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Integrating Demand Management into the Transportation Planning Process: A Desk Reference

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16. Abstract The document has been developed to serve as a desk reference on integrating demand management into the transportation planning process. The desk reference is organized around two fundamental aspects of transportation planning – policy objectives and scope of the planning effort. The report discusses how demand management relates to seven key policy objectives that are often included in transportation plans, such as congestion and air quality. It then discusses how demand management might be integrated into four levels of transportation planning from the state down to the local level. The report also includes information on tools available for evaluating demand management measures and on the known effectiveness of these measures.			
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Acknowledgments
This report describes approaches for integrating demand management into the planning process at various levels for addressing different policy objectives. The report also documents known effectiveness, modeling, and evaluation approaches for demand management strategies to enable transportation professionals to effectively include demand management into their planning and operational "tool box."

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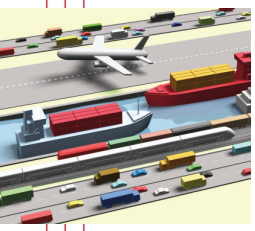
Acronym List

AASHTO	The American Association of State Highway Transportation Officials
ATDM	Active Transportation and Demand Management
ATM	Active Traffic Management
BCA	Benefit/Cost Analysis
BRT	Bus Rapid Transit
CBD	Central Business District
CCRPC	Champaign County Regional Planning Commission
CIVITAS	CIty-VITAlity-Sustainability
CMAQ	Congestion Mitigation and Air Quality
CMP	Congestion Management Program/Plan/Process
CTE	Center for Transportation and the Environment
C-TIP	Cross-town Improvement Project
CTR	Commute Trip Reduction
CUT	Chassis Utilization Tracking
CUTR	Center for Urban Transportation Research
CUUATS	Champaign Urbana Urbanized Area Transportation Study (Illinois)
DOT	Department of Transportation
DRG	Dynamic Route Guidance
DRI	Developments of Regional Impact
DRPT	Department of Rail and Public Transportation
EPA	Environmental Protection Agency
EPOMM	European Platform on Mobility Management
EWGCC	East-West Gateway Coordination Council
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
GRH	Guaranteed Ride Home
GTEC	Growth and Transportation Efficiency Center
HERO	Highway Emergency Response Operations
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
HUD	Housing and Urban Development
ICM	Integrated Corridor Management
IDM	Integrated Demand Management
IMEX	Intermodal Move Exchange
ITB	Influencing Travel Behavior
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System

JARC	Jobs Access Reverse Commute
JPO	Joint Program Office
LOS	Level of Service
LRTP	Long-range Transportation Plan
METRIC	Mobility Enhancement and Trip Reduction Index to aid in Comparison
MIM	Missoula in Motion (Montana)
MIS	Major Investment Studies
MOE	Measures of Effectiveness
MPO	Metropolitan Planning Organization
MTA	Metropolitan Transit/Transportation Authority
MTC	Metropolitan Transportation Commission
MTP	Metropolitan Transportation Planning
MWCOG	Metropolitan Washington Council of Governments
NAAQS	National Ambient Air Quality Standards
NCHRP	National Cooperative Highway Research Program
NCTR	National Center for Transit Research
NEPA	National Environmental Policy Act
NOx	Oxides of Nitrogen
NTD	National Transit Database
O/D	Origin/Destination
PAYD	Pay-As-You-Drive
R-TRIP	Redmond (WA) Trip Resource and Incentive Program
RTTM	Real-time Traffic Monitoring
SANDAG	San Diego Association of Governments
SHSP	Strategic Highway Safety Plan
SLRTP	Statewide Long-Range Transportation Plans
SMART	Specific, Measurable, Achievable, Realistic, and Time-bound
SOV	Single Occupancy Vehicle
STIP	State(wide) Transportation Improvement Plan/Program
STP	Surface Transportation Program
TCM	Transportation Control Measures
TCRP	Transportation Cooperative Research Program
TCSP	Transportation Community and System Preservation Program
TDM	Transportation or Travel Demand Management
TEEM	TDM Effectiveness Evaluation Model
TEL	Tolled Express Lane
TERMS	Transportation Emission Reduction Measures
TIGER	Transportation Investment Generating Economic Recovery
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TMA	Transportation Management Associations
TMC	Transportation Management Center

TMD	Transportation Management District
T-MDID	Truck-Mounted Driver Interface Device
TOD	Transit Oriented Development
TRIMMS	Trip Reduction Impacts of Mobility Management Systems
TRPP	Trip Reduction Performance Program
TSM	Transportation/Travel Systems Management
TSMO	Transportation Systems Management and Operations
VHT	Vehicle Hours Travelled
VMT	Vehicle Miles Travelled
VOC	Volatile Organic Compound
VTPI	Victoria [British Columbia, Canada] Transport Policy Institute
VTR	Vehicle Trip Reduction
WDU	Wireless Drayage Updating
WSDOT	Washington State DOT
WTRM	Worksite Trip Reduction Model



1. Introduction to Desk Reference

Travel Demand Management (TDM) has been included in many transportation plans over the past three decades as a means to address key policy objectives, including: energy conservation, environmental protection, and congestion reduction. For the purpose of this desk reference, TDM is synonymous and used interchangeably with the terms "Transportation Demand Management" or simply "demand management," and is defined a set of strategies aimed at maximizing traveler choices.

Many recent transportation plans appropriately place TDM very high in policy-level discussions. TDM is seen as a vital part of an approach to plan, design, and operate "smarter" and "more efficient" transportation systems in a region. For example, the Washington State Department of Transportation (DOT) plan for fighting congestion, Moving Washington, includes managing demand as one of three equal pillars of their approach.

> *"We can reduce congestion by focusing on three key strategies: strategically adding road capacity, operating the system we have more efficiently, and providing choices that help manage transportation demand."*
>
> Source: Washington State Department of Transportation, "Moving Washington – A Program to Fight Congestion," http://www.wsdot.wa.gov/movingWashington/, May 2, 2011

In addition to policy objectives, TDM strategies are usually listed within the set of projects that are found toward the end of most transportation plans or as part of the Transportation Improvement Program (TIP). Here, in many of the transportation plans, these projects are often concentrated on traditional commuter ridesharing concepts, such as the funding of ridesharing programs, vanpool subsidies, or telecommuting assistance, which primarily strive toward long-term trip reductions for air quality goals. However, the broader concept of demand management often gets lost in the middle, between high-level policy statements at the beginning of the planning process and specific projects that conclude most plans. In the heart of most transportation plans, TDM is not viewed as a vital, day-to-day operational philosophy on how to manage and operate a transportation system to address a wide variety of transportation issues such as mobility, accessibility, land-use, and livability.

While traditional TDM strategies such as ridesharing, vanpool, and telecommuting programs are still vital and serve large sections of the population, new opportunities to manage travel demand have emerged in recent years with the advent of technology (and more importantly connectivity) to the transportation arena. Personal technology and communication advances show promise in making personal travel decisions more dynamic and fluid. In parallel, transportation systems management is progressing toward a more "active" management of the system, recognizing the role of influencing the traveler early in the trip making process on a day-to-day basis. Together, these developments create new opportunities for demand management.

In fact, currently, our day-to-day efforts to manage and operate the transportation system are all about managing demand, since we cannot expand capacity in the very short run. For example, advanced traveler information is fundamentally a demand management strategy to help travelers learn of bottlenecks, slowdowns, and incidents so that they might avoid them by traveling a different route or at a different time. Acknowledging that most of what we do to operate our transportation system today is demand management goes a long way toward understanding the need to better integrate TDM into the transportation planning process.

Many federal, state, and local initiatives are seeking to better integrate TDM into transportation projects and overall solutions to congestion, environmental and energy concerns, and livability issues. For example, the U.S. DOT is supporting the concept of Integrated Corridor Management (ICM), which includes mode shift as a primary measure of improving the efficiency and person throughput of congested corridors.[1] The premise of ICM is that transportation corridors often contain unused capacity in the form of parallel routes, the non-peak direction on freeways and arterials, single-occupant vehicles, and transit services that could be managed through information to the travelers to help reduce congestion. By "load balancing" across facilities and managing the corridor as an asset, travel times and travel time reliability are improved (or maintained) for the individual traveler while the overall corridor throughput increases. Early deployments and demonstrations in Dallas and San Diego provide real-world case studies of demand management at a corridor level.

Source: DfT and the Highway Agency

Another major DOT program that highlights the role of demand management is the Urban Partnership Agreements/Congestion Reduction Demonstration Program. Demand management through pricing, traditional TDM, and transit improvements are three of the four pillars of this program. Cities involved in the program include Seattle, Minneapolis, Miami, Atlanta, San Francisco, and Los Angeles. Each of the cities is implementing a package of solutions aimed at managing demand across key facilities in their region.

Similarly, TDM planning processes around the country are evolving as well. New approaches to planning for operations try to move away from "project-based" decision making to focus on "outcomes-based" planning. Under this approach, regional performance outcomes—operations objectives—are developed. Planning and investment decisions are made utilizing performance measures, and relying on data to determine the most effective strategies for meeting operations objectives. A performance-based, objectives-driven approach to planning for operations is based on the concept that "what gets measured gets managed." Investments are made with a focus on their contribution to meeting regionally agreed-upon objectives. By implementing this approach, resources are allocated more effectively to meet performance objectives, resulting in improved transportation system performance.

With these programs and others, demand management is clearly evolving to encompass policy objectives other than just air quality conformity, including congestion, livability, and even goods movement. It is important that TDM be considered early, often, and effectively in the planning process. This document has been developed to serve as a desk reference on integrating this new, broader vision of TDM into the transportation planning process.

[1] USDOT/RITA, Joint ITS Program Office, Integrated Corridor Management, http://www.its.dot.gov/icms/index.htm.

The purpose of the desk reference is to provide the reader with a better understanding of where, how, and when to integrate TDM into the evolving performance-based transportation planning process. The importance of the planning process in helping provide a clear vision, goals and objectives, approach, and funding for demand management (as well as other transportation improvements) cannot be overstated. As such, this report complements and supports several other important Federal Highway Administration (FHWA) guidance documents on the transportation planning process, including guidance that discusses the role of TDM in the planning process. Table 1.1 provides bibliographic information on each FHWA reference. The web address for each report can be found at the end of this chapter. These documents provide guidance on how the planning process can be adapted for operations using an objective-driven approach at state and metropolitan levels.

Table 1.1: FHWA Resource Documents

Title	Report Number	Date
The Transportation Planning Process: Key Issues – A Briefing Book for Transportation Decision-makers, Officials and Staff	FHWA-HEP-07-039	2007
An Interim Guidebook on the Congestion Management Process in Metropolitan Transportation Planning	FHWA-HOP-08-008	2008
Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance-based Approach – A Guidebook	FHWA-HOP-10-026	2010
Advanced Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference	FHWA-HOP-10-027	2010
Statewide Opportunities for Integrating Operations, Safety and Multimodal Planning: A Reference Manual	FHWA-HOP-10-028	2010

While this report provides ample examples and illustrations, and discusses the known effectiveness of TDM strategies, the desk reference is not intended as a technical resource on TDM effectiveness or implementation for a given strategy or set of strategies. The desk reference does point the user to other resources and reports that are better suited to that purpose. Key resources are provided at the end of each section.

1.1 Organization of the Desk Reference

The desk reference is fundamentally organized around two aspects of transportation planning – policy objectives and scope of the planning effort. The report discusses how TDM relates to seven key policy objectives that are often included in transportation plans, such as congestion and air quality. It then discusses how TDM might be integrated into four levels of transportation planning from the state down to the local level. Acknowledging that readers will have differing levels of experience and skills when it comes to TDM and the planning process, the desk reference includes discussion of various levels of capabilities to help the reader determine the most targeted guidance for their situation. The report also includes information on tools available for evaluating TDM measures and on the known effectiveness of these measures. Figure 1.1 provides a cross-walk of the major sections in the document.

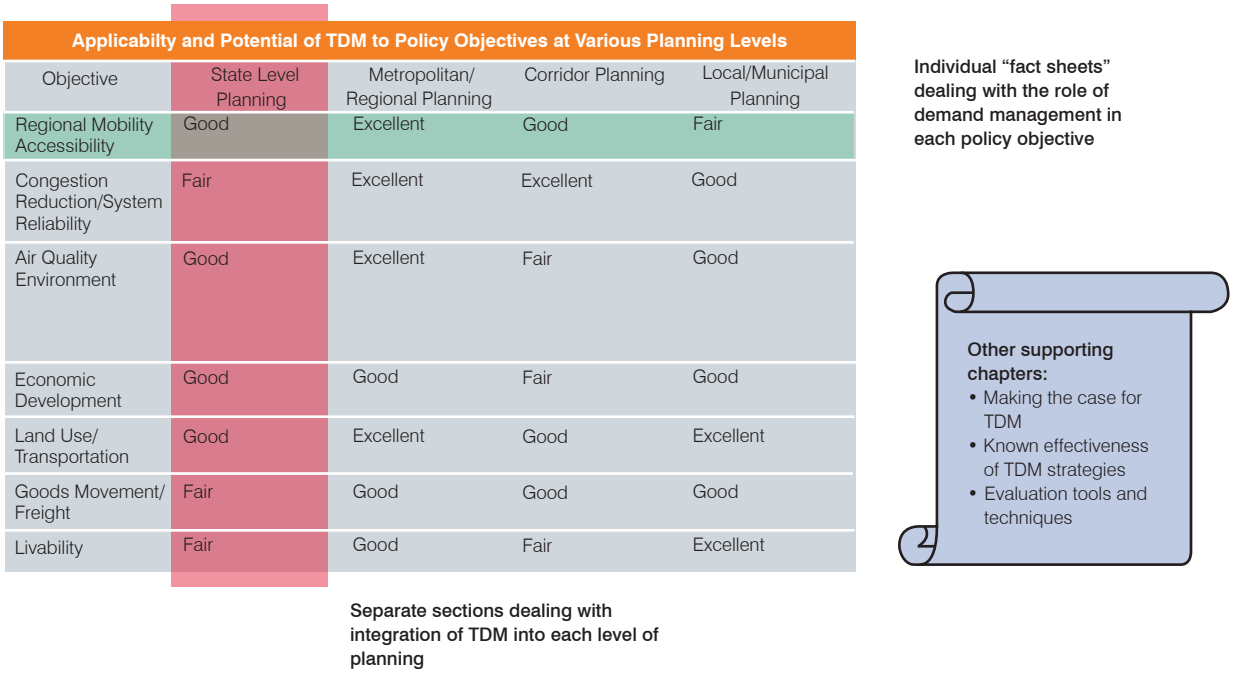


Figure 1.1: Desk Reference Structure

Source: Battelle

Integration into the planning process implies consideration of TDM at various steps starting with the highest level of strategy and visioning to more specific goal setting all the way to the incorporation into specific plans and conducting performance evaluations.

It is important to recognize that agencies are currently integrating TDM to the best of their abilities in their plans. The organization and the content of the desk reference are driven by the principle that there is no "one size fits all" solution to integrating TDM. In essence, integrating TDM into the planning process is about capability maturity across the various planning activities that occur at an agency. Leveraging existing research into the capability maturity model developed for The American Association of State Highway Transportation Officials (AASHTO),[2] the desk reference strives to provide agencies a model to self-identify/ assess their capability and identify the desired actions to improve their processes. The premise behind the model is that any process goes through evolutions as it is improved. By utilizing the same model and the same assessment approach, organizations can benchmark how their process rates against their peers and identify specific steps that they can take to move along the capability continuum.

[2] AASHTO, System Management and Operations Guidance, 2011, http://aashtosomguidance.org/

For each of the planning levels, three levels of capability are identified:

- Ad-Hoc: TDM is mostly an afterthought. At this level of capability, successful outcomes are largely through individual efforts or projects. Steps/Processes/Activities have not been formalized and shared across the agency or the region.
- Defined: At this level, there is recognition that TDM is important to achieving the planning goals. Overall, TDM is considered in the toolbox of approaches and can be applied repeatedly, but gaps remain in how TDM tools are planned and applied.
- Optimized: At this level, TDM is a vital tenet of the process and permeates all the steps. Continuous monitoring and performance ensure that TDM tools are correctly characterized and planned in combination with other strategies for all possible policy objectives and application settings.

The goal of integration is to move agencies along the capability continuum (from ad-hoc to defined and from defined to optimized) in the planning process by identifying specific actions as illustrated in Figure 1.2.

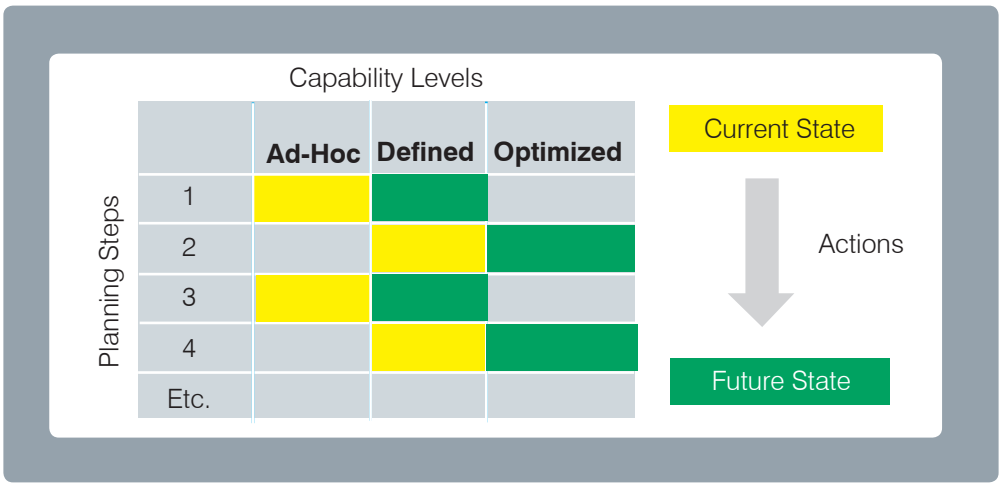


Figure 1.2: Capability Levels and Actions Inform the Structure of the Desk Reference

Source: Battelle

Topically, this desk reference is organized as follows:

- **Chapter 2** presents a definition of TDM that is broader than traditional commuter ridesharing, encompassing many travel choices, including: mode, location, route, and time of day. As such, this definition of TDM includes many strategies that are not always thought of as TDM, such as road pricing, traveler information, and measures aimed at improving the operational efficiency of existing facilities. In essence, it presents TDM as an operational philosophy that seeks to balance demand reduction strategies with smart capacity enhancements as part of a more holistic approach to urban transportation. It also includes sections on the role of technology in this expanded definition of TDM and on the economics of TDM, to assist planners and implementers in understanding the benefits and cost effectiveness of TDM.
- **Chapter 3** discusses the role of TDM in addressing seven key policy objectives, including: mobility/accessibility, congestion/reliability/safety, environment/air quality, economic development, goods movement, land use integration, and quality of life/livability/health. By including objectives related to economic vitality, the environment, and livability, these policy areas also encompass the basic components of sustainable urban transportation. For each policy area, the general relationship to TDM is discussed, specific TDM strategies to address each objective are offered, performance measures are enumerated, case studies and examples are provided, and advice on how to integrate TDM into the planning process is provided.

- **Chapter 4** presents the need for and experience with integrating TDM into the transportation planning process at various levels. This chapter also introduces the various planning steps involved in the objective-driven performance planning process and identifies how they fit with TDM. This chapter also discusses the linkages between the various planning levels.
- **Chapter 5** discusses integration at the statewide planning level. This complements a recent National Cooperative Highway Research Program (NCHRP) study on the role of state DOTs in implementing TDM programs.[3]
- **Chapter 6** focuses on integration into the metropolitan transportation planning process, including congestion management and long-range planning.
- **Chapter 7** presents guidance on how to integrate TDM into corridor planning processes for a given facility.
- **Chapter 8** discusses the integration of TDM into the local or municipal planning process.

In each case, the guidance is based not only on experience to date (with examples and illustrations), but also on how TDM integration might be improved, based on the role that TDM could play in the planning process to make it more effective in addressing key policy needs.

- **Chapter 9** provides an overview of the tools and techniques available to evaluate TDM during the planning process. This includes the ability to forecast the estimated impacts of various TDM strategies in different applications as well as the need to establish performance-based planning objectives for TDM. Finally, some discussion of the ability to perform benefit/cost analysis on TDM is provided.
- **Chapter 10** presents an overview of the known effectiveness of various TDM strategies in terms of fulfilling key performance objectives, such as vehicle miles traveled (VMT) reduction, mode shift, congestion relief, and emissions reduction. Acknowledging that our understanding of TDM effectiveness is still evolving, the centerpiece of this chapter is a matrix conveying the relative effectiveness of various TDM strategies to address the seven policy objectives enumerated in Chapter 3.
- **Chapter 11** provides a set of specific implementation steps that could be undertaken at each planning level to better integrate TDM into the planning process. It also includes some information on funding sources for TDM programs and projects.

The desk reference includes examples, case studies, and best practices to support the information in each section. These are presented in colored text boxes throughout the reference. Selected resources are also identified at the end of each section.

1.2 Use of the Desk Reference

The intended users of this desk reference are transportation planning professionals who are seeking information on the role of TDM in meeting specific needs they face in their planning efforts. Users can pick and choose the sections that are most related to their issue at hand (see Table 1.2 below). The report was purposely organized in a manner that would allow for this targeted use. This does imply a certain degree of repetition of terms and references in each section. Table 1.2 provides some directions on use of this document.

[3]NCHRP, State Department of Transportation Role in the Implementation of Transportation Demand Management Programs, Research Results Digest 348, ICF International, July 2010, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_348.pdf.

Table 1.2: Potential Uses of Desk Reference

Purpose for Desk Reference Use / Questions	Start with:
What is the contemporary view and role of demand management in transportation planning?	Chapter 2
Where can I find examples on the roles for TDM in specific policy issues that I have to address in my plans? Where can I find references/citations on TDM applications for specific goals, locations?	Chapter 3 3.1 Regional Mobility and Accessibility 3.2 Congestion/System Reliability/ Safety 3.3 Environment/Air Quality 3.4 Economic Development 3.5 Land-Use Integration 3.6 Goods movement/freight 3.7 Quality of Life/Livability/Health
How does TDM fit into the general planning process?	Chapter 4
I am a state DOT planner. How do I start including TDM in my plans?	Chapter 5
I work in a Metropolitan Planning Organization (MPO) and am updating my metropolitan plans. What steps should I take for including TDM?	Chapter 6
I work in an MPO and am coordinating with local jurisdictions on TDM for local settings and corridors. Whom should I talk to and what steps should I take?	Chapter 7 and 8
How do I select strategies and evaluate TDM?	Chapter 9
How effective have these strategies been elsewhere?	Chapter 10
What steps can my agency take to better support and implement TDM?	Chapter 11

KEY RESOURCES

Washington State Department of Transportation, "Moving Washington – A Program to Fight Congestion," http://www.wsdot.wa.gov/movingWashington/, May 2, 2011.

USDOT/RITA, Joint ITS Program Office, Integrated Corridor Management, http://www.its.dot.gov/icms/index.htm.

NCHRP, State Department of Transportation Role in the Implementation of Transportation Demand Management Programs, Research Results Digest 348, ICF International, July 2010, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_348.pdf.

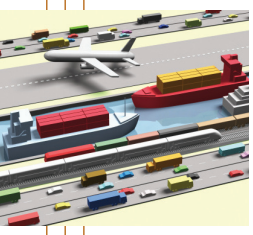
FHWA, Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance–based Approach – A Guidebook , SAIC, FHWA-HOP-10-026, 2010, http://www.ops.fhwa.dot.gov/publications/fhwahop10026/index.htm.

FHWA, Advanced Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference, SAIC, FHWA-HOP-10-027, 2010, http://www.ops.fhwa.dot.gov/publications/fhwahop10027/index.htm.

FHWA, Statewide Opportunities for Integrating Operations, Safety and Multimodal Planning: A Reference Manual, ICF International, FHWA-HOP-10-028, 2010, http://www.ops.fhwa.dot.gov/publications/fhwahop10027/index.htm.

FHWA, An Interim Guidebook on the Congestion Management Process in Metropolitan Transportation Planning, Cambridge Systematics, Inc, FHWA-HOP-08-008, 2008, http://www.fhwa.dot.gov/planning/statewide/manual/index.cfm.

FHWA, The Transportation Planning Process: Key Issues – A Briefing Book for Transportation Decision-makers, Officials and Staff, Transportation Planning Capacity Building Program, FHWA-HEP-07-039, 2007, http://www.planning.dot.gov/documents/BriefingBook/BBook.htm.



2. The Evolving Role of Demand Management

Few question the need to manage travel demand these days as growth in travel continues to exceed our ability to accommodate it with new capacity. The most recent edition of The Institute of Transportation Engineers (ITE's) Traffic Engineering Handbook concludes: "With a growing understanding of the effects of demand and congestion beyond the right of way, operating agencies, policy makers and the public may employ techniques which may minimize financial, emotional, environmental and physical costs on the individual and on society."[4]

Around the nation, agencies are getting smarter in how they manage existing infrastructure and in deciding when strategic capacity enhancements should be made in certain situations. For example, many of the capacity enhancements being made are incorporating TDM as a key component, be it high occupancy vehicle (HOV) or high-occupancy toll (HOT) lanes or other more operational components like ramp metering or bus rapid transit (BRT).

CHAPTER ACRONYM LIST

ATM	Active Traffic Management
BRT	Bus Rapid Transit
CMAQ	Congestion Mitigation and Air Quality
DOT	Department of Transportation
FHWA	Federal Highway Administration
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ITE	Institute of Transportation Engineers
ITS-JPO	The Intelligent Transportation Systems Joint Program Office
SOV	Single Occupancy Vehicle
TDM	Travel Demand Management
TRIMMS	Trip Reduction Impacts of Mobility Management Systems
TSM	Transportation Systems Management
VHT	Vehicle Hours Travelled
VMT	Vehicle Miles Travelled

When considering past urban transportation planning practices, planners attempted to "predict and provide" or estimate future travel demand based on population and employment projections. Utilizing this information, they worked to build enough capacity to meet this estimated demand. Costs, environmental concerns, time requirements, and various other factors have contributed to our inability to "build our way out" of the congestion problem. However, TDM has the potential to reduce overall travel demand for single-occupancy vehicle (SOV) use, when implemented sustainably and successfully, thus reducing or delaying the total need for capacity expansion. As such, TDM needs to be considered throughout the planning process, certainly well before project selection so that tradeoffs between demand reduction and supply expansion can be carefully assessed. Given the potential for lower costs – decreased environmental and energy impact – and the ability to expand travel choices, TDM may be the preferred solution in many instances. The Swedish Road Administration has institutionalized this process by adopting the "four-stage principle" that requires planners to consider demand management and mode shifting before considering efficiency measures, systems management, or minor road improvements, and new investment or major reconstruction as a last resort.[5]

[4]ITE, Traffic Engineering Handbook: 6th Edition, edited by Walter Kraft, 2009.

[5]FHWA, "Managing Travel Demand: Applying European Perspectives to U.S. Practice," Report No. FHWA-PL-06-015, May 2006.

This chapter provides a discussion of a new, broad definition for TDM and how it fits into today's management and operation of the transportation system. A new framework is presented on traveler choices within the context of TDM, suggesting that the concept goes well beyond mode choice. The chapter discusses how TDM can be a vital part of efforts to create a more sustainable transportation system. The contemporary view of TDM is also enhanced with advances in technology, making possible dynamic, immediate, and real-time choices. Finally, the economics of TDM are discussed to suggest the significant return on investment that can result from TDM.

2.1 A New Focus on Travel Choices for Reliable Travel

Traditionally, TDM has been narrowly defined as commuter ridesharing and its planning application restricted to air quality mitigation (conformity analysis), development mitigation (reducing trip generation rates and parking needs), or efforts to increase multi-modalism in transportation plans. At the heart of traditional ridesharing are measures to induce commuters to shift to higher occupant modes: carpooling, vanpooling, and transit. It also includes non-motorized modes or active transportation modes, such as bicycling and walking. Finally, traditional ridesharing also includes strategies to move commuters outside the peak congestion periods through work arrangements, such as flextime, telecommuting, and compressed work schedules. Traditional rideshare will continue to play a significant role in the contemporary view of TDM as it seeks to influence travel at the most congested places and times. Extensive guidance and documentation are available on best practices for implementing effective ridesharing programs, including the U.S. DOT's Ridesharing Options Analysis and Practitioner's Toolkit.[6]

A more contemporary definition of TDM consists of maximizing travel choices, as stated in the definition provided in an FHWA report on TDM:

> *Managing demand is about providing travelers, regardless of whether they drive alone, with travel choices, such as work location, route, time of travel and mode. In the broadest sense, demand management is defined as providing travelers with effective choices to improve travel reliability.*[7]

This definition of TDM, emerging from an international scan of practices in Europe, incorporates many strategies heretofore not considered within the realm of TDM, such as road pricing, operational strategies that shift travelers' route and time (such as advanced traveler information), and strategies that influence which lane travelers use on a given facility. Contemporary TDM recognizes that improvements to transportation system reliability come not only from system capacity expansion and improvements, but also from travel and TDM.

In a sense, the contemporary definition of TDM is probably closer to the concept of transportation systems management (TSM). The availability of choices not only reduces overall demand (VMT) but seeks to redistribute demand by making efficiency improvements to the road system, thereby potentially reducing vehicle hours traveled (VHT). As a result, the contemporary definition of TDM encompasses a variety of established solutions, including: traditional ridesharing, road pricing, and TSM.

Another key aspect of the definition includes choices for all travel and not just commuting. This may mean providing choices for school travel, special events, specific locations (such as national parks, historical cores), shopping or leisure travel, and highway reconstruction efforts.

[6]USDOT, Volpe Center, Ridesharing Option Analysis and Practitioner's Toolkit, prepared for FHWA, 2010, http://www.planning.dot.gov/documents/RidesharingOptions_Toolkit.pdf.

[7]FHWA, Mitigating Traffic Congestion—The Role of Demand-Side Strategies, prepared by ACT, Report No. FHWA-HOP-05-001, October 2004.

Similarly, this definition applies not only to the individual traveler but also to freight. For example, time choice is the key to the Pier Pass program in Los Angeles.[8] To address congestion/air quality issues and encourage off-peak truck travel near facilities and I-710, peak period access and egress to port facilities is priced. In this case, location choice is the key to freight consolidation strategies aimed at keeping larger trucks out of the urban core. This has been demonstrated in Europe (using clean vehicles to make deliveries to city center stores).[9] Alternately, mode choice was one reason for network-wide truck tolls in Germany, which induced a moderate shift to rail, as well as helping to maintain the road system.

Finally, TDM has always been about forming new partnerships with government agencies that support TDM. Most commonly, this partnership involves the private sector, such as employers, developers, or business organizations seeking cooperative means to serve commuters. Partnerships have also been formed with special interest groups, such as environmental groups, seeking to promote TDM as a strategy to meet mutual goals. More recently, partnerships are forming with private entities that are developing new tools for dynamic demand management, using social media and new technologies. Finally, partnerships are being formed with grassroots organizations aimed at improving the quality of life in a given area and seeking to promote more and healthier travel options. The benefits of these partnerships are many, including resources, policy support, technical assistance, and implementation aid. The adjacent quote by the Utah DOT TravelWise Coordinator, Angelo Papastamos, highlights the benefits of TDM partnerships.

> "Travel demand management, or as we call it in Utah "TravelWise," has allowed the Utah Department of Transportation to partner with other state agencies, businesses and large employers, transit providers, local governments and others involved in planning for our region in a proactive manner. In Utah, we have found that if we all do a little, we can do a lot to reduce traffic congestion, improve our environment, and reduce energy needs; all while strengthening Utah's economy."
>
> **Angelo Papastamos, P.E.**
> **Utah DOT TravelWise Coordinator**

A view of contemporary TDM strategies using this notion of choices is illustrated in the following trip-chain graphic (Figure 2.1). At the heart of the conceptual framework is the need to understand the difference between TDM and traffic management. Figure 2.1 shows the need to integrate travel demand and traffic management into a larger framework of travel choices and congestion reduction techniques. These choices begin with consideration of overall travel demand and work their way through traffic demand and network demand. The set of strategies shown on the right side of the figure are not exhaustive and are meant to show the kinds of strategies that focus on traffic management, TDM, or both. However, the key to the conceptual framework is to show differences between types of demands and how offering choices can influence these demands. Each set of demands and choices is discussed below, based on guidance provided by FHWA on integrating TDM and Active Traffic Management.[10]

[8]PierPASS, available at http://pierpass.org/

[9]Commercial Transport in European Cities: How do European cities meet the challenges of commercial transport? Experiences and case studies from the CIVTAS Programme of the European Commission, Hans-Joachim Becker, Diana Runge, Urte Schwedler, Michael Abrahamm, Berlin, July 2008, available at http://www.civitas-initiative.org/docs1/IVP_21.pdf, ISSN 1613-1258

[10]FHWA, Integrating Active Traffic and Travel Demand Management: A Holistic Approach to Congestion Management, prepared by ESTC for the International Technology Scanning Program, FHWA-PL-11-011, 2011, http://international.fhwa.dot.gov/pubs/pl11011/pl11011.pdf

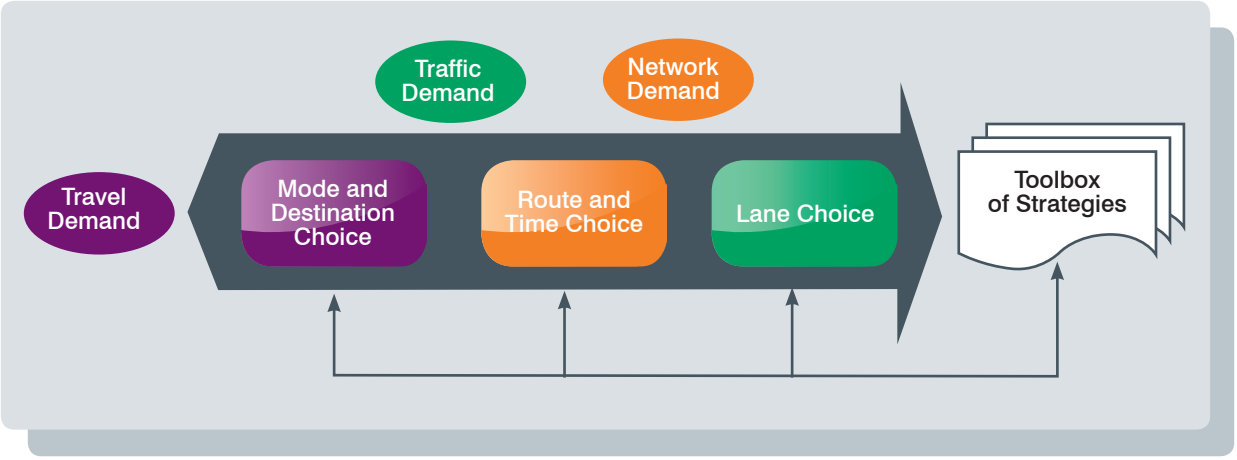


Figure 2.1: Travel Demand Management – A Philosophy of Choices

Source: FHWA – Integrating Active Traffic and Travel Demand Management

Stage One – Travel Demand and Mode and Destination Choices

This overall demand can be modulated by influencing traveler choices about whether to travel, which mode to use (car or other mode), and where to travel (the destination). Many techniques can be applied at this stage of the framework to reduce overall travel demand by car. This might include incentives to use higher occupancy modes (e.g., carpool, vanpool, transit) or non-motorized modes (bicycle, walk). It might also include programs to encourage working or shopping from home (addressing whether to travel) or to reduce trip lengths or overall VMT (by combining trips or shopping or working closer to home). Of course, congestion pricing has been proven to be an effective means to reduce travel demand by inducing mode shift and reducing overall peak travel.[11] Congestion pricing can come in the form of cordon pricing, such as the pricing schemes in London and Stockholm, or as a fee on all or targeted vehicle usage. Small changes in demand can have significant impacts.

> "In our work, we have the opportunity to speak with commuters directly about their commute choices. Research indicates that for commuters, TDM is a key component of the overall range of options they review. Although they might not know the meaning of 'TDM,' they recognize its benefits!"
>
> **Karen S. Smith, Senior Vice President of Research Strategy**

This stage involves influencing travel demand before the decision to drive (particularly alone) is made. Measures to influence travel mode and destination have the ability to reduce overall traffic volumes on the highway network, and when properly targeted, can reduce traffic volumes on key congested facilities during critical times of the day. The success of TDM initiatives, implemented during and as an integral part of highway reconstruction projects, provides solid evidence of the ability to manage travel demand to reduce overall traffic volumes.

Stage Two – Traffic Demand and Route and Time Choice

Once the vehicle trip demand by car is determined, traffic may be influenced through measures that affect time and route choice (i.e., real-time traveler information) before reaching a congested corridor and/or time period. Choices provided in this stage aim to change the time of day of travel to avoid the most congested periods or to seek alternate routes that might be less congested. This set of choices can also reduce the volume of vehicles using and impacting congested facilities – thus improving operational

[11]FHWA, Congestion Pricing: A Primer – Overview, FHWA-HOP-08-039, 2008, http://ops.fhwa.dot.gov/publications/fhwahop08039/cp_prim1_00.htm

Can managing demand have a real, noticeable impact on the highway system?

Consider the situation when relatively minor changes in daily urban activity can have a significant impact on traffic. Some observers point to the situation where government worker vacations (e.g., federal employees in Washington D.C.) or holiday schedules in some states (e.g., unique state holidays in California and elsewhere) can have a profound effect on recurring, peak period congestion. This suggests that as little as a 10% reduction in demand can eliminate recurring congestion in some circumstances (DeCorla-Souza, 2006).

Due to the short-term nature of these reductions, sufficient time is not available to restore equilibrium (when those who have used other travel choices move back to driving alone during the peak period). This suggests that strategies to "dynamically" manage demand may be effective in managing traffic while not allowing induced demand to refill freed capacity. In the longer run, efforts to manage demand need to address issues of induced demand and route diversion that might threaten to refill unused capacity. However, an overall demand-oriented approach would seek to reduce overall demand and modify behavior in ways that do not presume travel time minimization as the principal motivator for all drivers.

efficiency. Congestion pricing can also influence the time of day or route that a commuter or other traveler chooses. Most HOT lane projects in the U.S. increase the price of using the facility based on time of day and/or congestion levels. This has the impact of moving travelers to the edges of the peak period or even creating a route or mode shift to parallel facilities or to public transit or other less costly modes, such as carpooling (as mentioned earlier).

Stage Three – Network Demand and Lane Choice

Once a traveler makes the decision to travel on a given facility, network demand has been determined. In this case the final choice that can be influenced is the lane that travelers use on a given facility (and how each lane is used). At this point, the system operator heavily influences traveler choices on a given facility. This concept of influencing lane choice is rather new to the U.S., but is at the core of new operational concepts, such as Active Traffic Management (ATM).[12] Two examples of ATM include the use of the hard shoulder and dynamic lane controls. In several European countries, the hard shoulder is being used during congested periods as a travel lane, with safety issues being addressed with active monitoring and incident management. When implementing ATM, lane speeds are also reduced to maintain safe operation of the facility. In this manner, strategic capacity is added when, and only when, needed. Lane choice can also be actively managed during incidents, by slowing cars upstream and moving them into lanes unaffected by the incident. The use of overhead speed and information displays, coupled with real-time monitoring, helps accomplish this by showing motorists the reason for the slowing of traffic upstream.[13]

HOV and HOT lanes offer users the choice to experience reliable travel times in exchange for increased occupancy or paying a fee on a given facility. HOT lanes offer choices and do not force anyone to change their travel behavior.

Traditionally, many of these strategies are considered TSM, as they serve as an important element in ensuring that choices are sustained throughout the trip chain to ensure a reliable movement of goods and people.

[12]FHWA, "Active Traffic Management: The next step in congestion management," Report No, FHWA-PL-07-012, July 2007.

[13]FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006.

[14] ITE, Traffic Engineering Handbook: 6th Edition, edited by Walter Kraft, 2009.

Table 2.1 provides a comprehensive toolkit listing from the ITE Traffic Engineering Handbook on traffic management, TDM strategies, and key travel choices: Route (R), Mode (M), Location (L), Time (T), or origin/destination (OD).[14]

Table 2.1: Traffic Management and TDM Strategies Influencing Choices

Technique	Traveler Choices Affected
Arterial Management – The management of traffic signals, dynamic and fixed lane management along surface streets including speed management, pedestrian and bicycle interaction with vehicles, vehicle priority coordination, and coordination with other techniques such as traveler information, electronic payment, or incident management.	R, M, L
Freeway Management – The management of lanes along freeway and associated ramps interfacing with the arterials including speed management, and coordination with other techniques such as traveler information, electronic payment, or incident management.	R, M, L
Transit Management – Transit service available to a site, personal security, route and scheduling information, and coordination with traveler information services.	R, M, T, OD
Incident Management – The detection, response, and recovery from events that are non-recurring, providing information to response personnel and the public, minimizing the impacts on traffic flow, and optimizing the safety of the public and responders.	R, L, T, OD
Emergency Management – Hazardous material routing and security management, routing, coordination of emergency response service providers, and information dissemination and coordination.	R, M
Road Pricing and Electronic Payment – Payment services and systems associated with toll facility operations, variable pricing, VMT fees, parking facilities, and transit services.	R, M, L, T, OD
Traveler Information – Pre-trip, Near Pre-Trip, and en-Route information provided to the traveler via roadside, in-vehicle or personal communication devices on the current travel conditions, trip planning services, tourism, special events, and parking information.	R, M, L, T, OD
Roadway Operations and Maintenance – The management of work zones and route closures through the use of traveler information, lane and speed management systems, and enforcement and response service providers.	R, L, T, OD
Road Weather Management – Planning for and responding to weather events impacting traffic operations and roadway conditions, information distribution to travelers and response personnel, and operations of facility under inclement conditions.	R, M, L, T, OD
Commercial Vehicle Operations – Clearance and screening of commercial carriers to optimize flow of goods and services while optimizing safety and efficiency through the use of roadside and in-vehicle technology.	R, L, T
Intermodal Freight – Integrated operations of freight transported by multiple modes both internationally and domestically.	R, M, L, T, OD
Parking Management – Parking information, variable pricing, routing to available parking.	M, T, OD
Quality Pedestrian Movement – Availability of pedestrian facilities that are integrated within the overall transportation network and accommodate or even promote non-motorized travel.	R, M, T, OD
Amenities On-Site – Bicycle locks, showers, automated teller machines, vanpool or carpool parking, local shuttle service, infrastructure for teleworking.	M, T, OD
Ridematching Program – Carpools, vanpool programs, preferred parking, transit or parking subsidies.	R, M, L, T, OD
Alternative Work Schedules – Four 10-hour days per week, staggered hours, flexible hours.	R, M, L, T, OD
Telecommuting Options – Work environment that supports employer-employee relationship from remote sites with consideration of accessibility, accountability, and productivity.	R, M, T, OD
Travel Plans – Worksite, school, or event plans that incorporate travel demand and traffic management strategies to reduce the negative impacts of car use to the site.	M, T, L, OD
On-Site Travel Coordinator – Staff and services focused on travel services and demand management strategies.	R, M, T, OD

2.2 A Vital Tenet of a Sustainable Transportation System

As illustrated by this conceptual framework and discussion of choices, TDM is less about certain management strategies and more of an operational philosophy that seeks a holistic approach to urban transportation -- one that better balances demand and supply solutions, one that seeks to make better use of existing capacity, and one that seeks to do so in a more sustainable manner. One study describes this broader conceptualization of TDM as follows:

> *But travel demand management is a much broader concept than that assigned to mobility management or ridesharing. Implicit in the use of the term is the assumption that it is accompanied by the implementation of sustainable mobility, introduction of full cost pricing and organizational or structural measures to ensure a broad range of complementary interventions work effectively together to realize the benefits of sustainable transport. It is the unifying philosophy of TDM, not specific measures associated with it, that underpins the policy objective of a more sustainable system of transport. Perhaps this philosophy is better understood simply as 'urban transport management' – i.e. obtaining a more appropriate balance in favour of needs over wants. Put simply, where transport used to be supplied to accommodate travel demand, travel must now be managed to use the available transport supply most efficiently.*[15]

Transportation systems can be better managed and characterized by

- Expanding the supply and availability of (more sustainable) alternatives.
- Integrating demand-side strategies into operational efficiency initiatives.
- Controlling demand for the use of unsustainable modes.
- Providing incentives and rewards for undertaking sustainable travel habits.
- Imposing full-cost pricing on the use of the automobile.

TDM has many opportunities to promote sustainable transportation. Broadly, by offering choices, TDM becomes a value proposition for areas to reduce their dependence on SOV travel.

[15]Colin Black and Eric Schreffler, "Understanding TDM and its Role in the Delivery of Sustainable Urban Transport " Transportation Research Record 2163, pp. 81-88, 2010.

Potential Opportunities for TDM to promote sustainability:

- **TDM reduces the need for new or wider roads**

  By persuading people to drive less often, to closer destinations, outside of rush hours or using less busy routes, TDM can reduce the demand for new road infrastructure.

- **TDM makes personal travel decisions more efficient**

  Many drivers make travel decisions based on poor information and a lack of experience with non-automobile options. TDM improves their awareness and understanding of options, and their willingness to try them.

- **TDM maximizes return on infrastructure spending**

  Studies have shown that good information can significantly increase ridership on new transit infrastructure and services. Likewise, reducing overall travel demand on highways adds to the effective lifespan of strategic capacity improvements.

- **TDM makes the most of our current assets**

  It saves people money and time by helping them make efficient travel decisions. It improves health by promoting physical activity and less-polluting modes. It benefits employers by increasing productivity, reducing parking costs, and helping to attract and retain workers. It promotes economic development by reducing congestion and enhancing worker mobility.

- **TDM is a versatile and dynamic management tool**

  TDM measures can be customized for specific audiences (e.g., business park commuters), destinations (e.g., major hospitals), travel modes (e.g., cyclists), travel corridors (e.g., a busy highway), trip purposes (e.g., school) or specific timeframes (e.g., major events). TDM strategies can be delivered in months, rather than years.

- **TDM initiatives have multimodal benefits**

  It recognizes that people see alternatives to driving as a "suite" of options. Non-drivers tend to be public transport users, carpoolers, pedestrians, or cyclists at different times, for different reasons. TDM expands travel choices within this suite of options.

- **TDM works at the scale of individuals, but has huge power across a community**

  If every person who drives to work in a community decided to leave their car at home just one day a month, the 5% reduction in commuter traffic could significantly ease daily congestion.

2.3 Technology and Connectivity Driven

Contemporary TDM is also characterized by a heavy reliance on technology and communication systems. Personal and social connectivity through communications is rapidly changing the way we travel and why we travel. The world of traffic management has changed in response primarily to the explosion of the scope and the capability of communication technologies enabling a previously unimaginable level of connectivity. Broadly, the Intelligent Transportation Systems Joint Program Office (ITS-JPO) has defined connectivity as an important theme in their strategic plan for 2010-2014:

> *[Connectivity is] a concept that is rapidly changing our daily habits: real-time information gives us the power to make decisions and act on opportunities, provides us with details needed to understand our fast-paced world, and brings us an awareness of how our systems work. The start of the 21st century introduced advanced wireless technologies to our lives, and already they are having a dramatic impact on our connections to family, friends, and the social and entertainment worlds. These technologies are proliferating throughout the business, political, and educational arenas, changing our relationship to information and creating an awareness of situations that previously would have gone unnoticed. These technologies are redefining how we access knowledge; for the realm of transportation, this means unprecedented awareness about what is happening to and throughout our transportation system at all times.*[16]

For TDM, this has meant that existing approaches can now be enhanced and provided using new technologies and tools. Some non-exhaustive examples of the linkage between technology and TDM include the following:

- Advanced travel time information can now impact trip decisions in a much more comprehensive manner using new media (such as Facebook and Twitter), new sources of data (vehicle probes, crowd sourcing) leading to new information (comparative travel times, predicted travel times, real-time parking availabilities).
- Dynamic ridesharing approaches are starting to emerge, taking into account social networks.
- Personalized travel information via SmartPhones allows for better pre-trip planning by integrating real-time information from various traffic and transit systems.
- New mobility applications such as connection protection greatly increase the traveler's choices.

TDM has always been a user-driven industry. With these new tools and technologies, contemporary TDM can expand the scope, functionality, and application markets for a majority of market strategies to a greatly increased user population.

2.4 Economics of TDM

One issue that arises for planners seeking to integrate TDM into the planning process is how to "sell" TDM, since the use of non-SOV travel options is largely perceived as inconvenient and inferior. A first response might involve the realization that many travelers want more choices that have the potential to be faster, cheaper, and of higher quality than driving alone.

Cost often wins the debate for TDM, as TDM strategies offer the following benefits in terms of costs and cost effectiveness:

- TDM offers travelers lower cost options to driving alone.
- TDM allows considerable cost savings for travelers over time.

[16]ITS-JPO (2010), ITS Strategic Plan, 2010-2014: Transforming transportation through connectivity, retrieved from http://www.its.dot.gov/strategic_plan2010_2014/index.htm.

- TDM strategies are generally low cost as compared to capital projects, or can reduce the overall cost of integrated projects.
- TDM is a cost-effective means to meet key policy objectives.
- TDM strategies have very favorable benefit to cost ratios.

The first two points are fairly well accepted, that by sharing rides, riding transit, bicycling, and walking, travelers can save money over driving alone, even when considering only the perceived out of pocket costs of operating a vehicle. Over time, these savings can add up and most regional commute management websites include a "commute cost calculator" to show commuters prospective savings. However, the latter three points deserve additional discussion.

TDM Strategies are Low Cost for Meeting Mobility Solutions

In general, the budgeted amounts allocated for TDM are considerably less than more capital-intensive and operational projects. For example, the TDM portion of the T-REX highway reconstruction and light rail project in the Denver region was $3 million of a total $1.67 billion project. But the key question is whether TDM strategies fulfill mobility and accessibility needs commensurate with the money invested.

> "Nothing is more cost effective than TDM. "
>
> **Harold W. Barley – Executive Director, MetroPlan Orlando**

One program evaluation of the rideshare program in Los Angeles County[17] compared the cost effectiveness of the rideshare program to rail improvements planned for the region, both intended to enhance mobility options in the region. The cost per trip reduced and the cost per person placed into the rideshare program were compared to forecasts of the cost per new rider on a proposed light rail extension. The cost per trip reduced was $2.80 for the rideshare program and the cost per person placed into a new ridesharing arrangement was $0.82 per day. The comparative cost per new light rail rider per day was $6.94 to $7.77 in capital costs and $2.66 to $2.99 in operating costs.

TDM Strategies are Comparatively Cost Effective in Meeting Policy Objectives

Similarly, TDM strategies have been shown to be a cost effective means of meeting key policy objectives. One study of projects funded by the Congestion Mitigation and Air Quality (CMAQ) program (reported in detail in Chapter 10) concluded that TDM measures were among the most cost effective in reducing automobile emissions. The analysis showed that as a group, traffic flow projects received 33% of all funds, but resulted in a cost per pound of emissions reduced of $42.70. Rideshare programs accounted for only 4% of all funds, yet reduced a pound of emissions for $10.25. Likewise, miscellaneous TDM programs accounted for 3% of all CMAQ funds but reduced a pound of emissions for $7.66.[18]

Other studies tie cost effectiveness solely to the value of a vehicle trip reduced, as that used by Washington State DOT (WSDOT) to select TDM projects for funding. WSDOT sets the value of a trip reduced at a maximum of $460.00, equal to that possible using tolling. Therefore, any TDM project that removes a vehicle trip for less than that is considered cost-effective. As such, WSDOT approved 17 TDM projects in 2006 valued at $1.3 million to purchase 3,831 daily vehicle trips, at a cost of $339.00 per trip removed.

[17]LDA Consulting. LACMTA Rideshare Evaluation Project: Task 7 –Comparative Cost Effectiveness. Los Angeles County Metropolitan Transportation Authority, April 2002.

[18]Transportation Research Board. The Congestion Mitigation Air Quality Improvement Program: Assessing Ten Years of Experience. Special Report 264. National Academies, 2002.

TDM Strategies Generate Good Benefit/Cost Ratios

Several research projects have developed methodologies to calculate the costs and benefits of TDM in order to allow for objective project selection and evaluation. In seeking to create evaluation procedures for TDM that would produce values comparable to road projects, the New Zealand government developed a procedure that included the following benefits and costs when evaluating TDM measures:[19]

- Travel time saving.
- Vehicle operating costs.
- Parking costs.
- Health benefits of cycling and walking.
- Public transit fares.
- Congestion reduction.
- Walking and cycling costs.
- Accident costs.
- Public transportation costs (if expanded).
- Externality costs.

Applying such a methodology to an individualized marketing program in South Perth, Australia, resulted in Benefit to Cost Ratios of 13:1 (and 15:1 when factoring in reduced accidents).[20]

Similarly, the Trip Reduction Impacts of Mobility Management Systems (TRIMMS) model (see Chapter 9) developed at the Center for Urban Transportation Research includes a module to calculate the benefit/cost ratios for TDM strategies using a similar approach. The TRIMMS model allows for the estimation of trip reduction impacts for TDM strategies applied to a given situation and from that, the ability to calculate the value of the trips reduced and the benefit to cost ratio. One exemplary test of the model for a commute-trip transit fare reduction shows the net value of each vehicle trip reduced to $645.00 and a peak period benefit/cost ratio of 2.8.[21]

[19]Maunsell, P.R.a.B.A.H., Travel Behaviour Change Evaluation Procedures- A Technical Report. 2004, Transfund New Zeland/EECA: Melbourne, Australia

[20]Office, A.G., Evaluation of 26 Australian TravelSmart Projects in the ACT, South Australia, Queensland, Victoria, and Western Australia. 2006, Department of Environment and Heritage: Canberra, Australia.

[21]National Center for Transit Research, Economics of TDM: Comparative Cost Effectiveness and Public Investment, NCTR 77704, March 2007.

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Application of TDM to Policy Issues

Improvements in Regional Mobility and Accessibility

Congestion Reduction, System Reliability, and Safety

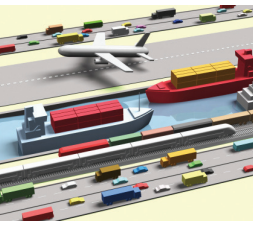
Air Quality and Environment

Economic Development

Land Use/Transportation Integration

Goods Movement and Freight

Quality of Life, Livability, and Health



3. Application of TDM to Policy Issues

This chapter provides the reader with a discussion of an expanded role for demand management in addressing a wide range of public policy issues. The goal of this chapter is to show how TDM can play a role in various typical policy objectives that are of concern today to state DOTs and MPOs. As the discussion of the policy issues will illustrate, the role of TDM extends beyond just air quality considerations. In fact, TDM can be a core function to achieve various other regional goals. The following seven policy issues will be described in this chapter:

- Improvements in Regional Mobility and Accessibility.
- Congestion Reduction, System Reliability and Safety.
- Air Quality.
- Economic Development.
- Land-Use Planning.
- Goods Movement and Freight.
- Quality of Life/Livability/Health.

The relationship between TDM and various policy objectives at each planning level is shown in Table 3.1. In some cases, the fit is better, such as with land use, which is most effectively dealt with at the local level where local police powers allow for zoning and development approval. Other issues, such as air quality, are better handled at a higher level, such as the metropolitan or state levels.

For each policy objective, the following information is presented:

- The role of TDM in addressing the policy objective.
- Potential TDM strategies that might address the policy objective.
- Key performance measures.
- Means to integrate TDM into the planning process.
- Key best practice planning examples.
- Key available resources.

