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Are Vehicle Travel Reduction Targets Justified?

Why and How to Reduce Excessive Automobile Travel

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Current planning practices create automobile-dependent communities. Vehicle travel reduction targets help create more compact, multi-modal communities where less driving is needed to serve people's needs.

Abstract

This study reflects the recognition that too much of a good thing is not good. Although motor vehicle travel can provide large benefits, it also imposes significant costs on users and communities. To be efficient and equitable, planning should strive to optimize vehicle travel: not too little and not too much. This study identifies current planning practices that overvalue and overinvest in automobile infrastructure to the detriment of other modes. This is unfair to non-drivers and results in economically-excessive vehicle travel. Planning reforms are justified to create more diverse and efficient transportation systems where people can meet their needs with less driving. To guide these reforms, some jurisdictions establish vehicle travel reduction targets. These help align individual planning decisions with strategic objectives. This report investigates why and how to implement such targets. It describes how to determine optimal levels of vehicle travel, identifies effective vehicle travel reduction strategies, and evaluates common criticisms. It concludes that with better planning and more efficient incentives people would drive less, rely more on non-auto modes and be better off overall as a result.

A summary of this report was presented at the
2023 World Conference for Transportation Research in Montreal, Canada.

An efficient and equitable transportation system must be diverse in order to serve diverse demands, including the needs of people who cannot, should not, or prefer not to drive. Vehicle travel reduction targets help align planning decisions to support these objectives.

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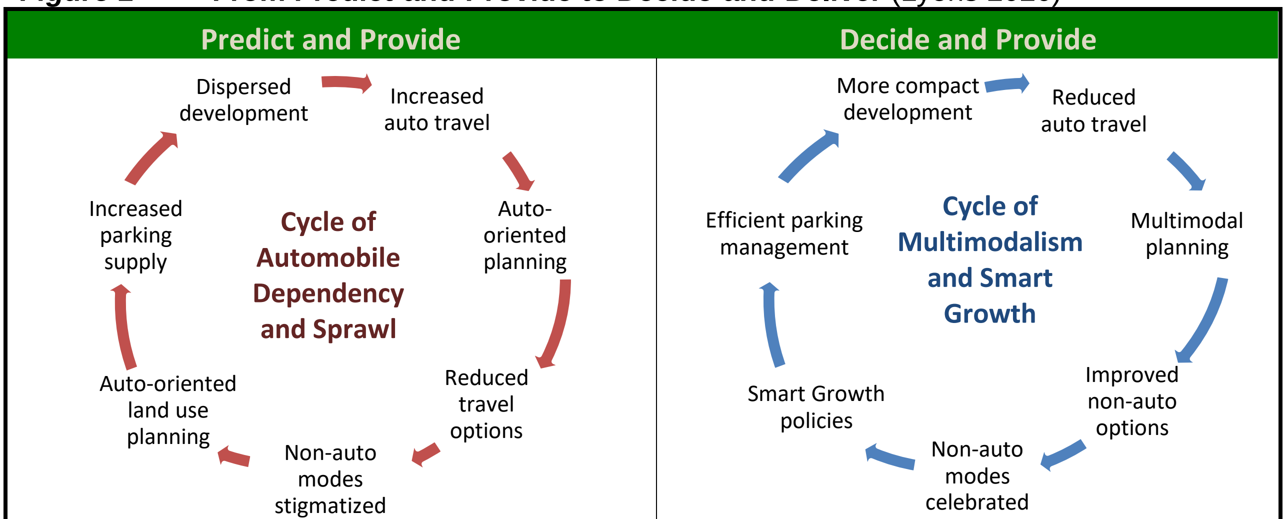
Introduction

Too much of a good thing is not good. For example, although eating makes us happy and healthy, many people consume too much and the wrong types of food. Public health requires improving food *quality* rather than *quantity*. Older policies designed to make rich and sweet food abundant and cheap, such as corn, milk, beef and sugar subsidies, are inappropriate for people suffering from obesity.

Similarly, many transportation planning practices created when mobility was scarce are intended to maximize motor vehicle travel, with little consideration for other modes or goals. "Predict and provide" planning, which expanded roadways in anticipation of traffic growth, created a self-reinforcing cycle of automobile-dependency and sprawl. Such planning fails to serve people who cannot, should not, or prefer not to drive, and increases many costs. The alternative, called "decide and provide planning" (TRICS 2021), implements multimodal planning and Smart Growth policies to achieve strategic goals, as illustrated below.

Figure 1 **From Predict-and-Provide to Decide-and-Deliver** (Lyons 2020)



"Predict and provide" transportation planning expanded roads and parking facilities in anticipation of future demands, creating a self-reinforcing cycle of automobile dependency and sprawl. "Decide and deliver" planning sets multimodal travel targets and implements policies to achieve them.

Current trends – aging population, urbanization, changing preferences, plus growing concerns about affordability, public health and environmental quality, plus improved telecommunications and e-bike technologies – are increasing non-auto travel demands and the value of serving them. You benefit if your neighbors drive less and use more resource-efficient modes. This is therefore a good time to reassess planning practices to ensure that they respond to changing needs.

Transportation planning is undergoing a paradigm shift, a change in the way that problems are defined and potential solutions evaluated (Boarnet 2013; Litman 2013). The old paradigm evaluated transportation system performance based primarily on *mobility*, measured as vehicle traffic speed. The new paradigm evaluates performance based on *accessibility*, the time and money required to access services and activities (Sundquist, McCahill and Brenneis 2021).

New paradigm planning is more multimodal and comprehensive: it recognizes the unique and important roles that non-auto modes play in an efficient and equitable transportation system, and so invests more in them (SSTI 2018). This allows travellers to use the best option for each trip: walking and bicycling for local errands, high quality public transportation on busy corridors, and automobiles when they are truly most efficient, considering all impacts. The following table compares these approaches.

Table 1 **Changing Transportation Planning Paradigm** (Litman 2013)

	Old Paradigm	New Paradigm
Definition of *Transportation*	*Mobility* (physical travel), mainly *automobile travel*.	*Accessibility* (people's overall ability to reach services and activities).
Modes considered	Automobile travel. Other modes are considered inferior.	Multi-modal: Walking, cycling, public transport, automobile, telework and delivery services.
Objectives	Reduce congestion, roadway costs, fuel consumption, and per-mile crash and emission rates.	Improve multimodal accessibility, affordability, equity, public fitness and health, energy conservation, emission reductions, and community livability.
Performance indicators	Traffic speeds, roadway level-of-service (LOS), per mile crash and emission rates.	Accessibility by various modes and groups. Per capita crash and emission rates. Environmental outcomes.

The old planning paradigm favored automobile-oriented transportation improvements. New paradigm planning considers more options and impacts, and so invests more in non-auto modes.

To implement these reforms many jurisdictions establish vehicle travel reduction targets. These align individual, short-term decisions with strategic goals to create more diverse and efficient transportation systems. They encourage more multimodal planning, Smart Growth policies, and TDM programs that create communities where people can meet their needs with less driving. This shifts from *mobility-based planning*, which strives to maximize travel speed and distance, to *accessibility-based planning*, which strives to minimize the mobility needed to access desired services and activities (Lee and Handy 2018). Using this approach, proposed projects are approved if they reduce per capita vehicle travel, and are rejected or mitigated if they increase vehicle travel (CAPCOA 2021).

These changes are controversial. Critics argue that vehicle travel reduction targets are costly, unfair, and harmful to consumers and the economy, and constitute a "war on cars." Technological optimists claim that electric and autonomous vehicles are better solutions to transportation problems (Curry 2022). Robert Poole (2009) called VMT reduction goals a "terrible idea" and challenges proponents to prove they are cost effective.

This study responds to that challenge. It describes examples of vehicle travel reduction targets, examines why and how communities establish such targets, evaluates criticisms, describes ways to optimize vehicle travel, and identifies effective vehicle travel reduction policies. This should be of interest to policy makers, practitioners (engineers, planners and analysts) and anybody who wants a more diverse, responsive, affordable and efficient transportation system.

Examples of Travel Reduction Targets

Many jurisdictions have targets to reduce vehicle travel, increase non-auto travel, and create more compact communities (ACEEE 2019; Klein 2020; Thorwaldson 2020). Below are examples.

Countries, States and Provinces

- *British Columbia:* reduce light-duty vehicle travel 25% and double non-auto trips by 2030 (CleanBC 2021).
- *California:* reduce per capita light-duty VMT 25% by 2030 and 30% by 2045 (Newsom 2022).
- *Colorado:* major projects must support emission reduction targets (Degood and Zonta 2022).
- *Ireland:* a 20% reduction in total vehicle travel (Ireland 2023).
- *Israel:* cut car travel in half (Zagrizak 2022).
- *Minnesota:* reduce vehicle travel 14% by 2040 and 20% by 2050 (Bellis 2021).
- *New Zealand:* reduce light-duty vehicle travel 20% by 2035 (NZMoE 2022).
- *North Carolina:* Implement various TDM strategies to reduce traffic problems.
- *Oregon:* reduce light-duty vehicle travel 20% by 2040.
- Quebec: reduce solo car trips 20% by 2023 (MdT 2018).
- *Scotland:* reduce vehicle travel by 20% by 2030 (Reid 2020).
- *United Kingdom:* half of all urban journeys will be by active modes by 2030 (DfT 2020).
- *United States:* reduce greenhouse gas pollution 52% from 2005 levels in 2030 (White House 2021).
- *Washington State:* 30% reductions by 2035 and 50% by 2050 (WSL 2008).

Regions and Cities

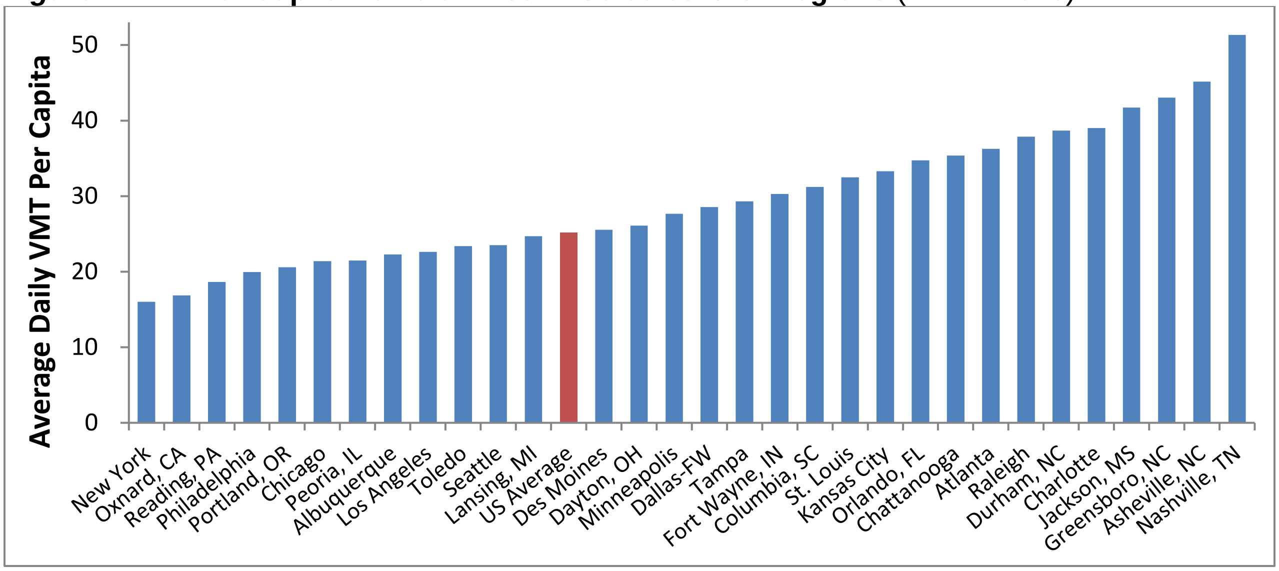
- *Boston:* Locate every home within 10 minutes of public transit, bike-, and car-share by 2050.
- *Columbus:* Create "smart mobility hubs," to help residents travel without a car.
- *Minneapolis:* reduce VMT 40% by 2040 by increasing non-auto travel and compact development.
- *Orlando:* most local trips are done on foot, bike, carpooling, or transit.
- *Phoenix:* 90% of residents are within a half-mile of transit and 40% commute by non-auto modes.
- *Portland:* reduce vehicle travel and associated emissions by 45%.
- *San Antonio:* reduce average daily vehicle-miles per capita from 24 now to 19 by 2040.

