

Travel Demand Management and Land Use Effectiveness Review for the Puget Sound Region

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To support a major corridor study in the Puget Sound (Seattle) region of Washington, the Washington State Department of Transportation (WSDOT) has sponsored an extensive project to review the effectiveness of travel demand management (TDM) and land use strategies in reducing the long-term demand for vehicle trips in congested corridors. The Trans-Lake Washington Study is identifying a set of reasonable and feasible solutions to improve mobility across and/or around Lake Washington. The Travel Demand Management and Land Use Effectiveness Review is using a series of case studies to provide information needed to evaluate a set of potentially applicable strategies.

The data generated by the case studies are being used to refine analytical tools developed by DKS Associates staff for the evaluation of TDM and land use strategies. The tools will be used to evaluate the TDM and land use strategies being considered for the Trans-Lake corridor. From the analysis, a recommended set of strategies will be developed and the potential trip reduction effect will be assessed for the corridor. This paper provides a description of this innovative method for assessing TDM and land use potential for trip reduction in major corridor studies and the tool that is resulting from it.

1. Project Need and Approach

1.1. Trans Lake Washington Corridor Study Needs

SR 520 is one of the main roadways connecting the City of Seattle, Washington with other Puget Sound cities such as Bellevue, Redmond and Kirkland on the east side of Lake Washington. The roadway is already heavily congested during commute hours, and the congestion is expected to worsen significantly over the next twenty years. To address this issue, the Washington State Department of Transportation (WSDOT) has undertaken the Trans-Lake Washington (SR-520) Study and EIS to identify and evaluate alternative investment options, and develop a plan for addressing the existing and future congestion. A key element of the Trans-Lake Washington (SR 520) Study and EIS is a Transportation Demand Management (TDM) and Land Use Corridor Agreement. The agreement is expected to set TDM and land use goals for key activity areas along the SR 520 corridor, and provide a framework for which TDM, land use and transportation actions best support the goals. The TDM and Land Use Effectiveness Review Project has been initiated by WSDOT to provide technical support for the development of the TDM and Land Use Corridor Agreement.

The TDM and Land Use Effectiveness Review Project has two primary elements: the development of a TDM effectiveness estimation methodology and development of case studies. The trip reduction estimation methodology will be developed from existing information and tools available to WSDOT and the DKS Associates consulting team, supplemented with new information about strategy effectiveness received from the case study jurisdictions. In order to develop the methodology, the team drew heavily from the State's Commute Trip Reduction (CTR) database, which contains information on which companies with more than 100 employees have tried trip reduction strategies in the past ten years, and how the actions have affected choice of mode for commute trips.

The purpose of the case studies is to provide information that the signatory parties of a TDM and Land Use Corridor Agreement can use to help determine TDM and land use goals for key activity areas within the corridor, appropriate transportation performance measures for those goals (peak and daily VMT, mode split, etc.), and which TDM, land use and transportation actions are needed to support the goals. The case studies can also be used to illustrate the use of the TDM effectiveness estimation methodology for future users by providing examples of input requirements and outputs.

The objectives of the TDM and Land Use Effectiveness Review Project are:

- To develop a methodology that can be used to estimate existing and potential effectiveness of TDM and land use actions in key activity areas along the SR 520 corridor;
- To identify existing TDM programs, land use actions, travel behavior and existing land use patterns in case study areas;

- To estimate existing effectiveness of TDM and land use actions in case study areas;
- To estimate potential effectiveness of TDM and land use actions in case study areas and in other key activity areas in the SR 520 corridor;
- To identify which TDM and land use actions will best support TDM and land use goals; for the case study areas and other key activity areas along the SR 520 corridor;
- To identify TDM and land use goals for the case study areas and other key activity areas along the SR 520 corridor.