CHAPTER ACRONYM LIST

ATM	Active Traffic Management
BRT	Bus Rapid Transit
CIVITAS	CIty-VITAlity-Sustainability
CMAQ	Congestion Mitigation and Air Quality
CMP	Congestion Management Program
C-TIP	Cross-town Improvement Project
CUT	Chassis Utilization Tracking
DOT	Department of Transportation
DRG	Dynamic Route Guidance
EPA	Environmental Protection Agency
EWGCC	East-West Gateway Coordination Council
FHWA	Federal Highway Administration
GIS	Geographic Information System
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
HUD	Housing and Urban Development
IMEX	Intermodal Move Exchange
ITB	Influencing Travel Behavior
ITS	Intelligent Transportation Systems
LOS	Level of Service
MPO	Metropolitan Planning Organization
NOX	Oxides of Nitrogen
RTTM	Real-time Traffic Monitoring
SOV	Single Occupancy Vehicle
TCM	Transportation Control Measures
TDM	Travel Demand Management
TERM	Transportation Emission Reduction Measure
TIGER	Transportation Investment Generating Economic Recovery
TIP	Transportation Improvement Program
TOD	Transit Oriented Development
TMA	Transportation Management Associations
TSM	Transportation Systems Management
TSMO	Transportation Systems Mgmt/Ops
VHT	Vehicle Hours Travelled
VMT	Vehicle Miles Travelled
VOC	Volatile Organic Compound
VTPI	Victoria [British Columbia, Canada] Transport Policy Institute
VTR	Vehicle Trip Reduction
WDU	Wireless Drayage Updating

Table 3.1: Ability of TDM to Address Policy Objectives

		Planning Levels			
Policy Goals		State Level Planning	Metropolitan/ Regional Planning	Corridor Planning	Local/Municipal Planning
	Regional Mobility/Accessibility	Good	Excellent	Good	Fair
	Congestion Reduction/ System Reliability/Safety	Fair	Excellent	Excellent	Good
	Air Quality/Environment	Good	Excellent	Fair	Good
	Economic Development	Fair	Good	Fair	Good
	Land Use/Transportation	Good	Excellent	Good	Excellent
	Goods Movement/Freight	Fair	Good	Good	Good
	Quality of Life/Livability/Health	Fair	Good	Fair	Excellent

Most regions have already begun taking steps across the board to incorporate TDM to address their policy issues. Depending on the region, and the policy objective, TDM approaches are either included at an ad-hoc level, defined level, or optimized level. Table 3.2 provides a broad description of the TDM inclusion/capability levels for all the policy objectives. Typically, agencies would fall at different levels for different policy objectives.

The intent of each of these sections is to provide a summary-level detail (a short "factsheet" format) for considering TDM for each policy objective. In general, the sections are written toward approaching a more defined approach to including TDM and where possible, optimized approaches. The factsheets are at a high level of detail and the reader is encouraged to focus on the key resources in each section for in-depth reading, and examples on the role of TDM for each policy objective.

Table 3.2: Levels of TDM Inclusion/Capability to Address Policy Issues

Objective	Level 1 – Ad Hoc	Level 2 - Defined	Level 3 – Optimized
Mobility	Public transit viewed as primary travel alternative	Expanded travel choices set as goal	Accessibility to destinations and services no longer connotes necessity to travel
Congestion	TDM considered after capacity enhancements and modal improvements	TDM strategies are considered during key parts of planning process with respect to congestion	TDM "philosophy" integrated into congestion management approach
Air Quality/ Environment	"Clean" aspects of modes and programs considered	Single-occupancy VMT reduction used as primary objective in plan	TDM linked to long-term air quality improvement
Economic Development	TDM not seen as a economic development driver	Expanded travel choices linked to economic development goals	TDM viewed as means to decouple economic and VMT growth
Land Use/ Transportation	Expected reductions in VMT removed from trip generation step	Planning process includes land use scenarios that support more travel choices	Concurrency adopted as means to assure adequate facilities and services in place
Goods Movement/ Freight	No link perceived between TDM and freight	Peak pricing/Off-peak deliveries viewed as demand management	TDM principles fully integrated into freight planning
Quality of Life/ Livability/Health	Bike/Walk added to travel choices	Non-traditional objectives added to plan (e. g. , satisfaction)	"Quality of life" objectives equal travel efficiency

3.1 Improvements in Regional Mobility and Accessibility

How Can Demand Management Address Mobility and Accessibility?

The application of TDM in the planning process and its long-term implementation can have a significant impact on addressing mobility and accessibility policy goals for a region. Within the context of this document, mobility can be considered the ability for transportation system users to maneuver within and utilize the various components of the system virtually unimpeded. The term accessibility can then be considered the ability of users to gain access to various destinations in the region by using the transportation system, be it highway, transit, bike, or walk. Ultimately, this represents access to the things we need to live, even without the need to travel.

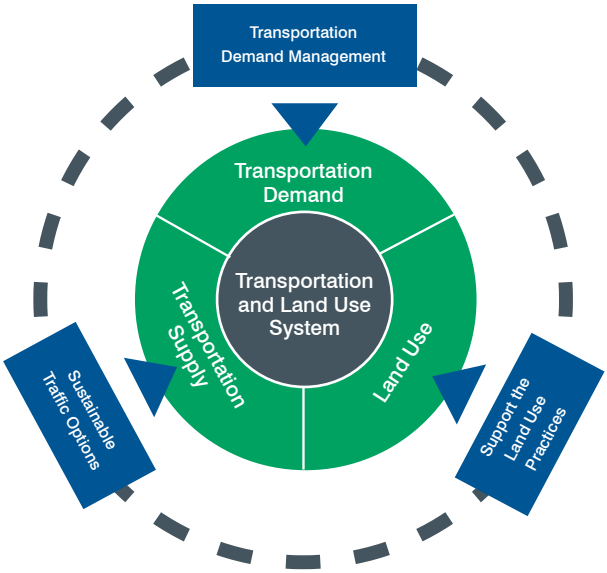


Figure 3.1: Factors in Urban Mobility

Source: EcoMobility Application Guide, Transport Canada, 2008

The major factors driving urban mobility needs and activities include three closely linked factors of land use, transportation supply, and transportation demand (Figure 3.1). A change in one leads to changes in others. As such, regions considering mitigating their urban mobility challenges need to include a multi-pronged approach involving activities in all three factors including:

- Improvements to sustainable travel options that build the capacity and quality of transportation infrastructure and services.
- More supportive land use practices that reduce the distances between origins and destinations and make transit, walking, and cycling more practical.
- The use of TDM to shape other key factors that influence personal travel decisions, such as attitudes and prices.[22]

Each TDM strategy that works to influence travel choices and behavior – be it location, time, mode, route, or lane – can help reduce the strain on the overburdened system to enhance mobility and accessibility for travelers. The TDM strategies that work to meet regional mobility and accessibility goals are also strongly related to helping meet various other policy goals, such as congestion, economic development, and livability. Additional information on how TDM addresses those policies is discussed in later sections of this chapter.

Potential TDM Strategies to Address Mobility and Accessibility

A number of TDM strategies that cover the spectrum of options can work to improve regional mobility and accessibility. Broadly, the following four types of initiatives that support TDM are available to transportation planners:

[22] Transport Canada, Urban Transportation Showcase Program, (www.tc.gc.ca/utsp)

- Traveler choices (e.g., mode, location, time, route choice).
- Incentives (e.g., financial inducement to use an alternative mode or stay off of a congested roadway).
- Information (e.g., real-time information about each choice).
- Enablers (e.g., new partnerships, regulations to support choices).

In many cases, improving mobility involves expanding and improving the range and quality of available travel choices. These choices may be short-term on a day-to-day or an hour-to-hour basis. In recent years, as urban mobility and accessibility needs change, TDM is applied at various application settings, and at various scales, as shown in Figure 3.2, developed for Transport Canada.

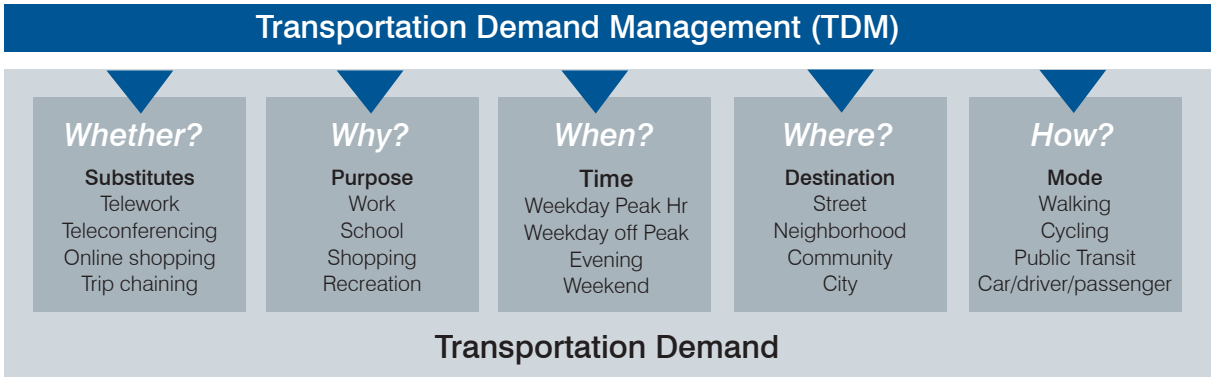


Figure 3.2: TDM Applications and Markets for Urban Mobility

Source: EcoMobility Application Guide, Transport Canada, 2008

Some of the strategies that work to address regional mobility and accessibility are not always considered typical TDM strategies by planning agencies. However, when TDM is framed as providing choices, these strategies influence various travel behaviors. For example, categories such as arterial management, freeway management, work zone management, and similar strategies that help manage the demand once it is on the network are not necessarily thought of as TDM strategies. Many agencies see these operational strategies as separate from more traditional TDM strategies such as carpool matching, car sharing, and telework programs. However, they all aim to provide choices to the traveler, as discussed in Chapter 2. The notion of choices and the integrated set of strategies to provide seamless choices to the traveler are the marks of a true implementation of TDM as a mobility and accessibility measure.

Key Performance Measures

The Victoria Transport Policy Institute, in studying the means to evaluate accessibility in transportation planning, has provided the following descriptions of mobility and accessibility and the measures used to evaluate them:[23]

Table 3.3: Transportation Evaluation Perspectives

	Vehicle Travel	Mobility	Accessibility
Definition of Transportation	Vehicle travel	Person and goods movement	Ability to obtain goods, services and activities
Measurement Units	Vehicle miles	Person-miles and ton-miles	Trips, generalized costs
Modes Considered	Automobile and truck	Automobile, truck and transit	Automobile, truck, transit, cycling and walking
Common Indicators	Vehicle traffic volumes and speeds, roadway level of service, costs per vehicle-mile, parking convenience	Travel distance and speeds, road and transit level of service, cost per person-mile, travel convenience	Quality of available transportation choices, distribution of destinations, cost per trip

As Table 3.3 shows, the focus on mobility or accessibility leads to different performance measures than if the focus were solely on vehicle travel. While mobility can be measured by the variety and use of various travel options (i.e., mode choice, mode shift, or relative travel times), accessibility is measured in terms of the proximity of activities to one another or the ability to access activities without a vehicle or with minimal miles.

Integrating TDM into the Planning Process to Address Mobility and Accessibility

The first step to including TDM into the planning process to help meet the regional mobility and accessibility policy goal is identifying those strategies that have goals and objectives that are in alignment with the policy. It is imperative that an agency develop a matrix of regional goals and relevant TDM strategies to help identify specific solutions that can be put forth as feasible options in the planning process.[24] These form the basic backbone of TDM by which an agency can influence the planning process. For example, an agency can take the following steps to advance TDM for regional mobility and accessibility:

- Incorporate TDM strategies and related objectives into general planning factors within the transportation planning process.
- Ensure that congestion management systems incorporate those TDM strategies that enhance regional mobility and accessibility so that they work in concert with other strategies to maximize the efficiency potential for the transportation system.
- Incorporate the TDM strategies for regional mobility and accessibility as potential solutions in major investment studies (MIS) to help address the factors influencing project solutions while efficiently and effectively meeting the needs of the community.
- Ensure that TDM strategies that address mobility and accessibility are part of the public involvement dialogue to gain the broad support of the community.

[23] Litman, Todd, Evaluating Accessibility for Transportation Planning - Measuring People's Ability To Reach Desired Goods and Activities, VTPI, April 2011.

[24] M. Grant, et al. Statewide Opportunities for Integrating Operations, Safety and Multimodal Planning. FHWA-HOP-10-028. ICF International Inc. and Delcan, Inc., 2010.

Once specific TDM strategies to enhance regional mobility and accessibility are incorporated into the transportation plan, it is important that agencies generate a list of high-level planning considerations related to specific strategies. These considerations can ensure proper attention to critical factors that can derail projects in the implementation phase. Such pitfalls can reduce the appeal of these TDM strategies and limit their potential use. Such considerations might include operational flexibility, decision-making needs, traffic control devices, enforcement, evaluation, monitoring, interoperability, marketing, legal and institutional issues, support facilities and services, and analysis tools and techniques.[25] While these considerations appear very specific and may be too detailed for the regional plan, the general consideration of these issues at the planning level ensures that they are included within the context of the overall network and can help ensure their successful implementation.

Best Practice Planning Example

An illustrative example showing the use of TDM in regional transportation systems management and operations to improve mobility and accessibility comes from Portland, Oregon. Metro, the Portland-area MPO, has developed a ten-year Regional Transportation System Management and Operations (TSMO) Plan.[26] In its vision statement, the MPO asserts that it will "strive to become a nationally recognized leader for innovative management and operations of its [regional transportation] system." The plan begins with a series of goals and objectives that direct the plan's specific TSMO investments, and a series of principles and aims that guide its implementation. This action-centric plan is structured around two distinct elements, regional investments and corridor investments. Metro defines TDM as strategies that increase use of travel options, decrease pollution and congestion, and increase mobility. The TSMO Plan, developed as part of the recently completed Regional Transportation Plan update, includes TDM and TSM/ITS strategies in the document. TDM strategies are coordinated with other system management strategies to maximize the impact on the region.

Regional investments are organized around four functional areas (including TDM), with several specific projects for each area (shown in Table 3.4). Detailed information for each project includes its goal/objective, priority, timeframe, capital cost, operation and maintenance cost, and the potential lead agency. In addition to the region-wide activities presented above, the plan divides the region into several unique corridors and identifies several projects that will be applied within each. For each corridor, the plan articulates current corridor conditions, assesses where the corridor stands in terms of current TSMO strategies, and presents a list of the regional multimodal traffic management, traveler information, and travel demand management strategies planned over the 10-year horizon of the plan.

[25] P. Worth, et al. Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference. FHWA-HOP-10-027. SAIC, Kittelson and Associates, Inc., and ICF International, Inc., 2010.

[26] Oregon Metro, Portland METRO TSMO Plan, June 2010, http://library.oregonmetro.gov/files//regional_tsmo_refinement_plan_june2010_final.pdf.

Table 3.4: Portland TSMO Strategies

Multimodal Traffic Management	Travel Demand Management
• Operate and Maintain Regional ITS Communications Network • Active Traffic Management (Regional Concept of Transportation Operations) • Transit Priority Treatment Performance Measurement • Region-Wide Access Management Strategies • Enhance Regional Traffic Signal System • Implement Freight Data Collection System • Congestion Pricing/HOT Lanes • Active Traffic Management Pilot Project • Next Generation Transit Signal Priority System • 24-Hour Transportation Operations Coverage • Automated Speed Enforcement	• Collaborative Marketing • Employer Services • Rideshare Services • Measurement • Regional TSMO Program • Parking Management Pilot Program • Smartcard Fare System Regional Concept of Operations • Smartcard Fare System Pilot Project • Youth Transit Pass Program • Regional Incentive/Disincentive System

Traveler Information	Incident Management
• Portland, OR Regional Transportation Data Archive Listing Enhancements • Multi-modal traveler data and tools • Park & Ride Traveler Information • TripCheck Travel Information Portal Enhancement • Arterial Performance Measure • Transit Performance Measurement System	• Incident Management • Expand Incident Management Teams/Training • Integrate Voice and Data Networks • Emergency Responders GIS System Upgrades • Dynamic Routing and Preemption Pilot Project

KEY RESOURCES

EcoMobility Application Guide, Transport Canada, 2008.

Litman, Todd, Evaluating Accessibility for Transportation Planning - Measuring People's Ability To Reach Desired Goods and Activities, VTPI, April 2011.

M. Grant, et al. Advancing Metropolitan Planning for Operations: An Objectives-Driven Performance-Based Approach. FHWA-HOP-10-026. SAIC and ICF International, Inc., 2010.

M. Grant, et al. Statewide Opportunities for Integrating Operations, Safety and Multimodal Planning. FHWA-HOP-10-028. ICF International Inc. and Delcan, Inc., 2010.

Oregon Metro, Portland METRO TSMO Plan, June 2010, http://library.oregonmetro.gov/files//regional_tsmo_refinement_plan_june2010_final.pdf.

P. Worth, et al. Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference. FHWA-HOP-10-027. SAIC, Kittelson and Associates, Inc., and ICF International, Inc., 2010.

Transport Canada, Urban Transportation Showcase Program, (www.tc.gc.ca/utsp)
T. Shaw. Performance Measures of Operational Effectiveness for Highway Segments and Systems: A Synthesis of Practice. NCHRP Synthesis 311. PBS&J, 2003.

3.2 Congestion Reduction, System Reliability, and Safety

How Can Demand Management Address Congestion?

Applying TDM in the planning process can play a pivotal role in helping agencies address their goals to reduce transportation system congestion, improve system reliability, and improve safety. Within the context of this document, congestion is the condition of the transportation system where demand exceeds available capacity, whether on a regular basis (recurrent) or as a result of unplanned events, such as incidents, emergencies, construction, or special events (non-recurrent). Enhanced travel choices, as defined in Chapter 2, can serve to address congestion in two ways. First, mode and location shift can reduce the total number of vehicles using the roadway system (reduce overall travel demand). Secondly, route and time choice can influence the temporal and spatial concentrations of congestion (by redistributing demand). The term "system reliability" can be considered the consistency or dependability of the transportation system, as measured from day to day and/or across different times of the day.[27] Congestion and reliability are directly linked, since the primary cause of reliability erosion is congestion.

Congestion is an ever-increasing reality in today's communities, and not just in large metropolitan areas. Many urban corridors in most large cities have been expanded to the extent feasible from subsequent widening projects, leaving few options to improving performance and efficiency other than TDM. Each TDM strategy that works to influence travel choices, and minimize recurrent and non-recurrent congestion,

[27] Travel Time Reliability: Making it There on Time, All The Time. FHWA-HOP-06-070. Texas Transportation Institute and Cambridge Systematics, 2006.

can help reduce the strain on the overburdened system. This is accomplished by reducing VMT, shifting travel outside the peak periods, and eliminating the need to travel – contributing to reductions in delay or VHT. The end result can be a reduction in congestion and an improvement in system reliability for travelers. TDM can also help provide travelers with reliable options that might not have been available before. The TDM strategies that work to meet the policy goals of congestion reduction and reliability improvement are also strongly related to helping meet regional mobility and accessibility, safety, and goods movement goals. Additional information on how TDM addresses those policies is discussed in other sections of this document, except for potential safety benefits, which are discussed later in this section.

Demand-side strategies are designed to better balance people's need to travel a particular route at a particular time with the capacity of available facilities to efficiently handle this demand.

Figure 3.3: WSDOT "Rice" Experiment

Source: WSDOT Department of Transportation

Fundamentally, congestion is an expression of the inability to manage demand and efficiently use capacity as shown in Figure 3.3, the WSDOT "rice" experiment.[28] The rice experiment was an attempt to demonstrate the linkage between travel demand and system capacity. As a fixed amount of rice is forced through a funnel with a fixed opening, the resulting back-up in the funnel is reminiscent of a traffic bottleneck. As the rate of the rice entering the funnel is managed, the back-ups are avoided, increasing the ability of the funnel to transfer the rice through the system.

Potential TDM Strategies to Address Congestion, Reliability, and Safety

There are several approaches to managing demand to mitigate congestion that have been implemented world-wide and in the U. S. Broadly, they can be categorized into four measures as shown below. Examples for each measure category, based on experience with demand management in Europe, can be found in the FHWA Report "Managing Travel Demand: Applying European Perspectives to U. S. Practice."[29]

- Financial/Pricing Measures (e.g., congestion pricing, VMT fees).
- Physical Measures (e.g., location-specific auto restrictions).
- Operational Measures (e.g., dynamic route information).
- Institutional Measures (e.g., sustainable travel planning).

Financial/Pricing Measures – By acknowledging the economic principles of supply and demand, congestion pricing channels discretionary rush-hour highway travel to other transportation modes or to off-peak periods, thereby taking advantage of the fact that the majority of rush-hour drivers on a typical urban highway are not commuters. By removing a fraction (even as small as 5%) of the vehicles from a congested roadway, pricing enables the system to flow, allowing more cars to move through the same physical space more efficiently.[30]

[28] Washington State Department of Transportation - The $1,000 Doug MacDonald Challenge - http://www.wsdot.wa.gov/Traffic/Congestion/Rice/Default.htm

[29] FHWA, Managing Travel Demand: Applying European Perspectives to U. S. Practice, FHWA Technology Scanning Program, FHWA-PL-06-015, May 2006. http://international.fhwa.dot.gov/traveldemand/

[30] FHWA, Congestion Pricing: A Primer – Overview, FHWA-HOP-08-039, 2008 - http://ops.fhwa.dot.gov/publications/congestionpricing/index.htm.

More details on congestion pricing can be found in the primer series developed by FHWA[31] or the FHWA Office of Innovative Program Delivery webpage on Road Pricing, which includes a discussion on the four types of pricing mechanisms with related key case studies.[32]

While congestion pricing is one financial measure and a "stick," other financial measures offer "carrots" to travelers with the promise to mitigate congestion. These financial measures range from the Atlanta Cash for Commuters program[33] vanpool start-up subsidies, carpool "trial" incentives, bicycle loan programs, travel allowances/parking cash-out, commuter tax benefits, and employer tax incentives. Another example includes the rush-hour avoidance schemes in the Netherlands, where travelers are paid to stay off congested roads at specific peak times.[34]

Rush Hour Avoidance Incentive – The Hague, The Netherlands
A research project, Rush Hour Avoidance (or spitsmijden in Dutch) involving the Dutch Ministry of Transport, several universities, consultants, and Bereik! was implemented in 2006. This involved piloting an incentive program to induce travelers to avoid the A12 motorway between Zoetermeer and The Hague during the rush hour period of 7:30 – 9:30 am. Participants were offered a financial incentive of about $4 per day (€3) to avoid traveling on the facility during these times (or, alternatively, offered a chance to win a smartphone). Cars were fitted with transponders to record where and when participants traveled. The proportion of participants traveling during the peak congested hours was halved during the experiment. While some of those who avoided the peak hours shifted to carpools, transit and cycling (the opening of a new rail service in the corridor was delayed), the greatest proportion simply shifted the hours they traveled, most to before 7:30 a. m. The success of the experiment is now being replicated on another stretch of the A12 to Gouda and even used by public transit operators to shift riders outside the overburdened peak period.

Physical Measures – These measures emphasize how strategic infrastructure improvements can influence travel demand and auto use. These may range from automobile access controls on specific streets (like Broadway in New York City, 16th Street Mall in Denver) to wider access control zones, as in Rome and most Italian cities).

[31] FHWA, Value Pricing Pilot Program Publications and Other Resources – http://ops.fhwa.dot.gov/tolling_pricing/value_pricing/publications.htm

[32] FHWA, Office of Innovative Program Delivery, "Road Pricing Defined" http://www.fhwa.dot.gov/ipd/revenue/road_pricing/defined/index.htm.

[33] Georgia DOT, Cash for Commuters, Survey Key Finding – 2009, Center for Transportation and the Environment, 2009, (http://www.dot.state.ga.us/informationcenter/programs/environment/airquality/Documents/reports/CAC_Cash_for_Commuters_FINAL_2009.pdf

[34] FHWA, Integrating Active Traffic and Travel Demand Management, A holistic approach to congestion management, FHWA-PL-11-011, 2011, January

These measures work by restricting automobile use in certain key facilities, such as centers of historic or economic interest. Park and Ride lots are another example of physical measures that entice mode shifts to transit (especially when coupled with real-time traveler information). In fact, parking measures and an overall parking management strategy that includes reconsideration of parking supply using techniques such as parking maximums (vs. minimums), parking caps, shared parking, preferential parking, satellite parking and shuttle, and on-street parking are often overlooked by regions but hold promise in mitigating congestion.

Figure 3.4: Access-Restricted Lanes near Heathrow, London

Source: Alastair Duff and BAA

Other physical measures deal with providing high-occupancy vehicle lanes, bus-only lanes, rush-hour lanes, using the shoulder for travel ("hard shoulder"), carsharing, and biking/pedestrian facilities. Figure 3.4 is an example of access-restricted lanes near Heathrow, London.

Operational Measures – These include traveler information, HOV to HOT conversions, parking information, and ATM. ATM requires that the full range of available operational strategies be considered, including the various ways these strategies can be integrated together and among existing infrastructure, to actively manage the transportation system so as to achieve system performance goals. Operational strategies include speed harmonization, incident management, queue warning, dynamic rerouting and traveler information, temporary shoulder use, and speed enforcement.

Institutional Measures – These include measures such as new partnerships, travel planning, coordination, and national policies on TDM. While traditionally considered "soft measures," they still have a vital role to play. Since the organizations that plan and manage demand management strategies are most often different from those managing traffic in a given corridor or area, new partnerships may be needed to proactively integrate the two concepts into one program or, at least, into a new coordination mechanism.

Individually, measures under these four categories have been implemented widely. However, increasingly it is becoming obvious that that the entire toolbox of strategies is needed to achieve the sustainability objectives. For example, the UK Highways Agency's Influencing Travel Behavior (ITB) program aims at "tackling congestion by providing access to information that enables people to make smarter travel choices."[35] Figure 3.5, from the UK Highways Agency, shows the levels of coordination and suite of strategies currently in consideration for influencing travel behavior.

[35] UK Highways Agency, http://www.highways.gov.uk/knowledge/9611.aspx

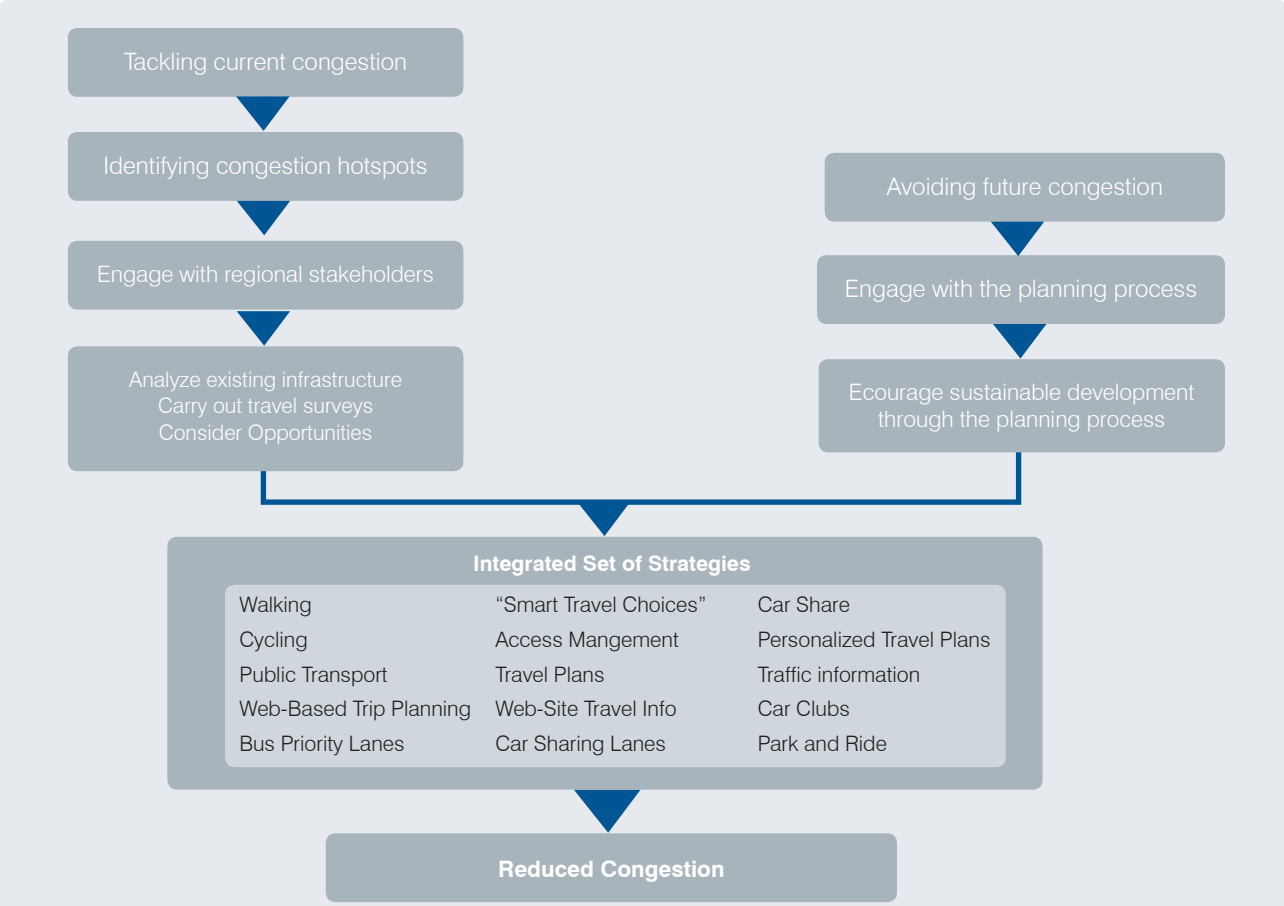


Figure 3.5: Influencing Travel Behavior Process Flow Chart

Source: UK Highways Agency

TDM and Reliability – Making All Trips More Reliable (Regardless of Mode)

While most definitions of trip reliability focus on the variability of average passenger vehicle travel times, the concept of reliability needs to be applied to all travel modes. As such, reliability may focus not only on travel time, but also on the quality and day-to-day consistency of travel modes, be they public transit, vanpooling, bicycling, walking, etc. Some states and regions have adopted multi-modal performance measures in the form of levels of service (LOS) for car, transit, and non-motorized modes, so as to equally assess the efficacy of each mode in meeting user needs.

TDM strategies that enhance travel reliability for all modes include those associated with real-time multi-modal traveler information, and those providing preferential treatment for HOV (HOV/HOT lanes) and transit vehicles (priority treatment). One primary benefit of HOT systems is an assurance of reliable travel times for HOV and SOV modes through the use of pricing.

TDM and Safety – An Emerging Connection

In general, there is an accepted correlation between reduced congestion and improved safety, especially in terms of accidents and injuries. Making the link between the potential safety benefits of TDM and its inclusion in transportation plans is something that agencies who are looking to mainstream might consider doing. According to research summarized in the Victoria [British Columbia, Canada] Transport Policy Institute (VTPI) On-line TDM Encyclopedia, TDM strategies can affect safety and health in several ways, as summarized below.[36]

[36] VTPI, Evaluating Safety and Health Impacts: TDM Impacts on Traffic Safety, Personal Security and Public Health, in TDM Encyclopedia, updated June 17, 2011, http://www.vtpi.org/tdm/tdm58.htm

- TDM strategies that reduce total personal travel can provide large safety benefits. Each 1% reduction in motor vehicle travel typically reduces total crashes and casualties by 1.4% to 1.8%. Examples: Distance-Based Charges.
- Pay-As-You-Drive (PAYD) vehicle insurance reduces total vehicle mileage and gives higher-risk drivers an extra incentive to reduce their mileage, and so can be particularly effective at reducing road risk. Each 1% reduction in mileage due to PAYD insurance is likely to reduce crash costs by 1.5-2. 0%.
- Strategies that reduce traffic speeds and traffic conflicts can reduce per-mile crash frequency and severity. Examples: Traffic Calming and Access Management.
- Strategies that reduce traffic congestion tend to reduce crash frequency but increase severity, because crashes occur at higher speeds. As a result, TDM strategies that shift automobile travel time, route, or destination but do not reduce total vehicle travel probably do little to increase road safety. Examples: Flextime, Telework, Congestion Pricing, and Parking Management.
- Strategies that shift travel from driving to transit and ridesharing tend to provide medium to large road safety benefits. Examples: Commute Trip Reduction Programs, Transit Improvements, Shuttle Services and Ridesharing.
- Strategies that shift automobile travel to non-motorized modes may increase per-mile risk for the people who change mode, but this can be offset by reduced risk to other road users, reduced trip length, and health benefits from aerobic exercise. Examples: Pedestrian Improvements, Bicycle Improvements, Non-motorized Transport Encouragement, and Universal Design.
- Strategies that create more accessible land use patterns and more balanced transportation systems may increase crash rates per lane mile (due to increased traffic density and congestion) but tend to reduce per capita fatalities and increased aerobic health. Examples: Smart Growth, Location Efficient Development, New Urbanism, Transit Oriented Development, and Clustering.
- Strategies that limit automobile traffic in an area may increase safety if they reduce total vehicle mileage, but may reduce safety if they simply shift traffic to other roadways. Examples: Vehicle Restrictions, Car-Free Planning, and Traffic Calming.
- Some TDM strategies directly improve personal security or promote safety. Examples: Security Concerns, Non-Motorized Transport Encouragement, Campus Transport Management.

As stated above, TDM measures that reduce VHT will impact delay and subsequently address congestion. Indeed, VMT, perhaps the most common performance measure associated with TDM evaluation, can be converted to delay impacts using some simplifying assumptions regarding average speed. Likewise, there is a direct correlation between VMT and key safety measures, including crashes and fatalities. Therefore, VMT and VHT are the key measures for assessing the role of TDM in addressing congestion, reliability, and safety.

Key Performance Measures related to the effectiveness of TDM in addressing congestion, reliability and safety, include:

- Vehicle trip reduction (VTR) (needed to derive VMT reduction).
- Vehicle miles of reduction (needed to derive delay reduction and safety impacts).
- VHT.
- Average travel times.
- Vehicle hours of delay.
- Travel time reliability.
- Ratio of travel times on all travel options to one another (e.g., transit/highway travel times).

The collection of data needed to calculate these performance measures is generally available from highway counts used to measure volumes and speeds. Travel time reliability is largely based on the variability of average travel times. Additionally, VTR and VMT reduction can be estimated based on mode and location shift (often using average trip lengths).

Integrating TDM into Planning for Congestion Reduction. The critical approach to including TDM in the planning process to help meet the congestion reduction and reliability improvement policy goals is identifying those strategies that have goals and objectives that are in alignment with the policies. It is imperative that an agency develop a matrix of regional goals and relevant TDM strategies to help identify specific solutions that can be put forth as feasible options in the planning process. These form the framework of TDM by which an agency can influence the planning process and ensure that policies are met with appropriate strategies.

But beyond the matching of TDM strategies to key regional goals and objectives, demand management, in its ultimate planning form, can be mainstreamed in several ways. First, demand-side strategies can be treated as equal to supply-side strategies in addressing congestion. Second, TDM initiatives can become major funding categories in and of themselves, with significant TDM projects developed for the TIP (rather than as enhancement to capital projects). Planners can acknowledge that reducing overall demand for SOVs is worth pursuing as a goal to address congestion, environmental, and energy objectives. Finally, decision-makers need to understand that congestion is not a "necessary evil" with economic growth – that traffic growth and economic growth can be "decoupled" and that areas that aggressively tackle congestion and even reduce overall traffic demand will be economically stronger in the long run.

An example of integrating TDM into the Congestion Management Process (CMP) is included in Chapter 4. The example below focuses on the Los Angeles County Metropolitan Transportation Authority CMP planning effort.

Best Practice Planning Example

The CMP provides a good example of the role TDM can play in key transportation planning efforts. One specific CMP that fully integrates TDM was implemented by the Los Angeles County Metropolitan Transportation Authority. The 2010 CMP[37] is a biennial plan that is required by state law, but also intended to meet federal requirements for the CMP. Additionally, the LA CMP is designed to link transportation, land use, and air quality considerations into a combined focus on congestion. As such, the CMP seeks to conform to the regional transportation plan and the region's air quality plan, each prepared by other agencies, but in close cooperation.

The LA CMP has several required elements, including: highway and roadway system monitoring, multi-modal system performance analysis, the TDM Program, and the Land Use Analysis Program. The program also includes implementation requirements for local jurisdictions aimed at bringing land use and transportation decisions in line. In fact, the CMP has been in existence for 18 years and includes a City requirement to adopt TDM ordinances to reduce the transportation impacts of new development. Local conformance with the requirements of the CMP is tied to distribution of state gas tax revenues.

TDM plays several integral roles within the CMP. Overall, TDM is stated as a means to maximize the efficiency of the roadway system. First, specific requirements are placed on new developments via local TDM trip reduction ordinances. Second, a major part of the CMP is the definition of roadway performance (LOS) deficiencies (roads operating below policy-determined LOS) and the recommendation that local jurisdictions (and regional entities) use TDM as a mitigation strategy to address these localized deficiencies. The CMP enumerates many regional, local, and public/private TDM initiatives, such as:

[37] Los Angeles County MTA, 2010 Congestion Management Program, 2010.

ridesharing requirements from the air district, TDM, vanpool and transit incentive programs, supporting projects (HOT lanes, etc.), public/private partnerships (TMAs) and Metropolitan Transit Authority (MTA) support for local initiatives (such as the "Call for Projects," which has funded 215 TDM projects since 1993 worth $162 million).

KEY RESOURCES

FHWA, Congestion Pricing: A Primer – Overview, FHWA-HOP-08-039, 2008 - http://ops.fhwa.dot.gov/publications/congestionpricing/index. htm.

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3.3 Air Quality and Environment

How Can Demand Management Address Air Quality and Environment?
TDM is often associated with efforts to address air quality goals by seeking to reduce automobile travel, a significant source of many regulated pollutants (cars account for the lion's share of CO_2 emissions within the transport sector). Environmental protection, and air pollution in particular, are often a priority goal within transportation plans, as a result of the following issues. First, environmental protection is a fundamental health and safety issue for urbanized areas. Second, state and federal regulations place standards on key pollutants as to the maximum concentration that is allowable. Third, and perhaps most importantly, federal planning regulations require that a region's transportation plan conform to the mobile emission budget estimated in the State (air quality) Implementation Plan. In other words, transportation projects that are shown to jeopardize the region's air quality attainment status, or plan for achieving it, should not be undertaken. "Conformity" was an issue mentioned earlier in the context of an expanded definition of TDM as going beyond employer ridesharing and its use in conformity analysis.

The role of TDM as an air quality strategy was solidified in 1990 with the passage of the federal Clean Air Act Amendments, which named several TDM strategies as Transportation Control Measures (TCMs). In fact, at one point, traditional TDM, called Employee Commute Options programs, were mandated among the ten urban areas with the highest ozone levels. As the air quality issue has been subsumed within the broader discussion on climate change, demand management has been forwarded as an effective strategy for its ability to reduce car use.

How does TDM address air quality policy objectives? First and foremost, TDM strategies often aim to generate the same result, the reduction of VMT, or reduced car use. Air pollution is emitted from the tailpipe, and a reduction in the amount of travel in a region equates to a reduction in emissions. VMT reduction can be accomplished in many ways. Reducing the growth in overall VMT may require long-term land use policies and economic factors that drive travel demand. However, in the shorter term, VMT reduction can be accomplished by reducing the amount of travel individuals make each week, via mode shift, trip elimination, or trip chaining.

Emissions are not only a function of the amount (distance) of car use, but also of car use in general. A proportion of emissions are generated by simply starting a car (cold start emissions). Therefore, TDM strategies that promote mode shift not only reduce the amount of car travel but cold start emissions, as travelers switch to higher occupancy or car-free modes. For this reason, when evaluating the effectiveness of TDM strategies in addressing air quality goals, it is important to measure both VMT reductions as well as the preferred mode to which drive-alone modes are transferred. For example, if a commuter shifts to taking the train to work, but drives to the station, the VMT reduction should be for the rail portion only and not the entire commute distance.

Potential TDM Strategies to Address Air Quality and Environment
Some of the key TDM strategies to directly address air quality objectives include:

- Shifting travelers to higher occupancy modes through incentives, pricing, and transit benefits.
- Shifting travelers to zero emission modes (bike, walk).
- Encouraging travelers to chain trips together to reduce "cold starts" and VMT.

- Working with major traffic generators (employers, schools, business parks, event venues, airports) to induce mode shift to cleaner modes.
- Starting programs to encourage smarter trip planning to avoid unnecessary starts and stops.[38]
- Starting programs to provide smoother traffic flow such as active traffic management.
- Encouraging the use of clean vehicles for alternative mode travel (e.g., buses and vans) or for all travel (e.g., allowing very clean vehicles into HOV lanes).
- Alternative work arrangements (such as compressed work weeks and telecommuting) to eliminate commute trips one or more days per week.

Whereas the role of TDM in meeting other policy objectives involves the smarter use of the car (e.g., efforts to encourage time or route choices for more efficient operation of highways to reduce congestion), the focus of TDM strategies to address air quality is grounded in the desire to reduce car use as measured in reduced VMT.

Key Performance Measures

A majority of TDM impact assessments on vehicle emissions require estimation of changes in VMT. In order to derive VMT reduction, measurement of both travel behavior change and trip distance is required. This might require traveler surveys to assess prior mode and even trip distance. Therefore, performance measures related to air quality include:

- Mode shift.
- Vehicle trip reduction.
- VMT reduction.
- Emission reduction (including any pollutants that are included in policy objectives, such as CO2 related to climate change goals.
- Cost per ton of emissions reduced.

Integrating TDM into the Planning Process to Address Air Quality and Environment

One important key to integrating TDM into the planning process is to move beyond viewing TDM as primarily a mitigation or conformity measure. If TDM is seen as more supportive of cleaner, healthier travel, then the reasons for including TDM in transportation plans will be much broader. In general terms, TDM has been viewed as a means to address unmet demand that cannot be accommodated with new or improved capacity. When TDM is viewed as an integral part of a sustainable transportation system, rather than as a short-term "fix" to unmet demand, then the range of strategies employed and policy objectives addressed will be much broader. Climate change action plans, as new types of plans, may become an increasingly popular means to consider TDM strategies.

It is likewise important to evaluate TDM strategies on a comparative cost effectiveness basis so that they can be evaluated on par with efficiency and capacity measures. For example, TDM strategies might be evaluated based on VMT reduction, whereas efficiency and capacity measures might be evaluated on improvements to speed or reductions in delay. Therefore, VMT reduction would need to translate to delay reduction, or conversely, supply-side strategies evaluated in terms of mobility or other criteria not traditionally used. This is especially critical when performing evaluation for funding purposes. TDM projects and programs, often funded with CMAQ funds, are selected among a variety of projects for their cost effectiveness. This is further discussed in Chapter 5.

[38] Auto Alliance – www.ecodrivingUSA.com

Best Practice Planning Example

The Washington D.C. Metropolitan region uses TDM strategies to help meet air quality targets. In keeping with the region's air quality plan and to meet conformity requirements, the Constrained Region Transportation Plan (and TIP) includes a number of strategies called Transportation Emission Reduction Measures (TERMs). TERMs have been included in the region's plans since 1995 and are aimed at addressing the region's ozone emission targets, namely two ozone precursors: VOCs (Volatile Organic Compounds) and NO_x (Oxides of Nitrogen) and more recently $PM_{2.5}$ (fine particulate matter). Four types of TERMs have been included, some related to improving traffic flow, and others related to clean heavy duty vehicle engines (trucks, school buses, etc.).[39]

One set of TERMs is related to commuter travel. Five TERMs, related to TDM, are designated for implementation by the regional TDM program, Commuter Connections. The five traditional TDM TERMs, (for the planning and evaluation period 2006-2008) were:

- Teleworking.
- Guaranteed Ride Home.
- Employer Outreach.
- Mass Marketing.
- Information Kiosks.

A sixth TDM element, the Commuter Operations Center, is also included as it represents the basic information and ride-matching services of the Commuter Connections program. An independent, triennial evaluation of these TERMs compared measured results to targets for each of the five TERMs. The evaluation was largely based on user surveys of participants (such as guaranteed ride home) or modeled results (such as employer outreach). The evaluation derived the number of commuters participating and, based on their observed or estimated mode shift, the daily trip reduction (trips), VMT reduction (miles), NO_x reduction (tons), and VOC reduction (tons). For the evaluation ending in 2008, the results of evaluating the five TDM TERMs, plus the Commuter Operations Center, resulted in the following comparison of results to stated objectives (Table 3.5):

Table 3.5: Washington DC Evaluation of TDM TERM Measures[40]

	Daily Vehicle Trips Reduced	Daily VMT Reduced	Daily NO_x Reduced (tons)	Daily VOC Reduced (tons)
2008 Goal	111,372	2,209,154	1. 121	0. 667
Measured Results	117,600	2,453,895	1. 139	0. 639

The daily NO_x and VOC reduction is crucial to conformity, and this evaluation revealed that the TDM program met its targets for trip and VMT reduction and NO_x emission reduction, but fell slightly short of its VOC target.

Future TERMs, studied as part of the 2009 long-range plan and related conformity analyses, include some additional TDM-related TERMs, for example, voluntary parking cash-out or required parking impact fees, in addition to expanded carsharing, bike station, and vanpool subsidy programs. Therefore, TDM measures are an important part of the Washington D.C. region's air quality strategy and are an integral part of its transportation plan.

[39]MWCOG, Commuter Connections Transportation Emission Reduction Measures Analysis Report FY2006 – FY2008, 2009, http://www.mwcog.org/uploads/pub-documents/xldWVw20090223160744.pdf

[40]MWCOG, Commuter Connections Transportation Emission Reduction Measures Analysis Report FY2006 – FY2008, 2009, http://www.mwcog.org/uploads/pub-documents/xldWVw20090223160744.pdf

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3.4 Economic Development

How Can Demand Management Address Economic Development?

Some economists view congestion as a sign of a healthy, growing economy, the demand for travel outpacing the supply of road capacity. However, gridlock results in millions of hours of wasted time for travelers stuck in traffic, which could be used more productively. Efforts to manage demand are sometimes viewed as being counter to economic growth because some strategies, especially mandates and disincentives, are viewed as constraining growth.

However, in the light of sustainability, managing demand is key to long-term economic viability and urban vitality. Economic development is one of the three key sustainability components, the others being environmental stewardship and social inclusion. Ultimately, the crucial question remains: "Can transportation growth be decoupled from economic growth?"

Put another way, can economic growth occur without a concomitant increase in VMT growth, especially growth of SOV use? Those subscribing to the concept of sustainable transportation believe that it can, and demand management is the key to this decoupling.[41] One international panel on sustainable

[41]OCED, Road Travel Demand, Meeting the Challenge, OECD, Paris, 2002.

transport suggested that two of the key means for decoupling transport and economic growth are related to influencing modal choices and addressing quality of life issues through trip substitution (e.g., e-commerce).[42]

One broad misconception is that TDM counters economic development by restricting mobility and accessibility through prescriptive measures aimed at modulating how, when, and where workers and shoppers can travel. This misconception may be derived from perceptions held in the 1990s that regulations requiring employer involvement in commuter TDM was a liability to business and not a means to broaden worker options and address societal objectives. Although their number has declined, some policy-makers still view TDM as counter to laissez faire economic development policies. A more contemporary view involves expanding and improving travel choices as favorable toward addressing economic development goals. In this view, travelers truly desire more options to meet their increasingly complicated daily routines. But another view is emerging as well, suggesting that transport growth and economic growth do not need to be directly linked, as commonly held. In other words, some areas are seeking to reduce VMT while at the same time growing their economic base. This "decoupling" can only be accomplished by the concomitant growth in travel demand, from new employment and business, being accommodated by means other than driving alone.

Potential TDM Strategies to Address Economic Development

TDM is founded in the notion of expanding travel choices to increase the mobility of travelers and accessibility to goods and services needed to make a city work. Generally effective, available travel options, such as public transit, shared ride, non-motorized, or even trip substitution strategies, are key characteristics of a vibrant, livable city in which people want to live and work. Likewise, measures that improve travel time reliability support economic development as journeys are more predictable and wasted time in congested conditions is minimized.

In the short term, TDM tends to work best in a growing economy. A competitive economic situation creates motivation for TDM stakeholders (such as employers and developers) to support travel choices and incentives to recruit tenants and employees. Likewise, in a growing economy, tax revenue and private investment are more readily available to implement innovative TDM strategies. Of course, demand management has been applied in all economic conditions, since it is often used to mitigate localized access, parking, and other issues at existing employment sites and major travel generators, such as sporting events. In the long run, cities that embrace and operate sustainable transportation systems are the places most likely to remain economically strong and attract new business and capital. TDM is a key component of such sustainable transportation systems.

At the most basic level, a TDM strategy that enhances or expands travel options is supportive of economic development. However, strategies that improve mobility and accessibility are also compatible with growing urban economies as they allow people to reach their destinations. Ultimately, strategies that reduce congestion are good for economic development in the long run. Of course, TDM strategies that enhance goods movement are vital to economic competitiveness. Several strategies that support economic development include:

- Improved travel options, such as: public transit, carpooling, vanpooling, bicycle, walk, etc.
- "Last mile" services, such as shuttles, carsharing, bike facilities, pedestrian connectivity, etc.
- Commute management consulting services to employers and developers to ease commuting and increase the ability to recruit and retain tenants and employees.
- Strategies related to congestion relief and mobility/accessibility goals (see above).
- Strategies that improve travel time reliability for one or all modes. These are beneficial to passenger and freight transport and the businesses that create demand on the system. Reliable travel times minimize uncertainty in travel and support economic development goals.

[42]Organization for Economic Cooperation and Development (OECD), The Economic and Social Impacts of Electronic Commerce, OECD, Paris, 1999.

Key Performance Measures

Measuring the impact of TDM on economic development is difficult because direct causality between transport measures and economic impacts are difficult to establish. However, if we define one goal of TDM in addressing economic development to be the expansion and use of travel options, then common performance measures might include:

- Growth in utilization of all travel options.
- Per capita use of principal travel options (e.g., annual transit rides per capita).
- Mode shift to non-SOV travel options.
    - Leads to reduced household vehicle expenditures, thereby increasing employment opportunities. A recent study found that $1 million in reduced fuel expenditures equates to a net increase in 4.5 jobs.[43]
- Rate of change in VMT in relation to change in economic indicators.

As such, data needed to derive these performance measures largely involves tracking mode shares, utilization, and VMT, which may require the type of household travel surveys normally conducted for transportation planning and modeling.

Integrating TDM into the Planning Process to Address Economic Development

Integrating TDM into regional plans and policies related to economic development may require a shift in thinking as much as a set of planning guidelines. First, policy-makers and other elected officials need to discard old ideas about the direct relationship between economic growth and travel or traffic growth. Sustainable transportation planning and smart land use principles can contribute to the ability to grow a region's economy without concomitant growth in traffic and congestion. One key to this new understanding is recognizing that there is a fundamental difference between travel demand (people) and traffic demand (cars), as outlined in Chapter 2. The Lund example described in the next section revealed that growth in travel demand can be accommodated with new and improved travel choices that do not rely on the drive-alone automobile traveling at peak periods. While the choices may vary from Europe to the U.S., based on city characteristics, the notion of providing alternatives to SOVs still holds.

Figure 3.6: Bicycle Parking in Lund, Sweden

Source: Schreffler

The second, and related, shift in thinking is the notion that sustainability is the key to future economic prosperity. Regions that embrace sustainable transport principles that allow for economic development without compromising environmental stewardship or social justice are taking a longer-term view of transportation planning. Sustainable transport systems seek to address the needs of today's travelers without compromising the ability to meet the needs of future generations. In the U.S., climate change

[43]Todd Litman, Evaluating Transportation Economic Development Impacts, Victoria Transport Policy Institute, 2009, p. 43 (http://www.vtpi.org/econ_dev.pdf.)

action plans are one form of sustainable urban transport planning. Some specific suggestions on how to successfully implement TDM initiatives while continuing to grow the local economy are suggested by those evaluating the Lund experience. They point to the need to:

- Educate all residents about sustainable transportation.
- Develop a wide range of travel options for various travel markets.
- Involve politicians and opinion leaders very early and throughout the planning process.
- Carefully evaluate and report experience.

Best Practice Planning Examples

A solid example of TDM serving economic development policy objectives would be provided from any example that documented a reduction in VMT, or in the rate of growth of VMT, during a period of economic growth. In another sense, a city or area that realized a reduction in congestion or in the growth in delay or travel times, during a period of economic growth, might illustrate the ability of TDM to complement economic development. Two examples are presented below: Lund, Sweden, and Arlington, Virginia.

The opposite has also been observed on several occasions when economic downturns have been accompanied by a reduction in congestion or VMT, as was the case in the so-called "dot com" boom and bust in the San Francisco Bay Area. Similarly, in periods of economic downturn, transportation capacity improvements are often funded as part of stimulus programs, as seen in both the original Federal-Aid Highway Act of 1956 and much more recently the TIGER (Transportation Investment Generating Economic Recovery) Grant stimulus program from U.S. DOT.

Lund, Sweden

As posited at the beginning of this discussion, can transport growth be decoupled from economic growth? A well-documented example comes from the city of Lund in Sweden.[44] Lund is a city in southwestern Sweden with over 100,000 inhabitants and a major university. It is located within the Õresund region that was formed in the early 2000s as a result of a new bridge spanning from the Copenhagen, Denmark, region to southwestern Sweden.

During the period from 2003 to 2006, the Õresund region enjoyed tremendous economic growth, more so on the Swedish side, where Lund is located. At about the same time, however, many cities in the region were developing and adopting sustainable transportation plans to allow for growth in a more environmentally and socially inclusive manner. In 1997, the City of Lund adopted the Lund Environmentally-friendly Transport Plan (Lundamats being the Swedish acronym). The objective of Lundamats was to cap traffic levels at 1995 levels for the life of the plan's first phase (through 2004). Lundamats had five major components:

1. Introduction of sustainable transport planning.
2. Recognition of Lund as a bicycle city (the city center was closed to traffic in 1971) (Figure 3.6 above).
3. Extension of public transit integrated with better land use policies.
4. Promotion of environmentally friendly car traffic (cleaner, higher occupancy, linked trips).
5. Reduction of employer-generated car traffic.

The integrated set of strategies implemented under the first phase of Lundamats included BRT, bicycle support, schools, trip reduction, employer trip reduction, and overall mobility consulting to citizens, visitors, schools, and businesses. A careful evaluation of Lundamats revealed that 15% of all residents had changed their travel behavior to use their car less. Overall, not only were traffic volumes maintained

[44]FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006

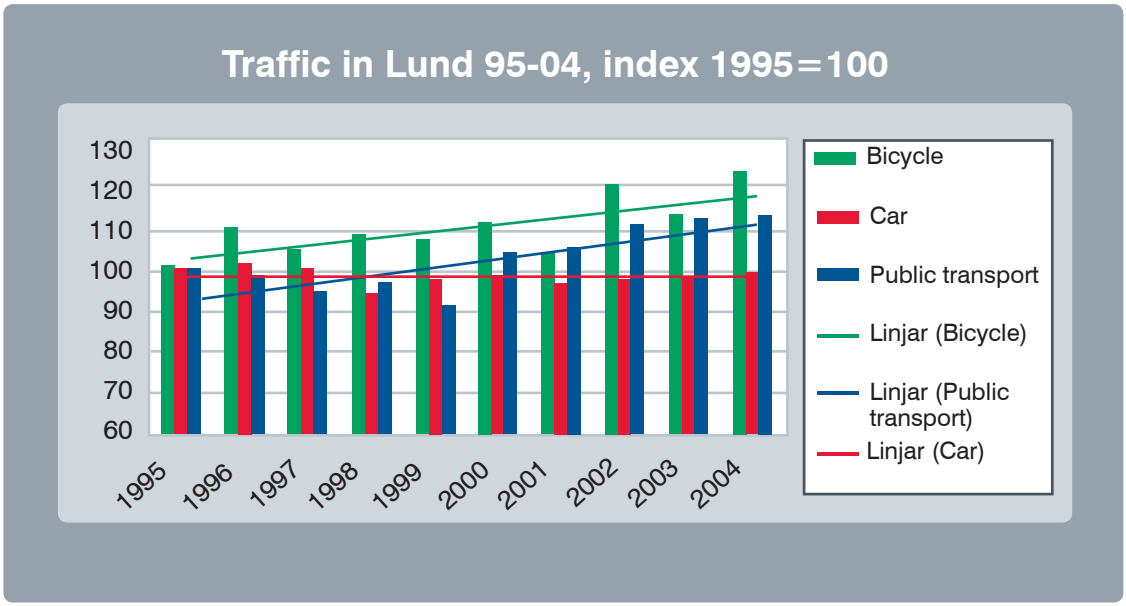

Figure 3.7: Reduction in VMT during a Period of Economic Growth in Lund, Sweden

Source: Trivector Traffic AB

at 1995 levels for the ten year plan horizon (set at 100 on the y axis in Figure 3.7), but traveler surveys showed that per capita VMT was reduced by 2 percent during that period (red line – Linjar (Car) in Figure 3-6). New travel demand was met through the increased use of transit and bicycling.