These targets are intended to achieve various goals. Older TDM programs were mainly intended to reduce traffic congestion and so focused on decreasing urban-peak vehicle trips but recent programs are also intended to reduce crashes and emissions, support social equity goals, and improve public fitness and health, and so support overall vehicle travel reductions and shifts to non-auto travel. Vehicle travel reduction targets support multimodal transportation planning and Smart Growth development policies. Many professional organizations now support these policies and provide tools for their evaluation (ABAG 2021; F&P 2022; ITE 2023; Tomer and George 2023). Some jurisdictions are reviewing and sometimes stopping highway expansions that would induce more vehicle travel (Caltrans 2020; Jossi 2024; Reid 2020).

Factors Affecting Vehicle Travel

The amount that people drive varies significantly, depending on community design and transportation policies, as illustrated below.

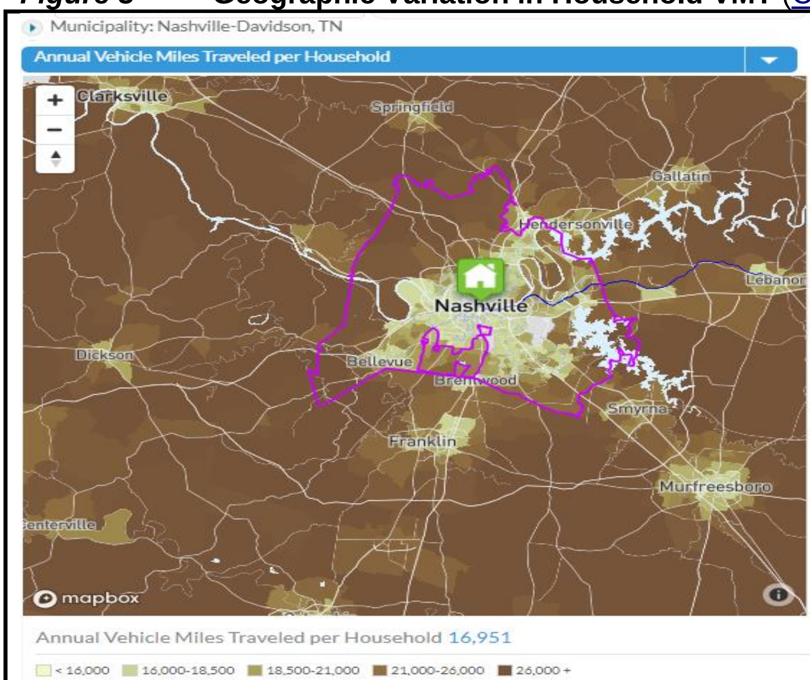
Figure 2 **Per Capita Vehicle-Miles in Selected U.S. Regions** (FHWA 2018)



Vehicle travel ranges from less than 20 to more than 40 daily vehicle-miles per capita.

Similar variations occur within regions, as illustrated below. Households located in compact, walkable neighborhoods drive 30-60% less than comparable families located in auto-dependent areas. This shows that significant vehicle travel reductions are possible.

Figure 3 **Geographic Variation in Household VMT** (CNT 2022)



This heatmap shows how average annual motor vehicle miles per household vary in a typical urban region, Nashville, Tennessee. Households in central neighborhoods average about half the amounts in automobile-dependent, sprawled areas.

This illustrates how compact, multimodal development can reduce vehicle travel.

The table below summarizes factors that affect vehicle travel. This can help identify vehicle travel reduction strategies. These factors have synergistic effects. For example, transit improvements may have little effect alone, but cause much larger vehicle travel reductions if implemented with TDM incentives and compact development policies.

Table 2 **Factors Affecting Vehicle Travel** (Litman 2021; CARB 2015)

Factor	Definition	Travel Impacts
Demographics	Age, gender, income, employment and caregiving responsibilities	Vehicle travel tends to peak at about 50 years of age, is higher for men than women, increases from low to moderate incomes, increases with employment and family responsibilities.
Regional accessibility and centricity	Location relative to regional urban center. Portion of jobs in city centers.	More central area residents typically drive 10-40% less than at the urban fringe. City center commuters drive less and rely more on walking, bicycling and public transit.
Density	People or jobs per unit of land area (acre or hectare).	Reduces vehicle ownership and travel, and increases alternative modes use. A 10% increase typically reduces VMT 0.5-1%.
Mix	Proximity between activities (housing, services, jobs, etc.)	Tends to reduce vehicle travel and increase use of non-auto modes. Mixed-use areas typically have 5-15% less vehicle travel.
Roadway design	Street scale, design and management.	Multi-modal street design and lower traffic speed reduce VMT and increase non-motorized travel.
Quality of non-auto travel options	Quantity, quality and safety of sidewalks, crosswalks, paths, bike lanes, public transit, carsharing, and telework.	Improving non-auto modes tends to increase their use and reduce automobile travel. Multimodal neighborhood residents tend to own 10-30% fewer vehicles, drive 10-30% fewer miles, and use non-auto modes more than in auto-oriented areas.
Parking supply and management	Number of parking spaces per building unit or acre, and how parking is managed and priced.	Tends to reduce vehicle ownership and use, and increase the use of alternative modes. Cost-recovery pricing (users finance parking facilities) typically reduces automobile trips 10-30%.
Transportation prices	Vehicle, fuel, parking and road prices.	Higher fuel, parking and road prices reduce vehicle travel. Cost recovery road tolls and parking fees typically reduce affected vehicle travel 10-30%.
TDM incentives	Policies and programs that encourage efficient travel.	Tends to reduce vehicle ownership and use, and increase use of alternative modes. Impacts vary depending on specific factors.
Convenience	Ease of obtaining information and using non-auto modes.	If non-auto modes are more convenient their use tends to increase and auto travel declines.
Perception	Social status of non-auto modes and urban locations.	Travellers may be more reluctant to use non-auto modes that are stigmatized or live in neighborhoods considered inferior.

This table describes various factors that can affect travel behavior.

People sometimes assume that vehicle travel reductions are only feasible in dense cities that have high quality public transit, but some non-auto modes (e-bikes, ridesharing and telework) are appropriate in suburban and rural areas. Many vehicle travel reduction strategies can be effective in those communities (Morton, Huegy, and Poros 2014).

How Much Vehicle Travel is Optimal? What Should be Reduced?

This section describes factors to consider when planning for optimal vehicle travel.

Optimizing for Accessibility

Accessibility-based planning recognizes that the ultimate goal is to maximize people's ability to access desired services and activities, and that various factors can affect this including *mobility* (travel speed and distance), *proximity* (the closeness of activities), and travel *affordability* (Levinson and King 2020). Many planning decisions involve trade-offs between these factors. For example, wider roads increase automobile traffic speeds but by create barriers to walking, which reduces non-auto access. Similarly, sprawled development reduces proximity, increasing the distances people must travel to reach destinations. As a result, an increase in mobility is not necessarily beneficial, it may reflect a decline in accessibility which forces people to drive more to reach the services and activities they want. Multimodal planning and compact development reduce optimal vehicle travel.

Auto and Non-Auto Travel Demands

Some trips are best made by automobile, others by non-auto modes, and many will depend on planning decisions, as summarized in the table below.

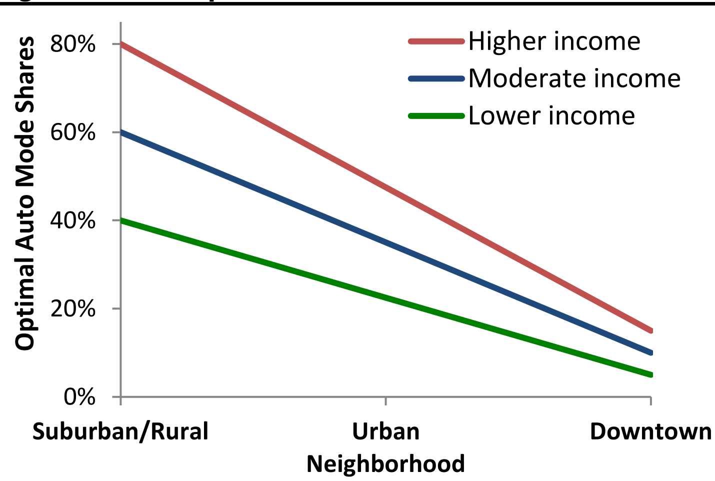
Table 3 **Auto and Non-Auto Travel Demands**

Optimal Automobile	Either Auto or Non-Auto	Optimal Non-Auto
Travel by people who can drive and afford a vehicle, when they carry heavy loads or have diverse destinations.	Trips with light loads that are less than five miles in length, or along heavy-volume travel corridor with high-quality public transit. Local policy and planning decisions affect these factors.	Travel by people who cannot drive or are financially burdened by vehicle expenses, who enjoy non-auto travel or value their health benefits, and travel in dense or environmentally sensitive areas where vehicle traffic has high external costs.

Several factors affect which modes are optimal for a particular trip. Many trips could be made by automobile or non-auto modes, depending on local policy and planning decisions.

Development densities and incomes affect optimal automobile mode shares, as illustrated below.

Figure 4 **Optimal Automobile Mode Shares**



High levels of automobile travel may be appropriate in affluent suburban and rural areas, but should decline as densities increase and incomes decline. Automobile mode shares should be less than 30% in most urban neighborhoods, and less than 10% in city centers.

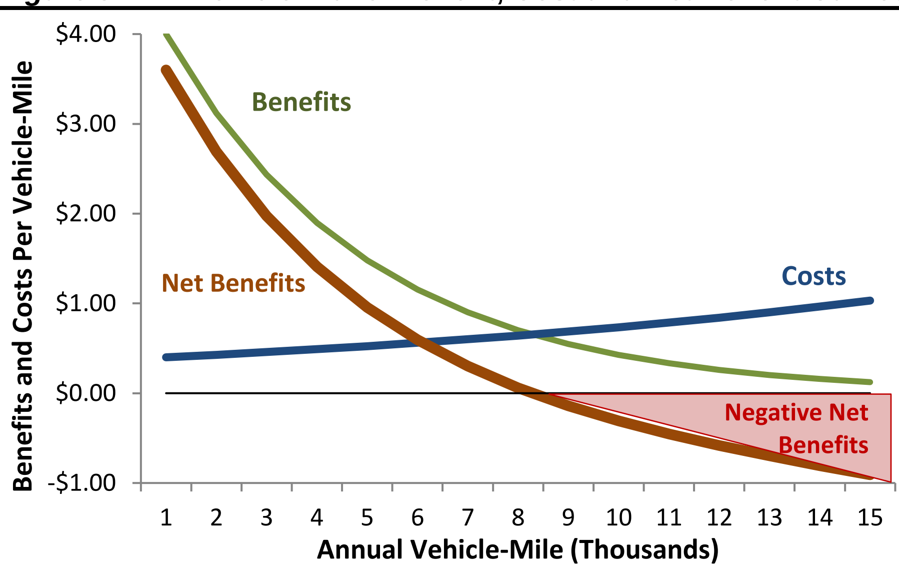
Conventional planning ignores these factors, resulting in more auto-oriented planning than is fair and efficient in most communities.

