersections, storage facilities at park and rides)? Yes=0 No=1</td>
<td></td>
</tr>
<tr>
<td>7. Does the project link or extend existing or planned bikeways? Yes=0 No=1</td>
<td></td>
</tr>
<tr>
<td>8. Does the proposed project link or extend existing or planned pedestrian facilities, &amp;/or include additional pedestrian amenities? Yes=0 No=1</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SCORE:**       
LAND USE WORKSHEET:

The purpose of this worksheet is to assess the current land use and local planning/transportation policies, plans, and implementation measures of the governing jurisdictions concerned with the proposed project area. For each question, check the appropriate answer or enter the appropriate response, and log score in the blank to the right.

<table>
<thead>
<tr>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the project included in the Comprehensive and/or Transportation Plan of any of the following? (If so, identify by name):</td>
<td></td>
</tr>
<tr>
<td>Regional Transp. Planning Org.</td>
<td></td>
</tr>
<tr>
<td>Other regional planning agency</td>
<td></td>
</tr>
<tr>
<td>County &amp;/or City government</td>
<td></td>
</tr>
<tr>
<td>Other local interests/agencies</td>
<td></td>
</tr>
<tr>
<td>2. Do all the local governments having an interest in the project include it in their plans as identified above? Yes=5 No=0</td>
<td></td>
</tr>
<tr>
<td>If no, has any action been taken by each of the appropriate planning agencies to approve the project? Yes=5 No=0</td>
<td></td>
</tr>
<tr>
<td>Indicate the action by what agency(cies):</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Has the &quot;Land Use Policy and Implementation&quot; file for local governments been updated in each jurisdiction that this project passes through? Yes=5 No=0</td>
<td></td>
</tr>
<tr>
<td>4. Is the project on a roadway that directly links two or more designated growth centers? Yes=3 No=0</td>
<td></td>
</tr>
<tr>
<td>5. Is the project located on an established or planned transit line/route? Yes=1 No=0</td>
<td></td>
</tr>
<tr>
<td>TOTAL SCORE:</td>
<td></td>
</tr>
</tbody>
</table>
SCORING GUIDELINES
November 15, 1993

COMMUNITY SUPPORT:

Scoring:

- #3. Score the scale of opposition referenced by common extremes: minimal=1 to 2 individuals or a group without substantial support; significant=mobilized opposition substantial enough to seriously threaten the success of the project.

- #5. Score only the scale of displacement by number of homes/farms/businesses displaced. Acerage estimation is additional information in the scoping process.

- #5a. No score is assigned. The question serves as a procedural checklist for completing the project cost estimate.

- Total Score = sum each score entered in the column to right.

Definitions:

- "Divide identifiable neighborhoods, schools, business service areas"- Subject to local plans/existing conditions this may become an affirmative response in the case of substantial widening projects, access restrictions, or barrier separated facilities. Refer to historical local response and community plans where available.

WETLANDS:

This worksheet is intended to prompt a paper inventory of wetland resources for each project area. The values are based on the body of federal, state, and local regulations related to wetland preservation. Most notably, concurrent with WSDOT [EPM3-2-1A] and other state agency procedures, the "Washington State Four-tier Rating System, September 1, 1990" is used as the worksheet framework and the replacement ratios for compensatory mitigation outlined in The Model Wetlands Protection Ordinance, Washington State Department of Ecology are applied. The required band of analysis (300') is also based on the body of literature and adopted ordinances which establish wetland buffers ranging from 25-300' statewide. These buffers are also subject to a 1:1 replacement ratio in RCW 36.70A mandated local regulations statewide, as reflected on the worksheet.

Refer to the District Resource List for local inventory information and see the enclosed outline of the "Washington State Four-tier Rating System, September 1, 1990".

Scoring:

- Evaluate the acerage of the footprint of proposed construction encroachment into an inventoried wetland area &/or the associated buffers only.

- When the equivalent Four-tier Category of a wetland is unknown, use the "Category 2 Forested" replacement ratio.

- Total Score = sum each score entered in the column to right.

- If there are ANY wetlands that may be affected as defined above, the minimum Total Score=0.5 acres regardless of the area of encroachment. If there are NO wetlands or buffer areas affected as defined above, the Total Score=0.0 acres.
Definitions:
- "wetlands" - lands that are either permanently or seasonally "inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction." (Presidential Executive Order 11990). [WSDOT EPM3-2-1A.]

WATER QUALITY AND PERMITTING:

Scoring:
- Refer to the WSDOT Environmental Procedures Manual 6.0-6.9, March 1990 to evaluate permit requirements for the proposed project.

- Total Score = subtotal of each score entered in the column to right subject to the final operation as noted on the worksheet.

Definitions:
- "body of water" - All inter/intrastate waters within the ordinary high water line such as lakes, rivers, streams (including intermittent streams), mudflats, sand-flats, wetlands, sloughs, prairie pot-holes, wet meadows, playa llakes, or natural ponds, including all waters which are subject to the ebb and flow of the tide (ending where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by hydrologic, wind, or other effects).

- "total impervious surface area" - The total surface area of the roadway upon completion of the proposed project (i.e., width including the improvements * length of the roadway segment within 2000' of any water body).

- "Hydraulic Project" - Construction or other work that will use, divert, obstruct, or change the natural flow or bed of any river or stream, or that will utilize any of the salt or fresh waters of the state, or materials from the stream beds (WAC 220-110-020(16)).

- "fish passage problem" - Any migration barrier condition that exists when adult &/or juvenile fish are either delayed or denied passage beyond a point in a stream system or marine shallow water habitats during the normal course of their migration for spawning or rearing purposes. If fish are delayed from reaching suitable spawning areas, mass spawning or spawning in unsuitable substrate can occur, resulting in a decrease in survival. [WDF/WDW/DOT MOU (GC9058), & WDF/DOT State Interagency Agreement for Fish Passage Inventory & Barrier Removal (GC9392)].

- "Shoreline of Statewide Significance" - water areas of the state, including reservoirs, and their associated wetlands, including lands within 200 feet of the high-water mark including associated marshes, bogs, swamps, floodways, riverdeltas, and flood plains for which there is a special interest in preserving the natural characteristics and in encouraging and increasing public access to enjoy the physical and aesthetic qualities of the natural shoreline with the overall best interest of the state and people generally being considered. The restriction for development is greater because the master plan must meet the requirements of RCW 90.58.020 (see RCW 90.58.030 for list).

- "new roadway" - project construction along a new alignment.
"Sensitive/Critical" - designation subject to definition by the local governing authorities under SEPA, GMA, or zoning code implementation.

"governing jurisdiction" - The public agency, political unit, or apparatus with administrative powers to command, determine, judge, or otherwise enforce the laws, public policy and affairs within the proposed project area.

"regulatory floodway" - the area regulated by federal, State or local requirements to provide for the discharge of the base flood (the flood which has a one percent chance of being equalled or exceeded in any given year, a.k.a 100-year floodplain) so the cumulative increase in water surface elevation is no more than a designated amount (not to exceed one foot). The "Zone A" designation on the Flood Insurance Rate Maps by the Federal Emergency Management Agency, indicates the 100-year floodplain, or minimum level to be used by a community in its floodplain management regulations. (44 CFR Ch.I 9.4)

"sole source aquifer area" - area designated by the EPA as the sole or principal source of drinking water for a given aquifer service area; that is, an aquifer which is needed to supply 50% or more of the drinking water for that area and for which there are no reasonably available alternative sources should the aquifer become contaminated. (Section 1424(c) of Safe Drinking Water Act, 1974)

"Forest Land" - all land that is capable of supporting a merchantable stand of timber (a stand of trees that will yield logs &/or fiber suitable in size and quality for the production of lumber, plywood, pulp, or other forest products and of sufficient value at least to cover all the cost of harvest and transportation to available markets) and is not being actively used for a use which is incompatible with timber growing. (RCW 76.09.020, WAC 222)

"Other jurisdictions/resource lands of regional significance" - areas including but not limited to: tribal governments, reservation lands, regulatory commissions (e.g., Columbia River Gorge Commission), significant/endangered wildlife corridors, prime/unique farmlands, archaeological/historical sites, National Park lands, other recreation land, and wild and scenic rivers that have been identified in the planning process as outlined in the Environmental Procedures Manual 3.0-3.12, March 1990.
NOISE:

The intent of this worksheet is that it be carried out in-house using aerial photographs of the right-of-way and the table provided on the worksheet.

Scoring:

- Determine whether there are existing noise impacts over 67dBA level that would require mitigation where feasible and reasonable (see definition below). Cost of mitigation measures MUST be included in the cost estimate EXCEPT where mitigation has been previously determined 'unfeasible' or 'unreasonable' by WSDOT procedures. This determination must be referenced on the worksheet in the space provided and is the only justifiable reason for not including these potential costs in the estimate.

- If the proposed project is on a new alignment evaluate the number of receptors within 400' of the edge of the existing roadway.

- If the proposed project will widen the roadway along the existing alignment, evaluate the number of receptors within 200' of the edge of the existing roadway.

- Working with aerial photographs of the area, group the number of receptors with respect to distance from the edge of proposed roadway as categorized on the worksheet chart. If new, <100', 101-200', 201-400'; if existing, <100', 101-200' ONLY).

- Using the Noise Level Risk Factors in question #4, compute the subtotals as follows: Divide the number of lanes that will be added/constructed by 2. This result will be the same for each Receptor Category. Multiply the result by the number of receptors in each distance category and by the appropriate risk factor. Apply only one risk factor to each Receptor Category from either the new or existing alignment column in the worksheet chart.

- Add the Subtotals in the right-hand column of the worksheet chart and log the Total Score in the blank provided.

Definitions:

- "existing noise impacts"- Noise priority sites as established by WSDOT Directive D 22-22, November 2, 1987. Guidelines are detailed for conducting a noise inventory for existing state highways. The priority listing was developed based on an inventory of noise sensitive developments which existed, or for which a building permit had been approved, prior to May 14, 1976 and is current as of August 19, 1986 in Appendix A. As new sites must be investigated, because of citizen complaints or public officials' concerns, the procedures in this Directive will be used to prioritize the new sites. More comprehensive or up-dated inventories may have been conducted by individual districts, check with environmental noise specialists. (WSDOT EPM 3.1, March 1990)

- "feasible mitigation"- Noise mitigation that has no overwhelmingly significant physical constraints to construction and will provide significant noise abatement for some of the impacted receptors. Refer to WSDOT Headquarters Environmental division for specific parameters.

- "reasonable mitigation"- Noise mitigation that will cost ≤ $10,500/residence, not withstanding scenic views, desirability, and other consideration. Refer to WSDOT Headquarters Environmental division.
MODE INTEGRATION:

Scoring:

• Total Score = Sum of each score entered in the the column to the right.

Definitions:

• "improve or facilitate linkage for movement of goods through port or terminal facilities"- The proposed project must facilitate the movement of goods along a roadway with high truck traffic (for roadway classifications by truck percentage, Refer to "Task B: Freight and Goods Transportation System; Cost Responsibility Study-Phase I", Final Report for the St of WA Legislative Transportation Commission, January 1993.) and be within a ten mile radius from the terminal facility.

• "increased mobility"- used here to indicate conditions of greater movement of people and/or goods along the main roadway than presently supported by the facility.

• "bikeway"- Includes all four bikeway classes described by WSDOT Design Manual Standards.

LAND USE:

Scoring:

• Total Score = Sum of each score entered in the the column to the right.

Definitions:

• "local governments having an interest"- Those counties/cities where the proposed project passes through their respective jurisdictional boundaries.

• "Land Use Policy and Implementation file"- reference to a DOT District specific library of up-to-date documents, long-range transportation policies, and implementation measures for each city or county government encompassed by the District planning area. Each file must contain the following elements to enter a score of 5 points: Land Use Checklist, Comprehensive Plan, Transportation Plan, Zoning Code, Road/Design Standards, Critical Areas/Sensitive Areas Code/Ordinance, and other supporting inter-local, regional, &city/county-wide policy documents.

• "Land Use Checklist"- Form used to facilitate distillation of the governing jurisdiction's codes and policies. Intended for use as a procedural checklist, only categorical completion of this form (yes/no) is scored. See blank form attached.