This is a very important finding because Lund was not only able to reduce the rate of growth in VMT, during this period of high economic growth, but the demand management efforts were instrumental in realizing a net reduction in car travel or VMT. As seen in Figure 3.7, growth in person travel demand was accommodated by bicycle and public transit modes, the focus of the sustainable travel strategies funded and implemented within Lundamats. Therefore, Lund was able to "decouple" traffic and economic growth by offering new and enhanced travel choices and incentives and teaching residents why and how to use them.

Arlington, Virginia

Arlington is an urban county next to Washington, D.C with over 210,000 residents, and 43.6 million square feet of office space organized around a series of transit-oriented urban villages. By the 1970s, Arlington was a stagnant suburb, with a declining population. Construction of the Metrorail began a spurt in Transit-oriented development (TOD), which in turn inspired economic growth that has continued today. Through commitments to transit and TDM, the county has been able keep the traffic on arterial roads flat from 1996-2011 while experiencing dramatic increases in transit usage during a period of explosive economic growth. The factors of success identified by the county include:

- High-density, mixed use development clustered around transit service.
- High quality transit service – regional and local.
- Excellent walking environment.
- Safe, visible bike routes and trails.
- HOV lanes.
- Complete Streets/Supportive Traffic management.
- Parking management (right supply, price).
- Demand Management – creating a culture of balanced options, less car dependence.

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3.5 Land Use/Transportation Integration

How Can Demand Management Address Land Use Planning?
In the long run, the ability to manage travel demand will be greatly enhanced by efforts to perform smarter land use planning that minimizes low-density development and provides greater opportunities for using alternative travel options – such as public transport, bicycling, walking – or avoiding SOV travel altogether.

TDM should be integrated into land use plans that seek to reduce our reliance on the car and shorten trip distances. TDM is instrumental in not only promoting more travel choices, but by creating programs and policies that educate, encourage, and support these more sustainable modes. Therefore, TDM needs to be an integral part of plans to integrate land use and transportation, often considered within the concept of smarter growth or sustainable growth.[45] Growth can either be "accommodated" with sufficient new transportation supply (which is increasingly unfeasible) or "managed" so as to minimize negative impacts of congestion, low-density development, energy, and environmental issues.

The land use-transportation interaction issue is becoming central to many transportation plans as policy-makers recognize the impact of land use decisions on the long-run effectiveness and efficiency of the transportation system. However, the role of TDM in bridging the connection between land use decisions and transportation investment is becoming more evident. While many land use decisions create longer trip distances due to the separation of uses and affordable housing locations, TDM seeks to reduce VMT by promoting options to long-distance drive-alone commutes and other trips. The treatment of TDM within the land use-transportation policy arena can differ from one agency to the next. Understanding these different approaches might assist the reader in determining the means to improve the connection in the planning process.

Differences in the treatment of TDM within the land use-transportation sphere occur within the strategy evaluation phase of the planning process. For example, some plans develop a target for VMT reduction that is desired from TDM and simply remove this travel from the trip generation step of the modeling process. In other words, without carefully determining the estimated impact of various TDM strategies, the planning process simply adopts a policy target for TDM effectiveness. A more rationalized planning

[45]Jennings, H., TDM: The Software that Supports the TOD Hardware, Arlington Commuter Services, October 2011

approach directly embeds TDM into future land use scenarios that involve more travel choices and land use policies that support them (and vice versa). Finally, when TDM is mainstreamed into the planning process, land use decisions are predicated on the concept of concurrency, where transportation solutions are defined and realized before certain development can occur.

Potential TDM Strategies to Address Land Use Planning

TDM has a long history of mitigating the traffic impacts of new developments. TDM is often integrated into the site planning process for new developments so as to reduce trip generation and parking needs. This assures that, at a minimum, the site design features are supportive of trip reduction strategies, such as having parking structures able to accommodate vanpools, sidewalks connected to bus stops, secure bicycle parking, and on-site showers/lockers for those using active commuting modes.

One powerful tool within the area of land use policy is parking. Parking has a profound impact on travel behavior. Free parking provides a large, hidden subsidy to the automobile and works against efforts to shift travelers into more sustainable modes. Parking policy, in terms of parking price, parking supply, and parking management, can be a significant lever in determining how, when, and where someone travels. One major inducement for developers to include TDM strategies in their site plans is the ability to reduce the amount of required parking.

In between the long-term planning objectives of land use/transportation integration and the short-term site design planning role for TDM, demand management strategies play a role in specific initiatives to create places with viable travel options, such as TOD. TODs seek to create mixed use developments around transit stations or hubs, and this in turn not only improves access to transit, but encourages bicycling and walking as average trip distances may be shorter for many travel needs.

Overall, the impact of land use and design on travel behavior has been summarized in Transportation Cooperative Research Program (TCRP) Report 95 – Chapter 15 (Land Use and Site Design):[46]

> *Where development is compact, land uses are compatible and intermingled, and there is good transit access and pedestrian interconnection, it appears that average trip lengths are shorter, greater use is made of transit and non-motorized travel modes, and household vehicle trip generation and particularly household VMT are less.*

Additional information on how land use and the built environment affect travel behavior is available from a seminal meta-analysis conducted by Ewing and Cervero[47] of known studies on the impact of land use characteristics and its spatial proximity to transportation systems and services.

Incorporating TDM into the Land Development Process is the subject of a comprehensive guidebook created by the Center for Urban Transportation Research at the University of South Florida. This guidebook includes an enumeration of the TDM strategies and supporting actions related to land development. As shown in Table 3.6, it is organized by the various ways of influencing travel behavior, such as mode shift, pricing, regulation, or the means to impact the trip-making, in terms of distance, time of day, etc.

The strategies listed in Table 3.6 include traditional TDM measures, such as the promotion of alternative commute modes, but also strategies related to parking, design and the physical attributes of developments that reduce car-dependency. TDM strategies that support longer-term policies of land

[46] TCRP Report 95, Chapter 15, "Land Use and Site Design: Traveler Response to Transportation System Changes," 2003.

[47] Reid Ewing and Robert Cervero, "Travel and the Built Environment: A Meta Analysis," Journal of the American Planning Association, Vol. 76, Issue 3, June 2010.

Table 3.6: Range of TDM Strategies Potentially Addressed in the Land Development Process[48]

MEANS OF INFLUENCING TRAVEL BEHAVIOR	TDM STRATEGY (EXAMPLES)	SUPPORTING ACTION (LAND DEVELOPMENT PROCESS)
Trip Length		
Reduce quantity of vehicle miles	• Transit oriented development • Proximate commuting by allowing employees to relocate job to the branch office nearest their homes	• Clustering related land uses and providing more direct access (comprehensive plans and land development regulations) • Providing incentives to employers
Mode		
Increase efficiency of system to carry more people in the same number of vehicles	• Developing land support of alternative modes, such as transit oriented development • Limited parking supply • Offering alternative modes, such as transit, vanpooling, carpooling, bicycling, walking • Carsharing	• Locating land development to take advantage of existing underutilized transportation services such as transit routes • Providing on-site amenities, such as lockers, showers, bicycle parking, and preferential carpool parking (land development regulations) • Providing support services such as marketing, ridematching, and guaranteed ride home • Providing transportation services and physical transportation facilities off-site • Shared parking
Route		
Bypass congestion	• Transit oriented development • Providing route alternatives • High occupancy vehicle lanes	• Providing a grid system, street connectivity, and destinations within easy walking distance (comprehensive plans and land development regulations) • Implementing Advanced Traveler Information Systems
Regulation		
Mandate specific traffic management actions or outcomes by local ordinance	• State growth management provisions • Concurrency • Trip reduction ordinances • Zoning ordinances • Subdivision ordinances • Parking ordinances • High occupancy vehicle lanes	• Carried out primarily by land developers, property managers, employers, neighborhood associations

[48] Center for Urban Transportation Research (CUTR) "Incorporating TDM into the Land Development Process", FDOT –BD549-12, 2005 (http://www.nctr.usf.edu/pdf/576-11.pdf)

MEANS OF INFLUENCING TRAVEL BEHAVIOR	TDM STRATEGY (EXAMPLES)	SUPPORTING ACTION (LAND DEVELOPMENT PROCESS)
Cost		
Establish incentives and disincentives	• Parking pricing • Transit subsidies • Parking cash-out • High occupancy toll lanes • Commuter tax benefits	• Tax benefit program assistance
Frequency		
Reduce number of trips over given time period	• Providing on-site amenities • Compressed work week • Telework	• Providing physical facilities, such as employee cafeteria, fitness center, bank • Providing technical support to employers
Time of day/day of week		
Move trips to less congested periods or avoid vehicle trip completely	• Compressed work week • Staggered work hours • Telework • Flex time	• Unbundling parking from employment site leases • Providing technical support to employers

use and transportation interaction are similar to the list provided here in that they support the three basic components of smart land use – the three "Ds": density, diversity, and site design. Density objectives create demand for shared ride modes, such as transit and carpooling. Diversity creates access to activities that may shorten trip length, thereby creating more demand for bicycling and walking. One study added two more "Ds" in destination accessibility (access by various modes) and distance (to transit, shopping, and activity centers).[49] Of course, site design, as mentioned above, can work to reduce our reliance on the car by creating livable, walkable, and safe spaces, including streets.

Key Performance Measures

The discussion of potential strategies to address TDM and land use directly suggests several key performance measures, including:

- Vehicle trip reduction.
- VMT reduction.
- Person throughput on key facilities or corridors.
- Trip generation rates by land use.
- Distance of key trip generators to transit.

Perhaps the key to evaluating the role of TDM in addressing the land use-transportation interaction issue is assessing the quality, availability, and utilization of various non-SOV modes by land use or by destination.

[49] Reid Ewing and Robert Cervero, "Travel and the Built Environment: A Meta Analysis," Journal of the American Planning Association, Vol. 76, Issue 3, June 2010.

Integrating TDM into the Planning Process to Address Land Use Planning

Land use planning can involve a slightly different set of plans and actors than those policies and plans focused solely on the transportation system. Whereas integrating land use and transportation, or smart growth, is often a key goal of regional transportation plans, issues may arise at other planning levels. These other planning processes might include:

- Statewide land use and growth plans, including developments of regional impact.
- Regional land use or smart growth plans.
- Regional or state economic development plans.
- Regional transit plans that might incorporate TODs.
- Municipal general plan updates.
- Municipal zoning regulations.

Incorporating TDM into the site development process is most often handled at the municipal level and requires a well-documented process, requirements, and schedule, given that the TDM strategies are included within a larger site planning and approval process. Having said that, most TDM measures are negotiated as part of this process, requiring that all parties have access to technical resources on what strategies are most cost effective and applicable to a given need.

Best Practice Planning Examples

Examples that document the effectiveness of smart land use policies are still relatively rare, as few comprehensive initiatives have been implemented and even fewer evaluated. However, some studies have sought to assess travel behavior in transit-oriented neighborhoods. Additionally, there is some evidence from specific TOD projects. Finally, additional information exists on the impact of integrating TDM into the development site plan review process.

- In Lund, Sweden (see subsection on Economic Development above), the city's sustainable urban transport plan included the integration of BRT and integrated land use policies. The Lundalink BRT system was built beyond the urbanized area to encourage new development that would be less reliant on the automobile. The City of Lund purchased much of the land adjacent to the BRT route and is only approving less car-dependent developments.[50]
- TCRP Report 95, Chapter 15 on land use, compared commute mode shares before and after four new light rail stations and related transit-oriented developments were opened in the Portland, Oregon, region. The comparison shows that the car share was reduced in three of the four areas, whereas train use was up in all cases and the bus share increased in three of four areas. Interestingly, the bike and walk share was reduced or remained the same in two of the four locations. In fact, the increase in the non-motorized share in the Lloyd District, near downtown Portland, appears to have come from reduced bus use.[51]
- One recent study of new office developments that have incorporated TDM strategies comes from the Twin Cities region in Minnesota. A study of six office developments that implemented TDM programs in order to reduce parking requirements was summarized in a 2010 report. The office sites ranged from 200 to 2,300 employees and most provided incentives for commuting by transit or carpooling, including preferential parking spaces for carpools and vanpools. The study revealed that trip generation was reduced by 27% to 37% and parking demand was reduced 11% to 21%.[52]

[50] FHWA, "Managing Travel Demand: Applying European Perspectives to U.S. Practice," Report No. FHWA-PL-06-015, May 2006

[51] TCRP Report 95, Chapter 15, "Land Use and Site Design: Traveler Response to Transportation System Changes," 2003

[52] Spack Consulting, "TDM: An Analysis of the Effectiveness of TDM Plans in Reducing Traffic and Parking in the Minneapolis/St. Paul Metropolitan Area," January 2010.

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3.6 Goods Movement and Freight

How Can Demand Management Address Goods Movement and Freight?

The need to enhance goods movement and freight in regions is often a vital policy imperative for planners from an economic competitiveness standpoint. More than other policy issues, the ability to move freight efficiently in, around, and out of the region has direct implications to regional economies. While congestion relief for commuters and accessibility to destinations is important for economic competiveness, congestion in freight transportation has more direct ramifications to the economy. The value added by freight transportation to the national gross domestic product (GDP) is substantial. Coupled with extraordinary growth in foreign trade, spurred by globalization of supply chains and containerization, the amount of goods moving through the country has exploded, placing unique stresses not only on the gateways themselves but also to the transportation networks that support them.

Freight congestion is a fairly recent phenomenon because the interstates, together with the existing rail, water, and pipeline systems, provided adequate surface freight capacity from the 1960s through the 1980s. Deregulation in the 1970s changed the face of freight transportation in the country, removing modal and jurisdictional barriers for carriers.

While the impacts of congestion on freight logistics cannot be understated, the impacts of freight traffic on regional mobility are also a concern to planners. In some sections of the country and on specific road segments, truck traffic is a significant contributor to congestion (examples include traffic around ports, multimodal terminals, and border crossings). The challenge in terms of policy is to minimize shipper and freight costs while also minimizing the external impacts due to freight transportation (infrastructure damage, air quality impacts, congestion, etc). TDM can play a vital role in mitigating the interaction between trucks and cars by both managing the demand for goods movement during peak congested periods and by reducing overall personal vehicle demand when and where goods movement is a priority.

The link between TDM and goods movement is just being realized, with most planning agencies having yet to make the connection. The greatest step forward in integrating TDM into the planning process to address freight and goods movement would entail a simple realization that a link does exist. As agencies become more attuned to the potential for addressing goods movement issues with TDM, planning agencies might seek pilot projects to better manage the time and location of trucks on the transportation system. However, the ultimate form of integration may come in the form of mainstreaming TDM as a principal means to reduce overall vehicular demand, or the spatial and temporal distribution of that demand to better manage the flow of people and goods in an integrated system.

Potential TDM Strategies to Address Goods Movement and Freight

TDM strategies that remove bottlenecks in general transport also benefit freight transportation. However, specific approaches that incorporate technology to manage freight transportation and supply chain management are still emerging. Among the various freight related strategies listed in the Online TDM Encyclopedia, the following potential ideas for freight transportation management may be of interest and under the purview of regional transportation planners:[53]

- Improve rail and marine transportation infrastructure and services to make these modes more competitive with trucking.
- Organize regional delivery systems so fewer vehicle trips are needed to distribute goods (e.g., using common carriers that consolidate loads, rather than company fleets).
- Use smaller vehicles and human powered transport, particularly for distribution in urban areas.
- Implement fleet management programs that reduce vehicle mileage, use optimal sized vehicles for each trip, and ensure that fleet vehicles are maintained and operated in ways that reduce external costs (congestion, pollution, crash risk, etc.).
- Change freight delivery times to reduce congestion.
- Create pricing and tax policies that encourage efficient freight transport.

Some of these strategies have been combined, such as using pricing to influence freight delivery times, as evidenced in the Port of LA/Long Beach's PierPass program that assesses a fee to trucks that enter or exit the port facilities during peak hours in order to reduce congestion and concomitant emissions on I-710 through central LA.[54] Similarly, the 2011 Virginia Tax Incentives for Port Users program address congestion in Richmond by incentivizing the transfer of goods and containers through barge and rail.[55]

Key Performance Measures

As the connection between freight and demand management is fairly new, a common or recommended set of performance measures has not been developed. However, most of the TDM measures designed to

[53] FGM-AMOR, CIVITAS II: 2005-2009 Final Brochure, prepared for European Commission and CIVITAS GUARD, September 2010 (www.civitas.eu).

[54] Hans-Joachim Becker, Diana Runge, Urte Schwedler, Michael Abrahamm , Commercial Transport in European Cities: How do European cities meet the challenges of commercial transport? Experiences and case studies from the CIVITAS Programme of the European Commission, Berlin, July 2008, available at http://www. civitas-initiative. org/docs1/IVP_21. pdf ISSN 1613-1258

[55] Virginia Tax Incentives Fact Sheet provided by Barbara Nelson from the Richmond MPO (11/17/2011)

reduce the impedance of freight movement on overall traffic flow are as follows:

- Mode shift of goods from truck to rail or individual to consolidated deliveries.
- Time shift of goods movement to off-peak hours.
- Route shift of goods movement to less congested facilities.

Integrating TDM into the Planning Process to Address Goods Movement and Freight

Including TDM into the planning process to help meet regional goods movement policy involves identifying those strategies that have goals and objectives that work to meet that policy. It is imperative that an agency develop a framework of regional goals and relevant TDM strategies to help identify specific solutions that can be put forth as feasible options in the planning process.[56] These form the platform of TDM by which an agency can influence the planning process. For example, an agency can take the following steps to advance TDM for goods movement:

- Seek ways to apply demand management to goods movement, such as real-time information, eco-driving, peak period pricing, mode shift, etc.
- Incorporate the strategies and related objectives of TDM that help address a goods movement policy into the general planning factors in the transportation planning process.
- Ensure that congestion management processes incorporate those TDM strategies that work to improve goods movement so that they work in concert with other strategies to maximize the efficiency potential for the transportation system.
- Incorporate TDM strategies that support goods movement enhancement as potential solutions in Major Investment Studies (MIS) to help address the factors influencing project solutions while efficiently and effectively meeting the needs of the community.
- Ensure that goods movement TDM strategies are part of the public involvement dialogue to gain the broad support of the community.

Once specific TDM strategies to address goods movement are incorporated into the transportation plan, it is important that agencies generate a list of high-level planning considerations related to these specific strategies. These considerations can ensure proper attention to critical factors that can create challenges in the implementation phase. Such challenges can reduce the potential success of these TDM strategies by limiting their implementation to meet a goods movement policy. Such considerations might include geometric design and cross-section, operational flexibility, decision-making needs, traffic control devices, enforcement, evaluation, monitoring, interoperability, marketing, legal and institutional issues, support facilities and services, and analysis tools and techniques. While these considerations appear very specific and may be too detailed for the regional plan, the general consideration of these issues at the planning level ensures that they are included within the context of the overall network and can help ensure their successful implementation.

[56] P. Worth, et al. Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference. FHWA-HOP-10-027. SAIC, Kittelson and Associates, Inc., and ICF International, Inc., 2010.

Self-Sustaining Urban Freight Traffic Management System in New York City

In a quest to find ways to encourage off-hour deliveries in New York City, the U.S. DOT's Commercial Remote Sensing and Spatial Information Technology Applications Program funded a project to design and develop a self-sustaining urban freight traffic management system for the New York City metro area. The project focused exclusively on urban deliveries, representing the bulk of freight traffic in urban areas. These urban deliveries are the target for freight demand management programs aimed at reducing the congestion they produce. In comparison to other segments of the freight industry, these deliveries typically have longer delivery tours, may incur tolls in cordon areas, and tend to have smaller shipment sizes.

The project is two-fold – including system design and pilot testing. It integrates remote sensing technology, freight demand management, traffic simulation, and policy. The project combines the revenue generation power of time-of-day pricing, with tax deductions to receivers willing to accept off-peak deliveries, and global positioning system (GPS)-based traffic monitoring, to induce a shift of truck traffic to the off-hours. Project results indicate that (1) financial incentives to receivers will be effective in inducing a shift of carriers to the off-hours; (2) the switch of truck traffic to the off-hours brings about substantial economic benefits, according to traffic simulations; (3) on average, a truck traveling in the off-hours achieves speeds of about 8 miles per hour, while in the regular hours they typically fall below 3 miles per hour, as measured by GPS devices on participant vehicles; and (4) there are substantial reductions in service times during the off-hours.

The project is one of the first in the world to successfully integrate the use of remote sensing technology (GPS enabled cell phones) as part of a system to reduce truck traffic in the congested hours of the day, through the use of incentives to receivers.

Source: U.S. DOT, Integrative Freight Demand Management in the New York City Metropolitan Area, (http://transp.rpi.edu/~usdotp/OHD_FINAL_REPORT. pdf)

Best Practice Planning Examples

One region that has made progress in linking freight planning with transportation planning and programming is the St. Louis regional MPO known as the East-West Gateway Coordinating Council (EWGCC). East-West Gateway has developed a framework to illustrate how freight planning activities fit within regional transportation planning processes and the development of critical planning documents. The creation of this framework has helped clearly illustrate the importance of freight issues in the overall process and helps ensure that critical freight transportation projects are not overlooked when projects are prioritized and funds are allocated. This planning framework could serve as a model to further integrate TDM into the transportation planning process in conjunction with goods movement.

Specific initiatives in the U.S., such as the Cross-Town Improvement Project (C-TIP) in the Kansas City region, are based on the concept of "freight travel demand management." The C-TIP is designed to coordinate cross-town traffic to reduce empty moves between terminals, bringing together traffic management systems with freight operations in order to manage freight demands on the highway system. The C-TIP project grew to incorporate all of the information and guidance strategies below:[57]

- **Intermodal Move Exchange (IMEX)** - facilitate the exchange of load data and availability information between railroads, terminal operators, and trucking companies. The primary function will be to allow collaboration on defining pickup and delivery schedules and locations that maximize the potential for linking moves, and eliminating bobtail and empty moves.

- **Chassis Utilization Tracking (CUT)** - provide a means for chassis owners and users to accurately account for asset use, which is crucial for the allotment of fees, and to maintain the proper balance of chassis to support cross-town and other container deliveries.
- **Real-Time Traffic Monitoring (RTTM)** - provide a means for up-to-the-minute information regarding roadway conditions, travel speeds, and predicted travel times to be captured and passed along to the trucking community. Using a combination of traditional roadway sensors, traffic probes (i.e., vehicles that report their progress while traveling on the roadways), and third party providers, RTTM will provide the traffic information necessary for drivers and dispatchers to make informed decisions regarding routing and departure times.
- **Dynamic Route Guidance (DRG)** - the DRG engine of RTTM will utilize inputs from RTTM and a Geographic Information System (GIS) source, along with simulation tools, to act as an intelligence tool to provide real-time visual routing around congested areas.
- **Wireless Drayage Updating (WDU)** - provide a means to wirelessly and inexpensively exchange information with drivers regarding trip assignments, traffic congestion information, trip status, and location information through a truck-mounted driver interface device (T-MDID).

In Europe, the multi-city CIVITAS (CIty-VITAlity-Sustainability) initiative is specifically focused on identifying and testing strategies for urban commercial transport. With the wide variety of local conditions to account for, a broad spectrum of strategies and measures (47 in all) were tested in 20 European cities.[58] Three main categories of goods movement strategies were identified:

- Intelligent use of vehicles approach – combines three strategic areas: distribution, fleet management, and car sharing. More than one third of the measures in the cities aimed to reduce the number of vehicles in circulation, number of supply trips, mileage and transport related air pollutant emissions, and noise by establishing distribution schemes and centers.
- Vehicle technology approach – introducing clean vehicles and clean fleets.
- Incentives approach – incentives or restrictions related measures to solve special problems, such as loading, unloading, access, and parking of the commercial transport.

Evaluation studies concluded that the measures showed great promise and were relatively successful where fully implemented. However, private sector and user opposition to the measures inhibited their full implementation and testing. In Toulouse and La Rochelle, France, electric delivery vehicles were used in the pedestrian zone, reducing CO_2 by 58%. In Burgos, Spain, new regulations on deliveries within a "clean zone" reduced the number of delivery vehicles by almost half (from 480 to 260 per day).[59]

[57] Cross-town Improvement Project, (http://www.ctip-us.com/contact.htm)

[58] FGM-AMOR, CIVITAS II: 2005-2009 Final Brochure, prepared for European Commission and CIVITAS GUARD, September 2010 (www.civitas.eu).

[59] Hans-Joachim Becker, Diana Runge, Urte Schwedler, Michael Abrahamm , Commercial Transport in European Cities: How do European cities meet the challenges of commercial transport? Experiences and case studies from the CIVITAS Programme of the European Commission, Berlin, July 2008, available at http://www.civitas-initiative.org/docs1/IVP_21.pdf ISSN 1613-1258

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3.7 Quality of Life, Livability, and Health

How Can Demand Management Address Quality of Life, Livability, and Health?
A policy objective that is of growing interest is quality of life. While often rather subjective, the sum total of the experience of living in a place, including the transportation system, affects its citizens' perceived quality of life. Availability of a range of quality, affordable travel choices can be part of this sense of good quality of urban living. This concept of quality of life is currently being realized through the notion of livability.

As it relates to transportation systems and services, livability seeks to maximize the positive benefits of mobility, accessibility, and economic development while minimizing the negative side effects, such as environmental, safety, and social concerns. It also recognizes the potential health benefits of certain travel options, especially bicycling and walking, which is part of quality of life. The FHWA Livability Initiative is part of the Department of Housing and Urban Development (HUD)/DOT/Environmental Protection Agency (EPA) Partnership for Sustainable Communities.[60] This connection points to the relationship between sustainable transportation and livable communities. Communities that have good, well-used travel choices equally available to all citizens are considered more livable than communities totally dependent on the single-occupant auto. Communities with a high use of walking and bicycling and that are well connected by transit will likely have healthier citizens and residents who rate the quality of life in their towns as high.

FHWA's definition of livability underscores the role of TDM:

> *Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safe streets. This includes addressing safety and capacity issues on all roads through better planning and design, maximizing and expanding new technologies such as ITS and the use of quiet pavements, using Travel Demand Management approaches to system planning and operations, etc.*[61]

One link between livability and sustainability is found within this definition. Again, sustainability includes three key components: economic, environmental, and social. This social component is founded in the notion that the transportation system should be inclusive of all segments of society, akin to the desire for environmental justice. By defining livability as founded in opportunities, access, affordability, quality, and safety, FHWA is making the case for sustainable transportation.

The HUD/DOT/EPA Partnership for Sustainable Communities has set forth six principles for livable communities, the first of which is directly related to providing more transportation choices. That principle is to "develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health."[62]

[60] HUD/DOT/EPA Partnership for Sustainable Community, EPA webpage, http://www.epa.gov/smartgrowth/partnership/index.html. 2010

[61] VTPI monograph: Sustainability and Livability: Summary of Definitions, Goals, Objectives, and Performance Indicators, July 2010

[62] HUD/DOT/EPA Partnership for Sustainable Community, EPA webpage, http://www.epa.gov/smartgrowth/partnership/index.html. 2010

VTPI defines livability as "the subset of sustainability goals" that directly affect communities, such as:

- Local economic development.
- Environmental quality.
- Equity.
- Affordability.
- Public safety and health.
- Community cohesion (positive interaction among neighbors).[63]

Livability, and its related concepts of quality of life, healthy transportation, and sustainable travel, are a rapidly emerging set of policy objectives in many transportation plans. While the health and well-being of citizens is an overriding goal of many plans, the integration of TDM as a means to achieve this is relatively new.

Planning agencies generally start by defining livability in terms of improved bicycle and pedestrian options. However, when TDM becomes more rationalized in the planning process, the concept of livability requires new performance measures, such as user satisfaction of the new travel options. Finally, when TDM integration is mainstreamed, concepts such as livability become as important as traditional objectives, such as system efficiency and congestion relief.

Potential TDM Strategies to Address Quality of Life, Livability, and Health

Beyond desiring a broader range of travel choices, many demand management strategies directly enhance livability and quality of life as they afford travelers with the ability to balance various personal and family needs. Flexible work schedules, telecommuting, and compressed work weeks afford commuters flexibility with when and where they work. Bicycle and walk facilities allow residents a healthier means of traveling shorter distances. Quality public transit and vanpooling allow commuters the ability to avoid the stress of driving to work. Sustainable transportation affords communities the ability to address larger climate change concerns and a feeling that they can "do their part." Finally, given the role of TDM and safety, discussed elsewhere in this chapter, a sense of enhanced safety is also associated with livability. This may involve travel options that are perceived as attractive, convenient, and safe. But it also means that conflicts between vehicles and active modes (bike and walk) are minimized so that travelers can feel confident and safe in using these modes. For example, one of the main reasons that so few school age children walk or ride a bike to school is parental fear that these modes are not safe in the face of growing, localized traffic congestion.

Livability, and its connection to sustainability, can be supported by most TDM strategies as demand management seeks to mitigate many of the negative impacts of traffic congestion, increase a sense of safety, and reduce our reliance on the single-occupant automobile. TDM strategies that seem to be particularly well suited to fulfill livability goals include:

- Bicycle and walk facilities, especially with neighborhood connectivity and continuity.
- Programs to encourage active transportation modes and educate travelers on their benefits.
- Neighborhood focused initiatives, including individualized marketing, and school pool programs (neighborhood children walking to school together).
- Alternative work arrangement strategies, such as telecommuting, flextime, and compressed work weeks that give travelers flexibility to balance work and home schedules.

[63] VTPI monograph: Sustainability and Livability: Summary of Definitions, Goals, Objectives, and Performance Indicators, July 2010

- Reliable and actionable real-time, multimodal traveler information that allows travelers to minimize uncertainty in their travel planning and avoid the most congested time periods and locations.

Key Performance Measures

Measures intended to evaluate the effectiveness of TDM in meeting livability objectives can be somewhat subjective, as quality of life and livability are perceived states of being. However, certain indicators can point to how well travel choices and the TDM measures are contributing to these perceptions, such as:

- Awareness of transportation services and mobility options.
- Satisfaction with travel options and incentives to use them.
- Utilization of travel options.
- Proportion of daily travel taken with non-motorized modes.

Many of these indicators require the direct surveying of target markets to which the travel options are intended. At least on a pilot basis, these efforts should be relatively straightforward and low cost.

Integrating TDM into the Planning Process to Address Quality of Life, Livability, and Health

Integrating TDM into planning processes aimed at improving livability is a relatively new challenge for the U.S. However, it is gaining in importance as sustainability and "green living" take hold in areas across the nation. TDM aimed at improving livability is supported by recent national initiatives, such as those demonstrated through the HUD/DOT/EPA partnership and the FHWA Livability Initiative. As stated earlier, livability can mean different things to different people.

It may come down to a great "customer" focus for our transportation system. Do we treat the users of the transportation system as customers to be served or vehicles to be moved? The British Highways Agency (equivalent to FHWA) has assumed a mission that better focused on the customer by seeking to serve "safer journeys, informed travelers and reliable journeys."[64] These are all precepts of a more livable, sustainable society as defined by the MetroPlan Orlando 2040 Long Range Transportation Plan, which incorporates alternative land use (see box).

A planning process that better incorporates customer or user views may be a good start in this direction. The scenario-based planning process, which seeks to define alternative futures rather than alternative transportation systems, is supportive of this approach. General population surveys that seek to understand values important to travelers may have value in gauging how transport fits into everyday life, since travel is a derived demand.

Having said this, planning processes that elevate TDM, namely transit and active transportation modes, to equals with road capacity solutions, will tend to support policy objectives related to livability.

Best Practice Planning Examples

The FHWA's Livability Initiative website referenced previously provides many case examples of cities and regions that are planning for more livable communities within the context of a sustainable transportation system. The case studies vary in strategies adopted, geographic location, and size of the city, region, or state to adopt strategies that support livability. A few highlights from these case studies include:

- "Reclaiming Streets" projects have been implemented in several large cities, including New York, Washington D.C., and San Francisco, where road space is being converted to bicycle lanes and pedestrian areas. In St. Louis, a Great Streets competition selected 3-4 urban streets for redesign. This is in keeping with the Complete Streets movement that embraces all users (e.g., pedestrians, bicycles, cars, delivery vehicles).

[64]Highways Agency, www.highways.gov.uk/

- The City of Raleigh, North Carolina, is making livability a foundation of its 2030 transportation element of the city's general plan. Raleigh's Transportation Plan contains policies that will create a well-connected, multi-modal transportation network, support increased densities, help walking become more practical for short trips, support bicycling for both short- and long-distance trips, improve transit to serve frequented destinations, conserve energy resources, reduce greenhouse gas emissions and air pollution, and do so while maintaining vehicular access and circulation.
- Many urban areas are seeking to better integrate land use/transportation decisions, and this can lead to more livable communities that enjoy a broad set of travel options and have access to services and amenities that require less reliance on cars. These case studies are discussed in the section on land use.

Orlando 2040 Long Range Transportation Plan Incorporates Alternative Land Use

Between March 2006 and August 2007, more than 20,000 Central Floridians answered the question "How Shall We Grow?" as part of a public input process involving community meetings, presentations, and surveys. The result was a shared community vision for growth in Central Florida. Citizens and local leaders identified several principles to guide future transportation decisions, including: preserve open space; provide transportation choices; and foster distinct, attractive places to live.

A study commissioned for the 2040 Long Range Transportation Plan compared a transportation plan shaped using the principles from "How Shall We Grow?" versus a plan that solely relies on trend land use patterns in the three-county area. The "How Shall We Grow?" alternative land use, which creates density along designated corridors, generated fewer VMT, fewer VHT, and significant air quality benefits when compared to the trend land use. The alternative land use also increased the role of transit in Central Florida's future transportation system by better connecting land use and transportation in the region. Noting the impact of the alternative land use identified during the planning process, the MetroPlan Orlando Board opted to develop the 2040 Long Range Transportation Plan using the principles of "How Shall We Grow?" versus the trend land use.

(Source: MetroPlan Orlando (http://www. metroplanorlando.com/files/view/2040_lrtp_scope_of_services.pdf)

KEY RESOURCES

FHWA – Livability Initiative - http://www.fhwa.dot.gov/livability/

HUD/DOT/EPA Partnership for Sustainable Community, EPA webpage, http://www.epa.gov/smartgrowth/partnership/index.html, 2010

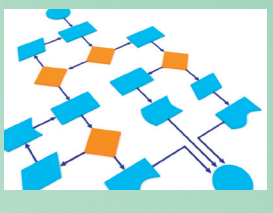
MetroPlan Orlando (http://www. metroplanorlando.com/files/view/2040_lrtp_scope_of_services.pdf)

VTPI monograph: Sustainability and Livability: Summary of Definitions, Goals, Objectives, and Performance Indicators, July 2010

Highways Agency, www.highways.gov.uk/


Airport

Integration of TDM into the Planning Process



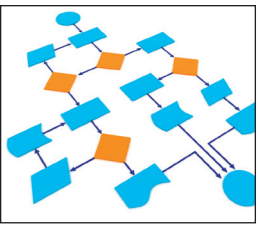
Context

Statewide Planning

Metropolitan Planning

Corridor Planning

Local Planning



4. Integration of TDM Into the Planning Process–Context

Chapter 3 dealt with the role and the opportunity of TDM to address some of the typical policy issues faced by planning agencies. While understanding the role at a policy level is critical, understanding how it fits into the transportation planning process is the primary focus of the desk reference. That focus on the transportation planning process can be accomplished in two ways. First, TDM integration could be conceptualized and illustrated by using a generalized description of transportation planning process. This would help planners understand the need to integrate TDM at each step of the process. The second way to discuss the integration of TDM in the planning process is to describe how it might be accomplished at various planning levels, be it local, state, regional, or corridor levels. The advantage here is that the planning context is more "real world" when discussed within actual organizations who work within various geographic and political scopes.

CHAPTER ACRONYM LIST

DOT	Department of Transportation
FHWA	Federal Highway Administration
MPO	Metropolitan Planning Organization
SMART	Specific, Measurable, Achievable, Realistic, and Time-bound
SOV	Single Occupant Vehicle
TDM	Travel Demand Management
TIP	Transportation Improvement Program
VMT	Vehicle Miles Traveled

The next four chapters will seek to provide guidance on where and how state DOTs, MPOs, and other local agencies should integrate TDM as part of their planning processes. Four levels of planning are discussed in this chapter:

- Statewide planning – e.g., system planning, policy direction, statewide TDM programs. This primarily falls under the purview of the state DOT.
- Metropolitan planning – e.g., long-range regional transportation plans, congestion management process activities undertaken by metropolitan-level planning organizations.
- Corridor planning – e.g., MIS, congestion management processes performed as part of specific corridor planning.
- Local planning – e.g., land use planning activities conducted at the local level by city planning organizations.

Each geographic level has unique opportunities to link TDM into the myriad activities typically undertaken as part of the planning scope. But regardless of the geographic or agency level, successful integration of TDM depends on developing an organizational mindset, if not a mission, that plans and implements policies and infrastructure investments in a modally and functionally coordinated way. The primary goal of these policies and investments must be to improve system efficiency and contribute to sustainability. This may require transportation agencies to collaborate more fully within and outside their regions, divisions, departments, and districts.

In general, recent federal planning guidance suggests that if plans are developed using an "objectives-driven, performance-based" process,[65] then TDM cannot get "lost in the process." The basic premise of this planning process is that:

[65] FHWA, Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance-Based Approach – A Guidebook, FHWA-HOP-10-026, 2010.

- goals and measurable objectives that advance operational performance outcomes of the transportation system are defined, then
- performance measures are used to track progress toward objectives, and
- TDM strategies are selected to meet the measurable objectives.

The objectives-driven process seeks solutions to fulfill key policy objectives rather than working backwards from desired projects that seek to match up to broad goals and objectives. In the objectives-driven, performance-based approach, planners and implementers work together to find workable measures to meet agreed-upon objectives. The performance-based process dictates that demonstrated accomplishments toward meeting key objectives be documented and included or expanded in future plans. To sum up, this approach focuses on objectives first and foremost and is consistent with the integration of TDM into the planning process, because TDM benefits cross many policy objectives, as shown in Chapter 3.

However, before discussing TDM integration within the context of planning levels, this chapter describes TDM integration concepts within a generalized transportation planning process.

Four opportunities identified in other recent FHWA guidance on including operations in statewide planning are of particular interest to TDM integration and should serve as key suggestions for the generalized planning process and the various planning levels described below:[66]

- Develop Multidisciplinary Teams/Initiatives.
- Use an Objectives-Driven, Performance-Based Approach.
- Use a Strategic Business Plan to Focus on Integration of Operations, Safety, and Planning.
- Foster Multimodal Coordination.

The first two opportunities in particular reflect themes that recur frequently in opportunities described in subsequent sections of this document. Establishing multidisciplinary teams and a performance-based approach to planning at all levels will result in the setting of realistic and measurable objectives as well as improved and focused data collection and evaluation. The last two opportunities relate to the agency's strategic focus and structure. In all cases, if these themes are pervasive within the agency, it will benefit decision-making at all levels, not only for TDM.

4.1 Integration of TDM into the Activities in the Transportation Planning Process

The approach to integrating TDM does not require the development of a new process. Nor does it need to be a cumbersome add-on to an agency's already full plate of planning processes. In fact, the organization and structure of Chapters 5 through 8 steers clear of suggesting any new requirements or processes. Rather, it focuses on identifying how better TDM can play a role in the existing activities carried out under the transportation planning process by states, MPOs, and local agencies.

To this end, it is important to identify the key planning activities that are universal across planning levels and agencies. As part of a national transportation planning capacity building program, FHWA published a briefing book for decision-makers describing the transportation planning process.[67] Using the briefing book and further developments in planning for operations as guidance, the following six activities within the transportation planning process are fairly representative and universal across all the agencies.

Activity 1 – Regional Vision and Goals

Agencies typically are driven by strategic vision and goals. Integrating TDM at the vision setting stage can include establishing goals such as enhancing travel choices or other long-term goals to manage demand

[66] FHWA, Statewide Opportunities for Integrating Operations, Safety and Multimodal Planning: A Reference Manual, 2010

[67] FHWA, The Transportation Planning Process: Key Issues - A Briefing Book for Transportation Decision-makers, Officials, and Staff, FHWA-HEP-07-039, September 2007.

in tandem with other synergistic elements such as network efficiency and land use. An overall vision that calls for a sustainable transportation system and livable communities will also necessarily draw upon TDM approaches as well.

For TDM, the simplest step is to introduce the concept of managing demand as a high-level goal of the agency. In the metropolitan transportation planning process, goals stem from the values inherent in the region's vision. The goals may be created during the development or update of the metropolitan transportation plan or in anticipation of the next update cycle.

Increasingly, TDM is making its way into agency mission statements, and ranges from being included in supportive objectives to being a primary policy statement. For example, the Pinellas County Florida 2035 Long Range Transportation Plan contains a rich list of 14 policies to support its TDM-related objective to "reduce traffic congestion and positively impact air quality by decreasing the use of single occupant vehicles (SOV) at peak hours." These policies range from developing VMT reduction goals to encouraging use and promotion of TDM strategies. The introduction of TDM at this stage can then initiate more in-depth planning related to defining specific objectives to help ensure TDM's success.

Activity 2 - Setting Objectives for TDM
Objective setting is a vital part of an agency's planning process. As the planning process evolves toward an objective-based approach to planning rather than a project-based approach, demand management- related objectives can start to drive the planning process. Working with stakeholders in the region, planners can develop a small number of demand management-related SMART[68] objectives that accurately reflect what the region would like to achieve and that stakeholders believe can be achieved within a certain time frame. These objectives may start out vague and then grow in specificity as the iterative process to define and refine the objectives advances.

Activity 3 - Definition of Performance Measures
Performance measures are driven by objectives. TDM performance measures are wide and varied depending on the objective. Chapter 3 provides more details on the key performance measures available for TDM for various objectives.

Activity 4 - Assessment and Selection of Strategies and Programs to Support Objectives
A plan that fully integrates TDM will include a balance of demand and supply side solutions for consideration. At this stage, TDM should not be an "add on" to all other strategies. In fact, TDM strategies should be afforded the same rigor and consideration as all other solution strategies, using specialized TDM models and protocols as necessary. TDM performance measures developed during the previous activity allow for direct comparison with other solutions in a meaningful way.

Activity 5 - Integration of Strategies into Plans and Funding Programs
By this activity, TDM, if broadly defined as suggested in Chapter 2, will be integrated throughout the plan, and not confined to a single section or citation. In fact, TDM will constitute an overriding philosophy for mobility and accessibility rather than a means simply to mitigate certain negative aspects of the transportation system. The generation of projects and activities to be included in transportation programming documents will include more options than traditional commuter ridesharing with TDM broadly defined as a program/set of strategies to provide enhanced travel choices.

Activity 6 - Monitoring and Evaluation of Progress toward Objectives
Integration actions in this activity ensure that TDM performance is measured in terms that relate to the operation of the transportation system, such as delay and person throughput. TDM cost effectiveness is compared on an equal basis with other capital and operational strategies. TDM effectiveness and performance are reported to decision-makers in a meaningful and understandable manner.

[68] SMART – Specific, Measurable, Achievable, Realistic, and Timebound

5. Integration of TDM at the Statewide Planning Level

State DOTs maintain and operate large and complex infrastructure systems. State DOTs typically control the high-capacity, high-speed components of the state's highway system that provide connectivity, accessibility, and mobility between centers of activity and with the rest of the nation, especially along key trade routes and corridors. Most DOTs are responsible for planning, constructing, and operating all of the interstate system and most of the major arterial systems in their states. DOTs have an interest in maintaining system mobility, reducing congestion, and addressing policy issues in the most efficient and cost-effective way possible and thus have a stake in initiating and partnering in TDM policies and programs.

The circumstances within which states can embrace TDM more fully have never been more compelling. Financial challenges are forcing agencies that had spent the past few decades growing their transportation systems to re-think their expansion plans toward preservation and efficiency – to squeeze every last bit of capacity out of their existing systems.

The state can assume a great variety of roles to establish, develop, and enhance the effectiveness of traditional TDM. Potential roles range from coordination to grant provision to direct operation of TDM programs. Clearly, the state's resources, its size, and economic complexity are factors that will point the way toward the most appropriate practices to institute. To be effective at any level of commitment, though, TDM needs to be in the "fabric" of the decision-making process.

A state DOT's everyday decisions and activities impact highway demand significantly, whether or not the state agency has a formal TDM program. These activities may not be organized within a single decision-making structure, because a DOT's operations, planning, and policy functions have evolved as separate and independent procedures. It is highly likely that state transportation agencies can take cost-effective steps to recognize, harness, and amplify the demand

CHAPTER ACRONYM LIST

CBD	Central Business District
CMAQ	Congestion Mitigation and Air Quality
CTR	Commute Trip Reduction
CUTR	Center for Urban Transportation Research
DOT	Department of Transportation
DRI	Developments of Regional Impact
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
GTEC	Growth and Transportation Efficiency Center
HERO	Highway Emergency Response Operations
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LOS	Level of Service
LRTP	Long-range Transportation Plan
METRIC	Mobility Enhancement and Trip Reduction Index to aid in Comparison
MPO	Metropolitan Planning Organization
NTD	National Transit Database
SHSP	Strategic Highway Safety Plan
SLRTP	Statewide Long-Range Transportation Plans
SMART	Smart, Measurable, Achievable, Realistic, and Time-bound
SOV	Single Occupancy Vehicle
STP	Surface Transportation Program
TDM	Travel Demand Management
TEL	Tolled Express Lane
VHT	Vehicle Hours Travelled
VMT	Vehicle Miles Travelled
VTR	Vehicle Trip Reduction

management activities they are already engaged in, by strengthening departmental linkages as a low-cost way to build the foundation of a TDM initiative.

A scan of statewide plans found that several had adopted a "capacity-last" policy or had set or reached absolute limits on the amount of highway capacity that they would provide in certain corridors or subareas. Others, in response to a policy decision to limit the transportation sector's contribution to global warming or to support statewide energy conservation policies, had set VMT growth limits or had set targets for an absolute reduction in VMT, relative to current levels. Both of these policy directions are quite compatible with the introduction or expansion or TDM strategies into statewide plans.

KEY TAKEAWAYS

States operate facilities that are vital to the well-being of residents and businesses, and states have a stake in managing demand on their system.

States can assume a variety of appropriate roles, from coordination and grant provision to direct operation.

To be effective, TDM should be in the "fabric" of the decision-making process concerning mobility.

The statewide management and/or coordination of TDM activities offers several benefits: 1) it helps to ensure a strong level of performance accountability; 2) it promotes higher levels of program visibility through marketing efforts that have a pervasive and consistent theme and message, and 3) it promotes efficiency by reducing or eliminating duplication of effort.

5.1 What Plans Should TDM be Included In?

Federal requirements for the development of statewide plans are generally less prescriptive than those for MPO plans. Therefore, very few states develop plans that follow the traditional planning procedures most commonly found in their metropolitan-level counterparts. Moreover, state DOTs have far greater responsibility for system preservation and operations over multiple modes and have a limited role in land-use planning. Typically, statewide transportation plans reflect these differences in policy orientations, requirements, and responsibilities.[69] In general, statewide plans are policy-based and include discussions on the plan's purpose, its visions, goals and guiding principles, transportation trends and needs, the issue of transportation financing, and recommended actions. Statewide plans generally fall into one of three categories: 1) policy-focused plans, which articulate goals, objectives, and the desired level of future funding levels/allocation among expansion, preservation, and operations functions; 2) corridor-based plans, which describe desired investments and policies to meet statewide corridor-level strategic needs; and 3) project-based plans, which provide a list of prioritized potential individual projects for implementation.[70]

A wide variety of statewide transportation plans and planning processes could include TDM as an integral element, as enumerated in Table 5.1:

[69] A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix C – Integrating Travel Demand Management in the Statewide Transportation Planning Process: Draft, March 22, 2010, pg. C-1

[70] A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix C – Integrating Travel Demand Management in the Statewide Transportation Planning Process: Draft, March 22, 2010, pg. C-1

Table 5.1: Statewide Planning

Type of Plan	How to Integrate TDM/Role of TDM
Statewide Long-Range Transportation Plans (SLRTP)	• Adopt a "capacity-last" policy setting limits on the amount of highway capacity a state will provide in certain corridors or subareas. • Set VMT growth limits or targets for an absolute reduction in VMT, relative to current levels (in support of energy conservation policies).
Land Use Policies and Plans	• Work with regional and local governments to assess the need for TDM to mitigate the impacts of large-scale developments (Developments of Regional Impacts [DRIs]) on adjacent highways. • Initiate "smart growth" programs to provide technical and policy guidance in local land use and zoning decisions that align a state's ability and intention to provide state system highway capacity with a locality's need and desire for land development or redevelopment.
Tolling, Pricing, and Taxing Policy	• Implement variably priced HOT facilities that allocate capacity based upon market demand. These pricing strategies help state DOTs better manage demand and achieve better performance of their system. • Note: Some states feel that equity issues and other consequences associated with such pricing measures require additional study and understanding prior to committing to their implementation.
Freight Plans	• Identify, sign, and map key truck routes on roadway segments and corridors that have the appropriate functional and alignment characteristics (e.g., turning radii, adequate shoulders) to accommodate single and multiple-unit vehicles in the traffic stream. • Identify locations at which low-cost improvements can improve traffic flow and throughput significantly with little or no additions to capacity.
Operations and ITS Plans	• Operate variable signing and other infrastructure control mechanisms to permit flexible system management in peak and off-peak periods of demand by, for example, changing hours of operation, permitting one or two way operation, changing vehicle occupancy requirements, etc.
Construction and Development Plans	• Employ variable message signing, flexible signal timing and public relations campaigns for high-impact capital projects to alert motorists of construction activities, allowing them the opportunity to reroute their trip or to change their travel times. • Form partnerships (highway and transit providers) to increase transit service opportunities, and to mitigate congestion in construction zones.
Multimodal Plans (various state DOT plans that deal with multimodal issues including new infrastructure projects)	• Operate statewide TDM programs and perform planning that includes the means to integrate TDM activities with other state functions. • Incorporate telecommunication technologies that have the potential to improve the efficiency of the transportation system, relieve congestion, decrease energy consumption, and improve air quality by reducing the need to travel.

5.2 What Is Your Capability with TDM at the State Planning Level?

This desk reference will be utilizing the guidance based on different levels of existing experience with TDM and transportation planning. Table 5.2 provides examples of how existing state DOTs might integrate TDM into their planning processes. This should assist users in determining the nature and location of key guidance within this section that is most applicable to their state. Three levels of TDM integration are presented: ad hoc, defined, and optimized. These levels correspond to the Institutional Capability Maturity Model proposed by FHWA in its Guide for Improving Capability for Systems Operation and Management.[71]

[71] SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

State DOTs with minimal experience in integrating TDM (ad hoc level) into their plans and policies might only include TDM when suggested by outside interests or when TDM might be required to mitigate the immediate impacts of a specific project (such as highway reconstruction projects). At the next level (defined), a state DOT might include TDM in most plans and policies as a means to increase travel choices and meet certain policy objectives, such as clean air or congestion reduction. Finally, when TDM becomes optimized (level 3), TDM is a key strategic element in most or all statewide plans and policies and is viewed as a primary means to efficiently operate the transportation system and meet most statewide policy objectives.

Table 5.2 provides specific examples of how a state DOT might work to integrate demand management into statewide transportation planning efforts at different levels of capability.

This matrix is intended to assist the reader in determining where his or her organization fits in terms of the capability levels described above. Once the reader has determined the appropriate capability level and identified the critical step on which the agency is focused, specific actions to move from one level to the next are suggested in the next section.

In terms of developing goals and objectives, most DOTs have the same fundamental mission: *to provide a safe, efficient, cost-effective, and reliable transportation system for both people and goods that supports economic development, improves the quality of life, and is sensitive to the environment.*[72] Nearly all states clearly articulate that they will shift their focus from constructing new facilities to meet current and future demand to one of managing demand and improving the efficiency of existing supply. To justify this shift in focus, many plans educate the public on the benefits of TDM and why the state is pursuing such strategies. Most states identify a wide range of options that will improve system efficiency by reducing demand. Strategies include maximizing the efficient use of the existing system, coordinating land use and transportation planning, encouraging sustainable development patterns, promoting and increasing transportation choices for people and freight, enhancing transit and rail service, deploying advanced technology, and various forms of pricing.[73] Using that mission and rationale as a touchstone, states should develop explicit, specific goals and SMART objectives for TDM.

Performance-based planning serves an important function for communicating and coordinating between a DOT's decision makers, policymakers, and the public and for assessing progress toward achieving the goals and objectives outlined above. Combined with data and analysis tools, performance measures serve an important role in helping to provide a basis for prioritizing investments. When coordinated with planned operations activities such as the implementation of ITS infrastructure and TDM programs, the data collection efforts required for performance measures can be supported with limited additional cost. These performance measures can then be utilized in other documents as well as regional and corridor planning efforts. TDM performance measures can suffer from two issues. First, TDM is more often measured in terms of "output" (e.g., how many carpools were formed or employers registered) than "outcome" (e.g., system impacts such as VMT reduction, delay reduction, or increases in person throughput.) Second, TDM performance measures are often not readily translatable to metrics used by highway planners. For example, VMT can be converted to delay reduction with some simple assumptions, but VMT reduction, in and of itself, is really only a surrogate, suggestive of other impacts, (delay, emissions, etc.) Specific TDM performance measures are enumerated and discussed in Chapter 3.

[72] A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix C – Integrating Travel Demand Management in the Statewide Transportation Planning Process: Draft, March 22, 2010, pg. C-3

[73] A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix C – Integrating Travel Demand Management in the Statewide Transportation Planning Process: Draft, March 22, 2010, pg. C-2

Table 5.2: State-level Self-Assessment Matrix

Planning Activities	Level 1 Ad-Hoc	Level 2 Defined	Level 3 Optimized
Establishing Vision and Goals	• TDM is acknowledged as part of the vision in the State but no true commitment in terms of remaining steps • No consensus around the concept of demand management as a policy option • No high-level political or decision-maker support for the idea	• State has created a policy statement and identified their role on TDM • Treated as substantial goal of the planning efforts • Political support emerging on this topic • State plays an important role in TDM Coalition/Stakeholder building	• Demand management is treated on par with supply-side solutions • Buy-in to TDM as an operational philosophy to meet multiple priorities of the region • Success in crafting enabling policies, legislations and ordinances • Long-term strategy for TDM identified
Setting Objectives for TDM	• Minimal to no role for TDM in planning objectives • Primarily linked to one or two objectives such as conformity • Not developed using a "SMART" approach • No linkage to strategies identification and selection	• Multiple objectives for TDM identified for a diverse set of State needs • Some objectives are "SMART" • Still a strong disconnect between objectives and strategies identification	• All objectives are SMART and based on real-world information • Objectives drives the strategy identification • Consensus around objectives
Definition of Performance Measures	• State role in TDM performance measurement is minimal to none	• State develops framework and consistent performance reporting for TDM for various levels within State	• Fulfillment of statewide objectives are based on clear performance measurement
Assessment and Selection of Strategies and Programs to Support Objectives	• No rigorous analysis/modeling of potential for TDM strategies to meet objectives • Typically, at this stage, TDM strategies are not considered • Selection of any TDM strategy is ad-hoc and limited to existing approaches or constituencies. Public Transit is seen as the primary alternative • TDM does not drive any of the alternative analysis scenarios	• TDM is a integral part of many alternatives • Some off-model analysis/modeling of TDM strategies and impacts on par with operational strategies • All travel choices are assessed including active transportation, ridesharing etc • TDM strategies typically still are stand-alone and not fully integrated with other programs/projects/strategies	• Demand management considered before supply side alternatives. A demand-management scenario identified • Developed a rationalized means of assessing TDM strategies • TDM strategy decisions are based on benefit-cost analysis

Planning Activities	Level 1 Ad-Hoc	Level 2 Defined	Level 3 Optimized
Integration of Strategies into Plans and Funding Programs	• Resulting projects/programs do not link back to objectives • The level of detail for TDM projects is significantly lesser than that for other projects, e.g., signal timing improvements • Tend to support traditional TDM efforts such as ride-sharing etc.	• TDM is better integrated into larger and capital projects • Greater level of detail for TDM projects • Pilot programs or experimental approaches included for TDM • Dedicated program/funding identified	• TDM projects as fleshed out as other projects in the plan • Dedicated and sustained program and funding • Fewer pilots and more mainstreaming of TDM
Monitoring and Evaluation of Progress Toward Objectives	• Limited to no role for State in evaluation	• Support tools and framework for TDM evaluation	• Follow a standardized approach to TDM evaluation

Agencies should collect data and develop a tracking system to evaluate progress in relation to these measures. Performance measure tracking can also be used to identify deficiencies, which can feed into regional, corridor, and sub-area planning. Monitoring impact of TDM strategies in reducing travel demand is as important as assessing the impact of capacity enhancements in accommodating unmet demand. While there are no standard TDM effectiveness approaches, Chapter 5 provides some techniques to collect and evaluate TDM performance.

