

TRANSPORTATION DEMAND MANAGEMENT

A Guide for Including
TDM Strategies in Major Investment Studies
and in Planning for other Transportation Projects

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August 1996

PURPOSE OF THIS GUIDE

This guide was produced primarily to assist WSDOT planners and project engineers in developing Transportation Demand Management (TDM) alternatives for ISTEA-required Major Investment Studies (MIS). Its secondary purpose is to serve as a TDM primer for those who may be new to TDM strategies and need an understanding of what these techniques entail and where they can "fit." As such, we believe this guide will also provide assistance for route development plans and other transportation studies.

The guide is designed to:

- Introduce the reader to the concept of TDM
- Provide background on Major Investment Studies, federal and state policy, and WSDOT's perspectives
- Outline a process that can be followed to develop a TDM alternative(s)
- Describe characteristics of key TDM strategies
- Propose screening criteria for assessing the TDM environment in the area being studied
- Identify TDM strategies that complement each other as part of a TDM package
- Discuss how to evaluate the potential impacts of TDM strategy packages
- List additional resources that the reader may want to investigate
- Recommend further work that should be undertaken to refine the understanding and knowledge of TDM

The need for this guide was identified at a management retreat of WSDOT's Planning and Programming Service Center. It was developed as one of many efforts aimed at elevating TDM being undertaken by the TDM Resource Center, housed at the department's Office of Urban Mobility in Seattle.

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The authors would like to acknowledge the considerable value to development of this guide of the Puget Sound Regional Council's "Update of the Metropolitan Transportation Plan for the Central Puget Sound Region, Technical Paper: MTP 12" (August 1994), its Congestion Management Plan, and its work on congestion pricing.

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INTRODUCTION

Transportation demand management (TDM) strategies have become a new focus for transportation professionals - planners, engineers, capital project managers, and policy makers -- who are seeking and evaluating alternatives to large capital investments. Demand management measures offer the lure of lower cost solutions to our congestion problems and capacity needs. They also offer the potential to forestall construction of new and expanded facilities by reducing road use and extending the life cycle of existing infrastructure. Both the Federal Transit Agency (FTA) and the Federal Highway Administration (FHWA) strongly suggest that TDM measures be included in alternatives analyses and Major Investment Studies (MIS). These measures have also been incorporated into the Washington State Transportation Policy Plan.

TDM remains a relatively new discipline. We are only now beginning to recognize and evaluate the potential applications for these strategies in road and highway planning. The dearth of TDM information, and the general unavailability of data about TDM effectiveness, affects all who are charged with developing and assessing the alternatives to building extensive new highway capacity.

Here we would like to note some fundamental difference between a TDM alternative and a "build" alternative:

- A built facility cannot be easily – or inexpensively – altered and must, therefore, anticipate the roadway requirements for the complete 20-year planning period. The "build" option is static, and if it is based on flawed assumptions – always a possibility, given the complexities of forecasting over a 20-year period – this alternative may not only fail to provide the remedies sought, but may lead to additional, unanticipated expenditures. TDM measures, on the other hand, are more flexible and can be altered to meet the changing conditions and requirements of a facility throughout its life. Indeed, such flexibility is essential, as a TDM measure's initial rate of effectiveness may deteriorate over time. However, engineers can modify the mix of measures in response to changing conditions so that the TDM alternative can continue to provide the level of service intended at the outset. Furthermore, because of its inherent flexibility, the TDM alternative is less likely to incur significant additional costs due to a flawed forecast.
- As noted by Todd Litman, Director of the Victoria Transport Policy Institute, TDM can have multiple benefits beyond simply reducing vehicle miles traveled (VMT). For example, TDM strategies that reduce vehicle trips can provide parking demand savings which can be a significant benefit, and which can more than offset TDM program costs (assuming that zoning requirements are flexible enough to allow developers and business to reduce their parking supply). Similarly, financial incentives represent economic transfers, not real costs, and measures that reduce automobile use can provide significant user savings, particularly if they reduce household automobile ownership requirements. These examples illustrate that some measures/ alternatives can have very different social costs than others. This points towards the desirability of incorporating full cost accounting within an alternative analysis process – something that for transportation planning, while it is evolving, is really in its infancy stage.

- Litman also pointed out that the concept of generated traffic is often ignored in specific project evaluation, which could have significant implications when a capacity expansion project is compared to TDM strategies. Generated traffic can reduce (and in urban areas, nearly eliminate) the expected benefits of capacity expansion, over the long term, reducing the net benefits and increasing external costs. Although generated traffic is being incorporated in some urban traffic models (called "feedback"), it is often ignored. This is also an issue on which further work is needed.

Federal Guidance on Including TDM in Major Investment Studies

Recent changes at the federal level encourage a specific focus on demand management and system management strategies. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) made substantial changes to the criteria and process for allocating federal funds to capital investment projects. As a result, all major transit and highway capacity expansions that include federal funds must be subjected to a Major Investment Study (MIS). The MIS is expected to identify all "reasonable alternative strategies" for addressing the transportation demands and problems in a corridor or subarea. The FTA and FHWA guidelines are not authoritative in requiring a stand-alone TDM/TSM (transportation systems management) alternative. They do, however, strongly suggest that demand management and system management alternatives be included for comparison with other investment options, and that combinations of TDM/TSM measures and conventional strategies be considered.

TDM in Washington State Transportation Policy

The State of Washington has joined the federal government in emphasizing TDM alternatives. The Transportation Commission has made TDM and TSM central components of Washington state's transportation policy. The adopted policies encourage all public agencies and the private sector to increase attention to demand management alternatives. Policies relating to TDM and TSM contained within the "*Washington State Transportation Policy Plan 1993 Report to the Legislature*" include the following:

"State and local agencies should establish procedures to ensure that system efficiency improvements are analyzed as components of, or alternatives to, new road and highway development."

"State, regional and local funding rules should be changed to allow TDM/TSM projects to compete equally with more traditional transportation projects such as adding lanes to a highway."

Preface from the Washington State Department of Transportation

The Washington Transportation Plan assumes that 22% of growth in trips over the next 20 years will be accommodated by TDM. This directs us as transportation professionals to look at things in new ways - to expand our thinking. Reviewing TDM Alternatives within the MIS process provides just such an opportunity, both within and outside of the department.

Additionally, ISTEA, the metropolitan planning process, and the MIS evaluation of alternatives all require that potential highway projects be looked at in a more open, collaborative and consensus building manner. The development of TDM Alternatives should promote an even-

handed comparison of alternative solutions - allowing us to move away from an exclusively supply-side outlook to one that is better balanced with demand-side measures. It is not sufficient to simply acknowledge the demand management activities that are assumed in local plans and models -- and then conclude that a stand-alone TDM alternative cannot meet the demand. We must look seriously at the trip reduction potential of demand management strategies and highlight for our decision makers the aggressive measures that might be required as an alternative to capital investments.

Ideally, every MIS should include a stand-alone TDM Alternative that can be analyzed side-by-side with the totally build option. And it is important that those two alternatives be comparable -- if the build option is priced at \$200M, then a \$200M TDM Alternative should be considered. Realistically, however, in some cases that situation may not be practical. It is likely that the preferred alternative resulting from an MIS process will be a combination of TDM, TSM and capacity expansion.

In the long range, a goal of the WSDOT is to ensure compatibility between major investment studies and the department's priority programming process. In effect, we are pursuing a mechanism to ensure that the preferred alternative in an MIS will also meet the cost/benefit scrutiny of Priority Programming. Work is already underway to make this happen. We are hopeful that criteria for the state Transportation Improvement Program (TIP) and Priority Programming can be modified to de-emphasize supply-side (capital intensive) solutions and permit the funding of strategies that will change travel behaviors. We anticipate that including TDM (and TSM) strategies will result in higher cost/benefit ratios and higher project ranking for state funding.

CHAPTER ONE

Introduction to Transportation Demand Management

TDM

Transportation Demand Management (TDM) is a term applied to a broad range of strategies that are primarily intended to reduce and reshape demand (use) of our transportation system. Such strategies are often relatively low cost. Their success depends both upon the active cooperation of the private sector, and upon affecting decision making by the individuals who use the transportation system.

Some TDM measures have been in use for years, such as the promotion of carpooling, which began in earnest during World War II. Broader implementation of TDM began occurring during the late 1970's and the early 1980's, often stimulated by problems related to our heavy reliance on foreign energy resources. TDM has recently "come of age", driven by ever increasing congestion, shrinking transportation funding and federal mandates – including that air quality be improved in our urbanized areas and that we give broader consideration to how federal transportation dollars are spent. The latter is being driven by the Intermodal Surface Transportation Efficiency Act (ISTEA).

In Washington State increased interest in TDM is also being driven by the legislative mandate for "least (or full) cost planning", something which many are currently struggling with how to achieve in transportation.

TSM

Transportation System Management (TSM) is a closely related concept that is differentiated from TDM by the fact that it deals with the operation and management of, rather than the demand for (i.e., use of), the transportation infrastructure. The goal of TSM is to maximize efficiency of the overall transportation system by providing the mechanisms to move more people and goods more efficiently. TDM and TSM can sometimes overlap. Examples of TSM strategies include: freeway ramp metering (bypasses of which for HOVs would be considered TDM), electronic driver information systems, incident detection/management programs, HOV lanes, signal optimization and coordination, channelization improvements and reversible lanes.

TDM Strategies

The TDM strategies looked at, in depth, within this document have been grouped into six major categories. The complete listing of measures, by category, is presented in the classification listing inset on the following page. The six categories follow:

- **Public Mode Support** includes publicly provided alternatives to SOV travel and those services and facilities that encourage and support other modes.
- **Employer Based TDM Strategies** are private sector programs and services that encourage employees to change commuting patterns. The strategies include incentives that make publicly provided modes more attractive, disincentives to solo commuting and employer

management policies that provide employees with flexibility in mode choices.

- **Pricing Strategies** are tax and pricing schemes that affect the cost of transportation and thereby provide monetary disincentives to some travel behavior.
- **Telecommunications Strategies** are emerging demand management solutions that are based in advanced telecommunications technologies.
- **Land Use Strategies** are potentially the most effective TDM strategies in the long run. They change densities, land use, urban design and land use mix to impact travel needs and patterns.
- **Public Policy and Regulatory Strategies** introduce restrictions and regulations to auto use and provide political support and guidance to new institutional relationships.