The work in the project is being supported by other related work currently being conducted by the WSDOT, King County and the Puget Sound Regional Council (PSRC). It is also being combined with related WSDOT work into a three-volume guidebook that can be used by the signatory parties of the SR 520 agreement for deciding TDM and land use goals and actions, or for use in the future for other corridor agreements. The three volumes of the guidebook, *Identifying TDM and Land Use Goals and Actions for Corridor Management*, will consist of:

1. *TDM-Supportive Land Use Actions for Corridor Management* - This volume will provide an overview of how selected land use actions can support transportation efficiency and TDM and land use goals. Guidance on which of those actions (or combination of actions) would best support transportation efficiency, and where those actions can be applied, will also be provided.
2. *TDM Actions for Corridor Management* - This volume will provide an overview of how selected traditional (non-land use) TDM actions can support transportation efficiency and TDM and land use goals, and which of those actions (or combination of actions) would best support those goals.
3. *Estimating Existing and Potential Effectiveness of Land Use and TDM Actions, and Identifying TDM and Land Use Goals for Key Activity Areas* - This volume will provide documentation of the methodology developed in the TDM and Land Use Effectiveness Review. Information is also provided on how that methodology was applied in the case study areas (and could be applied in other areas).

1.2. Assessing the Potential from TDM and Land Use Strategies

The work in this task of the project began with a review of the set of strategies that could be included in the Trip Reduction Estimation Methodology. The DKS Team worked with WSDOT and the project's Advisory Committee to identify fifteen strategies for inclusion.

1. **Vanpool Programs** – This strategy includes organized promotion and subsidy of vanpools offered to a portion of employees within a company, based on trip length and zone of residence.
2. **Alternative Mode Subsidy** – A direct subsidy paid by the employer to the employee for commute modes other than “Drive Alone”. This may include, but is not limited to, transit, carpooling, bicycling or walking.

3. **CTR-Type Programs for Non-CTR Affected Employers** – Provides non-CTR affected employers with planning, reporting and monitoring assistance to support meeting the goals of Washington’s Commute Trip Reduction law.
4. **Telecommuting** –Assumes employers allow employees to work at home for one or more days a week.
5. **Compressed Work Week** – Assumes employers allow employees to complete a full work period in less than the number of regular workdays during that period. Two types of compressed work weeks are being analyzed: 4/40, in which a full work week is completed in four work days and 9/80, in which two full work weeks are completed in nine work days.
6. **Transportation Management Association (TMA) Ridesharing Program** – Includes an employee transportation coordinator working with the companies in the TMA, ridesharing promotional materials, and coordination of ride-matching services with Metro and other regional agencies that provide ride matching.
7. **Increased Density Near Transit** – Increases the previously assumed densities along bus routes, near regional transit centers or near future high capacity transit stations.
8. **Encourage Mixed-Use Development** – Alters existing land use forecasts to reflect a greater mix of complementary land uses within the case-study areas. Complementary land uses are considered to be those that together reduce vehicle trip demand while not reducing person trip demand. This includes mixing of residential land use with commercial land use, to provide residents with employment and shopping within a short distance.
9. **Encourage Infill Development and Densification** –Assumes an increase in the previously assumed land-use forecasts to concentrate more employment and higher density housing in the existing activity or urban centers.
10. **Bicycle Lanes or Paths** –Assumes an increase in the network of bicycle routes (a combination of bicycle lanes in the street right of way and separate off-road paths).
11. **Provide Pedestrian Facilities** –Increases the network of sidewalks, trails, and other pedestrian facilities.
12. **Develop Interconnected Street Network** – Assumes modification of existing or planned street networks within activity centers or residential developments to provide more direct vehicular and non-vehicular access at a local level.
13. **Restricted Parking Supply** – Includes the imposition of maximum parking ratios for future development.
14. **Parking Pricing at Employment Sites** – Assumes parking charges at employment sites. This may take the form of an elimination of free parking, with the employer requiring some payment for reserved, on-site parking; or may include the offering of all parking to the public at the market rate with few or no spaces reserved specifically for employees of the building or site.
15. **Flexpass/Residential Pass** – This strategy includes offering transit passes to all members of a group at a reduced rate. The group may be an employer, all of the employers within a TMA, or a residential neighborhood.

