VMT as a Metric of Sustainability:

Why and How to Implement Vehicle Travel Reduction Targets

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Sustainable transportation planning strives to maximize transportation system efficiency. This involves changing from mobility-based to accessibility-based planning, which strives to minimize the amount of travel needed to access services and activities. To help guide this shift, some jurisdictions have established vehicle travel reduction targets and are replacing level-of-service (LOS) with vehicle miles of travel (VMT) performance indicators. This article describes why and how to make this shift. It summarizes the ITE report, *Vehicle-Miles Traveled (VMT) as a Metric for Sustainability.*

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A new paradigm is changing the way we define transportation problems and evaluate potential solutions. The old "mobility-based" paradigm assumed that our goal is to maximize travel speed. The new "accessibility-based" paradigm recognizes that the ultimate goal of most travel activity is access to services and activities such as shopping, education, and work. Table 1 compares these approaches.

This changes how transportation performance is evaluated.[1] Commonly-used indicators such as roadway LOS and hours of congestion delay only reflect vehicle travel conditions. This favors automobile travel to the detriment of slower but more affordable, inclusive, and resource-efficient modes. Accessibility-based planning evaluates performance based on the total time and money required to reach desired services and activities. It recognizes non-auto travel demands and therefore the important roles that walking, bicycling, and public transit play in an efficient and equitable transportation system. It strives to minimize the amount of vehicle travel required to serve travel demands and so supports multimodal planning, compact development, and TDM incentives that encourage travelers to use the most efficient option for each trip.

To support this shift, some jurisdictions have established vehicle travel reduction targets and are evaluating individual planning decisions based on whether they increase or reduce vehicle miles of travel (VMT). This article examines these practices. It examines why and how jurisdictions can apply VMT reduction targets, discusses methods for evaluating these impacts, and describes examples of successful VMT reduction programs. It summarizes key findings from the recent ITE report, *Vehicle-Miles Traveled (VMT) as a Metric for Sustainability*.[2] This should be of interest to practitioners who want to help create more sustainable transportation systems.

Why accessibility-based planning?

Accessibility-based planning recognizes that many factors affect people's ability to access desired services and activities including the speed, quality, and affordability of various modes, plus geographic proximity (the distances between destinations). This expands the range of solutions that can be used to solve transportation problems beyond network modifications and includes changes to land use. For example, mobility-based planning assumes that the preferred solution to traffic congestion is to expand roads to accommodate more vehicle traffic. Accessibility-based planning considers this plus other solutions such as improvements to non-auto modes, Smart Growth policies that create more compact and multimodal communities, and TDM incentives that encourage travellers to choose the most efficient option for each trip.

By improving travel options and reducing vehicle travel, accessibility-based planning can provide large savings and benefits. Residents of compact, multimodal communities own fewer vehicles, drive less, spend less time and money on transportation, and rely more on walking and bicycling, which improves their health. This also reduces roadway and parking infrastructure costs, crash rates, and pollution emissions. Accessibility-based planning is particularly beneficial to people who cannot or should not drive, and so helps achieve social equity goals. Table 2 lists these benefits.

Several current trends support the shift to accessibility-based planning. Per capita vehicle travel peaked in 2006 while demand for non-auto travel grew. New community goals including affordability, social equity, public health, and environmental protection require more multimodal and efficient transportation. Vehicle travel reductions are needed to achieve emission and crash reduction targets.

Table 1. Mobility- and Accessibility-Based Planning Compared.

	Mobility	**Accessibility**
Goal	Maximize travel speed and distance.	Maximize access to services and activities.
Travel Modes	Mainly automobile	Automobile, active transportation, public transport, and telecommunication.
Performance indicators	Vehicle traffic speeds, roadway level-of-service, hours of congestion delay.	Number of services and jobs that can be reached within people's time and money budgets.
Factors considered	Vehicle travel speeds. Vehicle operating costs.	Vehicle travel speeds. Total transportation costs. Non-auto travel speed, convenience and affordability. Geographic proximity (development density and mix).
Favored improvements	Roadway and parking facility expansions.	Road and parking facility expansions. Non-auto mode improvements. More compact, multimodal development. Transportation demand management (TDM) incentives for more efficient travel.

Mobility-based planning evaluates transportation system performance-based vehicle travel conditions, which favors roadway expansions. Accessibility-based planning recognizes other factors that affect accessibility, which supports multimodal planning, compact development, and TDM incentives.

Shifting from LOS to VMT/VkT

To support the shift to accessibility-based planning, some governments establish vehicle travel reduction targets. For example, California has regulatory targets to reduce per capita light-duty VMT 25 percent by 2030 and 30 percent by 2045, and requires government agencies to consider these targets in planning decisions. British Columbia, Canada; Colorado, USA; Minnesota, USA; Oregon, USA; and Washington State, USA have similar targets and policies.[3] Planners are required to evaluate whether individual transportation and land use planning decisions support or contradict those targets; those that reduce vehicle travel are favored and those that increase vehicle travel are rejected or mitigated. In some cases, major highway projects have been rejected because they increase rather than reduce vehicle travel.[4]

Transportation planning often involves trade-offs between options that increase or reduce vehicle travel. For example, money

Table 2. Multimodal Transportation Benefits.