Classification of TDM Strategies

Public Mode Support Strategies

Public Education and Promotion
 Area-Wide Ridematching Services
 Transit Services
 Vanpool Service
 Transit and Vanpool Fares
 Non-Motorized Modes
 HOV Facilities
 Park & Ride Lots

Employer Based TDM Strategies

(could be developer-based too)
 Monetary Incentives
 Alternative Work Schedules
 Commute Support Programs
 Guaranteed Ride Home
 Parking Management
 Facility Amenities
 Transportation Management Associations

Telecommunications Strategies

Telecommuting
 Advanced Telecommunications

Pricing Strategies

Gasoline Tax Increases
 VMT Tax
 Congestion Pricing
 Parking Tax

Land-Use Strategies

Development Impact Mitigation
 Mixed Land-Use, Jobs/Housing Balance
 Transit-Oriented and Pedestrian Friendly Design
 Residential Density Increases
 Employment Center Density Increases
 Parking Management
 On-Site Amenities

Public Policy and Regulatory Strategies

Trip Reduction Ordinances
 Restricted Access to Public Facilities
 Support of New Institutional Relationships
 Increase of HOV Lanes Restriction to 3+
 Parking Restrictions

Characteristics of TDM Strategies

As evidenced in the preceding description, TDM strategies include a great variety of programs, services, policies, and regulations. They cannot be applied equally and effectively in all markets. They take various lengths of time for development and implementation. And, they fall under the jurisdiction of different agencies, governments and authorities.

Table 1.1 presents a summary matrix of several characteristics of demand management strategies. Additional detail and discussion about each individual strategy is included in Appendix I. Table 1.1 is designed to provide the reader with summary information – at a single glance – for a preliminary comparison among the strategies. It should be helpful in identifying, quickly, the categories or individual measures that are likely candidates for inclusion in a study alternative. The characteristics presented in Table 1.1 are these:

- **Application or Market Area** is the target market to which the strategy can be applied. Markets are identified by geographic indicators, densities, types of development, type of facility, type of travel (commute), and/or time of day (peak vs. off-peak). It should be noted that in urbanized parts of the state, publicly provided TDM strategies and employer strategies are increasingly being implemented. It will be important for the planner to acknowledge the level of service currently in place before projecting trip reductions to be achieved through TDM measures. It is also important to consider new applications for strategies that have, to date, been restricted to specific markets. It may be effective, for example, to develop an alternative that combines express transit services in an HOV lane with a peak hour, free fare zone along an entire highway corridor – thereby addressing the target markets and target needs for trip reduction.
- **Time Frame to Implement** identifies the approximate term within which a demand management strategy could be implemented. Strategies are identified as requiring a short time period (less than two years), a medium time period (two to five years), or a long time period (more than five years). Timing is an interesting dimension of TDM assessment. Implementation time does not necessarily correspond to the time needed to bring about behavior changes. Land use designations, for example, can be implemented fairly quickly by a local jurisdiction, yet the changes in use and designation may be decades away from full realization.
- **Enabling Authority** identifies the party (or parties) responsible for introducing, enabling, or mandating each measure.
- **Implementing Authority** indicates the party (or parties) responsible to put the strategy in place, and administer, operate or enforce the TDM measure. The enabling and implementing authorities are important considerations for the TDM planner. The selection of appropriate strategies will depend to a great degree on what commitments can be gained from the various stakeholders. Some TDM strategies are totally within the authority of specific entities - such as regulation of land use by local jurisdictions. Others could be established and implemented under several different authorities – such as the initiation of vanpooling by individuals, employers, transit agencies, counties, cities, and state agencies. The bottom line of this issue relative to Major

Investment Studies is that authority and control of various aspects of TDM strategies may lie with several different stakeholders. Clearly, there may be delicate "turf" issues that will need to be handled carefully -- so that innovative strategies and combinations can be proposed, potentially with innovative new institutional arrangements.

Detailed Descriptions of TDM Strategies

In Appendix I the TDM strategies included in table 1.1 are each described in some narrative detail. Considerable effort has gone into gathering this information and compiling it into concise, yet detailed descriptions of the major TDM strategies. For each strategy the information is broken down as follows:

- **Description** - What the strategy is and does; who are actors key to the strategy; other factors that are important to implementation and success of the strategy
- **Market/Geographical Setting** - Where the strategies have been, or might be, applied
- **Time Frame** - the lead time required to implement the strategy, plus discussion of factors influencing that; some discussion of the time necessary before impacts can be expected
- **Cost** - The general level of costs associated with implementing the strategy and an indication of who bears those costs – primarily from the perspective of implementing and administering the strategy, not the cost to the user
- **Companion Strategies** - A narrative discussion of the kinds of TDM strategies that would be complimentary to the strategy that is being described
- **Effectiveness** - Further information on the general effectiveness of the strategy at reducing trips, plus factors that can affect that
- **Implementation Difficulties** - Issues that should be considered because they may make it more difficult to implement the strategies
- **Current Applications** - Examples of where the strategies have been or currently are in place

We recommend that the information contained in the following matrix (Table 1.1) be used in concert with the detailed strategy descriptions (Appendix I) and the Preliminary Screening Criteria in Chapter 3 to develop a preliminary, conceptual list of applicable strategies.

Table 1.1
Characteristics of TDM Strategies (Summary)

Characteristics of Transportation Demand Management (TDM) Strategies	Application Market Area	Time Frame To Implement	Enabling Authority				Implementing Authority			
			State	Region	City/County	Transit Agency	State	Region	City/County	Transit Agency
<i>Public Mode Support Strategies</i>										
Public Education and Promotion	all	short - long	√	√	√	√	√	√	√	√
Area-Wide Ridematching Services	urban & suburban commute trips	short - medium		√	√			√	√	√
Transit Service	urban & suburban	short - medium		√		√				√
Vanpool Service	urban & suburban commute trips	short - medium			√	√		√	√	
Transit and Vanpool Fares	urban & suburban	short - medium				√				√
Non-Motorized Modes	short commuting & non-commute	short-long		√	√			√	√	
HOV Facilities	congested corridors	medium-long	√				√			√
Park & Ride Lots	congested corridors	short-medium	√			√	√			√
<i>Employer Based TDM Strategies</i>										
Monetary Incentives	all commuter markets	short								√
Alternative Work Schedules	all commuter markets	short								√
Commute Support Programs	all commuter	short								√
Guaranteed Ride Home	commuter	short							√	√
Parking Management	commuter	short - medium								√
Facility Amenities	large employers and sites	short			√					√
Transportation Management Associations	multi-employer sites and areas	short						√		√

Table 1.1
Characteristics of TDM Strategies (Summary)

	Application Market Area	Time Frame To Implement	Enabling Authority				Implementing Authority			
			State	Region	City/County	Transit Agency	State	Region	City/County	Transit Agency
<i>Pricing Strategies</i>										
Gasoline Tax Increases	statewide or local: all vehicle trips	short-medium	√		√		√		√	
VMT Tax	statewide or regional; all vehicle trips	medium-long	√		√		√		√	
Congestion Pricing	congested routes, road segments or regions, peak or non-peak	long	√		√		√		√	
Parking Tax	dense urban areas; jurisdictional or areawide application	medium-long	√		√		√		√	
<i>Telecommunications Strategies</i>										
Telecommuting	urban & suburban commuters	short								√
Advanced Telecommunications	any	medium	√	√	√		√	√	√	
<i>Land Use Strategies</i>										
Development Impact Mitigation	developing areas	medium			√				√	
Mixed Land Use/ Jobs Housing Balance	urban & suburban	medium-long		√	√			√	√	
Transit-Oriented and Pedestrian Friendly Design	urban & suburban	medium-long			√				√	
Residential Density Increases	urban & suburban	medium-long		√	√				√	
Employment Center Density Increases	urban, planned development	long		√	√				√	
Parking Management	urban & suburban	medium-long			√				√	

Table 1.1
Characteristics of TDM Strategies (Summary)

	Application Market Area	Time Frame To Implement	Enabling Authority				Implementing Authority			
			State	Region	City/County	Transit Agency	State	Region	City/County	Transit Agency
<i>Land Use Strategies continued</i>										
On-Site Amenities	employment centers, major transit facilities, park & rides	short-medium			√	√			√	√
<i>Public Policy & Regulatory Strategies</i>										
Trip Reduction Ordinances	commuter markets urban counties	medium	√		√				√	√
Restrict Access to Facilities and Activity Centers	highly congested facilities or centers	long	√		√				√	
Support New Institutional Arrangements	urban & suburban areas	short-medium	√							
Increase HOV lanes to 3+	congested corridors	short	√					√		
Parking Restrictions	urban & suburban areas	short-medium	√					√		

CHAPTER TWO

Recommended Process to Follow in Developing a TDM Alternative

This chapter outlines a process that can be followed in developing a TDM Alternative. It encourages broad involvement of stakeholders and recommends the development and "testing" of three levels of TDM Alternatives. Those levels are:

1. **Stand-Alone Alternative** - we strongly recommend that, with the trip reduction target in mind, every effort first be made to develop a TDM Alternative that is designed to meet that target. This alternative may need to include highly aggressive strategies, such as congestion pricing and restricted access. It should illustrate the resources and costs required for a total demand solution. Demonstrating the ability to achieve trip reductions through application of TDM measures, over time, will help broaden understanding of the need to implement such aggressive strategies, perhaps region-wide.
2. **Maximum Reasonable Alternative** - with some projects it may not be possible to design a TDM Alternative so effective (and acceptable) that it can "stand-alone". The Maximum Alternative should represent the highest level of trip reduction that appears reasonably achievable due to a combination of TDM strategies.
3. **Hybrid Alternative** - for many projects it is likely that the most cost-effective alternative will be a combination of TDM/TSM and some of the "Build Alternative". This TDM Alternative identifies selective strategies designed to fit that situation.

For most studies it is possible that the TDM Planning Team (discussed further below) will recommend two or even three TDM Alternatives to the overall study planning team for their consideration. For example -- perhaps, the Stand-Alone Alternative, though feasible, may not appear to be politically acceptable due to local pressures to construct new capacity. Just the same, it should be developed and passed on for further consideration by the full project planning team. Or, perhaps, the Maximum Alternative, while not meeting all demand, may be thought of as capable of "buying some time" (i.e., postpone large scale capital expenditures). If so, again, the full planning team should be able to consider it. Again, in many if not most cases it is likely that a combination of TDM/TSM and the "Build" Alternative will prove most cost-effective.

Another important consideration is that because TDM strategies are always evolving and are market-based, it is probable that flexibility will have to be built in. For example, consensus could be reached on the trip reduction potential of the stand-alone package of strategies and what those strategies would cost. This could then result in a commitment of that level of funding for TDM over the 20 years, with the recognition that the strategies identified were only the initial strategies -- over time they would have to be monitored, adjusted, subtracted from and added to.

Finally, keep in mind when initiating development of a TDM Alternative that *it isn't sufficient to simply look at what TDM is already planned*. This is where all the stakeholders will need to really expand their thinking!

Developing a TDM Alternative(s)

The process we are recommending is designed to be integrated into a training course developed by the Federal Highway Administration. The diagram of the overall MIS process on page #11 was developed for that course. How our recommended process for TDM, as detailed below, fits within that overall MIS process is outlined on page #12.

In the "Initiation" phase of an MIS, information will have been developed that forms the basis for the development and review of all alternatives. That is assumed to have occurred, prior to implementing the process outlined below:

Step #1: Advanced Preparation for Developing the TDM Alternative

Review for the Project:

- Workplan for the Study
- Mobility Needs and Problems
- Goals and Objectives
- Geographical Boundaries
- Stakeholders

Step #2: Assemble a TDM Planning Team

We strongly recommend that for most studies a separate TDM planning team be convened to help develop the TDM Alternative, since those on the MIS planning team may not be those who are most knowledgeable in TDM. At a minimum we recommend that the TDM team provide review and input in Steps 5, 8, 10 and 11.