WSDOT and the DKS Team worked with the Advisory Committee to identify case study locations that are representative of the various types of activity areas in the SR 520 corridor. Ten case study locations were identified in five political jurisdictions:

Seattle

University District – A high-density, mixed-use commercial and residential district adjacent to the University of Washington’s main campus

South Lake Union – An older, primarily warehouse and light industrial urban neighborhood adjacent to downtown that is the focus of multiple public and private redevelopment efforts

Wallingford – An older, small-scale, medium density mixed-use urban neighborhood that is primarily residential, but encompasses a commercial street with a mix of retail and office use

Redmond

Downtown – A suburban downtown adjacent to SR-520 with a retail focus and some developing mixed-use, residential and office areas.

Willows Road Corridor – A developing commercial, low-density, linear office center located next to (but disconnected from) a low density residential neighborhood

Kirkland

Downtown – An older, medium-density suburban downtown near the eastern base of the SR-520 bridge

Totem Lake – A suburban activity center containing a hospital, medical offices, low-density commercial and a mix of multi-family and single-family residential developments at key interchanges on the I-405 circumferential freeway on the east side of the lake

Bellevue

Downtown – The largest and most rapidly growing downtown on the east side of Lake Washington, located near the east end of the SR 520 bridge

Crossroads – An older, suburban neighborhood surrounding a shopping mall, with medium-density residential apartment development and some office commercial

King County (unincorporated areas)

Redmond Ridge – A large, newly developing planned community that will include residential, office and retail development on the fringe of the region’s Urban Growth Boundary

The table below indicates which strategies are being tested in each of the ten case study areas.

Candidate Strategies by Case Study Area															
Case Study Area	Vanpool Programs	Alternative Mode Subsidy	CTR-type programs for Smaller Employers	Telecommuting	Compressed Work Week	Multi-Employer Rideshare Program	Increased Density near Transit Corridors	Encourage Mixed-Use Development	Encourage Infill & Densification	Bicycle Lanes, Paths	Provide Pedestrian Facilities	Develop Interconnected Street Network	Restricted Parking Supply	Parking Pricing at Employment Sites	Flexpass/Residential Pass
Seattle															
1 University District	.	●	●	.	.	.	●	.	.	●	.	.	.	●	.
2 South Lake Union	.	●	.	.	.	●	.	●	●	.	.	.	.	.	●
3 Wallingford	.	●	●	.	.	●	.	.	.	●	.	.	.	.	●
Redmond															
4 Downtown	●	.	.	.	.	.	.	●	.	.	.	●	●	●	.
5 Willows Road	●	●	.	●	.	.	●	.	.	●	.	.	.	.	.
Kirkland															
6 Downtown	.	.	.	●	.	●	.	.	.	.	.	.	●	●	●
7 Totem Lake	●	.	●	.	.	●	.	.	.	.	.	.	.	●	●
Bellevue															
8 Downtown	.	●	.	.	.	.	●	●	●	.	.	.	.	●	.
9 Crossroads	.	●	.	.	.	.	●	●	●	.	.	.	.	.	●
King County (unincorporated areas)															
10 Redmond Ridge	●	●	.	.	●	.	.	.	.	●	.	.	.	.	●
TOTAL	4	7	3	2	1	4	4	4	3	4	0	1	2	5	6

Once all of the analysis has been completed, each case study will be documented. The documentation will consist of the following four components:

- 1. Travel Behavior and Land Use** – A description of the existing and predicted future land use, transportation infrastructure and travel patterns.
- 2. Existing Effectiveness** – An inventory of the TDM and land use strategies that have been tried, and any evidence of their effectiveness.

3. **Potential Effectiveness and TDM & Land Use Goals** – Application of the TDM Effectiveness Estimation Methodology to the strategies considered most promising to achieve additional trip reduction.

4. **Recommendations** – A specific set of recommendations for the TDM and land use strategies and goals for each of the case study areas.

The recommendations will help the WSDOT and the Trans-Lake Washington Study team estimate how much the TDM and land use strategies will support the efficiency of the transportation system by reducing or changing travel demand within the SR 520 corridor. The recommendations will also be developed in a way that reflects consideration of how the high capacity transit, non-motorized modes and roadway investments recommended by the Trans-Lake Washington Study supports the recommended actions.