Equitable and efficient planning invests in non-auto modes at least as much as their potential demands, as discussed in more detail later. For example, if 30% of neighborhood trips could be by walking, bicycling and e-bikes, efficient and equitable planning invests up to 30% of road space and funding in sidewalks, crosswalks and bikeways, and more if needed to offset decades of underinvestment, plus TDM incentives to encourage shifts to these modes to help achieve strategic goals such as reducing traffic and parking congestion, improving public health, and reducing pollution. Similarly, optimal planning invests in public transit to the degree that it is cheaper than accommodating more automobile traffic on the same corridor, considering road and parking infrastructure costs, user costs, plus traffic congestion crash risk and pollution costs.

Economic Analysis

Like most goods, vehicle travel benefits tend to decline marginally since users rationally make the most beneficial trips first and add lower-value trips as their mobility increases, as illustrated below. The demand curve has a long-tail, meaning that as driving becomes cheaper people travel more although their marginal benefits become very small. On the other hand, unit costs tend to increase as more vehicle travel adds congestion and displaces other modes. As a result, *net benefits* (benefits minus costs) tend to decline and can become negative with high annual mileage, indicated by net benefits below zero. This travel is economically inefficient and inequitable because it imposes external costs, including infrastructure subsidies, delay, risk and pollution, and by displacing non-auto modes, reduces non-drivers' accessibility. A transportation system can become more equitable and efficient by favoring higher-value trips and more affordable and efficient modes, over lower-value trips, and expensive, resource-intensive modes.

Figure 5 **Vehicle Travel Benefit, Cost and Net Benefit Curves**



As vehicle travel increases marginal ***benefits*** *tend to decline since motorists rationally make the most beneficial trips first and add lower value trips as their driving increases.* ***Costs****, however, tend to increase with annual mileage due to increased congestion and displacement of other modes. As a result,* ***net benefits*** *(benefits minus costs) decline and can become negative at high annual mileage levels.*

As per capita vehicle travel increases so does the justification for policies that improve and encourage non-auto modes. For example, as vehicle traffic increases in a city so do the costs of expanding roads and parking facilities, plus crash and pollution costs, justifying more investments in resource-efficient modes (walking, bicycling and public transit), and TDM incentives to discourage driving and encourage mode shifts.

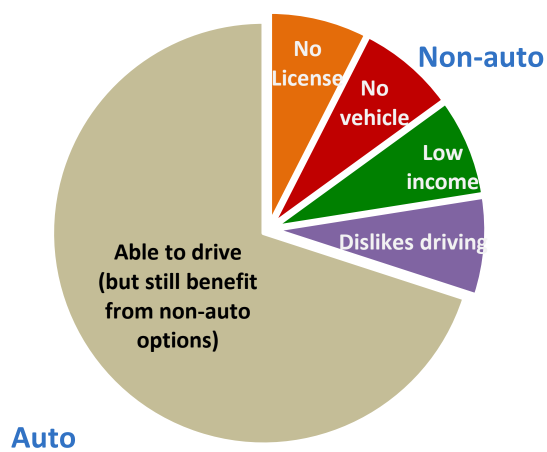
Economic Principles

The following principles can help determine optimal levels of vehicle travel. Also see Litman (2024) and Shill (2019).

1. Consumer Sovereignty

Consumer sovereignty means that planning decisions respond to user demands, including latent demands. Based on this principle, optimal vehicle travel is the amount people would choose if they had diverse options. To be efficient and equitable, transportation systems must be diverse to serve travellers who cannot, should not, or prefer not to drive, as summarized below.

Figure 6 **Auto and Non-Auto Travel Demands**



In a typical community 20-40% of travellers cannot, should not, or prefer not to drive, including people with disabilities and low-incomes, adolescents, drivers who lack personal vehicles, and people who prefer non-auto travel for health and enjoyment.

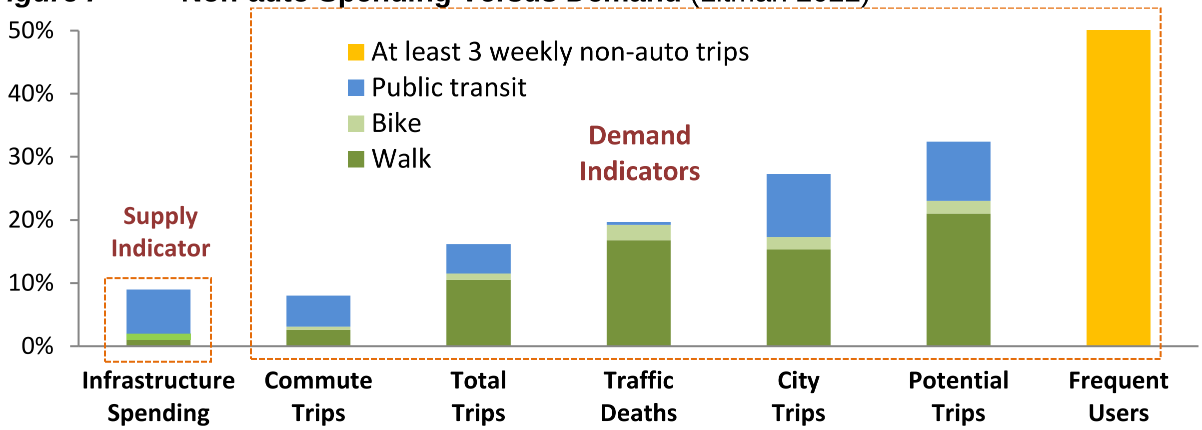
Auto-oriented planning deprives non-drivers of independence, forces them to bear excessive costs, imposes chauffeuring burdens on motorists, reduces public fitness and health, and increases traffic problems. This is unfair and economically inefficient.

Automobile-oriented planning degrades non-auto travel. For example, wider roads and high traffic speeds reduce walkability, and since most transit trips include walking links this reduces transit access. Parking minimums increase housing costs, particularly in areas with high land prices, reducing affordable housing in walkable neighborhoods. Consumer surveys indicate that many households would prefer to live in more compact, multimodal neighborhoods, drive less, rely more on non-auto modes, and spend less money on transportation (NAR 2023). Examples described later in this report show that automobile travel often declines and use of other modes increases after communities improve non-auto modes, indicating latent demands. Current demographic and economic trends – aging population, rising fuel prices, changing consumer preferences, increased health and environmental concerns – are increasing non-auto demands, justifying more multimodal planning and Smart Growth to serve future needs.

2. Fair Share Resource Allocation

Basic fairness requires that users receive similar shares of public resources unless there are specific reasons to do otherwise. For example, if walking currently has 12% mode share (portion of total trips), at least 12% of infrastructure funding or road space should be devoted to pedestrian facilities, and more if that would increase pedestrian mode shares, or to achieve strategic goals such as affordability and public health. Currently, most North American communities devote much less to non-auto modes than their potential mode shares, as illustrated in the following figure, indicating that non-auto modes deserve more investment.

Figure 7 **Non-auto Spending Versus Demand** (Litman 2022)



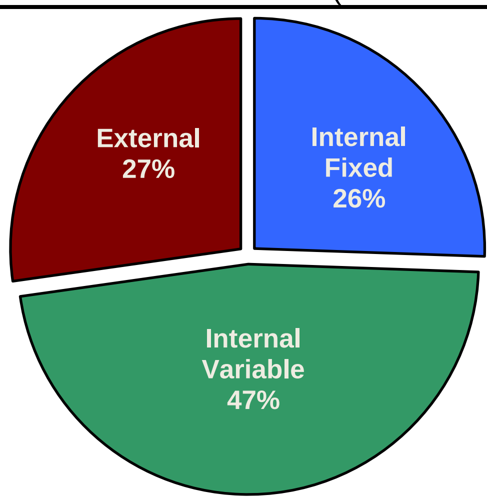
Non-auto modes receive less than 10% of total transportation infrastructure spending, which is less than their share of total trips, traffic deaths, potential trips or users.

3. Efficient ("Use Pays") Pricing

Efficient pricing means that consumers "get what they pay for and pay for what they get," with prices that reflect marginal costs. For example, if a vehicle trip imposes $5 worth of costs, motorists should pay fees of that amount. This ensures that society does not spend $5 worth of resources for trips that users value less, and prevents non-drivers from subsidizing motorists. Trips that motorists take if driving is underpriced but forego if charged cost recovery prices are economically inefficient; their costs exceed their benefits.

Automobile travel is currently underpriced; North American motorists only pay directly about half of their roadway costs, only a small portion of their parking costs, and are seldom charged for the congestion, risk and pollution costs they impose (ICF 2021; Litman 2019). In addition, many user charges, such as vehicle insurance, taxes and registration fees, are fixed, unrelated to the amount a vehicle is driven, although the costs they represent increase with annual mileage, so motorists who drive less than average cross-subsidize those who drive more than average.

Figure 8 **Vehicle Costs** (Litman 2019)



About a quarter of vehicle costs are external (road and parking costs not paid by user fees, plus congestion, risk and pollution costs imposed on other people), and about a quarter are internal-fixed (vehicle financing, insurance, taxes and registration fees). This price structure is inefficient and unfair; it forces people who drive less than average to subsidize others who drive more than average.

More efficient pricing typically reduces automobile travel 30-50%, consisting of lower-value trips that users value less than the total costs they impose.

The elasticity of vehicle travel with respect to operating costs is typically about -0.10 in the short-run and -0.30 over the long-run, so a 10% fee increase reduces vehicle travel about 1.0% within the first year, and about 3% after a few years (Litman 2014).

Table 4 **Efficient Transportation Pricing**

Type	Optimal Prices	Travel Impacts
Fuel taxes	Can be a road user fees and an emission fee. Optimal taxes are $2.00-4.00 per gallon.	If fuel prices average $4.00 per gallon, an additional $1.00 fuel tax typically reduces driving 2.5% in the short-run and 7.5% over the long-run.
Road tolls and fees	Recover roadway costs, with higher prices under congested conditions.	Cost-recovery road tolls add about 5¢ per vehicle-mile, which typically reduce driving 3% in the short-run and 12% over the long-run, with larger reductions (typically 20-40%) on congested roads.
Parking fees	Cost-recovery fees with higher rates during peak demands. Free parking should be *unbundled*, and *cashed out*.	Cost-recovery parking fees typically add $2-5 per trip, and $5-10 for urban commutes. This typically reduces affected trips by 10-30%.
Distance-based fees	Fixed vehicle insurance premiums and registration fees are prorated by mileage, so a $600 annual premium becomes 5¢ per mile and a $1,800 premium becomes 15¢ per mile.	Typically reduces affected vehicle travel by 10-15%, with larger reductions by higher-risk drivers (those who pay higher premiums, and so save more when they drive less), providing proportionately large crash reductions.

Efficient transportation pricing includes several fees.

These reforms give travellers new opportunities to save money that are not otherwise available. For example, currently, about half of roadway costs and the majority of parking facility costs are funded indirectly through general taxes, higher rents and retail prices, so people pay regardless of how much they drive; paying directly through tolls and user fees reduces these indirect costs, providing savings to people drive less than average. Parking *unbundling* (renting it separately from building space) reduces non-drivers' rents. Parking *cashing out* (non-drivers receive cash equivalent of parking subsidies) gives non-drivers new financial benefits. Distance-based insurance and registration fees provide financial savings to motorists who drive fewer than average annual miles.