Improve Non-Auto Travel	Increase Non-Auto Travel	Reduce Automobile Travel	More Compact Communities
• Improved user convenience, comfort, and safety. • Improved accessibility for non-drivers, which supports equity objectives. • Reduced chauffeuring burdens. • Improved public realm (more attractive streets).	• Improved public fitness and health. • Increased community cohesion (positive interactions among neighbors). • More neighborhood security ("eyes on the street").	• Less traffic congestion. • Road and parking facility cost savings. • Consumer savings. • Increased traffic safety. • Energy conservation. • Pollution reductions. • Economic development.	• Improved accessibility, particularly for non-drivers. • Reduced sprawl costs. • Openspace preservation. • More livable communities. • Higher property values and tax revenues.

Improving and increasing non-auto travel, reducing automobile travel, and creating more compact communities can provide many types of benefits.

and road space can either be dedicated to automobile traffic and parking, or to non-auto modes. Similarly, higher traffic speeds increase vehicle travel but create barriers to active travel. To guide decisions to support vehicle travel reduction targets, practitioners can change transportation performance indicators from LOS, which assumes that the goal is to maximize vehicle travel speeds, to VMT (or its metric equivalent, vehicle-kilometers traveled or VkT) which assumes that the goal is to reduce the amount of travel required to satisfy accessibility demands.[5]

A similar approach is to apply a sustainable transportation hierarchy, which means that when resources are limited, planning decisions favor more affordable and efficient modes, such as walking, bicycling, public transit, and telework, over more expensive and resource-intensive modes such as automobile and air travel. It also applies TDM solutions before expanding infrastructure.[6]

Measuring and Modeling Vehicle Travel

Vehicle travel reduction planning requires accurate predictions of how specific policies and planning decisions will affect future travel activity. Most current transportation models and data sets are inadequate for this task and require upgrading.

Commonly-used travel data tend to undercount active travel demand because they overlook non-commute travel, children's travel, recreational travel, and shorter trips (within a traffic analysis zone). These generally ignore the active links of motorized trips, so a bike-transit-walk trip is generally coded as simply a transit trip, and an auto-walk trip is simply coded as an auto trip even if it involves walking several blocks on public sidewalks. For example, the U.S. Census indicates that active modes serve less than 4 percent of commute trips, which implies that they are unimportant so improving walking and bicycling conditions can do little to solve transportation problems. However, the National Household Travel Survey indicates that active modes serve more than 12 percent of total trips, with higher rates in denser areas where congestion, crash and pollution problems are severe, indicating that active mode improvement programs can provide large savings and benefits. Planners also lack data on the travel demands of newer modes such as ridehailing, micromodes (e-bikes and e-scooters), telework (telecommuting, e-commerce, online schooling, etc.), and delivery services.

Multimodal planning also requires detailed information on active travel conditions. Most transportation agencies have detailed data on roadway LOS but little information on non-auto travel conditions. The current *Highway Capacity Manual* has guidance for multimodal LOS, but few jurisdictions collect the data necessary, making it difficult to identify obstacles to walking, bicycling and public transit, and evaluate potential improvements.

Most current models significantly underestimate Smart Growth travel impacts. Field studies find that households in compact, multimodal neighborhoods typically generate about half as many trips per capita as standard models predict.[7]

Most models use relatively low coefficients for evaluating the effects of changes in vehicle operating costs, such as fuel prices, road tolls, and parking fees, often based on older data on fuel price fluctuations rather than long-term effects.[8] This underestimates the impacts and benefits of pricing reforms such as road tolls, parking fees, and distance-based vehicle insurance premiums.

Most current models lack complete congestion feedback—the tendency of congestion to reduce peak-period vehicle trips—which tends to exaggerate congestion problems and underestimate the amount of additional vehicle travel induced by roadway expansions.

As a result of these omissions and biases, most current transportation models underestimate the impacts and benefits of improvements to non-auto modes, Smart Growth development policies, efficient transportation pricing, and TDM incentives.[9]

Basic four-step travel demand models can be improved with better data and better integration with land use models. Newer models, such as activity-based models (ABMs) that apply behavioral decision-making theory can incorporate more feedback, but are complex and have limitations in capturing long-term effects.[10] All models must be calibrated and validated, including dynamic testing that simulates real-world scenarios to verify the model's sensitivity to VMT effects.