2. Analytical Framework

2.1. Predicting Change

The DKS Team has developed and documented a methodology for estimating existing and potential effectiveness of TDM and land use strategies for use in evaluating how those strategies reduce or change travel demand. The methodology also includes procedures for cost estimation, so that the relative cost-effectiveness of strategies can be analyzed. The methodology developed by the DKS Team provides consideration for how transit service or other TDM-supportive infrastructure (such as HOV lanes, park-and-ride lots, and well-connected non-motorized facilities) can influence TDM and land use actions' ability to reduce or change travel demand.

The methodology has been designed to allow analysis of strategies in three different TDM and land use conditions:

- Case study areas
- Other key activity areas along the corridor that are similar in market or urban form to the case study areas
- Other key activity areas which are not similar to the case study areas.

The TDM Effectiveness Estimation Methodology has been developed by the DKS Team by building on analytical tools previously developed by the team members. Local data collected from the regional agencies and the case study jurisdictions is being incorporated into the following tools:

TCM Tools – a methodology designed to test 30 demand management measures when applied on an area-wide basis.

CM/AQ Analysis Tool – a methodology designed to test 59 potential congestion mitigation or air quality improvement project types, when applied in a specific project setting.

Transportation/Land Use Analysis Tool – a methodology design to test 9 potential transportation/land use strategies designed to reduce trips, VMT and pollutant emissions.

ECO Checklist – A methodology designed to test 15 employer-based trip reduction strategies in a specific employment and land-use setting.

The DKS Team is currently using information from the ten case studies to refine the analytical tools available to the team. The primary refinement is to develop strategy-effectiveness parameters from the SR 520 corridor to replace national defaults or other local-area parameters used in other projects where the tools were developed. The methodologies are being set up for application in the SR 520 corridor by specifying the baseline data on transportation services, land use and the travel behavior necessary to run the methodologies.

2.2. Performance Measures

The DKS team has worked with WSDOT and the Advisory Committee to identify transportation performance measures to use for keeping track of reductions or changes in travel demand due to TDM and land use actions.

- AM Peak and Daily VMT
- Total Daily Vehicle Trips
- AM Peak Commute Mode Split
- Person Throughput on SR 520 (at midpoint on bridge)

Each of the first three performance measures would be evaluated for the SR 520 corridor and within the boundaries of each case study.

2.3. Evaluating Impact of Strategies

The TDM Effectiveness Estimation Methodology (TEEM) predicts the potential effectiveness of a strategy by applying strategy-effectiveness factors to baseline data for a defined area. Whenever possible, the sensitivity factors are estimated from historical data from King County. If there is not sufficient evidence of effectiveness from King County, national research on the strategy effectiveness is used. Sensitivity factors are used to estimate the change in mode of travel or frequency of travel that will result from implementation of a TDM or land use strategy.

Many of the strategies in TEEM are employer-based programs and affect only work trips. The calculations for these strategies affect either the mode shares or frequency of work trips. They are:

- **Vanpool Programs**

- **Alternative Mode Subsidy**
- **CTR-Type Programs for Small Employers**
- **Multi-Employer Ridesharing Program**
- **Telecommuting**
- **Compressed Work Week**
- **Parking Pricing at Employment Sites**

Three other strategies related to facilitating non-motorized travel might affect both work and non-work trips if implemented, but only the effect on work trips is included in TEEM because of the limitation of data on effectiveness for non-work trips. These strategies are as follows:

- **Bicycle Lanes or Paths**
- **Provide Pedestrian**
- **Develop Interconnected Street Network**

The remaining five strategies can affect the frequency or mode shares for both work and non-work trips. These strategies are as follows:

- **Flexpass Pass**
- **Restricted Parking Supply**
- **Increased Density Near Transit**
- **Encourage Mixed-Use Development**
- **Encourage Infill Development and Densification**

The main source of strategy effectiveness in King County is the State of Washington's Commute Trip Reduction database. Beginning in 1993, employers with 100 or more employees have had to satisfy the requirements of the Commute Trip Reduction Law, which established procedures for reporting and implementing trip reduction programs. Every two years, CTR employers were required to describe the work site, the work force employed at the site, the trip reduction programs in place at the work site and the cost of providing the trip reduction programs in place. They were also required to conduct a survey of the employees to determine what the commute patterns were and what modes of travel were used. The reports and survey results are available for the years 1993, 1995, 1997, 1999 and 2001. DKS has identified which CTR employers made changes in their programs during those years and estimated what the effect of program changes were on employee commute patterns.