Efficient pricing could significantly reduce vehicle-travel. For example, road user fees currently only cover about half of roadway costs; cost-recovery road user fees would add about 5¢ per vehicle-mile, which would reduce vehicle travel about 5%; cost recovery parking fees typically reduce driving by 10-30% compared with unpriced parking; a $50 per tonne carbon tax would add about 50₵ per gallon of gasoline, which would reduce driving about 6%; and distance-based vehicle insurance could reduce vehicle travel about 10% (CAPCOA 2021). This suggests that efficient pricing would reduce vehicle travel 30-50% (Butner and Noll 2020; Litman 2014).

4. Comprehensive Analysis

A fourth principle is that planning analysis should consider all significant impacts and goals. For example, when deciding whether to expand a roadway or improving public transit service, the analysis should consider how they affect strategic goals such as affordability, public fitness and health, and environmental quality, not just traffic speeds. Current planning often overlooks important goals and impacts, as indicated in the following table.

Table 5 **Impacts Typically Considered in Transportation Planning**

Usually Considered	Often Overlooked
• Travel speeds and congestion delays • Parking convenience • Vehicle operating costs • Crash rates • Pollution emission	• Affordability (savings to lower-income households) • Independent mobility for non-drivers • Chauffeuring costs • Induced vehicle travel • Public fitness and health • Barrier effects (delay to non-drivers) • Sprawl costs (infrastructure costs, habitat loss, etc.)

Conventional transportation project evaluation considers some impacts but often overlooks others.

To the degree that planning overlooks these impacts and goals it tends to overinvest in automobile infrastructure and underinvest in affordable and resource-efficient modes than is optimal, resulting in excessive motor vehicle travel (Butner and Noll 2020; Shill 2019). This is particularly true in cities, where traffic impacts are severe, and in communities that place high values on affordability, social equity and environmental protection. Optimal automobile mode shares should decline as densities increase and incomes decline.

5. Accessibility-Based Planning

Accessibility-based planning evaluates transportation system performance based on people's ability to reach desired services and activities, taking into account the following factors:

- *Mobility.* Physical movement and therefore the quality (availability, speed, frequency, comfort, etc.) of travel modes (walking, bicycling, taxies, public transport, air travel, etc.).
- *Geographic proximity*. The distances between destinations, and therefore land use development factors such as development density and mix, which affect these distances.
- *Transport system connectivity*. The density of sidewalks, roads and public transit networks, and intermodal connection quality, such as bike access to transit, and transit access to airports.
- *Affordability.* The financial costs of travel relative to users' income.
- *Convenience*. The ease of obtaining travel information, paying fares and carrying luggage.

Such planning should consider trade-offs between different accessibility factors. For example, wider roads designed to maximize auto traffic speeds tend to create barriers to walking and bicycling, and compact development tends to reduce traffic speeds but increases proximity and the efficiency of walking, bicycling and public transit.

This type of planning tends minimize the amount of mobility required to achieve a given level of accessibility, and so supports vehicle travel reduction policies.

Summary

The table below summarizes common planning distortions that violate these principles. These favor automobile travel over other modes, and sprawl over compact development, resulting in economically excessive motor vehicle travel.

Table 6 **Twelve Common Transportation Planning Distortions**

Type of Distortion	Effects	Reforms
Elite bias. Policy makers and planners favor automobile travel and undervalue other modes.	Prioritizes automobile travel over other modes in policy, planning and investments.	Better analysis, guidance and tolls for multimodal planning. Include non-drivers in planning.
Industry influence. The substantial cultural and political influence by automobile and petroleum industries.	Increases popular and political support for policies that increase automobile ownership and use.	Analysis and control of excessive industry influence.
Transportation organization goals and practices. Transport agencies prioritize roadway planning and give little consideration to other modes.	Favors roadway expansions over improvement to other modes, and provide minimal support for transportation demand management.	Reform transportation organizations to be more comprehensive and multimodal, and to support TDM programs.
Incomplete non-auto data. Survey and travel data undercount non-auto travel activity and demands.	Underinvests in non-auto modes relative to their demands (including latent demands) and potential benefits.	More comprehensive travel data, including latent demands. Recognize data biases.
Mobility-based performance indicators (e.g., roadway level-of-service and travel time index).	Favors faster modes, higher roadway design speeds, and sprawl over compact development.	Consider other planning goals beside speed. Apply accessibility-based planning.
Biased travel models. Underestimate elasticities and induced travel.	Overinvests in roadway expansions and underinvests in alternatives.	Account for induced vehicle traffic in planning analysis.
Incomplete impact analysis. Conventional planning tends to overvalue speed and undervalue other community goals.	Favors faster modes and higher road design speeds over slower but more affordable, inclusive and efficient options	More comprehensive impact analysis, additional performance targets and more multimodal planning.
Dedicated road and parking funds, but not for other modes.	Favors automobile infrastructure over investments in other modes.	Least-cost transportation planning. Multimodal planning.
Non-auto underinvestment. Walking, bicycling and transit receive less than optimal funding and road space.	Makes walking, bicycling and public transit inconvenient, unsafe and expensive, reducing their use.	Multimodal planning. Targets for improving non-auto modes and increasing their use.
Automobile underpricing (unpriced roads, parking, risk, pollution, etc.)	Increases automobile travel and reduces non-auto travel demands.	More efficient pricing and more investments in non-auto modes.
Parking minimums. Local mandates for off-street parking.	Increases automobile ownership and use, degrades walking conditions, and encourages sprawled development.	Reduce or eliminate parking mandates. More efficient parking management.
Sprawl-oriented development policies. Density restrictions and parking minimums.	Creates dispersed communities that increase travel distances and provide poor non-auto access.	Smart Growth policies that create more compact, multimodal communities.

Many common planning distortions favor automobile travel and sprawl over more affordable, inclusive and efficient modes, and sprawl over compact, multimodal development.

Vehicle Travel Reduction Strategies

Various strategies can increase transportation system efficiency and reduce vehicle travel (ITDP 2022; NCDOT 2021; TfA and SGA 2020; TTI 2022). The following table lists examples.

Table 7 **Vehicle Travel Reduction Strategies** (ICAT 2020; ITF 2022; VTPI 2020)

Improve Options	TDM Incentives	Smart Growth Policies	Programs
Transit improvements Active transport (walking and bicycling) improvements Rideshare programs Flextime Telework Carsharing	Road space reallocation Congestion pricing Distance-based fees Parking cash out Parking pricing Fuel or carbon tax increases	Complete streets Smart Growth/New Urbanism/Transit Oriented Development (TOD) Parking reforms VMT developer fees Car-free planning	Commute trip reduction programs School and campus transport management Freight transport management TDM marketing

Various strategies can help reduce vehicle travel. These tend to have synergistic effects, so the most effective programs include a combination of positive and negative incentives to reduce driving.

Many of these strategies reflect the economic principles described earlier. For example, improving non-auto travel options, and Smart Growth policies that improve housing options in multimodal neighborhoods, reflect consumer sovereignty and fair share planning. Many TDM incentives reflect efficient pricing. Many of these strategies help achieve multiple community goals and so are justified by comprehensive planning.

New tools, such as California's *Vehicle Miles Traveled-Focused Transportation Impact Study Guide* (Caltrans 2020), and the *San Francisco TDM Tool* (www.sftdmtool.org), predict how policies and programs affect vehicle travel, and how to achieve VMT reduction targets. The Brooking Institute's *Building for Proximity* (Tomer and George 2023), and *GreenTRIP Connect* (connect.greentrip.org) calculate how location and development policies can reduce driving, parking facility costs and emissions. The *Cool Climate Network* (coolclimate.berkeley.edu) produces interactive heat maps showing where infill development can reduce household emissions. Many jurisdictions are starting to use these tools to plan vehicle travel reduction programs (Bellis 2021; DeGood and Zonta 2022). Some proposed road building projects have been halted or revised to avoid increasing traffic and emissions (Morris 2023).

Vehicle travel reduction programs tend to be most effective if implemented as an integrated program that includes both positive and negative incentives (STTI 2018). Various examples described later in this report indicate that cost-effective programs can typically reduce affected vehicle travel by 5-15% if they only include positive incentives (improved travel options and encouragement campaigns); 10-30% if they include financial incentives (cost recovery road tolls and parking fees, and distance-based insurance pricing), and 20-60% if they also include Smart Growth development policies (upzoning, infill and reduced parking minimums).

The following table summarizes the impact of various vehicle travel reduction strategies. They tend to become more effective and beneficial if implemented as an integrated program.

Table 8 **Travel Reduction Impacts (CARB 2015, Kuss & Nicholas 2022, VTPI 2020)**

Strategy	Description	Typical Travel Impacts
Efficient parking pricing and management	Charge cost-recovery parking fees with rates that vary by demand. Cash out and unbundle parking. Eliminate parking mandates.	5-15% reduction in vehicle ownership and 10-30% reduction in affected vehicle trips.
Active and micro modes (walking, bicycling, e-bikes and variants)	Improve walking and bicycling conditions, and encourage their use. Include e-bikes in electric vehicle subsidy programs. Create compact 15-minute neighborhoods.	Infrastructure improvements increase active and micro mode travel 50-100% and reduce driving 5-15%. Compact, walkable communities reduce driving 20-40%.
High quality public transit	Frequent, fast, convenient, comfortable transit services. Amenities such as free wifi and improved payment systems.	Service improvements increase affected transit travel 20-50%, and reduce auto travel 5-15%, and sometimes more.
Smart Growth, New Urbanism, Transit-oriented development	Develop compact, mixed-use neighborhoods around high quality public transit.	Residents tend to walk, bike and use public transit 20-100% more, and drive 20-60% fewer annual miles.
Commute, school and campus transport management programs	Improve non-auto travel options and encourage their use with financial incentives (parking pricing and cash out).	Programs that only use persuasion reduce driving 5-15%, those that provide financial incentives reduce auto trips 10-30%.
Roadway redesigns to favor sustainable modes	Improve sidewalks, add bike- and bus lanes, and reduce traffic speeds. Apply complete streets policies	Non-auto travel typically increases 20-100%, and auto travel declines 10-30%. Reducing traffic speeds reduces VMT.
Efficient road pricing	Motorists pay cost-recovery tolls on urban highways and fees to enter city centers	10-30% reduction in affected road traffic volumes.
Distance-based pricing	Vehicle insurance and registration fees are prorated by average annual mileage.	Up to 15% if total insurance premiums and registration fees are prorated.
Vehicle sharing	Provide car- and bikesharing services in urban neighborhoods.	12-15 private cars replaced by each shared car.
Freight transport management	Require or encourage shippers to use efficient vehicles and logistics.	Can reduce freight vehicle travel and emissions 10-30%.
Limited traffic zone	Limit vehicle trips to central city areas.	10-20% reduction in city-centre cars.
Personalized travel planning	Residents encouraged to use non-auto modes. Transit fare discounts.	6-12% reduction in car use by participants.
Sustainable mobility apps	Mobile apps provide user information, payments and rewards for reduced driving.	73% of app users reduce their vehicle travel.

There are many ways to reduce driving and increase non-auto travel. Impacts vary depending on design and conditions. They tend to have synergistic effects: they become more effective if implemented as integrated programs that include non-auto improvements, TDM incentives and Smart Growth development policies.

Potential Savings and Benefits

This section describes potential vehicle travel reduction benefits.

Because motor vehicles are large, heavy and fast they are more expensive to use, require more costly infrastructure (roads, parking facilities and traffic services), and impose more external costs (congestion, risk and pollution) than most other modes when measured per mile. Since motorists tend to travel more annual miles than non-drivers they usually have higher annual costs (Litman 2019). Similarly, sprawled development consumes more land, requires more costly infrastructure, and by increasing travel distances increases transportation costs.