Suggested Stakeholders/TDM Advocates:

- Transit/Rideshare Agency(ies)
- Key Local Jurisdiction Staff (perhaps administrators of local CTR ordinances)
- Others from the Community (e.g., staff of Transportation Management Associations; major employers)
- WSDOT TDM Staff (if available)
- TDM Consultant (if available)

Step #3: Assemble Data on Project Environment & Existing and Planned TDM

This step is essential to fully understand what is occurring in and planned for the study area. It becomes the basis for identifying TDM strategies to package into a TDM Alternative.

Step #4: Review List of TDM Strategies and their Markets

This will result in a more complete understanding of TDM strategies and how they may or may not fit within different markets.

See Chapter 1, Table 1.1 and Appendix I

Step #5: Develop Preliminary Definition of Markets and Applicable TDM Concepts

Defining the travel/transportation market(s) that potentially will be impacted by the project is a necessary first step to identifying appropriate TDM strategies to address those markets. This will help you to make best use of Table 1.1.

Step #6: Utilize Recommended Preliminary Screening Process and Criteria to Select Primary TDM Strategies

This is where existing conditions, existing plans, the transportation markets and potential TDM strategies are brought together.

See Chapter 3

Step #7: Select Companion TDM Strategies

Some TDM strategies are more complementary than others -- and some are virtually essential companion strategies. Therefore, it is necessary to give this issue careful consideration.

See Chapter 4

Step #8: Review all Available Information about Possible TDM Strategies

This is the time to ensure that you are fully knowledgeable in the TDM strategies that are appearing to be likely candidates for inclusion in a TDM Alternative.

See Appendix I

Step #9: Define Detailed TDM Alternatives

At this point, what are evolving as the TDM Alternatives best suited to the project should be clearly defined.

Step #10: Evaluate TDM Alternatives using TDM Criteria

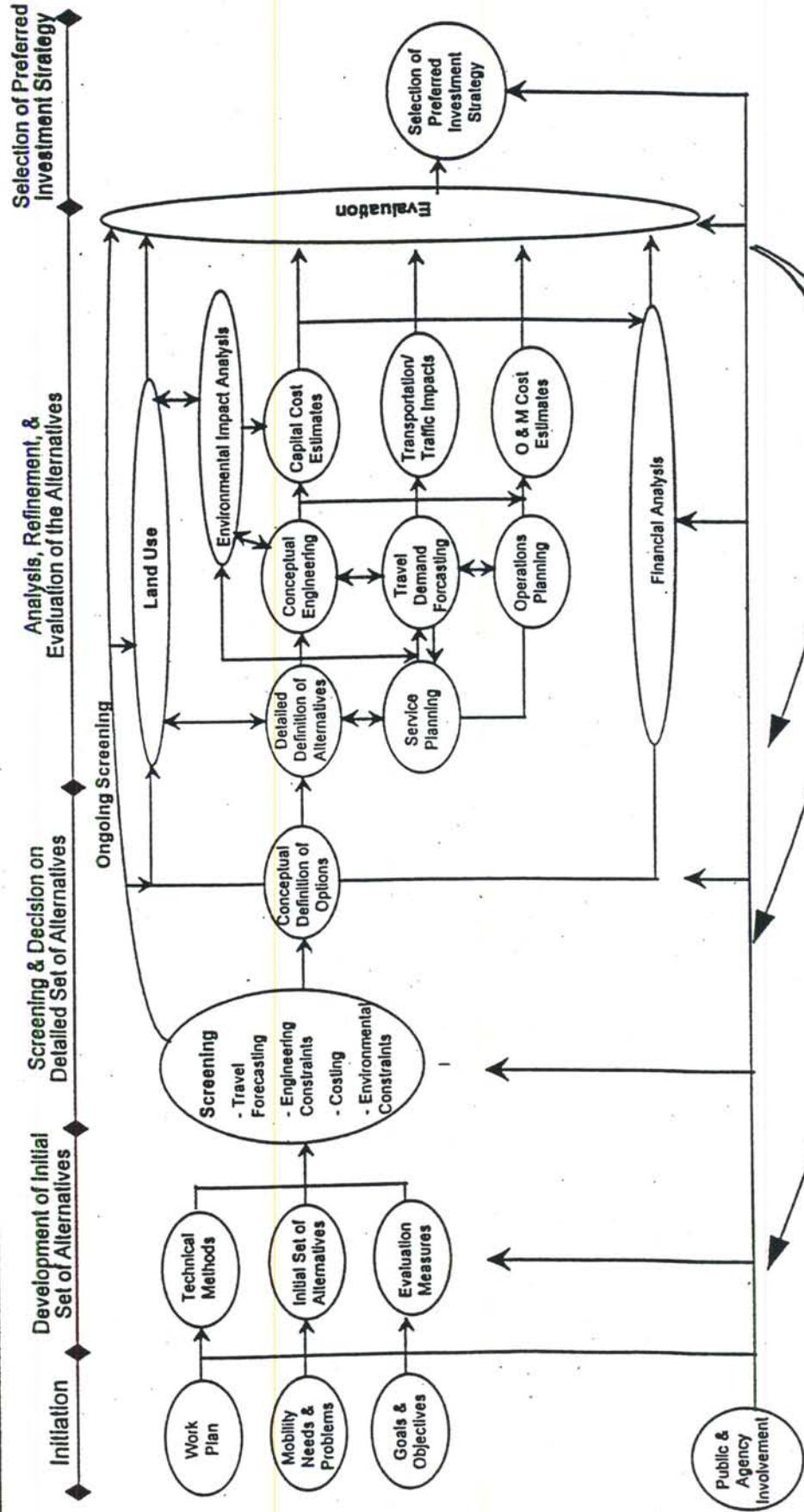
Using the data within this guide on effectiveness of TDM strategies, plus the collective wisdom of the TDM planning team -- since for many strategies hard data doesn't exist -- estimate trip reductions and costs for the alternatives being considered.

Note: As discussed elsewhere in this guide, it's possible that the model being used for the MIS already assumes a significant percent of trip reduction due to "planned" TDM, which may not actually be planned -- just assumed. This could mean that strategies sufficient to reach the trip reduction from TDM that is assumed by the model must also be included within the TDM alternative. Care should be taken to avoid double counting -- this issue is worthy of serious discussion!

See Chapter 5, Table 5.1 and Appendix I

Step #11: Carry Forward Preferred TDM Alternative(s) for Full Analysis, Refinement and Evaluation along with other Non-TDM Alternatives that have been developed.

The Major Investment Study Process



Integrating Development of a TDM Alternative into the Overall Major Investment Study Process

The Overall MIS Process (from previous page)

Recommended Process for Developing TDM Alternative

Location in this Guide

I. Initiation	Chapter 1	⇒ Review List of TDM Strategies and their Markets
	Chapter 1	⇒ Develop Preliminary Definition of Markets and Applicable TDM Concepts
	Chapter 2	⇒ Assemble TDM Planning Team
	Chapter 2	⇒ Assemble & Review Data on Project, Project Environment & Existing and Planned TDM
II. Development of Initial Set of Alternatives	Chapter 3	⇒ Utilize Recommended Preliminary Screening Process & Criteria to Select Primary TDM Strategies
	Chapter 4	⇒ Select Companion Strategies (Incorporate from all Six Categories)
	Appendix I	⇒ Review All Available Information about Selected Measures
		⇒ Define Detailed TDM Alternatives

Goal is to work towards Three TDM Alternatives:

Stand-Alone Alternative - highly aggressive, designed to meet total trip reduction target

Maximum Reasonable Alternative - aggressive, designed to reduce as many trips as reasonably possible with TDM, but falls short of meeting total trip reduction target

Hybrid Alternative(s) - selective strategies for combination with portions of the Build Alternative

Chapter 5	⇒ Evaluate TDM Alternatives using TDM Criteria
	⇒ Carry Forward Preferred/Viable TDM Alternative(s) for Full Analysis, Refinement, and Evaluation

In the MIS steps, all alternatives that have been identified (the recommended process for TDM is noted above) come together for comparison and analysis.

- III. Screening and Decision on Detailed Set of Alternatives**
- IV. Analysis, Refinement and Evaluation of the Alternatives**
- V. Selection of Preferred Investment Strategy**

CHAPTER THREE

Recommended Preliminary Screening Criteria for TDM Alternatives

It is impossible to recommend a combination of TDM measures, which will be effective for any given project, without knowing a substantial amount about the environment of that project. The following chapter presents a series of steps to assess that environment, and identify the primary types of TDM measures which may work best. It is important to remember that any given project may exhibit a number of the characteristics described below, and that the way these characteristics interact will vary with each situation. Therefore, the measures for such a complex project may well be different than a simple summation of the measures suggested here.

Demand management is anchored in the travel market. This chapter uses four screening categories to review and assess that travel market, and seventeen criteria in all, to guide the MIS planner. This should not be viewed as a prescription to be followed, but rather as a set of guidelines and perspectives for considering primary TDM strategies that may apply.

Summary of Recommended Preliminary Screening Criteria for TDM Alternatives

Service Accessibility -

- | | | |
|------------------|----|--|
| <i>Criteria:</i> | #1 | Availability of Competitive (to SOV) Alternative Modes |
| | #2 | Alternative Mode Share, Capacity |
| | #3 | Availability of Mode Support Strategies |
| | #4 | Availability of Mode Support Facilities |

Route and Trip Characteristics -

- | | | |
|------------------|----|---|
| <i>Criteria:</i> | #5 | Level of Congestion |
| | #6 | Availability of Alternative Routes |
| | #7 | Identification of Significant Trip Generators |
| | #8 | Available Capacity Outside of Peak |

Operating Environment -

- | | | |
|------------------|-----|----------------------------|
| <i>Criteria:</i> | #9 | Policy Environment |
| | #10 | Technological Environment |
| | #11 | Public/Private Cooperation |
| | #12 | Public Attitudes |

Land Use -

- | | | |
|------------------|-----|------------------------------|
| <i>Criteria:</i> | #13 | Housing Density |
| | #14 | Employment Density |
| | #15 | Mixture of Uses |
| | #16 | Urban Environment and Design |
| | #17 | Future Development |

The following discusses in some detail each of the recommended preliminary screening criteria and how they might be applied to a transportation study.

SERVICE ACCESSIBILITY

This category examines the types and levels of existing HOV and HOV support services.

Criteria #1: Availability of Competitive (to SOV) Alternative Modes

What kind of HOV service currently exists? Are there transit routes serving the area? Are there vanpools that operate, either employer based or area wide? Are shuttle services available that serve a nearby transit or activity center?