• "designated growth center"- An area designated by regional or local planning agencies to receive a major share of the regional employment growth in the future.
**LAND USE CHECKLIST**

Indicate the specific zoning code/ordinances, comprehensive plan, transportation plan, road/design standards, or other adopted policy documents that implement each policy described below:

<table>
<thead>
<tr>
<th>Policy</th>
<th>Citations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Requires sidewalks as part of site planning.</td>
<td></td>
</tr>
<tr>
<td>b. Requires/Encourages integrated bikeways or bicycle systems/facilities.</td>
<td></td>
</tr>
<tr>
<td>c. Requires transit coordination for major residential, commercial, or retail development projects. (e.g., Bus turnouts, Sheltered passenger waiting facilities, etc.).</td>
<td></td>
</tr>
<tr>
<td>d. Allows trade-offs between parking requirements and TDM measures.</td>
<td></td>
</tr>
<tr>
<td>e. Requires/Encourages Clustering of major buildings</td>
<td></td>
</tr>
<tr>
<td>f. Requires/Encourages physical orientation of major buildings to facilitate transit use.</td>
<td></td>
</tr>
<tr>
<td>g. Requires Large-scale developments to integrate preferential lane treatment in their site design.</td>
<td></td>
</tr>
<tr>
<td>h. Promotes measures to minimize impacts from development of adjacent land on roadway capacity (e.g., requiring combined driveways where possible, rear access, one-way drives, etc.).</td>
<td></td>
</tr>
<tr>
<td>i. Other exceptional policies as appropriate:</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

STATEWIDE RESOURCE SUMMARY


RESOURCES LIST:

WSDOT District 1

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| **King County** | **General Contact:** Clint Lank, Administrator-Environmental Division  
                       King County Building and Land Development  
                       3600 136th Place SE, Bellevue, WA 98006-1400  
                       (206) 296-6602, SCAN: 667  

GMA: yes, mandate effective July 1, 1990.  

Critical Areas Ordinance: yes, #9614 "Sensitive Areas Ordinance" adoption effective November 27, 1990. Designates areas to include: wetlands, streams, flood hazard areas, steep slopes, erosion, landslide, seismic, volcanic, and coal mine hazard areas. "Sensitive Areas Map Folio", inventory established.  

Shorelines: King County Shoreline Management Master Program  
           November 1975. King County Planning Department.  

Wetlands Inventory: yes, "King County Wetlands Inventory", field-verified inventory. Also refer to King County Surface Water Management applicable Basin Reconnaissance Program Reports. Contact: Mary Jorgensen, Basin Planning Unit 400 Yesler Way, Rm.400, Seattle, 98104-2637 (206) 296-8002. The City of Auburn has their own Wetlands Inventory Reports covering the Mill Creek (1/89) and Green & White (6/90) River Basins.  

Publications to Order: "King County Nonmotorized Transportation Plan", Dept. of Public Works, adopted May 1993.  

| City of Bothell | **General Contact:** Gordon Y. Ericksen, Director  
                   Department of Community Development  
                   18305 101st Avenue NE, Bothell, WA 98011  
                   (206) 486-8152, fax 487-1204  

GMA: yes, mandate effective July 1, 1990.  


Wetlands Inventory: no, National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology maps and areas included in the King County Wetlands Inventory are used a preliminary indicators.  

## RESOURCE LIST:

### WSDOT District 1 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Federal Way   | **General Contact:** Greg Fewins, Planner  
City of Federal Way Planning Department  
33530 First Way South, Federal Way, WA 98003  
(206) 661-4000, fax 661-4129  

**GMA:** yes, mandate effective July 1, 1990.  

**Critical Areas Ordinance:** yes, FWCC Article 14, adopted February 28, 1990. Identifies and adopts "Environmentally Sensitive Areas Inventory" to include: streams, wetlands, wellheads, regulatory lakes, and geological hazardous areas.  


**Wetlands Inventory:** no, incorporate *King County Wetlands Inventory* data into the map inventory identified above, and refer to the National Wetlands Inventory, U.S. Fish & Wildlife Service, Washington Dept. of Ecology maps as supplementary indicators.  

| City of Issaquah     | **General Contact:** Stephen R. Clark, Senior Planner  
Development Review Department  
1775 12th Avenue NW, P.O. Box 1307  
Issaquah, WA 98027 (206) 391-1002, fax 391-1049  

**GMA:** yes, mandate effective July 1, 1990.  


**Wetlands Inventory:** no, incorporated *King County Wetlands Inventory* data into the map folio identified above.  

**Other:** The city may be petitioning EPA for Sole Source Aquifer status. For current information, contact: Sheldon T. Lynne, Project Engineer, Public Works Department (206) 391-1004.
RESOURCE LIST:

WSDOT District 1 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of SeaTac     | General Contact: Jack A. Dodge, Land Use Supervisor  
|                    | Department of Planning & Community Development  
|                    | 19215 28th Avenue South  
|                    | SeaTac, WA 98188 (206) 878-9272, fax 878-9416 |

GMA: yes, mandate effective July 1, 1990.

Critical Areas Ordinance: yes, -interim #92-1041, adopted October 27, 1992. Identifies and adopts “Sensitive Areas in the City of SeaTac” inventory including areas of erosion, landslide, and seismic hazards; and “Wetland and Stream Classifications in the City of SeaTac” inventory. Also refer to the Federal Emergency Management Agency, Flood Insurance Rate Maps, for detailed floodplain boundaries.

Wetlands Inventory: yes, refer to the “Wetland and Stream Classifications in the City of SeaTac” inventory and areas also included in the King County Wetlands Inventory as preliminary indicators.
RESOURCE LIST:

WSDOT District 1 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| Snohomish County  | General Contact: Greg Williams, Manager  
|                   | Department of Planning and Community Development  
|                   | County Administration Building, 3000 Rockefeller  
|                   | Everett, WA 98204-4060  
|                   | (206) 388-3313, fax 388-3670  
|                   | GMA: yes, mandate effective July 1, 1990.  
|                   | Critical Areas Ordinance: no, ordinance currently challenged.  
|                   | Contact: Tom Niemann, Senior Planner II, Planning Department  
|                   | SEPA ordinance: yes, Title 23 SCC. Implements RCW 43.21C and 197-11  
|                   | WAC, Environmental Checklist.  
|                   | Shorelines: Snohomish County Shoreline Management Master Program,  
|                   | Flood plain ordinance: yes, Title 27 SCC updated February 27, 1984. Refer  
|                   | to Federal Emergency Management Agency, National Flood Insurance Rate  
|                   | Maps. Community #535534 for detailed floodplain boundaries.  
|                   | Wetlands Inventory: yes,"Stream & Wetland Survey Atlas" inventory,  
|                   | August 1986 -includes Cowardin classifications and complete field-  
|                   | verification. Contact: Daniel Holeski, Cartographer (206) 388-3313 for  
|                   | maps, & Frank Scherf, Biologist for survey classifications(206) 388-3624.  
|                   | Other: "Snohomish County Agricultural Preservation Plan", ordinance #82-134  
|                   | adopted March 1983. Identifies and designates map inventory of  
|                   | agricultural areas of primary importance.  
|                   | "Snohomish County Interim Forest Land Conservation Plan", ordinance  
|                   | #92-283, adopts map inventory as exhibit B. Identifies and designates  
|                   | interim Forest Reserve, interim Commercial Forest, and U.S.F.S. areas.  

# RESOURCE LIST:

## WSDOT District 1 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Edmonds     | **General Contact:** Robert Chave, Planning Manager  
                      City of Edmonds Planning Division  
                      Civic Center, 250 Fifth Avenue North  
                      Edmonds, WA 98020  
                      (206) 775-2525, SCAN: 495-0218  
                      **GMA:** yes, mandate effective July 1, 1990.  
                      **Critical Areas Ordinance:** yes-interim #2879, June 26, 1992, ECC Title 20.15B. Identifies and adopts "Critical Areas" -paper inventory with project specific field-verification.  
                      **Wetlands Inventory:** yes, -paper inventory with project specific field-verification, otherwise based on NWI maps & DNR (streams) hydrography. Also refer to the Snohomish County "Stream and Wetland Survey Atlas" for field-verified wetlands on periphery. |
| City of Everett     | **General Contact:** Steve Ingalsbe, Assistant Planner  
                      City of Everett Planning Department  
                      3002 Wetmore Avenue  
                      Everett, WA 98201 (206) 259-8731, Scan: 723-1011  
                      **GMA:** yes, mandate effective July 1, 1990.  
                      **Wetlands Inventory:** yes, -paper inventory. Also refer to the Snohomish County "Stream and Wetland Survey Atlas" for field-verified wetlands on periphery. |
# Resource List:

## WSDOT District 1 (Continued)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Lynnwood   | **General Contact:** J. Robert Henderson, Director  
19100 44th Avenue West, P.O. Box 5008  
Lynnwood, WA 98046-5008  
(206) 670-6645  

**GMA:** yes, mandate effective July 1, 1990.  

**Critical Areas Ordinance:** yes-interim #1877, adopted Feb 24, 1992.  
- includes generalized inventory. Refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed floodplain inventory. **Contact:** Jeff Elekes, Public Works Department (206) 670-6644.  

**Wetlands Inventory:** yes, also refer to the Snohomish County "Stream and Wetland Survey Atlas" for field-verified wetlands on periphery.  

City of Mill Creek  

**General Contact:** Beth Humphreys, Planner  
City of Mill Creek Planning Department  
15728 Mill Creek Blvd.  
Mill Creek, WA 98012  
(206) 745-1891, 337-1116  

**GMA:** yes, mandate effective July 1, 1990.  

**Critical Areas Ordinance:** yes, adopted January 1992. Designations to include: erosion/slippage hazardous areas, 100-yr flood plain area, salmon bearing & other streams, aquatic habitat areas, & wetlands. Refer to "Environmental Critical Areas" map inventory. Also refer to Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed flood plain boundaries.  

**Wetlands Inventory:** yes, paper inventory based on Snohomish County, "Stream & Wetland Survey Atlas" designations.
**RESOURCES LIST:**

**WSDOT District 1 (Continued)**

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Mountlake Terrace | **General Contact:** Emily J. Lavin, Associate Planner  
Community Development Department  
23200 58th Avenue West  
Mountlake Terrace, WA 98043 (206) 776-1161  
**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes, -interim #1584, November 10, 1984. Identifies and adopts “Environmentally Sensitive Areas” generalized inventory. Also refer to National Flood Insurance Rate Maps, Federal Emergency Management Agency for detailed flood plain boundaries.  
**Wetlands Inventory:** no, -project specific field delineations for the majority of sites are available.                                                                                           |
| Whatcom County          | **General Contact:** Terry Galven, Planner  
Whatcom County Planning Department  
284 W. Kellogg Road, Suite B  
Bellingham, WA 98226 (206) 676-6756  
**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes, -temporary #93-032 adopted June 23, 1992 currently challenged-- repealed by referendum November 1993 (refer to SEPA Implementation). Mapped designations include: geologically hazardous areas, rivers and streams, & wetlands partially field-verified.  
**Flood plain Ordinance:** yes, #87-25, updated 1987. Refer to the National Flood Insurance Rate Maps, Federal Emergency Management Agency for detailed flood plain boundaries.  
**Shorelines:** Whatcom County Shoreline Management Master Program, August 27, 1976. Amended January 28, 1993. **Contact:** Matt Amott x6907.  
**Wetlands Inventory:** yes, -paper inventory based on National Wetlands Inventory, U.S. Fish & Wildlife Service maps on GIS system. **Contact:** Chris Piers, Biologist for maps. |
<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Bellingham | **General Contact:** Patricia Decker, Planning Director  
Department Community Development  
210 Lottie Street  
Bellingham, WA 98225 (206) 676-6982  
**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** no.  
**SEPA Implementation:** BMC Chapter 16.04. See also, Subdivision ordinance #8192 (updated by amendments).  
**Flood plains:** yes, BMC Chapter 17.76. Refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed flood plain designations.  
**Shorelines:** City of Bellingham Shoreline Management Master Program, updated 1989, ordinance #9887, pursuant to RCW 90.58. City of Bellingham Planning and Economic Development Department.  
**Wetlands Inventory:** yes, governed by separate ordinance #10267, adopted December 9, 1991. Refer to "City of Bellingham Wetlands Inventory", maps for field-verified classifications. Also covers streams.  
**Other:** City of Bellingham Comprehensive Plan, #88-68 (amended) 1980. |
| City of Lynden   | **General Contact:** Amy Mangum, Planner  
City of Lynden Planning Department  
323 Front Street, Lynden WA 98264 (206) 354-3446  
**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes-interim #885 LMC "Environmental Policy" Title 16.16, adopted October 1991. Mapped designations include: steam & creeks, slopes, and wetlands. Also refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed flood plain designations.  
**Wetlands Inventory:** yes, refer to Critical areas map - paper inventory. Also refer to the Whatcom County GIS wetlands mapping - paper inventory. |
<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contacts</th>
</tr>
</thead>
</table>
| Puget Sound Regional Council | **RTPO Contact:** Mary McCumber, Executive Director  
                                216 First Avenue South  
                                Seattle, WA 98104 (206) 464-7090, fax 587-4825 |
|                              | **Publications to Order:** VISION 2020, Growth and Transportation Strategy for the Central Puget Sound Region”, October 1990. |
| King County                  | **Zoning Implementation:** Code Development Department  
                                Building and Land Development  
                                3600 136th Place SE, Bellevue, WA 98006-1400  
                                (206) 296-7283 |
|                              | **Long-Range Planning policies:** Nancy Ousley, Chief  
                                Comprehensive Planning Section  
                                707 Smith Tower, Seattle, WA 98104  
                                (206) 296-8609  
                                Don Ding, Planner  
                                Department of Public Works  
                                Transportation Planning Section  
                                King County Courthouse  
                                Seattle, WA 98104 (206) 296-6553 |
| City of Bothell              | **Zoning/Planning policies:** Barbara J. Grace, Associate Planner  
                                Department of Community Development  
                                18305 101st Avenue NE, Bothell, WA 98011  
                                (206) 486-8152, fax 487-1204 |
| City of Federal Way          | **Long-Range Planning policies:** Larry Springer, Planning Manager  
                                City of Federal Way Planning Department  
                                33530 First Way South  
                                Federal Way, WA 98003  
                                (206) 661-4102, fax 661-4129 |
|                              | **Zoning Implementation:** Greg Moore, Land Use Manager  
                                (206) 661-4106 |
## RESOURCE LIST:

### WSDOT District 1 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contracts</th>
</tr>
</thead>
</table>
| City of Issaquah   | **Long-Range Planning policies:** Stephen R. Clark, Senior Planner  
  Development Review Department  
  1775 12th Avenue NW, P.O. Box 1307  
  Issaquah, WA 98027  
  (206) 391-1002, fax 391-1049  |
|                    | **Zoning Implementation:** Jerry Lind, Senior Planner  
  (206) 391-1002, fax 391-1049  |
| City of Sea-Tac    | **Zoning/Planning Policies:** Jack A. Dodge, Land Use Supervisor  
  Dept. of Planning & Community Development  
  19215 28th Avenue South  
  SeaTac, WA 98188 (206) 878-9272, fax 878-9416  |
| Snohomish County  | **Transportation/Long-Range plan:** John Davis, Transportation Planner  
  Snohomish County Planning Dept.  
  County Administration Building  
  3000 Rockefeller, Mail Stop: 604  
  Everett, WA 98201-4060  
  (206) 388-3313, fax 388-3670  |
|                    | **Zoning/Current policies:** Barret Schmanska, Senior Planner  
  Snohomish County Planning Department  |
|                    | **Publications to Order:**  
  Snohomish County Comprehensive Plan-relevant area portions.  
  "Interlocal Agreement between Snohomish County & the Cities of Everett ... & Woodway for Implementation of the Growth Management Act.", 7/21/92. See also, "Urban Centers in Snohomish County", Planning Advisory Committee Recommendation, 3/25/93.  |
RESOURCE LIST:

WSDOT District 1 (Continued)

JURISDICTION Land Use/Transportation Planning Contracts

City of Edmonds

Transportation Plan: Gordy Hider, Engineer
City of Edmonds Public Works Department

Current & Long-Range Planning policies:
Robert Chave, Manager
City of Edmonds Planning Division
Civic Center, 250 Fifth Avenue N.
Edmonds, WA 98020
(206) 751-3202, SCAN: 693-1011

Zoning Implementation: John Bissell, Planner
City of Edmonds Planning Division


City of Everett

Zoning/Planning policies: Paul Roberts, Director
Dept. of Planning & Community Development
City Hall, 3002 Wetmore St.
Everett, WA 98201 (206) 259-8731, SCAN: 723


City of Lynnwood

Zoning/Planning policies: David W. Woods, Associate Planner
Lynnwood Planning Department
19100 44th Avenue West, P.O. Box 5008
Lynnwood, WA 98046-5008
(206) 670-6656

City of Mill Creek

Zoning/Planning policies: Beth Humphreys, Planner
City of Mill Creek Planning Department
15728 Mill Creek Blvd.
Mill Creek, WA 98012 (206) 745-1891, 337-1116
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<tr>
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</thead>
</table>
| City of Mountlake Terrace        | Zoning/Planning policies: Emily J. Laven, Associate Planner  
                                  | City of Mountlake Terrace Planning Dept.  
                                  | 23204 58th West  
                                  | Mountlake Terrace, WA 98043  
                                  | (206) 776-1161, fax 778 6421  
                                  | Transportation Plan: Joel E. Birchman, Director/City Engineer  
                                  | Public Works Department |
| Whatcom County Council of Gov't's | RTPO Contact: Rob Griffith, Transportation Project Manager  
                                  | 1203 Cornwall, Suite 104  
                                  | Bellingham, WA 98225 (206) 676-6974  
                                  | Publications to order: "Whatcom County Urban Transportation Plan",  
| Whatcom County                   | Transportation/Long-Range planning policies:  
                                  | Dan Taylor, Director & Gordon Rogers, Planner  
                                  | Whatcom County Planning Department  
                                  | 284 W. Kellogg Road, Suite B  
                                  | Bellingham, WA 98226 (206) 676-6756  
                                  | Zoning Implementation: Refer to appropriate Sub-Area plan. |
| City of Lynden                   | Transportation/Long-Range plan: Dwight Davis, Public Works Director  
                                  | 323 Front Street, Lynden WA 98264  
                                  | (206) 354-4270  
                                  | Zoning/Planning policies: Amy Mangum, Planner  
                                  | City of Lynden Planning Department |
| City of Bellingham               | Zoning/Planning policies: Patricia Decker, Planning Director  
                                  | Dept. of Planning & Economic Development  
                                  | 210 Lottie Street, Bellingham WA 98225  
                                  | (206) 676-6982, SCAN: 644 |
**RESOURCE LIST:**

**WSDOT District 2**

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelan County</td>
<td></td>
</tr>
<tr>
<td><strong>General Contact:</strong></td>
<td>Tim Smith, Planner</td>
</tr>
<tr>
<td></td>
<td>Chelan County Planning Department</td>
</tr>
<tr>
<td></td>
<td>Wenatchee, WA 98801</td>
</tr>
<tr>
<td></td>
<td>(509) 664-5225.</td>
</tr>
<tr>
<td><strong>GMA:</strong></td>
<td>yes, mandate effective August 25, 1993.</td>
</tr>
<tr>
<td><strong>Critical Areas Ordinance:</strong></td>
<td>no, interim ordinance currently in progress.</td>
</tr>
<tr>
<td><strong>SEPA ordinance:</strong></td>
<td>yes, <em>Environmental Ordinance</em> #8480-1, October 1, 1984. Implements WAC 197-11-960 <em>Environmental Checklist.</em></td>
</tr>
<tr>
<td><strong>Shorelines:</strong></td>
<td>Chelan County Shoreline Master Program, April 1975, updated 1979. Chelan County Planning Department. <strong>Contact:</strong> Tim Smith.</td>
</tr>
<tr>
<td><strong>Wetlands Inventory:</strong></td>
<td>no, refer to National Wetlands Inventory, U.S. Fish &amp; Wildlife Service, Washington Dept. of Ecology, paper inventory with some areas classified, &amp; hydric soils mapping from the Soil Conservation Service.</td>
</tr>
<tr>
<td><strong>Other:</strong></td>
<td>&quot;Draft Map: Proposal of Agriculture lands/Forest lands of long-term commercial significance.&quot; Chelan County Planning Department.</td>
</tr>
<tr>
<td>City of Leavenworth</td>
<td></td>
</tr>
<tr>
<td><strong>General Contact:</strong></td>
<td>Mike Cecka, City Administrator</td>
</tr>
<tr>
<td></td>
<td>City of Leavenworth</td>
</tr>
<tr>
<td></td>
<td>City Hall, 815 Front Street,</td>
</tr>
<tr>
<td></td>
<td>P.O. Box 287, Leavenworth, WA 98826</td>
</tr>
<tr>
<td></td>
<td>(509) 548-5275</td>
</tr>
<tr>
<td><strong>GMA:</strong></td>
<td>yes, mandate effective August 25, 1993.</td>
</tr>
<tr>
<td><strong>Critical Areas Ordinance:</strong></td>
<td>no, interim ordinance currently in progress.</td>
</tr>
<tr>
<td><strong>SEPA ordinance:</strong></td>
<td>yes, #753, 1984. No site designations have been mapped to date.</td>
</tr>
<tr>
<td><strong>Floodplain ordinance:</strong></td>
<td>yes, #600, 1976. Refer to: <em>National Flood Insurance Rate Maps</em>, Federal Emergency Management Agency, for detailed floodplain boundaries.</td>
</tr>
<tr>
<td><strong>Wetlands Inventory:</strong></td>
<td>no, see above-Chelan County.</td>
</tr>
</tbody>
</table>
Okanogen County

**General Contact:** Laurie L. Grimes, Assistant Director
Okanogen County, Office of Planning & Development
P.O. Box 1009, Okanogen, WA 98840
(509) 422-7120, fax (509) 422-7106.

**GMA:** no.

**Critical Areas Ordinance:** no, ordinance expected by 12/93.


**Shorelines:** Okanogen County Shoreline Master Program, July 7, 1987.
Okanogen County Planning Department. **Contact:** Laurie L. Grimes.


**Wetlands Inventory:** no, rely on National Wetlands Inventory, U.S. Fish & Wildlife Service, Washington Dept. of Ecology, paper inventory with some areas classified, & hydric soils mapping from the Soil Conservation Service.
<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contracts</th>
</tr>
</thead>
</table>
| North Central Regional Transp. Planning Org. | RTPO Contact: Dave Honsinger  
District 2, WSDOT (509) 663-9641 |
| Chelan County | Transportation plan: Lloyd L. Berry, County Engineer  
Director, Chelan County Public Works  
Wenatchee, WA 98801 (509) 664-5225.  
Zoning/Planning policies: Rick Simon, Senior Planner  
Chelan County Planning Department  
Wenatchee, WA 98801 (509) 664-5225. |
| City of Leavenworth | General Contact: Mike Cecka, City Administrator  
City of Leavenworth  
City Hall, 815 Front Street,  
P.O. Box 287, Leavenworth, WA 98826  
(509) 548-5275 |
| Okanogen County | Transportation plan: Steven A. Hyzer, Division Manager  
Roadway Engineering Division  
Okanogen County Public Works  
237 4th Avenue North, P.O. Box 232  
Okanogen, WA 98840  
(509) 422-7200, fax (509) 422-7301.  
Zoning/Current policies: Louis Webster, Assistant Planner  
Okanogen County Planning Department  
Long-Range planning policies: Laurie L. Grimes, Assistant Director  
Okanogen County Planning Department  
P.O. Box 1009, Okanogen, WA 98840  
(509) 422-7120, fax (509) 422-7106. |
# RESOURCE LIST:

## WSDOT District 3

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| Clallam County     | **General Contact:** Bill White, Director  
Callam Department of Community Development  
223 E. 4th Street, Port Angeles, WA  98362  
(206) 452-7831.  

**GMA:** yes, mandate effective July 1, 1990.  

**Critical Areas Ordinance:** yes, interim-C.C.C27.12 adopted by #471/493 effective July 1/December 10, 1992.  
Adopts an overlay inventory of: geological hazardous areas, fish & wildlife habitat conservation areas, frequently flooded areas, critical aquifer recharge areas, & wetlands.  

**Shorelines:** Clallam County Shoreline Management Master Program Designation of Environments, June 30, 1976.  
Clallam County Planning.  

**Wetlands Inventory:** yes, implemented by Critical Areas Ordinance, December 10, 1992-paper inventory overlay.                                                                                                                                                                                                                                           |
| City of Forks      | **General Contact:** Dave Zeller, Public Utilities Supervisor  
City of Forks, 5th & Division  
P.O. Box 1998, Forks, WA  98331  
(206) 374-5412, SCAN 737  

**GMA:** yes, mandate effective July 1, 1990.  

**Critical Areas Ordinance:** yes, -interim #342 adopted February 24, 1992.  
Identifies and adopts performance criteria to be applied case-by-case. No designations have been made yet, refer to the Federal Emergency Management Agency, Flood Insurance Rate Maps, for floodplain boundaries.  

**Wetlands Inventory:** no, National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology maps are used a preliminary indicators.  
Governed by separate wetlands ordinance #341, adopted February 24, 1992.
<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Port Angeles | **General Contact:** Bradley Collins, Planning Director  
|                      | City Planning Department  
|                      | 321 East 5th, P.O. Box 1150  
|                      | Port Angeles, WA 98362  
|                      | (206) 457-0411                |
|                      | **GMA:** yes, mandate effective July 1, 1990.  
|                      | **Critical Areas Ordinance:** yes, -interim #2656, adopted November 25, 1991. Identifies and adopts "Critical Areas Composite Map" an inventory of: streams & stream corridors, frequently flooded areas, geological hazardous areas, fish & wildlife habitat conservation areas, locally unique features, & wetlands.  
|                      | **Wetlands Inventory:** yes, refer to "Critical Areas Composite Map" cited above- paper inventory based on NWI wetlands maps and SC5 hydric soils inventory. Also governed by separate wetlands ordinance #2655, adopted November 25, 1991. |
## Jefferson County

**General Contact:** Craig Ward, Director  
Jefferson County Planning & Building Department  
County Courthouse, 1820 Jefferson Street  
P.O. Box 1220, Port Townsend, WA 98368  
(206) 385-9140.