The main source of land use strategy effectiveness in King County is zonal land use and travel data for the case-study areas. Statistical analysis was conducted on the relationship between vehicle trips per person and three land use/transportation factors: total density, density near transit services and the mix of land uses.

2.4. Strategy Effectiveness Calculation

TEEM uses reported experience of effectiveness with each of the strategies to predict the response to a change. The follow concepts define the calculations for each of the individual strategies:

Vanpool Programs

- Use average participation rate among employees offered vanpooling promotion and subsidy by size of employer and trip-length characteristic to calculate shift in vanpooling.
- Draw new vanpoolers proportionally from other motorized modes

Alternative Mode Subsidy

- Use elasticities of mode use with respect to cost for each mode for work trips to calculate change in work mode shares
- Draw new trips to a mode proportionally from other modes

CTR-Type Programs for Non-CTR Affected Employers

- Calculate change in work mode shares for the number of employees added to the CTR program based on the observed effects of the past CTR program.
- Apply a factor to discount the magnitude of the mode shift to reflect smaller employers being added to the CTR program.

Telecommuting

- Use the reported participation rates among employees offered telecommuting to calculate participation among new employees offered telecommuting.
- Apply the same patterns among the new participants as observed for the telecommuters in the CTR database: days per week worked at home, days of week worked at home.

Compressed Work Week

- Use the reported participation rates among employees offered compressed work week to calculate participation among new employees offered compressed work week.
- Apply the same patterns among the new participants as observed for the compressed work week participants in the CTR database: days per week worked, days of week not worked.

Multi-Employer Ridesharing Program

- Apply sensitivity factor to calculate change in drive-alone share.
- Redistribute the reduction in drive-alone share to other modes in proportion to base shares.

- Calculate change in vehicle trips by applying vehicle occupancy factors to the change for each mode.

Increased Density Near Transit

- Calculate revised future year trip ends by purpose for each local traffic analysis zone using the appropriate rates by transit service, density and mix use ratio categories.

Encourage Mixed-Use Development

- Calculate revised future year vehicle trip ends by purpose for each local traffic analysis zone using the appropriate rates by transit service, density and mix use index categories.

Encourage Infill Development and Densification

- Calculate revised future year trip ends by purpose for each local traffic analysis zone, using the appropriate rates by transit service, density and mix use ratio categories.

Bicycle Lanes or Paths

- Calculate change in work mode share by bicycle based on change in percentage cover of work trips less than six miles in length.

Provide Pedestrian Facilities

- Calculate change in work mode share by bicycle based on change in percent coverage of sidewalks for work trips fewer than six miles.
- Draw new walk trips proportionally from other work trip modes.
- Calculate change in vehicle trips produced and attracted using appropriate vehicle occupancies.

Develop Interconnected Street Network

- Calculate change in work mode share by walk and bicycle based on change in percentage coverage of interconnected streets for work trips less than one mile in length.
- Draw new walk and bicycle trips proportionally from other work-trip modes
- Calculate change in vehicle trips produced and attracted using appropriate vehicle occupancies.

Restricted Parking Supply

- Calculate future parking demand assuming a proportional increase based on the baseline growth in vehicle trips to each local traffic analysis zones
- Calculate change in development (floor area) by type, based on the change in predicted employment of each type

- Calculate change in parking supply by applying proposed parking code requirements to forecast growth in development
- Apply vehicle trip reduction (person trip diversion) factors for each local traffic analysis zone based on the expected future year parking V/C ratio for the each local traffic analysis zone.
- Subtract all of the reduction in vehicle trips from drive-alone and reallocate to non-auto modes on a proportional bases.

Parking Pricing at Employment Sites

- Calculate the percentage change in average daily auto operating costs that would result from the parking charge being tested
- Calculate change in work drive-alone share by applying an elasticity of auto use with respect to auto operating cost to the base drive-alone share
- Allocate reduction in drive-alone share to other modes proportionally

Flexpass/Residential Pass

- Estimate the effect of the Flexpass on average transit fare paid per trip for the group offered the pass.
- Calculate the percentage change in average transit fare paid per trip for Flexpass users.
- Calculate the change in transit share for each trip type for each group offered the pass (work trips only for study area employees offered the pass and work and non-work trips for study area residents offered the pass).
- Calculate the change in vehicle trips by trip purpose by drawing the change in transit trips proportionally from all other non-transit modes.