Integrating planning and programming are essential to ensuring that the SLRTP and other statewide plans are realistic in their assessments of available resources and that they result in the identification of implemented projects that support goals and objectives. Programming at the statewide level in order to produce the STIP requires the careful balancing of projects identified to meet system needs with the appropriate funding resource. In terms of TDM funding, one sign of a successful integration of TDM into the statewide planning process will be the specific programming of resources in order to fund TDM efforts that are expected to address specific objectives and meet quantifiable targets.

Goals and objectives identified in the SLRTP, Strategic Highway Safety Plan (SHSP), and other planning documents should lead to development of policies, strategies, programs, and investments that support attainment of objectives. Currently, there is little documentation within long range transportation plans (LRTPs) that explains how, or if, various TDM projects are specifically evaluated and prioritized. Some MPOs award "bonus" points if a given project supports or explicitly includes elements of demand management. By linking the strategies to the objectives, states have a more clear rationale and expectation of TDM projects and programs.

What follows are specific actions that could enable state DOTs to move from Level 1 (ad hoc integration) to Level 2 (defined) and from Level 2 to Level 3 (TDM as an optimized part of the planning process).

5.3 Actions to Move Statewide Planning Process from Level 1 (Ad-Hoc) to Level 2 (Defined)

Several specific actions can be suggested to move a state DOT's planning process from Level 1 (ad hoc integration of demand management) to Level 2 (defined integration). For each action, a rationale is provided, an explanation of how to implement the action, and examples are provided where available. Table 5.3 highlights the relative ease or difficulty of implementing the actions.

Action 1 – Develop a TDM policy statement and define a specific role/organizational structure for TDM

Rationale and Explanation – Development of an overall statewide policy statement on TDM will assist with most planning efforts by establishing the overall role of TDM in meeting statewide goals. A policy statement legitimizes the inclusion of TDM in plans by setting an overall vision and allowing planners and policy makers to reference a higher level of policy direction. A statewide TDM policy might be developed as part of a transportation visioning exercise, a plan development process, or as a stand-alone exercise to develop strategic direction for TDM. In addition, TDM often gets lost in the organizational chart of a state DOT, sometimes with no true "home." It is important that TDM, if it is to be integrated into the planning process, have a clear organizational home. This is to establish clear roles for who is to develop, consult on, and approve TDM strategies and the lines of communication during the process.

Example – A good example of a TDM policy statement that has been in place for over 5 years is provided by NJDOT. NJDOT's overall policy for TDM is to "develop new strategies, incentives, and pilot programs to reduce vehicle miles traveled (VMT) and improve air quality, and to expand the state's park-and-ride system to encourage more multimodal trips." The policy statement was developed to guide existing TDM efforts and help develop a new statewide TDM strategic plan. This policy statement helps NJDOT

Table 5.3: List of Actions and Associated Level of Difficulty to Move Statewide Planning Process from Level 1 to Level 2

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Develop a TDM policy statement and define a specific role/ organizational structure for TDM	Moderate	Moderate	Low	Moderate	Moderate
2	Establish leadership position among key internal and external stakeholders for consensus building on TDM	Moderate	Difficult	Moderate	Moderate	Moderate
Setting Objectives for TDM						
3	Develop SMART objectives for TDM	Low	Low	Low	Low	Low
Definition of Performance Measures						
4	Identify concrete performance measures for TDM beyond air quality and conformity	Low	Moderate	Low	Moderate	Low
5	Create a report card or dashboard for TDM performance	Low	Low	Low	Low	Low
Assessment and Selection of Strategies and Programs to Support Objectives						
6	Draw upon existing tools to improve TDM modeling and analysis	Low	Low	Low	Low	Low
7	Integrate TDM into obvious projects such as reconstruction and mega projects	Moderate	Low	Difficult	Difficult	Moderate
8	Take advantage of existing programs to further TDM strategies	Low	Low	Low	Low	Low
Integration of Strategies into Plans and Funding Programs						
9	Incorporate TDM into all other possible plans for illustrating the linkages of TDM to other activities	Moderate	Low	Low	Moderate	Moderate
10	Broaden the availability of eligible funding beyond CMAQ	Moderate	Moderate	Low	Low	Moderate
Monitoring and Evaluation of Progress Toward Objectives						
11	Provide technical assistance on TDM performance evaluation and monitoring tools	Low	Low	Low	Low	Low

make decisions about which TDM strategies to include in their planning and programming efforts. NJDOT funds about $10 million of TDM activities, largely through a network of Transportation Management Associations (TMAs). The policy also includes a clear performance measure in VMT reduction.[74]

In the Atlanta region, the Georgia DOT (GDOT) brokered a "TDM Framework" to establish roles and responsibilities for the various partners in TDM, including GDOT, the Atlanta Regional Commission, the Clean Air Campaign, area TMAs, TDM service providers (e.g., vanpooling), and program evaluators.

Action 2 – Establish leadership position among key internal and external stakeholders for consensus building on TDM

Rationale and Explanation – When integrating TDM into the planning process, it is important for it to have a clear organizational home. This placement establishes clear roles for who is to develop, consult on, and approve TDM strategies and the lines of communication during the process.

Example: In Utah, the Utah DOT (UDOT) established a statewide TDM program (TravelWise - Figure 5-1) and strategic plan by convening key stakeholders at the state, regional, and local levels, including service providers, policy-makers, and planning agencies. This was intended to establish a leadership role for UDOT and address the governor's policy on energy conservation.

A statement from the governor, on the TravelWise Utah website[75] underscores the goals of the program:

> *"An efficient transportation system supports Utah's economy and enhances our quality of life. We can each help make the transportation system a little more efficient with TravelWise, ultimately reducing energy use, reducing traffic congestion and improving air quality. We're not asking one person to do everything, we're asking everyone to do something. As individuals, businesses and organizations embrace and implement TravelWise strategies, our roadways will function more efficiently and all Utahns will benefit. "*

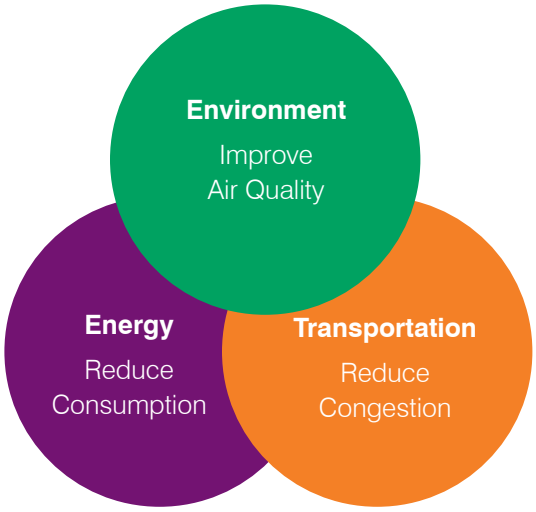


Figure 5.1: TravelWise TDM Program Solutions
Source: Utah DOT

Action 3 – Developing SMART objectives for TDM

Rationale and Explanation – As with many transportation-related policies, objective setting often results in rather vague targets. In TDM, appropriate objectives areas might be: offer more travel choices, reduce congestion, improve air quality, or assist commuters. Using a SMART objective setting process, TDM goals and objectives should be made as precise as possible. This requires a more involved planning process to reach consensus, especially with regards to measurable targets, but it allows for a more robust planning and evaluation process that in turn allows for better monitoring of objective attainment, strategy correction, and funding decision-making.

Example – The Washington State 2006 Commute Trip Reduction (CTR) Efficiency Act continued a state mandate that goes back to 1991.[76] Cities and counties are able to set their own specific goals and targets for employee commute trip reduction, as long as they met the minimum state targets of a 10% reduction in single occupant commute trips by 2011 to address congestion and a 13% reduction in VMT

[74] NCHRP, State DOT Role in the Implementation of TDM Programs, Research Results Digest 348, based on NCHRP 20-65, July 2010.

[75] http://travelwise.utah.gov/

[76] http://www.wsdot.wa.gov/NR/rdonlyres/01C32E8B-4273-482A-9F09-86083556AFFF/0/6566SPL.pdf

to address greenhouse gas emissions. In the first three years of the program, 154 million VMT have been reduced at over 1,000 worksites representing over a half a million commuters. This is estimated to have reduced highway delay by 8% in the Central Puget Sound region and almost 70,000 metric tons of greenhouse gases (GHG) statewide. While the state legislation behind the CTR Efficiency Act was a major policy effort, the need for and ability to set quantifiable targets was fairly straightforward.

Action 4 – Identify concrete performance measures for TDM beyond air quality and conformity

Rationale and Explanation – TDM has largely been used as a means to achieve conformity between transportation and air quality plans. As such, VMT reduction, which can easily be transformed into emission reduction, has been the primary performance measure. As TDM is used to address other policy objectives (congestion, livability, land use, and economic development), additional performance measures will need to be developed. For example, the meta-analysis of how land use influences travel provides weighted average travel elasticities of VMT, transit use, and walking with respect to the built environment variables.[77] These variables include: density (population, employment, commercial floor area ratio); diversity (land use mix [Entropy Index], jobs-housing balance); design (street connectivity indexes [e.g. intersection densities, % of 4-way intersections, link/node ratios, etc.]) ; destination accessibility (access by mode); and distance to transit, shopping, central business district (CBD). The effect of these strategies is cumulative. While the effect of any one on VMT reduction and mode shift is small/moderate, the combined effects from improving upon several of these can be substantial.

Additional identified performance measures include: traditional National Transit Database (NTD) statistics; emissions; household transportation costs; housing and transportation affordability index; and Dissimilarity Index (level of racial integration). Other quality of life indicators such as per capita income, Wealth Index, and Gross Regional Product could also be included given the economic benefits of improving modal balance. For example, $1 million in reduced fuel expenditures equates to a net increase in 4.5 jobs.[78]

Example – The State of Florida has developed and adopted multi-modal LOS standards for comparison among and between modes and projects. FDOT's Quality/Level of Service Handbook of 2009 (Figure 5.2) provides a methodology and analysis tools to develop and use multimodal performance measures for car, transit, bike, and walk travel for a given urban corridor.[79]

Action 5 – Create a report card or dashboard for TDM performance

Rationale and Explanation – TDM is seldom reported to policy-makers and the public in an accessible and user-friendly manner. The development of a report card or dashboard for reporting TDM performance can help in this regard. This requires the timely collection of overall TDM performance in meeting stated objectives and the means to report them in a simple manner. Some states and regions have developed report cards, state of the commute reports, and TDM dashboards.

Example – The Virginia Department of Rail and Public Transportation (DRPT) has developed a multi-modal dashboard to report on performance of the commonwealth's multimodal system, including:

- Transit ridership.
- Transit efficiency.
- Energy efficiency.
- TDM.
- Amtrak.
- Freight rail.

[77] Reid Ewing and Robert Cervero, "Travel and Built Environment: A Meta-Analysis," Journal of the American Planning Association, Vol. 767, Issue 3, June 2010.

[78] Todd Litman, Evaluating Transportation Economic Development Impacts, Victoria Transport Policy Institute, 2009, p. 43 (http://www.vtpi.org/econ_dev.pdf.)

[79] http://www.dot.state.fl.us/planning/systems/sm/los/default.htm

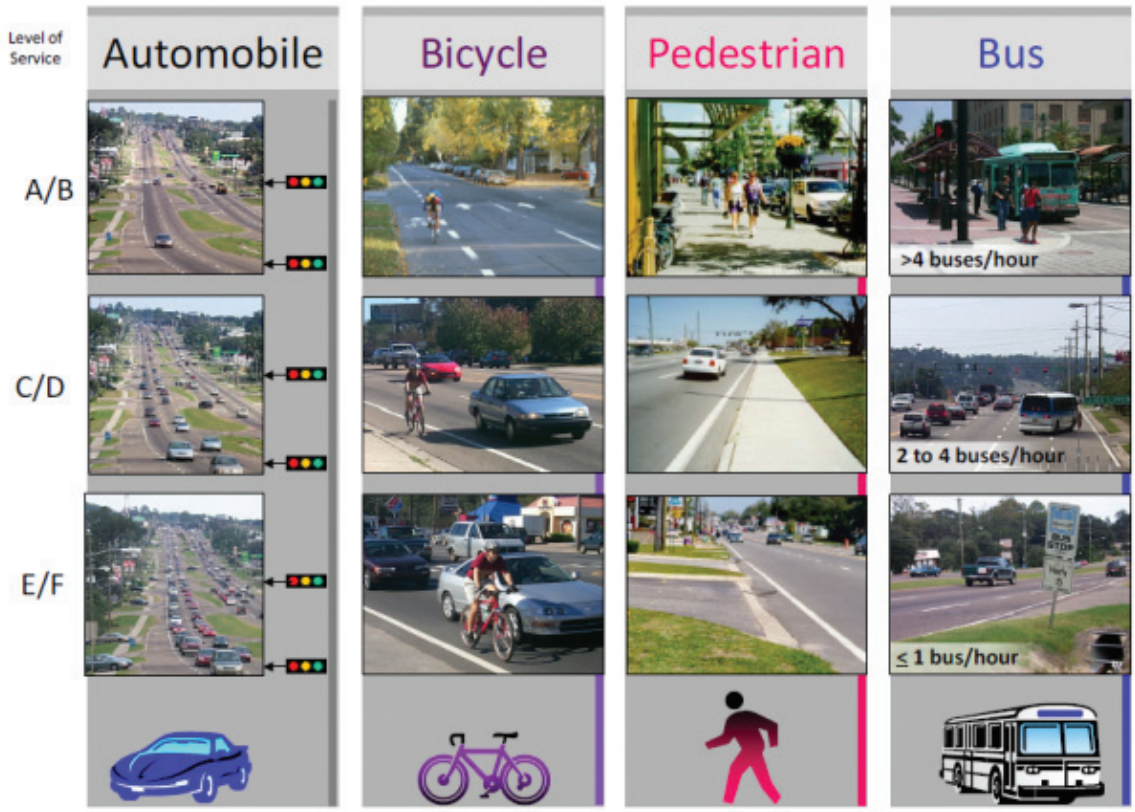


Figure 5.2: Florida State Multi-Modal LOS Standards

Source: Florida DOT

TDM performance reports will be available on the statewide dashboard soon.[80]

Additionally, the process for creating a TDM report card has been developed by several sources, including the METRIC (Mobility Enhancement and Trip Reduction Index to aid in Comparison) process that allows for benchmarking of a state or region's TDM efforts, based on over 100 criteria.[81]

***Action 6* – Draw upon existing tools to improve TDM modeling and analysis**

Rationale and Explanation – TDM analysis can often be very piecemeal and based on anecdotal evidence, rules of thumb, and sketch planning techniques, at best. However, several tools are available to assist with the evaluation of TDM strategies as part of the planning, alternatives analysis, and project selection process. Utilizing these tools largely requires the time and commitment to learn about them in advance of the planning process.

Example – Chapter 9 includes a description of several existing tools aimed at allowing for the quantification of TDM impacts for various strategies and packages of strategies. This includes the FHWA TDM Evaluation Model and the TRIMMS available from the Center for Urban Transportation Research (CUTR; see more discussion in Section 9.1 on Tools and Techniques for Evaluating TDM).

***Action 7* – Integrate TDM into obvious projects such as reconstruction and mega projects**

Rationale and Explanation – TDM can be integrated into large-scale highway projects as a mitigation strategy or even as a means for reducing overall vehicle volumes. The most obvious projects are highway reconstruction projects, where TDM can be called upon to provide travel alternatives during

[80] http://www.drpt.virginia.gov/dashboard/pages/Reports.aspx?id=3

[81] Black and Schreffler, Understanding TDM and its Role in Delivery of Sustainable Urban Transport, Transportation Research Record 2163, 2010.

highly congested construction periods. This allows new and existing TDM strategies to be applied to larger travel markets and exposes travelers to new options that they might continue to use after reconstruction is complete.

Example – The Colorado DOT (CDOT) employed TDM as part of the reconstruction of I-25/225 in the Denver region, which included the building of a new light rail segment (Figure 5.3). TDM was promoted, as part of the public information campaign, to increase the use of transit, vanpooling, and carpooling utilizing a temporary HOV lane.[82] CDOT project managers cited the existence of TDM as reducing their overall risk on the project and providing travelers with enhanced options that market research studies show travelers very much appreciated (even if they did not use them). CDOT worked closely with FHWA and local agencies to identify a preferred alternative, which included the following elements:

- General Purpose Lanes.
- Tolled Express Lanes (TEL).
- Upgraded Interchanges.
- Express Bus Service/Stations.
- Commuter Rail Service/Stations.
- Commuter Bus Service/Stations.
- Congestion Management Improvements.[83]

Figure 5.3: HOV Use during I-25 Construction

Source: Colorado Department of Transportation

Top: Before Construction

Middle: During Construction Showing Temporary HOV Lane Created by Restriping

Bottom: Post Construction - New Capacity Including Light Rail

[82] FHWA, Mitigating Traffic Congestion, the Role of Demand-Side Strategies, FHWA-HOP-05-001, October 2004.

[83] Colorado DOT – Fact Sheet: North I-25 Environmental Impact Statement, August 2011, http://www.coloradodot.info/projects/north-i-25-eis/Final-EIS/documents/NorthI25FactSheet.pdf

Action 8 – Take advantage of existing programs to further TDM strategies

Rationale and Explanation – TDM strategies should not be considered nor implemented in a vacuum or by themselves. TDM can enhance many other types of strategies aimed at meeting mutual policy objectives. For example, smart land use strategies can create the demand for more travel choices, especially for shorter trips, such as bicycling and walking. Therefore, TDM should take advantage of other programs and initiatives, including those related to transit improvements, HOV systems, and ITS strategies.

Example – Tennessee's 25-year Transportation Plan views TDM as a complement to ITS as stated in the plan itself:

> *"TDM can be considered as transportation system support "software" as a parallel strategy to ITS as "hardware" because it focuses on managing travel demand to make better and most cost-effective use of transportation capacity through strategies oriented to influencing and incentivizing travel decisions on making trips: the need to travel, when to travel, where to travel in fulfilling the trip purpose, what mode to take, whether to travel with others, what path to follow, so on."*[84]

Action 9 – Incorporate TDM in all other possible plans illustrating the linkages of TDM to other activities

Rationale and Explanation – As shown in Table 5.1 previously, TDM can be incorporate into many planning efforts conducted by state DOTs (and other agencies, such as air quality). It is important to establish TDM as an integral means of planning, managing, and operating the transportation system. As such TDM should be utilized, or at least considered, in all planning efforts that seek to more efficiently and effectively operate the transportation system in order to achieve policy goals, such as mobility.

Example – Table 5.1 enumerates a number of plans that could incorporated TDM, many of which go beyond the highway system and vehicle travel (land use, freight, tolling/taxing, etc.).

Action 10 – Broaden the availability of eligible funding beyond CMAQ

Rationale and Explanation – CMAQ is the most prevalent source of funding for TDM, at the state, regional, and even local level. TDM is one of the few strategies that can address both congestion mitigation and air quality simultaneously. However, as TDM rises in importance as a solution strategy for a myriad of policy objectives, additional funding sources will likely be needed. Making the case for funding TDM with traditional highway funds will be the hurdle to be overcome. However, as TDM becomes accepted as a rational approach to maximizing the efficiency of highway management and operations, this barrier should be lowered. One obvious source of federal funding is the dedication of Surface Transportation Program (STP) funds to TDM. Additionally, state funding sources, such as gas tax set-asides or other funds, could be used as well.

Example – The Oregon DOT operates its "Flexible Fund Program" using STP funds.[85] Through the Flexible Fund Program, MPOs and other agencies submit applications for projects that improve modal connectivity, mobility, the environment, and access. Projects likely to be funded include transit, bicycle and pedestrian, TDM, and the planning, research, and project development that supports those projects as well as related programs and services. In 2011 ODOT set aside $21 million in STP funding for this program to fund multimodal and non-highway transportation projects.

Action 11 – Provide technical assistance on TDM performance evaluation and monitoring tools

Rationale and Explanation – States can play a key role is developing and supporting standardized methodologies and related tools to monitor and evaluate TDM program and strategies. This allows for comparisons over time and across regions and programs in order to provide accountability for funding decisions based on the fulfillment of stated TDM objectives.

[84] Tennessee Long-Range Transportation Plan, January 2006, available at http://www.tdot.state.tn.us/plango/pdfs/tup.pdf

[85] Oregon DOT Proposed Flexible Funds Grant Awards, available at http://www.oregon.gov/ODOT/TD/TP/FlexFunds.shtml

Example – As mentioned earlier, the California Air Resources Board provides assistance to agencies throughout the state on the methods to evaluate TDM efforts. The State of Florida has developed a standardized methodology for evaluation of commuter assistance programs that are partially funded by the state. The use of the Commuter Assistance Program Evaluation Manual is required for continued funding.[86]

5.4 Actions to Move Statewide Planning Process from Level 2 (Defined) to Level 3 (Optimized)

Several specific actions can be suggested to move a state DOT's planning process from Level 2 (defined integration of demand management) to Level 3 (optimized integration). Table 5.4 highlights the relative ease or difficulty of each action in moving from Level 2 to Level 3.

Action 1 – Involve public in TDM visioning

Rationale and Explanation – Creating a broad consensus on the need for and benefits of TDM should involve input from travelers themselves, since much of TDM is about enhancing travel choices to improve the quality of life for citizens. In order to involve the traveling public, many states (as well as regions and municipalities) are adopting visioning exercises as part of their long-range transportation plan updates. This seeks to gain insight on the choices that travelers want and the kind of urban form they desire. This, in turn, provides rich information with which to craft TDM strategies and their role in addressing key policy objectives.

Example – Several states and regions have used visioning exercises as part of their long-range transportation plan update process. Many of these processes are entitled "Envision," including Envision Utah (Salt Lake Valley) and Envision Missoula. In the case of Missoula, three scenarios were extensively discussed with the public, including: a "business as usual" case, a focus on growth to suburban satellites, and then a "focus inward" scenario to concentrate development and improve travel choices, especially in an "in-town mobility district." This last scenario involved improved transit, bike, and walk facilities and services to improve access combined with increased density to manage travel demand.[87]

Action 2 – Develop supporting regulations and policies

Rationale and Explanation – State DOTs can support TDM planning and implementation through the development of regulations and policies that enhance the implementation and effectiveness of TDM. This might include land use policies that support increased densities to support alternative modes. Regulations on employers and new development have been adopted by many states to provide regions with this ability (such as the Washington State CTR law mentioned above). Such regulations and policies provide the mandates that allow regions and cities to bring key players to the TDM arena and increase the effectiveness of TDM efforts.

Example – Some states are also using TDM in mitigating the impacts of new development, a role more commonly assumed by local government. The Massachusetts Office of Transportation Planning's Public/Private Development Unit coordinates state DOT review of private development projects that require certain state approvals, such as highway access permits for new or modified access to state highway. As stated in the Commonwealth's 2006 LRTP, "the Office of Transportation Planning is developing a monitoring system to verify implementation of transportation demand management programs, as well as a follow-up evaluation once projects are built." By encouraging developers to incorporate bicycle and pedestrian facilities into their site development plans, MassDOT is ensuring that project site designs accommodate walking and bicycling, consistent with the principles of its award-winning Project

[86] http://www3.cutr.usf.edu/tdm/projects/208-01.htm

[87] ftp://www.co.missoula.mt.us/opgftp/Transportation/TTACAttach/2008/OctMtg/EMSLAFinalRpt.pdf

Table 5.4: List of Actions and Associated Level of Difficulty to Move Statewide Planning Process from Level 2 to Level 3

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Involve public in TDM visioning	Low	Low	Low	Low	Low
2	Develop supporting regulations and policies	Moderate	Moderate	Moderate	Moderate	Moderate
3	Train all levels of management on TDM	Difficult	Difficult	Low	Moderate	Difficult
4	Create incentive-based approaches for TDM	Low	Low	Moderate	Moderate	Low
Setting Objectives for TDM						
5	Define SMART TDM-related objectives for a variety of policy issues	Moderate	Moderate	Low	Moderate	Moderate
Definition of Performance Measures						
6	Develop performance measures that express TDM effectiveness in operational terms	Low	Moderate	Low	Moderate	Moderate
Assessment and Selection of Strategies and Programs to Support Objectives						
7	Develop procedures for considering demand management strategies prior to other, more capital intensive alternatives	Difficult	Moderate	Low	Moderate	Moderate
8	Develop new tools/approaches to incorporate all travel choices into the analysis approach	Low	Low	Moderate	Moderate	Low
Integration of Strategies into Plans and Funding Programs						
9	Develop capability to include TDM in all projects in appropriate manner	Moderate	Moderate	Low	Moderate	Moderate
Monitoring and Evaluation of Progress Toward Objectives						
10	Adopt or develop a standardized approach to reporting TDM performance	Low	Low	Low	Low	Low

Development & Design Guide.[88] Project proponents are also required to work with the local/regional transit authority to determine the viability of public transportation at their site and, if feasible, make provisions to make public transit available.

Action 3 – Train all levels of management on TDM

Rationale and Explanation – Even if top policy support is gained for integrating TDM into the planning (and implementation) process, TDM will not be fully accommodated if planners, project managers, and department administrators are not educated on the benefits and impacts of TDM. Staff training may be required to make sure all involved in the planning (and implementation) process are up to speed on TDM, especially the broadened definition offered in this desk reference. Training could include in-house education by staff specializing in TDM, the use of external trainers, or participation in professional organizations and conferences that focus on TDM.

Example – Two states that have developed an extensive in-house knowledge base on TDM are Washington State and Colorado. Washington State DOT's Public Transportation Division assists cities with their CTR requirements, informs the public, supports transportation providers, contains a research library, and serves as an in-house resource for all travel choices. As stated on the WSDOT Public Transportation Division's webpage:[89]

> *More than ever, people in Washington are choosing to share a ride, catch a bus, ride a bicycle and use other efficient transportation choices to get around with driving alone less often. Our bottom line: make a measurable, meaningful difference for individuals, communities, the economy and environment.*

Likewise, Colorado DOT has developed tools to assist its planners and project managers, as well as local government and business, with TDM implementation. Their TDM Toolkit and the TDM Corridor Projects Study offer a complete list of strategies with TDM successes throughout Colorado and the U.S.[90]

Action 4 – Create Incentive-based Approaches for TDM

Rationale and Explanation – As discussed in Chapter 6, incentives are a key component of the most effective TDM strategies. State DOTs can champion the need for and form of such incentives. This may require the need for substantial buy-in from decision-makers to provide the funding and support enabling legislation. Some decision-makers view incentives as "as paying people to do what they should be doing" rather than viewing incentives as short-term measures to induce a longer-term behavior change that supports multiple policy objectives.

Example – In 2011, the Virginia General Assembly approved new tax credit legislation aimed at encouraging private sector telework. Teleworking is considered, by the General Assembly, to be an effective congestion management strategy to reduce highway traffic. It has also been shown to improve employee productivity, retention, and satisfaction. The purpose of the Telework Tax Credit is to remove auto trips by eliminating commute trips to and from work. Only employees who travel to an office in Virginia qualify. The legislation provides for a tax credit (for new teleworkers) of up to $1,200 per employee and up to $50,000 per organization for eligible telework expenses incurred during taxable years 2012 and 2013. Additional legislation is required to continue this tax credit after 2013. Any business subject to Virginia income tax is eligible to apply for the tax credit. This is done through approval by the Virginia Department of Taxation. Employees must telework at least once a week in order for expenses incurred under the telework agreement to be eligible.[91]

[88] Massachusetts DOT, Project Development & Design Guide, available at http://www.mhd.state.ma.us/default.asp?pgid=content/designguide&sid=about

[89] http://www.wsdot.wa.gov/Transit/overview.htm

[90] CDOT, Colorado 2035 Statewide Transportation Plan, Travel Demand Management Technical Report, March 2008.

[91] http://www. teleworkva. org/go/for-managers/telework-tax-credit/

Action 5 – Define SMART TDM-related objectives for a variety of policy issues

Rationale and Explanation – Once TDM is recognized as a means to address many policy objectives, specific objectives, beyond congestion or air quality, can be set. This includes areas heretofore not commonly associated with TDM, such as goods movement, livability, and land use. This will require careful selection of SMART objectives that are meaningful and measurable in areas that have not historically involved a connection with TDM. While some guidance is emerging, such as with livability and TDM, connections with other policy objectives are quite new. However, for TDM to realize its full potential, such objective-setting exercises will be needed. One key role for state DOTs is not only to encourage a connection between TDM and key policy objectives (and exemplified below with land use) but also to develop sample performance objectives that can be used in order to realize the full benefits of TDM.

Example – In the case of land use, most state DOTs can only play a role of encouraging local jurisdictions to make better land use-transportation decisions and set concomitant requirements. For example, Colorado DOT's long-range plan states that the DOT is working on leadership opportunities that coordinate transportation and land use planning to minimize impacts and manage demand on the state highway system. Likewise, the Ohio DOT's plan encourages local governments with land use authority to implement land use policies that promote or facilitate the use of alternative modes, park-and-ride lots, carpooling, and other TDM concepts.

Action 6 – Develop performance measures that express TDM effectiveness in operational terms

Rationale and Explanation – The most prevalent performance measures for TDM are either output based (e.g., number of carpools formed) or outcome based (e.g., resulting VMT reduction). However, these metrics are sometimes foreign to other transportation planners, engineers, and especially policy-makers. There is a need to translate TDM effectiveness into terms that traditional transportation planners and engineers can better understand, such as reductions in delay, increase in person throughput, and reductions in needed lane miles. While one might argue that performance measures that are expressed in terms of the utilization of sustainable modes or increases in quality of life indices are just as important, TDM will be partially judged by those focused on the efficient operation of the road system.

Example – Using VMT reduction, volumes, and speeds, estimates of reduction in delay can be derived. Going one step further, the CUTR has developed a methodology that merges mode shift data with a highway micro-simulation model to graphically show how employer trip reduction programs can reduce delay for a given highway segment.[92] This research was originally conducted using CTR data from the Seattle region as applied to a portion of I-5 through downtown Seattle. The methodology and recommended approach are contained in a report entitled "Impact of Employer-based Programs on Transit System Ridership and Transportation System Performance."[93]

Action 7 – Develop procedures for considering demand management strategies prior to other, more capital intensive alternatives

Rationale and Explanation – While federal planning guidance suggests that alternatives be considered before options that accommodate the SOV, state DOTs may wish to consider structuring this philosophy in the planning process by requiring that specific corridor planning efforts first prove why TDM cannot be a primary solution before considering options that add capacity, or even efficiency improvements. This would require a fundamental change in thinking that involves viewing TDM not as a short-term mitigation strategy, but as a long-term approach to reducing overall vehicle demand.

[92] http://www.dot.state.fl.us/planning/systems/sm/los/default.shtm

[93] http://www.nctr.usf.edu/abstracts/abs77605.htm

Example – One example of the full institutionalization of TDM into the planning process comes from Sweden. In 2002, the Swedish National Roads Administration adopted the "four stage principle," which requires planners and engineers to evaluate options in the following order:

- Measures that affect the demand for transport and the choice of mode.
- Measures that foster the more efficient use of the existing road network.
- Measures that promote improvements to existing roads.
- Measures that make new investments in road capacity or major rebuilding.

Planners are, therefore, required to consider and rule of demand management before they can consider infrastructure improvements.[94]

Action 8 – Develop new tools/approaches to incorporate all travel choices into the analysis approach

Rationale and Explanation – Moving from the defined approach to a more optimized integration of TDM may require the development of tailored and specialized analytic tools to evaluate the effectiveness of TDM strategies in addressing key policy objectives. While many "off the shelf" tools now exist, in order to analyze the full set of TDM strategies and their impact across a myriad of objectives, specialized tools may be required. This might include new, tailored means of using the traditional four-step travel models or newer activity-based models. It might also involve other new tools, such as the micro-simulation tool, developed by CUTR and mentioned in Action 7 above, which uses employer TDM data and CORSIM (Corridor Simulation, sponsored by FHWA).

Example – The traditional four-step travel demand modeling process can be used to evaluate TDM strategies that can be analyzed in terms of time and cost variables. However, many off-model tools have been developed to analyze congestion pricing strategies, bicycle and walk strategies, and other strategies that cannot be expressed in terms of time and cost indicators. A good discussion of the means to incorporate TDM into regional travel demand models is provided by CUTR in a report entitled "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model," which was developed for WSDOT and included a specific TDM Assessment Procedure that uses the CUTR TRIMMS model and processes resulting TDM impacts through trip tables.[95]

Action 9 – Develop capability to include TDM in ALL projects in an appropriate manner

Rationale and Explanation – Once TDM becomes optimized and managing demand becomes an overall philosophy of how to manage and operate the transportation system, then TDM strategies will become a part of most if not all projects. This requires a strong capability at the management and technical levels to assure that TDM is appropriately considered for all projects, both in the long-range planning process as well as individual project-level planning.

Example – The Colorado DOT has developed a means for moving from broad statewide plans to specific solutions. Increasingly, Colorado's long-range transportation plan is assuming a more corridor-centric look. The 2035 statewide plan includes "corridor visions," which discuss various proposed strategies aimed at meeting each corridor's unique transportation goals. Taken together, the corridor vision establishes an integrated, system-wide vision that balances local and statewide transportation goals and strategies.[96]

[94] FHWA, Managing Travel Demand – Applying European Perspectives to U.S. Practice, FHWA-PL-06-015, May 2006.

[95] WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746. 1, March 2010.

[96] www.coloradodot.info/content/programs/planning/2035CVCD/index.html

***Action 10* – Adopt or develop a standardized approach to reporting TDM performance**

Rationale and Explanation – In order to provide an effective feedback loop to the objective setting and strategy selection process, standardized TDM evaluation methodologies are required. This might involve developing a tailored approach for a given state DOT or adopting a widely accepted methodology. Such methodology development or adoption should be vetted with TDM professionals and researchers to assure that it is understandable, rigorous, and usable.

Example – The MAX-SUMO monitoring and evaluation approach developed in Europe is easily adaptable to the U.S. experience for many TDM strategies. The methodology is described in Chapter 9.

5.5 Best Practice Examples: State-Level TDM Integration

Washington State

WSDOT is recognized for having one of the most comprehensive DOT-supported TDM programs in the nation. Since the early 1990s, the Washington State Legislature has enacted an evolving set of laws that spell out statewide TDM initiatives and the DOTs role in implementing them. One of the most significant pieces of legislation is the 2006 CTR Efficiency Act, which enhanced a 1991 law by requiring county and local governments in congested regions to develop and implement plans for employers to reduce SOV trips. WSDOT supports the Act and other TDM initiatives in the following ways:

- A state-level policy framework, called Moving Washington, has been adopted to guide decision-making. It has three principal tenets: operate efficiently, manage demand, and add capacity strategically. The DOT policy is aimed at aligning the objectives of all its partners to assure a reliable, sustainable, and responsible transportation system.
- A 2005 University of Washington study of the role of TDM at the state DOT concluded that "it is in WSDOT's strategic interest to employ TDM measures to increase existing system capacity during congested times and to minimize the need to build new roadway lanes."[97]
- Through the CTR program, WSDOT provides formula funding to local governments to work with employers that implement trip reduction programs in their jurisdictions. Local governments review employer programs, provide training and networking, and coordinate measurement surveys at worksites.
- WSDOT offers technical assistance and over 18 years of trip reduction performance data to agencies and companies to help implement trip reduction programs. Technical assistance includes training, support with data collection and analysis, providing policy and planning guidance to networks of partners, and documenting best practices.
- WSDOT provides technical assistance to Transportation Management Area-like regions called Growth and Transportation Efficiency Centers (GTECs), sub-areas areas of dense, mixed-use development. GTECs complement the CTR program (which targets larger employers) by focusing on providing trip reduction options for smaller employers, students, and residents.
- WSDOT operates an extensive HOV system and has initiated a HOT lane pilot program. Approximately 225 lane-miles of a planned 320-mile freeway HOV system have been built. WSDOT works closely with local agencies and construction project teams to find low-cost ways to minimize the risk of construction-related traffic backups, including traveler information, contractor incentives, and programs that boost people's use of carpools, vanpools, telework, and buses.

[97] Washington State Transportation Center, "WSDOT's Role in TDM: Strategic Interests, Structure, and Responsibilities," Report No. WA-RD-616. 1, July 2005.

- WSDOT invests in local efforts to manage congestion through regional mobility grants. These grants fund a variety of capital and operating investments, including new buses, park and ride lots, bus lanes, and new transit services. More than $100 million has been invested since 2005.
- WSDOT provides capital assistance for the state's 20 transit agencies that operate vanpool programs across the state. Washington state vanpooling represents the largest public vanpool fleet in North America, with more than 2,400 daily vanpools and 20,000 daily riders in June 2010. WSDOT is developing RideshareOnline.com and other electronic commute management tools to strengthen local trip reduction and ridesharing programs by enhancing accountability, supporting performance measurement, and securing additional resources through partnerships.
- WSDOT supports the Lake Washington Urban Partnership Agreement, which provides federal funds to help WSDOT, King County, and the Puget Sound Regional Council manage congestion through a combination of tolling, transit service, trip reduction, and Smarter Highways technology.

Georgia DOT

GDOT's TDM program is a response to high levels of congestion, limited opportunities for additional roadway expansion, and serious air quality conformity challenges. Georgia DOT coordinates statewide TDM services, which are funded through federal CMAQ, state, and local funds, through partnerships with contractors and other public agencies. Figure 5.4 illustrates the organization of the Georgia program. GDOT provides support for local TDM programs as well as part of the statewide coordinated approach.

- GDOT's TDM support is conducted through its Air Quality Branch within the Office of Planning. The Branch has hired separate contractors with statewide and regional responsibility for specific functions, including ride-matching, guaranteed ride home, statewide and local employer services, and statewide marketing and coordination.
- GDOT supports TDM through federal CMAQ funds matched with GDOT's state funds and funds from other state agencies (Environmental Protection, Natural Resources) and with in-kind support from the Georgia Clean Air Campaign.
- GDOT has pledged $20 million (including the match) over the next 3 years to support TDM at the statewide level. This level of support reflects a commitment from the highest levels of the organization to manage congestion by managing demand. This level of support also reflects GDOT's recognition that reducing peak demand can produce maintenance and operations benefits.
- GDOT provides funding support for The Clean Air Campaign, a private non-profit organization that offers TDM incentive programs, public awareness campaigns, and employer and commuter outreach services statewide, especially in areas not served by TMAs. The Campaign has found an effective marketing strategy in communicating the monetary savings of using commute options.
- GDOT contracts with the Atlanta Regional Commission (the Atlanta region's MPO) to manage the operation of the Atlanta region's TMAs. The region's TMAs encourage the use of non-SOV commute options through promotion of statewide incentive programs and transportation services and statewide marketing campaigns. GDOT notes that managing the TMAs by contract through a single contractor has improved accountability and increased the effectiveness of the local programs.

- The Center for Transportation and the Environment, based out of Atlanta, monitors TDM performance in the state. In 2009, GDOT provided grants to support the center's evaluation efforts.
- GDOT operates over 90 miles of HOV lanes and 96 park and ride lots throughout the state.
- The Department funds highway emergency response operations (HERO) through CMAQ grants and offers incentives to clear crashes quickly. The Department's communications office publishes a report on incident response performance annually.

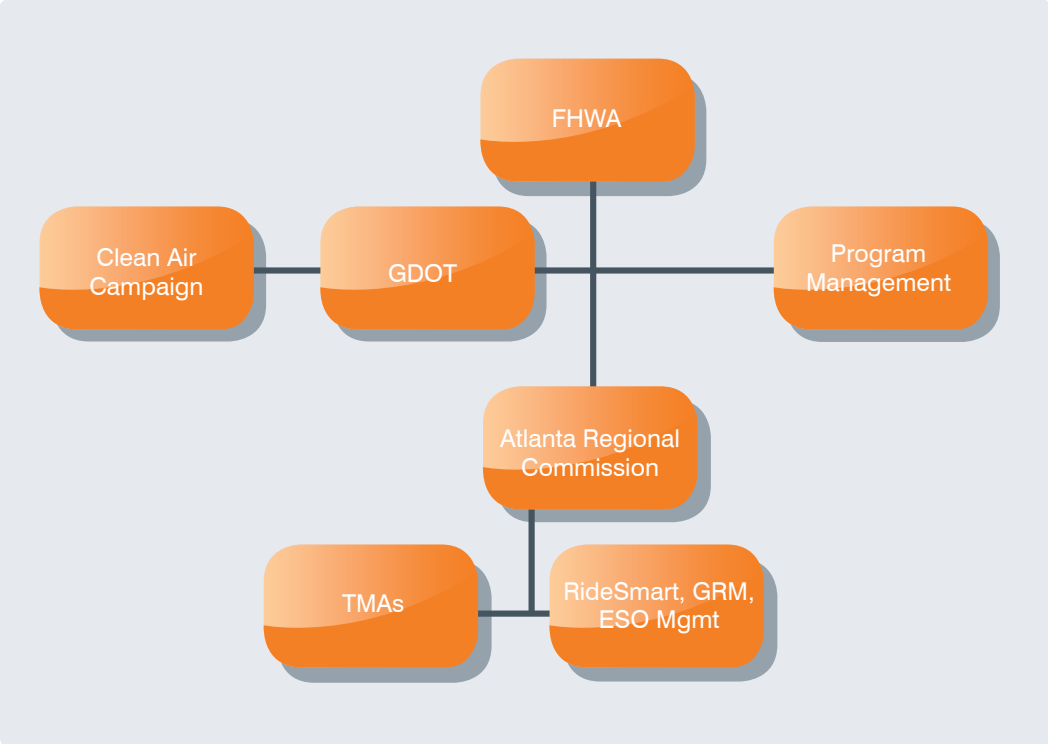


Figure 5.4: Georgia DOT TDM Program Coordination

Source: Georgia DOT

KEY RESOURCES

A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix C – Integrating Travel Demand Management in the Statewide Transportation Planning Process: Draft, March 22, 2010

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CDOT, Colorado 2035 Statewide Transportation Plan, Travel Demand Management Technical Report, March 2008.

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http://www.drpt.virginia.gov/dashboard/pages/Reports.aspx?id=3

http://www.dot.state.fl.us/planning/systems/sm/los/default.htm

http://www.arb.ca.gov/planning/tsaq/eval/eval.htm

http://travelwise.utah.gov

NCHRP, State DOT Role in the Implementation of TDM Programs, Research Results Digest 348, based on NCHRP 20-65, July 2010

SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

Washington State Transportation Center, "WSDOT's Role in TDM: Strategic Interests, Structure, and Responsibilities, "Report No. WA-RD-616.1, July 2005.

WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746.1, March 2010.

6. Integration of TDM at the Metropolitan Planning Level

MPOs throughout the United States are responsible for carrying out a continuing, comprehensive, and coordinated transportation planning process. This is true for all MPOs, no matter the size of the region or number of staff. However, the extent to which an MPO can effectively shepherd such a process is often a function of resources. While all MPOs need to develop the same prescribed plans and programs, the depth of the processes to develop these plans and programs can vary widely. This section offers guidance for MPOs at various levels of "TDM-enabled" planning to effectively integrate TDM into their planning processes.

While the size of an MPO does not necessarily correspond to the level of penetration of TDM, there is typically a close correlation. Generally speaking, the larger the MPO's population, the more likely it is that TDM has become a significant element of the planning process, likely due to the presence of traffic congestion, air pollution, etc. The challenge, then, is to both motivate smaller MPOs to integrate TDM into their planning processes and present recommendations and guidance to the larger MPOs to broaden and deepen TDM-based planning.

Regardless of their size, MPOs can play an important role in planning for TDM at the regional level. By encompassing a wide variety of local jurisdictions, MPOs can take a more "holistic" view of TDM, unhindered by jurisdictional boundaries. MPOs that most comprehensively incorporate TDM in their transportation planning processes are those that encompass local jurisdictions that have developed laws requiring some form of TDM measures.[98] For example, Washington's CTR Efficiency Act of 2006 requires each MPO to

CHAPTER ACRONYM LIST	
CBD	Central Business District
CCRCP	Champaign County Regional Planning Commission
CMAQ	Congestion Mitigation and Air Quality
CMP	Congestion Management Process
CUTR	Center for Urban Transportation Research
CUUATS	Champaign Urbana Urbanized Area Transportation Study (Illinois)
DOT	Department of Transportation
FHWA	Federal Highway Administration
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
JARC	Jobs Access Reverse Commute
METRIC	Mobility Enhancement and Trip Reduction Index to aid in Comparison
MIM	Missoula in Motion (Montana)
MOE	Measure of Effectiveness
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Planning
MWCOG	Metropolitan Washington Council of Government
SANDAG	San Diego Association of Governments
SLRTP	Statewide Long-Range Transportation Plans
SOV	Single Occupancy Vehicle
STP	Surface Transportation Program
TDM	Travel Demand Management
TERM	Transportation Emission Reduction Measure
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TRIMMS	Trip Reduction Impacts of Mobility Management Systems
TSM	Transportation Systems Management
TSM&O	Transportation Systems Management and Operations
VMT	Vehicle Miles Travelled

prepare and periodically update their regional transportation strategies to effectively address alternative transportation modes and demand management measures in regional corridors.[99] In addition, highly populated MPOs have structured their MTP around a series of core issues and strategies, with TDM included. For example, the Houston-Galveston Area Council's 2035 Regional Transportation Plan highlighted demand management for peak-period travel as a major strategy to achieve its goal of a better quality of life through mobility, better access, and a healthier environment.[100]

MPOs can also steer valuable resources to TDM initiatives in the form of federal funding for support, implementation, and operation of a variety of TDM programs. Already MPOs that are designated as TMAs must consider TDM strategies as part of their federally mandated Congestion Management Process. While most MPOs extend their purview to cover only planning, support, and funding for TDM, an increasing number of MPOs are becoming TDM implementers. Many regional TDM programs are operated by MPOs, given their regional scope and because many TDM programs are funded with CMAQ dollars and the CMAQ funding process is overseen by MPOs in most areas.

KEY TAKEAWAYS

How can MPOs advance TDM initiatives as a comprehensive part of addressing urban mobility challenges?

- Coordinate planning for TDM activities at local, regional, and state levels
- Incorporate TDM goals and objectives in long-range plans
- Embrace TDM as both a short-term operations and long-term sustainability strategy
- Build awareness and motivation among member jurisdictions that have not pursued TDM
- Encourage communities that support TDM to take specific action
- Challenge communities that have taken TDM action to ratchet up their efforts
- Set aside funding for TDM initiatives
- Develop TDM-specific performance measures to evaluate project-specific and system wide performance

[98] A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix C – Integrating Travel Demand Management in the Statewide Transportation Planning Process: Draft, March 22, 2010, pg. B-4

[99] Washington State Department of Transportation Commute Trip Reduction Laws & Program Requirements, http://www. wsdot. wa. gov/Transit/CTR/law. htm

[100] 2035 Houston-Galveston Regional Transportation Plan – Executive Summary, October 26, 2009, http://www. h-gac. com/taq/plan/documents/2035_final/2035%20RTP%20ExSum%202007-10-26%20REVISED. pdf

6.1 What Plans Should TDM be Included In?

Within the long-range, regional transportation planning process, TDM can be incorporated into a number of formal MPO-adopted plans as highlighted in Table 6.1.

Table 6.1: Metropolitan Planning

Type of Plan	How to Integrate TDM/Role of TDM
Metropolitan Transportation Plans	• Large MPOs: Make TDM a cornerstone of their long-range plans. • Medium-sized MPOs: Set aside funding for TDM initiatives. • Small MPOs: Explore TDM-based approaches and gauge the interest of member jurisdictions. • Envision that TDM projects can reduce, or at least postpone, the need for capital-intensive projects that increase roadway capacity.
Congestion Management Processes	• MPOs designated as TMAs can demonstrate, as part of their CMP process, that demand management programs have been given due consideration prior to recommending projects that add general purpose capacity to a given roadway corridor. • Provide a way to analyze TDM and operational strategies for construction projects in non-attainment zones that result in an increase of SOV travel. Travel demand reduction and operational management strategies should be incorporated into the SOV project or committed to by the State and MPO for implementation. • Define specific TDM and Travel System Management (TSM) strategies for a region's most congested facilities, and prioritize potential TDM and TSM strategies for each facility.
TDM-Specific Plans	• Develop TDM-specific strategic plans to help guide (1) long-range pursuit of TDM initiatives or (2) shorter-term operation of in-house TDM operations. • TDM-focused Task Forces/Working Groups – To further refine TDM-related initiatives, organize specific TDM committees, task forces, or advisory boards to help guide the overall planning process related to TDM. • Articulate regional TDM goals by (1) recommending TDM activities to meet these goals, (2) guiding investments in TDM activities, (3) defining an administrative structure to oversee the regional TDM program, and (4) establishing evaluation measures.

While long-range transportation plans are mandated by federal regulations, the Congestion Management Process specifically requires consideration of TDM strategies to address congestion as cited below:

> "The transportation planning process in a TMA shall address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under title 23 U. S. C. and title 49 U. S. C. Chapter 53 through the use of travel demand reduction and operational management strategies." **– Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule: 23 CFR § 450. 320(a)**

The Congestion Management Process, defined within the federal transportation planning regulations, is designed to evaluate, recommend, implement, and monitor a variety of solutions to roadway congestion, and is the way that many MPOs introduce TDM into their transportation planning processes.[101] For example, the South Western Region MPO in Stamford, CT, assesses candidate projects individually within its Congestion Management Process based on their potential to: reduce peak-period in person trips, reduce peak-period VMT, measure shift from SOV to alternative modes, measure shift from SOV to HOV, measure systems/operational efficiency improvement, and desired capacity increases.[102]

Pursuant to the Clean Air Act, all federally funded construction projects, in TMAs designated as non-attainment for ozone or carbon monoxide, that result in an increase of SOV travel must be reflected in the CMP process. Furthermore, the CMP should provide a means to analyze TDM and operational management strategies for such projects. Only if the analysis demonstrates that such strategies cannot fully satisfy the need for additional SOV capacity can the project use federal funds. Even still, all identified reasonable travel demand reduction and operational management strategies must be incorporated into the SOV project or committed to by the State and MPO for implementation.

6.2 What Is Your Capability with TDM at the Metropolitan Planning Level?

This desk reference will be utilizing the guidance based on different levels of existing experience with TDM and transportation planning. Table 6.2 provides examples of how existing MPOs might integrate TDM into their planning processes. This should assist users in determining the nature and location of key guidance within this section. Three levels of TDM integration are presented: ad hoc, defined, and optimized. These levels correspond to the Institutional Capability Maturity Model proposed by FHWA in its Guide for Improving Capability for Systems Operation and Management.[103]

MPOs with minimal experience in integrating TDM (ad hoc level) into their plans and policies might only be exploring the concept of TDM or seeking to use it to improve livability since there might be need to address congestion or air quality. At the next level (defined), an MPO might include TDM in most plans and policies as a means to increase travel choices and meet certain policy objectives, such as clean air or congestion reduction. In this case, TDM is likely one element of the overall plan. Finally, when TDM becomes optimized (Level 3), TDM may become a central focus of the entire plan if the MPO's policy board adopts an overall "philosophy" of managing demand and encouraging sustainable transport.

Table 6-2 provides specific examples of how an MPO might work to integrate demand management into regional transportation planning efforts. This matrix is intended to assist the reader in determining where his or her organization fits in terms of the capability levels described above. Once the reader has determined the appropriate capability level and identified the critical step on which the agency is focused, specific actions to move from one level to the next are suggested in the next section.

[101] A Framework for TDM in the Transportation Planning Process – Technical Memorandum: State of the Practice Review – Appendix B – Integrating Travel Demand Management in the Metropolitan Transportation Planning Process: Draft, March 22, 2010, pg. B-13

[102] South Western Regional Planning Agency (SWRPA) – Congestion Management Process, http://www.swrpa.org/default.aspx?Transport=171

[103] SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

Table 6.2: Metropolitan Planning Self-Assessment Matrix

Planning Activities	Level 1 Ad-Hoc	Level 2 Defined	Level 3 Optimized
Establishing Vision and Goals	• TDM is acknowledged as part of the vision in the state but no true commitment in terms of remaining steps • Varied understanding of the concept of demand management as a policy option • Limited high-level political or decision-maker support for the idea • Primary role of MPOs is to fund limited TDM activities	• TDM is a part of the vision statement for the metropolitan region • Enhanced understanding of TDM concepts and strategies at staff levels • Treated as substantial goal of the planning efforts • Political support emerging on this topic • Many roles (funding, coalition building, operations) becoming realistic for MPOs in the area of demand management	• TDM is an equal and long-term strategy in the metropolitan vision with capacity expansion and operations • TDM permeates through the entire strategic planning and decision-making process • Existence of strong political champions and decision-makers for TDM • MPO becomes a hub for various TDM roles (funding, operations, coalitions)
Setting Objectives for TDM	• Minimal role for TDM in planning objectives or in the CMP • Primarily linked to one or two objectives such as conformity • Not developed using a "SMART" approach • No linkage to strategies identification and selection	• Multiple objectives for TDM identified for a diverse set of State needs including congestion, air quality, and land-use strategy • Some objectives are "SMART" • Still a strong disconnect between objectives and strategies identification • CMP includes specific TDM objectives	• TDM objectives additionally include broader considerations of regional mobility, accessibility, economic development • All objectives are SMART and drive strategy identification and selection • Specific long-term objectives set for TDM
Definition of Performance Measures	• TDM not linked to MPO efforts at performance-based planning and management • Outcome measures for TDM limited to trip and VMT reductions	• TMD is linked to performance-based planning and management • Performance measures begin to define TDM "outcomes," at a metro level including: o Mode split o Vehicle throughout o Rideshare rates o Air quality	• Performance measures developed for most objectives. • Performance measures include fully developed TDM "outcomes" o Reduction in congestion o Increase in alternative mode use o Increased person throughput

Planning Activities	Level 1 Ad-Hoc	Level 2 Defined	Level 3 Optimized
Assessment and Selection of Strategies and Programs to Support Objectives	• TDM Assessment not based on rigorous modeling/evaluation especially when compared to other alternatives • TDM does not drive any of the alternative analysis scenarios • Specific strategies for TDM do not completely address broader TDM objectives and goals • Selection of any TDM strategy is ad-hoc and limited to existing approaches or constituencies. Public transit or traditional ridesharing is seen as the primary alternative	• TDM is a integral part of many alternatives • Assess some TDM strategies by incorporating cost and time impacts into traditional travel demand models • Also perform off-model analysis/modeling of TDM strategies as necessary • All travel choices are assessed including active transportation, ridesharing etc. • TDM strategies typically still are stand-alone and not fully integrated with other programs/projects/strategies	• Demand management considered before supply side alternatives. A demand-management scenario identified • Developed a rationalized means of assessing TDM strategies • TDM strategy decisions are based on benefit-cost analysis • Strategies and programs reflect the broad vision for TDM • TDM is not only a separate project/program but also is integral to most of the projects developed by the MPOs.
Integration of Strategies into Plans and Funding Programs	• Resulting projects/programs do not link back to objectives • The level of detail for TDM projects is significantly lesser than that for other projects, e.g., signal timing improvements • Tend to support traditional TDM efforts such as ridesharing etc	• TDM is better integrated into larger and capital projects • Greater level of detail for TDM projects • Pilot programs or experimental approaches included for TDM • Dedicated program/funding identified	• TDM projects as fleshed out as other projects in the plan • Dedicated and sustained program and funding • Fewer pilots and more mainstreaming of TDM
Monitoring and Evaluation of Progress Toward Objectives	• Evaluation methods for TDM are different from operational strategies • Planners are monitoring awareness levels through surveys, focus groups, and workshops, among relevant stakeholders and the public	• Formal methodology is in place to evaluate performance metrics • TDM and system performance are reported in a similar way (e.g., delay) • MPOs start to perform evaluation of TDM effectiveness at regional, city and local levels.	• Performance measurement includes quantitative and qualitative methods • Conduct evaluation of comparative cost effectiveness of TDM to other capital and operating strategies

The foundation of most metropolitan transportation plans is a series of goals, objectives, strategies, and/or policies that guide the overall planning process. TDM can be incorporated into these strategic planning elements, and range from being included in supportive objectives to being a primary policy statement. To be more effective, however, MPOs should elevate their role in TDM beyond the platitudes of simple "support" and "encouragement," and move toward planning for specific project implementation, and perhaps more importantly toward including TDM as an effective response to key urban policy issues. Large MPOs can make TDM a cornerstone of their long-range plans and develop specific TDM plans; medium-sized MPOs set aside funding for TDM initiatives; while small MPOs can begin the task of exploring TDM-based approaches and gauge the interest of their member jurisdictions.