- Condition - Available HOV Services.
Look to TDM actions that will encourage use of the available HOV modes. These may be incentives for use, such as reduced fares, or disincentives for non-use, such as parking charges. Increase promotion of existing services.
- Condition - Inadequate HOV Services Available.
Improve the HOV services so that they can reasonably be used by the target market. Develop new routes and/or schedules that better serve the area. Review and, perhaps, adjust pricing policies. Implement shuttle services or vanpool programs.

Available HOV Alternatives?

<i>Yes:</i>	<ul style="list-style-type: none"> • Increase promotion • Develop HOV incentives • Develop SOV disincentives
<i>No:</i>	<ul style="list-style-type: none"> • Develop/improve services • Review pricing of services

Criteria #2: Alternative Mode Share, Capacity

When alternative modes are present; what is the level of utilization? Do services operate at or near capacity, or are they under utilized? Is there latent demand for HOV alternatives?

- Condition - At Capacity
Expand capacity.
- Condition - Below Capacity.
Increase promotional efforts. Ensure that service meets community needs. Increase support activities at both the public end with actions such as regional ridematch service, etc.; and at the employer end with Transportation Management Associations (TMAs), TDM support strategies and complementary facility support. Implement SOV disincentives such as parking management programs or transportation pricing techniques. Consider HOV facilities if the lack of these keeps people out of HOVs.

Available HOV Capacity?

<i>Yes:</i>	<ul style="list-style-type: none"> • Increase promotion • Improve service • Increase support activities • Strengthen SOV disincentives • Construct HOV support facilities
<i>No:</i>	<ul style="list-style-type: none"> • Expand capacity

Criteria #3: Availability of Mode Support Strategies

Besides actual alternative modes, what facilitating and support strategies are available? Is there a regional ridematch system? Do any trip reduction ordinances require employers to undertake certain HOV supportive activities? Are TMAs present in the region that can provide support? What kind of promotional activities have taken place?

- Condition - Available Support Strategies
Increase marketing of available mode support systems. Insure that services meet community needs. Implement SOV disincentives such as parking management

programs or transportation pricing techniques. Consider HOV facilities if the lack of these keeps people out of HOVs.

- Condition - Moderate or Low Available Support Strategies
Strengthen existing services or initiate new services

Available Mode Support?

<i>Yes:</i>	<ul style="list-style-type: none"> • Increase promotion • Improve service • Increase support activities • Strengthen SOV disincentives • Construct HOV support facilities
<i>No:</i>	<ul style="list-style-type: none"> • Develop/improve mode support services

Criteria #4: Availability of Mode Support Facilities

Do facilities such as HOV lanes, access and signal priority, Park & Ride lots, and bicycle facilities exist? Is it feasible to add to the existing infrastructure?

- Condition - Available Support Facilities
Promote use of services which will use the existing facilities. Improve or enhance transit, vanpool and carpool service to facilitate greater use of facilities. Initiate shuttle or circulator service to accommodate "local" portion of trip. Increase disincentives for SOV use to generate interest in HOVs. Encourage development of activity centers near support facilities.
- Condition - Inadequate Support Facilities
Create additional support facilities. Encourage "peak spreading" techniques such as alternative work schedules.

Available Mode Support Facilities?

<i>Yes:</i>	<ul style="list-style-type: none"> • Increase promotion • Improve service • Increase support activities • Strengthen SOV disincentives • Encourage supportive land use
<i>No:</i>	<ul style="list-style-type: none"> • Develop/improve mode support facilities • Encourage "peak spreading"

ROUTE AND TRIP CHARACTERISTICS

This category examines the factors which affect travel along and within the impacted corridor.

Criteria #5: Level of Congestion

Using measures such as level of service (LOS), vehicle miles traveled (VMT), average vehicle occupancy (AVO), mode choice percentages, and hours of delay, how congested is the impacted corridor? How is it expected to change in the future.

- Condition - Current Congestion
Look for strategies with a short term result. Can improved transit service help? Are parking charges or tolls necessary? Will peak spreading work?
- Condition - Future Congestion
Consider land use strategies which will minimize future problems.

Level of Congestion

<i>Current:</i>	<ul style="list-style-type: none"> • <i>Develop short term strategies</i> • <i>Improve transit service</i> • <i>Increase support activities</i> • <i>Strengthen SOV disincentives</i> • <i>Implement parking charges, tolls</i>
<i>Future:</i>	<ul style="list-style-type: none"> • <i>Develop/improve mode support facilities</i> • <i>Encourage supportive land use</i>

Criteria #6: Availability of Alternative Routes

Are there alternate routes which could serve many of the same trips?

- Condition - Available Alternative Routes
Encourage use of alternate routes. Develop Advanced Traveler Information Systems (ATIS) which can provide pre-trip and enroute information to facilitate route changing. Work with affected jurisdictions to develop regional arterials, for example, through signal coordination.
- Condition - Inadequate Alternative Routes
Develop or promote transit and rideshare services through incentives, service improvements, and SOV disincentives. Encourage use of alternative work schedules to spread peak.

Alternative Route Availability

<i>Yes:</i>	<ul style="list-style-type: none"> • <i>Encourage use of alternate routes</i> • <i>Develop ATIS</i> • <i>Develop regional arterials</i>
<i>No:</i>	<ul style="list-style-type: none"> • <i>Increase promotion</i> • <i>Develop/improve HOV services</i> • <i>Encourage "peak spreading"</i>

Criteria #7: Identification of Significant Trip Generators

To what extent is the traffic within the study area caused by trip generators inside the area? Are there major employment sites, residential sites, or special attractors within the corridor, or is traffic "passing through" to sites outside the study area?

- Condition - Major Internal Employment Sites
Consider employer based TDM strategies, including Transportation Management Association development and promotion, encouragement of voluntary TDM support activities, and trip reduction ordinances for affected areas. Also, coordinate with transit providers to investigate implementing special services tailored to employer/employee needs. Encourage alternative work hours and telecommuting. Where feasible, encourage facility-based complementary support measures or future mixed use development.
- Condition - Major Internal Residential Sites
Investigate improving transit or ridesharing services, including vanpooling. Consider construction of HOV facilities, including special lanes and Park & Ride lots. Where residential development is still occurring, encourage inclusion of transit oriented site design.
- Condition - Major Internal Special Attractors
Investigate developing shuttles from nearby satellite sites. Include mitigation payments in development process.
- Condition - External Trip Generators
Apply actions to source of trip generation. Construct HOV lanes. Look at regional solutions.

Trip Generator types

<i>Major Internal Employment:</i>	<ul style="list-style-type: none"> • Implement employer based TDM • Develop special transit services • Explore complementary facility-related strategies
<i>Major Internal Residential:</i>	<ul style="list-style-type: none"> • Develop/improve HOV services • Construct HOV support facilities • Encourage transit oriented design
<i>Major Internal Special Attractors:</i>	<ul style="list-style-type: none"> • Investigate satellite shuttles • Development mitigation payments
<i>External Generators:</i>	<ul style="list-style-type: none"> • Construct HOV support facilities • Apply TDM at trip source

Criteria #8: Available Capacity Outside Peak

How long is the peak period, and is there room outside of the peak to spread use?

- Condition - Available Capacity
Encourage use of alternative work hours. Consider congestion pricing schemes. Consider peak period commercial traffic restrictions.
- Condition - Inadequate Off-peak Capacity
Construct HOV lanes. Improve transit service. Encourage telecommuting.

Off-Peak Capacity

<i>Yes:</i>	<ul style="list-style-type: none"> • Encourage alternate schedules • Institute congestion pricing • Restrict times for commercial traffic
<i>No:</i>	<ul style="list-style-type: none"> • Construct HOV facilities • Develop/improve transit services • Encourage telecommuting

OPERATING ENVIRONMENT

This category examines the institutional, technological and political framework within an area that may enable (or preclude) certain types of actions.

Criteria #9: Policy Environment

What ordinances, policies, plans, etc., exist that may provide support for alternative mode usage? Are they being adhered to? These may exist as policies or regulations on planning, land use, growth management, or environmental protection, as well as transportation.

- Condition - Supportive Policy Environment
Insure that current and planned development occurs along plan's outlines. Tighten "loopholes" in policies to ensure original intent.
- Condition - Inadequate Policy Support.
Work with policy makers to develop supportive policies.

Policy Environment

<i>Supportive:</i>	• Insure development follows policy
<i>Not supportive:</i>	• Develop supportive policies

Criteria #10: Technological Environment

What is the state of the technology in the area? What electronic infrastructure exists to support data collection or distribution? Is the area covered by a "Traffic Management Center"? Are telephone, cable, or computer network technologies available and readily accessible?

- Condition - Advanced Technological Environment
Develop and utilize Advanced Traveler Information Systems. Use changeable message signs to encourage enroute route changing when needed in response to delay. Develop systems to facilitate use of HOV modes.
- Condition - Inadequate Technological Environment
Where feasible, begin to develop the technological infrastructure needed. Develop plans for long term technological goals including automated traffic data collection, traffic management center, centralized signal coordination and control, etc.

Technological Environment

<i>Advanced:</i>	<ul style="list-style-type: none"> • <i>Develop ATIS</i> • <i>Use changeable message signs</i>
<i>Inadequate:</i>	<ul style="list-style-type: none"> • <i>Develop technological infrastructure</i>

Criteria #11: Public/Private Cooperation

What type of trust and cooperation exists between private employers and developers and government agencies and transit providers? Is there a common definition of the problem or is the relationship confrontational? Do any Transportation Management Associations exist?

- Condition - Cooperative Spirit
When a cooperative spirit prevails, innovative program ideas can be more easily tested.
- Condition - Confrontational Spirit
Work to improve the relationship by providing services and assistance when possible.

Public/Private Cooperation

<i>Cooperative:</i>	<ul style="list-style-type: none"> • <i>Work together on solutions</i>
<i>Confrontational:</i>	<ul style="list-style-type: none"> • <i>Improve collaborative level first</i>

Criteria #12: Public Attitudes

How do the public and elected leaders feel about the situation? Have there been recent public votes on tax levies or bond issues to support transportation projects? How have they fared? How are existing TDM projects being received? Is new tax policy political suicide, or are people ready to "try anything"? Have any recent attitudinal surveys been done?

- Condition - TDM Supportive Public
Reach out to community to identify ways to improve transit service. Develop HOV facilities. SOV disincentives may be more acceptable, but must be accompanied with improved alternatives for HOV service.
- Condition - Unsupportive or Unaware Public
Undertake research to determine what the issues are. Conduct a public education campaign to inform the population of the problems and possible solutions. Work to create understanding and consensus.

Public Attitudes

<i>Supportive:</i>	<ul style="list-style-type: none"> • <i>Maintain support through outreach</i> • <i>Identify/enact transit service improvements</i>
<i>Unsupportive:</i>	<ul style="list-style-type: none"> • <i>Implement public education</i>

LAND USE

This category examines the current and future land use environment in the area under study.

Criteria #13: Housing Density

What is the current and planned housing density within the study area?