2.5. Reflecting Current and Future Baseline Conditions

TEEM is designed to pivot off of observed or baseline conditions. The model does not predict the travel patterns to from or within a study area, but instead predicts the change in travel patterns that would most likely result from a TDM or land use strategy. To use TEEM to test a strategy requires that data be provided to describe the baseline conditions that currently exist or would exist in the future without the implementation of the strategy. Baseline data are needed to describe the population and employment in the study area, the distribution of employees by employer size, the number of person trips produced and attracted by mode and by purpose for each zone, the quantity of transit service to the area, and the quantity of pedestrian and bicycle facilities in the area.

2.6. Analysis Years

Baseline data are being developed for three years for each of the case study areas: 2000, 2020 and 2030. The year 2000 has been used as the year to represent the conditions that currently exist. This is a date for which there are data as well as data on transit service, transit ridership and vehicle volumes. Two forecast years are being defined to provide flexibility in applying

the methodology for the King County applications. Model data is available from the PSRC model for both years, but the models used by the local jurisdictions only have forecasts for 2020. The relationships between PSRC and local model data for 2000 and 2020 will be used to extrapolate local model data to 2030, which is the forecast year for the Trans-lake Washington Corridor Study.

2.7. Predicting the Impact of Multiple Strategies

The methodologies for all of the fifteen strategies are designed to operate on the same baseline travel patterns. In most cases, the cumulative effect from combining most strategies can be found by sequentially predicting the effect of one, then adjusting the baseline data and applying the next one. Strategies such as these are referred to as multiplicatively additive. Other strategies, when combined, affect different markets and the results can be combined directly. These are referred to as directly additive. This could include a strategy affecting only employee trips being combined with a strategy affecting only residential non-work trips. A third type of combination is one that conflicts in ways that are not accounted for by readjusting the base shares. These are referred to as conflicting strategies and a correction factor must be specified to be able to estimate the combined effect of both. Similarly, the final category of strategy combination is referred to as synergistic. When combined, they produce greater results because of their supportive nature than a direct addition of their impacts would suggest. Again, a correction factor is required.

2.8. Predicting the Impact on SR 520

The effects of strategies will first be calculated for trips to, from or within each study area. After this calculation has been made, the potential impact on SR 520 will be predicted using model information on the percentage of vehicle trips to or from each case study area that cross the mid-point of SR 520 during the A.M. peak hour and on a daily basis.

3. TDM Effectiveness Estimation Methodology

3.1. Software

The TDM Effectiveness Estimation Methodology has been programmed in an Excel spreadsheet workbook. In this format, the methodology will be available to virtually everyone who has a computer. It will also allow maintenance and upkeep (explain more) of the methodology by anyone familiar with Excel.

3.2. User Interface

The TDM Effectiveness Estimation Methodology contains many calculations using a broad range of data sets. In most cases the input needs are quite simple. In testing a strategy scenario for one of the forecast years for which the methodology is calibrated, most of these calculations and data sets are not changed by the user. In cases where inputs are required by the user, a simple user interface has been written to allow the user to enter in a screen template only the information needed to test a strategy. The user interface is written in Visual Basic.

3.3. Output

Output from the model is provided in two forms: a table giving the change in each of the performance measures and a file with adjusted trip ends. The summary table is useful in direct interpretation of the analysis results, but the file of adjusted trip ends can be used to modify a model trip table to reflect the effect of the strategies tested.