Vehicle travel reduction strategies and Smart Growth development can reduce these costs, providing various benefits (Ahlfeldt and Pietrostefani 2017; Ewing and Hamidi 2014). They also impose various costs. The table below summarizes these impacts, categorized according to their travel impacts.

Table 9 **Multimodal Planning Benefits and Costs**

	Improve Non-Auto Travel	Increase Non-Auto Travel	Reduce Automobile Travel	More Compact Communities
Benefits	• Improved user convenience, comfort and safety. • Improved accessibility for non-drivers, which supports equity objectives. • Higher property values along walk-, bike- and busways. • Improved public realm (more attractive streets).	• User enjoyment. • Improved public fitness and health. • More local economic activity. • Increased community cohesion (positive interactions among neighbors). • More neighborhood security ("eyes on the street").	• Reduced traffic congestion. • Road and parking facility cost savings. • Consumer savings. • Reduced chauffeuring burdens. • Increased traffic safety. • Energy conservation. • Pollution reductions. • Economic development.	• Improved accessibility, particularly for non-drivers. • Transportation cost savings. • Reduced sprawl costs. • Openspace preservation. • More livable communities. • Higher property values
Costs	• Facility costs. • Lower traffic speeds.	• Equipment costs and transit subsidies. • User crash risks.	• Slower travel.	• Increases some development costs.

Improving non-auto modes has various benefits and costs.

These impacts vary. Not every vehicle travel reduction program provides all of these benefits, but most provide many. Vehicle travel reduction and Smart Growth policies tend to help achieve social equity goals: they improve mobility and accessibility for physically and economically disadvantaged groups, ensure that non-drivers receive their fair share of infrastructure investments, increase affordability, and reduce external costs (congestion, risk and pollution) that motor vehicles impose on other people.

Examples

Below are examples of successful vehicle travel reduction programs. For more information see "TDM Success Stories" (www.vtpi.org/tdmss.pdf) and "Tools of Change" (www.toolsofchange.com).

Active Transportation Improvements

Many studies find that walking and bicycling improvements significantly increase use of these modes (CPSTF 2017). For example, after the Federal Highway Administration's *Nonmotorized Transportation Pilot Program* invested about $100 per capita in pedestrian and bicycling improvements in four typical U.S. communities (Columbia, MO; Marin County, CA; Minneapolis area, MN; and Sheboygan County, WI), walking trips increased 23%, bicycling trips increased 48%, and automobile travel declined 3% (FHWA 2014). Another study found that a 10% increase in per capita bikeway-miles increases bicycle commute mode shares 2.5%, and a 10% increase in protected bicycle lanes increases bicycle mode shares 4% (Yang, et al. 2021). Cities with extensive active mode networks such has Davis, CA, Eugene, OR, and Boulder, CO have more than 15% active commute mode shares, five times the national average, plus under 20 daily vehicle miles travelled per capita, 20% less than the national average (Buehler 2016).

Induced Travel Impact Models

The Rocky Mountain Institute's *Smarter MODES Calculator: Smarter Mobility Options for Decarbonization, Equity, and Safety* (RMI 2024), and *State Highway Induced Frequency of Travel (*RMI 2021) helps states quantify the emissions, health and user cost savings of vehicle miles travel (VMT) reduction strategies that expand transportation options and complement vehicle electrification.

TDM Program Effectiveness

The article, *Don't Underestimate Your Property: Forecasting Trips and Managing Density over the Long Term* (Galdes and Schor 2022) summarizes experience with TDM programs in suburban Fairfax County, particularly Tyson's Corner. It found that residential and commercial developments that had comprehensive but cost-effective TDM programs actually generate 49% fewer trips than predicted by ITE trip generation models. This reduces parking and roadway costs, and allows more development to occur on available land. As one traffic engineer explained,

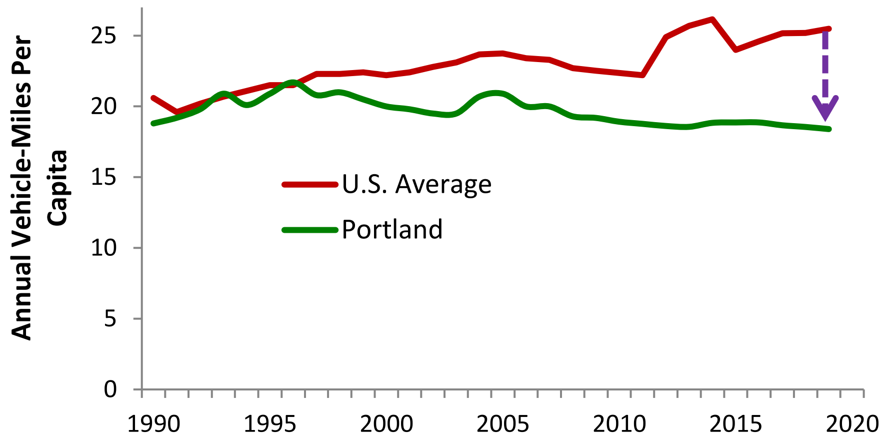
> "Underestimating trip generation can have deleterious effects on a neighborhood because trip generation is so closely linked to the amount of square footage that a property is allowed. More than any other feature of a development, vehicle trip generation estimates determine density limits and impacts." (Mike Workosky, traffic engineer and President of Wells + Associates)

Similarly, a detailed study, *Travel Demand Management: An Analysis of the Effectiveness of TDM Plans in Reducing Traffic and Parking* (Spack and Finkelstein 2014) found that office buildings in the Minneapolis-St. Paul metropolitan region that implemented TDM Plans generate, on average, 34% to 37% less traffic and need 17% to 24% fewer on-site parking spaces than Institute of Transportation Engineers' average trip generation rates.

Regional Vehicle Travel Reduction Programs

Some North American urban regions have implemented integrated vehicle travel reduction programs that significantly reduce per capita vehicle travel. For example, during the last two decades the city of Portland shifted highway expansion funding to improve regional bus and rail transit services, implemented TDM programs, reformed its parking policies, and implemented Smart Growth policies that encourage more compact development. As a result, per capita vehicle travel declined in that region while it increased nationally, resulting in average per capita vehicle travel nearly 30% lower than the U.S. average, as illustrated in the following graph.

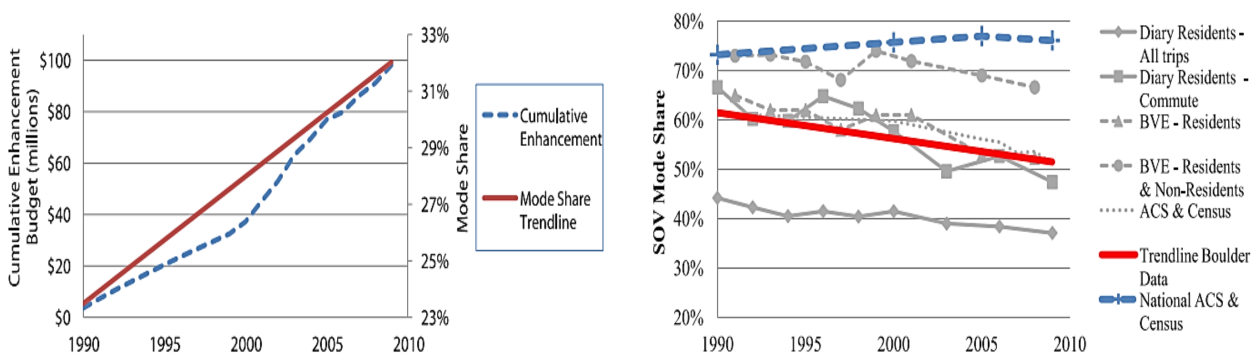
Figure 9 **Portland, Oregon Travel Trends** (Metro 2021)



Portland, Oregon's integrated TDM and Smart Growth policies reduced average vehicle travel in both the city and its urban region (which includes the Vancouver, Washington suburb), while driving increased elsewhere in the U.S.

Similarly, after Boulder, Colorado increased non-auto mode investments to about $100 annually per capita, use of those modes increased, and automobile mode share declined from 62% to 52%, as illustrated below.

Figure 10 **Non-Auto Funding and Mode Share, Boulder** (Henao, et al. 2015)



After Boulder increased non-auto investments to about $100 annual per capita (left) their mode shares increased to about a third of all trips and single occupant vehicle (SOV) shares declined about 17%.

California SB 743

California has targets and plans to achieve carbon neutrality by 2045, in part by reducing per capita light-duty vehicle travel 25% by 2030 and 30% by 2045. To achieve these targets California law requires that transportation projects be evaluated based on their vehicle travel impacts (Lee and Handy 2018). Although some organizations continue to expand roadways (NextGen 2023), the California State Transportation Agency (CalSTA 2021) and the California Air Pollution Control Association (CAPCOA 2021) developed guidelines for applying these policies to planning decisions.

Campus Transportation Management Programs
Many colleges and universities are implementing transportation demand management programs in order to reduce traffic and parking problems, increase affordability and better serve students, staff and visitors. These usually include a combination of active and public transit service improvements, u-pass (the campus purchases highly-discounted transit service for all students), efficient parking pricing, bike- and car-sharing, and more accessible campus design. These typically reduce automobile trips to campus by 20-50%.

For example, Stanford University implemented its comprehensive TDM program in an agreement with the local government to eliminate the requirement for traffic impact studies and mitigation for campus development (more classrooms, laboratories, research institutes and housing) provided there is no net increase in total vehicle trips. As a result drive alone rates declined from 72% to 46% for staff, and just 39% for total commuters, including students, drive. This allowed construction of millions of square feet of additional building space that accommodate more students and staff without expanding roads and parking facilities.

Scottish Planning Rules (BBC 2023)
Scotland established new planning rules intended to support “transformational reduction in private car use” by creating “20-minute neighbourhoods” where all services are within walking or bicycling distance, improving public transit services, and reducing out-of-town shopping malls and drive-throughs. This will help achieve national targets to reduce car trips 20% by 2023.

Rural Community Multimodal Planning (Lynott 2014)
Some rural communities are implementing multimodal planning to improve affordable and healthy travel options and help reduce vehicle-travel. For example, Washington State’s *Rural Mobility Grant Program* and a *Travel Washington Intercity Bus Program* supports public transit services in rural counties. As a result, it is possible to travel around the Olympic Peninsula using the Olympic Transit Loop, which consists of six coordinated local public transit agencies.

European Sustainable Urban Mobility Plans (Eltis 2021 and EU 2021)
The European Union’s new *Urban Mobility Framework* requires municipal governments to develop Sustainable Urban Mobility Plans (SUMPs) by 2025 (EU 2021). This is intended to help solve air pollution, congestion, accessibility, traffic safety, growth of e-commerce, and other urban mobility challenges. SUMPs are multifaceted and tailored to each region’s unique needs and abilities. They typically include a combination of active and public transport improvements, roadway and parking design changes, efficient road and parking pricing, development policy reforms, regulatory reforms, improved data collection and program evaluation, and mobility management programs to improve both personal and freight transport efficiency.

To support these plans, the European Union sponsors the *Urban Mobility Observatory*, managed by *Eltis*, a network of research organizations that provides extensive, practical guidance on SUMP development (Eltis 2021). These resources include the *Planner's Guide to Sustainable Urban Mobility Management (SUMP)* a *Toolbox for Mobility Management*, and the *Eltis Case Study Database* which describes in detail numerous, diverse examples from the European Local Transport Information Service. Eltis also provides tailored training on all aspects of the SUMP process and its implementation, improved data collection and evaluation tools, and financial support for implementing and testing innovation.