Regardless of size, all MPOs are struggling with the issue of limited financial resources for transportation infrastructure projects. In addition to this funding gap, other issues such as recent rises in fuel prices and growing concerns about the environment, energy consumption, air quality, and overall livability and sustainability are the primary factors that drive MPOs to consider the benefits of TDM strategies as a part of a balanced, multimodal approach within their transportation planning processes.

A variety of TDM strategies have been developed that complement capacity expansion projects and offer other ways to make the transportation system more efficient and more flexible, while minimizing negative community impacts. Most transportation planners understand that the days of adding capacity as the sole strategy for addressing their regional transportation needs are gone and that strategies that focus on changing travel behavior to mitigate traffic congestion are needed, especially within the Congestion Management Process. In fact, some MPOs go as far as to state that TDM strategies will be just as critical, if not more so, to improve the efficiency of the transportation system as strategies to increase capacity.

Clearly, however, there is no one-size-fits-all approach to TDM; and, even in areas where TDM has made significant inroads, TDM is not a panacea. Rather, it is envisioned that TDM projects can reduce, or at least postpone, the need for capital-intensive projects that increase roadway capacity.

6.3 Actions to Move Metropolitan Planning Process from Level 1 to Level 2

Table 6.3 lists several specific actions to move an MPO's planning process from Level 1 (ad hoc integration of demand management) to Level 2 (defined integration). For each action, a rationale for the action, an explanation of how to implement the action, examples where available, and an indication of the relative ease or difficulty of implementing each action is below.

Table 6.3: List of Actions and Associated Level of Difficulty to Move Metropolitan Planning Process from Level 1 to Level 2

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Develop TDM long-range strategic plan	Low	Moderate	Low	Moderate	Low
2	Establish a regional TDM Committee	Moderate	Moderate	Low	Low	Low
3	Create/support local ordinances, guidance and policy development for TDM	Moderate	Difficult	Moderate	Moderate	Moderate
Setting Objectives for TDM						
4	Adopt an objectives-driven, performance-based planning process to include TDM	Moderate	Moderate	Low	Low	Moderate
5	Review the role of TDM in the CMP process	Low	Moderate	Moderate	Moderate	Moderate
Definition of Performance Measures						
6	Identify concrete performance measures for TDM beyond air quality and conformity	Moderate	Moderate	Low	Moderate	Moderate
7	Establish the link between TDM and quality of life	Moderate	Moderate	Low	Moderate	Moderate
8	Create a report card or dashboard for TDM performance	Low	Low	Low	Low	Low
Assessment and Selection of Strategies and Programs to Support Objectives						
9	Assess the current capabilities of the travel demand modeling process to evaluate TDM	Low	Moderate	Moderate	Moderate	Moderate
10	Incorporate TDM and travel choices into existing visualization tools and processes	Low	Moderate	Moderate	Moderate	Moderate
Integration of Strategies into Plans and Funding Programs						
11	Broaden the availability of eligible funding beyond CMAQ	Moderate	Moderate	Low	Low	Moderate
Monitoring and Evaluation of Progress Toward Objectives						
12	Strengthen TDM performance evaluation and monitoring methods and tools	Low	Moderate	Moderate	Moderate	Moderate

Action 1 – Develop TDM Long-Range Strategic Plan

Rationale and Explanation – In order for TDM to bridge the gap between broad policy statements and specific strategies and projects being included in the TIP, it is important to have a stand-alone plan for TDM in the region. Many regions have developed 5-year TDM Strategic Plans to guide the development of TDM services, organizational structure, and funding beyond the TIP. This becomes a sort of Transit Development Plan for TDM.

Example – To further articulate regional TDM goals, recommend TDM activities to meet these goals, guide investments in TDM activities, define an administrative structure to oversee the regional TDM program, and establish evaluation measures, the Denver Regional Council of Governments has published a regional TDM Strategic Plan (Figure 6.1). The plan "identifies TDM as a key strategy for meeting the goal of providing safe, environmentally sensitive and efficient mobility choices for the region's residents and visitors. Providing viable travel options and supporting infrastructure simultaneously opens roadway capacity, increases transit system efficiency, and decreases auto travel. Expanded travel options allow individuals to select from various modes to meet travel needs, make trips during less congested times, and avoid some auto trips altogether." The TDM plan clearly identifies the location emphasis of the TDM efforts. While the plan states that TDM promotional efforts will occur throughout the region and incentives will be available in all areas, it notes that efforts will also be targeted toward certain areas such as: 1) CBDs of larger cities, 2) High-employment concentrations, 3) Along highway corridors with bus/HOV lanes, and 4) Adjacent to rapid transit stations and high-transit service locations. In addition, specific goals and actions are identified in the plan and funding sources identified for achieving the actions.

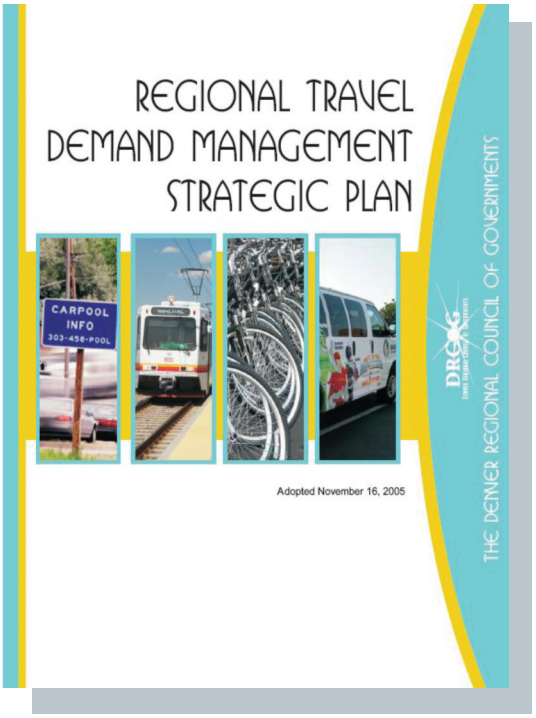

Figure 6.1: Regional TDM Strategic Plan
Source: Denver Regional Council of Governments

Action 2 –Establish a regional TDM Committee with local champions

Rationale and Explanation – TDM is often spread across the organizational chart of MPOs, including long-range planning, regional ridesharing, congestion management, etc. TDM, if it is to be integrated into the planning process, needs clear policy direction and this can come from a dedicated TDM committee. Such a committee can provide direction to MPO staff, assist with the allocation of regional funds, and provide a focal point for all TDM coordinating activities in the region. TDM can be a difficult concept for many traditional transportation professionals and remains largely unknown to many policy-makers that advise MPOs. As such, finding one or more champions to help forward the concept and underscore its benefits may be crucial. Such a champion needs to be a trusted peer. In the case of an MPO governing board, this might be an elected official from one member jurisdiction that has solid experience with TDM in his/her town. In the case of area transportation planners who might be working on plans that should incorporate TDM, it could be a trusted professional that can explain the "philosophy" and specifics of TDM to other professionals. It is important to establish key leadership positions within and outside of the MPO in order to foster consensus-building and to move TDM initiatives through the planning process.

Example – The regional TDM program in the Greater Washington D.C. metro area, Commuter Connections, is housed within the MPO, the Metropolitan Washington Council of Governments (MWCOG). As shown in Figure 6-2, the MPO has established a State TDM Work Group that reports directly to the Transportation Policy Board and consists of state DOT representatives who fund the region TDM program. Below the State TDM Work Group is a Commuter Connections Subcommittee, responsible for the planning and operation of the TDM program. In addition, many MPOs rely on TDM champions to forward the concept and its benefits. In San Diego, the role of a champion was clearly present in determining the successful implementation of the I-15 HOT lanes. (A local mayor, who sat on the MPO board, was seeking support for high-capacity transit service in the I-15 corridor. The means to fund such service were identified as toll revenues from converting HOV to HOT lanes. When the local mayor was elected to the state senate, he sponsored the legislation to allow tolling on I-15, thus creating the opportunity for one of the first HOT lanes in the U.S.)

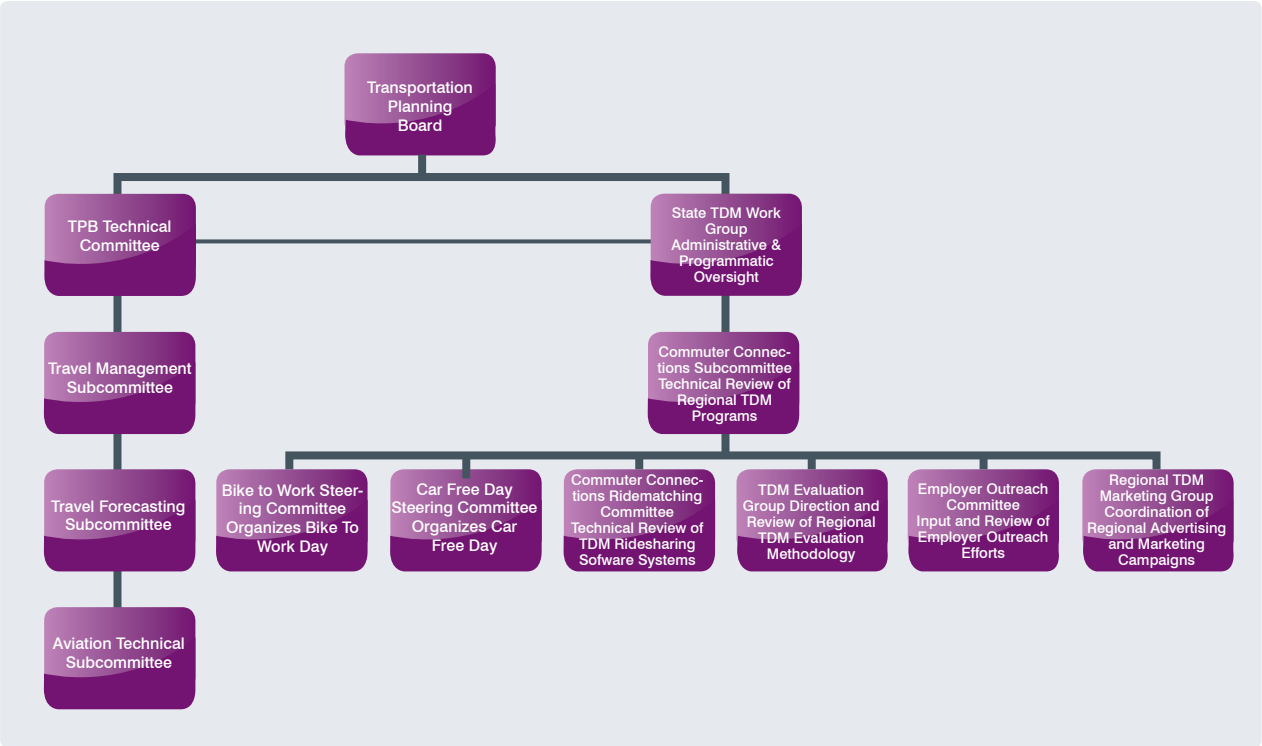

Figure 6.2: Metropolitan Washington Council of Governments Organizational Structure

Source: MWCOG

***Action 3* –Create/support local ordinances, guidance and policy development for TDM**

Rationale and Explanation – MPOs can provide a leadership role in fostering TDM initiatives at the local level in several ways. First, MPOs are generally comprised of local member jurisdictions, thus creating a good forum for discussing the merits of TDM and its integration into the planning process. Second, MPOs may have broader expertise in planning than some local jurisdictions, thus creating an opportunity to provide technical assistance. Finally, many MPOs have created model regulations, ordinances, and planning guidelines designed to maximize the impacts of TDM on new development. The effectiveness of TDM model ordinances is less in getting cities to adopt them, but more to encourage them to aggressively apply the requirements during the site plan review process.

Example – The Congestion Management Program (CMP) for Los Angeles County requires that all 89 cities within the county adopt a TDM ordinance. The CMP TDM ordinance focuses on designing "TDM-friendly" facilities as part of new development and is realized through the site plan review process. TDM-friendly

facilities refer to building design elements that support use of travel modes other than driving alone. Examples include: bicycle parking, preferred parking for carpools and vanpools, and direct building access from the street for pedestrians. The CMP document provides a model local TDM ordinance and requirements.[104]

Action 4 – Adopt an objectives-driven, performance-based planning process to include TDM

Rationale and Explanation –Truly integrating TDM into operations requires shifting from a project-based approach focused on addressing problems to an objectives-driven, performance-based approach. Such an approach has been promoted by FHWA.[105] This approach recognizes that what is measured matters in decision-making, and setting specific, measurable performance objectives will facilitate incorporating operations strategies into the MTP. An objectives-driven, performance-based approach, therefore, is recommended as a means to meet federal transportation planning requirements for including "operational and management strategies to improve the performance of existing transportation facilities" in the MTP and promoting "efficient system management and operation."[106]

Example – The Champaign Urbana Urbanized Area Transportation Study (CUUATS) in Illinois serves as the transportation-focused arm of region's MPO, the Champaign County Regional Planning Commission (CCRPC). CUUATS has adopted an objectives-driven, performance-based approach to metropolitan transportation planning that is evident throughout its recent plan, Choices 2035.[107] Through the development of Choices 2035, CUUATS and its planning partners defined 12 regional goals, several of which tie directly to improving TSM&O. Specific objectives were identified to support each of the 12 regional goals. For each objective, measures of effectiveness to track progress toward the objective and recommended actions were identified. For example, one goal related to access and mobility set a specific target of reducing average peak travel times by 1.5 minutes. The plan identified performance measures that included travel time, level of service, and congestion levels. It also identified specific strategies aimed at meeting this objective, to include alternative modes, car-sharing, and pedestrian and bicycle improvements. The plan includes an evaluation of whether the prior plan objectives were met using established measures of effectiveness (MOEs). CUUATS has witnessed a number of positive outcomes as a result of instituting this approach to planning, including increased public engagement, a greater level of government accountability, and a safer, more bike-friendly community.

Action 5 – Review the role of TDM in the CMP

Rationale and Explanation – TDM can be a significant focus of the Congestion Management Process. As noted earlier in this section, travel demand reduction is an integral part of regional congestion reduction. However, experience shows that TDM, especially as defined in this guidance, varies in its importance in CMP planning efforts. It is important to review the local CMP to assess how well TDM is currently integrated as a set of solution strategies and to find opportunities for better integration.

Example – The objective-driven, performance-based approach, as defined in Action 4, provides an excellent template for MPOs to follow in integrating TDM in an effective manner into the CMP process. Figure 6.3 is from "An Objectives-Driven, Performance-Based Approach to Planning for Operations" and presents the traditional flow of the long-range planning process. The figure shows how objectives can be defined for congestion management as part of the CMP.

[104] Los Angeles County Metropolitan Transportation Authority, 2010 Congestion Management Program, Appendix C, 2010, http://www.metro.net/projects_studies/cmp/images/CMP_Final_2010.pdf

[105] FHWA, Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance –based Approach – A Guidebook, FHWA Report No, HOP-10-026, 2010. /

[106] "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)," Section 6001(i), 2005.

[107] Champaign-Urbana Urbanized Area Transportation Study Long Range Transportation Plan, available at http://www.ccrpc.org/transportation/lrtp2/

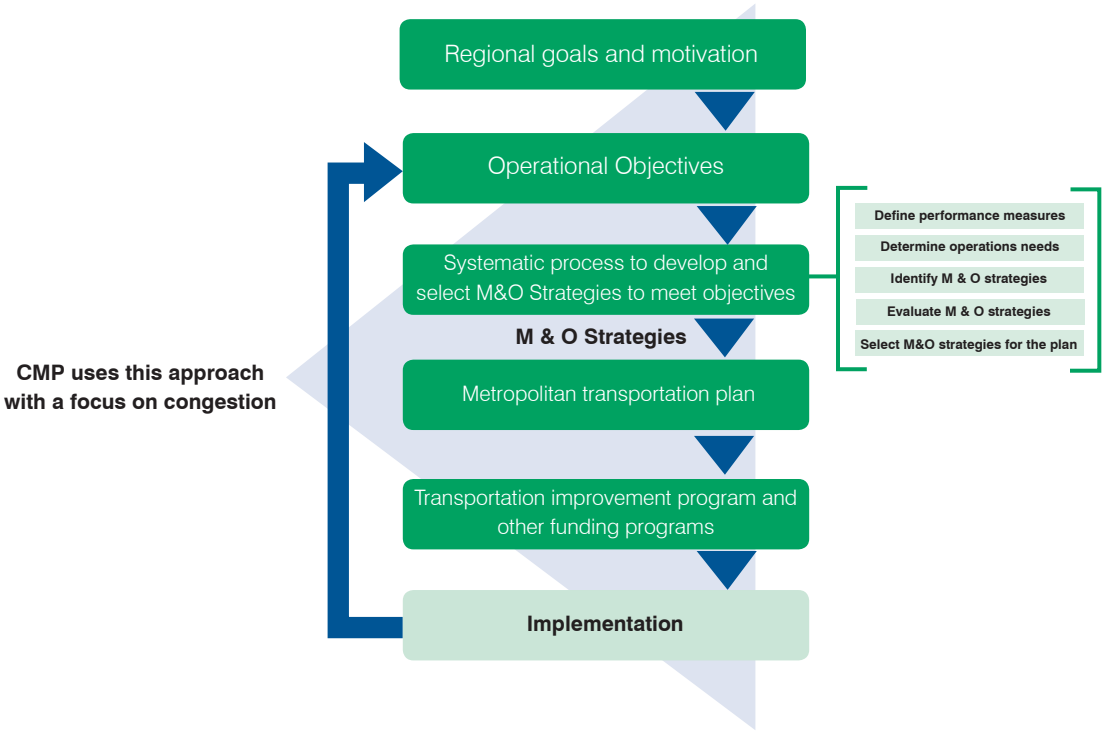

Figure 6.3: An Objectives-Driven, Performance-Based Approach to Planning for Operations

Source: U.S. DOT, FHWA

The approach is iterative, with monitoring and evaluating used to refine and adjust operations objectives over time. In addition, developing operations objectives and selecting TDM strategies is often an iterative process. Congestion objectives may be somewhat vague when first drafted and become more specific as financial constraints are clarified and baseline performance data are gathered. Selecting TDM strategies to meet the operations objectives also may be refined as financial constraints are applied. Coordinating and collaborating among planners and operators is a critical component of the approach, which supports developing agreed-upon regional operations objectives, identifying strategies, and monitoring and evaluating system performance.

Action 6* – *Identify concrete performance measures for TDM beyond air quality and conformity

Rationale and Explanation – TDM has largely been used as a means to achieve conformity beyond transportation and air quality plans. As such, VMT reduction, which can easily be transformed into emission reduction, has been the primary performance measure. As TDM is used to address other policy objectives (e.g., congestion, livability, land use, economic development) new performance measures will need to be developed. While many of these will have a link to existing performance measures (mode shift, VMT, etc.), new performance measures will evolve.

Example – The Delaware Valley Regional Planning Commission, serving the greater Philadelphia area, has developed a set of livability performance indicators and included them in a livability report card that is shown in Figure 6.4.[108]

[108] EPA report, EPA 231-K-10-004 (August 2011) http://www.epa.gov/dced/pdf/Sustainable_Transpo_Performance.pdf

What We Track	How is the DVRPC Region Performing?	Trend
TR 1: Have vehicle crashes and fatalities declined?	Between 2001 and 2005, the DVRPC region experience an 18 percent decrease in fatalities per million VMT and less than 1 percent decrease in all crashes per million VMT. However, the overall number of crashes rose 4. 6 percent during this same time period.	
TR 3: Is transit ridership increasing?	While transit ridership has experienced some fluctuation, it has increased in the last 5 years.	
TR 5: Are roads better maintained?	The region saw a slight increase in road miles considered to be deficient, mostly due to NJDOT's stricter standards.	
TR 7: Are people driving less?	There are more cars and more drivers driving more miles every year in the region. The region appears to be more auto-dependent.	

Figure 6.4: Delaware Valley Livability Report Card

Source: EPA

Green = Good Red = Bad

Action 7* – *Establish the link between TDM and quality of life

Rationale and Explanation – Perhaps the newest policy objective to be linked to TDM is quality of life, and its related objectives, livability and health. If TDM is all about travel choices, not just for commuting, and these choices are healthier (bike, walk), safer (carpool, vanpool), and less stressful (transit and telework), then they contribute to the overall quality of life of those using these more sustainable modes.

Example – The TSM&O Plan, developed by Oregon Metro, seeks to integrate TDM and roadway management and operations strategies in key corridors in the Portland area. The TSM&O Plan includes four key goals: Reliability, Safety and Security, Quality of Life, and Traveler Information. Therefore, quality of life is a major desired outcome of the plan, and a set of objectives is enumerated that revolve around expanded travel choices and their positive impacts on the community.[109]

Action 8* – *Create a report card or dashboard for TDM performance

Rationale and Explanation – TDM is seldom reported to policy-makers and the public in an accessible and user-friendly manner. The development of a report card or dashboard for reporting TDM performance can help in this regard. This requires the timely collection of overall TDM performance in meeting stated objectives and the means to report them in a simple manner. Some states and regions have developed report cards, state of the commute reports, and TDM dashboards.

Example – The University of Virginia's Parking and Transportation program runs a campus-wide TDM program, including carpooling, car-sharing, parking management, etc. The university reports on the impacts of its TDM program as part of its overall College Sustainability Report Card.[110]

[109] http://library.oregonmetro. gov/files//regional_tsmo_refinement_plan_june2010_final.pdf

[110] http://www.virginia.edu/parking/TDM/

Additionally, the process for creating a TDM report card has been developed by several sources, including the METRIC process that allows for benchmarking of a state or region's TDM efforts, based on over 100 criteria.[111]

Action 9 – Assess the current capabilities of the travel demand modeling process to evaluate TDM

Rationale and Explanation – Current travel demand models can help evaluate some TDM strategies, those that can be expressed in terms of time and cost, but off-model tools are more often needed to assess a fuller range of TDM strategies. It is important to review the region's travel demand modeling process in light of the growing role of TDM strategies to determine whether changes to the four-step process might be needed or post-processor tools added to the process.

Example – Chapter 9 includes a description of several existing tools aimed at allowing for the quantification of TDM impacts for various strategies and packages of strategies. This includes the FHWA TDM Evaluation Model and the TRIMMS available from the CUTR (see more discussion in Section 9 on Tools and Techniques for Evaluating TDM). The CUTR has developed guidance entitled "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model" for the State of Washington, which provides a very good discussion of these issues.[112]

Action 10 – Incorporate TDM and travel choices into existing visualization tools and processes

Rationale and Explanation – TDM is most often evaluated in terms of mode shift, vehicle trip, and VMT reduction. However, these measures can be less meaningful to policy makers and traffic engineers who think in terms of traffic flow, speeds, and delay. Therefore, it is crucial to translate TDM impacts into terms that others can better understand. For example, with some simplifying assumptions, VMT reduction can be translated into improvements in delay. As will be shown in the next section on corridor-level planning, this translation of TDM to congestion relief can be visualized using existing tools, such as CORSIM.

Example – The Arlington County Commuter Services program carefully measures the impact of TDM services provided in terms of removing cars from the Virginia region's highways. The program estimates that it removes 40,000 SOVs per day from area roads and this is compared to the capacity of area highways of 4,000 – 6,000 cars during the peak period, concluding that the TDM program reduces the need for multiple lanes of highway to meet traffic demand.[113]

Action 11 – Broaden the availability of eligible funding beyond CMAQ

Rationale and Explanation – CMAQ is the most prevalent source of funding for TDM, at the state, regional, and even local level. TDM is one of the few strategies that can address both congestion mitigation and air quality simultaneously. However, as TDM rises in importance as a solution strategy for a myriad of policy objectives, additional funding sources will likely be needed. Making the case for funding TDM with traditional highway funds will be the hurdle to be overcome. However, as TDM becomes accepted as a rational approach to maximizing the efficiency of highway management and operations, this barrier should be lowered. One obvious source of federal funding is the dedication of STP funds to TDM. Additionally, regional funding sources, such as county-level dedicated sales tax funds, have been used as well.

Example – The San Diego Association of Governments (SANDAG) operates the regional TDM program under its Smart Mobility Services program. Funding for FY 2012 was just over $6 million, two-thirds of which supports vanpool incentives. While the vast majority of the funding comes from CMAQ, funding for bicycle

[111] Black and Schreffler, Understanding TDM and its Role in Delivery of Sustainable Urban Transport, Transportation Research Record 2163, 2010.

[112] WSDOT, "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model" prepared by CUTR, Report No. WA-RD-746.1, March 2010.

[113] Jennings, H., TDM: The Software that Supports the TOD Hardware, Arlington Commuter Services, October 2011.

outreach programs to employers is also funded through federal JARC (Jobs Access Reverse Commute) – New Freedom funds and regional TransNet sales tax revenue.

Action 12 – Strengthen TDM performance evaluation and monitoring methods and tools

Rationale and Explanation – MPOs perform much of the analysis and evaluation related to TDM as part of the planning process and project evaluation efforts linked to funding requirements. MPOs have developed and supported standardized methodologies and related tools to monitor and evaluate TDM programs and strategies. This allows for comparisons over time and across regions and programs in order to provide accountability for funding decisions based on the fulfillment of stated TDM objectives.

Example – MWCOG's Commuter Connections program has been a pioneer in developing, refining, and maintaining rigorous and consistent methodologies for evaluating TDM strategies implemented and supported by the MPO and its partners. This evaluation process, the TERM Evaluation, is conducted on a triennial basis and is based on an approved Evaluation Framework adopted by an evaluation subcommittee of the aforementioned Commuter Connections subcommittee.[114]

6.4 Actions to Move Metropolitan Planning Process from Level 2 to Level 3

Several specific actions can be suggested to move an MPO's planning process from Level 2 (defined integration of demand management) to Level 3 (optimized integration). Table 6-4 highlights the relative ease or difficulty in moving from Level 2 to Level 3.

Action 1 – Perform a TDM visioning exercise with a broad set of travel choices

Rationale and Explanation – Creating a broad consensus on the need for and benefits of TDM, and the travel choices it represents, should involve input from travelers themselves, since much of TDM is about enhancing travel choices to improve the quality of life for citizens. In order to involve the traveling public, many states (as well as regions and municipalities) are adopting visioning exercises as part of their long-range transportation plan updates. This seeks to gain insight on the choices that travelers want and the kind of urban form they desire. This, in turn, provides rich information with which to craft TDM strategies and their role in addressing key policy objectives.

Example – Several states and regions have used visioning exercises as part of their long-range transportation plan update process. Many of these processes are entitled "Envision," including Envision Utah (Salt Lake valley) and Envision Missoula (see Best Practice case study below). In the case of Missoula, three scenarios were extensively discussed with the public, including: a "business as usual" case, a focus on growth to suburban satellites, and then a "focus inward" scenario to concentrate development and improve travel choices, especially in an "in-town mobility district." This last scenario involved improved transit, bike and walk facilities and services to improve access combined with increased density to manage travel demand. [115]

Action 2 – Create incentive-based approaches for TDM and obtain buy-in for funding

Rationale and Explanation – As discussed in Chapter 6, incentives are a key component of the most effective TDM strategies. MPOs can champion the need for and form of such incentives. This may require substantial buy-in from decision-makers to provide the funding and support enabling legislation. Some decision-makers view incentives as "as paying people to do what they should be doing" rather

[114] MWCOG, Transportation Emission Reduction Measure (TERM)

[115] ftp://www.co.missoula.mt.us/opgftp/Transportation/TTACAttach/2008/OctMtg/EMSLAFinalRpt.pdf

Table 6.4: List of Actions and Associated Level of Difficulty to Move Metropolitan Planning Process from Level 2 to Level 3

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Perform a TDM visioning exercise with a broad set of travel choices	Moderate	Moderate	Moderate	Moderate	Moderate
2	Create incentive-based approaches for TDM and obtain buy-in for funding	Difficult	Moderate	Moderate	Moderate	Moderate
Definition of Performance Measures						
3	Develop performance measures that express TDM effectiveness in operational terms	Low	Moderate	Low	Moderate	Moderate
4	Explore role of TDM in improving health and safety and develop objectives accordingly	Moderate	Moderate	Low	Moderate	Moderate
Assessment and Selection of Strategies and Programs to Support Objectives						
5	Develop procedures for considering demand management strategies prior to other, more capital intensive alternatives	Difficult	Moderate	Low	Moderate	Moderate
6	Develop new tools/approaches to incorporate all travel choices into the analysis process	Low	Low	Moderate	Moderate	Low
Integration of Strategies into Plans and Funding Programs						
7	Develop capability to include TDM in all projects in an appropriate manner	Moderate	Moderate	Low	Moderate	Moderate
Monitoring and Evaluation of Progress Toward Objectives						
8	Adopt or develop a standardized approach to reporting TDM performance	Low	Low	Moderate	Moderate	Low

than viewing incentives as short-term measures to induce a longer-term behavior change that supports multiple policy objectives. However, MPOs have substantial control over the allocation of federal funding, namely CMAQ, which has been used for these programs.

Example – The County Transportation Commissions in Los Angeles, Riverside, and San Bernardino Counties have been funding financial incentive programs for commuters for almost 20 years. Funds are provided by federal and county sources. The programs involve the offer of a financial incentive for eligible commuters to switch from driving alone to an alternative mode. After the direct financial incentive has ended (usually after 90 days), commuters who continue in an alternative mode are eligible for "club" type awards and drawings. Evaluations of these incentive programs have shown them to be very cost effective in reducing VMT and as such, decision-making bodies at each of these agencies continue to support the programs.

Action 3 – Develop performance measures that express TDM effectiveness in operational terms

Rationale and Explanation – The most prevalent performance measures for TDM are either output based (e.g., number of carpools formed) or outcome based (e.g., resulting VMT reduction). However, these metrics are sometimes foreign to other transportation planners, engineers, and especially policy-makers. There is a need to translate TDM effectiveness into terms that traditional transportation planners and engineers can better understand, such as reductions in delay, increase in person throughput, and reductions in needed lane miles. While one might argue that performance measures that are expressed in terms of the utilization of sustainable modes or increases in quality of life indices are just as important, TDM will be partially judged by those focused on the efficient operation of the road system.

Example – Using VMT reduction, volumes and speeds, estimates of reduction in delay can be derived. Going one step further, the CUTR has developed a methodology that merges mode shift data with a highway micro-simulation model to graphically show how employer trip reduction programs can reduce delay for a given highway segment.[116] This research was originally conducted using CTR data from the Seattle region as applied to a portion of I-5 through downtown Seattle. The report titled "Impact of Employer-based Programs on Transit System Ridership and Transportation System Performance"[117] shows the deterioration of travel speeds in the absence of the VMT reductions caused by employer TDM programs. More information is provided in the following chapter on corridor-level planning.

Action 4 – Explore role of TDM in improving health and safety and develop objectives accordingly

Rationale and Explanation – Two broad policy objectives that can be addressed with TDM include personal health and safety. MPOs, with mandates broader than transportation, can help elevate the role of TDM in addressing health and safety. Growing evidence (as shown in Chapter 3) suggests that users of alternative modes are healthier (in terms of fitness and stress) and that these modes can be safer than driving alone, especially in light of growing concern about distracted driving. Clearly, TDM's role in air quality is ultimately focused on health concerns.

Example – The Whatcom Council of Governments in Bellingham, WA, has incorporated health and safety into the TDM activities within its long-range transportation plan. The 2007 Whatcom Transportation Plan includes 13 key goals, related to: public information and education, safety, access, environmental justice, connectivity, freight mobility, con gestion and mobility, TDM, alternative forms of transportation, land use, health, public participation, and other modes. The inclusion of safety and health, within a

[116] http://www.dot.state.fl.us/planning/systems/sm/los/default.shtm

[117] http://www.nctr.usf.edu/abstracts/abs77605.htm

plan so focused on sustainable travel modes, illustrates the importance of these two emerging policy objectives.[118]

***Action 5* – Develop procedures for considering demand management strategies prior to other, more capital-intensive alternatives**

Rationale and Explanation – While federal planning guidance suggests that alternatives be considered before options that accommodate the SOV, state MPOs may wish to consider structuring this philosophy in the planning process by requiring that specific corridor planning efforts first prove why TDM cannot be a primary solution before considering options that add capacity, or even efficiency improvements. This would require a fundamental change in thinking that involves viewing TDM not as a short-term mitigation strategy, but as a long-term approach to reducing overall vehicle demand.

Example – For its 2025 Long Range Transportation Plan, the Brevard MPO (FL) performed a five-level strategy screening process for ten regionally significant corridors in Brevard County to identify potential projects and strategies for further consideration. This process evaluated the potential application of numerous transportation and land use strategies for each corridor according to the following five prioritized strategy tiers:

1. Actions that decrease the need for trip making (such as growth management strategies, creation of activity centers, congestion pricing, and some transportation demand strategies).
2. Actions that place trips into transit or other non-automobile modes (such as public transportation capital and operating improvements, parking management, and other strategies).
3. Actions that encourage the use of HOV lanes.
4. Actions that optimize the roadway network's operation for SOV trips and for all other trips using. highway facilities/modes (traffic signalization modifications, intelligent transportation systems, etc.).
5. Actions that increase the capacity of the roadway network for SOV trips by adding general-purpose lanes.

***Action 6* – Develop new tools/approaches to incorporate all travel choices into the analysis process**

Rationale and Explanation – Moving from the defined approach to a more optimized integration of TDM may require the development of tailored and specialized analytic tools to evaluate the effectiveness of TDM strategies in addressing key policy objectives. While many "off the shelf" tools now exist, in order to analyze the full set of TDM strategies and their impact across a myriad of objectives, specialized tools may be required. This might include new, tailored means of using the traditional four-step travel models or newer activity-based models. It might also involve other new tools, such as the micro-simulation tool, developed by CUTR and discussed in the next section that uses employer TDM data and CORSIM.

Example – The traditional four-step travel demand modeling process can be used to evaluate TDM strategies that can be analyzed in terms of time and cost variables. However, many off-model tools have been developed to analyze congestion pricing strategies, bicycle and walk strategies, and other strategies that cannot be expressed in terms of time and cost indicators. As mentioned above, a good discussion of the means to incorporate TDM into regional travel demand models is provided by CUTR in a report entitled "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model." This approach, which was developed for WSDOT, includes a specific TDM Assessment Procedure that uses the CUTR TRIMMS model and processes resulting TDM impacts through standard trip tables.[119] In fact,

[118] Whatcom COG, Whatcom Transportation Plan: A Combined Metropolitan and Regional Plan, June 25, 2007.

[119] WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746. 1, March 2010.

the use of the TRIMMS model itself (discussed in Chapter 9) to perform cost/benefit analysis for TDM strategies could represent a significant movement toward mainstreaming TDM integration.

***Action 7* – Develop capability to include TDM in ALL projects in an appropriate manner**

Rationale and Explanation – Once TDM becomes optimized and managing demand becomes an overall philosophy of how to manage and operate the transportation system, then TDM strategies will become a part of most if not all projects. This requires a strong capability at the management and technical levels to assure that TDM is appropriately considered for all projects, both in the long-range planning process as well as individual project-level planning.

Example – The Oregon Metro's Regional Transportation Systems Management and Operations Plan includes four sets of strategies targeted at key corridors. These include capital and operating projects in four key areas: multimodal traffic management, traveler information, traffic incident management, and TDM.[120] The funding for TDM, as shown in Figure 6.5, is almost 45% of total 10-year funding for these corridor-level strategies and projects.

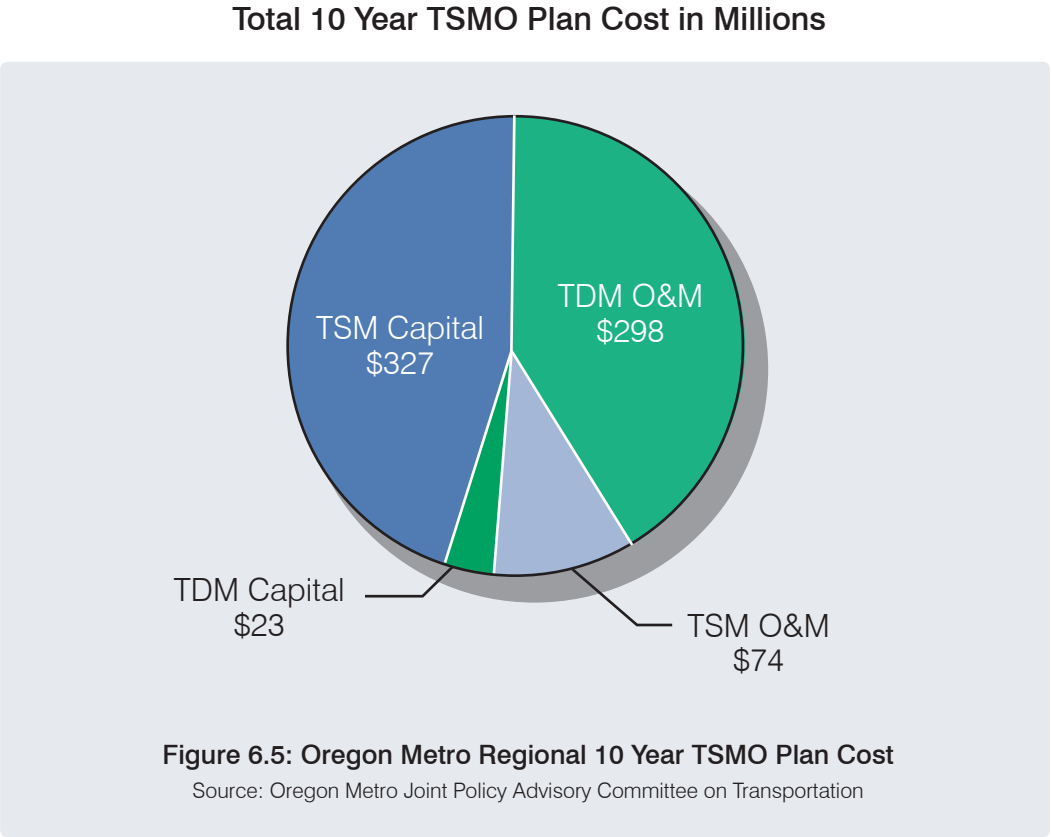

Figure 6.5: Oregon Metro Regional 10 Year TSMO Plan Cost
Source: Oregon Metro Joint Policy Advisory Committee on Transportation

[120] http://library.oregonmetro.gov/files//executive_summary_june2010_final.pdf

***Action 8* – Adopt or develop a standardized approach to reporting TDM performance**

Rationale and Explanation – In order to provide an effective feedback loop to the objective setting and strategy selection process, standardized TDM evaluation methodologies are required. This might involve developing a tailored approach for a given MPO or adopting a widely accepted methodology. Such methodology development or adoption should be vetted with TDM professionals and researchers to assure that it is understandable, rigorous, and usable.

Example – The MAX-SUMO monitoring and evaluation approach developed in Europe is easily adaptable to the U.S. experience for many TDM strategies. The methodology is described in Chapter 9.

6.5 Best Practice Examples: Metropolitan-Level TDM Integration

Missoula, Montana (less than 200,000 population)

A cornerstone of the 2008 Missoula MPO's Metropolitan Transportation Plan was a visioning process ("Envision Missoula"), which included a set of future scenarios that "represent different concepts of what Missoula might be like with a population of 200,000." Two of the three scenarios sought to manage travel demand by refocusing growth in either multiple town centers or a single concentrated downtown area. The purpose of the scenarios is to "explore the potential benefits of managing travel demand by concentrating activity in a highly walkable and transit-friendly downtown area." The upshot of the scenario planning and evaluation is that the plan includes a mix of transit, bicycle/pedestrian, and other TDM-related projects.

Underlying the visioning efforts, the MPO's Transportation Technical Advisory Committee formed a TDM subcommittee called "Missoula in Motion" (MIM). The work of this entity is funded with federal CMAQ funds, supported by cash and in-kind services. MIM's preliminary TDM efforts focused on outreach, education, and marketing to both employers and the public at large. As MIM has evolved, it has codified its approach to introducing and implementing TDM activities in Missoula within the following five steps:

1. Coordinate the efforts of all agencies involved in TDM in Missoula through the MIM Steering Committee.
2. Work with employers to establish and maintain programs that reduce work-related trips.
3. Create and implement an on-going, broad-based public education campaign to make people aware of their options and encourage them to reduce the number of miles they drive.
4. Provide, enhance, and market certain TDM services to give Missoulians more convenient and affordable alternatives to driving alone.
5. Evaluate the program to determine its impact and ensure that resources are being used effectively.

Another effective component to the MPO's TDM efforts is its annual "TDM Congress," a working TDM dinner event to which boards, policy-makers, and representatives from business and community groups are invited. During the event, participants brainstorm TDM strategies and priorities for the region and discuss methods of both supporting and advancing these strategies.

The work of the Missoula MPO and its MIM subcommittee provide an excellent example of a small, relatively isolated metropolitan area that has not only recognized the need to explicitly incorporate TDM into its long-range transportation planning processes but also taken the steps necessary to develop specific TDM projects and programs in order to meet its future regional transportation needs.

Denver (More than 1,000,000 population)

To further articulate regional TDM goals, recommend TDM activities to meet these goals, guide investments in TDM activities, define an administrative structure to oversee the regional TDM program, and establish evaluation measures, the Denver Regional Council of Governments has published a regional TDM Strategic Plan.[121] The plan "identifies TDM as a key strategy for meeting the goal of providing "safe, environmentally sensitive and efficient mobility choices" for the region's residents and visitors. Providing viable travel options and supporting infrastructure simultaneously opens roadway capacity, increases transit system efficiency, and decreases auto travel. Expanded travel options allow individuals to select from various modes to meet travel needs, make trips during less congested times, and avoid some auto trips altogether.

- The plan identified a very broad and ambitious rationale for TDM, encompassing the notion of choices.
- Reducing vehicle use and congestion will lead to lower levels of pollution. When traffic flow is improved, vehicle idling times are minimized and engine efficiency is improved, which means less pollution.
- Efficient land-use patterns that mix residential and commercial uses, have moderate or high densities, provide good access to transit stops, and provide an interconnected pedestrian and bicycle network can decrease SOV trips.
- Reducing the need for new and expanded transportation facilities will lower infrastructure costs.
- Less SOV use allows local governments and private businesses to build fewer parking spaces.
- More travel-mode options and faster travel times can improve regional access to jobs and services.
- Making walking and bicycling more feasible and attractive can improve community health.
- Providing the elderly with convenient options like walking, bicycling, transit, and ridesharing helps them remain independent and productive. Currently 12 percent of the region's population is age 60 or older; this number will increase to more than 22 percent by 2030.
- People who cannot drive will have better access to jobs, health services, education, and other daily needs.

Perhaps uniquely, the TDM plan clearly identifies the location emphasis of the TDM efforts. While the plan states that TDM promotional efforts will occur throughout the region and incentives will be available in all areas, it notes that efforts will also be targeted toward certain areas such as:

- CBDs of larger cities
- High-employment concentrations
- Along highway corridors with bus/ HOV lanes
- Adjacent to rapid transit stations and high-transit service locations.

In addition, specific goals and actions are identified in the plan and funding sources are identified for achieving the actions.

[121] Denver Regional Council of Governments Regional Travel Demand Management Strategic Plan, available at http://www.drcog.org/documents/RegionalTDMPlanFinal.PDF

KEY RESOURCES

2035 Houston-Galveston Regional Transportation Plan – Executive Summary, October 26, 2009, http://www.h-gac.com/taq/plan/documents/2035_final/2035%20RTP%20ExSum%202007-10-26%20REVISED. pdf

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Washington State Department of Transportation(WSDOT) Commute Trip Reduction (CTR) Laws & Program Requirements, http://www.wsdot.wa.gov/Transit/CTR/law.htm

WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746. 1, March 2010.

Whatcom COG, Whatcom Transportation Plan: A Combined Metropolitan and Regional Plan, June 25, 2007.

7. Integration of TDM at the Corridor Planning Level

While TDM has historically been focused on mitigating traffic at localized trip generators (e.g., large employment sites, new developments, etc.), it is increasingly being applied to congested corridors, including interregional corridors that cross county and state boundaries. This is because TDM has focused on the commuter travel market, which, in turn, is associated with peak period congestion on key highway facilities. In fact, one of the nation's first ride-matching services was offered by a radio station attempting to find solutions to traffic congestion on Boston's Southeast Expressway and other key facilities in 1973. Today, TDM is part of an overall scheme to better and more efficiently manage the operations of congested highways. TDM in highway operations is needed because, on a day-to-day basis, the operators of our highway systems cannot add capacity to meet changing conditions, but they work to manage the daily demands placed on our highways. This can be accomplished by offering travelers more and better travel choices.

Managing how many vehicles are on a given facility at any one time, via demand management techniques, can influence the effective capacity of the roadway and maintain traffic flow. This is the premise of the now popular "rice experiment" promoted by Washington State DOT.[122] The rice experiment showed that by modulating the rate at which vehicles entered the system (in the experiment, rice through a funnel), travel times can be increased or at least made more reliable.

At a smaller scale, this is the function of ramp metering. However, if travelers can shift their travel time, location, route or mode, fewer total vehicles may be using the facility during peak, congested periods.

CHAPTER ACRONYM LIST

ATDM	Active Transportation and Demand Management
CMP	Congestion Management Program
CTR	Commute Trip Reduction
CUTR	Center for Urban Transportation Research
DOT	Department of Transportation
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
IDM	Integrated Demand Management
ITS	Intelligent Transportation Systems
LOS	Level of Service
MIS	Major Investment Studies
MPO	Metropolitan Planning Organization
NCHRP	National Cooperative Highway Research Program
SMART	Specific, Measurable, Achievable, Realistic, and Time-bound
SOV	Single Occupancy Vehicle
TDM	Travel Demand Management
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TMC	Transportation Management Center
TRIMMS	Trip Reduction Impacts of Mobility Management Systems
TSM	Transportation Systems Management
TSM&O	Transportation Systems Management and Operations
VMT	Ve hicle Miles Travelled
VTR	Vehicle Trip Reduction

[122] Washington State Department of Transportation Rice Experiment, available at http://www.wsdot.wa.gov/Traffic/Congestion/Rice/Default.htm

From a planning standpoint, TDM needs to be integrated into the planning process to maximize the ability to reduce peak period demand. This is most relevant when considering major improvements to a corridor, so that the benefits of the improvements can be extended by lowering overall demand levels. This might involve strategies to price the facility, provide preferential treatment for HOVs, integrate traditional TDM programs for adjacent employment centers and other major traffic generators, improve facilities/operations of facilities parallel to the new corridor, or manage access to the corridor or land development adjacent to the corridor. But it is also important to explicitly consider TDM strategies, linked to a corridor, when planning for the ongoing operations of a facility with the goal of maximizing efficiency. This might be as simple as including all travel choices in the traveler information provided or linking regional ridesharing providers to the TMC.

KEY TAKEAWAYS

Integrating Demand- and Supply-side Strategies in a given corridor can:

- Influence travel before choices are made and make more efficient use of existing facilities.
- Improve reliability and system performance. A small change in demand can have great benefits. (Improved traffic flow on a federal or state holiday is an example.)
- Prolong the need for capacity expansion, lengthen the life of new investments, and/or make managed facilities more efficient and effective.
- Provide a set of strategies that are relatively low cost and easy to implement.
- Foster new public/private partnerships to manage system.
- Mitigate some of the negative impacts of traffic, including environmental and energy-related.

7.1 What Plans Should TDM be Included in?

The integration of TDM into corridor planning efforts is quite broad and can involve organizations at the state, regional, and local level. Some interregional corridor planning activities can even cross state boundaries. Some of the corridor-level plans that might involve TDM integration are enumerated in Table 7.1.

Table 7.1: Corridor Planning

Type of Plan	How to Integrate TDM/Role of TDM
Major Investment Studies	• States and regions looking at significant improvements that might add capacity in a given corridor can integrate TDM into planning activities through efforts such as MIS. • Plans include a TDM or Transit/TDM scenario aimed at assessing the effectiveness of mode choice measures in meeting growing travel demands via trip reduction strategies.
New Smart Capacity Project Plans	• Integrate demand management in a holistic manner, to create "smarter" capacity improvements, such as managed lanes.
Reconstruction Plans	• Add enhanced travel options (such as vanpooling and special bus service) and incentives to use them (special discounts or financial rewards). • Expand the nature and number of travel options provided through enhanced travel information services. • Implement temporary demand management infrastructure, such as HOV lanes, during construction.
Congestion Management Process (CMP)	• Address system deficiencies that might with relatively short-term, low cost solutions, including TDM. • Convene TDM/CMP Task Force to formulate TDM strategies that can address key bottlenecks on congested facilities.
Integrated Corridor Management Plans (ICM)	• Inform traveler of approaching congestion and the availability of parallel transit service with parking availability to instigate in-route mode shift.
HOV/HOT System Plans	• Plans, such as HOT corridor studies in Virginia, have integrated TDM and transit supportive measures into the plans in order to maximize the efficiency and person throughput of the enhanced facility.
Interregional Corridor Plans	• Incorporate discussions on interregional travel which crosses state lines and requires special planning activities through special collaboration.
Corridor TDM Program Plans	• Develop plan for relieving congestion in corridors to make travel easier for commuters. • Identify better travel choices that help to foster responsible economic growth.

There are two significant decisions related to integrating TDM into the corridor planning process – timing of the integration and scope or breadth of the TDM strategies considered.

In terms of timing, TDM strategies, and the general philosophy of balancing demand and supply solutions, should be considered at the start of the corridor planning process. Too often, TDM is considered almost an afterthought – a means to mitigate potential impacts of highway construction or as part of a list of supportive measures that are not truly integrated into the future operation of the facility.

Regarding scope, TDM strategies are often considered in a narrow or piecemeal fashion. The full set of TDM strategies, or travel choices, need to be included in corridor planning efforts. In some cases, the only "alternative" mode considered is transit and in other cases only traditional commuter-based TDM is considered. Time, location, and route choices should be considered in addition to mode choice. The Congestion Management Process is one framework that should help address this deficiency in the link between demand management and corridor solutions. As another example of this disconnect, the synergistic benefits of packaging TDM strategies are sometimes overlooked. For example, efforts to plan HOT lanes assess the impact of pricing on behavior change and facility operations, but often do not include provisions to support HOV services to achieve maximum throughput of the HOT facility.

Finally, involving all key stakeholders in the corridor planning process is important as well. These potential stakeholders are enumerated below, but critical participation is needed from those who will ultimately operate the facility and related services. This includes participation from day-to-day operators and service providers, such as the TMC, other traveler information providers, and service providers, such as transit operators, vanpool providers, and bicycle user groups.

7.2 What Is Your Capability with TDM at the Corridor Planning Level?

This desk reference will be utilizing the guidance based on different levels of existing experience with TDM and transportation planning. Table 7.2 provides examples of how planning agencies might integrate TDM into their corridor planning processes. This should assist users in determining the nature and location of key guidance within this section. Three levels of TDM integration are presented: ad hoc, defined, and optimized. As explained earlier in this document, these levels correspond to the Institutional Capability Maturity Model proposed by FHWA in its Guide for Improving Capability for Systems Operation and Management.[123]

Agencies with minimal experience in integrating TDM (ad hoc level) into their corridor plans and policies might only be viewing TDM as a mitigation strategy during reconstruction or seeking to use it to improve livability since there might be need to address congestion or air quality. At the next level (defined), an MPO might include TDM in most plans and policies as a means to increase travel choices and meet certain policy objectives, such as clean air or congestion reduction. In this case, TDM is likely one element of the overall plan. Finally, when TDM becomes optimized (Level 3), TDM may become a central focus of the entire plan if the MPO's policy board adopts an overall "philosophy" of managing demand and encouraging sustainable transport.

Table 7.2 provides specific examples of how an MPO might work to integrate demand management into regional transportation planning efforts at different levels of capability. This matrix is intended to assist the reader in determining where his or her organization fits in terms of the capability levels described above. Once the reader has determined his/her capability level and identified the critical step on which he/she is focused, specific actions to move from one level to the next are suggested in the next section.

[123] SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

Table 7.2: Integrating TDM into the Corridor Planning Process: An Overview

Planning Activities	Level 1 Ad-hoc	Level 2 Defined	Level 3 Optimized
Establishing Vision and Goals	• TDM largely not perceived as a corridor solution • TDM goals are not well aligned with corridor goals • TDM goals are often seen an afterthought to corridor operational measures	• TDM is viewed as a means to fulfill corridor level goals • Focused primarily on commute applications • Not explicitly connected to overall corridor performance	• Goals embrace a broader definition of TDM and are fully-integrated with corridor operational goals • Emphasis on person throughput rather than vehicle throughput • Goals go beyond commute trip and include other application markets • TDM is seen as the key strategy to enhance corridor operations by reducing overall single occupant vehicle demand
Setting Objectives for TDM	• TDM objectives focus primarily on marketing and educating the public on the benefits of transportation alternatives available in the corridor • Primary use of TDM objectives for short-term or time limited congestion mitigation activities • Not developed using a "SMART approach"	• Objectives for TDM are based on long-term benefits to the corridor in terms of congestion • Some objectives are "SMART" • TDM objectives are stand-alone and not clearly linked to overall corridor performance	• Objectives for TDM are based on long-term benefits to the corridor not only in terms of congestion but also for other priorities like mobility, access to destinations, economic development etc • All objectives are "SMART" and based on real-world information • TDM objectives are integrated into overall regional objectives for corridor performance
Definition of Performance Measures	• TDM performance measures are primarily oriented around "outputs," including: o Awareness of modes o TDM services o Related benefits • TDM performance measures linked to public awareness and satisfaction	• Performance measures begin to define TDM corridor-level "outcomes," including: o Mode split o Vehicle throughout o Rideshare rates o VMT o Air quality	• Performance measures include fully developed TDM corridor-level "outcomes" o Reduction in congestion o Increase in alternative mode use o Increased person throughput

Planning Activities	Level 1 Ad-hoc	Level 2 Defined	Level 3 Optimized
Assessment and Selection of Strategies and Programs to Support Objectives	• No rigorous analysis/modeling of potential for TDM strategies to meet objectives • Typically, at this stage, TDM strategies are not considered and do not drive any alternate scenarios • Strategies and programs that do get included (mostly commuter-based): o Marketing and education of all modal options and benefits o Promotion of active transportation o Establishment of short term TDM programs o Establishment of TMAs	• TDM is an integral part of many alternatives • Some off-model analysis/modeling of TDM • Strategies and programs that do get included may include: o Incentives for alternative modes and programs o Improvements to alternative modes o Partnerships with corridor businesses to provide employer services	• Developed a rationalized means of assessment of TDM strategies on corridor performance • Strategies and programs that may get included: o Enhanced linkages with ITS and Traffic Operations o Parking management as a core component of demand management o Use of technology to support more fluid travel behavior (multi-modal comparative travel times, real-time parking information etc.)
Integration of Strategies into Plans and Funding Programs	• Level of detail for TDM projects is significantly less than other projects • Tend to support traditional projects such as ride-sharing	• Greater level of detail for TDM projects • TDM becomes integral part of corridor short-term solutions especially during reconstruction	• TDM projects are as fleshed out as other projects • TDM continues to be part of long-term corridor management and operations
Monitoring and Evaluation of Progress Toward Objectives	• Evaluation methods for TDM are different from operational strategies • Planners are monitoring awareness levels through surveys, focus groups, and workshops, among relevant stakeholders and the public	• Formal methodology is in place to evaluate performance metrics • TDM and system performance are reported in a similar way (e. g., delay)	• Performance measurement includes quantitative and qualitative methods • Evaluate comparative cost effectiveness of TDM to other capital and operating strategies

7.3 Actions to Move Corridor Planning Process from Level 1 to Level 2

Several specific actions can be suggested to move an agency's corridor planning process from Level 1 (ad hoc integration of demand management) to Level 2 (defined integration). For each action, a rationale is provided, an explanation of how to implement the action, and examples are given where available. Table 7.3 indicates the relative ease or difficulty of implementing each action.