**GMA:** yes, opted in 1992.

**Critical Areas Ordinance:** no, ordinance currently under review.  
**Contact:** Eric Taves & James Fahland, Jefferson County Planning Dept.


**Shorelines:** Jefferson-Port Townsend Shoreline Management Master Program, March 7, 1989. Jefferson County Planning Department.


**Other:** ordinance in place granting County discretion in sensitive area designation when not covered by map inventory designations.
### RESOURCE LIST:

#### WSDOT District 3 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Port Townsend      | **General Contact:** Michael Hildt, Executive Assistant/Planner  
City of Port Townsend  
540 Water Street, Port Townsend, WA  98368-5724  
(206) 385-3000  

**GMA:** yes, opted in, 1992.  

**Critical Areas Ordinance:** yes-interim, #2319, adopted October 19, 1992. Identifies and adopts "Sensitive Area Determinations", map drafted July 8, 1992-generalized inventory of: geological hazards, habitat conservation area, frequently flooded areas & critical drainage corridors, critical aquifer recharge areas, & wetlands.  

**Wetlands Inventory:** yes, implemented by Environmentally Sensitive Areas Ordinance, July 8, 1992-paper inventory with some field delineation based on NWI maps, SCS soils, planimetric & DNR (streams) hydrography. |

| Kitsap County              | **General Contact:** Ron Perkerewicz, Director  
Kitsap County Department of Community Development  
614 Division Street, MS 36  
Port Orchard, WA  98366 (206) 876-7182, fax 895-4925  

**GMA:** yes, mandate effective July 1, 1990.  

**Critical Areas Ordinance:** yes,-interim strategies adopted January 27, 1992. Classifies and designates critical areas including: aquifer recharge area, fish and wildlife habitat, geologically hazardous area, frequently flooded areas, streams & wetlands. Generalized inventory is available.  

**Contact:** John P. Vodopich, Planner, Kitsap County DCD (206) 876-7181  

**Shorelines:** Kitsap County Shoreline Management Master Program, July 11, 1977. Department of Community Development, Port Orchard, WA.  

**Wetlands Inventory:** yes, refer to Environmentally sensitive/Critical areas map designations: paper inventory only.  

**Other:** "Strategies for Resource Lands Designations and Interim Development Regulations" adopted April 20, 1992. Classifies and designates resources lands to include: agricultural, forest, and mineral resource lands. Inventory currently underway.  

**Contact:** John P. Vodopich, Planner. |
## RESOURCE LIST:

### WSDOT District 3 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
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<tbody>
<tr>
<td>City of Poulsbo</td>
<td><strong>General Contact:</strong> Laurence Stockton, Planning Director&lt;br&gt;City of Poulsbo Planning Department, City Hall&lt;br&gt;19050 Jensen Way NE, Poulsbo, WA 98370&lt;br&gt;(206) 779-3006&lt;br&gt;&lt;br&gt;<strong>GMA:</strong> yes, mandate effective July 1, 1990. <strong>Critical Areas Ordinance:</strong> yes-interim, #91-17, adopted May 15, 1991. Identifies and adopts &quot;Environmentally Sensitive Area Map&quot;, -generalized inventory of: steep slopes, shorelines, stream channels, &amp; wetlands. Refer to the Federal Emergency Management Agency &quot;Flood Insurance Rate Maps&quot; for detailed floodplain inventory, available at the city offices.&lt;br&gt;&lt;br&gt;<strong>Wetlands Inventory:</strong> yes, refer to &quot;Environmentally Sensitive Area Map&quot; -paper inventory based on National Wetlands Inventory, U.S. Fish &amp; Wildlife Service, Department of Ecology maps.</td>
</tr>
<tr>
<td>Grays Harbor County</td>
<td><strong>General Contact:</strong> Kenneth Kimura, Director&lt;br&gt;Grays Harbor County Planning and Building Dept.&lt;br&gt;100 West Broadway, P.O. Box 390&lt;br&gt;Montesano, WA 98563 (206) 249-5579&lt;br&gt;&lt;br&gt;<strong>GMA:</strong> no. <strong>Critical Areas Ordinance:</strong> yes, - resolution #92-32 adopted April 6, 1992. Designates Resource lands and Critical areas including: agricultural, forest, &amp; mineral lands, geologically hazardous areas, frequently flooded areas, aquifer recharge areas, fish and wildlife habitat conservation areas, &amp; wetlands. Partial inventory of resource lands in zoning code and Assessor’s office, Federal Emergency Management Agency &quot;Flood Insurance Rate Maps&quot; referred to for floodplain identification, other area inventories not available. <strong>Shorelines:</strong> Grays Harbor County Shoreline Management Master Program, June 3, 1974. Grays Harbor Planning and Building Department. <strong>Wetlands Inventory:</strong> no, refer to National Wetlands Inventory, U.S. Fish &amp; Wildlife, Dept. of Ecology, map designations.</td>
</tr>
<tr>
<td>JURISDICTION</td>
<td>Critical/Sensitive Areas Citations</td>
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</tr>
</tbody>
</table>
| Pierce County         | **General Contact:** Joe Scorcio, Director  
Pierce County Department of Planning & Natural Resource Development  
2401 South 35th Street, Suite 2  
Tacoma, WA  98409 (206) 591-7158, SCAN 236  

**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes, -((interim # adopted November 1991. ))  
Identifies and adopts “Critical Areas Atlas” to include designations for: aquifer recharge areas, fish and wildlife habitat & streams, mine/seismic/volcanic/landslide & erosion hazard areas.  **Contact:** Department of Planning and Land Services  

**Floodplain Ordinance:** yes, (# adopted). Refer to: National Flood Insurance Rate Maps, Federal Emergency Management Agency, for detailed floodplain boundaries.  

**Shorelines:** Pierce County Shoreline Management Master Program. ((July 11, 1977. Planning and Land Services Department. Refer to the “Pierce County: Shoreline Environment Atlas” at the Pierce Co.Development Center.  

**Wetlands Inventory:** yes, -governed by ordinance #88-182, adopted February 28, 1989. Designations are inventoried in “Pierce County Wetlands Atlas: 1988” -paper inventory with partial field verification and categorization. |

| City of Puyallup      | **General Contact:** Michael Casey, Director  
Planning & Community Development Department  
Municipal Building, 330 Third Street SW  
Puyallup, WA  98371  (206) 841-5502  

**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes-#2324, adopted July 28, 1992. Designations include: geological hazards, recharging ground water areas, surface water systems, wildlife habitat areas, & wetlands. Mapped inventory covers all types except wildlife habitat areas. Also refer to the Federal Emergency Management Agency “Flood Insurance Rate Maps” for detailed floodplain inventory, available at the city offices.  

**Wetlands Inventory:** yes, refer to Critical areas maps.  

**Other:** Agricultural Resource areas are identified and protected by zoning overlay identified in the comprehensive plan.
## Resource List

### WSDOT District 3 (Continued)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Sumner     | **General Contact:** Greg McCormick, Director  
                      Department Community Development  
                      City Hall, 1104 Maple Street  
                      Sumner, WA 98390 (206) 863-5263 |
|                    | **GMA:** yes, mandate effective July 1, 1990. |
|                    | **Critical Areas Ordinance:** yes-#1539-43, 1545-7, & 1551, adopted March 16, & April 6, 1992. Designations include: agricultural & mineral resources, wetlands, aquifer recharge areas, seismic & volcano hazards, wildlife habitat areas, & frequently flooded areas. Mapped inventory available. Also refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed floodplain designations. **Contact:** John Doan, Planner, DCD. |
|                    | **Wetlands Inventory:** yes, refer to Critical areas maps. |
| Thurston County     | **General Contact:** Paula Ehlers or Pene L. Speaks  
                      Thurston County Planning Department  
                      2000 Lakeridge Drive SW  
                      Olympia, WA 98502-6045 (206) 786-5554, fax 754-4462 |
|                    | **GMA:** yes, mandate effective July 1, 1990. |
|                    | **Critical Areas Ordinance:** no, currently under review. **Contact:** Steve Morrison, Thurston Regional Planning Council (206)786-5480. |
|                    | **Floodplain Ordinance:** no. |
|                    | **Shorelines:** Thurston County Shoreline Management Master Program, updated May 15, 1990. Thurston County Planning Department. |
|                    | **Wetlands Inventory:** yes, -governed by zoning: chapter 20.36 ordinance #67-08, adopted September 1, 1980. Designations are inventoried in "Thurston County Wetlands Inventory" -color infra-red aerial photography inventory with partial (20%) field verification and categorization. |
|                    | **Other:** Comprehensive plan identifies zoning overlay for marine bluffs, & includes unique habitats, geologic hazard areas, aquifers/ & sensitive areas, fish bearing streams, special plants & animal communities, & wetlands under "Environmentally Sensitive Areas" map set. Comprehensive plan also includes noise impact areas, farmland, forestry areas, open space and preserves designation maps. |
**RESOURCE LIST:**

**WSDOT District 3 (Continued)**

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Lacey | **General Contact:** Robert L. Patrick, Director  
Department Community Development  
City Hall, 420 College Street SW, P.O. Drawer B  
Lacey, WA 98390  (206) 863-5263  

**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes-#1539-43, 1545-7, & 1551, adopted March 16, & April 6, 1992. Designations include: agricultural & mineral resources, wetlands, aquifer recharge areas, seismic & volcanic hazards, wildlife habitat areas, & frequently flooded areas. Refer to "Environmental Protection and Resource Conservation Plan" for inventory. Also refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed floodplain designations. **Contact:** John Doan, Planner, DCD.  
**Wetlands Inventory:** yes, refer to Critical areas maps. |
| City of Olympia | **General Contact:** Harold Robertson, Planning Director  
Department Community Development  
Building 1, Administration, 2000 Lakeridge Drive SW  
Olympia, WA 98502  (206) 753-8314  

**GMA:** yes, mandate effective July 1, 1990.  
**Critical Areas Ordinance:** yes-interim #5272, adopted April 16, 1992. Identifies areas including: aquifer recharge areas, erosion, landslide, & seismic hazards, frequently flooded areas, significant upland habitat, streams, & wetlands. **Contact:** Todd Stamm, Environmental Review Officer  
**Floodplains:** yes, #4334 adopted 1981. Refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed floodplain designations.  
**Wetlands Inventory:** yes, refer to "Thurston Regional Wetland & Stream Corridor Inventory", maps for generalized aerial remote sensing survey as indicators with some classification & field verification.  
**Other:** The 1985 SEPA ordinance adopted "Environmentally Sensitive Areas" maps that are still referred to in addition to current inventories. 1985 designations included: woodlands, fishbearing streams, steep slopes, scenic vistas, and wetlands. Protections of some areas has been retained in some cases outside of the Critical Areas Ordinance. |
**JURISDICTION** | **Critical/Sensitive Areas Citations**
--- | ---
City of Tumwater | **General Contact:** Doug Baker, Director  
Department Community Development  
City Hall, 555 Israel Road  
Tumwater, WA 98501  
(206) 754-4180

**GMA:** yes, mandate effective July 1, 1990.

**Critical Areas Ordinance:** yes- "Conservation Plan", adopted August 20, 1991. Designations include: agricultural/forest/mineral resource lands, aquifer recharge areas, frequently flooded areas, geologically hazardous areas, fish & wildlife habitat areas, and wetlands. Refer to the Federal Emergency Management Agency "Flood Insurance Rate Maps" for detailed floodplain designations.