Some new specialized models are designed to predict and evaluate long-term travel and emission impacts and help design vehicle travel reduction programs.[11] These include the California Department of Transportation's *Vehicle Miles Traveled-Focused Transportation Impact Study Guide* and the *Emission Estimator Model*.[12, 13]

Other specialized models are designed to predict the impacts and benefits of TDM programs. For example, North Carolina Department of Transportation's *Vehicle Miles Traveled (VMT) Reduction Toolkit* and the California *Mitigation Playbook* identify various ways to reduce vehicle travel.[14, 15] The *San Francisco TDM Tool* and the Fehr & Peers *TDM+ Tool* estimate the effectiveness of various TDM strategies.[16]

Table 3 summarizes common problems with current transportation model and potential corrections. The Federal Highway Administration's Transportation Model Improvement Program website provides useful resources for applying these changes.[17]

Vehicle Travel Reduction Strategies

Recent case studies demonstrate that jurisdictions can significantly reduce vehicle travel in ways that are overall cost effective, beneficial, and politically popular.[18] The most successful include an integrated package of multimodal planning, TDM incentives, Smart Growth development policies, and parking policy reforms.

For example, Washington State requires large urban employers to develop commute trip reduction plans, and the state supports

Table 3. Transportation Model Improvements.

Problems	Corrections
Inadequate non-auto travel data.	Utilize emerging technology to improve surveys and data sets to provide more information on non-auto travel demands.
Inadequate data on new modes such as ridehailing, micromodes, telework, and delivery services.	Collect more information on new mode demands and benefits.
Evaluates auto travel conditions but not other modes.	Collect data on non-auto travel conditions. Apply multimodal LOS.
Inadequate feedback which exaggerates roadway expansion benefits.	Incorporate feedback that accurately predicts induced vehicle travel and the costs it imposes.
Use unrealistically low price elasticity coefficients that reflect short-term price effects.	Use price elasticity values that reflect long-term effects.
Measure a few impacts (travel time and vehicle operating costs).	Analyze more impacts including user costs, affordability, crashes, emissions, pedestrian delays, and health impacts.
Fail to analyze the distribution of impacts and therefore social equity effects.	Analyze equity impacts including costs and benefits to disadvantaged groups.
Underestimate land use impacts.	Develop more integrated transportation and land use models.
Overlooks and undervalues TDM programs.	Incorporate better information on TDM impacts, or use special TDM evaluation models.
Uncertainty about predicted travel changes resulting from various models.	Calibrate and validate the models for the study area being analyzed.

This table summarizes common problems with transportation models and ways to correct them.

various programs to improve non-auto travel. As a result of these policies, between 2010 and 2018 vehicle travel in the Puget Sound region declined 5 percent per capita, while walking, bicycling, and public transit travel increased significantly.

Many cities have successful TDM programs. The cities of Boston, MA, USA and Chicago, IL, USA limit parking supply in some locations, require large developments to have TDM plans, and provide tools for identifying the best TDM strategies for a particular site. In the Minneapolis-St. Paul, MN, USA metropolitan region, field studies found that buildings that implemented TDM plans generate a third less traffic and need a fifth fewer parking spaces than ITE models predicted. Similarly, after Fairfax County, VA, USA established vehicle trip reduction targets, field studies found that developments with TDM programs actually generate 63 percent fewer trips than conventional trip generation models predict.

Accessibility planning can also be applied in rural areas. For example, the report, *Mitigating Vehicle-Miles Traveled in Rural Development* identifies vehicle travel reduction strategies most suitable in lower-density areas.[19] The report, *Rural Multimodal Planning* describes practical ways to improve and encourage non-auto travel in small towns and rural communities.[20] The Smart Growth Network's *Putting Smart Growth to Work in Rural Communities* describes how to create more accessible and multimodal rural communities.[21] Rural vehicle travel reduction strategies typically include improving walking and bicycling conditions, providing rural public transport services, and concentrating services and new housing in walkable villages and towns.

Other countries are even more successful. The European Union requires city governments to develop Sustainable Urban Mobility Plans (SUMPs) individually designed to reflect their unique needs and abilities. These plans typically include a combination of multimodal planning, Smart Growth development policies, and TDM programs. To support these plans, the European Union sponsors the *Urban Mobility Observatory* which provides practical guidance on SUMP development.[22] Many of these cities have experienced significant reductions in automobile travel plus improved livability. For example, since the City of Brussels, Belgium's *Good Move Plan* was implemented, automobile travel declined by 19 percent and bicycling more than tripled.

Conclusions

Sustainable transportation planning increases overall efficiency by reducing the vehicle travel required to access services and activities. To align individual planning decisions with this goal, some jurisdictions establish VMT reduction targets and evaluation methods, which is sometimes described as a shift from LOS to VMT analysis. It is important that planning practitioners understand these changes. **itej**

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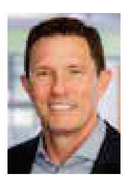

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