- Condition - Low Housing Density
These areas will be difficult to serve with traditional transit. However, innovative services may be effective, such as circulators, shared-ride taxis, and subscription buses serving employment and/or even transit centers. HOV support facilities, both lanes, and Park & Ride lots may work. Telecommuting centers may effectively serve these areas. Allowing some types of mixed commercial use may reduce non-work trips on congested roadways.
- Condition - High Housing Density
These areas are usually easier to serve with traditional transit. Service may need to be improved, and promotion may need to be increased.

Housing Density

<i>Low:</i>	<ul style="list-style-type: none"> • <i>Develop innovative transit service</i> • <i>Construct HOV support facilities</i> • <i>Encourage telecommuting</i> • <i>Allow limited mixed use development</i>
<i>High:</i>	<ul style="list-style-type: none"> • <i>Increase promotion</i> • <i>Develop/improve transit/HOV services</i>

Criteria #14: Employment Density

What is the current and planned employment density within the study area?

- Condition - Low Employment Density
These areas are hard to serve by traditional transit. Encouraging TMA formation may help provide services that transit agencies cannot provide, and individual employers can't afford. Vanpools, carpools, and subscription buses may work. Complementary facility support may also alleviate the need for a car at work, thus assisting ridesharing.
- Condition - High Employment Density
These areas frequently have good traditional transit service. Insure that service meets the needs of users. Parking management programs can be very effective where transit service is available.

Employment Density

<i>Low:</i>	<ul style="list-style-type: none"> • <i>Develop innovative transit service</i> • <i>Encourage TMA formation</i> • <i>Encourage vanpooling</i> • <i>Encourage complementary facility support</i>
<i>High:</i>	<ul style="list-style-type: none"> • <i>Increase promotion</i> • <i>Develop/improve transit/HOV services</i> • <i>Enact parking management programs</i>

Criteria #15: Mixture of Uses

To what extent are types of land uses segregated or integrated in the target area?

- Condition - Highly Segregated Land Use
Rezoning to allow certain types of mixed uses can be a very effective way to reduce the need for, or length of certain types of trips. Examples of beneficial mixes include allowing certain types of commercial development in both office and residential areas. Local shuttle service between segregated use areas (e.g., employment to commercial) can help eliminate the need for SOVs.
- Condition - Well Balanced Land Use
TMAs or other entities can put together incentive programs to encourage use of "locally" provided services, eliminating the need for driving trips. Is the built environment encouraging of walking or bicycling between home, office and services? If not, changes may encourage pedestrian use of the balanced area.

Land Use Mix

<i>Highly Segregated:</i>	<ul style="list-style-type: none"> • <i>Develop innovative transit service</i> • <i>Rezone to allow mixed use</i>
<i>Well Balanced:</i>	<ul style="list-style-type: none"> • <i>Encourage TMAs</i> • <i>Ensure transit/user oriented built environment</i>

Criteria #16: Urban Environment and Design

Is the study area, or any activity center within the study area, pedestrian or transit oriented? Are walkways safe and inviting, are transit shelters provided?

- Condition - Pedestrian/Transit Oriented Environment
Under this condition, the built environment will not serve as an impediment to transit, pedestrian or bike use. However, it may still be necessary to further encourage such use through incentives, i.e., improved transit service, bike and pedestrian support facilities, financial incentives, etc., or SOV disincentives such as parking management.
- Condition - Auto Oriented Environment
It may be possible to retrofit the built environment with transit and pedestrian amenities. Bus shelters and turnouts, clear and safe walkways, even bike lanes can all be added after initial construction. Of course, these design changes will need to be accompanied by programmatic actions to provide and encourage use of non-SOV alternatives.

Urban Environment and Design

<i>Ped./Transit Oriented:</i>	<ul style="list-style-type: none"> • <i>Develop/improve transit, HOV services</i> • <i>Develop financial incentives for HOV use</i> • <i>Implement SOV disincentives</i>
<i>Auto Oriented:</i>	<ul style="list-style-type: none"> • <i>Retrofit where possible</i> • <i>Accompany retrofits with service improvements</i>

Criteria #17: Future Development

What are the plans for this area? Is it in or leading to a designated "urban center"? Is it slated to remain essentially as it is, or is it to develop as a future employment, residential or activity center?

- Condition - Future Use Different from Current Use
Insure that the design and construction of future roadways and developments provide for transit usage, and pedestrian and bicycle traffic.
- Condition - Future Use Same as Current Use
Even without an anticipated change in land use, congestion can be expected to increase. Use relevant TDM measures discussed above to reduce demand.

Future Development

<i>Different Future Use:</i>	<ul style="list-style-type: none">• <i>Develop with pedestrian, transit use in mind</i>
<i>Same Future Use:</i>	<ul style="list-style-type: none">• <i>Implement TDM measures, dependent upon other factors</i>

(For an example of how this screening criteria can be applied, refer to Appendix II)

CHAPTER FOUR

Complementary TDM Strategies

Determining an appropriate package of TDM strategies to compete as a stand alone alternative -- or in combination with portions of a "build" option -- in a Major Investment Study can be a daunting task to the uninitiated. Since this is a relatively new approach, many planners and engineers involved in MISs are unfamiliar with the available TDM options, and with developing a package of integrated TDM strategies. The matrix (Table 4.1) presented in this chapter can be useful in developing an awareness of the interrelationships between and among various TDM strategies and using this knowledge to form an effective MIS alternative. Again, it is most probable that hybrid options, incorporating facets of both TDM/TSM and "build" scenarios, will appear most effective at addressing the problems which instigated the MIS.

Reading the Companion Strategies Matrix

While the matrix may appear complex, its reading is quite straightforward. Reading down the columns are listings of *TDM Measures*, *Highly Complementary Strategies* and *Corridor Applicability*. Reading across the rows, each measure has an identification code (e.g., E1 for *Monetary Incentives*), followed by the strategy's name/description, a list of highly complementary TDM measures and a ratings of the measures' applicability on a corridor basis.

Selecting Primary and Complementary Strategies

To use the Companion Strategies Matrix effectively, you should first select one or more TDM strategies that are appropriate to the particular situation being examined. Using the screening criteria described earlier should provide several primary strategies suitable to the project under consideration. These primary strategies should yield some HOV percentage increase or SOV percentage decline, thereby providing at least a partial alternative to any proposed "build" option for the MIS. The purpose of the Companion Strategies Matrix is to provide additional tools to augment the effectiveness of the strategies provided by the screening process.

With a few exceptions, TDM strategies are universally complementary. However, some are more complementary than others. For example, *Transit* or *Vanpool Services* are good TDM techniques in their own right, but either's effects are increased synergistically when combined with *Guaranteed Ride Home* and *Promotion*.

As companion strategies, *Transit Services* and *Vanpool Services* provide one of those rare examples of techniques which may be somewhat counterproductive when tied together in some markets. When transit services are introduced into an area of high vanpool usage, vanpool participation may suffer, as some of those who opt for transit are those who were already in vanpools. While the new transit service also garners some new HOV users from the ranks of SOVers, planners should be aware of the potential for negative impacts, and may want to consider alternative strategies which are positive or neutral in their effects on existing or proposed companion TDM measures.

Synergies and Multiplier Effects

As noted earlier, TDM measures can have a synergistic effect on each other. For example, Frank and Pivo noted several examples of synergistic relationships in *Relationships Between Land Use and Travel Behavior in the Puget Sound Region*. (September 1994). While housing and employment density each affect mode choice, in combination their individual effect can be greatly enhanced. For example, increasing population density at the origin and destination of modeled shopping trips to 40 people per acre increased transit use from 1.74% to 7%. Incorporating an employment density of 100 employees per acre in

addition to the population density of 40 per acre yielded another 4% transit utilization, for an 11% total share.

A 1994 Cambridge Systematics, Inc. study for the Federal Highway Administration suggests other synergies. In particular, the Cambridge study notes the effectiveness of combining land use and urban design characteristics with financial inducements to alter commute trip behavior. The study also finds that employer-provided transportation assistance programs, while insignificant alone, achieved meaningful changes in drive-alone modal share and average vehicle occupancy rates when incorporated at sites which had a variety of nearby convenience-oriented services.

In creating a package of TDM measures to address the requirements of a major investment study, then, it is essential to develop a mix of approaches. Although more research needs to be done, it appears that incorporating a variety of strategies from *all six TDM category types* may increase the effectiveness and political viability of the TDM option. For example, an effective corridor-type MIS TDM alternative might include:

- *area-wide ridematching services, transit and vanpool service increases with corresponding fare subsidies from **Public Mode Support Measures**;*
- *mixed land use and jobs/housing balance, urban design (pedestrian and transit oriented), and residential and employment density increases from **Land Use Strategies**;*
- *congestion pricing from **Pricing Strategies**;*
- *guaranteed ride home, parking management, commute support programs and alternative work programs from **Employer-Based TDM Measures**;*
- *telecommuting from **Telecommunications Strategies**; and*
- *restrict access to facilities and activities centers, trip reduction ordinances, and parking restrictions from **Policy and Regulatory Strategies**.*

Incorporating strategies from a broad array of sources is useful in two ways: First, it increases the potential effectiveness of the TDM alternative. This is accomplished both through providing more measures which are likely to reduce vehicle miles traveled on their own merit, and through the greater opportunities for synergistic effects which accompany a broader utilization of TDM measures. In the example above, synergies are likely to be generated between any action in one category and most actions from other categories. For example, *increase in transit services* is likely to benefit synergistically from all the **Land Use, Pricing and Policy and Regulatory Strategies** cited, as well as from *guaranteed ride home, parking management, commute support programs* from **Employer-Based TDM Measures**. Examination of other TDM strategies suggests similarly broad synergies.

Second, by incorporating a broadly based variety of strategies, the political burden of enacting potentially unpopular measures is shared. Elected officials may feel less heat if a mix of strategies, some of which are reliant on the private sector, are utilized, rather than developing a predominant reliance upon **Policy and Regulatory and Pricing Strategies**. Furthermore, incorporating measures whose costs are borne by those incurring the (future) demands on the system, such as most **Land Use Strategies**, may establish a sense of fairness in the process, creating greater acceptance of the other strategies which assess costs to present travelers who have rarely been charged the full cost of their travel to date.