**Wetlands Inventory:** yes, refer to local portion of the "Thurston County Wetlands Inventory" as indicators.
### RESOURCE LIST:

#### WSDOT District 3 (Continued)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>RTPO Contact</th>
<th>Land Use/Transportation Planning Contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clallam County</td>
<td>Wendy Clark, Associate Planner Department of Community Development 223 E. 4th Street, Port Angeles, WA 98362 (206) 452-7831, ext.240, fax (206) 452-0470</td>
<td>&quot;Transportation Facilities &amp; Strategies&quot;, June 30, 1992.</td>
</tr>
<tr>
<td>City of Forks</td>
<td>Phil A. Olbrechts, City Attorney/Planner P.O. Box 1998, Forks, WA 98331 (206)374-5412, SCAN 737</td>
<td></td>
</tr>
<tr>
<td>City of Port Angeles</td>
<td>David Sawyer, Senior Planner City of Port Angeles Planning Department 321 East Fifth, P.O. Box 1150 Port Angeles, WA 98362 (206) 457-0411 ext.296, SCAN 538-1296</td>
<td></td>
</tr>
<tr>
<td>Jefferson County</td>
<td>Bruce Laurie, Program Manager Jefferson County Dept. of Public Works P.O. Box 1220, Port Townsend, WA 98368 (206) 385-9168</td>
<td></td>
</tr>
<tr>
<td>City of Port Townsend</td>
<td>Kit Perkins, Planner City of Port Townsend 540 Water Street, Port Townsend, WA 98368 (206) 385-3000</td>
<td>&quot;Gateway Development Plan&quot;, City of Port Townsend &amp; WSDOT, adopted August 2, 1993.</td>
</tr>
<tr>
<td>Puget Sound Regional Council</td>
<td>Mary McCumber, Executive Director 216 First Avenue South Seattle, WA 98104 (206) 464-7090, fax 587-4825</td>
<td></td>
</tr>
<tr>
<td>JURISDICTION</td>
<td>Land Use/Transportation Planning Contacts</td>
<td></td>
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</tr>
<tr>
<td>Kitsap County</td>
<td>Transportation/Long-Range plan: Chuck Shank, Transportation Planner Kitsap County Dept. of Public Works 614 Division Street, MS 36 Port Orchard, WA 98366 (206) 876-7121, fax 895-4925 Zoning/Current policies: Holly Boothe, Planner Kitsap-Dept. of Community Development</td>
<td></td>
</tr>
<tr>
<td>City of Poulsbo</td>
<td>Zoning/Planning policies: Bonnie Whitson, Planning Technician City of Poulsbo Planning Department P.O. Box 98, Poulsbo, WA 98370 (206) 779-3006</td>
<td></td>
</tr>
<tr>
<td>Grays Harbor Regional Planning Commission</td>
<td>RTPO Contact: Sue Patnude, Executive Director 2109 Sumner Avenue, Suite 202 Aberdeen, WA 98520 (206) 532-8812, SCAN 325-1370</td>
<td></td>
</tr>
<tr>
<td>Grays Harbor County</td>
<td>Zoning/Planning policies: Robert D. Fink, Planner Grays Harbor Co. Planning and Building Dept. 100 West Broadway, P.O. Box 390 Montesano, WA 98563 (206) 249-5579</td>
<td></td>
</tr>
<tr>
<td>Pierce County</td>
<td>Zoning/Planning policies: Kimberly Freeman, Transportation Planner Pierce County Planning &amp; Land Services 2401 South 35th Street Tacoma, WA 98409-7490 (206) 596-2722, fax (206) 291-3680 Transportation/Long-Range plan: &quot;Pierce County Transportation Plan&quot;-ordinance #92-147, adopted 12/28/92.</td>
<td></td>
</tr>
<tr>
<td>City of Puyallup</td>
<td>Zoning/Planning policies: Cathy Harbert, Planner Planning &amp; Community Development Dept. Municipal Building, 330 Third Street SW Puyallup, WA 98371 (206) 841-5502</td>
<td></td>
</tr>
<tr>
<td>City of Sumner</td>
<td>Zoning/Planning policies: Department Community Development City Hall, 1104 Maple Street Sumner, WA 98390 (206) 863-5263</td>
<td></td>
</tr>
<tr>
<td>JURISDICTION</td>
<td>Land Use/Transportation Planning Contacts</td>
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</tbody>
</table>
| Thurston Regional         | **RTPO Contact:** Todd Carlson, Senior Transportation Planner  
Building #1, Administration, 2000 LakeRidge Drive SW  
Olympia, WA 98502 (206) 786-5480  
**Publications to order:** "Transportation Future 2010: Making Connections",  
Thurston Regional Transportation Plan, March 1993.  
"Thurston Metropolitan Area Bicycle Plan", TRPC-  
| Planning Council          |                                                                                                              |
| Thurston County           | **Zoning/Planning policies:** Lynn Doscherry, Planner  
Thurston County Planning Department  
2000 LakeRidge Drive SW  
Olympia, WA 98502-6045 (206) 786-5554  
**Transportation/Long-Range plan:** Todd Carlson, Senior Planner  
Thurston Regional Planning Council  
**Publications to Order:**  
"Transportation Future 2010: Making Connections",  
Thurston County Regional Transportation Plan, TRPC, March 1993.  
Thurston Metropolitan Area Bicycle Plan, TRPC, January 1987. |
| City of Lacey             | **Zoning/Planning policies:** Toni Fields, Planner  
Department Community Development  
City Hall, 420 College Street SW, P.O. Drawer B  
Lacey, WA 98390 (206) 491-5642 |
| City of Olympia           | **Transportation/Long-Range plan:**  
Randy Weffelman, Planner  
Department Community Development  
Building 1, Administration, 2000 LakeRidge Dr. SW  
Olympia, WA 98502 (206) 786-5745  
**Zoning/Current policies:**  
Steve Friddell, Planner  
Dept. of Community Development  
(206) 753-8591 |
| City of Tumwater          | **Zoning/Planning policies:** Department Community Development  
City Hall, 555 Israel Road  
Tumwater, WA 98501 (206) 754-4180 |
RESOURCE LIST:

WSDOT: WSDOT District 4

JURISDICTION                  Critical/Sensitive Areas Citations

Clark County

General Contact:  Dave Wechner, Environmental Planner
                  Clark County Planning & Development Review Division
                  1408 Franklin, P.O. Box 9810
                  Vancouver, WA  98666-9810
                  (206) 699-2375

GMA: yes, mandated July 1, 1990.

Critical Areas Ordinance: no, in development/draft. Interim adoption of
                          the following zoning code & ordinances accepted under GMA.

SEPA ordinance: yes, "Environmental Policy" ordinance #CCC chapter 20.
                  Implements WAC 197-11-960 Environmental Checklist, and adopts
                  countywide "Environmentally Sensitive Areas Map". Amended in 1991 to
                  include wellhead protection areas, #1991-08-45.

Floodplains: regulated by the Floodplains Combining District in zoning
             code chapter #CCC 18.327. Refer to Federal Emergency Management
             Agency, Flood Insurance Rate Maps, for detailed floodplain boundaries.

Shorelines:  Clark County Shoreline Management Master Program, #CCC
             18.330.

Wetlands Inventory: yes, "Wetlands Atlas" -paper inventory based on the
                   National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology survey
                   and hydric soil overlay. Future plans include field delineations of Class I &

Other: Natural Resource Lands are identified and protected under zoning
       ordinances #CCC 18.300-302, 18.329, 1991-08-50, as the special districts:
       Agriculture/Wildlife, Forest, & Surface Mining Combining District. #CCC
       18.325 also identifies the Environmental Combining District which includes
       seven specific habitat areas and NWI wetlands. District mapping on current
       Comprehensive Plan map. Geological Hazard Areas are additionally

Contact: Jerri L. Bohard, Senior Planner, Dept. of Community
         Development coordinator of an Agriculture Focus Group to address prime
         designations, etc. Fall 1993.
## RESOURCE LIST:

### WSDOT District 4 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Battle Ground | **General Contact:** Dean Hergeschiener, Planner  
                                       400 East Main Street, P.O. Box 37  
                                       Battle Ground, WA 98604 (206) 687-7131  
                                       
                                       **GMA:** yes, mandated July 1, 1990.  
                                       **Critical Areas Ordinance:** no.  
                                       **SEPA Ordinance:** yes, #523, adopted 1984. Implements WAC 197-11-960 Environmental Checklist.  
| City of Camas      | **General Contact:** Gary Stockhoff, Planning Director  
                                       Public Works Department  
                                       City Hall, 616 NE 4th Avenue, P.O. Box 1055  
                                       Camas, WA 98607 (206) 834-3451  
                                       
                                       **GMA:** yes, mandated July 1, 1990.  
                                       **Critical Areas Ordinance:** yes, -interim "Sensitive Lands Ordinance" #1823, April 12, 1991. Designates sensitive land areas to include: steep/unstable slopes, streams, fish & wildlife habitat, and wetlands.  
                                       **Wetlands Inventory:** yes, -paper inventory based on the National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology survey and hydric soil overlay. |
**RESOURCE LIST:**

**WSDOT District 4 (Continued)**

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| City of Vancouver    | **General Contact:** Marian Lahave, Planner  
                        Planning & Development Department  
                        City Hall, 210 East 13th Street, P.O. Box 1995  
                        Vancouver, WA 98668-1995  
                        (206) 696-8005  
                        **GMA:** yes, mandated July 1, 1990.  
                        **Critical Areas Ordinance:** yes, -interim #M2992 adopted March 3, 1992.  
                        Designates sensitive land areas to include: agricultural, mineral, & forest resource lands, unstable slopes, aquifer recharge, fish & wildlife habitat, flood plains, geologic hazards, and wetlands.  
                        **Wetlands Inventory:** yes, -paper inventory based on the National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology survey and hydric soil overlay. |
| Cowlitz County       | **General Contact:** Cathy Harndin, Planner  
                        Department of Community Development  
                        County Administration Building, 207 4th Avenue North  
                        Kelso, WA 98626  
                        (206) 577-3052, SCAN: 562  
                        **GMA:** no.  
                        **Critical Areas Ordinance:** no, -interim in progress. **Contact:** Mary Melik, Cowlitz-Wahkiakum Council of Governments, (206) 577-3041, SCAN: 562.  
                        **SEPA Ordinance:** yes, #84-221 adopted October 1, 1984. Implements WAC 197-11-960 Environmental Checklist.  
                        **Shorelines:** Cowlitz County Shoreline Management Master Program, August 17, 1977. Cowlitz County Planning Department.  
                        **Wetlands Inventory:** no, refer to the National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology maps as indicators. |
## Klickitat County

**General Contact:** Francine Havercroft, Director  
Klickitat County Planning Department  
Courthouse Annex, 228 West Main Street, Room 150  
Goldendale, WA 98620 (509) 773-5703

**GMA:** no.

**Critical Areas Ordinance:** no.

**SEPA Ordinance:** yes, #121084 adopted December 10, 1984. Implements WAC 197-11-960 *Environmental Checklist*, on case-by-case basis.


**Shorelines:** Klickitat County Shoreline Management Master Program, updated April 9, 1990. Klickitat County Planning Department.

**Wetlands Inventory:** no, refer to the National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology maps as indicators.

**Other:** Resource lands are protected by special zoning codes: Agriculture (consistent with current use), & Forest Use (areas capable of supporting a merchantable stand of timber).
**JURISDICTION**

<table>
<thead>
<tr>
<th>Skamania County</th>
</tr>
</thead>
</table>

**General Contact:** Mark Mazeski, Planner  
Skamania County Planning Department  
Courthouse Annex-Vancouver Avenue, P.O. Box 790  
Stevenson, WA 98648  
(509) 427-9458

**GMA:** no.

**Critical Areas Ordinance:** no.

**SEPA Ordinance:** yes, #1985-02, adopted into Skamania County Code, Title 16. Implements 197-11 WAC, *Environmental Checklist*.

**Flood plains:** no ordinance, reviewed through County building codes.

**Shorelines:** Skamania County Shoreline Management Master Program, 1974. Skamania County Planning Department.

**Wetlands Inventory:** no, refer to the National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology maps as indicators.

**Other:** Zoning code identifies & governs sensitive areas under "Natural Area" zone, agriculture and forest lands are also protected by special zoning limitations.
**RESOURCE LIST:**

**WSDOT: WSDOT District 4**

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contacts</th>
</tr>
</thead>
</table>
| **Southwest Washington Assoc. of Governments** | **RTPO Contact:** Rod Orlando, Executive Director  
P.O. Box 9810, Vancouver, WA 98668  
(206) 699-2375, fax (206) 699-2011 |
| **Clark County**                           | **Zoning/Planning policies:** Monty Anderson, Planner  
Planning & Development Review Division  
1408 Franklin, P.O. Box 9810  
Vancouver, WA 98666-9810  
(206) 699-2375 |
| **City of Battle Ground**                  | **Zoning/Planning policies:** Dean Hergeschiener, Planner  
400 East Main Street, P.O. Box 37  
Battle Ground, WA 98604  
(206) 687-7131 |
| **City of Camas**                          | **Zoning/Planning policies:** Gary Stockhoff, Planning Director  
Public Works Department  
City Hall, 616 NE 4th Avenue, P.O. Box 1055  
Camas, WA 98607  
(206) 834-3451 |
| **City of Vancouver**                      | **Zoning/Planning policies:** Darin Atteberry, Transportation Planner  
Planning & Development Department  
City Hall, 210 East 13th Street, P.O. Box 1995  
Vancouver, WA 98668-1995  
(206) 696-8005 |
| **Cowlitz-Wahkiakum Council of Governments** | **RTPO Contact:** Julie Menkin, Transportation Planner  
Administration Annex  
207 Fourth Avenue North, Kelso, WA 98626  
(206) 577-3041, fax (206) 423-9986, SCAN: 562 |
| **Cowlitz County**                         | **Zoning/Planning policies:** Marjorie Pitcher, Planner  
Department of Community Development  
County Admin. Bldg, 207 4th Avenue North  
Kelso, WA 98626  
(206) 577-3052, SCAN: 562 |