Action 1 – Establish guidance on how to and benefits of integrating TDM into corridor planning at the very beginning

Rationale and Explanation – TDM needs to be integrated early into the corridor planning process in order to realize its full benefits. Too often, TDM is an afterthought or only included as a mitigation strategy during reconstruction projects.

Example – Most guidance related to integrating TDM into corridor planning comes from highway reconstruction efforts. NCHRP Synthesis 273, Project Development Methodologies for Reconstruction of Urban Freeways and Expressways, provides guidance on the role of TDM in mitigating the traffic impacts of reconstruction.[124]

Action 2 – Determine organizational and inter-organizational responsibilities for TDM in corridor planning

Rationale and Explanation – TDM is often spread across the organizational chart of responsible agencies, including long-range planning, corridor planning, regional ridesharing, congestion management, etc. Corridor planning can be isolated from TDM operations, even when undertaken with in the same organization. It is important that roles be clearly defined in advance of specific corridor planning efforts, such as MIS.

Example – When plans were developed to make operational improvements on the SR 520 corridor in the Puget Sound, TDM strategies were included from the beginning. Improvements include active traffic management, tolling, transit improvements, bicycle facilities, as well as vanpool and telecommute promotion among area employers and TDM agents. This was due, in part, to the fact that Washington State DOT has a very active TDM program and that TDM implementation agents, such as Seattle Metro and area TMAs, were involved from the beginning.

Action 3 – Developing SMART objectives for TDM

Rationale and Explanation – As with many transportation-related policies, objective setting often results in rather vague targets. In TDM, appropriate objectives might be to: offer more travel choices, reduce congestion, improve air quality, or assist commuters. Using a SMART objective setting process, TDM goals and objectives should be as precise as possible. This requires a more involved planning process to reach consensus, especially with regards to measurable targets, but it allows for a more robust planning and evaluation process that allows for better monitoring of objective attainment, strategy correction, and funding decision-making. The objectives from many corridor improvements are based on reducing travel times and increasing the efficiency of the facility to move vehicles in an unimpeded manner. However, by including TDM strategies in corridor plans, partially to mitigate the negative impacts of traffic, other objectives can be more fully addressed, including mobility, accessibility, economic development, and livability.

[124] NCHRP, Project Development Methodologies for Reconstruction of Urban Freeways and Expressways, Synthesis 273, 1999.

Table 7.3: List of Actions and Associated Level of Difficulty to Move Corridor Planning Process from Level 1 to Level 2

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Establish guidance on how to and benefits of integrating TDM into corridor planning at the very beginning	Low	Low	Low	Moderate	Low
2	Determine organizational and inter-organizational responsibilities for TDM in corridor planning	Low	Moderate	Low	Moderate	Low
Setting Objectives for TDM						
3	Develop SMART objectives for TDM	Low	Low	Low	Low	Low
Definition of Performance Measures						
4	Identify concrete performance measures for TDM	Moderate	Moderate	Low	Low	Moderate
5	Create means to translate TDM performance metrics into highway operations metrics	Moderate	Moderate	Low	Moderate	Moderate
Assessment and Selection of Strategies and Programs to Support Objectives						
6	Draw upon existing tools to improve TDM modeling and analysis	Moderate	Moderate	Moderate	Moderate	Moderate
7	Integrate TDM into all scenarios for corridor Improvements	Moderate	Low	Low	Low	Low
8	Seek means to include traditional ridesharing and incentives into corridor plans	Moderate	Low	Low	Low	Low
Integration of Strategies into Plans and Funding Program						
9	Include TDM elements in overall corridor project funding	Moderate	Moderate	Low	Low	Moderate
Monitoring and Evaluation of Progress Toward Objectives						
10	Strengthen TDM performance evaluation and monitoring methods and means to report impacts	Low	Moderate	Low	Moderate	Moderate

Example – The Washington State 2006 CTR Efficiency Act continued a state mandate that goes back to 1991. Cities and counties are able to set their own specific goals and targets for employee commute trip reduction, as long as they met the minimum state targets of a 10% reduction in single occupant commute trips by 2011 to address congestion and a 13% reduction in VMT to address GHG emissions. In the first three years of the program, 154 million VMT have been reduced at over 1,000 worksites representing over a half a million commuters. This is estimated to have reduced highway delay by 8% in the Central Puget Sound region and almost 70,000 metric tons of GHG statewide. While the state legislation behind the CTR Efficiency Act was a major policy effort, the need for and ability to set quantifiable targets was fairly straightforward. Another example involves the 1996 Boulder, Colorado, Transportation Management Plan, which identified 10 multimodal corridors and improvements for all modes of travel along them. As these corridors carried a majority of the trips in the community and linked important activity and commercial centers, maximizing their efficient trip-carrying ability required improving the relationship between the multimodal transportation system, land use, and design along these corridors.

Action 4 – Identify concrete performance measures for TDM

Rationale and Explanation – TDM has largely been used as a means to achieve conformity between transportation and air quality plans. As such, VMT reduction, which can easily be transformed into emission reduction, has been the primary performance measures. As TDM is used to address other policy objectives (congestion, livability, land use, economic development), new performance measures will need to be developed. While many of these will have a link to existing performance measures (mode shift, VMT, etc.), new performance measures will evolve.

Example – The State of Florida has developed and adopted multi-modal LOS standards for comparison among and between modes and projects. FDOT's Quality/Level of Service Handbook of 2009 provides a methodology and analysis tools to develop and use multimodal performance measures for car, transit, bike, and walk travel for a given urban corridor.[125]

Action 5 – Create means to translate TDM performance metrics into highway operations metrics

Rationale and Explanation – Many of the performance measures used to measure highway operations and congestion are not the same measures used to gauge TDM program performance. This can create a dilemma as each discipline (TDM and highway operations) seeks to understand the impact of TDM on a particular highway. Indicators linked to congestion in a given corridor include:

- Travel time reliability.
- Delay (including vehicle hours of travel).
- LOS.

Performance indicators more appropriate to TDM include:

- VTR.
- VMT reduction.
- Person throughput (HOV use).
- Mode shift.
- Transit service reliability.

The measure that likely comes closest to linking the two disciplines is person throughput. Knowing vehicle occupancy, including transit, can help planners understand the efficiency of the facility in moving travelers, not vehicles.

[125] http://www.dot.state.fl.us/planning/systems/sm/los/default.shtm

Example – The example shown in the action described below illustrates one means of translating TDM effectiveness, in terms of mode shift, to reductions in delay. In this case, the mode shift impacts documented for the CTR law among employers in downtown Seattle are graphically shown as changes in travel time on I-5.

Action 6 – Draw upon existing tools to improve TDM modeling and analysis

Rationale and Explanation – TDM analysis can often be very piecemeal and based on anecdotal evidence, rules of thumb, and sketch planning techniques, at best. However, several tools are available to assist with the evaluation of TDM strategies as part of the planning, alternatives analysis, and project selection process. Utilizing these tools largely requires the time and commitment to learn about the use of the tools in advance of the planning process.

Example – Chapter 9 includes a description of several tools aimed at allowing for the quantification of TDM impacts for various strategies and packages of strategies. This includes the FHWA TDM Evaluation Model and the TRIMMS available from the CUTR (see more discussion in Section 9 on Tools and Techniques for Evaluating TDM).

However, in terms of tools to evaluate the impact of TDM on corridor operations, CUTR has developed a means to graphically display the temporal and spatial distribution of trip reduction, due to TDM, on a given facility, using CORSIM.

Action 7 – Integrate TDM into all Scenarios for Corridor Improvements

Rationale and Explanation – Corridor analyses, such as those included in MIS, generally involve the assessment of several alternatives. While TDM tends to be included in one alternative (the "TDM" or "TSM/TDM" or "TDM/Transit" alternative), it is important to include TDM in all alternatives, especially if one is to subscribe to the synergistic effects of TDM when integrated into management and operational strategies or as a means to reduce or redistribute demand.

Example – A paper summarizing the use of TDM in MIS conducted by the North Central Texas Council of Governments concluded that TDM and TSM can effectively complement major transportation investments. These strategies promote the use of transit and alternative commute modes, as well as improves transportation system performance. Both TDM and TSM strategies are relatively low-cost, quick-implementation transportation programs and projects, which should not be overshadowed by proposed major transportation improvement(s). Since an MIS is an intensive and comprehensive study of transportation alternatives in a travel corridor, this study process provides an excellent opportunity to explore the implementation of these low-cost, quick-deployment transportation strategies.[126]

Action 8 – Seek means to include traditional ridesharing and incentives into corridor plans

Rationale and Explanation – One of the most common types of corridor improvements included in plans involves technology enhancements and ITS. As such, many TDM improvements included in these plans are linked to technology, such as dynamic ridesharing and other traveler information enhancements. However, traditional TDM, such as carpool and vanpool promotion, telecommuting, and financial incentives for using alternative modes, can also be an important ingredient in corridor solutions.

Example – During the 2002 reconstruction of U.S. 101 over the Cuesta Grade in San Luis Obispo County, CA, several demand management strategies were implemented to mitigate the impact of the roadwork on commuters. These measures included additional peak period bus service in the corridor, vanpool subsidies, and subsidized fuel cards for carpools. An evaluation of the impact of the demand

[126] L. Dantas, Incorporating TDM and TSM in Major Investment Studies – The Dallas- Ft. Worth Metropolitan Area Experience, presented at ACT International Conference, 2000.

management program concluded that the combination of measures eliminated 310 cars per day from the facility and about 8,000 miles of vehicle travel by raising overall vehicle occupancy from 1.206 to 1.266. The daily cost to take each car off the road was estimated at $7.50. These reductions contributed to an overall perception by the traveling public that the reconstruction project was less disruptive than originally feared.[127]

Action 9 – Include TDM elements in overall corridor project funding

Rationale and Explanation – In order to fully integrate TDM into corridor projects, adequate funding is required and should be addressed at the programming phase of planning. TDM is often an afterthought as a mitigation strategy without adequate resources being dedicated.

Example – The Colorado DOT included a comprehensive TDM program in its T-REX project to reconstruct I-25/I-225 and expand light rail. TDM funding was included in the public involvement budget, with specific funds for targeted traveler information, transit and vanpool incentives, and local coordination and outreach.

Action 10 – Strengthen TDM performance evaluation and monitoring methods and means to report impacts

Rationale and Explanation – Agencies that manage highway facilities collect considerable information on operations (volumes, travel times, etc.) but often do not evaluate the impact of TDM or alternative mode initiatives on those operations. New and better methods are required to translate highway operations and TDM effectiveness data into common metrics, such as reductions of VMT and delay.

Example – The evaluation of HOT lane projects often includes data that relate TDM to highway operations, such as vehicle occupancy, person throughput, alternative mode utilization, etc.

7.4 Actions to Move Corridor Planning Process from Level 2 to Level 3

Several specific actions can be suggested to move a corridor's planning process from Level 2 (defined integration of demand management) to Level 3 (optimized integration). Table 7.4 highlights the relative ease or difficulty for each action in moving from Level 2 to Level 3.

Action 1 – Determine range of travel markets that can be influenced by TDM

Rationale and Explanation – While the journey to work is likely the most influential travel purpose for most corridors, other travel markets can heavily influence the timing and location of traffic congestion and general traffic patterns. Large-scale generators, such as universities, airports, and event centers can influence traffic and may require a very different set of TDM strategies to address, given differences in operating hours, type of vehicles, and other characteristics.

Example – An FHWA guidance document entitled "Mitigating Traffic Congestion: The Role of Demand-side Strategies" enumerates many travel markets or applications for TDM, beyond traditional commuters.[128] These venues include: schools and universities, recreation and tourism, special events, hospitals, and airports.

[127] http://international.fhwa.dot.gov/pubs/pl11011/pl11011.pdf

[128] FHWA "Mitigating Traffic Congestion: The Role of Demand-Side Strategies," available at http://www.ops.fhwa.dot.gov/publications/mitig_traf_cong/mitig_traf_cong.pdf

Table 7.4: List of Actions and Associated Level of Difficulty to Move Corridor Planning Process from Level 2 to Level 3

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Determine range of travel markets that can be influenced by TDM	Low	Low	Low	Low	Low
2	Determine whether TDM is an overall operating philosophy or mitigation strategy	Difficult	Moderate	Moderate	Moderate	Moderate
3	Train corridor project managers on TDM	Low	Moderate	Low	Moderate	Moderate
4	Develop new partnerships in key corridors	Low	Moderate	Low	Moderate	Moderate
Setting Objectives for TDM						
5	Set longer term objectives for TDM	Difficult	Moderate	Moderate	Moderate	Difficult
Definition of Performance Measures						
6	Develop corridor performance measures tied to person throughput	Moderate	Moderate	Low	Moderate	Moderate
Assessment and Selection of Strategies and Programs to Support Objectives						
7	Develop procedures for considering demand management strategies prior to other, more capital intensive alternatives	Difficult	Moderate	Low	Moderate	Moderate
8	Use TDM as a means to reduce need to expand road capacity	Difficult	Difficult	Low	Moderate	Difficult
9	Develop new tools/approaches to incorporate all travel Choices into the analysis process	Low	Low	Moderate	Moderate	Low
10	Include active demand management to integrate TDM into corridor solutions	Moderate	Moderate	Moderate	Moderate	Moderate
Integration of Strategies into Plans and Funding Programs						
11	Include TDM as a key element to reducing overall, long-term demand	Difficult	Difficult	Low	Moderate	Difficult
Monitoring and Evaluation of Progress Toward Objectives						
12	Adopt or develop a standardized approach to reporting TDM performance	Low	Low	Moderate	Moderate	Low

Action 2 – Determine whether TDM is an overall operating philosophy or mitigation strategy

Rationale and Explanation – Agencies that adopt an overriding philosophy of TDM, rather than limit it as a mitigation strategy, are obviously more apt to integrate TDM strategies into all or most aspects of corridor planning and operations. Today, using real-time travel information, much of what TMCs do is manage demand by seeking to reduce or influence traffic at the most congested places and times. Once an agency adopts a philosophy of maximizing travel choices rather than minimizing auto travel times, TDM will become a much larger part of the way facilities are planned and managed.

Example – FHWA is developing a new program entitled "Active Transportation and Demand Management" (ATDM), which is defined as the dynamic management, control, and influence of travel demand, traffic demand, and traffic flow of transportation facilities. Through the use of available tools and assets, traffic flow is managed and behavior influenced in real time to achieve operational objectives. ATDM is not a set of specific strategies; rather it is an over-arching philosophy for managing a facility through demand management and dynamic traffic management.

Action 3 – Train corridor project managers on TDM

Rationale and Explanation – In keeping with the objective to provide guidance on corridor TDM planning, it would be helpful to offer specific training to project managers that oversee corridor improvements on the fundamentals of TDM. Some planners cite a disconnect between TDM integration into corridor plans and the occasional lack of execution by project managers. In other words, if project managers do not fully understand the how and why of TDM implementation, even the best plans may not be realized.

Example – As noted in the state-level section of this document, Colorado DOT has developed tools to assist its planners and project managers, as well as local government and business, with TDM implementation, including The TDM Toolkit and the TDM Corridor Projects Study (see T-REX example above), which offer a complete list of strategies with TDM successes throughout Colorado and the U.S.[129] However, sometimes the skill mix and training of project managers can work to restrict innovations, such as TDM. In fact, the Dutch Ministry of Transport has implemented a program to broaden the types of professionals who are assigned as major infrastructure project managers, retaining not only engineers, but economists, psychologists, social scientists, and anthropologists.

Action 4 – Develop new partnerships in key corridors

Rationale and Explanation – Travel corridors and highway facilities cross jurisdictional boundaries. Therefore, unique partnerships are needed to coordinate planning efforts among public and private interests. These partnerships will include the facility operator (often the state DOT), localities in the corridor, and planning agencies, as well as private interests, such as large employers or developers.

Example – Corridor coalitions have been used extensively for urban segments (U.S. Highway 169 Corridor Coalition) and interregional efforts (I-95 Corridor Coalition). These efforts bring all levels of government as well as the private sector to the table to plan and implement corridor improvements. The U.S. Highway 169 Corridor Coalition's mission is "Working together to enhance safety, reduce congestion and maximize economic development along the U.S. Highway 169 interregional corridor. " This includes freight, intercity, and commuter travel.

Action 5 – Set longer term objectives for TDM

Rationale and Explanation – TDM is often viewed as a short-term, stop gap measure to mitigate traffic during reconstruction, during major events, or until capacity enhancements can be made. However, if TDM is recognized as a means to reduce overall demand on a facility, longer term benefits can be realized. Thus, longer term objectives can be set for TDM, presumably for the entire life of a long-range plan or the life of a highway improvement or expansion.

[129] CDOT, Colorado 2035 Statewide Transportation Plan, Travel Demand Management Technical Report, March 2008.

Example – The UK Department for Transport developed a concept entitled "Integrated Demand Management" (IDM), originally designed to incorporate demand management into comprehensive corridor improvement plans and projects. The IDM concept is being applied to the reconstruction and widening of the M25 motorway around London. The Highways Agency describes IDM as "a holistic approach based upon making best use of the existing road-space and locking in the benefits of widening. " The philosophy behind IDM is to maximize the efficiency of the facility using ATM and to maximize the effective life of the improvement by reducing overall demand for its use.

Action 6 – Develop corridor performance measures tied to person throughput

Rationale and Explanation – Common practice still focuses corridor performance on vehicle movement measures (travel time, level of service) and not person movement. Corridor plans that seek to maximize travel choices should also include related performance measures, such as person throughput, vehicle occupancy (including transit), and overall accessibility. As one observer put it, "Higher person throughput can extend the effectiveness of the managed lane facility, thereby yielding a better return on investment and greater life-cycle performance of the system. This can only be achieved by positively affecting the balance of modes towards high-occupancy vehicles, particularly multi-person carpools, vanpools, and transit."[130]

Example – The HOT lane demonstration project on I-15 in Salt Lake City, UT, revealed that the Express Lane (open to carpools, vanpools, buses, motorcycles, and paying solo drivers) carried almost twice as many persons as the average general purposes lane during the PM peak period.[131]

Action 7 – Develop procedures for considering demand management strategies prior to other, more capital intensive alternatives

Rationale and Explanation – While federal planning guidance suggests that alternatives be considered before options that accommodate the SOV, state DOTs may wish to consider structuring this philosophy in the planning process by requiring that specific corridor planning efforts first prove why TDM cannot be a primary solution before considering options that add capacity, or even efficiency improvements. This would require a fundamental change in thinking that involves viewing TDM not as a short-term mitigation strategy, but as a long-term approach to reducing overall vehicle demand.

Example – One example of the full institutionalization of TDM into the planning process comes from Sweden. In 2002, the Swedish National Roads Administration adopted the "four stage principle" that requires planners and engineers to evaluate options in the following order:

1. Measures that affect the demand for transport and the choice of mode.
2. Measures that affect the more efficient use of the existing road network.
3. Measures that make improvements to existing roads.
4. Measures that make new investments in road capacity or major rebuilding.

Planners are, therefore, required to consider and rule out demand management before they can consider infrastructure improvements.[132]

Action 8 – Use TDM as a means to reduce need or delay to expand road capacity

Rationale and Explanation – If the broader benefits of TDM are accepted, namely reducing overall demand, the need for capacity expansion may not just be delayed, it might even be eliminated. Agencies that plan corridor improvements are not likely to accept the prospect of eliminating the need for one or more lanes of expansion unless evidence is available to show that TDM can reduce traffic. However, many cities are adopting the concept of "road diets" to reduce space for automobiles and increase that for bicycles and pedestrians.

[130] http://david.ungemah.com/commentary-menu/24-tdmreviewmanagedlanes.html

[131] University of Utah Transportation Lab, "I-15 Express Lanes Evaluation – Final Report" UTL-1106-89, November 26, 2007.

[132] FHWA, Managing Travel Demand – Applying European Perspectives to U.S. Practice, FHWA-PL-06-015, May 2006.

Example – In a few cities, the TDM philosophy is fully embraced and the result is an overall reduction in car travel. In Lund, Sweden,[133] and Arlington, Virginia,[134] reductions in VMT and vehicle volumes have been observed and documented in line with implementation of aggressive TDM programs. Arlington County, Virginia, has documented a reduction (12-16%) in traffic levels on several key arterials concurrent with considerable growth in public transport ridership (38%) and demand management success with area employers and institutions.

Action 9 – Develop new tools/approaches to incorporate all travel choices into the analysis process

Rationale and Explanation – Moving from the defined approach to a more optimized integration of TDM may require the development of tailored and specialized analytic tools to evaluate the effectiveness of TDM strategies in addressing key policy objectives. While many "off the shelf" tools now exist, in order to analyze the full set of TDM strategies and their impact across a myriad of objectives, specialized tools may be required. This might include new, tailored means of using the traditional four-step travel models or newer activity-based models. It might also involve other new tools, such as the micro-simulation tool, developed by CUTR and discussed earlier in this document, which uses employer TDM data and CORSIM.

Example – The traditional four-step travel demand modeling process can be used to evaluate TDM strategies that can be analyzed in terms of time and cost variables. However, many off-model tools have been developed to analyze congestion pricing strategies, bicycle and walk strategies, and other strategies that cannot be expressed in terms of time and cost indicators. As mentioned above, a good discussion of the means to incorporate TDM into regional travel demand models is provided by CUTR in a report entitled "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model." This approach, which was developed for WSDOT, includes a specific TDM Assessment Procedure that uses the CUTR TRIMMS model and processes resulting TDM impacts through standard trip tables.[135] In fact, the use of the TRIMMS model itself (discussed in Chapter 9) to perform cost/benefit analysis for TDM strategies could represent a significant movement toward mainstreaming TDM integration.

Action 10 – Include active demand management to integrate TDM into corridor solutions

Rationale and Explanation – As mentioned above, many of the solution strategies used in corridors rely on technology enhancements to move vehicles and data more efficiently. TDM, which is partially dependent on information to influence mode choice, has made many advances in this area over the past 10 years, with the advent of dynamic ridesharing initiatives and instant ridematching. The ability to integrate these TDM technology advancements into corridor plans will create better travel choices for a variety of modes.

Example – The ATDM program, being developed by FHWA, provides examples of four types of "active demand management" strategies to complete active traffic and active parking management. These active demand management strategies include: dynamic ridesharing, on-demand transit, dynamic pricing, and predictive traveler information.[136]

Action 11 – Include TDM as a key element to reducing overall, long-term demand

Rationale and Explanation – If TDM is accepted, as suggested in Actions 6 and 10, as a means to reduce overall vehicle demand, then the nature and size of corridor projects that flow from the planning process to programming could be rather different. Not only might capital projects be more modest in scope, but TDM programs may take a much larger part of the TIP, in order to fund the necessary efforts to promote, encourage, and maintain the use of sustainable travel options.

[133] FHWA, "Managing Travel Demand: Applying European Perspectives to U.S. Practice," Report No. FHWA-PL-06-015, May 2006.

[134] Jennings, H., TDM: The Software that Supports the TOD Hardware, Arlington Commuter Services, October 2011.

[135] WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746. 1, March 2010.

[136] FHWA, "ATDM Program Brief: An Introduction to Active Transportation and Demand Management", 2011.

Example – As cited in the last section on metropolitan-level planning, the TSM&O plan in the Portland region devotes almost as much funding to TDM as to capital and efficiency improvements.

***Action 12* – Adopt or develop a standardized approach to reporting TDM performance**

Rationale and Explanation – In order to provide an effective feedback loop to the objective setting and strategy selection process, standardized TDM evaluation methodologies are required. This might involve developing a tailored approach for a given MPO or adopting a widely accepted methodology. Such methodology development or adoption should be vetted with TDM professionals and researchers to assure that it is understandable, rigorous, and usable.

Example – The MAX-SUMO monitoring and evaluation approach developed in Europe is easily adaptable to the U.S. experience for many TDM strategies. The methodology is described in Chapter 9.

7.5 Best Practice Examples: Corridor-Level TDM Integration

Two types of best practice examples are provided here – one focused on TDM and highway reconstruction in Colorado and another focused on planning for TDM and innovative corridor operations (HOT lanes) in Virginia.

TDM and Highway Reconstruction

TDM strategies are increasingly being integrated into highway reconstruction projects and therefore are an integral part of the planning process. One of the most comprehensive examples comes from the T-Rex project in the Denver area (Figure 7-1), the reconstruction of I-25/225 and extension of light rail (completed in 2007).[137] During reconstruction, a temporary HOV lane was added to provide a travel time advantage to carpools, vanpools, and buses. TDM was built into the public outreach component of the

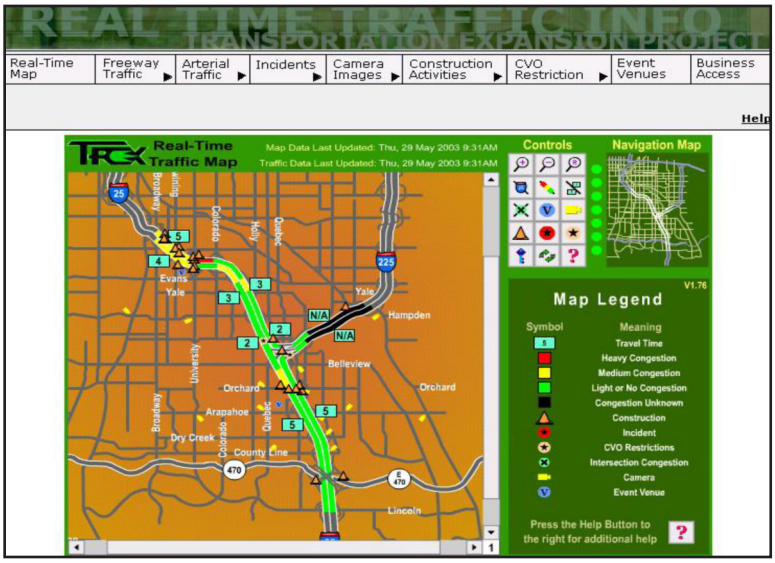


Figure 7.1: Denver T-Rex I-25/225 Reconstruction

Source: Colorado DOT

[137] FHWA, Mitigating Traffic Congestion: The Role of Demand-side Strategies, FHWA-HOP-05-001, 2004

project at an early stage. Some $3 million was dedicated to TDM to support the following:

- Support and expansion of a TMA in the corridor.
- Integration of TDM information into a project traveler information website.
- Subsidized transit passes, available from TMA.
- Subsidized vanpools for new vanpool groups in corridor.

Colorado DOT noted that the TDM activities reduced the risks associated with the reconstruction project and that follow-up surveys showed that travelers were very supportive of the TDM strategies. CDOT now plans to build TDM into all major reconstruction projects as a matter of procedure.

TDM and HOT Lane Planning

Many HOT lane projects have provided new or improved transit services as an alternative to paying the toll. However, the conversion of an HOV facility to HOT operations (priced use of excess capacity by drive alone travelers) should consider means to maintain or grow HOV use in order to maximize the operational efficiency and person throughput of the facility. Some plans have been largely based on the assumption that HOV will recognize the benefits of free travel in the HOT lane and continue to share rides. However, in some cases, the vehicle occupancy level is being raised to 3+ occupancy in order to create capacity to sell, creating the need to maintain existing HOV levels so as not to create new drive alone modes.

The Virginia Department of Rail and Public Transportation undertook a planning process to assess the most cost effective use of HOT lane revenue for transit and TDM in order to maintain and enhance HOV utilization as part of planning for the I-95/I-395 HOT lane project in northern Virginia, from Arlington to south of Fredericksburg.[138] An I-95/I-395 Transit/TDM Technical Advisory Committee was created to study, analyze, and plan for the best mix of transit and TDM strategies to maintain and grow alternative modes use while introducing HOT lane operations. Two stated objectives for the planning effort were to:

- Preserve transit and HOV ridership while implementing the HOT lanes by providing improvements that help maintain current market share for transit, carpools, and vanpools.
- Utilize new HOT lane features to attract new transit and HOV riders by using a corridor management approach to improve existing service and serve new markets.

This is a departure from some plans, which largely assume HOV use to be constant and seek ways to capitalize on unused capacity, by seeking ways to grow HOV and transit use within the context of HOT lane operations. The plan outlines many new and enhanced transit services and many enhanced TDM measures, including: capital assistance for vanpools, enhanced Guaranteed Ride Home programs, financial incentives for vanpools and carpools, rideshare program operational support, TDM program marketing support, and telework program assistance.

[138] VDRPT, 1-95/I-395 Transit/TDM Study: Final Report, 2008, available at http://www.drpt.virginia.gov/studies/files/I95_I395_Transit_Final.pdf

KEY RESOURCES

CDOT, Colorado 2035 Statewide Transportation Plan, Travel Demand Management Technical Report, March 2008.

FHWA, "ATDM Program Brief: An Introduction to Active Transportation and Demand Management, 2011.

FHWA, Managing Travel Demand – Applying European Perspectives to U. S. Practice, FHWA-PL-06-015, May 2006.

http://david.ungemah.com/commentary-menu/24-tdmreviewmanagedlanes.html

http://international.fhwa.dot.gov/pubs/pl11011/pl11011.pdf

http://www.dot.state.fl.us/planning/systems/sm/los/default. shtmhttp://international.fhwa.dot.gov/traveldemand/t1_p08.cfm#netherlands

L. Dantas, Incorporating TDM and TSM in Major Investment Studies – The Dallas- Ft. Worth Metropolitan Area Experience, presented at ACT International Conference, 2000.

NCHRP, Project Development Methodologies for Reconstruction of Urban Freeways and Expressways, Synthesis 273, 1999

SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

University of Utah Transportation Lab, "I-15 Express Lanes Evaluation – Final Report" UTL-1106-89, November 26, 2007.

WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746.1, March 2010.

8. Integration of TDM at the Local Planning Level

Travel demand management is very often implemented at the local level, especially as it relates to site-level programs (employment sites, new developments, sporting venues). Local planning is generally associated with municipal governments, (i.e., city planning activities), but sometimes TDM is planned at a local level outside the institutional framework of city government (e.g., TMAs or sub-regional planning activities). Municipalities play a very important part in TDM planning, because they are often the key actors in program implementation. For example, municipal land use and parking policies are very important mechanisms for influencing demand. As corridor-level transportation management strategies are developed, effects on parallel arterials and city streets are vital considerations. Finally, the implementation of some specific TDM strategies, such as bicycle and walk infrastructure, transit signal prioritization, carsharing, and parking management, are within the purview, plans, and budgets of municipalities.

CHAPTER ACRONYM LIST

CMAQ	Congestion Mitigation and Air Quality
CTR	Commute Trip Reduction
CUTR	Center for Urban Transportation Research
DOT	Department of Transportation
EPOMM	European Platform on Mobility Management
FHWA	Federal Highway Administration
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle SMART Smart, Measurable, Achievable, Realistic, and Time-bound
SOV	Single Occupancy Vehicle
TDM	Travel Demand Management
TOD	Transit Oriented Development
TSM	Transportation Systems Management
VMT	Vehicle Miles Travelled
VTR	Vehicle Trip Reduction

Some of the most successful TDM programs are planned and implemented in high-growth cities. The negotiating leverage of these cities to mitigate the traffic impacts of this growth via TDM is key. Finally, some of the most innovative demand management strategies have been implemented by cities, namely cordon pricing (London and Stockholm), demand-based parking pricing (Redwood City, CA), growth management (Portland, OR), and pedestrian/bicycle prioritization (New York City).

KEY TAKEAWAYS

What is the appropriate role for municipalities in integrating TDM into the planning process?

- Use a site plan review process to incorporate TDM into new developments.
- Participate in regional committees and planning efforts that include TDM.
- Build upon control of cities over parking management as a TDM measure.
- Focus on community-level planning for bike and walk initiative tied to livability.
- Cities are the focus of sustainable transportation and climate change action plans.

8.1 What Plans Should TDM be Included In?

The integration of TDM into local planning practices can occur as part of a wide variety of local planning activities, as enumerated in Table 8.1.

Table 8.1: Local Planning

Type of Plan	How to Integrate TDM/Role of TDM
General Plan Circulation Elements	• Include recommendations on TDM in the circulation element of the general plan as a strategy to make local arterials operate more efficiently. • Include TDM as a complement to parking management activities. • Include TDM mitigation requirements for new developments when outlining land use and zoning policies.
Site Development Review Process	• Codify the role of TDM in the site plan review process via trip reduction ordinances or more informal, negotiated processes.
TMA or TDM Plans	• Elicit TDM planning under the auspices of localized TDM implementing agents, such as Transportation Management Associations (TMAs) or Transportation Management Districts (TMDs).
Municipal TDM Plans	• Develop citywide TDM plans to focus the TDM –specific activities of the municipality. May include a description of current city activities, how these fit into state and regional plans and efforts, and a set of specific implementation objectives for the next several years.
Climate Action Plans	• Develop action plans to address climate change, since the reduction of car use is often a key strategy in climate action plans, TDM often plays a central role. • Include ways that cities and citizenry can operate greener and cleaner (low energy solutions, clean municipal fleets).
Sustainable Urban Transport Plans	• Make TDM the centerpiece by developing transportation solutions that are grounded in sustainability. Plan places travel choices, environmental mitigation, and social inclusion as the top of the plan's goals and objectives.
Future Applications	• Elevate the importance of TDM to a stand-alone planning activity in order to coordinate all related activities at the municipal level. Municipal TDM plans should seek to go beyond traditional TDM (often the focus of site-level mitigation strategies) to include the broad spectrum of travel demand influencing efforts, including parking pricing, neighborhood marketing, special event planning, cordon pricing, preferential treatments on arterials.

TDM is often used as a mitigation strategy to minimize the impacts of new traffic generated by new or expanded development. Many cities have codified the role of TDM in the site plan review process via trip reduction ordinances or more informal, negotiated processes. Some cities have codified the review process into a Transportation Management Plan requirement for new, major trip generators (e.g., San Francisco, Seattle). Trip reduction requirements are often supported by regional plans and policies that promote good practice and model ordinances. Major development areas sometimes prompt a specific plan for a planned unit development or major employment center. To ensure that integrated strategies are developed for the entire area, these plans often include a comprehensive TDM element to mitigate traffic impacts and "build" TDM into the travel choices for future tenants and visitors.

8.2 What Is Your Capability with TDM at the Local Planning Level?

This desk reference will be utilizing the guidance based on different levels of existing experience with TDM and transportation planning. Table 8.2 provides examples of how local planning agencies might integrate TDM into their corridor or regional planning processes. This should assist users in determining the nature and location of key guidance within this section. Three levels of TDM integration are presented: ad hoc, defined, and optimized. As explained earlier in this desk reference, these levels correspond to the

Table 8.2: Integrating TDM into the Local Planning Process: An Overview

Planning Activities	Level 1 Ad-hoc	Level 2 Defined	Level 3 Optimized
Establishing Vision and Goals	• Minimal or no role envisioned by City decision-makers for TDM (primarily seen as a regional problem)	• TDM is largely associated with site development • Emphasis on bike/ped, public transit solutions • Parking solutions/policies are beginning to be considered • City begins to react to grass-roots advocacy for increased use of sustainable modes	• TDM goals linked to non-traditional objectives such as livability and health • Emphasis on all choices, all modes • Parking supply and pricing rationalized in the City • Effective land-use integration creates demand for sustainable modes • Leadership and commitment by City decision-makers drives TDM approaches
Setting Objectives for TDM	• Specific TDM objectives tied to traffic mitigation for new site development • Broader TDM objectives focus primarily on TDM program branding, marketing and educating the across City agencies and the public on the benefits of transportation alternatives available throughout the City • Objectives are not developed using the "SMART" approach	• Specific objectives include the incorporation of TDM-friendly TOD design and facility improvements; and the development of strategic City-wide partnerships • Some objectives are SMART	• Objectives include an emphasis on reliable choices and long-term traveler behavior changes • TDM objectives are viewed as vital to economic growth • All objectives are SMART
Definition of Performance Measures	• TDM performance measures are primarily oriented around "outputs," including: o Awareness of modes o TDM services o Resident satisfaction	• Performance measures begin to define TDM local-level "outcomes," including: o Business impacts o Mode split o Vehicle throughout generation rates o Rideshare rates o VMT o Air quality	• Performance measures include fully developed TDM local-level "outcomes" o Reduction in congestion o Increase in alternative mode use o Enhanced livability/quality of life/health

Planning Activities	Level 1 Ad-hoc	Level 2 Defined	Level 3 Optimized
Assessment and Selection of Strategies and Programs to Support Objectives	• Assessments based on peer reviews, special studies and local experience • TDM less likely to be called out as unique element in plans • Strategies are very localized both in scope and analysis • Strategies and programs include: o Utilization of existing resources to implement alternatives or services that are relatively common o Marketing and education of all modal options and benefits o Promotion of active transportation	• Use of sketch planning tools to estimate impacts of strategies • Strategy scope and analysis are more activity-center oriented • Strategies and programs include: o Improvements to alternative modes o Incentives for alternative modes o Codify developer requirements and rationale	• Specialized tools and models used for TDM assessment • TDM considered a city-wide effort and increasing acquiring regional/inter jurisdictional flavor • Strategies and programs include (moving beyond current experiences): o Implementation of TDM-supportive site design o Establishment of alternative work schedules o Coordination of employer services o Creation of specialized transit services
Integration of Strategies into Plans and Funding Programs	• Short-term, ad-hoc projects included in plans with no dedicated source of funding • Typically bike/walk projects are included	• Establishment of a city-wide TDM marketing fund which is used for projects including pilots • Plans go beyond site development process with respect to TDM strategies	• TDM is included as a foundational strategy in the plans for sustainability • Plans include long-term programs with dedicated funding
Monitoring and Evaluation of Progress Toward Objectives	• Typically self-reporting among developers and employers	• City plays active role in monitoring and evaluation including establishing reporting structures, collecting and monitoring specific data elements such as parking	• Monitoring and evaluation is consistent with region and standardized • Data is used for objective-setting and decision-making

Institutional Capability Maturity Model proposed by FHWA in its Guide for Improving Capability for Systems Operation and Management.[139]

Municipalities and local agencies with minimal experience in integrating TDM (ad hoc level) into their plans and policies might only be viewing TDM as a mitigation strategy for addressing the impact of traffic generated by new development. Moving to the next level (defined), a city might include TDM in most plans and policies as a means to increase travel choices and meet certain policy objectives, such as circulation or livability. In this case, TDM is likely one element of the overall general plan. Finally, when TDM becomes optimized (Level 3), TDM may become a central focus of sustainability or climate change plans if the city council adopts an overall "philosophy" of managing demand and encouraging sustainable transport.

Table 8-2 provides specific examples of how localities might work to integrate demand management into regional transportation planning efforts. This matrix is intended to assist the reader in determining where his or her organization fits in terms of the capability levels described above. Once the reader has determined his/her agency's capability level and identified the critical step on which the agency is focused, specific actions to move from one level to the next are suggested in the next section.

In general, TDM is being integrated into existing plans and planning processes. TDM is often mentioned in General Plans or Comprehensive Plans for cities as part their routine updating process. This is where the relationship between land use, parking, and TDM can be defined and exploited. As such, no new or specialized planning process needs to be developed. However, in the case of stand-alone TDM or climate action plans, a process may need to be established for the review and approval of the new plan. This may even require the appointment of new committees and advisory bodies. Some plans are developed through unique public/private partnerships, such as the plans directing the activities of TMAs or the development of a Transportation Management Plan for major developments or trip generators (e.g., hospitals, special event venues, stadia, etc.). It is also important that municipal TDM planning efforts be coordinated with regional or corridor-level TDM planning. Municipal programs (e.g., parking) and policies (e.g., site review) can be very important aspects of broader TDM strategies at the corridor or metropolitan level. Cities with active TDM policies and plans can encourage neighboring cities within their region to integrate TDM into their plans. Municipal efforts to manage demand can also be important mechanisms for realizing objectives with other metropolitan area plans, such as the Congestion Management Process.

Other processes can be somewhat less formal, such as the role of TDM in the site review process. Many cities that allow and encourage TDM as a mitigation strategy do so via trip reduction or TDM ordinances that set the ground rules for negotiated or regulated TDM planning activities. As such, TDM plans are not developed until requested by city review staff or as proffered by developers. One lesson from many years of experience with this process is the need for well-established and documented guidelines. Developers and their agents are more willing to plan and implement meaningful TDM strategies when the process for developing these measures is transparent and fair. The process for developing TDM plans as part of the development review process can also be aided by other tools, such as the TDM planning simulation workshop process developed in Europe, part of the guidance on TDM and land use within the European Platform on Mobility Management (EPOMM).[140]

8.3 Actions to Move Local Planning Process from Level 1 to Level 2

Several specific actions can be suggested to move an agency's local planning process from Level 1 (ad hoc integration of demand management) to Level 2 (defined integration). For each action, the rationale, an explanation, and examples are provided where available. Table 8.3 indicates the relative ease or difficulty of implementing each action.

[139] SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

[140] European Platform on Mobility Management (http://www.epomm.eu/index.phtml?ID1=2180&id=2180)

Table 8.3: List of Actions and Associated Level of Difficulty to Move Local Planning Process from Level 1 to Level 2

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	Solicit broad stakeholder input into role of TDM in local plans and policies	Low	Low	Low	Moderate	Low
2	Educate local traffic commission and city council staff on TDM	Low	Low	Low	Low	Low
Setting Objectives for TDM						
3	Develop SMART objectives for TDM	Low	Low	Low	Low	Low
4	Integrate TDM into TOD, Smart Growth and Complete Streets Initiative	Moderate	Moderate	Low	Low	Moderate
Definition of Performance Measures						
5	Shift TDM performance measures from outputs to outcomes	Low	Moderate	Low	Low	Low
Assessment and Selection of Strategies and Programs to Support Objectives						
6	Draw upon existing tools to improve TDM modeling and analysis	Moderate	Moderate	Moderate	Moderate	Moderate
7	Assess impact of TDM beyond specific sites	Moderate	Low	Low	Low	Low
Integration of Strategies into Plans and Funding Programs						
8	Update plan review process and requirements for new developments	Moderate	Moderate	Low	Low	Moderate
9	Establish a TDM fund, providing improved travel choices and related services with city assuming a larger role	Moderate	Moderate	Moderate	Low	Moderate
Monitoring and Evaluation of Progress Toward Objectives						
10	Strengthen TDM performance evaluation and monitoring methods and means to report impacts	Moderate	Moderate	Low	Low	Moderate

Action 1 – Solicit broad stakeholder input into role of TDM in local plans and policies

Rationale and Explanation – The key individuals involved in municipal TDM planning go well beyond city staff. The individuals involved in TDM planning will somewhat depend on how novel or routine TDM planning is and specific issues that might require the involvement of certain interests. The range of stakeholders might include:

- City staff, including: traffic, streets and/or transportation staff, planning and development review staff, city council staff, city manager, and specialized departments, such as parking, transit, or environment.
- Transportation service operators, including: all transit service providers operating within the city, shuttle services, vanpool operators, carsharing companies, bike stations, etc.
- Developers, including their planning contractors and on-site tenant services providers.
- Employers, including those fulfilling trip reduction mandates, those at sites subject to traffic mitigation as well as other large and enlightened employers (including the city as an employer).
- Business organizations, such as: chambers of commerce, business and industry councils, and TMAs.
- Advocacy groups, including environmental groups, bicycle and walking advocates, and transit user groups.
- Commute management organizations – providers of ridesharing and other TDM services, sometimes housed and/or funded by regional planning organizations but sometimes housed within municipal governments.
- Owners and operators of other transportation facilities (e.g., transit stations, freight operators).

Example – The Heathrow Transport Forum (UK) was formed to address growing traffic and access issues around the expanding airport. As part of a surface access strategy required by the national government, the Forum was comprised of adjacent municipalities, airport employers and operators, transportation providers, and other interests. The Forum was instrumental in developing a package of TDM strategies for airport employees that were available to area residents as well.[141]

Action 2 – Educate local traffic commission and city council staff on TDM

Rationale and Explanation – TDM may be a rather foreign concept to those involved in local decision-making, given a traditional focus on streets and intersections. It will be important to educate decision-makers about the benefits of supporting and implementing TDM as a means to address specific local transportation and quality of life objectives.

Example – Many local planning and municipal organizations offer training and technical assistance on various initiatives, such as TDM. For example, the League of California Cities offers sessions on TDM planning as part of its various conferences and workshops.

Action 3 – Developing SMART objectives for TDM

Rationale and Explanation – As with many transportation-related policies, objective setting often results in rather vague targets. In TDM, appropriate objectives might be to: offer more travel choices, reduce congestion, improve air quality, or assist commuters. Using a SMART objective setting process, TDM goals and objectives should be as precise as possible. This requires a more involved planning process to reach consensus, especially with regards to measurable targets, but it allows for a more robust planning and evaluation process that allows for better monitoring of objective attainment, strategy correction, and funding decision-making.

[141] http://international.fhwa.dot.gov/traveldemand/pl06015.pdf

Example – The Washington State 2006 CTR Efficiency Act continued a state mandate that goes back to 1991. Cities and counties are able to set their own specific goals and targets for employee commute trip reduction, as long as they met the minimum state targets of a 10% reduction in single occupant commute trips by 2011 to address congestion and a 13% reduction in VMT to address GHG emissions. In the first three years of the program, 154 million VMT have been reduced at over 1,000 worksites, representing over a half a million commuters. This is estimated to have reduced highway delay by 8% in the Central Puget Sound region and almost 70,000 metric tons of GHG statewide. While the state legislation behind the CTR Efficiency Act was a major policy effort, the need for and ability to set quantifiable targets was fairly straightforward.

Action 4 – Integrate TDM into TOD, smart growth, and complete streets initiatives

Rationale and Explanation – Many of the local initiatives to promote travel choices focus on concepts such as transit-oriented development, smart growth, and complete streets, designed to make transit use, bicycling, and walking more attractive to reduce VMT. However, most of these initiatives are oriented toward land use policies and design. TDM can be integrated into these initiatives in order to promote the use of these sustainable modes and provide incentives to use them.

Example – Planning for transit improvements and transit-oriented development in the Dulles Corridor (Virginia/DC) includes aggressive employer-based TDM, parking management, and trip reduction requirements for new large-scale commercial developments.

Action 5 – TDM performance measures shift from outputs to outcomes

Rationale and Explanation – Many of the precepts included in the regional TDM planning process, in terms of the objectives-driven, performance-based approach to transportation planning, apply at the municipal level as well.[142] For example, the need to be outcome-based is very important to TDM. Many TDM efforts are judged on outputs (what services were delivered, what information was provided?) rather than on outcomes (did residents change travel behavior resulting in a measurable reduction in VMT?). Even so, some of the specific objectives within this recommended approach cite the number of local communities who will plan and implement key demand management strategies (e.g., shared parking policies) and look to city staff as a source of performance data.

Example – The NYSDOT has developed new guidance for local TDM programs to develop outcome-based performance measures and related program objectives therein.

Action 6 – Draw upon existing tools to improve TDM modeling and analysis

Rationale and Explanation – TDM analysis can often be very piecemeal and based on anecdotal evidence, rules of thumb, and sketch planning techniques, at best. However, several tools are available to assist with the evaluation of TDM strategies as part of the planning, alternatives analysis, and project selection process. Utilizing these tools largely requires the time and commitment to learn about the use of the tools in advance of the planning process.

Example – Chapter 9 includes a description of several existing tools aimed at allowing for the quantification of TDM impacts for various strategies and packages of strategies. This includes the FHWA TDM Evaluation Model and the TRIMMS available from the CUTR (see more discussion in Section 9 on Tools and Techniques for Evaluating TDM).

[142] FHWA, Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance-based Approach: A Guidebook, 2011.

Action 7 – Assess impact of TDM beyond specific sites

Rationale and Explanation – TDM is widely viewed as most effective at the site-specific level. However, for TDM to be accepted as a means to address a broad set of objectives, the impacts of TDM on subareas, corridors, and city-wide need to be assessed. This can be accomplished by either aggregating site-specific (e.g., employer or developer) impacts or measuring effectiveness on a broader level (such as resident travel surveys, etc.).

Example – The Washington State CTR law requires worksites in urbanized counties to reduce vehicle trips and VMT. Standardized surveys, data collection, and analysis allow CTR results to be reported by city and county.

Action 8 – Update plan review process and requirements for new developments

Rationale and Explanation – Beginning in the 1980s, many growing suburban cities enacted regulations that sought to mitigate the impact of new development on localized traffic. These ordinances directed planners to review site development plans with the intent of requiring TDM measures at new developments in order to mitigate vehicle trip generation. Many of these mandates are still in force, but a lack of staff continuity, changing conditions, and inconsistent or weak enforcement have minimized the lasting impact of these requirements. Cities could update their TDM ordinances in order to maximize effectiveness and applicability.

Example – Several cities have recently updated their TDM ordinances, including Pasadena, California, and Fairfax, Virginia. In both cases, TDM requirements were modified to reflect empirical evidence on effectiveness of various TDM strategies and enhanced reporting and enforcement.

Action 9 – City assumes larger role by establishing a TDM fund, providing improved travel choices and related services

Rationale and Explanation – Cities can assist with TDM implementation by establishing a TDM fund that could pay for innovative strategies and pilot studies, and serve as matching funds for private funds. In some cases, these funds can be supported by local sales tax initiatives and developer impact fees. In addition, cities are in a good position to expand the set of travel choices available to residents, workers, and visitors. This is especially true of "last mile" solutions to get commuters to and from their destinations. This might include: bike paths, connected sidewalks, shuttle services, telework assistance, etc.

Example – The City of Rockville, Maryland, maintains a TDM fund that generates about $200,000 per year, from a transportation improvement fee levied on new development. The fund supports activities included in the city's transportation demand management plan.[143] Many cities have assisted with or provided carsharing services, such as CityCarShare in Berkeley, California.

Action 10 – Strengthen TDM performance evaluation and monitoring methods and means to report impacts

Rationale and Explanation – Two areas where performance evaluation and reporting can be strengthened at the local level include self-monitoring and reporting to decision-makers. Many trip reduction requirements, on employers and developers, involve the self-reporting of program effectiveness. This can result in inaccurate, incomplete, or non-existent data being collected from the trip generators that are subject to these requirements. New methods for automated reporting of commuter behavior (see example from Redmond, Washington in section 8.5) can help avoid some of the issues with required surveying. Reporting of TDM results to city policy-makers is often lacking, or it may not be couched in terms that decision-makers can understand.

[143] http://www. rockvillemd. gov/transportation/plans. html

Example – Many TDM programs are monitoring travel behavior change through the use of commuter calendars, completed by commuters themselves and validated by supervisors. Many of these automated calendars are used to qualify users for incentives and giveaways.

8.4 Actions to Move Local Planning Process from Level 2 to Level 3

Several specific actions can be suggested to move an agency's local planning process from Level 2 (defined integration of demand management) to Level 3 (optimized integration). Table 8.4 highlights the relative ease or difficulty of implementing each action in moving from Level 2 to Level 3.

Action 1 – TDM becomes a primary means to improve livability, health, and quality of life

Rationale and Explanation – TDM has become a very common response to air quality and congestion issues and is growing in popularity as a means to address land use and freight issues. However, TDM can become much more humanized as a means to improve residents' quality of life, including livability and health. Cities that link TDM and enhanced travel choices to citizens' health and quality of life have the potential of creating a very personalized appeal for TDM.

Example – Many cities cite the health benefits of walking and bicycling in their efforts to promote city-provided facilities and programs. However, a growing number of TDM programs are citing the health benefits of all sustainable modes, in terms of reduced stress and improved personal safety (lower risk of accidents).

Action 2 – Include TDM in efforts to integrate land use and transportation

Rationale and Explanation – As mentioned earlier, many efforts to integrate land use and transportation involve design improvements, such as transit-oriented development and sidewalk continuity. However, in order to make the travel choices enhanced through these design features more effective, TDM programs can provide the soft promotional support that induces drivers to switch to these more sustainable modes. Therefore, cities could better integrate TDM into their smart growth policies to make enhanced travel options utilized to the maximum extent.

Example – Land use plans and policies seek to balance the desire for growth while minimizing its negative consequences. As such, TDM is a valuable and well-used tool for reducing traffic generated by new development. While some TDM plans for new development are based on desired mode split or proportion of projected vehicle trips reduced, some (as seen in the City of Irvine, CA, example below in section 8.5) are simply based on setting a cap on trip generation and monitoring of compliance. TDM strategies included in traffic mitigation plans are often based on the known or expected impacts of various strategies, but require periodic monitoring to assess whether agreed-upon targets are met.

Action 3 – TDM becomes key part of city's sustainability initiative

Rationale and Explanation – Many cities have developed sustainability policies, initiatives, programs, or even departments. TDM can become a key part of this initiative by providing a means for cities to improve the environment and maintain economic competitiveness while not compromising social inclusion. Cities can form a TDM subcommittee of its sustainability initiative. In fact, when TDM becomes a cornerstone of sustainability, a key goal of TDM is to develop and implement reliable travel choices.

Example – The City of San Francisco's Sustainability Plan includes a transportation element. The plan defines a sustainable transportation system as one in which people's needs and desires for access to jobs, commerce, recreation, culture, and home are accommodated using a minimum of resources. Applying principles of sustainability to transportation is anticipated to reduce pollution generated by gasoline-powered engines, noise, traffic congestion, land devaluation, low density development, economic segregation, and injury to drivers, pedestrians, and cyclists. In addition, the costs of

Table 8.4: List of Actions and Associated Level of Difficulty to Move Local Planning Process from Level 2 to Level 3

	Integration Actions	Policy Support	Ease of Implementation	Cost	Time Requirement	Overall
Establishing Vision and Goals						
1	TDM becomes a primary means to improve livability, health, and quality of life	Difficult	Moderate	Low	Low	Moderate
2	Include TDM in efforts to integrate land use and transportation	Difficult	Moderate	Moderate	Moderate	Moderate
3	TDM becomes key part of city's sustainability initiative	Low	Moderate	Low	Moderate	Moderate
Setting Objectives for TDM						
4	TDM not viewed as counter to economic development goals	Difficult	Moderate	Moderate	Moderate	Difficult
Definition of Performance Measures						
5	TDM performance measures are linked to sustainability and livability	Moderate	Moderate	Low	Low	Moderate
6	Develop objectives and performance measures that include influence of parking	Moderate	Moderate	Low	Low	Moderate
Assessment and Selection of Strategies and Programs to Support Objectives						
7	Assess impact of local TDM activities on corridor and region	Low	Moderate	Low	Moderate	Moderate
8	Develop new tools/approaches to incorporate all travel choices into the analysis process	Low	Low	Moderate	Moderate	Low
Integration of Strategies into Plans and Funding Programs						
9	Develop long-term funding strategy for TDM	Difficult	Difficult	Low	Moderate	Difficult
Monitoring and Evaluation of Progress Toward Objectives						
10	Adopt or develop a standardized approach to reporting TDM performance	Low	Low	Moderate	Moderate	Low

commuting, shipping, housing, and goods also will be reduced. Ultimately, the plan foresees that "in a sustainable San Francisco, almost all trips to and within the City will be on public transit, foot or bicycle."[144]

***Action 4* – TDM not viewed as counter to economic development goals**

Rationale and Explanation – TDM can be consistent with economic development goals by seeking to enhance mobility and accessibility, reduce congestion, and address air quality. If TDM is viewed as broadening travel choices, and not as strictly a means to inhibit car use, TDM can be part of a long-term strategy to make a city more attractive to development. This is in keeping with the definition of sustainable transportation discussed above.

Example – The City of Lund, Sweden, implemented a more environmentally friendly transport plan in the mid-1990s that included bus rapid transit, TDM, and bicycle improvements. The goal was to maintain vehicle traffic levels at 1995 levels while allowing the city to grow. This was accomplished through the success of the plan and fact that travel demand growth was accommodated on alternative modes, rather than by driving.[145]

***Action 5* – TDM performance measures are linked to sustainability and livability**

Rationale and Explanation – In terms of setting objectives and measuring performance, many of the same objectives and performance measures used in regional plans will apply to municipal TDM plans and policies, especially those related to the core metrics related to vehicle trip, VMT, emissions, and energy reduction. However, cities possess some specific areas of influence, namely parking, land use, arterial management, and bicycle/pedestrian programs that may dictate the types of objectives and performance measures included in municipal plans. Going one step further, performance measures should be developed for new objectives, such as livability, and many of these measures may be somewhat subjective (e.g., residents' perceptions about quality of life and travel choices) as well as quantitative (utilization of travel options by various disadvantaged user groups).