Table 4.1
Complementary Strategies Matrix

<i>Public Mode Support Measures</i>		Highly Complementary Strategies	Corridor Applicability
S1	Public Education and Promotion	all TDM strategies	High
S2	Area-Wide Ridematching Services	S4, S7, R3, E4, E7, L2	Medium
S3	Transit Services	all except S2, S4, S6, E2, T1 and T2	High
S4	Vanpool Service	GRH (E4) especially complementary; S2 also highly complementary	High
S5	Transit and Vanpool Fares	Public Mode Support Measures; Land Use Strategies	High
S6	Non-Motorized Modes	marketing is critical; E5, L2, L3, L6, S3	High
S7	HOV Facilities	S2, S3, S5, S8	High
S8	Park and Ride Lots	S2, S3, S5, S7	High
<i>Employer-Based TDM Strategies</i>			
E1	Monetary Incentives	Complements all Employer Based Strategies; S2, S3, S4	Medium
E2	Alternative Work Schedules	S2, S5, T1, P3	Medium
E3	Commute Support Programs	E5, S3, S4, S5, S6, S7, S8	Medium
E4	Guaranteed Ride Home	S2, S3, S4, S6	Medium
E5	Parking Management	E3, E4, S2, S3, S4, S5	Medium
E6	Facility Amenities	S2, S3, S4, S5, S6, S8	Medium
E7	Transportation Management Associations	Employer Based Strategies; R1	High
<i>Pricing Strategies</i>			
P1	Gasoline Tax Increase	S3, S5, S7	Low
P2	Vehicle Miles Traveled Tax	S3, S5, S7	Low
P3	Congestion Pricing	S3, S5, S7	High
P4	Parking Tax	S3, S5, S7, S8	Medium
<i>Telecommunications Strategies</i>			
T1	Telecommuting	E2, R1, R2, R3	Medium
T2	Advanced Telecommunications	Pricing Strategies	High

Table 4.1
Complementary Strategies Matrix

<i>Land Use Strategies</i>		Highly Complementary Strategies	Corridor Applicability
L1	Development Impact Mitigation	All Land Use Strategies; S6, S7, S8	High
L2	Mixed Land Use and Jobs/Housing Balance	All Land Use Strategies; S3, S5, S6	Medium
L3	Transit-Oriented and Pedestrian Friendly Design	L2, L6, S3, S5, E6, P4	High
L4	Residential Density Increases	L1, L2, L3, L5, S3, S5	Medium
L5	Employment Center Density Increases	Employer Based & Land Use Strategies; Public Mode Measures	High
L6	Parking Management	Most Public Mode Measures; E5, P3, P4	Medium
L7	On-Site Amenities	Most Land Use Strategies; S7, S8, R1	Medium
<i>Policy and Regulatory Strategies</i>			
R1	Trip Reduction Ordinances	Aids all TDM efforts; particularly Employer Based Strategies and Public Mode Support Measures	Medium
R2	Restrict Access to Facilities and Activities Centers	Aids all TDM efforts; especially helpful to Public Mode Support Measures	High
R3	Support New Institutional Relationships	Land Use Strategies; T1, T2, E2, E6, E7, S6, S7	High
R4	Increase HOV lanes to 3+	Public Mode Support Measures	High
R5	Parking Restrictions	Public Mode Support Measures	Medium

TDM strategies tend to work synergistically: strategy combinations may yield greater returns than the sum of individual strategy's effects. Strategy combinations that are non-complementary are rare, and where these occur (usually between transit modes such as transit and vanpool service), negative impacts tend to be localized, whereas benefits accrue regionally.

CHAPTER FIVE

Evaluating Packages of TDM Strategies (TDM Alternatives)

The comparison and evaluation of TDM alternatives can include a number of different criteria and factors. ISTEAs required assessment, FTA Guidelines, FHWA directions and EIS processes, put forth a large number of impacts and performance criteria that should be included in the investment study process. Ultimately, TDM alternatives must be assessed on the evaluative criteria chosen by the stakeholders and decision makers for the individual investment study.

Methods for Measuring Effectiveness of Individual TDM Strategies

Measuring the effectiveness of individual TDM strategies is difficult and has not necessarily been a high priority in the past, although this is beginning to change with the increased interest in TDM. The following is intended to give a general sense of how the effectiveness of individual TDM strategies can be, and have been, measured. For more specific information on the effectiveness of individual strategies gathered from extensive research, refer to Table 5.1 and to the detail documentation of strategies in Appendix I.

The Washington State Transportation Center (TRAC) at the University of Washington recently identified three general approaches that are being utilized to evaluate the impact of TDM (Research Project # T9223, Task 10). In gathering data for this guide, we used all three. They are:

- **Case Studies** - TRAC found these to be particularly effective for analyzing employer-based, site-specific TDM strategies, and that they can provide the basis for projecting broader impacts (this is primarily because most TDM to date has been directed at commute trips).
- **Best Estimates** - This approach starts with assumptions that, when used in the traditional four-step modeling process (trip generation, trip distribution, mode split, and trip assignment) TDM can either be reflected in the trip generation step (reduced number of person trips) or in the mode split step (reduced number of vehicle trips or VMT). TRAC noted that this approach does not evaluate the effects of TDM strategies, so much as it evaluates a transportation network with a theoretical reduced demand.
- **Models** - Models attempt to estimate changes in behavior based on data collected in past TDM applications. TRAC identified two models (COMSIS and JHK & Associates), the latter of which focuses on employer-based TDM strategies -- again, because those strategies are the ones most widely implemented and evaluated.

Recommended Evaluation Criteria for TDM Strategies within a TDM Alternative

Table 5.1 presents a matrix of evaluation criteria specific to demand management strategies. The criteria incorporated into this table are considered key to assessing the differences in performance and acceptability among TDM measures. Like Table 1.1 which presented characteristics of the strategies, this table provides a simple summary of differences among the categories and individual strategies. The enhanced summaries presented in Appendix I provide much more specific information. This matrix (table 5.1) provides concise information on the following evaluation criteria, for each of the selected TDM strategies:

- **Potential Effectiveness** indicates the demonstrated (or modeled) effectiveness for each strategy. Generally this is provided as a range of potential changes in VMT (vehicle miles traveled) or in trip reduction. Where the potential change has not been demonstrated the effectiveness is classified as "unknown."
- **Implementation Difficulties** provides a qualitative indication of known or anticipated

difficulties – financial, political, and public. Although some difficulties relate to technological developments, most are attributed to resistance to change and the acceptance of more radical policies.

- **Incremental Cost** provides a general indication of the level of costs anticipated to implement a strategy. Costs will vary tremendously based on the area of application and the size of the program or service implemented. Consequently, only a qualitative assessment of costs is provided in the matrix. Costs are labeled as being of low, medium or high levels.
- **Who Pays** suggests which parties are likely to bear the burden of the costs associated with the strategy. This matrix illustrates the group or groups that would *traditionally* pay for the strategy. It is helpful to remember, when using this chart, that an MIS demand management alternative may propose a new financing source. Eventually, with changes to the state's priority programming process, highway funds may be made available to cover the softer TDM program and service costs (including operating costs) over a long period of time – as an alternative to the highway capital investment.

Comments on the Evaluation of TDM Strategies and Alternatives

A number of concerns and cautions should be acknowledged relative to evaluating demand management strategies and the TDM alternatives included in the major investment study. These are:

- **Data and Forecasting Issues** should be well known to those involved in major investment studies. Still, they bear additional highlighting when it comes to demand management strategies. As noted earlier TDM is still a fairly young discipline. We have yet to collect all the needed data, fully document potential effectiveness and develop reliable forecasting tools (this information is especially lacking for non-commute trips). It is important, therefore, that the information provided in this guide – particularly relative to effectiveness – be treated with a degree of caution.
- **Multiplier Effects and Combined Strategies** present additional issues. Even where there is reliable data on the effectiveness of individual TDM measures, there is still limited information on the combined effect resulting from a package of TDM strategies. Some strategies have no impact without the presence of other basic TDM services and techniques. Transit pass subsidies at suburban employment sites, for example, have little or no effect until sufficient transit service exists to support employee commutes (although it should be noted that many transit agencies do permit employer-subsidized transit passes to be applied to vanpool fares). At the same time, the impacts of a package of TDM strategies is not likely to be linear – and cannot be estimated by simply adding the potential effectiveness scores for each of the included measures. In fact, the cumulative effect of a combined package may be less than the sum of the parts – or, given a synergistic relationship, it may be substantially more. Examples of the former are readily apparent for employer programs. An increase in telecommuting, for example, may take place among the low and mid-level management commuters who already utilize incentives to ride the bus or vanpool to work. The increased utilization of one mode may come at the expense of another HOV mode. An example of the latter, where a multiplier effect results in unanticipated impacts, has been seen with the addition of HOV supporting measures, including guaranteed ride home programs, which generate significant increases in the use of other TDM programs and in a larger HOV shift than the individual strategies would typically generate alone.
- **Timing** for the implementation of demand management activities presents two important considerations. First, TDM can effectively delay more costly capital expenditures. The introduction of TDM programs, for example, may be used to

postpone a needed infrastructure expansion for a decade or more. Planners are encouraged to consider the inclusion of demand management activities as part of an integrated package of TDM and capital expenditures over a twenty year construction time frame. Second, most TDM strategies are market intervention measures. Because they are designed to meet current market conditions they may gain or lose effectiveness over time and with changes in the larger environments. With advancing technologies and a changing political scene planners may need to identify potential trip reduction from TDM measures without permanent commitment to specific techniques, while providing sufficient funds to cover a range of potential strategies over a twenty year period.

- **Travel Demand Models** often incorporate a fairly high level of projected trip reduction resulting from TDM. Commonly, the achievement of a specific level of trip reduction is just assumed to happen over time, due to actions that are usually unspecified. It is suggested that MIS planners examine the assumptions of the models that they are relying on for trip forecasting. This review can serve as a reality check on the trip reduction already incorporated into the model and attributed to TDM activities. It will also prevent the planner from generating a TDM alternative that is largely based on programs and trip reductions that have already been assumed. This also may mean that some of the impacts of the assumed TDM will have to be attributed to the TDM alternative being developed, even before the new impacts of the alternative can be counted.

Relative to models, the following cautionary advice is offered in *"The Use and Evaluation of Transportation Control Measures"*, a recent study completed by the Texas Transportation Institute, in cooperation with the FHWA and the Texas DOT (Transportation Control Measures (TCMs) are transportation - based strategies that can be implemented to reduce air pollution. Many of them are also TDM strategies):

"Regional travel demand models can also make large errors in estimating traffic volumes and speeds on individual network links. It is common for even the best procedures to make errors of over 30% in link volumes and over 50% in speeds. The magnitude of these errors by themselves greatly exceed the magnitude of travel impacts of most TCMs."

(Error rates vary greatly depending upon the size of the system link being modeled, as well as the time frame being considered.)

"...travel demand models are not equipped to predict shifts in demand due to employer-based transportation management programs, and similar programs initiated by the local government. Only those activities that alter the modal availability or change the time and cost of a travel mode uniformly across all the users in a particular class (e.g., all service employees) can be evaluated using the regional travel demand models."

"Sketch-planning is gross in nature, but also the most promising and cost-effective of the TCM evaluation methods currently available."

(This is the approach that we are recommending.)

It is in this area of evaluating packages of strategies and developing the TDM alternative final recommendations that it is particularly valuable to be working with a team from the community whose members are knowledgeable in TDM. As noted several times, evaluating TDM is not an exact science. A common-sense approach, utilizing the best available knowledge is needed.