**RESOURCES LIST:**

**WSDOT District 4 (Continued)**

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Columbia River Gorge Commission</strong></td>
<td>Long-Range Planning policies: Brian Litt, Transportation Planner</td>
</tr>
<tr>
<td></td>
<td>P.O Box 730</td>
</tr>
<tr>
<td></td>
<td>White Salmon, WA 98672 (509) 493-3323</td>
</tr>
<tr>
<td><strong>Klickitat County</strong></td>
<td>Zoning/Planning Policies: Curt Dreyer, Planner</td>
</tr>
<tr>
<td></td>
<td>Klickitat County Planning Department</td>
</tr>
<tr>
<td></td>
<td>Courthouse Annex, 228 W. Main Street, Rm 150</td>
</tr>
<tr>
<td></td>
<td>Goldendale, WA 98620 (509) 773-5703</td>
</tr>
<tr>
<td><strong>Skamania County</strong></td>
<td>Zoning/Planning Policies: Mark Mazeski, Planner</td>
</tr>
<tr>
<td></td>
<td>Skamania County Planning Department</td>
</tr>
<tr>
<td></td>
<td>Courthouse Annex-Vancouver Ave, PO Box 790</td>
</tr>
<tr>
<td></td>
<td>Stevenson, WA 98648 (509) 427-5141</td>
</tr>
</tbody>
</table>
# RESOURCE LIST:

## WSDOT District 5

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical Sensitive Areas Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benton County</td>
<td></td>
</tr>
<tr>
<td>General Contact:</td>
<td>D. Larry Wright, Senior Planner</td>
</tr>
<tr>
<td></td>
<td>Benton County Planning &amp; Building Department</td>
</tr>
<tr>
<td></td>
<td>County Courthouse, P.O. Box 910, Prosser, WA 99350</td>
</tr>
<tr>
<td></td>
<td>(509) 786-5612.</td>
</tr>
<tr>
<td>GMA:</td>
<td>yes, opted in effective November 1990.</td>
</tr>
<tr>
<td>Critical Areas Ordinance:</td>
<td>no, currently undergoing review.</td>
</tr>
<tr>
<td>SEPA ordinance:</td>
<td>no, refer directly to 197-11 WAC criteria.</td>
</tr>
<tr>
<td>Shorelines:</td>
<td>Refer directly to 173-18 WAC designations.</td>
</tr>
<tr>
<td>Wetlands Inventory:</td>
<td>no, refer to the National Wetlands Inventory, U.S. Fish &amp; Wildlife, Dept. of Ecology maps as indicators.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>City of Richland</td>
<td></td>
</tr>
<tr>
<td>General Contact:</td>
<td>Scott Revell, Planner</td>
</tr>
<tr>
<td></td>
<td>Department of Planning &amp; Community Development</td>
</tr>
<tr>
<td></td>
<td>505 Swift, P.O. Box 190, Richland, WA 99352</td>
</tr>
<tr>
<td></td>
<td>(509) 943-7596, fax (509) 943-5666.</td>
</tr>
<tr>
<td>Critical Areas Ordinance:</td>
<td>no, currently undergoing council review.</td>
</tr>
<tr>
<td>SEPA Ordinance:</td>
<td>yes, #26-84. Implements WAC 197-11-960.</td>
</tr>
<tr>
<td>Other:</td>
<td>Chapter 23.60 of zoning code cites overlay districts for highway frontage, landing fields, agricultural, scenic, &amp; floodplain areas.</td>
</tr>
<tr>
<td>JURISDICTION</td>
<td>Critical Sensitive Areas Citations</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Franklin County      | **General Contact:** Richard B. German, Director  
Franklin County Planning Department  
1016 North Fourth Avenue  
Pasco, WA 99301 (509) 545-3521, SCAN: 726   |
|                      | **GMA:** yes, opted in October 1, 1990.                                                          |
|                      | **Critical Areas Ordinance:** yes, -interim #4-93, adopted July 1, 1993. Designates permitted uses in identified critical/natural areas including: critical recharge areas, fish & wildlife habitat conservation areas, frequently flooded areas, geologically hazardous areas & wetlands. |
|                      | **Shorelines:** Franklin County Shoreline Management Master Program, 1974 (updated July 8, 1983). Franklin County Planning Department. |
|                      | **Wetlands Inventory:** no, refer to the National Wetlands Inventory, U.S. Fish & Wildlife, Dept. of Ecology maps as indicators. |
| City of Pasco        | **General Contact:** Larry Peterson, Associate Planner  
Department Community Development  
412 West Clark, P.O. Box 293, Pasco, WA 99301  
(509) 545-3441, fax (509) 545-3499 SCAN: 726-3441   |
<p>|                      | <strong>GMA:</strong> yes, opted in October 1, 1990.                                                          |
|                      | <strong>Critical Areas Ordinance:</strong> yes-interim #2923, February 16, 1993. Adopts existing SEPA ordinance and Shorelines Program. |
|                      | <strong>Floodplain Ordinance:</strong> yes, #2648, 1987. Refer to the Federal Emergency Management Agency &quot;Flood Insurance Rate Maps&quot; for detailed floodplain designations. |
|                      | <strong>Wetlands Inventory:</strong> no, primarily covered under Shoreline jurisdiction: refer to the National Wetlands Inventory, U.S. Fish &amp; Wildlife, Dept. of Ecology maps as indicator. |</p>
<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contracts</th>
</tr>
</thead>
</table>
| Benton-Franklin Governmental Conference | **RTPO Contact:** Donald Morton, Executive Director  
1622 Terminal Drive, P.O. Box 217  
Richland, WA 99352 (509) 943-9185, SCAN: 526-2288 |
| Benton County                | **Zoning/Planning policies:** D. Larry Wright, Senior Planner  
Benton County Planning & Building Dept.  
County Courthouse, P.O. Box 910  
Prosser, WA 99350 (509) 786-5612 |
| City of Richland             | **Zoning/Planning policies:** Scott Revell, Planner  
Dept. of Planning & Community Development  
505 Swift, P.O. Box 190, Richland, WA 99352  
(509) 943-7596, fax (509) 943-5666 |
| Franklin County              | **Zoning/Planning policies:** Richard B. German, Director  
Franklin County Planning Department  
1016 North Fourth Avenue  
Pasco, WA 99301 (509) 545-3521, SCAN: 726 |
| City of Pasco                | **Zoning/Planning Policies:** David McDonald, Director  
Department Community Development  
412 West Clark, P.O. Box 293, Pasco, WA 99301  
(509) 545-3441 |
RESOURCE LIST:

WSDOT District 6

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Critical/Sensitive Areas Citations</th>
</tr>
</thead>
</table>
| Spokane County        | General Contact: Thomas G. Mosher, Senior Planner  
                        Spokane County Planning Department  
                        Public Works Building  
                        1026 W. Broadway Avenue, Spokane, WA 99260  
                        (509) 456-2205, fax (509) 456-2243. |
|                       | GMA: yes, mandate effective July 1, 1993.  
                        Critical Areas Ordinance: no  
                        SEPA ordinance: yes, Spokane Environmental Ordinance, October 1, 1984.  
                        Implements WAC 197-11-960 Environmental Checklist, and adds local Aquifer Sensitive Area to the list.  
                        Shorelines: Spokane County Shorelines Master Program, Jan 1975. Spokane County Planning Department. Contact: Thomas G. Mosher.  
                        Contact: Tammie Williams, Spokane Co. Public Works, 99260-0170 (509) 456-3600, fax (509) 324-3478.  
                        Contact: Thomas G. Mosher, request "Generalized Wetlands Area Maps".  
                        Other: 1981 Comprehensive Plan identifies Aquifer sensitive area governed by EPA regulations.  
                        Contact: Stan Miller, Water Quality Program, Spokane County Public Works Department, 99260-0170 (509) 456-3600, fax(509) 324-3478. |
| City of Cheney        | General Contact: Glenn Scholten, City Planner  
                        City of Cheney  
                        609 Second Street, Cheney, WA 99004  
                        (509) 235-7221, fax (509) 235-7206  
                        SCAN: 545-2975. |
|                       | GMA: yes, mandate effective July 1, 1993.  
                        Inventory: City of Cheney Critical Areas Inventory, 1992.  
                        Field-verified paper inventory, with preliminary classifications.  
                        Identifies floodplains, habitat area, shorelines, & wetlands.  
                        Resource lands ordinance currently in development phase. |
RESOURCES LIST:

WSDOT District 6 (Continued)

<table>
<thead>
<tr>
<th>JURISDICTION</th>
<th>Land Use/Transportation Planning Contracts</th>
</tr>
</thead>
</table>
| Spokane Regional Council | **RTPO Contact:** Glen Miles, Transportation planner  
                          Spokane Regional Council  
                          West 808 Spokane Falls Blvd.  
                          Sixth Floor Municipal Building  
                          Spokane, WA 99201-3333  
                          (509) 625-6370 |
|                        | **Publications to Order:** High Capacity Transportation System Plan Phase I, June 30, 1993.  
                          Spokane's 1985 Transportation Plan Update, currently undergoing revision, expected by July '94.  
                          Regional Transportation Improvement Program, currently being coallated, completion date unknown |
| Spokane County         | **Transportation plan/TIP:** Pat Harper, Planner  
                          Division of Engineering and Roads  
                          Spokane County Public Works  
                          1026 West Broadway Avenue  
                          Spokane, WA 99260-0170  
                          (509) 456-3600, fax:(509) 324-3478 |
|                        | **Zoning/Current policies:** Tim Lawhead, Current Planning  
                          Spokane County Planning Department |
|                        | **Long-Range planning policies:** Pat Francovich, Planner  
                          Long-Range Planning  
                          Spokane County Planning Department  
                          1026 West Broadway Avenue  
                          Spokane, WA 99260  
                          (509) 456-2205, fax:(509) 456-2243 |
| City of Cheney         | **General Contact:** Glenn Scholten, City Planner  
                          City of Cheney  
                          609 Second Street, Cheney, WA 99004  
                          (509) 235-7221, fax (509) 235-7206  
                          SCAN: 545-2975. |
|                        | **Publications to Order:** Capital Improvement Requests, 1994-1999, Executive Summary & Arterial Street Fund, Arterial Master Plan, currently underway, completion date unknown. |
### Other Agency Resources:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Wetlands Inventory</td>
<td>To Order Maps: Washington Department of Ecology</td>
</tr>
<tr>
<td>U.S. Fish and Wildlife</td>
<td>Shorelands and Coastal Zone Management Program</td>
</tr>
<tr>
<td>Service</td>
<td>(206) 459-6836/6202, fax:(206) 438-7537 SCAN: 585</td>
</tr>
<tr>
<td></td>
<td>or USGS-ESIC 1-800-USA-MAPS.</td>
</tr>
<tr>
<td></td>
<td>Publication: Annotated List of Statewide Inventories, see sections E,F,&amp; G.</td>
</tr>
<tr>
<td>Wetlands database WSDOT G.I.S.</td>
<td>WSDOT Management Information Services &amp; Geographic Services</td>
</tr>
<tr>
<td>Inquires</td>
<td>Bernie Chaplin, Environmental Program Manager</td>
</tr>
<tr>
<td></td>
<td>Washington State Department of Transportation</td>
</tr>
<tr>
<td></td>
<td>Environmental Branch, P.O. Box 47329</td>
</tr>
<tr>
<td></td>
<td>Olympia, WA 98504-7329 (206) 705-7924</td>
</tr>
<tr>
<td>Project Inquires</td>
<td>Mary Ossinger, Biologist (206) 664-0136</td>
</tr>
<tr>
<td></td>
<td>Jim Schafer, Biologist SCAN 705-7403</td>
</tr>
<tr>
<td>Highway Culvert Inventories</td>
<td>Citation: Fish Passage Program Progress Performance Report for Biennium 91-93.</td>
</tr>
<tr>
<td>Washington Dept. of</td>
<td>Washington Department of Fisheries &amp; WSDOT</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Interagency Agreement FY 92.30(1)GC 9392.</td>
</tr>
<tr>
<td>Data Requests</td>
<td>Paul Sekulich, Resource Manager</td>
</tr>
<tr>
<td></td>
<td>Habitat Management Division</td>
</tr>
<tr>
<td></td>
<td>Department of Fisheries</td>
</tr>
<tr>
<td></td>
<td>1111 Washington St. S.E., PO Box 43155</td>
</tr>
<tr>
<td></td>
<td>Olympia, WA 98504-3155</td>
</tr>
<tr>
<td></td>
<td>(206) 902-2527, fax:(206) 902-2946, SCAN: 902.</td>
</tr>
<tr>
<td>Sole Source Aquifer Area</td>
<td>Data Requests: Chief, Office of Ground Water</td>
</tr>
<tr>
<td>Designations U.S. EPA</td>
<td>U.S. Environmental Protection Agency, Region 10</td>
</tr>
<tr>
<td></td>
<td>1200 Sixth Avenue, Mail Stop: 409</td>
</tr>
<tr>
<td></td>
<td>Seattle, WA 98101 (206) 555-0682</td>
</tr>
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</table>
### OTHER AGENCY RESOURCES:

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Lands Designated &amp; U.S.F.S. lands</td>
<td>DNR Area Contact: Department of Natural Resources Northwest Region, 919 N. Township St. Sedro Woolley, WA 98284 (206) 856-0083</td>
</tr>
<tr>
<td>District 3:</td>
<td>Thurston County -Central Region, 1405 Rush Road Chehalis, WA 98532 (206) 748-8616 Olympic Region, Route 1, Box 1375 Forks, WA 98331 (206) 374-6131</td>
</tr>
<tr>
<td>District 4:</td>
<td>Central Region, 1405 Rush Road (Lewis &amp; Pacific Co.) Chehalis, WA 98532 (206) 748-8616 Southwest Region, 601 Bond Road Castle Rock, WA 98611 (206) 577-2025 Southeast Region, 713 E. Bowers Road (Klickitat Co.) Ellensburg, WA 98926 (509) 925-6131.</td>
</tr>
<tr>
<td>District 5:</td>
<td>Southeast Region, (see above)</td>
</tr>
<tr>
<td>District 6:</td>
<td>Northeast Region, 225 S. Silke Road Colville, WA 99114 (509) 684-5201</td>
</tr>
</tbody>
</table>

**U.S. Forest Service:** Supervisors Office, of local National Forest lands.

**Inquiries:** Dan Bigger, Forest Practices (206) 902-1408 & David Larsen, Natural Resources Economist Land & Water Conservation, (206) 902-1699, fax:(206) 902-1788 Washington State Department of Natural Resources Olympia, WA 98504-7046
<table>
<thead>
<tr>
<th>Subject</th>
<th>Contact</th>
</tr>
</thead>
</table>
| Soils/Agriculture land of Regional Significance | Ronald E. Shavlik, Area Conservationist  
Scion Conservation Service, Area I  
U.S. Department of Agriculture  
Evergreen Plaza Building, Room 502, 711 Capitol Way  
Olympia, WA 98501-1278 (206) 753-9454 |
| District 2 | Soil Conservation Service, Area II  
(Chelan: CD-42, Okanogan: CD-51)  
U.S. Department of Agriculture  
32 C Street N.W., Room 317  
Ephrata, WA 98823-1636 (509) 754-3553/4687 |
| District 4 | Jerry A. Jacoby, Area Conservationist  
Soil Conservation Service, Area III (see Area I, also)  
(Klickitat: CD-8, CD-31)  
U.S. Department of Agriculture  
Angus Plaza Building, Suite O, 513 N. Front Street  
Yakima, WA 98901-2378 (509) 575-5865 |
| District 5 | Soil Conservation Service, Area III (see above)  
(Benton: CD-19, Franklin: CD-67) |
| District 6 | Judson L. Melton, District Conservationist  
Soil Conservation Service, Spokane County CD-4  
U.S. Department of Agriculture  
North 222 Havana  
Spokane, WA 99202-4724 (509) 353-2120 |
| Statewide Directory | James A. Carley, State Soil Scientist  
SCS, U.S. Department of Agriculture  
Rock Pointe Tower II, Suite 450  
West 316 Boone Avenue  
Spokane, WA 99201-2348 |

Existing Noise Impacts Citation: Priority Study for Noise Abatement on Existing State Highways, District 1, November 1985. "Retrofit Noise Barrier Priority List, April 13, 1993". Contact: Sam Teitzel, WSDOT District 1.

## OTHER AGENCY RESOURCES:

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-attainment Areas TCM Inquiries &amp; State Implementation Plan</td>
<td><strong>Area Contact:</strong> Puget Sound Air Pollution Control Authority, (206) 689-4065 Northwest Air Pollution Authority, (206) 428-1617</td>
</tr>
<tr>
<td></td>
<td><strong>District 2:</strong> Central Regional Office: Chelan/Douglas/Okanogan (509) 575-2490. Eastern Regional Office: Ferry County. (509) 456-2926.</td>
</tr>
<tr>
<td></td>
<td><strong>District 3:</strong> Olympic Air Pollution Control Authority (206) 438-8768</td>
</tr>
<tr>
<td></td>
<td><strong>District 4:</strong> Central Regional Office: Klickitat County (509) 575-2490. Olympic Air Pollution Control Authority: Pacific County (206) 438-8768. Southwest Air Pollution Control Authority (509) 575-4116.</td>
</tr>
<tr>
<td></td>
<td><strong>District 5:</strong> Benton-Franklin-Walla Walla Counties Air Pollution Control Authority (509) 545-2354, (509) 946-4489. Central Regional Office: Kittitas County (509) 575-2490. Eastern Regional Office: Asotin, Columbia, Franklin, Garfield Counties, (509) 456-2926. Yakima County Clean Air Authority (509) 575-4116.</td>
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<td><strong>District 6:</strong> Ronald J. Edgar, Chief Technical Services Spokane County Air Pollution Control Authority West 1101 College Spokane, WA 99201 (509) 456-4727, fax: (509) 459-6828</td>
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</table>
| | **Statewide:** Gary Idleburg (206) 493-9354 & Doug Scheider (206) 438-7134 Air Quality Division, Washington State Department of Ecology Citation: Appendices to the Washington State Implementation Plan, January 22, 1993, Publication No: 93-06F.
## OTHER AGENCY RESOURCES:

<table>
<thead>
<tr>
<th>SUBJECT</th>
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<tr>
<td><strong>Local Transit Service</strong></td>
<td><strong>Area Contacts</strong></td>
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</table>
| **District 1:** | Kenneth J. Graska, Executive Director  
Community Transit  
1133 164th St. SW, Suite 200, Lynnwood, WA 98037  
(206) 348-7101, fax 353-4749 |
| | W.M. Link, Manager  
Everett Transit System  
3200 Cedar Street, Everett, WA 98201  
(206) 259-8803, fax 259-8864, SCAN 723 |
| | Emmett Heath, Manager, Capital Planning & Development  
Metro Transit  
821 Second Avenue, Seattle, WA 98104  
(206) 684-1953, SCAN: 288-1953 |
| | Jim Lair, Executive Director  
Skagit Transit System  
700 South Second, Room 203, Mount Vernon, WA 98273  
(206) 336-9333, fax 336-9307 |
| | Martin Minkoff, General Manager  
Whatcom Transportation Authority  
2200 Nevada Street, Bellingham, WA 98226  
(206) 676-6843, fax 738-7302, SCAN: 644-6843 |
| **District 2:** | Eric Phillips, Transportation Planner  
Link (Chelan & Douglas County PTBA)  
P.O. Box 3244, Wenatchee, WA 98807-3244  
(509) 662-1155, fax (509) 662-1595  
Citation: Route Maps & Timetables, 1993-1994. |
| **District 3:** | Timothy J. Fredrickson, General Manager  
Clallam Transit System  
2417 West 19th, Port Angeles, WA 98362  
(206) 452-1315, fax (206) 452-1316  
Citation: Comprehensive Transportation Plan, 1993-1998. |
| | Dave Rostedt, Manager  
Grays Harbor Transportation Authority  
3000 Bay Avenue, Hoquiam, WA 98550  
(206) 532-2770, SCAN 325-9364 |
| | Richard Hayes, Executive Director  
Kitsap Transit  
234 South Wycoff  
Bremerton, WA 98312  
(206) 479-6962/478-6230, fax (206) 377-7086 |
### OTHER AGENCY RESOURCES:

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| Local Transit Service | **District 3:** Don S. Monroe, Executive Director  
Pierce Transit  
3701 96th Street SW, P.O. Box 99070  
Tacoma, WA 98499-0070  
(206) 581-8080, fax (206) 581-8075  
**Publications:** Pierce Transit System Plan, December 1992. |
|                  | Stefan Fabian-Marks, Manager Advance Planning  
InterCity Transit  
526 Pattison SE, P.O. Box 659  
Olympia, WA 98507-0659 (206) 786-8585, SCAN 229-1011  
**Publications:** Transit Development Plan, October 15, 1991. |
|                  | **District 4:** Leslie R. White, Executive Director  
C-TRAN  
2524 NE 65th Avenue, P.O. Box 2529  
Vancouver, WA 98668-2529  
(206) 696-4494, fax (206) 696-1602 SCAN: 476-6799 |
|                  | Leroy Gower, Director of Public Works  
Community Urban Bus Service(CUBS)  
(Cowlitz TransportationAuthority)  
City of Longview, 254 Oregon Way, P.O. Box 128  
Longview, WA 98632 (206) 259-8803, SCAN: 328-3399 |
|                  | Dan DiGuilio, Director Pacific Transit  
216 North Second Street, Raymond, WA 98577  
(206) 875-9418, fax (206) 875-9419, SCAN: 541-9418 |
|                  | **District 5:** Victoria Mata, Service Representative  
Ben Franklin Transit  
1000 Columbia Drive SE, Richland, WA 98352  
(509) 735-4131, fax (509) 735-1800 |
|                  | **District 6:** Spokane Transit  
1230 West Boone Avenue  
Spokane, WA 99201-2686 (509) 325-6000  
**Citation:** Spokane Transit SystemMap, Fall 1992. |
STATEWIDE DIRECTORIES:

Planning Agencies
Regional Councils of Washington
c/o Benton-Franklin Regional Council
1622 Terminal Drive, PO Box 217
Richland, WA 99352 (509) 943-9185; fax: (509) 943-6756
Citation: Regional Councils of Washington Directory, 1993

Barbara Gooding, Director
Washington State Department of Community Development
Local Government Assistance Division/Growth Management Office
906 Columbia Street S.W. PO Box 48300
Olympia, WA 98504-8300 (206) 586-0488
Citation: The Directory of Planning & Community Development Agencies

Transit Agencies
Rosalyn Wilmes, Public Transportation Office
Transit Research & Intermodal Planning (TRIP) Division
WSDOT, Transportation Building, PO Box 47370
Olympia, WA 98504-7370 (206) 705-7921
Citation: Washington State Transit Phone Book 1993-1994

WSDOT PUBLICATIONS:

Environmental Procedures Manual, (revision #5), WSDOT, Program
Development Division, Engineering Publications, No: M31-11, updated

Transportation Planning and Environmental Relationships (workshop 4),
Washington State Four-tier
Wetlands Rating System
September 1, 1990

The following rating system is designed to be used to assist in determining wetlands buffer widths, replacement ratios and criteria for avoiding wetlands impacts for Washington State. Guidance for implementation of the rating criteria will become available during the evaluation period. Regionalized systems may also be developed by the Department of Ecology.

The rating system is general and preliminary and is under a nine-month evaluation process that is designed to identify and make improvements, if necessary. The evaluation of the rating system will be an ongoing process.

(A) Category I Criteria
(i) Documented habitat for endangered or threatened plant, fish, or animal species or for potentially extirpated plant species recognized by state or federal agencies;
(ii) High quality native wetland communities, including documented category I or II quality Natural Heritage wetland sites and sites which qualify as a category I or II quality Natural Heritage wetland;
(iii) High quality, regionally rare wetland communities with irreplaceable ecological functions, including sphagnum bogs and fens, kelp and eelgrass beds, estuarine, wetlands, or mature forested swamps; or
(iv) Wetlands of exceptional local significance. The criteria for such a designation shall be developed and adopted by the local jurisdiction under appropriate public review and administrative appeal procedures. The criteria may include, but not be limited to, rarity, groundwater recharge areas, significant habitats, unique educational sites or other specific functional values within a watershed or other regional boundary.

(B) Category II Criteria
(i) Regulated wetlands that do not contain features outlined in category I; and
(ii) Documented habitat for sensitive plant, fish or animal species recognized by federal or state agencies; or
(iii) Rare wetland communities listed in subsection (A)(iii) which are not high quality; or
(iv) Wetland types with significant functions which may not be adequately replicated through creation or restoration.
(v) Wetlands with significant habitat value based on diversity and size.
(vi) Wetlands which provide exceptionally high quality habitat, or represent regionally rare habitat to anadromous salmonid fish or priority fish species; or
(vii) Wetlands with significant use by fish and wildlife.
(C) **Category III Criteria**
   (i) Wetlands that do not contain features outlined in category I, II or IV.

(D) **Category IV Criteria**
   (i) Wetlands which do not meet the criteria of a category I, II or III wetland; and
   (ii) Wetlands that are less than or equal to one acre in size and have only one wetland class only one dominant plant species (monotypic vegetation); or
   (iii) Isolated wetlands that are less than or equal to two acres in size, and have only one wetland class and a predominance of exotic species.