Evaluating Criticisms

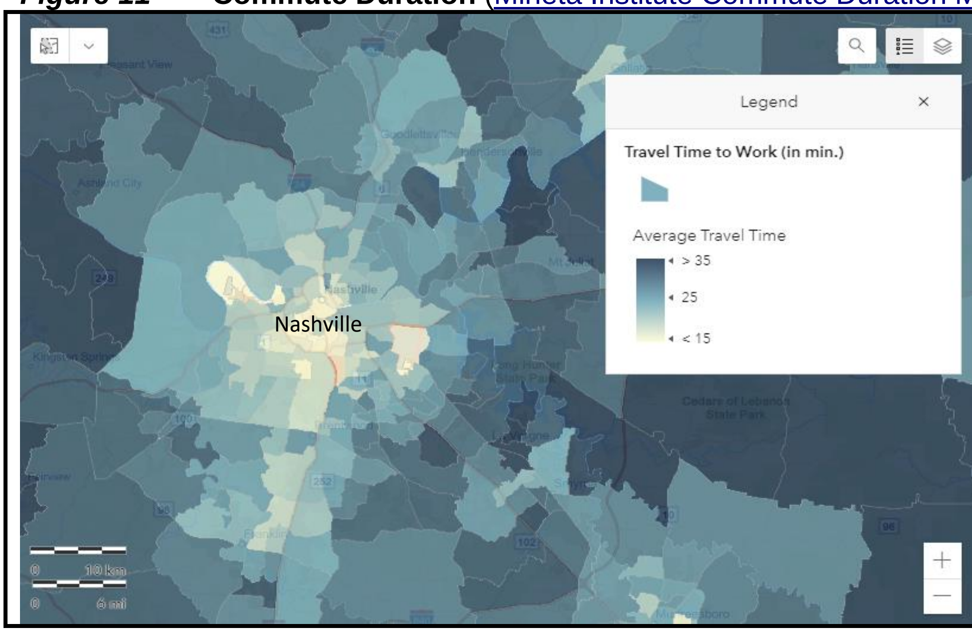
This section evaluates various criticisms of vehicle travel reduction targets and programs.

Reduces Transportation Efficiency

Critics argue that, because automobiles are faster than other modes, auto-oriented planning benefits everybody, including non-drivers who travel as automobile passengers and use goods delivered by motor vehicles. To justify automobile-oriented planning critics cite examples of high-value automobile trips, such as travellers with disabilities, workers who truck heavy materials and tools to job sites, and commutes that would be slow and difficult by non-auto modes. However, this argument is a non sequitur: the fact that automobiles are most efficient for *some trips* does not mean that they are best for *all trips*, or that vehicle travel cannot be efficiently reduced.

Compact, multimodal community residents spend less total time and money on transportation than in automobile-dependent, sprawled areas, as illustrated below. Much of the time savings provided by automobile travel is offset by the additional working hours required to own and operate a vehicle. When measured as *effective speed* (defined as travel distance divided by time spent travelling plus time spent earning money to pay travel expenses), non-auto travel is often faster than driving, particularly for lower-income workers (Tranter 2010). The study, "Urban Access Across the Globe: An International Comparison" (Wu, et al. 2021) found that U.S. urban regions have *less* access than in other countries due to automobile dependency and sprawl.

Figure 11 **Commute Duration** (Mineta Institute Commute Duration Mapping System)



Average commute duration (minutes per commute) are generally much lower in compact, multimodal neighborhoods than in automobile-dependent, sprawled areas, due to better accessibility.

This figure shows Nashville, Tennessee, using US Census Data. Similar patterns are seen in most cities.

Vehicle travel reduction strategies can increase automobile travel efficiency by reducing traffic and parking congestion, and reduce chauffeuring burdens. In automobile-dependent areas about 15% of trips are made to chauffeur a non-driver. These are particularly inefficient because they often involve an empty backhaul, so a five mile trip generates ten vehicle-miles and requires twenty minutes of driving.

Harms Disadvantaged Groups

Critics argue that because some people with disabilities and low incomes use motor vehicles, vehicle travel reduction policies harm disadvantaged groups. This is generally untrue. Most vehicle travel reduction strategies benefit disadvantaged groups, and vehicle travel programs can be designed to support equity goals. The table below summarizes these effects.

Table 10 **Vehicle Travel Reduction Strategies: Distribution of Impacts**

	Non-drivers	Low-Income Drivers	High-Income Drivers
Benefit	Active and micro mode improvements Transit and ridesharing improvements Flextime and telework Smart Growth (affordable infill) Parking unbundling & cash out Road tolls and fuel taxes	Smart Growth (affordable infill) Flextime and telework Carsharing Distance-based fees Parking cash out	Flextime and telework Parking management Parking fees Road tolls & congestion pricing
Harmed	Reduced travel as a vehicle passenger.	Fuel or carbon tax increases* Parking fees* Road tolls * Road space reallocation	Road space reallocation that reduces traffic capacity

*Non-drivers and lower-income drivers benefit from strategies that improve non-auto modes, create more accessible communities or reduce the external costs that motorists impose on other people. Higher prices (indicated by *) burden low income drivers but their overall impacts depend on how there are structured, how revenues are used and the quality of alternatives.*

Disadvantaged groups tend to benefit from strategies that improve affordable modes and affordable housing options, or reduce traffic external costs. Parking cash out (non-drivers receive the cash equivalent of parking subsidies provided to motorists) and parking unbundling (parking is rented separately from housing) are particularly progressive since they provide large financial benefits to non-drivers. Increasing fuel taxes, parking fees and road tolls can harm motorists directly but their overall impacts depend on how they are structured; if they include discounts for lower-income travellers, or revenues are invested in affordable modes or used to reduce regressive taxes, they can benefit low-income households overall.

Critics claim that disadvantaged workers earn more if they have an automobile (Pisarski 2009), but their additional income is usually less than their additional expenses, making them financially worse off overall. For example, Smart and Klein (2015) found that formerly carless households that obtain a car typical earn about $2,300 more annually but must spend an additional $4,100 on their vehicles. Automobile travel also increases risk and health problems (Lens 2021). As a result, disadvantaged communities tend to benefit more from non-auto improvements than from vehicle subsidies (CTS 2010; Gao and Johnston 2009). Disadvantaged groups can benefit from efficient road tolls since they seldom drive under congested conditions and bear external traffic costs (Manville and Goldman 2018).

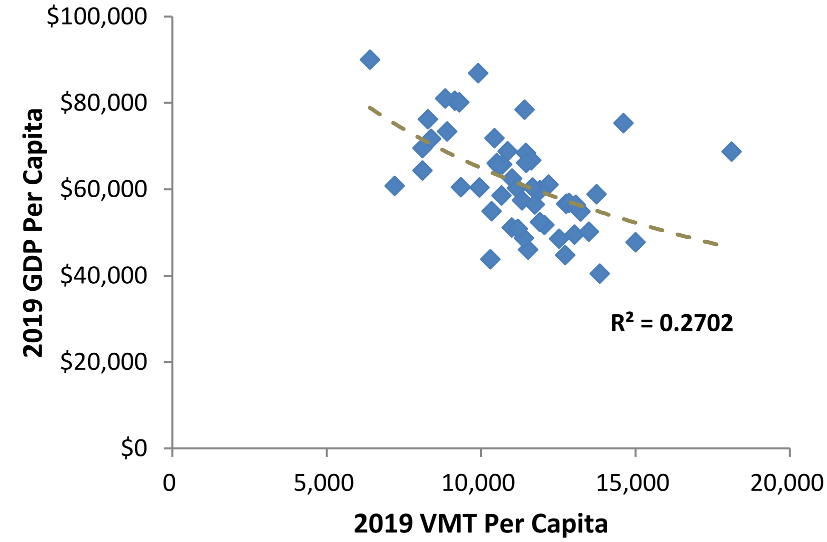
This indicates that most disadvantaged people benefit overall from vehicle travel reduction strategies that improve affordable modes, provide financial savings to non-drivers, create more compact, multimodal communities and reduce external costs. Any equity concerns can be addressed by providing need-based discounts (Alexander, Alfonzo and Lee 2021).

Harms the Economy

Critics sometimes argue that because most economic activities involve motor vehicle travel, vehicle travel reductions reduce economic productivity (Pozdena 2009). That is generally untrue. Although vehicle travel supports economic activities it also imposes large costs. Vehicle travel reduction strategies that increase transportation system efficiency provide economic benefits. For example, TDM incentives that reduce congestion delays and favor commercial and public transit vehicles tend to increase productivity. Efficient parking management can reduce development costs. Non-auto travel improvements can improve workers' access to jobs and the pool of workers available to businesses (Wu, et al. 2021). Businesses tend to be more productive in denser urban areas due to agglomeration efficiencies (Melo, Graham and Noland 2009).

Research indicates that increases from very low to moderate levels of mobility tend to increase economic productivity, but beyond an optimal level (typically about 5,000 annual vehicle-miles per capita, depending on conditions) additional vehicle travel reduces productivity (DOE 2021; Ecola and Wach 2012; Kooshian and Winkelman 2011; McMullen and Eckstein 2011; Ecola and Wachs 2012). This makes sense since marginal benefits tend to decline while costs tend to increase at high levels of mobility, as described in Figure 6. Within developed countries there tends to be a negative relationship between vehicle travel and economic productivity (Zheng, et al. 2011), as illustrated below.

Figure 12 **Per Capita GDP and VMT for U.S. States (FHWA 2019)**



Per capita economic productivity tends to increase as vehicle travel declines. (Each dot is a U.S. state.)

This suggests that more compact and multimodal urban regions tend to be more economically productive than sprawled, automobile dependent regions.

This indicates that vehicle travel reduction strategies with well-designed vehicle travel reduction programs that reflect economic principles are likely to increase productivity, employment, property values and tax revenues.

Cost Efficiency

Critics argue that vehicle travel reduction programs are less efficient at achieving specific goals, such as congestion or emission reductions, than engineering solutions such as road expansions and clean (efficient and alternative fuel) vehicles (Poole 2009). This may be true if goals are considered individually, but engineering solutions tend to induce additional vehicle travel which exacerbates other problems (Moshiri and Aliyev 2017). The table below compares various transportation improvement strategies: Roadway expansions can reduce congestion, and clean vehicles help conserve fossil fuel and reduce pollution, but by inducing more vehicle travel they contradict other objectives. Vehicle travel reduction programs help achieve many planning objectives and so tend to be most cost-effective overall (Alarfaj, Griffin and Samaras 2021).

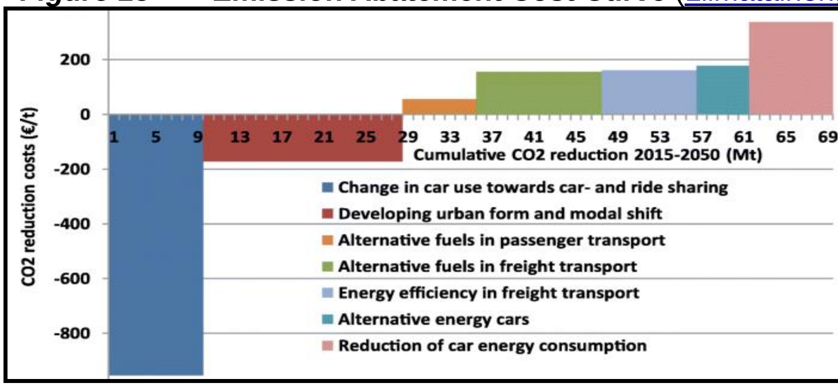
Table 11 **Comparing Impacts**

Planning Objectives	Roadway Expansions	Efficient and Alt. Fuel Vehicles	TDM and Smart Growth
Vehicle Travel Impacts	*Increased*	*Increased*	*Reduced*
Congestion reduction	✓	×	✓
Roadway cost savings	×	×	✓
Parking cost savings	×	×	✓
Consumer savings and affordability	×	Mixed	✓
Traffic safety	×	×	✓
Independent mobility for non-drivers	×	×	✓
Fossil fuel conservation	×	✓	✓
Pollution reduction	×	✓	✓
Physical fitness and health	×	×	✓
Efficient development (reduced sprawl)	×	×	✓

(✓= Achieve objectives. ×= Contradicts objective.) Roadway expansions can reduce congestion and clean vehicles can conserve fossil fuel and reduce pollution, but by inducing more vehicle travel they contradict other objectives. TDM and Smart Growth strategies help achieve all objectives.