Table 5.1
Evaluation of TDM Strategies

Evaluation Criteria for Transportation Demand Management (TDM) Strategies	Potential Effectiveness	Implementation Difficulties	Incremental Cost	Who Pays			
				Taxpayers	Users	Employers	Municipality
Public Mode Support Measures							
Public Education and Promotion	increases the effectiveness of other strategies up to 3% ^{1,5}	none	low - medium	√		√	√
Area-wide Ridematching Services	0.1 - 3.6% VMT reduction ^{2,3}	none	low			√	√
Transit Services	up to 2.5% VMT reduction ²	ongoing competition for public funds	medium - high	√	√	√	
Vanpool Service	up to 8.3% commute VMT reduction ⁵	high fares compared to transit; finding riders & drivers	medium		√	√	
Transit and Vanpool Fares	up to 2.5% regional VMT reduction ²	competition for public funds; equity concerns	medium	√	√	√	
Non-Motorized Modes	0 - .2% regional VMT reduction ⁵	minimal for low cost actions; great for high cost actions	low - high	√	√	√	
HOV Facilities	up to 1.5% VMT reduction & .2% trip reduction ⁶	high cost; public acceptance	medium - high	√			
Park and Ride Lots	0 - 0.5% VMT reduction ²	none	medium - high	√			
Employer Based TDM Measures							
Monetary Incentives	8 - 18% trip reduction at site ²	tax implications for some subsidies	low - medium			√	
Alternative Work Schedules	as much as a 1% regional VMT reduction ^{2,7}	employee or management reluctance	low			√	
Commute Support Programs	0.1 - 2.0% regional VMT reduction ²	none	low			√	
Guaranteed Ride Home	unknown ⁸	liability concerns of employers	low	√		√	

Table 5.1
Evaluation of TDM Strategies

	Potential Effectiveness	Implementation Difficulties	Incremental Cost	Who Pays			
				Taxpayers	Users	Employers	Municipality
Employer Based TDM Measures continued							
Parking Management	20 - 30% site reduction in SOV trips ⁴	employee opposition	low to revenue producing		√	√	
Facility Amenities	minimal alone ²	space; local zoning requirements	low to revenue producing			√	
Transportation Management Associations	6 - 7% commute trip reduction * ⁹	funding and political support required	low - medium			√	√
* These results are from pre CTR experiences. A broader range of effectiveness would be expected in the presence of CTR legislation.							
Pricing Strategies							
Gasoline Tax Increases	4 - 10% regional VMT reduction ²	public resistance; legislative action; travel alternatives required	revenue producing		√		
VMT Tax	0.1 - 11% regional VMT reduction ²	public resistance; legislative action; travel alternatives required	revenue producing		√		
Congestion Pricing	up to 5% regional VMT reduction ²	public and political opposition; travel alternatives required; technical and enforcement difficulties	revenue producing		√		
Parking Tax	1 - 5% regional VMT and trip reduction ²	legislative action; negative public sentiment opposition from private sector	revenue producing		√	√	
Telecommunications Strategies							
Telecommuting	up to 10% commute VMT reduction ²	prevailing corporate culture	low			√	
Advanced Telecommunications	moderate to high ^{1, 10}	untested, unproven concepts	low-high	√	√		

Table 5.1
Evaluation of TDM Strategies

	Potential Effectiveness	Implementation Difficulties	Incremental Cost	Who Pays			
				Taxpayers	Users	Employers	Municipality
Land Use Strategies							
Development Impact Mitigation	varies with mitigation requirements ^{10,11}	landowner and developer resistance	low to medium	√	√		
Mixed Land Use/ Jobs Housing Balance	VMT reductions up to 10% ^{2,4}	public resistance; slow rate of effective change	low to medium	√	√		√
Transit-Oriented and Pedestrian Friendly Design	increase in transit, bike and pedestrian trips ^{12,6}	requires design review; developer resistance	medium to high	√		√	√
Residential Density Increases	VMT reductions of up to 10% per household ¹²	public and developer resistance to required densities	medium to high	√			
Employment Center Density Increases	SOV work trip reductions of up to 50% ¹²	large increase in density often required to realize significant change	medium to high	√		√	
Parking Management	1 to 5% regionwide VMT reduction ²	local council action required; public/retailer resistance; enforcement issues	low		√	√	
On-Site Amenities	unknown; probably reflects effectiveness of mixed use development ¹³	requires policy changes, public & private inertia are barriers	low to medium	√			
Policy & Regulatory Strategies							
Trip Reduction Ordinances	.1 - 4% regional VMT reduction ²	legislative action required; resistance to expanded regulation	low - medium	√		√	√
Restrict Access to Facilities and Activity Centers	2.8 - 10% VMT reduction ¹	political will to face public opposition	low to high	√			
Support New Institutional Arrangements	unknown ^{1,2}	require strong advocacy, public & private sector support	low to high	√			

Table 5.1
Evaluation of TDM Strategies

	Potential Effectiveness	Implementation Difficulties	Incremental Cost	Who Pays			
				Taxpayers	Users	Employers	Municipality
<i>Policy & Regulatory Strategies continued</i>							
Increase HOV lanes to 3+	Possible 1.5% reduction ^{2, 14}	legislative action needed; public resistance	low	√			
Parking Restrictions	1 - 5% trip reduction ^{2, 11}	public, developer resistance	low		√		

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CHAPTER SIX

Recommendations For Further Work

Throughout the State of Washington, and most likely the whole country, planners and policy-makers are struggling to complete comprehensive planning efforts and to promote a more even-handed comparison of alternative solutions to transportation problems. Whether this is attributable to ISTEA mandate, the need to secure low cost alternatives, or the public outcry against highway "build" scenarios is irrelevant. We continue to search for creative approaches to road and highway congestion and demand that quickly outstrips supply. TDM holds the promise of providing lower cost, market-based solutions that can be accomplished without large expenditures of capital.

Preparation of this guide has been an effective reminder that we fall far short of goals to provide adequate data and appropriate guidance for incorporating TDM strategies into a competitive study and funding process. Rather we find significant gaps in needed data, the absence of technical analysis and technical expertise, and policy and process barriers to fully including demand management alternatives in planning efforts. The following discussion enumerates the authors' recommendations for further work in this area.

Gaps in TDM Knowledge and Information

Our efforts have been hampered by the lack of basic data about demand management alternatives and their impacts on travel behavior. We've identified the need for additional inquiries about:

- **Non-commute Trips** - which constitute 80% of the typical household's travel in urban areas. We know little about the characteristics of non-commute travel; we know much less about the potential TDM strategies for changing that travel behavior.
- **Market Segmentation** - of both commute and non-commute trips. We are beginning to acquire the needed trip data to develop reasonably adequate trip models for highway utilization, at least on a regional and near-term basis. We still lack basic data, and applied demonstrations, for identifying the elasticity of mode choice.
- **Employer TDM Activities** - which have been well documented only at the individual work site level (and becoming increasingly so, due to Washington State's Commute Trip Reduction Law). We need added study of the effects of employer based strategies at the area, regional, and corridor level and a better understanding of the real cost impacts on the business community.
- **Combinations of TDM Strategies** - and their appropriate application. We need to evaluate the appropriate mixes of demand management activities for different situations. There is little documentation on interactive impacts, multiplier effects and optimal combinations.

Technical Research Needed

Beyond the basic generation of data and information we recognize the need for new tools and methodologies for incorporating knowledge into alternatives analysis. We recommend further technical research and new methodology for:

- **Improved Forecasting** - of the impact of demand management activities. We need to address the long term effectiveness of strategies and techniques that have, to date, been observed only in short term applications.
- **Projecting Effectiveness** - of many TDM measures and techniques. For the most part, only employer-based activities have been addressed by researchers. To expand the

body of knowledge we need to undertake applied demonstrations and specific efforts to document and evaluate non-commute strategies.

- **Cost/Benefit Analysis** - cost effectiveness, life cycle cost analysis, and least cost planning. Each of these are potentially key components of MISs and the state's programming and financing processes. TDM actions are difficult to assess in these evaluative processes – but, so are more traditional transportation projects. As noted in the introduction, considering the full societal cost of any transportation alternative is virtually not done outside, perhaps, of academia. Planners, however, are being increasingly pushed in that direction. The lack of methodologies to do such all inclusive comparison severely hampers our ability to define TDM alternatives and to compare them to other solutions.
- **Including TDM Measures in Travel and Trip Modeling** - modeling has significantly advanced during the past decade, especially at a regional and near-term level. Its remaining shortcomings, however, present clear barriers and disincentives to including TDM measures. Models are generally vehicle based (as opposed to trip or person based) and they are unable to acknowledge the key attributes and changes anticipated by demand management activities: travel time, land use, changes in departure times, trip chaining, and travel costs. Efforts are needed to ensure that the next generation of models is more responsive to TDM and to the potential market changes these measure can generate.
- **Estimating Generated Trips** - of capacity expansion projects. To enable us to make more honest comparisons of alternatives to capacity expansion projects, we need to ensure that we can, and do, account for the trips generated by capacity expansion itself.

Policy and Process Barriers

The key to the future of TDM activity may lie in changes to our planning policies and processes. An evolutionary change in planning philosophy is already underway. The next step is to create the institutional structures that will force a continuing focus on TDM and thereby legitimize demand strategies in a supply-oriented system. Potential changes include modifying:

- **Criteria for Prioritization of Projects** - in local, regional and state decision processes. Revisions to the mobility prioritization criteria and the current scoring guidelines can provide the method for comparing TDM and capacity alternatives and increase the competitiveness of a demand side alternative. It should be a priority to utilize least or full cost accounting principals that include full costs to society.
- **Funding Priorities and Funding Parameters** - to permit greater funding of demand management activities. Many TDM measures are programmatic and require operating dollars. Current funding guidelines may prevent allocation to non-capital projects. Modifications, including the introduction of a new mechanism to reserve funds for future TDM activities, may be the critical next step.
- **Level and Nature of Inter/Intra Agency Collaboration** - to integrate planning and implementation of demand management alternatives. A serious turf issue currently restricts state planners from generating alternatives that are beyond the locus of responsibility, and resources, of the state. Solutions that demand commitments from transit and land use agencies, or employer stakeholders may be eliminated or restricted because of the limited areas of responsibility assumed by the participants. Existing tension could be eased if the TDM solution was more assured of funding -- at least as much as the capacity solution is. Modifying the process could also occur through the provision of incentives (and disincentives) to truly collaborative proposals.

Work is underway to address the issues enumerated here. The Washington State Transportation Center is attempting to address aspects of the first two policy issues (above) during the '95/'97 biennium. Work is also underway to develop methodology for applying least cost planning principals to transportation. WSDOT is undertaking additional research on the effectiveness of TDM strategies. And, additional work is underway to refine, and develop further demonstrations of, the planning process recommended within this guide.

Clearly, more work is needed.

APPENDIX II
Screening Criteria Example
I-5 Ship Canal Bridge

To show how the Preliminary Screening Criteria can be used in considering TDM strategies for inclusion in MIS projects, the example below will apply them to a hypothetical project on I-5. In this example, the stretch of I-5 under consideration is the bridge that spans the Lake Washington Ship Canal, just north of downtown Seattle. After addressing each of the points raised in the Screening Criteria, Recommendation 1 will combine the "Potential Actions" to develop a TDM only alternative, while Recommendation 2 will look at the addition of an HOV lane in combination with TDM strategies.

The numbers used in this example are estimates.