Source: "Strategies for Critical Area Designations and Interim Development Regulations, 12/91", Kitsap County Department of Community Development. Appendix 1-G
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<th>KING</th>
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**CODES:**
- unk = Unknown
- P = shoreline
- E = estuarine
- R = rivers
- L = lentic
- V/M = verified
- V = verified
- C = combined verified and unverified
- I = intermediate
- O = verified using ob/gas plane
- L = limited
- N = notebook
- M = maps
- S = summary in sensitive
- R = rating
- A = areas notebook
- D = database
- AM = automated
- SI = stream inventory

Rev 9/12/89
Washington Sole Source Aquifers

Explanation:
- Designated Aquifer
- Designated Source Area
- Petitioned Aquifer
- County Boundary
- Streams

EPA

[Map of Washington showing Sole Source Aquifers]
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<th>Sole Source Aquifer</th>
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<td>43 FR 5566</td>
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<td>Camano Island Aquifer, WA</td>
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<td>Whidbey Island Aquifer, WA</td>
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<td>Cross Valley Aquifer, WA</td>
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<td>North Florance - Dunal Aquifer, Lane County OR</td>
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<td>10/03/82</td>
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# STATUS OF SOIL SURVEYS – WASHINGTON

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## PLANNED PUBLICATION AFTER 1993

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* Out of Print — Not available for distribution but a reference copy may be available in University or other libraries.
The GMA encourages the development of a long-term community-generated vision for city and regional development. The comprehensive planning process links this vision to land use and transportation planning via the creation of a Land Use Element and an interrelated Transportation Element. The Land Use Element defines the distribution and location of general land uses, population densities, major capital facilities, and critical areas protection strategies. The Land Use Element responds to future growth, and describes the desired pattern of land use in the community, as defined by the goals of the community. The Land Use Element provides the basis for the development of the transportation system. The Transportation Element recognizes the interrelationship between land use and transportation by first requiring the identification of present land uses and future land use assumptions.

The comprehensive plan also requires a Capital Facilities Element and a Utilities Element. Counties must also include a Rural Element, including lands not designated for urban growth, agriculture, forest, and mineral resources. The GMA planning process integrates these elements with the Land Use and Transportation Elements to produce a comprehensive approach to transportation planning.
Environmental protection is both an implicit and explicit goal of the GMA and strongly linked to land use planning and transportation. The GMA requires the classification of agricultural, forest, and mineral lands, and critical areas. It establishes development regulations for natural resource lands and critical areas and requires that all agencies designate these land uses in their jurisdictions by September 1991. Critical areas include land areas with natural development constraints: wetlands, floodplains, aquifer recharge areas, geologically hazardous areas, and fish and wildlife habitat.

Transportation activities require the dedication of land to transportation-related uses. These uses may or may not be compatible with adjacent or nearby land uses. Incompatibilities are most important when transportation facilities are located in such a manner which affects sensitive lands or habitat. Transportation systems produce pollutant byproducts (e.g. toxic chemical runoff, noise, and air pollution) which may have adverse effects on such environments. For example, water quality issues are important in the siting of transportation facilities due to the ease with which toxic pollutants from cars, trucks, buses, and trains can enter aquatic systems. Some critical areas, such as geologically hazardous lands, may also present potential hazards for the siting of transportation facilities. Also, some transportation facilities and activities may not be compatible with the maintenance of resource lands, such as agricultural lands and/or forest preserves. These direct environmental consequences should be considered in the GMA transportation planning process.

◆◆◆◆◆

Important Laws and Regulations

The importance of the interrelationship of land use, transportation, and the environment as been recognized by recent federal and state legislation. Important laws and policy recommendations relating to land use and transportation include the following:


The High Capacity Transportation legislation provides potential revenue sources for state programs associated with high-capacity transportation systems, including passenger and freight rail, high-occupancy vehicle (HOV) support, and high-capacity transit. This legislation allows, among other

APPENDIX G

GENERAL GUIDELINE FOR USER BENEFIT CALCULATION
USER BENEFIT WORKSHEET
Capacity Improvement (additional GP Lane)

SR: ____________________________
Project Title: ____________________________
Subject Section: ____________________________
Length of Subject Section: _______________
Number of Lanes: _____________
# of Lanes (w/ improvement): _____________
Evaluated by: ____________________________

Roadway Characteristics

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Peak hr Volumes:</td>
<td>Working Peak hr Volumes:</td>
</tr>
<tr>
<td>% HOV:</td>
<td>% HOV:</td>
</tr>
<tr>
<td>% Trucks:</td>
<td>% Trucks:</td>
</tr>
</tbody>
</table>

Data Source/Procedures:

STEP ONE:
Determine Capacity for Subject Section with improvement and without improvement using procedures outlined in the Highway Capacity Manual. Account for ALL relevant factors (i.e.: lane width, shoulder width, truck volumes-speed, grade) or cite justification for generalizing based on local/regional traffic counts [see HCM equations 3.2, 3.4, 8.1-5, etc.]. Refer to the base capacities below and attach additional calculations:

- Urban Multilane Highway or Freeway: 2200 vphpl
- Rural/Small Urban Freeway: 2000 vphpl
- 2 Lane Highway: 1300 vphpl
- Arterial: 1600 vphpl
- HOV lane: 1500 vphpl

Capacity without improvement: ____________
Capacity with improvement: ____________

STEP TWO:
Given Volume and Capacity above, determine V/C (volume/capacity) for with and without the improvement:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>V/C w/o improvement:</td>
<td>V/C w/o improvement:</td>
</tr>
<tr>
<td>V/C w/ improvement:</td>
<td>V/C w/ improvement:</td>
</tr>
</tbody>
</table>

STEP THREE:
If the above V/C ratio is over 1.0, then the following method should be used to determine the Travel Time. Record results in Travel Time section below.

\[
\text{Travel Time (hrs)} = \frac{(\text{Volume} - \text{Capacity})}{2}
\]

If the V/C ratio is under 1.0, then the following method should be used to determine the Travel Time. Using appropriate charts (Figure 16.1, 8, 13, or 14) from Traffic Engineering Handbook (Second edition) and the V/C ratio determine Operating Speed:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Speed w/o imprvmt:</td>
<td>Operating Speed w/o imprvmt:</td>
</tr>
<tr>
<td>Operating Speed w/ imprvmt:</td>
<td>Operating Speed w/ imprvmt:</td>
</tr>
</tbody>
</table>

GPForm.94 (revised-95)
Given Length of Subject Section and Operating Speed above, calculate Travel Time (hours) with the following equation:

\[
\text{Travel Time} = \frac{\text{Distance} \times \text{Volume}}{\text{Speed}}
\]

Record the results for Travel Time in the table below:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time w/o improvement:</td>
<td>Travel Time w/o improvement:</td>
</tr>
<tr>
<td>Travel Time w/ improvement:</td>
<td>Travel Time w/ improvement:</td>
</tr>
</tbody>
</table>

**STEP FOUR:**

Calculate **Travel Time Savings (TTS)** by taking the difference between the Travel Time with improvements (TT\text{BUILD}) and without improvements (TT\text{NO-BUILD}) for both Year 1 (1995) and Year 20 (2015):

\[
\text{TT\text{BUILD}} - \text{TT\text{NO-BUILD}} = |\text{TTS}\text{Year 1 or 20}|
\]

Year 1 Travel Time Savings:_______ Year 20 Travel Time Savings:_______

If **HOV percentage of traffic is known** (%HOV %SOV), then convert Travel Time Savings (hrs) into Travel Time Savings (hrs) for SOV, HOV, and Trucks. This can be accomplished by multiplying the Travel Time Savings by %SOV(S), %HOV(H), and %Trucks (T). For example, if the Year 1(1995) factors are H=10% and T=10% then %SOV is S=80%:

\[
\text{TTS}_{\text{Year 1}} \times 0.80 = |\text{TTS}_{\text{Year 1 for SOV traffic}}|
\]

Year 1:
- Travel Time Savings - SOV:_______
- Travel Time Savings - HOV:_______
- Travel Time Savings - Trucks:_______

Year 20:
- Travel Time Savings - SOV:_______
- Travel Time Savings - HOV:_______
- Travel Time Savings - Trucks:_______

If **HOV percentage of traffic is not known**, then multiply Travel Time Savings (hrs) by by %Trucks (T) to determine Travel Time Savings for trucks (TTS\text{T}). Also multiply Travel Time Savings by the remaining percentage (100%-%Trucks = %GP) to obtain a theoretical composition for general purpose use. For example, if Year 1 factors are: T=10% then %General Purpose is GP=90%:

\[
\text{TTS}_{\text{Year 1}} \times 0.90 = |\text{TTS}_{\text{Year 1 for GP traffic}}|
\]

Year 1:
- Travel Time Savings - GP:_______
- Travel Time Savings - Trucks:_______

Year 20:
- Travel Time Savings - GP:_______
- Travel Time Savings - Trucks:_______

**STEP FIVE:**

Translate Delay estimates into User Benefits using the appropriate equation below:

\[
\text{User Benefits}_{\text{Year 1 or 20}} = (\text{TTS}_{\text{SOV}} \times \text{CP}_{\text{SOV}} \times 260) + (\text{TTS}_{\text{HOV}} \times \text{CP}_{\text{HOV}} \times 260) + (\text{TTS}_{\text{T}} \times \text{CP}_{\text{T}} \times 260)
\]

OR:

If the HOV percentage is NOT known and the theoretical composition is being used above for the Travel Time then the following equation should be used:

\[
\text{User Benefits}_{\text{Year 1 or 20}} = (\text{TTS}_{\text{GP}} \times \text{CP}_{\text{GP}} \times 260) + (\text{TTS}_{\text{T}} \times \text{CP}_{\text{T}} \times 260)
\]
where variables for each analysis year are:

\[ \text{TTS}_{\text{SOV}} = \text{Time Savings (hrs) for SOV} \]
\[ \text{TTS}_{\text{HOV}} = \text{Time Savings (hrs) for HOV} \]
\[ \text{TTS}_{\text{T}} = \text{Time Savings (hrs) for Trucks} \]
\[ \text{TTS}_{\text{GP}} = \text{Time Savings (hrs) for GP traffic} \]

and Cost Parameters (including operating costs) are:

\[ \text{CP}_{\text{GP}} = 6.30 \times 1.35 \ [\text{AVO}] \]
\[ \text{CP}_{\text{SOV}} = 6.30 \times 1.21 \ [\text{AVO}] \]
\[ \text{CP}_{\text{HOV}} = 6.30 \times \text{AVO}_{\text{HOV}} \]
\[ \text{CP}_{\text{T}} = 21.40 \times 1.0 \ [\text{AVO}] \]

Enter the corresponding results below:

Year 20 (2015) User Benefits:

**STEP SIX:**
The final step is to calculate the present value of the User Benefits. Using Figure 5 from the AASHTO - Manual on User Benefit Analysis of Highway and Bus-Transit Improvements, 1977 (the Red book), find the Present Value Factor (PVF). The Period of the Estimate and the Analysis period will always be 20. The discount rate will be 4%. Please only refer to the nomograph as a guide, the formula should be used in ALL cases.

[Note that the AASHTO figure refers to the Net present worth (f) of a given project, this definition is consistent with the term Net present value (PVF) which WSDOT will refer to throughout the prioritization method. No adjustments are necessary.]

a) Calculate the Year 20/Year 1 ratio (\( \alpha \)) = 

b) Determine the Present Value Factor where:

\[ Y = \text{Period of Estimate (20 yrs.)} \]
\[ r = \ln (\alpha) / Y \ [\text{Annual Growth Rate}] \]
\[ i = \text{Discount Rate (4\%)} \]
\[ n = \text{Analysis Period (20 years)} \]

\[ \text{PVF} = (e^{(r \times n)} - 1) / (r - i) \]

= 

c) Multiply the Year 1 User Benefits (1995) by the PVF to determine the Present Value of the User Travel Time (and Operating)Savings Benefits. Record the results below and on the COST EFFICIENCY WORKSHEET:

**Present Value of User Benefits (PV_B):**
APPENDIX H

SUMMARY OF DELPHI ANALYSIS FOR WEIGHT SETTING
SUMMARY OF DELPHI ANALYSIS FOR WEIGHT SETTING

September, 1993
University of Washington Campus

Introductory Discussion:

- Presentation of ranking methodology and categories of evaluation criteria.
- Presentation of the Delphi Analysis framework and session proceedings.

ROUND 1 RESULTS:

<table>
<thead>
<tr>
<th></th>
<th>NPV</th>
<th>CMTY</th>
<th>ENV</th>
<th>MODE</th>
<th>L/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>51</td>
<td>17</td>
<td>12</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>18</td>
<td>11</td>
<td>7</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Major Discussion Points:

- Concern that Community Support is not adequately represented
- Concern that project costs will eliminate certain high cost projects

ROUND 2 RESULTS:

<table>
<thead>
<tr>
<th></th>
<th>NPV</th>
<th>CMTY</th>
<th>ENV</th>
<th>MODE</th>
<th>L/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>53</td>
<td>17</td>
<td>11</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Std Dev.</td>
<td>11</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Major Discussion Points:

- That NPV represents a large number of policy goals and is not being given adequate emphasis
- Next round - resolved to give each sub-goal under NPV its own weight and sum total for NPV full weight.

ROUND 3 RESULTS:

<table>
<thead>
<tr>
<th></th>
<th>NPV</th>
<th>CMTY</th>
<th>ENV</th>
<th>MODE</th>
<th>L/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>65</td>
<td>14</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Std Dev.</td>
<td>8</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Major Discussion Points:

- The criteria objectives need to be repackaged to make it explicit that NPV carries a fair number of policy goals with it.
- These results shall be the committee recommendation to full WSTC for adoption.