4. Research on Strategy Effectiveness

4.1. Commute Trip Reduction Database

The most important dataset for understanding the effectiveness of TDM strategies in the Puget Sound Region is one generated by the Commute Trip Reduction (CTR) law passed by Washington's state legislature in 1991. Three different types of surveys have been conducted with businesses having more than 100 employees: a survey of employees to determine how they travel to and from work, a survey of employers to determine what TDM programs they offer, and another survey of employers to determine the cost of providing TDM programs. Businesses are surveyed periodically to determine how the CTR program is being implemented for that employer and how effective it is. Data are available for 1995, 1997, 1999 and 2001. Because of a number of changes in how the employer surveys were conducted between 1997 and 1999, only two sets of changes can be assessed for employers in the CTR program: 1995 to 1997 and 1999 to 2001. For each employer, the DKS team has determined what the employee commute mode shares were in each reporting year and what programs were in place in each year. The team has also identified which employers made changes in programs between reporting years and how the commute mode shares changed between those years. The table below provide summary statistics for the database as a whole, and for the six program types that are relevant for our project:

- Providing Vanpooling
- Ridematching Services
- Transit Subsidy
- Bicycle Subsidy
- Telecommuting
- Compressed Work Week

Table 2 -- Summary of the CTR Database Characteristics

Years with Employees Commute Travel Characteristics Survey		1993, 1995, 1997, 1999, 2001
Years with Employer Program Description Survey		1995, 1997, 1999, 2001
Years with Employer Program Cost Survey		2001
Employers Reporting		
	1995	380
	1997	430
	1999	512
	2001	528
Employees Reporting		
	1993	78,059
	1995	103,615
	1997	109,448
	1999	117,048
	2001	119,486
Employers Adopting Programs While a CTR Employer		
Vanpooling Program		129
Ridematching Program		183
Transit Subsidy		93
Bicycle Subsidy		56
Telecommuting Program		296
Compressed Work Week Program		97

4.2. National Research

Local data is not available to assess the effectiveness of all of the kinds of strategies included in this project. The DKS team has conducted a thorough search of the national literature on TDM and land use effectiveness to find other evidence of strategy effectiveness. Much of this information was already available to DKS team members because of the prior work done by the team members. The results of the national research will be used to supplement the local data where necessary and to provide a check on the results gained from the local data.

4.3. Application of Research Findings

The results of the local and national research on strategy effectiveness are used in the TDM Effectiveness Estimation Methodology in several ways:

1. To estimate how effective a strategy is in changing mode or time of travel to work;
2. To determine how effectiveness varies by employer characteristic (number of employees, type of employment, etc.);
3. To determine how strategies interact when more than one is implemented
4. To determine the cost of implementing programs;
5. To determine the travel patterns of people participating in various programs (e.g. which days employees on compressed work weeks do not work).

The factors and other travel profile data that are used in the TDM Effectiveness Estimation Methodology are identified in the appendix of the documentation, which contains a full description of the calculations incorporated in the methodology and the sources of the data used.

5. Baseline Data

The TDM Effectiveness Estimation Methodology is designed to pivot off of baseline data for the study area where it is being applied. The baseline data for a study area includes information about existing and forecast year (without new TDM or land use strategies in place) travel patterns and development characteristics. Because the effectiveness of strategies is predicted as percentage changes in various travel characteristics, the baseline data are necessary to know what the expected change would be. The TDM Effectiveness Estimation Methodology is designed to produce output in a summary form for each of the performance measures, but also as revisions of the baseline data. This later form of output allows the analyst to more easily use the results to incorporate the results in sub-area models or to do more detailed assessment of how study area travel patterns would change as a result of the tested strategies. The sections below provide a description of the baseline data used in the TDM Effectiveness Estimation Methodology and the source of the data. Data are provided for 2000, 2020 and 2030. Much of the data come from area travel models. Some are derived from the regional model maintained by PSRC, but most are derived from two local area models used by the jurisdictions with the case studies. These include a model maintained by the City of Seattle and the Bellevue-Kirkland-Redmond (BKR) model used by the three eastside jurisdictions. The BKR model is also used as the source of information for the Redmond Ridge case study.

5.1 Population and Employment of Case Study Area

Population data is provided for each local traffic analysis zone (TAZ) for each of the three analysis years. The population data is based on the PSRC forecast data but are allocated to local TAZs by the number of dwelling units which is available in the local models.

Employment data is also provided at the local TAZ level in two categories: retail employment and all other employment. The data is taken directly from the local models which have been reconciled with the PSRC forecast database.