SERVICE ACCESSIBILITY

1. Competitive Alternative Modes

The study area is well served by transit, with many King County (Metro) and Community Transit buses traversing the bridge. Numerous vanpools operate on the bridge, with destinations in downtown Seattle, further south (Tacoma, Olympia), and north of the bridge in the University District, Northgate, and Snohomish County.

Potential Actions:

- Increase promotion of existing services.
- Provide additional incentives to use HOVs such as:
 - Decrease bus and vanpool fares for routes using bridge
 - Increase frequency of bridge-using bus routes
 - Provide preferential HOV parking at bridge destinations.
- Create disincentives to SOV use:
 - Increase/impose parking charge at bridge destinations
 - Impose toll for use of bridge.

2. Alternative Mode Share, Capacity

At peak hours, transit operates at an average of 80% (est.) capacity. Certain express routes however, are running at "standing room only" capacity. Vanpools serving the bridge operate at about 90% (est.) capacity.

Potential Actions:

- Increase promotion of existing services.
- Ensure appropriate service provision:
 - Add capacity to routes that are full
 - Consolidate routes operating with few riders.
- Increase HOV support activities.
- Construct HOV support facilities.
- Provide additional incentives to use HOVs such as:
 - Decrease bus and vanpool fares for routes using bridge
 - Increase frequency of bridge-using bus routes
 - Provide preferential parking at bridge destinations.
- Create disincentives to SOV use:
 - Increase/impose parking charge at bridge destinations
 - Impose toll for use of bridge.

3. Mode Support Strategies

Both King County (Metro) and Community Transit have extensive outreach programs, with corporate pass sales programs. Both are part of the regional ridematching system to place people in carpools and vanpools. At present, no Transportation Management Associations

(TMAs) serve downtown or the University District, the two large employment centers on either end of the bridge. However, both downtown Bellevue and Redmond-Overlake (which are impacted by bridge travel) do have TMAs. The Commute Trip Reduction Law (CTR) affects many employers whose employees use the bridge. Additionally, the University of Washington and several downtown employment sites are regulated under Seattle's Major Institution Ordinance, which contains requirements for strict transportation demand control.

Potential Actions:

- Increase promotion of existing services.
- Ensure appropriate service provision .
- Increase HOV support activities.
- Construct HOV support facilities.
- Provide additional incentives to use HOVs such as:
 - Decrease bus and vanpool fares for routes using bridge
 - Increase frequency of bridge-using bus routes
 - Provide preferential parking at bridge destinations.
- Create disincentives to SOV use:
 - Increase/impose parking charge at bridge destinations
 - Impose toll for use of bridge.

4. Mode Support Facilities

One HOV lane operates on the reversible express section of the bridge, on a level below the main roadway. Some HOV access priority is also available to the upper level of the bridge (no HOV lanes on upper level). I-5 is well served with Park & Ride lots north of the bridge that access bridge-using express buses with current utilization rates of between 40 and 100%

Potential Actions:

- Increase promotion of existing Park & Ride lots, especially those with excess capacity.
- Enhance HOV support facilities:
 - Create HOV lanes on I-5 non-reversible flow lanes leading to and on upper deck
 - Create additional HOV priority access.
- Encourage "peak spreading":
 - Promote alternative work hours and telecommuting.

ROUTE AND TRIP CHARACTERISTICS

5. Level of Congestion

The I-5 Ship Canal bridge currently experiences a high state of congestion. It is at LOS F for 2.0 (est.) morning hours and 2.5 (est.) evening hours. This is projected to increase to 3.5 (est.) morning hours and 4 (est.) evening hours by 2020. The AVO for vehicles crossing the bridge is 1.10 (est.). Of the bridge commuters, 80% (est.) use SOVs, 7% (est.) use transit, 13% (est.) use carpools or vanpools.

Potential Actions:

- Seek short-term solutions.
- Consider parking charges, tolls.

6. Availability of Competitive Routes

For some trips into and out of downtown Seattle, SR99 can be considered a competitive alternative route. South of Greenlake and north of the West Seattle Bridge, there are no traffic lights on SR99. SR99 has a shorter peak period, with a .75 (est.) morning peak hour, and 1 (est.) evening peak hour at LOS F. Additionally, four other bridges (Montlake, University, Fremont, Ballard) cross the Ship Canal that can be used as alternatives,

especially for shorter trips. These bridges also serve as alternate routes for pedestrian and bicycle traffic.

Potential Actions:

- Investigate development of N 85th St. between I-5 and SR99 as part of an alternative route. Consider using timed signals and reversible HOV lanes on both 85th and SR99.
- Develop Advanced Traveler Information Systems (ATIS) and provide motorists with en-route information (e.g., changeable message signs) on time savings via alternatives.

7. Significant Trip Generators

Although there are obviously no trip generators on the bridge, downtown Seattle, South Lake Union, the University District, Northgate, and the major Boeing plants are major employment trip generators. Additionally, the Ship Canal bridge links commuters from north of the bridge to the SR520 bridge and employment and residential centers on the Eastside.

Potential Actions:

- Encourage development of Transportation Management Associations (TMAs) in employment centers.
- Strengthen CTR to provide broader coverage.

8. Off-Peak Capacity

Currently, off-peak capacity is available, although levels will diminish considerably.

Potential Actions:

- Encourage use of alternative work hours to spread peak.
- Consider congestion pricing schemes.
- Consider restricting commercial traffic to off-peak hours.

OPERATING ENVIRONMENT

9. Policy Environment

Seattle's Major Institution Ordinance has strict traffic controls that affect many large employment sites, including the UW. Many downtown and other employers are covered by the City's CTR ordinance. Additionally, the Growth Management Act, the Puget Sound Regional Council's Vision 2020, and Metropolitan Transportation Plan all recognize the role that TDM must play in reducing the region's traffic congestion.

Potential Actions:

- The policy underpinnings for TDM action exist.

10. Technological Environment

The Seattle area has implemented many technological improvements that can be used to influence traffic conditions. A Traffic Management Center (TMC) exists, loop detectors are in place under I-5, and changeable message signs are used. Additionally, several developmental projects have been completed, are underway, or are planned.

Potential Actions:

- Continue development of ATIS and attempt to deploy systems as they become available.

11. Public-Private Cooperation

The City and other public agencies and most employers within the City enjoy a cooperative working relationship. This has been fostered in recent years by the development of the U-Pass program between King County (Metro) and the UW, and a cooperative effort on developing the city's CTR ordinance (required by the state's CTR law).

12. Public Attitudes

Public pressure has been strongly against a recent proposal to use toll roads to fund some highway improvements. The Regional Transit Authority's initial proposal for a rapid transit system in the region was defeated regionally, but was narrowly passed by Seattle voters. However, there is also a history of opposition to roadway construction projects that add capacity.

LAND USE

13. Housing Density

The areas on either side of the I-5 bridge have a relatively high housing density. Residential areas farther away from the bridge, in north and east King County and south Snohomish County, have a low residential density.

Potential Actions:

- Develop and improve transit and HOV services.
- Increase promotion of existing services.
- Develop Park & Ride lots in outlying areas.
- Use land-use policies and regulations to improve environment for HOVs:
 - Encourage the development of higher density housing
 - Require transit and pedestrian friendly residential development.

14. Employment Density

The areas on either side of the I-5 bridge have a relatively high employment density. However, the bridge also serves commuters going to areas of low employment density in north and east King County and south Snohomish County.

Potential Actions:

- Increase the promotion of HOVs.
- Develop and improve transit and HOV services.
- Enact parking management programs.
- Utilize land-use policies and regulations to improve the environment for HOVs:
 - Encourage the development of higher density employment centers in outlying areas
 - Require transit and pedestrian amenities in employment center development.

15. Mixture of Uses

Areas on either side of the I-5 bridge have a relatively good mixture of land uses. Downtown Seattle, while somewhat lacking in residences, does contain industries, offices and commercial businesses. The U-District has a good balance of residential, office and commercial uses. The further one gets from the bridge, the less balanced becomes the land-use mix.

Potential Actions:

- Encourage TMA development.
- Encourage mixed-use development in outlying areas.
- Encourage developments such as the Seattle Commons.

16. Urban Environment and Design

Areas on either side of the I-5 bridge can be considered pedestrian and transit friendly. They generally have good transit access, well lit and safe sidewalks, and bicycle lanes and paths. Outlying areas served by the bridge generally are more auto-friendly and less pedestrian-friendly.

Potential Actions:

- Improve transit, HOV services.
- Increase incentives of HOV use.
- Increase disincentives for SOV use.
- Utilize land use policies and regulations to require pedestrian and transit friendly development.

17. Future Development

Areas on either side of the I-5 bridge will continue in their present use in the foreseeable future. Residential densities may increase in downtown Seattle. Overall, the region is expected to grow dramatically, and the I-5 bridge will play an increasingly important role in regional mobility.

RECOMMENDATION 1: TDM ONLY (Example)

As an alternative to building new lanes on the I-5 Ship Canal bridge, a course of action implementing the following TDM strategies should be undertaken.

Publicly Provided Alternative Mode Support

- Improve promotion of existing transit, carpooling and vanpooling services.
- Improve transit service:
 - Examine routes using the bridge for increased service frequency potential
 - Examine routes linking to bridge routes for increased service frequency potential
 - Deploy inexpensive circulators in the U-District, downtown Seattle outside free-ride zone, and in outlying employment areas.
- Decrease transit fares for express routes using the I-5 bridge.
- Decrease vanpool fares.

Employer Based TDM Strategies

- Encourage and assist the development of TMAs in downtown Seattle, the University District, Northgate, and other areas immediately served by the I-5 bridge.
- Strengthen CTR to accomplish its application to additional employers.
- Develop policies to encourage telecommuting.
- Enact parking management programs, including a parking charge.

Emerging TDM Strategies

- Implement tolls and congestion pricing on the bridge.
- Use ATIS to encourage the use of alternative routes.
- Encourage telecommuting.

Alternative Route Development

- Equip N. 85th St. with reversible flow HOV lanes and coordinate traffic signals between I-5 and SR99.
- Convert middle lane of SR99 from N. 85th to John St. (Battery St. Tunnel) into a reversible flow lane with one lane reserved for HOVs.

RECOMMENDATION 2: HOV LANE ADDITION PLUS TDM (Example)

The list of TDM recommendations above contains some items, such as parking charges, congestion pricing, and tolls, that may be politically unacceptable. A more acceptable, albeit potentially more expensive alternative may be to engage in new construction on the

bridge. (Before such a decision is made, however, it would be beneficial to compare the average cost per user - in higher taxes or bond indebtedness - of new construction versus tolls. This comparison would include the possibility of using toll revenue to decrease revenue generation from other sources.) In the case of an HOV lane addition, all of the above actions except for Alternative Route Development would be undertaken, along with the following.

HOV Facility Development

- Add one HOV lane to the non-reversible flow lanes leading to and on the upper bridge level.
- Add HOV-only access directly to HOV lanes at southbound 45th, southbound 85th, southbound 50th and northbound SR520.