***Action 6* – Develop objectives and performance measures that include influence of parking**

Rationale and Explanation – First, with respect to parking, parking management can include the management of parking supply, price, and demand. Specific objectives related to parking include:

- Parking supply caps.
- Off-street parking standard maximums.
- Establishment of parking districts and targeted functioning.
- On-street parking pricing policies.
- Relationship between parking and mode choice (e.g., transit use).
- Parking utilization (turnover, cruising, occupancy).
- Parking information.

Many of these strategies can serve to manage travel demand by discouraging car use at certain times of day, in certain areas, or overall. Parking management has been shown to influence mode shift, especially transit use. From this, specific performance measures can be established to gauge the success of parking management policies and strategies in influencing travel demand. Most parking data are observed (occupancy, turnover, etc.) and this is a good source for assessing the temporal and spatial characteris-

[144] http://www.sustainable-city.org/Plan/Transit/intro.htm

[145] http://international.fhwa.dot.gov/traveldemand/pl06015.pdf

tics of parking use, but in order to get at mode shift, surveys of parkers or travelers are needed to assess how and why behavior changed.

Example – Parking policies, in conjunction with a comprehensive TDM program, in the Lloyd District near downtown Portland, OR, have resulted in a reduction of the drive-alone rate and an increase in transit use by 20 percentage points, as shown in Figure 8.1.[146]

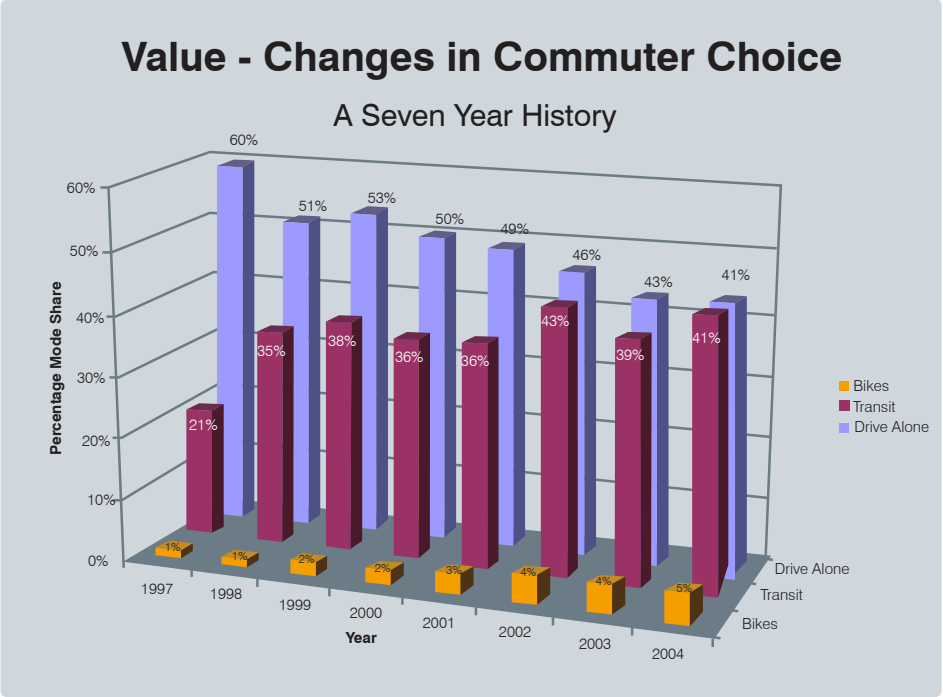


Figure 8.1: Mode Shift from Lloyd District TDM Program (1997-2004)

Source: WSDOT, 2004

Action 7* – *Assess impact of local TDM activities on corridor and region

Rationale and Explanation – As mentioned earlier, while TDM impacts are most often tied to very site-specific program results, the ability to assess the wider impacts of TDM will be important to its broader acceptance. Cities can assess the temporal distribution of trips reduced from employer and developer trip reduction programs on area highways and on the region as a whole.

Example – Using VMT reduction, volumes and speeds, estimates of reduction in delay can be derived. Going one step further, the CUTR has developed a methodology that merges mode shift data with a highway micro-simulation model to graphically show how employer trip reduction programs can reduce delay for a given highway segment.[147] This research and examples of the graphic displays are shown earlier in this document.

[146] Lloyd District TMA, Lloyd District Partnerships Plan: A Case Study in Transportation Efficiency, accessed at http://www.wsdot.wa.gov/NR/rdonlyres/F9571913-97CC-4891-8B0E-8F2685F914AF/0/Lloyd_District_Parking_management.pdf)

[147] http://www.dot.state.fl.us/planning/systems/sm/los/default.shtm

Action 8 – Develop new tools/approaches to incorporate all travel choices into the analysis process

Rationale and Explanation – Moving from the defined approach to a more optimized integration of TDM may require the development of tailored and specialized analytic tools to evaluate the effectiveness of TDM strategies in addressing key policy objectives. While many "off the shelf" tools now exist, in order to analyze the full set of TDM strategies and their impact across a myriad of objectives, specialized tools may be required. This might include new, tailored means of using the traditional four-step travel models or newer activity based models. It might also involve other new tools, such as the micro-simulation tool, developed by CUTR and discussed in earlier in this section, which uses employer TDM data and CORSIM.

Example – The traditional four-step travel demand modeling process can be used to evaluate TDM strategies that can be analyzed in terms of time and cost variables. However, many off-model tools have been developed to analyze congestion pricing strategies, bicycle and walk strategies, and other strategies that cannot be expressed in terms of time and cost indicators. As mentioned above, a good discussion of the means to incorporate TDM into regional travel demand models is provided by CUTR in a report entitled "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model." This approach, which was developed for WSDOT, includes a specific TDM Assessment Procedure that uses the CUTR TRIMMS model and processes resulting TDM impacts through standard trip tables.[148] In fact, the use of the TRIMMS model itself to perform cost/benefit analysis for TDM strategies could represent a significant movement toward mainstreaming TDM integration.

Action 9 – Develop long-term funding strategy for TDM

Rationale and Explanation – If TDM is to be part of a longer-term strategy to reduce overall vehicle demand, then programs and projects need assurances that resources will be in place to fund them. Developer impact fees can be highly variable based on economic conditions. While many TDM programs are funded out of federal CMAQ funds, these funds have a distinct time limit (3 years). However, some TDM programs, especially in California, are partially funded through county sales taxes.

Example – Many counties in California have a voter-approved ½ to 1 cent sales tax dedicated to transportation. Most of these funding programs include a broad set of roadway, transit, and TDM projects. The TransNet 20-year program in San Diego provides funding for transit and bicycle facilities. Measure M in Riverside County helps pay for TDM services and incentives.

Action 10 – Adopt or develop a standardized approach to reporting TDM performance

Rationale and Explanation – In order to provide an effective feedback loop to the objective setting and strategy selection process, standardized TDM evaluation methodologies are required. This might involve developing a tailored approach for a given MPO or adopting a widely accepted methodology. Such methodology development or adoption should be vetted with TDM professionals and researchers to assure that it is understandable, rigorous, and usable.

Example – The MAX-SUMO monitoring and evaluation approach developed in Europe is easily adaptable to the U. S. experience for many TDM strategies. The methodology is described in Section 9 and graphically depicted in Figure 9.1.

[148] WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746. 1, March 2010.

8.5 Best Practice Examples: Local Level TDM Integration

Two examples of municipal or local TDM planning efforts and results are provided here: Irvine, California and Redmond, Washington. The Irvine case relates to the planning of TDM measures for new developments. The Redmond case involves the role of the city in both offering TDM services and managing demand at new or expanding developments.

Irvine, California

The Irvine Spectrum is a very large commercial and retail development in Orange County in southern California. It is a 5,000 acre business park and high-density development, which is now home to over 3,600 companies employing in excess of 65,000 people. In 1986, the Irvine Company gained final development approval by the City of Irvine following an extensive consultative process and development of a transportation management plan. Transportation management goals and use provisions were assigned to the development permit. Planning requirements and goals were established in meeting the City of Irvine's vision for successful development mitigation. Several demands were placed upon the developer including the establishment of a multi-modal transportation system including rail, bus, car- and vanpooling, and preferential parking within the development. These permit provisions established goals and requirements for land use design that considered and planned for alternative transportation modes. Additionally, the development was permitted with trip generation targets and assigned permitted future growth planning goals. A TMA, Spectrumotion, was chartered to provide ongoing management of the transportation plan for the development and its tenants. The Spectrumotion TMA is charged with implementing the planning requirements through transportation goal attainment, alternative mode promotion and program development, and follow-up surveys and evaluations. The Irvine Company is responsible for permit compliance; it raises funding through tenant assessments to pay for programs and improvements.

Tenant employee travel behavior and trip counts are made on a regular basis to assess fulfillment of the mitigation targets, especially on trip generation. There are five sectors within the Spectrum development. Spectrum 1, 3, 4, and 5 are covered by the permit. Each sector represents a phase of development, and the trip reduction requirements are different for each, both in terms of targets, and also performance measures. Some use average vehicle ridership; others use a trip limit per usable square footage. Key findings conclude that mode shift is occurring as planned and goals established in the growth and planning projections are being met. The permit trip generation caps have never been exceeded and are well within established limits. [149]

Redmond, Washington

The City of Redmond, Washington, near Seattle, has used TDM as a key strategy to address municipal policies for over 20 years. The stated mission of TDM is to "improve mobility and achieve greater efficiency on the arterial system by offering and promoting alternatives to single occupant vehicle travel." The City's TDM program is the principal means to achieve the mode split goals established in the overall city Master Plan. The city assists employers located within its boundaries to comply with the state CTR

[149] MAX, Integrating Land Use and Mobility Management, Case Study 28: Irvine, 2010 - http://www. epomm. eu/docs/mmtools/conference/C28_Irvine-BusinessPark. doc

law, as well as state mandates on environmental protection and growth management. Redmond also helped found and fund the Greater Redmond TMA, which represents most of the city's large employers and developers and is now self-sufficient through membership dues. Redmond requires Transportation Management Programs of new and expanding development sites and sets targets based on parking allowances and the proportion of commuters who travel using alternative modes. These requirements also mandate specific supportive physical improvements at development sites, including preferential parking for carpools and vanpools, bicycle lockers and racks, employee showers and lockers, on-site connectivity to transit stops, and internal sidewalks and trails.

One unique feature of Redmond's TDM efforts, as described in the TDM element of the Master Plan, is R-TRIP (Redmond Trip Resource and Incentive Program). R-TRIP is aimed at reducing congesting and improving air quality by offering incentives to those who agree to use commute alternatives. It is open to anyone who lives or works in Redmond and offers a one-time financial incentive (cash, bus pass, or vanpool incentives) for those who participate and then a chance at prize drawings thereafter. Commuters keep track of their daily travel on the on-line incentive calendar (www.gortrip.com) shown in Figure 8.2.

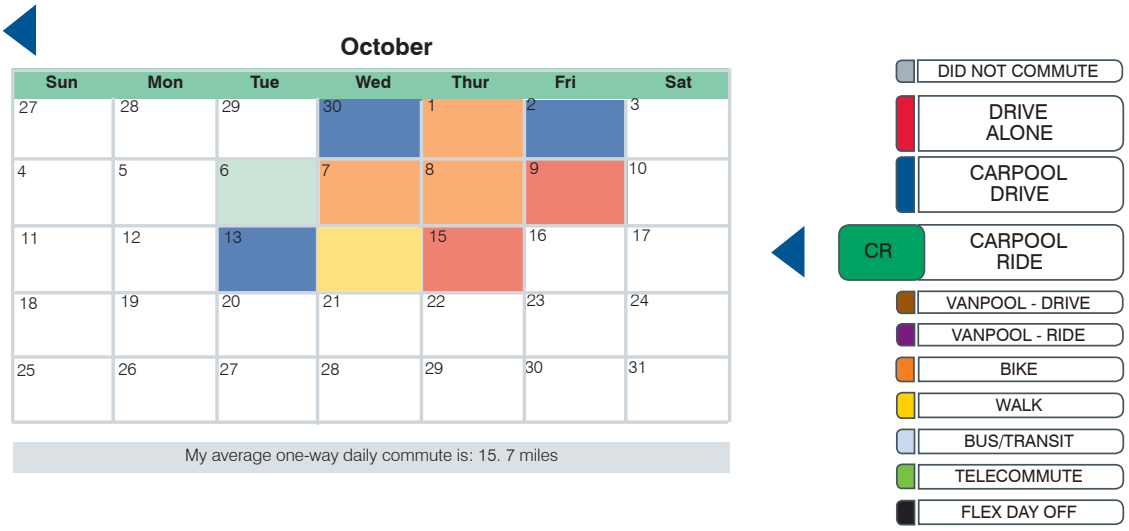


Figure 8.2: City of Redmond TDM Online Incentive Calendar

Source: www.gortrip.com

The results of Redmond's TDM efforts are reported in the 2005 Transportation Master Plan TDM element and state that the R-TRIP program reduced over 2 million miles of travel in 2004 (more recent figures are several times that amount annually) and that employers complying with state CTR mandates had removed 19,000 peak period trips from roads in and around Redmond.[150] The TDM element of the Redmond Master Plan called for four new or expanded strategies:

- Continued implementation of TDM programs as a transportation mobility tool.
- Development of residential TDM programs to achieve mode share goals.
- Development of long-term strategy for marketing TDM, especially multi-modalism.
- Development of a new TDM demonstration project each biennium to test and evaluate new concepts.

[150] City of Redmond, Redmond Transportation Master Plan, 5f. Demand Management, 2005, available at http://www.redmond.gov/cms/one.aspx?portalId=169&pageId=26754

KEY RESOURCES

FHWA, Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance-based Approach: A Guidebook, 2011).

http://www.dot.state.fl.us/planning/systems/sm/los/default. shtm http://www.sustainable-city.org/Plan/Transit/intro.htm

http://international.fhwa.dot.gov/traveldemand/pl06015.pdf

http://www.rockvillemd.gov/transportation/plans.html

http://www.fhwa.dot.gov/livability/case_studies/guidebook/livabilitygb10.pdf

http://www.worldcarfree.net/wcfd/

http://international.fhwa.dot.gov/traveldemand/pl06015.pdf

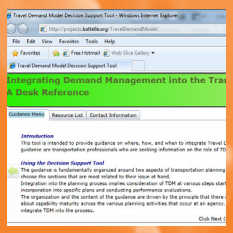
Lloyd District TMA, Lloyd District Partnerships Plan: A Case Study in Transportation Efficiency, accessed at http://www.wsdot.wa.gov/NR/rdonlyres/F9571913-97CC-4891-8B0E-8F2685F914AF/0/Lloyd_District_Parking_management.pdf)

MaxLUPO (http://www.epomm.eu/index.phtml?ID1=2180&id=2180)

SHRP II, Guide for Improving Capability for Systems Operation and Management, TRB, prepared by Parsons Brinkerhoff, Report S2-L06-RR-2, 2011.

WSDOT, Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model, prepared by CUTR, report WA-RD-746.1, March 2010.

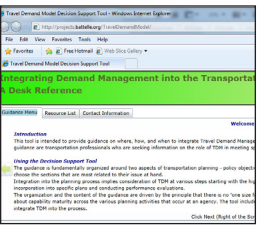
TDM Evaluation, Effectiveness, Evaluation, and Implementation



Tools and Techniques for Evaluating TDM

Known Effectiveness of TDM Strategies

Transitioning from Planning to Implementation



9 Tools and Techniques for Evaluating TDM

A major thrust of this desk reference is the need to better integrate TDM into the transportation planning process and, as discussed in Chapter 2, this involves the adoption of a new way of thinking about TDM as more than ridesharing. It also requires the consideration of TDM throughout the planning process. However, once TDM is appropriately positioned within the planning process, the technical work remains to select the most effective strategies for addressing specific policy objectives. Evaluation is the process of assessing and selecting strategies for inclusion in the plan and ultimately for implementation.

There are two critical types of evaluation important to the planning process: a priori forecasting of estimated impacts and ex post facto measurement of actual results so as to measure progress against stated objectives.

CHAPTER ACRONYM LIST	
BCA	Benefit/Cost Analysis
DOT	Department of Transportation
FHWA	Federal Highway Administration
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
LOS	Level of Service
NCTR	National Center for Transit Research
SOV	Single Occupancy Vehicle
TDM	Travel Demand Management
TEEM	TDM Effectiveness Evaluation Model
TOD	Transit Oriented Development
TRIMMS	Trip Reduction Impacts of Mobility Management Systems
TRPP	Trip Reduction Performance Program
TSM	Transportation Systems Management
VMT	Vehicle Miles Travelled
VTR	Vehicle Trip Reduction
WTRM	Worksite Trip Reduction Model

Forecasting is a well established part of the transportation planning process, and this chapter provides some guidance on tools for use in predicting the potential impact of TDM. However, the need for monitoring and evaluation, after the fact, is growing in importance within the objectives-driven, performance-based planning process.

FHWA guidance on the objectives-driven, performance-based planning process for operations cites the following benefits of monitoring and evaluation to help transportation planners and other stakeholders:

- Better understand the effectiveness of transportation strategies and investments so transportation planners and operators can work together to devise more effective investment strategies to meet regional objectives.[151]
- Fine-tune the implementation of ongoing operational programs.
- Provide assistance in calibrating and refining planning tools and models, such as regional travel demand models, so that relationships and traveler responses are properly reflected.
- Spur greater collaboration between planners and operations managers in collecting and monitoring data, which can yield benefits in terms of both developing and refining operations objectives and performance measures as well as in identifying successful strategies.

[151] FHWA, Advanced Metropolitan Planning for Operations: An Objectives-driven, Performance –based Approach – A Guidebook , SAIC, FHWA-HOP-10-026, 2010, http://www. ops.fhwa.dot.gov/publications/fhwahop10026/index.htm

The ability to accurately monitor and evaluate TDM strategies will also allow for more knowledge on TDM effectiveness, as will be discussed in the next chapter. The careful measurement of impacts of TDM strategies will create a more informed knowledge base from which to develop more effective future plans.

The remainder of this chapter provides guidance and resources on three topics related to TDM evaluation: modeling of TDM impacts, evaluation of actual results, and the role of cost effectiveness analysis.

9.1 Forecasting Potential TDM Impacts

As TDM becomes more recognized by planners and policy-makers for its growing importance as a meaningful set of solution strategies, the need to rigorously and carefully forecast impacts becomes greater. Once objectives are set for transportation system performance and related elements, strategies need to be selected that will address and work to fulfill these objectives. Assessing the potential impact of TDM strategies in reducing travel demand is as important as assessing the impact of capacity enhancements in accommodating unmet demand. A clear distinction needs to be made at the outset – there might be significant differences in approach, rigor and methods, and resource requirements to evaluate the short-term impacts of a single, site-specific TDM measure (e.g., for funding selection) versus the long-term forecasting of a set of TDM strategies applied to a whole region.

There are two general practiced approaches to estimating the potential impacts of TDM strategies: sketch planning and modeling. Sketch planning involves the use of simple factors – elasticities, comparative case study findings, and more qualitative approaches to assess the potential impacts of TDM – for a package of TDM strategies or individual strategies. One example of sketch planning involves the meta-analysis of how land use influences travel. This comparison provides weighted average travel elasticities of VMT, transit use, and walking with respect to the built environment variables (although none is greater than 0.39 and most are less – meaning that a 10 percent shift in land use characteristics will be expected to lead to a 4 percent reduction in VMT and alternative mode use).[152] These variables include: density (population, employment, commercial FAR); diversity [land use mix (Entropy Index), jobs-housing balance]; design [street connectivity indexes (e.g. intersection densities, % of 4-way intersections, link/node ratios, etc.)]; destination accessibility (access by mode); and distance to transit, shopping, CBD. The effects of these simple factors are cumulative. While the effect of any one on VMT reduction and mode shift is small/moderate, the combined effects from improving upon several of these can be substantial. This may be a very appropriate approach for screening TDM measures and for comparing the relative impact of TDM to other solutions. For example, sketch planning might be used to represent the general benefits of emphasizing TDM within a regional transportation plan for screening purposes.

However, caution should be taken when using single case studies or "rules of thumb" when evaluating TDM strategies, especially packages of strategies and longer-term planning horizons. Pointing to a single case example and transferring the results to another city and application is not a sound means to estimate the potential impact of a given TDM strategy. Likewise, using generalized rules of thumb, such as assuming that TDM can reduce vehicle trips by 10 to 15 percent, can lead to unrealistic expectations especially if policies and funding are insufficient to support that change. While some very focused, site-specific TDM programs, by aggressively using financial incentives, disincentives, and parking management, can reduce trips by much more than 15 percent, the ability to realize this impact over a larger base of travelers, trip generators, and geographic areas is doubtful without substantial changes in policies, resources, and background conditions.

[152] Reid Ewing and Robert Cervero, "Travel and Built Environment: A Meta-Analysis," Journal of the American Planning Association, Vol. 767, Issue 3, June 2010.

Many transportation planning processes use some form of modeling to predict future outcomes of alternative plan elements. The four-step transportation modeling process: trip generation, trip distribution, mode choice, and trip assignment is a common approach that has been used for many years. Unfortunately, it is not well-suited to evaluate many TDM strategies. Common transportation models boil strategy attributes down to cost and time variables. In general, many TDM strategies cannot be adequately described in those terms (see discussion of TRIMMS model below). Also, in the mode choice step, the primary modes considered are car driver, car passenger, and transit rider. The ability to assess strategies to increase car occupancy and strategies that promote active transportation (bike and walk) and alternative work arrangements (telecommuting, compressed work weeks) is severely limited with traditional travel demand models.

One common means for evaluating TDM strategies is to assume a reduction in overall "off the top" travel demand through the collective effectiveness of TDM measures and reducing trip generation by some percentage. While such an approach might be viable and adequate for representing the general benefits of TDM in a transportation plan, especially at regional levels, this approach is not suitable to evaluate specific TDM strategies and their interaction with smart capacity enhancements. For such applications, several "off-model" tools have been developed to systematically evaluate the effectiveness of TDM strategies with resulting outputs (vehicle trip, VMT, mode shift) results fed back into travel models in order to adjust each step in the process, especially mode choice and trip assignment. While some focus on TDM measures, others deal with related issues, such as the impact of land use or growth management measures to reduce VMT, as in the case of the scenario-based model developed by Bartholomew and Ewing[153] and related tools such as the Southern California Association of Governments Sustainability Tool.[154]

Four TDM-specific models have been developed and used in various parts of the U.S.:

- EPA COMMUTER Model.
- TDM Effectiveness Evaluation Model (TEEM).
- Worksite Trip Reduction Model (WTRM).
- Trip Reduction Impacts of Mobility Management Strategies (TRIMMS).

These models have been developed for two purposes: to predict the impact of TDM measures on commuters and other travelers based on 1) employer-provided TDM measures and 2) government-provided incentives for alternative mode usage. While the models have been developed for the commuter target group, they have also been used for other target groups, such as schools, tourists, or any group where a set of baseline mode shares are available. They have been developed for use at the site-specific level, but have also been used to evaluate corridor and regional plans. Each is briefly discussed below.

COMMUTER Model – The EPA COMMUTER Model is the oldest and most widely used model for planners to forecast the impact of various TDM programs, implemented by employers or by government entities in the form of incentives (public transport service improvements) or disincentives (parking charges). The COMMUTER Model v.2.0 evolved from the FHWA TEEM. As such, the model is over 20 years old and has been used extensively by all levels of government and private employers in the U.S. The logit component of the model provides a pivot point tool to predict mode shift changes resulting from measures that change the time and/or cost of travel for a given mode choice. This feature also allows considering interactive effects. This means that TDM strategies do not just shift travelers from driving

[153] Keith Bartholomew and Reid Ewing, "Land Use-Transportation Scenarios and Future Vehicle and Land Consumption: A Meta-Analysis, Journal of the American Planning Association, October 2008

[154] SCAG Sustainability Tool, http://www.scag.ca.gov/modeling/mtf/presentations/012710/mtf012710_SustainabilityToolDev.pdf, 2010.

alone, but they can draw travelers from other alternative modes as is the case in the real world. The employer support program component is based on the professional judgment of the model developers, and is in the form of average modal share changes from supportive activities for those modes (such as guaranteed ride home services for those who ride public transport). A reliance on professional judgment is a distinct weakness of the COMMUTER Model.[155]

TDM Effectiveness Evaluation Model - TEEM is a post-processor spreadsheet-based model, which includes price and service point elasticities of demand to estimate potential changes in vehicle trips from these measures. TEEM was developed for WSDOT for use in predicting the impact of TDM measures and land use policies applied to activity centers in a corridor of planned highway reconstruction. TEEM also provides some guidance on how to assemble and evaluate packages of measures, to assure that counterproductive measures are not evaluated equally and that the net impact of these packages is not necessarily additive. An elasticity-based spreadsheet model is a simple and user-friendly tool, but can mask real complexities of some strategy interactions and does require specification of the starting conditions. Elasticity-based models estimate the impact of various measures and sum the impacts. Multimodal logit-based models (such as that in the COMMUTER Model) can account for some interactions between measures. For example, some measures will draw travelers from other sustainable modes, not just driving alone. A new bicycle program might draw people off of public transport as well as out of their cars. Interactive predictive models shift travelers from all modes based on newly introduced TDM measures.[156]

Worksite Trip Reduction Model - the WTRM, released in 2004, was developed for the Florida Department of Transportation and U.S. DOT under the National Center for Transit Research (NCTR) at the University of South Florida. This model has the greatest articulation of separate measures for consideration in predicting the impact of various packages of TDM measures. It includes over 100 individual measures with some logical groupings for some of the analyses and reporting functions. The WTRM is based on a very large database of thousands of worksite travel plans, from Southern California, Tucson (AZ), and Seattle. Using a neural network formulation, WTRM analyzes time series data from required worksite reports to develop average changes in the vehicle trip rate (cars per 100 employees). The model is wholly experiential and based on conditions with low public transport shares (0-10%), modest carpool shares (10-20%), and high drive alone shares (70-90%), perhaps appropriate for areas with high starting drive alone shares.[157] Merging datasets improved the model. For example, the neural network model built with equally sampled data from the three areas performed better for Los Angeles than the model built with only data from Los Angeles.

Trip Reduction Impacts of Mobility Management Strategies, or TRIMMS, first released in 2007 with version 3.0 released in 2012, was developed under NCTR and builds upon previous model development experience to create a hybrid model that combines the features of both the WTRM and TEEM models. The TRIMMS model documentation includes a comparison with the EPA COMMUTER Model and WTRM, building upon their strengths. TRIMMS uses constant elasticity of substitution trip demand functions to evaluate “harder” measures (that can be expressed in cost or time) and the cross-sectional benchmarking results of the WTRM for “softer” support and informational measures. TRIMMS was developed for a single worksite or a subarea with a predefined travel market. The newer version of the model (TRIMMS II) focuses on municipal and regional decision-making and allows estimating the impact of land use controls on transit ridership levels. These strategies include land use policy changes affecting gross population density and retail establishment density levels, transit station accessibility improvements, and transit-

[155] The Commuter Model v 2.0 and related guidance documents can be accessed at: http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm#cp

[156] Information on the TEEM Model and its application in the Seattle region can be found at: http://www.dksassociates.com/admin/paperfile/WSDOT%20TEEM.pdf

[157] Information on the WTRM model can be found at http://www.nctr.usf.edu/pdf/473-14. pdf and the model at http://www.nctr.usf.edu/worksite/

oriented development initiatives. One unique function of the TRIMMS model is the ability to evaluate a full range of societal benefits (beyond VMT and emissions) against program costs. As such, the effectiveness and costs of various measures and packages of measures can be evaluated. The outputs from the TRIMMS Model are more extensive than those of the other models, including: change in mode shares, change in social externalities (i.e., the impact of car use on the environment, congestion, safety, etc.), program benefit/cost ratio, and detailed emission impacts by pollutant.[158]

In comparing the four predictive models, as shown in the Table 9.1 below, the TRIMMS model may have the greatest applicability for use in the transportation planning process and the range of TDM strategies to be tested. As stated above, TRIMMS combines the power of demand elasticities to predict the impacts of "harder" measures with the experiential richness of a cross-sectional analysis of actual TDM implementation results. TRIMMS has the added feature of a cost effectiveness and benefit/cost estimation module. The model inputs are not too onerous, but do provide an adequate baseline for predictive purposes. The TRIMMS 3.0 Model estimates a wide range of emission pollutants and incorporates a new module that evaluates the impact of land use strategies on transit patronage. TRIMMS uses the emission inventory of the Environmental Protection Agency Motor Vehicle Emission Simulator (MOVES2010a)[159] This model enables users to conduct cost-benefit assessments for many strategies aimed at reducing emissions without the cost and expertise required by more sophisticated models. It also benefits from improved user-friendliness, unlike the COMMUTER Model, which can be rather cumbersome to use.

Table 9.1: Comparative Assessment of TDM Models

TDM/ MODEL	Source of Model Development Data		Basis of Change		Special Features	
EPA COMMUTER Model	○	Informed professional judgment – Delphi	●	Logit model coefficients	○	Accounts for interactive effects
TDM Effectiveness Evaluation Model (TEEM)	○	Based on case study data	○	Point elasticities, price and service	○	Model structure useful; guidance on how to combine measures
Worksite Trip Reduction Model (WTRM)	●	Multi-year, obligatory employer travel plan data	○	Neural network and experimental Data based on thousands of employer trip reduction plans	○	Enumeration of a large number of employer TDM strategies and interactive effects. Has many strategies but provides only changes to vehicle trip reduction rates at the worksite
Trip Reduction Impacts of Mobility Management Strategies (TRIMMS)	○	Based in cross sectional case studies	○	Point elasticities, price and service and experiential data	●	Model structure useful – focus on benefits and costs- Includes many strategies – focus on benefits and costs- good hybrid approach

Note - Dark circles in the table are better than light circles.

[158] Information on the TRIMMS model can be found at http://www.trimms.com

[159] US Environmental Protection Agency, MOVES (Motor Vehicle Emission Simulator, available at http://www.epa.gov/otaq/models/moves/index.htm

9.2 Measuring Actual TDM Impacts

Why evaluate TDM strategies after they are implemented? Of course, funders and program managers want to know how their programs and projects are doing. Evaluation is a sound management practice. In some cases, contracts require monitoring for performance-based provisions of the funding agreements. But evaluation should also be seen as an integral part of the planning process.

As stated earlier, it is important that TDM strategies within transportation plans be geared to address specific policy objectives, as enumerated in Chapter 3. With each objective, specific performance measures should be developed, monitored, assessed, and reported in order to determine the level of fulfillment achieved. This is at the heart of the objectives-driven, performance-based planning for operations process. Developing a well-conceived, balanced set of multiple performance measures for assessing the ability of TDM to fulfill specific policy objectives and to assess the comparative contribution of TDM to meeting transportation plan goals is very important. Monitoring and evaluation need to be built into the planning process as a concrete feedback loop to inform the overall effectiveness of TDM (and other measures) in addressing plan objectives.

Therefore, developing and tracking pertinent performance measures is a key to an enlightened planning process. A range of performance measures can be enumerated when considering TDM in light of the broader definition used in this report. For example, the following set of mobility-related performance measures was developed for a statewide TDM planning process for the Utah DOT[160] (Table 9.2).

Table 9.2: Mobility-Related Performance Measures in Current Practice

Source: (Cambridge Systematics, 2009)

Type of Measure	Examples	Intended Use
Traffic operations measures	Percent of highway system operating at LOS D or better Vehicle-hours of travel spent under congested conditions Total vehicle-hours of delay; hours of delay per person	Measure ability to move vehicles at expected speeds on the highway system
Mobility measures	Average travel time between point A and B Average speed of travel across corridor Travel time index (ratio of travel time in the peak period to travel time at free-flow conditions)	Measure speed of movement through a corridor or between key destinations
Reliability measures	95th percentile travel time – for general purpose & HOV (Seattle) Planning time index (ratio of highest peak travel time in a month to off-peak travel time)	Measure ability of highway system users to reach destinations within an expected time

[160] Cambridge Systematics, "Best Practices in Multimodal Congestion and Mobility Performance Measures," prepared for Utah DOT, Technical Memo dated June 17, 2009.

Type of Measure	Examples	Intended Use
VMT reduction or mode share targets	Statewide VMT reduction target (Washington State) Local VMT reduction targets (Oregon – Transportation Planning Rule) Mode share targets (Seattle, Oregon)	Reduce environmental impacts associated with transportation Related to extent to which mobility objectives are met by non-SOV modes
Multi-modal levels of service	Bicycle, pedestrian, and transit LOS measures (Florida) Pedestrian and bicycle indicators (Boulder)	Measure quality of service for each mode; roll up into an area-wide rating
Accessibility measures	Destinations (jobs, services, etc.) within X minutes travel time of the average resident, by mode (San Francisco, Columbus)	Measure system-wide accessibility; compare by mode, population group, etc.
Customer-focused measures	Awareness of and satisfaction with transportation services and mobility options (European Union)	Measure ability of transportation alternatives to meet travel needs

The specification and use of TDM-related performance measures, such as those enumerated in the table above, can inform broader performance measures, including those not directly related to the transportation system, such as: livability; economic development or gross regional product; other economic benefits such as household transportation spending; per capita income; health measures, such as obesity and asthma rates; and safety measures, such as crashes and injuries. TDM performance could also impact the performance of other parts of the transportation system, such as transit ridership and auto ownership.

Measures specific to more traditional TDM can be found within the FHWA guidance report "The Building Blocks of a Model Transportation Plan Incorporating Operations." That report provides sample performance objectives for: employer trip reduction programs, commuter shuttle service, carpool/vanpool programs, walking/bicycling initiatives, parking management, and marketing. It also provides excerpts from a model transportation plan that incorporates operations, including TDM.[161]

Once performance measures are selected, the focus shifts on how to monitor and measure fulfillment. Monitoring TDM performance is often rather different from highway or even transit operations, where the primary data collection method is direct observation. Counting cars and transit riders along spatial and temporal dimensions is a key focus of performance monitoring for these strategies. However, TDM is all about choices and, therefore, the need exists to monitor the acceptance and use of travel choices and to measure a shift in behavior to a more sustainable mode. This often requires user surveys to assess not only how travelers are behaving, but whether this amounts to a shift from another travel pattern and even why the shift was made (what was the impetus or incentive). Finally, evaluation should be objective, often suggesting that a third party conduct the evaluation given the somewhat more interpretive nature of TDM behavioral data.

[161] FHWA, Advanced Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference, SAIC, FHWA-HOP-10-027, 2010, http://www.ops.fhwa.dot.gov/publications/fhwahop10027/index.htm

A standardized methodology for evaluating TDM strategies does not yet exist in the U.S. However, Canadian and European transportation interests have developed common methods and approaches and these can help inform planners and other transportation professionals in planning for evaluation. The Transport Canada-funded Canadian Guidelines for the Measurement of TDM Initiatives[162] and the European Commission-funded Max-SUMO guidelines[163] are based on a similar approach and set of assessment levels. The Max-SUMO process, developed as part of the MAX project,[164] offers a structured approach to evaluating TDM strategies from user awareness and acceptance, through mode shift, through to calculated system impacts. These assessment levels are illustrated in Figure 9.1. The approach is focused on implementation of a new TDM program or service or incentive to a given target travel market. The Max-SUMO reference also provides guidance on setting objectives and on data collection and monitoring.

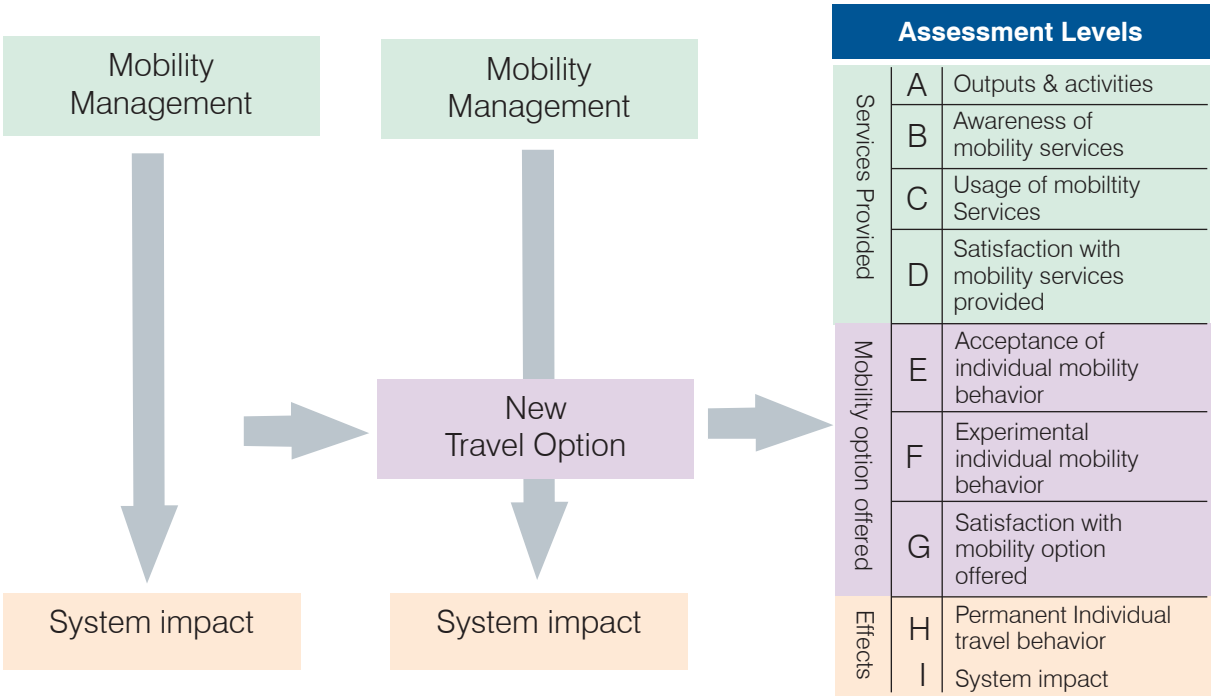


Figure 9.1: Max-SUMO Assessment Levels

Source: EPOMM

Finally, once evaluation results are compiled, the findings should be presented in terms that both policy-makers and other transportation professionals can understand. Each transportation discipline has its own language, terminology, and abbreviations, and TDM is no exception. For example, policy-makers and even transportation engineers do not necessarily understand the concept of vehicle trip reduction because it is rather abstract. It is better to convey TDM findings in terms to which other transportation planners can relate, for example reporting vehicle trip reduction as the number of cars removed from

[162] HDR/iTRANS, Canadian Guidelines for the Measurement of TDM Initiatives , prepared for Transport Canada, March 2009, http://www.tc.gc.ca/eng/programs/environment-urban-guidelines-practitioners-tdmguide2009-1-1675.htm

[163] ILS, et al, MAX Work Package B Final Report, Successful Travel Awareness Campaigns and Mobility Management Strategies, funded by European Commission, 6th Framework Program, November 2009, http://www.epomm.eu/index.phtml?ID1=2359&id=2359

[164] The MAX-project ran from 2006 to 2009 and was the largest research project on Mobility Management within the EU's sixth framework programme. The MAX consortium, of 28 partners, served to extend, standardise and improve Mobility Management – it did so in the fields of quality management, campaigns, evaluation, modeling and land use planning. http://www.max-success.eu/

a particular road or corridor or the equivalent reduction in delay or increase in person throughput. In fact, TDM is the only transportation solution set that focuses on the "trip not taken" rather than on the accommodation of vehicles. As such, TDM cost effectiveness can compare the cost of removing vehicles from the road as compared to accommodating travel via transit, rail, paratransit, and road capacity improvements.

9.3 Cost Effectiveness

Given that the transportation planning process is often fiscally constrained and the analysis of strategies ultimately involves an assessment of costs and funding opportunities, it is important to evaluate the cost effectiveness of TDM strategies. The analysis can take three forms: cost effectiveness, comparative cost effectiveness, and benefit/cost analysis.

Cost effectiveness is fairly straightforward and involves dividing total program or project costs by total impacts or outcomes, for example, the cost per mile of travel reduced or cost per ton of emissions reduced. A recent evaluation of three "Sustainable Travel Towns" in the U.K. assessed total VMT reduction as a result of the various TDM programs implemented in all the cities and assessed these total findings against the total public investment in TDM.[165] This provides an indication of the cost of an intended program outcome. The resulting cost effectiveness measure was that the sustainable transportation efforts resulted in reducing the cost for a mile of travel by about 4 pence (US$0.06). This provides an indication of the cost effectiveness of the program, which resulted in overall decreases in per capita car use and shifts to bike, walk, and public transit. The evaluation also revealed that the per capita cost of the program was about US$15 per resident, a measure of program inputs rather than program outcome.

Comparative cost effectiveness takes this analysis to the next level to help policy-makers and planners understand the relative value of TDM strategies versus other solution strategies. For example, one evaluation of the ridesharing program in Los Angeles County[166] concluded that the program maintained a commuter in a ridesharing mode, or the equivalent, removed a car from the regional highway system, for about $1 per day. When compared to other mobility and congestion relief strategies implemented by the agency, TDM was seen to be comparatively cost effective. For example, the cost effectiveness analysis concluded that the operation and maintenance of a new light rail line in LA was going to cost about $2.50 per new daily rider. Therefore, TDM was viewed as a more cost effective means to remove cars from the highway system than the new light rail system. These findings were used in planning and programming decisions by the agency. Ultimately, comparative cost effectiveness can be a powerful tool to show the cost of removing a car through demand management versus the cost of accommodating that car with capacity improvements or expansion.

Another example of basing program decisions on comparative cost effectiveness is provided by the State of Washington's Trip Reduction Performance Program (TRPP).[167] The legislature created TRPP in 2003 as a way for the state to fund organizations that implement sustainable, cost-effective projects that increase the capacity of the transportation system by reducing the number of drive-alone trips and VMT for commute purposes. TRPP funds are awarded on a competitive basis to entrepreneurs, private employers, public agencies, nonprofit organizations, developers, and property managers who provide financial incentives to commuters for using alternatives to driving alone. The purpose of the program is to create a trip reduction "market" in which WSDOT takes "bids" from organizations to reduce commute trips. WSDOT sets a cap on the price it is willing to pay per trip reduced over the course of a year. The program is different from a standard grant program in that the final award for a contractor is dependent on

[165] Department for Transport, The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Summary Report, February 2010

[166] LDA Consulting, LA Ridesharing Evaluation: Cost Effectiveness Analysis, prepared for Los Angeles County MTA, 2005

[167] http://www.ecy.wa.gov/climatechange/2008CATdocs/IWG/tran/tran_VMT05_TRPPbriefing_V07.pdf

the performance of a project. Contractors are eligible for financial bonuses (up to a cap) if their projects exceed their goals.

Finally, transportation projects are often justified with Benefit/Cost Analysis (BCA). This analysis monetizes the potential benefits of a project or program and compares them to program costs. A B/C ratio greater than 1.0 reveals that the benefits outweigh the costs. The difficulty in this analysis is monetizing costs and benefits. On the cost side, like any transportation project, TDM often involves many types of costs: some are capital, but many TDM costs are staffing, incentives, marketing, and other operational costs. However, many TDM programs/services are not fully allocating the costs by project or activity, which can distort results. Also, many TDM costs are borne by the private sector, such as employer and developer efforts. But as with any BCA, the difficulty comes in trying to monetize societal benefits, such as congestion relief (often expressed as time savings), safety improvements (expressed as crash reduction and injury cost savings), environmental improvement (also expressed as health cost savings), etc. However, with all the drawbacks of accurately estimating costs, BCA is a powerful and well recognized tool that is available to the TDM community. In fact, given the relatively modest costs in relation to benefits, TDM programs often have a very good B/C ratio. BCA has already been incorporated into the TRIMMS Model (v. 3. 0). TRIMMS includes monetized benefits, by region of the U.S., for the following: congestion, air and noise pollution, climate change, fuel consumption, and health and safety. The TRIMMS model, using TDM cost data and derived impact estimates from the model, can generate B/C ratios for TDM packages of TDM strategies and uses Monte Carlo simulation to reflect the uncertainty in various inputs.

KEY RESOURCES

Cambridge Systematics, "Best Practices in Multimodal Congestion and Mobility Performance Measures," prepared for Utah DOT, Technical Memo dated June 17, 2009.

SAIC, with ICF and KAI, "Advancing Metropolitan Planning for Operations: An Objectives-Driven, Performance-Based Approach - A Guidebook, prepared for FHWA, Report No. FHWA-HOP-10-026, February 2010.

SAIC, with ICF and KAI, "Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations - A Desk Reference, final draft prepared for FHWA, Report No. FHWA-HOP-10-027, April 2010.

HDR/iTRANS, Canadian Guidelines for the Measurement of TDM Initiatives , prepared for Transport Canada, March 2009, http://www.tc.gc.ca/eng/programs/environment-urban-guidelines-practitioners-tdmguide2009-1-1675.htm

Concas, Sisinnio, "TRIMMS Aims to Quantify Net Social Benefits of Vehicle Trip Reduction" in FLOW, Vol. 3, No. 2, Newsletter of National Center for Transit Research, March 2010.

ILS, et al, MAX Work Package B Final Report, Successful Travel Awareness Campaigns and Mobility Management Strategies, funded by European Commission, 6th Framework Program, November 2009, http://www.epomm.eu/index.phtml?ID1=2359&id=2359

LDA Consulting, LA Ridesharing Evaluation: Cost Effectiveness Analysis, prepared for Los Angeles County MTA, 2005

Reid Ewing and Robert Cervero, "Travel and Built Environment: A Meta-Analysis," Journal of the American Planning Association, Vol. 767, Issue 3, June 2010.

Keith Bartholomew and Reid Ewing, "Land Use-Transportation Scenarios and Future Vehicle and Land Consumption: A Meta-Analysis, Journal of the American Planning Association, October 2008.

SCAG Sustainability Sketch Planning Tool, http://www.scag.ca.gov/modeling/mtf/presentations/012710/mtf012710_SustainabilityToolDev.pdf, 2010

Sisinnio Concas and Philip L. Winters. Estimating Costs and Benefits of Emissions Reduction Strategies for Transit by Extending the TRIMMS Model" final report prepared for Florida Department of Transportation, funded by National Center for Transit Research. January 2012. http://www.nctr.usf.edu/wp-content/uploads/2012/02/77932-final.pdf

10 Known Effectiveness of TDM Strategies

In selecting TDM strategies to address key public policy objectives, it is useful for planners to know how effective they might be. While the previous chapters provide guidance and references on emerging approaches to evaluate and model TDM effectiveness, the empirical evidence on TDM effectiveness is somewhat sporadic and incomplete. It is also difficult to compare across all measures, as the performance measures and method of evaluation vary from one measure to the next. Studies often lack controls, and significant exogenous variables such as the price of gasoline and unemployment rates affect travel behavior changes. With those caveats, some rigorous and thoughtful evaluations have been undertaken, and this chapter presents some of known impacts of demand management strategies. Much of this effectiveness research focuses on air quality benefits given the application of TDM to conformity and environmental issues over the past 20 years. After presenting some of the published findings on TDM effectiveness for all policy objectives, this chapter concludes with a master table of policy objectives and TDM measures that indicate the relative effectiveness of the strategies in measurably fulfilling the objectives.

CHAPTER ACRONYM LIST	
CMAQ	Congestion Mitigation and Air Quality
DOT	Department of Transportation
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
LOS	Level of Service
SMART	Smart, Measurable, Achievable, Realistic, and Time-bound
SOV	Single Occupancy Vehicle
TCRP	Transportation Cooperative Research Program
TMD	Travel Demand Management
TOD	Transit Oriented Development
TSM	Transportation Systems Management
VMT	Vehicle Miles Travelled
VTR	Vehicle Trip Reduction
VTRM	Worksite Trip Reduction Model

10.1 Overview

Before presenting some of the key references on TDM effectiveness, some general comments can be made about TDM effectiveness:

- **One Size Does Not Fit All** – TDM effectiveness is highly dependent on the application setting, complementary strategies, nature of the travel market segment being targeted, and even the "vigor" with which TDM is implemented and promoted. Unlike many physical improvements, TDM strategies require some amount of education and outreach. This is all to say that the transferability of TDM strategy effectiveness is highly dependent on local conditions. Some of the more subjective evaluation findings on why a given TDM initiative was more successful in one location over another are issues such as the presence of a local champion, a history of alternative transportation, and the appropriate selection of a

target market of travelers. So, to use another cliché, there is "no one recipe for success" when it comes to TDM effectiveness. There are "ingredients" such as parking pricing that are correlated to program success. However, correlation does not prove causality.

- **TDM Impacts are Largely Localized** – TDM effectiveness is most readily measured at a localized level, and this appears to be where the greatest impacts can be found. TDM is applied to specific worksites, developments, employment centers, venues, or activity centers. Localities with well-defined travel markets tend to produce the most readily available and significant impacts. When the impact of TDM at a broader geographic level is sought, say at the corridor, city-wide, or regional level, the localized nature of TDM effectiveness diffuses the results at a broader scale. One study of implementing mandatory trip reduction programs in the Twin Cities, with strong parking management in a mixed use setting, showed that the programs would reduce vehicle trips by 8 to 27 percent at affected worksites translating to only a 2 percent peak period traffic reduction on the adjacent interstate.[168] However, small changes in demand (total demand or the spatial or temporal distribution of travel demand) can significantly affect traffic flow in congested locations and times. Likewise, the benefits of demand management accrue to both those who switch to sustainable modes as well as all travelers, including solo drivers (in terms of reduced delay, improved air quality, safety, etc.).
- **Travelers Respond to Their Wallets** - Most evaluation studies point to the overwhelming effectiveness of financial incentives and disincentives to manage demand. At one level, this makes sense as price influences demand in a classic microeconomic analysis. Cordon pricing in London and Stockholm have reduced traffic volumes entering the city center by as much as 20%.[169] Parking pricing is another widely accepted demand management technique. Adding or increasing parking charges at worksites can produce dramatic mode shifts, as reported in Shoup's seminal reference, The High Cost of Free Parking.[170] However, these examples relate to key disincentives to car use. In the U.S., TDM programs focused on modest financial incentives have been highly effective in inducing a shift to more sustainable modes. These incentive programs are often in the form of "Try-It-You'll-Like-It" inducements. For example, the Atlanta Clean Air Campaign's Cash for Commuters offers drive-alone commuters a daily cash incentive ($3/day) for using an alternative mode (carpool, vanpool, transit, bike, walk) for up to 90 days. An independent evaluation showed that the incentive caused 1,800 commuters to switch modes, resulting in 1,300 fewer vehicle trips and 30,000 VMT on the region's highways. More importantly, over 70% of incentive recipients continued their new commute mode after the subsidy lapsed, and half were still using a non-drive alone mode one year later.[171] In the Netherlands, congestion management efforts have resorted to paying commuters to stay off backed-up highways during the peak, so-called Rush Hour Avoidance.[172] Financial levers, even modest amounts, can influence travel behavior in a very significant manner.
- **Parking Influences Travel Choices** - Parking management is another widely accepted strategy to effectively change travel behavior, especially mode shift, time shift, and location shift. Parking pricing was mentioned above, but parking supply management can be effective as well. If parking is tight, meaning that all cars cannot be accommodated if everyone drives alone, commuters will adapt by sharing rides, shifting to transit, or even bicycling or walking if the distance allows. One study of developer TDM requirements revealed an 11-21% reduction in parking demand among worksites with aggressive TDM programs.[173] Travel demand can be influenced by time of day and short- vs. long-term parking rates to reduce travel, including cruising for parking, during congested periods.

[168] TCRP, Report 95 – Chapter 19 – Employer and Institutional TDM Strategies: Traveler Response to Transportation System Changes, 2010.

[169] FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006.

[170] Shoup, Donald, The High Cost of Free Parking, Planners Press, 2005.

[171] Center for Transportation and Environment (CTE),The Clean Air Campaign, Cash for Commuters Program, Report on April 2004 Follow-up Surveys, 2004, http://www.dot.state.ga.us/informationcenter/programs/environment/airquality/Documents/pdfs/clean_air_campaign_cash_for_commuters_program_report_on_april_2004_follow_up_surveys.pdf.

[172] FHWA, Integrating Active Traffic and Travel Demand Management: A Holistic Approach to Congestion Management, prepared by ESTC for the International Technology Scanning Program, FHWA-PL-11-011, 2011, http://international.fhwa.dot.gov/pubs/pl11011/pl11011.pdf.

[173] Spack Consulting, "TDM: An Analysis of the Effectiveness of TDM Plans in Reducing Traffic and Parking in the Minneapolis/St. Paul Metropolitan Area," January 2010.

- **Packaging is Key** - TDM strategies are most effective when packaged into logical, complementary packages to realize synergistic effects. On the other hand, some strategies do not complement one another. One example of an unintended consequence from traditional TDM is flex-time and carpooling. Some employers who implement flex-time strategies as an employee perk or to address congestion at parking entrances have found that this can also serve to discourage ridesharing arrangements, which tend to do better with set work hours. At the same time, flexibility could reduce the peak period volumes and improve flow without changing mode split. Looking at some newer strategies, such as HOT lanes, efficiency improvements can also work to discourage some ridesharing arrangements. HOT lane projects which need to raise vehicle occupancy requirements from 2+ to 3+ in order to create sufficient capacity to sell may serve to break apart existing two-person carpools who choose to drive alone in the mixed flow lanes rather than pay a toll or find another rider.

But complementary measures can lead to greater results than strategies implemented alone. The effect of many TDM strategies is multiplicative: the impact of any one measure on VMT reduction or mode shift might be modest, but the combined effects from improving upon several, complementary measures can be substantial. For example, systems management improvements, such as ramp metering, can be complemented with provisions for HOV bypass lanes, employer trip reduction programs in the corridor, and traveler information that includes HOV time savings among the traffic statistics provided. One study concluded that employer TDM programs that combined incentives and improved commute alternatives experienced an average trip reduction of almost 25%, where those implementing incentives alone realized a 16.4% reduction and alternatives alone 8.5%.[174] As one international TDM study put it: "Experience throughout the OECD region has shown that… packaged, complementary solutions are usually more effective than a single measure."[175]

- **TDM is Not a Solution to All Transportation Problems** – TDM can be highly effective at a relatively low cost (as compared to capacity enhancements) when applied in the right place, at the right time for the right travel market. However, TDM, in and of itself, is not adequate to solve congestion, air quality, energy, and other urban woes. Too often the expectations are unstated or disconnected from allocated resources and incompatible policies (e.g., developers are required to build a minimum number of parking spaces, often offered for free to employees and customers, that serves to generate even more driving).[176] As mentioned above, TDM is most effective, or at least most measurable, at the localized level. The impact of TDM at a corridor or regional level is very hard to evaluate. Modeling and simulation, such as that done using employer trip reduction data to show the likely impact of TDM on I-5 in Seattle, suggests that aggressive and relatively widespread TDM programs at a local level can have a measurable and significant impact on a corridor.[177] However, it is very difficult to measure empirically given issues of multiple influences, externalities, and causality. This clearly points to the need to carefully marry TDM strategies to smart infrastructure enhancements, such as ATM. When efficiency improvements are combined with efforts to reduce peak demand, the greatest impacts should be realized.

The remainder of this chapter provides evidence of TDM effectiveness in terms of two primary areas of performance: travel impacts (mode shift) and environmental (emissions) impacts. Other impacts, including traffic and safety impacts and impacts related to goods movement, economic development, and livability, are touched upon. The known impacts reported are related back to the policy objectives discussed in Chapter 3 where possible. The chapter concludes with a comprehensive matrix of TDM strategies and their relative effectiveness in addressing key urban policy objectives.

[174] TCRP, Project B-4, Estimating the Cost Effectiveness of Employer-based Trip Reduction Programs, unpublished technical memorandum, 1995.

[175] OECD, Road Travel Demand, Meeting the Challenge, 2002.