For example, studies that calculate emission reduction cost efficiency find that engineering strategies, such as more efficient and alternative energy cars, are relatively expensive, while vehicle travel reduction strategies often have negative costs due to their co-benefits (Farbes, Haley and Jones 2021), as illustrated below. Vehicle travel reductions strategies are cost effective and necessary for achieving emission reduction goals (McCahill 2021).

Figure 13 **Emission Abatement Cost Curve** (Liimatainen, Pöllänen and Viri 2018)



This study found that vehicle travel reduction strategies, such as car- and ride-sharing and compact urban form, have negative costs (they provide net savings, indicated by costs below zero) due to their large co-benefits, while alternative fuels and energy efficient cars tend to have relatively high costs, over 100€ per tonne.

Road User Fee "Diversions" Are Unfair to Motorists

Critics argue that it is unfair to use road user fees, such as fuel taxes and road tolls, to finance non-auto modes, which they call these *diversions* (Feigenbaum and Hillman 2020). However, user fees only cover about half of roadway costs and a smaller portion of government-mandated parking facilities; the rest is financed in ways that residents pay regardless of how they travel. If it is unfair for motorists to fund non-auto infrastructure it is more unfair for non-drivers to fund automobile infrastructure (Litman 2022). The OECD report, *Distributional Effects of Urban Transport Policies to Discourage Car Use* (Lindsey, Tikoudis and Hassett 2023) concludes that vehicle travel reduction policies can benefit disadvantaged groups in many ways, and can be designed to support social equity goals.

All Travel Imposes External Costs

Critics argue that all travel imposes external costs, so it is unfair to focus on automobile external costs (O'Toole 2019), but their analysis is faulty (Walker 2016). Critics only consider a limited set of costs, and measure them per mile, which ignores the higher costs resulting from motorists' higher annual mileage. Walking and bicycling have low external costs. Transit has higher costs and subsidies but operates in dense urban areas where automobile costs are particularly high, and is generally less costly than providing taxi service for non-drivers. In most situations, automobile external costs are higher than other modes per mile, and since motorists travel more per year their per capita annual external costs are generally much higher than for non-drivers (Gössling, et al. 2018; Litman 2019; Schröder, et al. 2022).

Reduces Freedom

Critics sometimes argue that vehicle travel reduction policies are "social engineering" and a "war on cars" that reduces travellers' freedom (Fix 2017; Greenhut 2019). It is true that cars give motorists freedom of movement, but by reducing non-auto travel options and imposing external costs on others, auto-oriented planning reduces other freedoms, as indicated in the table below. As Professor Mark Hallenbeck explains, "All transportation planning is social engineering. We've spent 100 years making it easy to drive. We've spent 100 years making it really hard to walk, bicycle or take a bus. So people drive, because it makes sense." (Sabatini 2018)

Table 12 **Auto Travel Impacts on Freedom**

Freedoms Increased	Freedoms Reduced
• Motorists' freedom of movement.	• Independent mobility for non-drivers. • Drivers' freedom from chauffeuring burdens • Travellers' financial freedom. • Freedom from congestion, risk and pollution.

Automobile travel increases motorists' freedom of movement but reduces other types of freedom.

Responding to Criticisms

A poorly designed vehicle travel reduction programs could be inefficient and unfair. To maximizing their effectiveness and benefits, vehicle travel reductions programs should include an integrated set of policies that reflect basic economic principles: consumer sovereignty, efficient pricing and comprehensive analysis as recommended in this report. Such programs increase overall accessibility in ways that enhance high-value travel while reducing vehicle travel with negative net benefits. This maximizes efficiency and fairness.

Conclusions

North Americans currently average about 10,000 annual vehicle-miles per capita. Conventional planning assumes all that vehicle travel is justified and beneficial. This study offers a different perspective. It indicates that high levels of vehicle travel result, in part, from planning distortions that result in automobile dependency and sprawl, creating low-accessibility/high-mobility communities. This is wasteful and unfair. This report identifies why and how to create more accessibility and multimodal communities where people can meet their needs with less driving.

To be efficient and equitable a transportation system must reflect certain principles, as summarized in the table below. This study indicates that given better options and efficient incentives people would choose to drive less, rely more on non-auto modes, spend less time and money on travel, and be better off overall as a result.

Table 13 **Principles and Reforms for Optimal Vehicle Travel** (Litman 2024)

Principle	Description	Reforms Needed	Travel Impacts
Consumer sovereignty	Planning responds to consumer demands.	More multimodal planning. Consider non-auto demands.	Improves and increases non-auto travel.
Fair share resource allocation	All users receive comparable shares of public resources.	More multimodal planning and investments.	Improves non-auto travel and reduces auto travel.
Efficient pricing	Users pay directly for infrastructure and external costs.	Efficient fuel taxes, road tolls, parking and emission fees.	Reduces vehicle travel, particularly under urban-peak conditions.
Comprehensive planning	Individual, short-term decisions should support strategic, long-term goals.	More comprehensive analysis of impacts, including currently overlooked planning goals.	Increases investments in non-auto modes and in TDM programs.
Accessibility-based planning	Evaluates performance based on accessibility.	Accessibility-based planning analysis.	Reduces the amount of driving needed to achieve access.

These five principles can help guide planning decisions. They tend to support more comprehensive and multimodal planning, Smart Growth policies and TDM incentives.

To support these reforms many jurisdictions are establishing vehicle travel reduction targets. These help align individual planning decisions with strategic goals. Analysis in this study indicates that vehicle travel reduction targets of 20-40% are justified. Many community goals, including congestion and emission reductions, affordability, equity, public health, and community livability are only achievable with more multimodal planning and reduced driving.

Critics argue that vehicle travel reduction targets are inefficient and unfair, sometimes described as a "war on cars," but their arguments cannot stand scrutiny. High levels of automobile travel result from planning distortions which force people who drive less than average to subsidize those who drive more than average, which is unfair, and since driving increases with income, tends to be regressive – it harms disadvantaged groups. This research indicates that vehicle travel can be reduced in ways that achieve economic, social and environmental goals, provide financial savings, benefit most travellers, and enhance freedom overall.

References

ABAG (2021), *VMT Policy Adoption Peer Exchange Resources*, Association of Bay Area Governments (https://abag.ca.gov); at https://bit.ly/3V5dxH7.

ACEEE (2019), *Sustainable Transportation Planning*, American Council for an Energy Efficient Economy (www.aceee.org); at https://database.aceee.org/city/sustainable-transportation-planning.

Gabriel Ahlfeldt and Elisabetta Pietrostefani (2017), *Demystifying Compact Urban Growth: Evidence from Across the World*, New Climate Economy (newclimateeconomy.report); at https://bit.ly/2XbGliS.

Abdullah F. Alarfaj, W. Michael Griffin and Constantine Samaras (2021), "Decarbonizing US Passenger Vehicle Transport Under Electrification and Automation Uncertainty has a Travel Budget," *Environmental Research Letters*, Vo. 15/9 (iopscience.iop.org/article/10.1088/1748-9326/ab7c89).

Serena E. Alexander, Mariela Alfonzo and Kevin Lee (2021), *Safeguarding Equity in Off-Site Vehicle Miles Traveled (VMT) Mitigation in California*, Mineta Institute (DOI: 10.31979/mti.2021.2027).

BBC (2023), *New Planning Rules to Help Hit Scottish Emissions Targets*, British Broadcasting Corporation (www.bbc.com); at www.bbc.com/news/uk-scotland-scotland-politics-64234765.

Reyla Bellis (2021), *Minnesota and California Move Toward Reducing VMT to Address Climate Change*, State Smart Transportation Initiative (https://ssti.us); at https://bit.ly/3e4VpbY.

Marlon G. Boarnet (2013), "The Declining Role of the Automobile and the Re-Emergence of Place in Urban Transport," *Regional Science Policy & Practice*, Vo. 5/2, pp. 237–253 (doi.org/10.1111/rsp3.12007).

Ralph Buehler (2016), *Moving Toward Active Transportation: How Policies Can Encourage Walking and Bicycling*, Active Living Research (https://activelivingresearch.org); at https://bit.ly/2WpfkKx.

Matt Butner and Bethany A. Davis Noll (2020), *A Pileup. Surface Transportation Market Failures and Policy Solutions*, Institute for Policy Integrity (https://policyintegrity.org); at https://bit.ly/3d65QuM.

CalSTA (2021), *Climate Action Plan for Transportation Infrastructure* (CAPTI), California State Transportation Agency (https://calsta.ca.gov); at https://calsta.ca.gov/subject-areas/climate-action-plan.

Caltrans (2020), *Vehicle Miles Traveled-Focused Transportation Impact Study Guide*, California Department of Transportation (https://dot.ca.gov); at https://bit.ly/3DDSm5H. Also see *SB 743 Implementation Resources* (https://dot.ca.gov/programs/sustainability/sb-743/sb743-resources).

CAPCOA (2021), *Handbook for Analyzing Greenhouse Gas Emission Reductions*, California Air Pollution Control Association (www.caleemod.com); at www.caleemod.com/handbook/index.html.

CARB (2015), *Impacts of Transportation and Land Use-Related Policies*, California Air Resources Board (http://arb.ca.gov/cc/sb375/policies/policies.htm).

CARB (2022), *SB 150 Dashboard - Tracking Progress - Sustainable Communities*, California Air Resources Board (http://arb.ca.gov); at https://tinyurl.com/47v534s4.

CleanBC (2021), *Roadmap to 2030*, British Columbia (www.gov.bc.ca); at https://bit.ly/3elVc8i.

CNT (2022), *Housing and Transportation Affordability Index*, Center for Neighborhood Technology (https://htaindex.cnt.org); at https://htaindex.cnt.org/total-driving-costs.

Cool Climate Network (https://coolclimate.berkeley.edu) produces heat maps showing household emissions by zip code taking into account transportation, housing, food and consumer goods.

CPSTF (2017), *Physical Activity: Built Environment Approaches Combining Transportation System Interventions with Land Use and Environmental Design*, Center for Disease Control, The Community Guide (www.thecommunityguide.org); at https://bit.ly/3jnTwIg.

CTS (2010), *How Light-Rail Transit Improves Job Access for Low-Wage Workers*, Center for Transportation Studies, University of Minnesota (www.cts.umn.edu); at https://bit.ly/3yScTRa.

Melanie Curry (2022), *CARB's Scoping Plan for Climate Action Calls for Much Less Driving*, StreetBlog CAL (https://cal.streetsblog.org); at https://bit.ly/3WDPDTH.

Kevin DeGood and Michela Zonta (2022), "Colorado's Greenhouse Gas Emissions Rule for Surface Transportation Offers a Model for Other States and the Nation," *American Progress* (www.americanprogress.org); at https://ampr.gs/3NCBiTe.