5.2 Employment by Size and Type of Employer

The employment in each study area is also categorized by size of employer for 2000. This information was provided by PSRC but is derived by data from the Washington Employment Security Department. Four categories of employer size are used:

- 1 to 50
- 51 to 100
- 101 to 500

- over 500

The distribution of employment by size of employer is assumed to remain the same for future years. No forecasts of distribution by size of employer are available.

In many parts of the TDM Effectiveness Estimation Methodology, employment is also characterized as CTR or non-CTR. This is based on the actual number of CTR employers and the people employed as represented by the 2001 CTR database.

The type of employer is differentiated only as retail or non-retail. This information derived from the local models, the ESD data and the CTR database (for CTR employers).

5.3 Transit Services and Ridership

Transit service in and to each case study area was described using information from King County Metro. This information was used to categorize each local TAZ as high, medium or low with respect to the quality of transit service. The definitions of the grades are:

Transit Service	Definition
High 1	At least one (1) rail route or five (5) or more high frequency routes
High 2	Four (4) high frequency routes or at least fifteen (15) total routes
Medium 1	Three (3) high frequency routes or at least ten (10) total routes
Medium 2	Two (2) high frequency routes or at least five (5) total routes
Low 1	At least two (2) total routes
Low 2	Less than two (2) total routes

Transit ridership is used only in the description of mode choice for trips to, from and within the study areas. The data on transit use is derived primarily from the local models (the Seattle model uses the same mode shares as the PSRC model and so there is no variation between TAZs within a PSRC zone). Other sources of data on transit use by employees are the 1990 Census Journey to Work Survey, the 2001 CTR survey, and a commute mode survey conducted by the City of Bellevue for Downtown Bellevue.

5.4 Baseline TDM and Land Use Strategy Applications

The primary source of information on what is already being implemented in each study area is the CTR database. Supplemental information is also available from Traffic Mitigation Program reports (primarily in Redmond) and from King County Metro (Flexpass and Vanpool program participation). Some information on land use strategies is also available from research conducted by Anne Moudon, Larry Franks and Scott Rutherford.

5.5 Work Trips and Mode Shares

Data on work trips and mode shares is provided for each local TAZ and is taken almost directly from the local models. Supplemental data is also available from the 1990 Census

Journey to Work Survey, the CTR Database, and a commute mode survey conducted by the City of Bellevue for Downtown Bellevue.

5.6 Non-Work Trips and Mode Shares

Data on non-work trips and mode shares is also provided for each local TAZ and is taken directly from the local models.

5.7 Time of Travel by Trip Type

A distribution of trip starts and ends by trip purpose is used in the TDM Effectiveness Estimation Methodology to determine when changes in travel affect the A.M. or P.M. peak periods. The distribution used in the methodology is derived from PSRC survey data.

5.8 Trip-Length Distribution

A profile of work trip length distribution is provided for each study area based on data from the local travel model. Work trip length is used in determining the attractiveness of strategies designed to encourage certain modes such as vanpooling, bicycling and walking.

5.9 Origin-Destination Patterns for Auto Trips on SR 520 (on bridge midpoint)

The PSRC model is used to determine the origins and destination of person trips crossing the mid-point of the SR 520 Bridge. This information is used to determine the proportion of trips to and from a study area that use the bridge on a daily basis and in the A.M. and P.M. peak hours. This proportion is used to determine how a reduction in vehicle trips to or from a study area will affect the SR 520 Bridge.

6. Conclusion

The Travel Demand Management and Land Use Effectiveness Review Project represents a unique effort to systematically quantify the role that demand management can play in the long-range maintenance of mobility in a major urban corridor before decisions are made about major new capacity increasing investment. The project is also unique in producing software for demand management analysis that predicts the impact of strategies, not only within the sub-area where the strategies are to be applied, but also within a specific corridor being analyzed. The project is making use of a rich source of information on demand management experience generated by the State's Commute Trip Reduction Law. Ten years of reporting on the strategies implemented, the cost of applying them, and the effects of the strategies on commute mode shares is being evaluated comprehensively and will be used to support forecasting software. WSDOT is testing this approach in the Trans-Lake Washington Study with the expectation that it will be fine-tuned and applied in many other corridor studies in the future.

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