[176] http://shoup.bol.ucla.edu/TruthInTransportationPlanning.pdf

[177] CUTR, Impacts of Employer-based Programs on Transit Ridership and Transportation Systems Performance, prepared for Florida DOT, FDOT-BD549-WO25, May 2007, http://www.nctr.usf.edu/pdf/77605.pdf

10.2 Travel Impacts

TDM originated from commuter-based programs aimed at shifting commuters from drive alone travel choices to other modes. These mode shift impacts address several policy measures, namely congestion relief, accessibility improvement, air pollution mitigation, and smarter land use decisions. The principal means for evaluating TDM, and therefore the core performance measures, are related to travel impacts, especially changes in the use of drive-alone vehicles. At the core of these performance measures is a basic quantification or estimation of changes in travel behavior: changes reflecting adoption of new travel choices. This focuses the core performance measures on:

- Mode shift (change in % use of each travel mode).
- VTR (reduction in the number of vehicles used by travelers adopting other choices).
- VMT Reduction (reduction in the amount of travel represented by shift in travel mode or location).

From these performance measures, especially VMT reduction, a host of other performance indicators can be derived, especially those related to emissions (environmental) and energy use. Table 10.1 shows estimated ranges of TDM program effectiveness by type of program or strategy and level of transit service, as developed for site-specific TDM programs in Fairfax County, VA.[178] In this table, "high" transit service corresponds to rail, "moderate" to peak-period bus headways of 20 minutes or less, and "low" to other conditions. These estimates of net mode shift were developed for the Fairfax County Department of Transportation, based on an assessment of various literature sources combined with professional judgment, in order to provide TDM planners with a basic understanding of the potential for mitigating trip generation, and therefore added traffic, from new developments.

Table 10.1: National Evidence on TDM Program Impacts
Vehicle Trip Reduction from Background Conditions

Source: Cambridge Systematics, 2010 (Fairfax County, VA)

TDM Program or Strategy	High Transit	Moderate Transit	Low Transit
Support, Promotion, Information	3-5%	1-3%	<1%
Alternative Commute Services	5-10%	5-10%	1-3%
Financial Incentives	10-20%	5-15%	1-5%
Combined Strategies			
With Free Parking	15-20%	10-15%	3-7%
With Paid Parking	25-30%	15-20%	N/A

Other guidance has gone further than this simple table. One of the earliest FHWA guidance documents on TDM provided dozens of effectiveness look-up tables derived from the FHWA predecessor to the COMMUTER Model. The 1993 report, "Implementing Effective TDM Measures: Inventory of Measures and Synthesis of Experience,"[179] provided charts showing the corresponding VTR for various employer TDM strategies applied to various starting conditions (as is the case with the transit conditions in Table 10.1).

[178] Cambridge Systematics, Inc, Increasing the Integration of TDM into the Land Use and Development Process, prepared for Fairfax County Department of Transportation, draft final report, May 2010.

[179] FHWA, "Implementing Effective TDM Measures: Inventory of Measures and Synthesis of Experience" DOT-T-94-02, September 1993, http://ntl.bts.gov/DOCS/474.html

A recent TCRP report on "Employer and Institutional TDM Strategies," published as one of a series of reports on Traveler Responses to Transportation System Changes,[180] provides an update to this knowledge base on trip reduction impacts of TDM strategies. This report includes a broad set of TDM strategies, including financial incentives and disincentives, service provision (shuttle buses and vanpools), support strategies for bike and walk commuting, alternative work arrangements (compressed work weeks, telecommuting), and institutional arrangements for implementing TDM programs. The report analyzed TDM impact data from 82 employer programs where sufficient (before and after) and rigorous (unbiased data collection) data existed. The TCRP report corroborates some of the information in Table 10.1 by revealing that worksites with good transit availability realized a vehicle trip reduction (VTR) rate of 26% versus 12% at worksites without good transit. Some other comparative findings showed that:

- The existence of aggressive employer support programs (e.g. , guaranteed ride home) results in a 4-5% VTR in and of itself.
- The offer of alternative commuting services (e.g. , shuttle bus, vanpool) resulted in an average VTR of 22% as compared to 14% among worksites with the offer of these services.
- The existence of financial incentives and disincentives produced VTR results in the range of 23-30%.

The TCRP report provides many look-up tables displaying the results of the 82-worksite analysis showing average VTR in the presence or absence of key TDM strategies and support elements. For example, Table 10.2 shows the relative effectiveness of combining financial incentives with other key employer program attributes, such as transit availability and support services. The case studies used in the analysis shown in the table are considered "top performers" and do not represent "average" impacts among all worksites implementing similar TDM measures. As such, these findings should be considered upper bounds of potential impacts.

Likewise, the WTRM development project examined 1,671 distinct incentive plan combinations in total, and out of these, 50 combinations are implemented by at least 75 records. And these 50 distinct incentive plan combinations have been implemented by 9,866 records in total. A series of look-up tables for these top 50 plan combinations vary based on starting VTR that show the ACTUAL changes report, WTRM predicted value, and the number of plans that fit that profile.[181]

[180] TCRP, Report 95 – Chapter 19 – Employer and Institutional TDM Strategies: Traveler Response to Transportation System Changes, 2010.

[181] See Chapter 5. Worksite Trip Reduction Model Report http://www.nctr.usf.edu/pdf/473-14.pdf

Table 10.2: Vehicle Trip Reduction Percentages Related to Monetary Incentives and Other Site Programs or Conditions

Source: TCRP, 2010

VTR by Type of Incentive Offered (Sample Size)																	
Other Condi-tions	Parking Pricing		HOV Discounts		Transit Subsidy		Vanpool Subsidy		Carpool Subsidy		Bike/Walk Subsidy		Travel Allowance		Other Monetary		All
	With	W/out	With	W/out	With	W/out	With	W/out	With	W/out	With	w/o	With	W/out	With	w/o	
All	24. 6%	12.3%	25.7%	13.8%	20.6%	13.1%	15.3%	17.2%	23.0%	16.6%	18.2%	16.9%	19.3%	16.0%	23.1%	16.1%	16. 9%
Transit Availability																	
High	27.0%	18.9%	26.4%	25.1%	27.4%	22.5%	26.2%	25. 9%	n/a	26.0%	n/a	26.0%	20.3%	26.8%	38.2%	24.9%	26%
Medium	13.7%	8.0%	19.0%	9.6%	11.2%	13.6%	10.5%	13.5%	20.5%	10.5%	12.1%	12.1%	19.6%	7.7	15.0%	11.5%	12.1%
Low	47.4%	12.9%	47.7%	12.9%	20.3%	10.5%	10.5%	14.4%	30.4%	13.3%	30.4%	13.3%	17.6%	12.1	22.0%	12.3%	13.8%
Level of Support																	
High	24.4%	12.5%	23.7%	16.6%	22.8%	15.7%	14.9%	19.6%	n/a	19.0%	n/a	19.0%	20.7%	18.1%	17.3	19.5%	19.0%
Medium	27.3%	12.9%	31.9%	13.1%	20.4%	11.7%	11.5%	17.1%	27.1%	14.8%	18.2%	15.7%	20.9%	14.3%	33.1	13.6%	15.9%
Low	22.8%	9.6%	24.0%	10.2%	17.8%	10.0%	44.2%	13.2%	10.5%	15.3%	n/a	15.0%	13.6%	15.6%	n/a	15.0%	15.0%
Transportation Services																	
Transit	35.3%	2.6%	35.3%	2.6%	35.3%	2.6%	n/a	18.9%	n/a	18.9%	n/a	18.9%	21.1%	16.7%	42.4	11.1%	18.9%
Vanpool	34.1%	10.7%	34.1%	10.7%	25.0%	17.0%	23.1%	20.3%	n/a	21.3%	n/a	21.3%	30.7%	17.8%	13.8	22.1%	21.3%
Both	23.6%	16.1%	38.0%	14.5%	30.2%	9.3%	16.0%	19.3%	42.4%	16.4%	n/a	18.8%	3.4%	20.0%	n/a	18.8%	18.8%
Co. Veh's	36.6%	14.6%	34.8%	18.9%	34.4%	7.6%	16.4%	27.5%	38.9%	23.2%	n/a	26.2%	40.0%	15.9%	20.7	23.8%	24.6%
No Serv's	18.2%	11.3%	15.6%	13.1%	13.1%	14.2%	5.8%	14.3%	17.7%	13.4%	18.2%	13.3%	13.5%	13.7%	19.2	12.5%	16.3%

One other means to induce a mode shift involves physical restrictions on the automobile, namely closing roads or areas of high pedestrian use to cars. Several European cities have closed their core central district to car traffic, at least on Saturdays (shopping days). This involves establishment of peripheral parking areas and good transit, bicycle, and pedestrian access. In South America, the Ciclovia concept has taken root and involves closing major thoroughfares on Sundays, allowing families to walk and bike. Such auto restrictions have created significant mode shift impacts. For example:

- In central Bremen, Germany, 58% of all shopping trips are made by bus and 22% of all trips in the downtown are made by bike.[182]
- In Rome, a Limited Traffic Zone, substantially limiting the number of cars into the historic center, has reduced traffic levels by almost 20 percent and increased public transit use by 5%. Such traffic restriction zones now exist in most Italian cities.[183]
- In Hasselt, Belgium, rather than build a third ring road, the mayor closed the second ring road, made it a bike/pedestrian way, and made transit free. Transit use increased 8 fold after the car restrictions and transit improvements were put in place.[184]
- Transit malls in the U.S., have increased downtown transit use, such as in Denver where the 16th St. transit mall serves 63,000 daily riders while the street is responsible for 6% of Denver's business tax revenue.[185]
- Several studies of limiting cars in shopping districts, in the UK and San Francisco, have revealed an interesting finding – patrons who walk to shopping districts spend more, on average, than car users.[186]

While many pedestrian streets were created in the 1970s (such as Boston's Downtown Crossing), they are experiencing a resurgence in places like New York City (recently banning cars from Times and Herald Squares) and San Francisco (currently closing streets in Golden Gate Park on Sundays and contemplating closing Market Street to cars). The VTPI TDM Encyclopedia[187] summarizes the likely impacts of car-free treatments in Table 10.3, differentiating the impacts based on size of the application area (e.g., one or two streets versus a whole district).

Finally, one other recent innovation is social marketing campaign to induce travel behavior change. TravelSmart Australia, a community and government based program encouraging the use of alternative modes, took a comprehensive community based social marketing approach to Adelaide in Western Australia. They compared participant behavior with non-participants and discovered that participants decreased in distance traveled over the study period at a rate of 10.4 km per household per day (18% reduction) and decreased car travel by 36 km. At the same time, non-participants actually reported an increase in distance traveled over the study period of 14 km on weekdays and an increase in car travel of 4.5 km on weekends.[188] Such measures, also called Travel Blending and Individualized Marketing, have also been tested in Japan, Germany, and the U.S.

[182] OECD, Road Travel Demand, Meeting the Challenge, 2002.

[183] FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006

[184] VTPI, Online TDM Encyclopedia, updated 2010, http://www.vtpi.org/tdm/tdm118.htm and /tdm6.htm

[185] 21st Century Urban Solutions, Last Lessons from the Centennial State, updated September 3, 2009

[186] Accent Marketing & Research, Town Centres Survey, 2003-04, prepared for Transport for London 2004. and Elizabeth M Bent, Modal Choices and Spending Patterns of Travelers to Downtown San Francisco: Impacts of Congestion Pricing on Retail Trade, San Francisco County Transportation Authority, 2008

[187] VTPI, Online TDM Encyclopedia, updated 2010, http://www.vtpi.org/tdm/tdm118.htm and /tdm6.htm

[188] http://www.sa.gov.au/upload/franchise/Transport,%20travel%20and%20motoring/TravelSMART/TravelSMART_Households_in_the_West.pdf

Table 10.3: Travel Impact Summary – Car Free Areas

Source: VTPI, 2010

Objective	Small Area	Large Area
Reduces total traffic	1	2
Reduces peak period traffic	1	2
Shifts peak to off-peak periods	0	0
Shifts automobile travel to alternative modes	1	2
Improves access, reduces the need for travel	1	2
Increased ridesharing	1	2
Increased public transit	2	2
Increased cycling	2	2
Increased walking	3	2
Increased telework	0	0
Reduced freight traffic	0	1
Rating- From 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.		

10.3 Traffic and Network Impacts

Of course, mode shift, trip reduction, and VMT reduction do not indicate the impact on the road system. Obviously, fewer cars and less travel contribute to highway performance, but the correlation is not always clear. Performance indicators for TDM's role in highway operations need to be related to highway performance, such as:

- LOS.
- Vehicle Hours of Travel.
- Delay.
- Travel time reliability.
- Person throughput.

LOS indicators have been developed for other travel choices (such as transit and bicycle LOS or HOV travel time reliability). The Florida DOT has adopted a multimodal Quality/LOS system for four modes: car, bus, bike, and walk.[189] Figure 10.1 provides a simple, visual representation of what the various LOS might look like, based on work developed by Florida DOT.

[189] Florida DOT, FDOT Quality/LOS Handbook, 2009

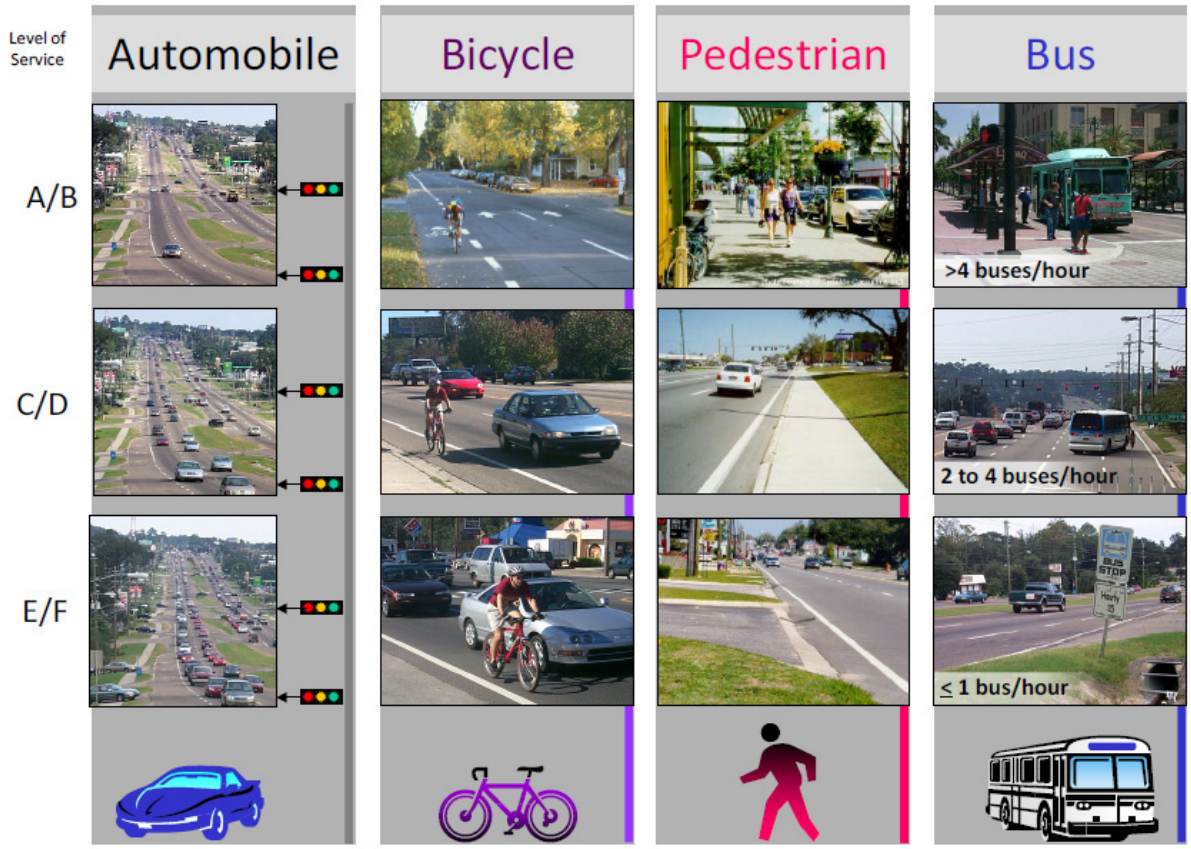


Figure 10.1: Florida State Multi-Modal LOS Standards

Source: Florida DOT

The direct traffic impacts of demand management are amply demonstrated in three areas: pricing-related strategies including managed lanes, real-time traveler information, and active traffic management.

Congestion pricing benefits drivers and businesses by reducing delays and stress, by increasing the predictability of trip times, and by allowing for more deliveries per hour for businesses. Pricing, in combination with transit services, provides bus riders with travel-time savings equivalent to those for drivers and reduces waiting time for express bus riders due to more frequent service. Introduction of pricing in central London and Stockholm has resulted in significant shifts of commuters to transit, particularly buses. Bus-related delays in central London dropped by 50 percent after the introduction of the pricing scheme. There was a 7 percent increase in bus riders. In Stockholm, 200 new buses were put into service in August 2005, several months in advance of the pricing trial, which began in January 2006. After the pricing scheme was implemented, daily public transportation use, compared with the same month in 2005, was up by 40,000 riders daily. Ridership on inner-city bus routes rose 9 percent compared with a year earlier. On the State Route 91 priced lanes in Orange County, California, traffic during rush hours moves at over 60 mph, whereas the traffic in adjacent lanes crawls at average speeds of 15 mph or less. Commuters on the priced express lanes thus save as much as half an hour each way on the 10-mile trip, or as much as an hour a day.[190]

[190] FHWA, Congestion Pricing: A Primer – Overview, FHWA-HOP-08-039, 2008

As has been noted in Chapters 2 and 3, real-time traveler information is transforming the way transportation professionals can manage travel demand with technology and new dissemination mechanisms enabling short-term, spur-of-the-moment decisions made just before a trip takes place or even en-route. Individual benefits from traveler information are well-documented and range from avoiding congestion to reducing uncertainty and stress, saving time, and improving travel safety.[191] These benefits are the direct effect of providing travelers with choices about the time, route, mode, and destination of travel. The value of these services is often gauged by the increased participation in and usage of these services. Nationally, the growth of 511 systems (both in number and in use) and traffic information websites is a well-documented phenomenon. Surveys of travelers and users of such systems show changes in behavior at an individual level; however, system-level impacts due to traveler choices have been evaluated through several simulation models.

10.4 Environmental Impacts

In addition to our knowledge on TDM effectiveness being focused on employer trip reduction programs, other evaluation results come from environmental studies. This is to be expected given the role of TDM in emission-reduction programs and conformity analyses. TDM impacts on reducing emissions not only address environmental policies, but can contribute to other policies, such as livability, sustainability, and even economic development (in the long run). The evaluation of TDM tends to assess TDM in terms of VMT reduction and convert these findings into emissions reductions via per-mile emission factors. VMT reductions can also be converted to energy impacts by applying energy consumption (miles per gallon) factors to travel reductions.

A recent study analyzed a host of GHG emission reduction strategies to assess the ability of transportation strategies to address climate change. That study corroborated many of the conclusions already noted in this chapter. Regarding packaging, the study concluded that "an integrated, multi-strategy approach that combines techniques such as travel activity, local and regional pricing, and operational and efficiency strategies can contribute to significant GHG reductions" and that "implementing various 'bundles' of transportation efficiency strategies could achieve annual GHG emission reductions of up to 24 percent less than expected Baseline levels in 2050, by changing current transportation systems and operations, travel behavior, land use patterns, and public policy and regulations."[192]

Moving Cooler[193] noted that the strategies that contribute the most to GHG reductions are:

- Local and regional pricing and regulatory strategies that increase the cost of single-occupancy vehicle travel.
- Regulatory strategies that reduce and enforce speed limits.
- Educational strategies to encourage eco-driving behavior that achieves better fuel efficiency.
- Land use and smart growth strategies that reduce travel distances.
- Multimodal strategies that expand travel options.

This last finding, on multimodalism, is critical in that it confirms the importance of providing more travel options as a cornerstone to TDM and sustainable travel in general, and it is also cited in the Urban Mobility Index reporting, prepared by the Texas Transportation Institute.

[191] RITA, ITS Benefits Database, Traveler Information, http://www.itsbenefits.its.dot.gov/its/benecost.nsf/SingleTax?OpenForm&Query=Traveler+Information

[192] Urban Land Institute (ULI), Moving Cooler _An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions : Executive Summary prepared by Cambridge Systematics for Moving Cooler Steering Committee, June 2009. http://movingcooler. info/Library/Documents/Moving%20 [189] Cooler%20Executive%20Summary.pdf

[193] Moving Coller: An Analysis of Transportation Strategies to Reducing Greenhouse Gas Emissions, available at http://www.movingcooler.info/

TDM strategies can impact emissions in more ways than simply reducing VMT. One FHWA study of the ability of transportation strategies to impact multiple pollutants (Table 10.4) to shows how TDM strategies reduce emissions (e.g., VMT, trip, speed, idling reductions, time shift, or shift in fleet mix or fuels) for various pollutants.[194] While the table does not provide estimates on the amount of emission reduction that might be expected, it serves as useful guidance on precisely how TDM strategies influence air quality and can assist planners in understanding the relationship between specific TDM strategies and air quality.

Table 10.4: General Emissions Impacts of TDM Strategies

Source: FHWA, 2006

	Category of Primary Effect						General Pollutant Effect						
Strategy	**Reduce VMT**	**Reduce vehicle trips**	**Shift travel time**	**Reduce idling**	**Change speeds**	**Change vehicle stock or fuels**	**PM-2.5**	**PM-10**	**CO**	**NOx**	**VOCs**	**SOx**	**NH3**
1. Park-and-Ride Facilities	√	-					↓	↓	↓	↓	↓	↓	↓
2. HOV Lanes	√	√			√		↓	↓	↓	↓	↓	↓	↓
3. Ridesharing	√	+					↓	↓	↓	↓	↓	↓	↓
4. Vanpools	√	+					↓	↓	↓	↓	↓	↓	↓
5. Bicycle/Pedestrian	√	√					↓	↓	↓	↓	↓	↓	↓
6. Transit Service Enhancement	√	√					↓*	↓*	↓	↓*	↓	↓*	↓
7. Transit Marketing, Information and Amenities	√	√					↓	↓	↓	↓	↓	↓	↓
8. Transit Pricing	√	√					↓	↓	↓	↓	↓	↓	↓
9. Parking Pricing/Management	√	√					↓	↓	↓	↓	↓	↓	↓
10. Road Pricing	√	√	+				↓	↓				↓	↓
11. VMT Pricing	√	√					↓	↓	↓	↓	↓	↓	↓
12. Fuel Pricing	√	√				√	↓	↓	↓	↓	↓	↓	↓
13. Employer-based TDM Programs	√	√	+				↓	↓	↓*	↓*	↓*	↓	↓
14. Non-Employer-based TDM	√	√	+				↓	↓	↓*	↓*	↓*	↓	↓
15. Land-Use Strategies	√	√			√		↓	↓	↓*	↓*	↓*	↓	↓

√=primary effect; +=may be a notable effect, but not in all cases; -=may have the opposite effect, in some cases ↓=decrease; ↓*=generally decreases, but possibility of an increase; ↓/↑=varies; ↓=increase; N=no change/not quantified

[194] FHWA, Multi-Pollutant Emissions Benefits of Transportation Strategies - Summary of Findings, 2006.

Finally, as stated in Chapter 9, one of the most powerful evaluation findings that can be developed will show the relative cost effectiveness of TDM versus other projects or programs intended to meet the same policy objective. One study that provided an insight into the cost effectiveness of many TDM strategies was TRB Special Report 264.[195] The 2002 report states that TDM strategies represented a significant proportion of the projects funded by CMAQ, and an analysis was performed among projects with quantifiable, reported impacts to show the relative cost per ton of pollution reduced by various categories of emission-reducing projects. The results, shown in Table 10.5, reveal that TDM related strategies were among the most cost effective. Among the top 10 strategies, the most cost effective alternative mode strategies are:

- Regional ridesharing programs (including carpool matching).
- Pricing programs (including parking pricing and congestion pricing).
- Vanpool programs.
- Miscellaneous TDM programs (efforts to promote alternative modes).
- Conventional transit service improvements (new lines, more frequency).
- Employer trip reduction.

Table 10.5: CMAQ Project Category Cost Effectiveness
Source: TRB, 2002

CMAQ Strategy	Cost Per Pound of Emissions Reduced
Inspection and maintenance	$0.95/lb.
Regional rideshare programs	$3.70/lb.
Charges and fees	$5.15/lb.
Vanpool programs	$5.25/lb.
Miscellaneous TDM	$6.25/lb.
Conventional fuel bus replacement	$8.05/lb.
Alternative fuel vehicles	$8.09/lb.
Traffic signalization	$10.05/lb.
Employer trip reduction	$11.35/lb.
Conventional transit service upgrades	$12.30/lb.
Park-and-ride lots (rideshare and transit)	$21.50/lb.
Modal subsidies and vouchers	$23.30/lb.
New transit capital systems/vehicles	$33.20/lb.
Bicycle and pedestrian programs	$42.05/lb.
Shuttles, feeders, and paratransit	$43.75/lb.
Freeway/incident management	$51.20/lb.
Alternative fuel buses	$63.20/lb.
HOV facilities	$88.10/lb.
Telework	$125.90/lb.

Telework, a common TDM strategy, was rated at the bottom of the list, as the least cost effective, due to the fact that the CMAQ analysis was evaluating public sector programs to promote telecommuting and that the programs evaluated largely consisted of telework centers, which can be costly in terms of capital and operating expenses, not the cost effectiveness of telecommute arrangements themselves. This type

[195] Transportation Research Board, The Congestion Mitigation Air Quality Improvement Program: Assessing Ten Years of Experience, Special Report 264, National Academies, 2002.

of analysis provides powerful evidence of the effectiveness and cost of TDM in meeting environmental objectives.

10.5 Other Impacts

The sections above have discussed the documented impacts of TDM on travel behavior, traffic, and air quality. Clearly, this report suggests that TDM can have a positive impact on other policy objectives, such as goods movement, land use, livability, and economic development. Unfortunately, very little empirical research exists documenting the impact of TDM strategies toward these policies in a comprehensive, systematic, and comparative manner. As such, individual case studies and experiential information from earlier in the desk reference is summarized below:

- **Goods movement** - Two strategies have been discussed in this report: consolidated deliveries and pricing. Consolidated deliveries has been shown to reduce the number of delivery vehicles, in places like Burgos, Spain, but other impacts have not been documented, such as congestion reduction.[196] A delivery scheme in two French cities, using electric vehicles, reduced related CO_2 by 58%. Pricing, on the other hand, has been proven to be quite effective. Truck tolling in Germany has resulted in a small shift from truck to rail and a reduction in empty deadheading trips. Peak period fees (Pier Pass) at the Port of Los Angeles have reduced congestion in the terminal areas and have reduced midday truck volumes on I-710.[197]
- **Land use** – TDM is often used as a mitigation strategy to reduce the additional trips generated by new development, and success cases revealing trip reductions on the order of 10-25% are fairly abundant. Land use and design issues, as a longer-term strategy, have the potential to increase non-automobile modes, as revealed in comparisons of the mode split between towns with and without good bike, pedestrian, and transit infrastructure.
- **Livability** – Measuring the impact of TDM on livability can be a subjective process. But livability might be seen as the product of several other effective roles for TDM, namely reduced congestion, increased safety, improved environment, and healthy economic conditions. Mostly, livability can be associated with increased travel choices, a fundamental purpose of demand management.
- **Economic Development** – In mitigating the negative impacts associated with growth (congestion, air pollution, energy consumption, reduced safety), TDM can improve the attractiveness of a region or city to prosper economically. As seen in cases such as Lund, Sweden, and the Sustainable Travel Town pilots in the U.K., economic growth can be decoupled from traffic growth. In Lund, the region grew substantially (population and employment) during a period when TDM was being implemented, reducing VMT by 1-2% overall. The growth in travel demand was met by increases in transit use and bicycling.[198]

10.6 Summary of TDM Effectiveness – Relative Impact on Policy Objectives

The preceding sections have summarized some of the research on the known effectiveness of TDM strategies. The available impact information is largely based on the VTR impacts of employer-based TDM strategies and the emission reduction impacts based on the application of TDM to address air quality policy objectives. The impact of TDM on all the policy objectives enumerated in Chapter 3 have been

[196] FGM-AMOR, CIVITAS II: 2005-2009 Final Brochure, prepared for European Commission and CIVITAS GUARD, September 2010 (www.civitas.eu)

[197] FHWA, Port Peak Pricing Program Evaluation, FHWA-HOP-09-014, 2009, http://ops.fhwa.dot.gov/publications/fhwahop09014/sect2.htm

[198] FHWA, "Managing Travel Demand: Applying European Perspectives to U. S. Practice," Report No. FHWA-PL-06-015, May 2006 and Transport for Quality of Life, et al., The Effects of Smarter Choice Programmes in the Sustainable Travel Towns – Summary Report, prepared for UK Department for Transport, February 2010.

touched upon in this chapter, However, this is an incomplete picture of the impact of the wide variety of TDM strategies included in this desk reference. Empirical evidence, in a form and amount sufficient to warrant comparative analysis, is not available for many strategies, beyond individual case studies. Likewise, impacts are often not expressed in comparative terms to allow for the evaluation of one type of TDM strategy against another.

However, policy-makers and planners make decisions every day as to which TDM strategies to apply to a given project, problem, or policy objective. In order to assist in this process, the authors of this desk reference have produced a "master table" (Table 10.6) showing the relative effectiveness of some 32 TDM strategies in six categories (traditional employer TDM, land use, transit, parking, pricing, and systems management) as applied to the seven policy objectives discussed in Chapter 3. The key word here is "relative" as we are attempting to show whether a given TDM strategy will influence a particular policy objective in a significant way or simply contribute in a modest manner. Clearly, attached to each policy objective are a number of performance measures that would be used to measure effectiveness. In very general terms, highly effective equates to a greater than 10 percent reduction in travel among the target population; moderately effective to a 2 to 10 percent reduction in travel; and nominally effective up to a 2 percent reduction in travel (acknowledging that small reductions can have significant impacts on congested facilities). As implied, many strategies have not yet been evaluated in terms of their impact on a given policy objective. For example, we do not know the impact of HOT lanes on economic development, given the relatively new nature of this measure. We believe that these strategies will have a positive impact on addressing key policy objectives, but empirical evidence is not available from which to make a relative assessment.

These relative ratings are based on the professional judgment of the authors of this report and are based on a review of available studies on TDM effectiveness and the authors' extensive experience with TDM evaluation. If used properly (as an initial screening tool to select TDM strategies to address particular policy objectives before further, more detailed analysis and modeling), this matrix can be a useful first step.

Table 10.6: TDM Strategies and Their Relative Effectiveness in Addressing Key Policy Objectives

	Traditional TDM								Land Use/Active Transportation					Transit			Parking			Pricing				Systems Management			
STRATEGIES	HOV/HOT/Managed Lanes	Employer Trip Reduction Programs	Alternative Work Arrangements	School-based Trip Reduction	Event-based Trip Reduction	Recreation-based Trip Reduction	Car-Sharing	Vanpool Programs	Developer Trip Reduction	Land Use Strategies	Car-free or Access-Restricted Zones	Bicycle Facilities and Programs	Pedestrian Facilities and Continuity	Transit Service Improvements	Transit Prioritization/BRT	Transit Fare Discounts	Parking Information	Parking Supply Management	Parking Pricing	Cordon Pricing	Congestion Pricing	General Financial Incentives	VMT Tax	Ramp Metering	Integrated Corridor Management	Traveler Information	Eco-Driving
POLICY OBJECTIVES																											
Mobility	O	O	O	O	O	O	O	○	○	O	○	O	O	○	O	○	O	✕	✕	✕	✕	●	✕	✕	○	O	N
Congestion Relief	✱	○	○	○	○	○	✕	○	○	○	O	○	○	○	○	○	○	O	○	●	●	○	●	O	○	O	✕
Air Quality	✱	O	O	O	○	○	O	●	○	○	O	O	O	O	O	O	○	O	O	●	●	●	●	✕	✱	○	○
Economic Development	✱	✕	○	✱	✱	✱	○	○	✕	○	✕	○	○	✱	○	○	○	✕	✕	✱	✱	O	✕	N	✱	○	✕
Land Use Interaction	○	N	○	✱	✱	✱	○	✱	O	O	O	O	O	○	○	○	○	O	O	○	○	○	O	N	N	N	✕
Goods Movement	○	○	○	N	○	○	N	○	N	N	○	✱	✱	✱	✕	✕	○	N	○	O	O	O	O	○	O	○	O
Livability	○	○	●	●	○	○	O	○	○	●	●	●	●	○	○	○	○	O	O	✱	✱	○	✱	✕	N	○	O

KEY: ● = highly effective; O = moderately effective; ○ = nominally effective; ✱ = likely effective (but still undocumented); N = not applicable; ✕ =minimal to no impacts

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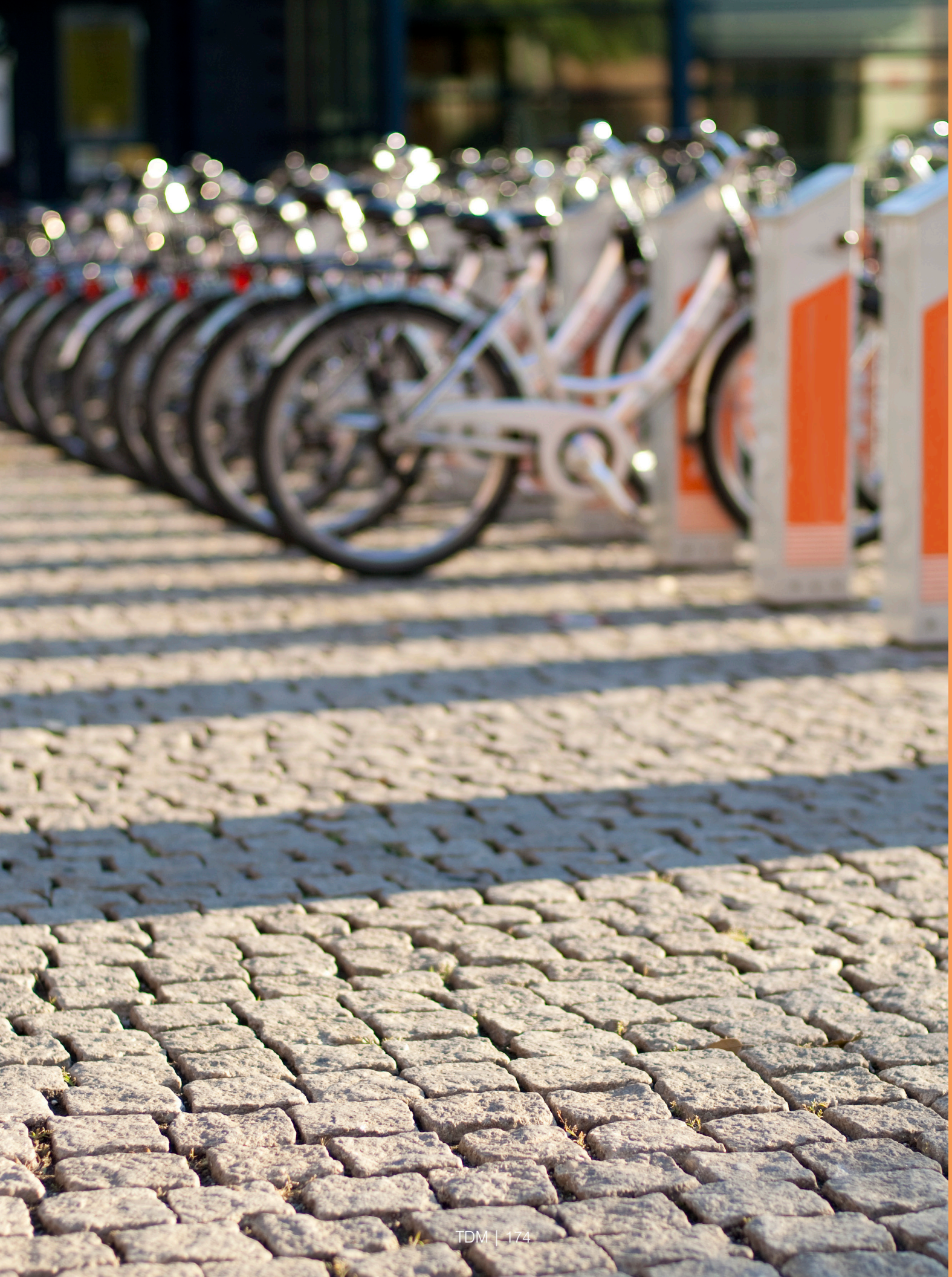

11 Transitioning from Planning to Implementation

This chapter examines TDM programs nationwide to identify examples of successful implementation and support of demand management programs by state DOTs, MPOs, and TMAs, corridor-level projects, and local planning organizations. It concludes with a discussion of how TDM programs are funded, focused largely on federal sources.

CHAPTER ACRONYM LIST	
CMAQ	Congestion Mitigation and Air Quality
CTE	Center for Transportation and the Environment
DOT	Department of Transportation
DRPT	Department of Rail and Public Transportation
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GRH	Guaranteed Ride Home
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LOS	Level of Service
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission
MAAQS	National Ambient Air Quality Standards
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
SOV	Single Occupancy Vehicle
STP	Surface Transportation Program
TCM	Transportation Control Measures
TCSP	Transportation Community and System Preservation Program
TDM	Travel Demand Management
TMA	Transportation Management Association
TMD	Transportation Management District
TOD	Transit Oriented Development
TSM	Transportation Systems Management
VMT	Vehicle Miles Travelled
VTR	Vehicle Trip Reduction
WTRM	Worksite Trip Reduction Model

11.1 State Level

Based on an extensive outreach effort in executing NCHRP Project 20-65 Task 24, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," a nationwide survey of state DOTs was conducted to identify national trends regarding the extent of their involvement in TDM and related activities. Over 90 percent of responding state DOTs indicated that their agencies play a role in TDM.[199] The most commonly identified roles were the use of TDM on project-level activities and providing funding/technical assistance to local organizations focused on TDM. However, state DOTs can play many different roles in implementing TDM services. Some potential roles are listed below:

- Administering TDM Services – Through this role, state DOTs focus on various programmatic TDM activities, such as encouraging alternative modes by offering assistance to employers in setting up worksite programs, maintaining ridematching databases, offering transit incentives, and providing a Guaranteed Ride Home (GRH) program. An example of this type of involvement is the Virginia DOT's efforts to support teleworking by providing funds to the Telework!VA program, a public/

[199] National Highway Cooperative Research Program, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," Project 20-65 Task 24, July 2010.

private partnership founded by the DRPT to reduce traffic congestion, improve air quality, and facilitate better transportation through technology.[200] With help from Virginia DOT's funds, Telework!VA provides telework training and financial incentives for Virginia businesses to establish or expand telework programs for their employees.

- Conducting Marketing – This role focuses on providing a statewide level of support for changing travel behaviors through informed decision-making and public education on TDM. The most effective TDM marketing programs involve a variety of partners within a community, including public officials, community organizations, and individuals who support alternative modes. Utah DOT (UDOT) launched a $1.5 million program known as TravelWise – a set of strategies that encourage Utahns to use alternatives to driving alone, thereby reducing energy consumption, reducing traffic congestion, and improving air quality. Several of these strategies include alternative work schedules, active transportation, ridesharing, and teleworking. Through a cooperative relationship with eight TMAs, New Jersey DOT (NJDOT) manages a TDM program focused on strategies, incentives, and pilot programs developed to reduce VMT and improve air quality.[201] NJDOT TDM strategies include rideshare marketing, rideshare incentives and support services, transit incentives and support services, transit service improvements, and park and ride lot expansion.[202]

- Funding Investments in Travel Options – State DOTs also focus on the provision and direct support for alternative mode infrastructure, including carsharing, park-and-ride facilities, bicycle/pedestrian improvements, and HOV lanes.[203] These types of TDM program activities identify investment needs and define the most effective infrastructure improvements. For example, Massachusetts DOT's (MassDOT) travel options program, MassRides, partners with 300 elementary and middle schools to deliver the Safe Routes to School program to educate the community on the transportation, safety, and health benefits of walking/bicycling to school. In addition, MassRides is specifically working with 40 schools to identify infrastructure improvements such as crosswalks, pedestrian traffic signals, school speed zones, and sidewalk connections. Many of these identified infrastructure improvements will be funded through the federal Safe Routes to School program.[204]

Telework!VA Tax Legislation

In 2011, the Virginia General Assembly approved new tax credit legislation aimed at encouraging private sector telework. Defined as "a work arrangement where an employee is allowed to perform normal work duties at a location other than their central work location" teleworking is considered, by the General Assembly, to be an effective congestion management strategy to reduce highway traffic. It's also been shown to improve employee productivity, retention, and satisfaction.

The purpose of the Telework Tax Credit is to remove auto trips by eliminating commute trips to and from work. Only employees who travel to an office in Virginia qualify. The legislation provides for a tax credit (for new teleworkers) of up to $1,200 per employee and up to $50,000 per organization for eligible telework expenses incurred during taxable years 2012 and 2013. Additional legislation is required to continue this tax credit after 2013. Any business subject to Virginia income tax is eligible to apply for the tax credit. This is done through approval by the Virginia Department of Taxation. Employees must telework at least once a week in order for expenses incurred under the telework agreement to be eligible.

(Source: Virginia's Telework!VA webpage (http://www.teleworkva.org/go/for-managers/telework-tax-credit/))

[200] Virginia DOT – Telework!VA, http://www.teleworkva.org/, accessed 01/13/2012

[201] Utah DOT – TravelWise, http://www.travelwise.utah.gov/index.php, accessed 01/14/2012

[202] New Jersey DOT Traffic Mitigation Guidelines - http://www.state.nj.us/transportation/eng/documents/TMG/TMG.shtm#s36, accessed 01/14/2012

[203] National Highway Cooperative Research Program, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," Project 20-65 Task 24, July 2010

[204] Massachusetts DOT Remarks to the Association for Commuter Transportation – http://www.massdot.state.ma.us/Portals/0/Downloads/infoCenter/remarks/ACT_061010.pdf, accessed 01/13/2012

- Integrating TDM into Internal Business Practices – Another way for state DOTs to be promoters of TDM is to provide commuter options programs for their employees. Arizona DOT (ADOT) participates in a Trip Reduction Program by offering incentives and programs, through Capitol Rideshare, to encourage state employees to reduce travel.[205] Capitol Rideshare incentives include commuter club discounts, preferential rideshare parking permits, emergency ride home benefits, transit subsidy program, and a vanpool education program.[206]
- Establishing Cooperative Relationships – State DOTs may establish cooperative relationships to ensure coordination toward common goals. Through its new TravelWise program, UDOT is identifying strategies to optimize the existing statewide transportation system.[207] As the state does not have TMAs, it is instead focusing on partnerships with community organizations, private businesses, and government offices, to build its network and expand its TDM services, along with the Utah Transit Authority (UTA).[208] In 2010 the TravelWise Program, in coordination with CommuterLink and Express Lanes, reached out to Utah companies to encourage more efficient commuting and work-related travel. This coordinated effort allows UDOT's programs to work together to maximize the transportation system.[209]

11.2 Metropolitan Level

Metropolitan transportation planning provides the information, tools, and public input needed for improving transportation system performance. TDM strategies are part of a toolbox of actions available to those involved in MPOs for solving transportation problems. Currently, most MPOs provide an overall coordination role in planning and programming funds for projects and operations. However, MPOs can play many different roles in implementing TDM services. Some potential roles are listed below:

- Developing/Promoting Alternative Transportation Programs – MPOs and TMAs may develop/promote alternative transportation programs that support their members' and communities' concerns regarding access and congestion, environmental/sustainability goals, economic development, and land use planning. *Commuter Connections* – a program of the National Capital Region (NCR) Transportation Planning Board, the region's designated MPO at the MWCOG – provides commuter services and information to area residents and employers in order to reduce traffic congestion and emissions caused by SOVs.[210] Core value-added services provided by Commuter Connections for NCR residents include the GRH program, Rideshare Tuesday, Telework Week, and Employer Services.[211]
- Providing Technical Assistance – MPOs may provide technical assistance/feedback in reviewing TMA work plans. TMAs are public/private partnerships, focused on an employment center or other geographic area, formed to provide collaborative TDM services to member employers and others. MPOs may also provide input on TDM activities they would like the TMA to pursue. For example, the New Jersey Transportation Planning Authority (NJTPA) is encouraging the TMAs in its service area to undertake anti-idling activities in their work plan.[212]
- Leveraging Public and Private Funds – TMAs also work together to gain funding from public and private entities to increase the use of various TDM activities, thereby reducing traffic congestion and improving air quality. MassCommute – a group of 11 private, non-profit business associations in Massachu-

[205] Arizona DOT Multimodal Planning Air Quality Planning – http://mpd.azdot.gov/mpd/air_quality/hpa.asp, accessed 01/14/2012

[206] Arizona DOT Capitol Rideshare – http://capitolrideshare.com/files/services.htm, accessed 01/12/2012

[207] Utah DOT – TravelWise, http://www.udot.utah.gov/main/f?p=100:pg:0::::T,V:2375,50746, accessed 01/14/2012

[208] National Highway Cooperative Research Program, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," Project 20-65 Task 24, July 2010

[209] Utah DOT – TravelWise, http://www.udot.utah.gov/main/f?p=100:pg:0::::T,V:2375,50746, accessed 01/14/2012

[210] Commuter Connections: Washington Metropolitan Region Transportation Demand Management Resource Guide and Strategic Marketing Plan – http://www.mwcog.org/commuter2/pdf/publication/SMP-FY12-Final-Report-December20,%202011.pdf, accessed 01/16/2012

[211] Commuter Connections - http://www.mwcog.org/commuter2/commuter/index.html, accessed 01/16/2012

[212] National Highway Cooperative Research Program, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," Project 20-65 Task 24, July 2010

setts – works together to leverage public and private funds to increase the use of ridesharing and other commuting alternatives.[213] In addition, NJTPA provided funding to the TMAs, through its local CMAQ Mobility Initiative, to conduct an online survey for a bus study.[214]

- Integrating TDM into Operations – Similar to State DOTs, MPOs may consider integrating demand management into operations. The San Francisco Bay Area Metropolitan Transportation Commission (MTC) created the Regional ITS Plan as a roadmap for transportation systems integration in the Bay Area over the next 10 years.[215] One ITS project initiated by the MTC involves a comprehensive phone and web source for up-to-the-minute Bay Area traffic, transit, rideshare, and bicycling information, known as the Bay Area 511 Program (511). 511 unites several traveler information programs into a one-stop resource on traffic conditions, incidents and driving times.[216]

11.3 Corridor Level

Effective corridor improvement projects seek to maximize the efficient use and capacity of a roadway and/or transit corridor. As such, transportation management strategies have been integrated as effective components to promote alternative modes, increase vehicle occupancy, reduce travel distances, and ease peak hour congestion.[217] TDM elements have played a key role in corridor projects.

- Construction Mitigation – Major corridor infrastructure projects often take many years to complete and affect transportation capacity and access to adjacent businesses. TDM programs applied at this level provide critical mitigation strategies to reduce the negative impacts of construction. The Houston-Galveston Area Council seeks to integrate transportation management programs by providing traveler information regarding construction activities, working with corridor employees and other businesses to develop access alternatives, and coordinating with transit agencies to adjust existing transportation facilities and services.
- Employer-Based Programs – Extensive employer-based TDM efforts may be conducted for an entire corridor, in order to reduce SOV commuting and VMT to worksites. WSDOT initiated an extensive employer-based program on the I-405 Corridor in the Seattle area. Efforts included telework, alternative work arrangements, tax credits, parking cash-out incentives, and an expansion of the CTR program.[218]

11.4 Local Level

A quantifiable and results-driven local TDM program can achieve greater transparency to its stakeholders, provide a clearer linkage to related strategies and initiatives, strengthen its role as a significant player within an integrated approach between land use and transportation, and offer a better return on investment to funding partners.[219] Implementing TDM at the local level involves TDM programming initiatives, strategies, and policies in short-, mid-, and long-term time frames.

- Administering full-service TDM Programs – Local TDM programs have broadened their scope of activities from a narrow focus on marketing a single mode into full-service programs that promote all non-drive modes of transportation. The City of Alexandria (VA) TDM program, LocalMotion, promotes

[213] MassCommute – http://www.masscommute.com/masscommute_mission.htm, accessed 01/13/2012

[214] National Highway Cooperative Research Program, "State Department of Transportation Role in the Implementation of Transportation Demand Management Programs," Project 20-65 Task 24, July 2010

[215] San Francisco Bay Area Metropolitan Transportation Commission: Planning: Intelligent Transportation Systems: Bay Area ITS Architecture – http://www.mtc.ca.gov/planning/ITS/, accessed 01/16/2012

[216] California DOT State Route 4 Corridor System Management Plan Appendices – http://www. dot. ca. gov/dist4/systemplanning/docs/csmp/SR4_CSMP_appedices. pdf, accessed 01/16/2012

[217] Transportation Demand Management and Corridor Planning: A Guidebook for Houston Area Planners, Engineers and Policy Makers – http://www.commutesolutionshouston. org/resources/TDM_and_Corridor_Planning. pdf, accessed 01/14/2012

[218] Transportation Demand Management and Corridor Planning: A Guidebook for Houston Area Planners, Engineers and Policy Makers – http://www.commutesolutionshouston. org/resources/TDM_and_Corridor_Planning. pdf, accessed 01/14/2012

[219] LOCAL MOTION: A Long Range TDM Plan for Local Motion – http://alexandriava. gov/localmotion/info/default. aspx?id=45180, accessed 01/15/2012

a range of tools and resources for accessing destinations throughout the city. This expanded range of services affirms the program's commitment to improving mobility.[220]

- Monitoring Developer Programs – Many cities place requirements on new developments to mitigate trip generation through TDM and other trip reduction measures. City staff review site development plans, place TDM conditions, and then work to help implement and monitor the programs' success in meeting its trip reduction targets. In some cases, future phases of development are conditioned on meeting and documenting these reductions.
- Building Strategic Partnerships – Local TDM programs are coordinating with leading local companies to promote their employer-based programs, for those not currently participating, or to support their recruitment and retention efforts, for those participating. The LocalMotion program continually coordinates with the Local Chamber of Commerce, Alexandria Economic Development Partnership (AEDP), Small Business Association, and Society of Human Resource Management (SHRM) to gain feedback and promote their programs.
- Developing Youth Programs – Local programs integrate demand management into youth programs, encouraging children to learn about public transportation. The Potomac and Rappahannock Transportation Commission (PRTC) has implemented two programs, the Preschool and Elementary Student Program and the Teen Summer Pass Program, with a third program currently in development, the Middle School Program. The Preschool and Elementary Student Program involves a Safe Bus Adventure Program where children are taught about bus safety rules and the benefits of using transit.[221] The Teen Summer Pass Program provides those ages 13-19 with unlimited Omnilink rides all summer for a one-time cost of $30.[222]

11.5 Funding of TDM Programs

For states and MPOs that plan, administer, and deliver core TDM services, various federal, state, metropolitan, and private funding programs are available for TDM program implementation.

Federal funds have been a main source for TDM programs. A 2006 study of nine regional TDM programs conducted by the Center for Transportation and the Environment (CTE) found that over two-thirds of TDM funding came from federal sources. The most significant of these federal sources are CMAQ, the STP; and the Transportation, Community and System Preservation Program. All require the participation of DOTs and in many cases, MPOs, with a default funding match requirement of 80%. The 2006 study by CTE also found that state (16 percent) and local (18 percent) funding are also significant alternative sources of TDM funding for states and MPOs.

Another funding source is the STP, which provides flexible funding that may be used by states and localities for projects on any Federal-aid highway, including the National Highway System. Carpool, pedestrian, bicycle, and safety projects may be implemented with STP funding on roads of any functional classification, under the provisions of 23 U.S.C. 133(c). Similar to the CMAQ program, STP is considered a "flexible fund" where a state DOT can direct dollars to non-highway modes and the associated non-DOT agency, typically a public transit agency. As an example, the Oregon Department of Transportation operates its "Flexible Funding Program" through STP funds. Through the Flexible Fund program, MPOs and other agencies submit applications for projects that improve modal connectivity, mobility, the environment, and access.

[220] LOCAL MOTION: A Long Range TDM Plan for Local Motion – http://alexandriava.gov/localmotion/info/default.aspx?id=45180, accessed 01/15/2012

[221] Potomac and Rappahannock Transportation Commission Preschool and Elementary Student Program – http://www.prtctransit.org/special-programs/youth-programs/kids-programs.php, accessed 01/16/2012

[222] Potomac and Rappahannock Commission Teen Summer Pass Program – http://www.prtctransit.org/special-programs/youth-programs/teen-programs.php, accessed 01/16/2012

As it relates to TDM, Federal/State Planning Research (SPR) funds may be used to plan for TDM; monitor and analyze the effectiveness of TDM; and integrate/mainstream TDM and related activities into general transportation plans and programs. For example, SPR funds may be utilized for a "before and after" study of a new TDM program, known as a "state of the commute" report, which tallies regional TDM usage and effectiveness, and/or SPR funds may be used for a commuter survey to assess potential future TDM strategies.

However, non-federal funding sources are playing an increasingly significant funding role in providing leverage for matching federal funds, especially in areas currently ineligible for federal funds or where federal funds are unavailable. Such non-federal funds might include:

- State transportation funds and grants.
- Local sales tax funds (dedicated to transportation).
- Local general fund sources.
- Developer impact fees.
- Special grants (e.g., smart growth, livability).
- Parking revenue sources.

For example, at a state level, the Virginia DRPT Transportation Efficiency Improvement Fund (TEIF) Program supports new and/or expanded transportation services and facilities that reduce demand for SOVs and initiatives at the state, regional, and community level.[223] Eligible grant recipients include the following public transportation agencies: local and state government, transportation district commissions, public service corporations, planning district commissions, private corporations, and TMAs. The TEIF Program includes projects in all categories of public transportation and TDM are eligible, including: parking management, employee benefits, improved public transportation facility access, flexible work hours, and telecommuting. Program emphasis areas include services that reduce VMT by SOV; involve the public sector and enhance economic development; support modal connectivity; increase AVR; and utilize advanced technology to improve productivity and quality of public transportation and TDM services.[224]

At a city level, the establishment and funding of Transit Management Organizations and Transportation Management Districts is one way to incorporate TDM programs. For example, The Warner Center Transit Management Organization (TMO) was established in the late 1980s between the City of Los Angeles and the Warner Center developer, as it is the third largest urban center in the city, housing millions of square feet of commercial office space, apartments, and condominiums.[225] Through the purchase of the land, the primary developer agreed to include an additional $5 million contribution to a trust fund for the creation and support of a TMO. Subsequently, for every commuter that a new developer's office space will attract, the developer must pay $3,500 into the trust fund. As such, the TMO receives $85,000 from the trust fund to spend on transportation improvements, such as widened roads, additional traffic lights, additional freeway lanes, and improved public transit.

Similarly, The North Bethesda TMD was established in 1994 to address traffic and air quality issues in Montgomery County, Maryland.[226] In proposing the TMD's creation, the county identified public parking

[223] Virginia Department of Rail and Public Transportation (DRPT), "Public Transportation and Commuter Assistance Grant Program Application Guidance," November 2008, pg. 34

[224] Virginia Department of Rail and Public Transportation (DRPT), "Public Transportation and Commuter Assistance Grant Program Application Guidance," November 2008, pg. 34

[225] Network Tele-Seminar, "Innovative Funding Sources for Transportation Demand Management and Best Workplaces for Commuters," http://www.bestworkplaces. org/pdf/networkts_6-8-04. pdf, pg. 4

[226] Network Tele-Seminar, "Innovative Funding Sources for Transportation Demand Management and Best Workplaces for Commuters," http://www.bestworkplaces. org/pdf/networkts_6-8-04. pdf, pg. 1

charges—parking meter payments, parking violation fines, and monthly permits for public parking lots – as the best sources of revenue to support the program. As such, the county installed more than 800 new parking meters in areas identified by a number of factors, including the area's composition of business (retail vs. office space) and the prevailing parking rates in nearby private garages. The county's goal was to determine an effective placement strategy and rate schedule. Since 1996, the county's parking meters have generated gross revenues of over $240,000 per year, parking fines have generated $123,000 per year, and monthly parking permit sales have earned the county $230,000 per year.[227]

[227] Network Tele-Seminar, "Innovative Funding Sources for Transportation Demand Management and Best Workplaces for Commuters," http://www.bestworkplaces.org/pdf/networkts_6-8-04.pdf, pg. 2

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