DfT (2020), *Gear Change: A Bold Vision for Cycling and Walking*, UK Dept. for Transport (www.dft.gov.uk); at https://bit.ly/39ZgZ0t.

DOE (2021), *Gross Domestic Product and Vehicle Miles Traveled*, US Department of Energy (www.energy.gov); at https://bit.ly/3F9hpjy.

Liisa Ecola and Martin Wachs (2012), *Exploring the Relationship between Travel Demand and Economic Growth*, Federal Highway Administration (www.fhwa.dot.gov); at https://bit.ly/3yXXNJO.

Eltis (2021), *Planner's Guide to Sustainable Urban Mobility Management (SUMP)* and a *Toolbox for Mobility Management*, Urban Mobility Observatory (www.eltis.org); at https://bit.ly/3HK8SX0. Also see the *Eltis Case Study Database* (www.eltis.org); at https://www.eltis.org/resources/case-studies.

EU (2021), *The New European Urban Mobility Framework*, European Union (https://ec.europa.eu); at https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6729.

Reid Ewing and Shima Hamidi (2014), *Measuring Urban Sprawl and Validating Sprawl Measures*, Metropolitan Research Center for Ntl. Cancer Inst. (https://gis.cancer.gov); at https://bit.ly/2I6StdG.

Jamil Farbes, Ben Haley and Ryan Jones (2021), *Marginal Abatement Cost Curves for U.S. Net-Zero Energy Systems*, Environmental Defense Fund (www.edf.org); at https://bit.ly/3gqSXli.

F&P (2022), *Providing VMT: Getting Beyond LOS*, Fehr & Peers (www.fehrandpeers.com); at www.fehrandpeers.com/vmt-impacts. Also see the *SB743 Website* (www.fehrandpeers.com/sb743) and the *VMT+ Tool* (www.fehrandpeers.com/project/find-my-vmt).

Baruch Feigenbaum and Joe Hillman (2020), *How Much Gas Tax Money States Divert Away From Roads*, Reason Foundation (https://reason.org); at https://bit.ly/3vvbjpi.

FHWA (annual reports), *Highway Statistics*, US Federal Highway Administration (www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.cfm).

FHWA (2014), *Nonmotorized Transportation Pilot Program*, John A Volpe National Transportation Systems Center, USDOT (www.fhwa.dot.gov); at https://bit.ly/1KakRWU.

Lauren Fix (2017), *The War on Cars*, Prager University (www.prageru.com); at www.youtube.com/watch?v=k8Lo0ieyQtQ.

Yonah Freemark (2022), *What the Inflation Reduction Act Will — And Won't — Do For Sustainable Transportation*, StreetBlog USA (https://usa.streetsblog.org); at https://bit.ly/3GNP8RZ.

Camille A. Galdes and Justin Schor (2022), *Don't Underestimate Your Property: Forecasting Trips and Managing Density*, Wells and Assoc. (www.wellsandassociates.com); at https://bit.ly/3CW2itO.

Shengyi Gao and Robert A. Johnston (2009), "Public vs. Private Mobility for Low Income Households," *Transp. Research Rec. 2125* (www.trb.org), pp. 9-15; at www.worldtransitresearch.info/research/82.

Steven Greenhut (2019), "California's War on Cars," *Spectator* (https://spectator.org); at https://spectator.org/californias-war-on-cars.

Stefan Gössling, et al. (2018), "The Social Cost of Automobility, Cycling and Walking in the European Union," *Ecological Economics*, Vol. 158, pp. 65-74 (https://doi.org/10.1016/j.ecolecon.2018.12.016).

Zeke Hausfather (2020), *Factcheck: How Electric Vehicles Help to Tackle Climate Change*, Carbon Brief (www.carbonbrief.org); at https://bit.ly/36VQMhK.

Alejandro Henao, et al. (2015), "Sustainable Transportation Infrastructure Investments and Mode Share Changes," *Transport Policy*, Vol. 37, pp. 64-71, (https://doi.org/10.1016/j.tranpol.2014.09.012).

ICAT (2020), *ICAT Toolbox: Policy Assessment Guidelines*, Initiative for Climate Action Transparency (https://climateactiontransparency.org); https://bit.ly/3q8iEXn and https://bit.ly/3iK5US5.

ICF (2021), *The Costs of the Vehicle Economy in Hawaii*, Ulupono Initiative (https://ulupono.com); at https://ulupono.com/media/ingpfb23/final-report-costs-of-vehicle-economy-in-hawaii-03-9-21.pdf.

Ireland (2023), *Climate Action Plan 2023*, Government of Ireland (www.gov.ie); at www.gov.ie/en/publication/7bd8c-climate-action-plan-2023.

ITDP (2021), *Taming Traffic: Strategies to Reduce Driving and Prioritize Sustainable Transportation In Cities*, Institute for Transportation and Development Policy (itdp.org); at https://tinyurl.com/y2rb2pu6.

ITE (2023), *Vehicle-Miles Traveled (VMT) as a Metric for Sustainability*, Institute of Transportation Engineers (www.ite.org); at https://ecommerce.ite.org/imis/ItemDetail?iProductCode=IR-154-E. Also see, "VMT as a Metric of Sustainability: Why and How to Implement Vehicle Travel Reduction Targets," *ITE Journal* (www.ite.org); at www.vtpi.org/ITEJ_VMT_as_a_Metric_July2024.pdf.

ITF (2021), *Travel Transitions: How Transport Planners and Policy Makers Can Respond to Shifting Mobility Trends*, International Transport Forum (www.itf-oecd.org); at https://bit.ly/3BGJewh.

ITF (2022), *Transport Climate Action Directory*, International Transport Forum (www.itf-oecd.org); at www.itf-oecd.org/tcad-measures. Describes and evaluates over 60 climate mitigation strategies.

Frank Jossi (2024), "Minnesota Highway Projects Will Need to Consider Climate Impacts in Planning," *MINNPost* (www.minnpost.com); at https://tinyurl.com/2hupj4y5.

Tammy Klein (2019), "What U.S. Cities Are Doing to Decarbonize Transport: Focus on Fuels & VMT Reduction," *Future Fuel Strategies* (https://futurefuelstrategies.com); at https://bit.ly/3jOiRM0.

Chuck Kooshian and Steve Winkelman (2011), *Growing Wealthier: Smart Growth, Climate Change and Prosperity*, Center for Clean Air Policy (www.ccap.org); at www.growingwealthier.info.

Paula Kuss and Kimberly A. Nicholas (2022), "A Dozen Effective Interventions to Reduce Car Use in European Cities," *Case Studies on Transport Policy* (https://doi.org/10.1016/j.cstp.2022.02.001).

Amy E. Lee and Susan Handy (2018), "Leaving Level-of-Service Behind: Implications of a Shift to VMT Impact Metrics," *Transportation Business and Management* (doi.org/10.1016/j.rtbm.2018.02.003).

Michael Lens (2021), *Low-Density Zoning, Health, and Health Equity*, Health Affairs (www.healthaffairs.org); at www.healthaffairs.org/do/10.1377/hpb20210907.22134/full.

Heikki Liimatainen, Markus Pöllänen and Riku Viri (2018), "CO_2 Reduction Costs and Benefits in Transport," *European Journal of Futures Research*, Vo. 6/22 (doi.org/10.1186/s40309-018-0151-y).

Robin Lindsey, Ioannis Tikoudis and Katherine Hassett (2023), *Distributional Effects of Urban Transport Policies to Discourage Car Use*, Paper 211, OECD (doi.org/10.1787/8bf57103-en).

Todd Litman (2013), "The New Transportation Planning Paradigm," *ITE Journal* (www.ite.org), Vol. 83, June, pp. 20-28; at www.vtpi.org/paradigm.pdf.

Todd Litman (2014), *Economically Optimal Transport Prices and Markets,* Int. Transportation Economic Dev. Con. (www.vtpi.org/ITED_optimal.pdf); at www.vtpi.org/sotpm.pdf.

Todd Litman (2019), *Transportation Cost and Benefit Analysis*, Victoria Transport Policy Institute (www.vtpi.org/tca).

Todd Litman (2020), *Win-Win Transportation Emission Reduction Strategies*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/wwclimate.pdf.

Todd Litman (2021), *Land Use Impacts on Travel*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/landtravel.pdf.

Todd Litman (2022), *Fair Share Transportation Planning*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/fstp.pdf.

Todd Litman (2023), *Are Vehicle Travel Reduction Targets Justified*, World Conference for Transportation Research (https://wctrs-society.com); at www.vtpi.org/vmt_red.pdf.

Todd Litman (2024), *Transportation Planning Principles, Distortions and Reforms*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/distort.pdf; originally published as "Transportation Market Distortions," *Berkeley Planning Journal* (https://escholarship.org/uc/item/7s57r2j3).

Todd Litman, Ousama Shebeeb and Ronald T. Milam (2024), "VMT as a Metric of Sustainability: Why and How to Implement Vehicle Travel Reduction Targets," *ITE Journal* (www.ite.org/publications/ite-journal); at www.vtpi.org/ITEJ_VMT_as_a_Metric_July2024.pdf.

Todd Litman and Meiyu (Melrose) Pan (2023), *TDM Success Stories*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/tdmss.pdf.

Jana Lynott (2014), *Reconnecting Small-Town America by Bus: New Federal Transit Rules Spur Investment*, American Association of Retired Persons (www.aarp.org); at http://tinyurl.com/pgtct9q.

Glen Lyons (2020), *The Benefits of a 'Decide and Provide' Approach to Transport Planning*, Transport for the North (https://transportforthenorth.com); at https://bit.ly/3F8sst3.

Michael Manville and Emily Goldman (2018), "Would Congestion Pricing Harm the Poor? Do Free Roads Help the Poor?" *Journal of Planning Education & Research*, Vo. 38/3, pp. 329-344 (doi.org/10.1177/0739456X17696944)

Chris McCahill (2021), *The Amount We Drive Could Make or Break Clean Energy Plans*, State Smart Transportation Initiative (https://ssti.us); at https://bit.ly/3ifHouH.

B. Starr McMullen and Nathan Eckstein (2011), *The Relationship between Vehicle Miles Traveled and Economic Activity*, Oregon Transportation Research and Education Consortium (OTREC); at https://bit.ly/2YvW3aC; summary at *Transportation Research Record* (https://doi.org/10.3141/2297-03).

MdT (2018), *Transporting Québec Towards Modernity: Sustainable Mobility Policy Action Plan for 2018-2023*, Ministère des Transports (www.transports.gouv.qc.ca); at https://bit.ly/3WCxgzh.

Patricia C. Melo, Daniel J. Graham and Robert B. Noland (2009), "Meta-Analysis of Estimates of Urban Agglomeration Economies," *Regional Science and Urban Economics*, Vol. 39/3, pp. 332-342 (doi.org/10.1016/j.regsciurbeco.2008.12.002).

Metro (2021), *Daily Vehicle Miles of Travel*, Portland Metro (www.oregonmetro.gov); at https://bit.ly/3YyJl9s.

Steven Morris (2023), "Welsh Road Building Projects Stopped After Failing Climate Review, *The Guardian* (www.theguardian.com); at https://bit.ly/3q4JsNc.

Brian J. Morton, Joseph Huegy, and John Poros (2014), *Close to Home: A Handbook for Transportation-Efficient Growth in Small Communities and Rural Areas*, NCHRP; at https://bit.ly/2wYzMF8.

Saeed Moshiri and Kamil Aliyev (2017), "Rebound Effect of Efficiency Improvement in Passenger Cars," *Ecological Economics*, Vo. 131, pp. 330-341 (doi.org/10.1016/j.ecolecon.2016.09.018).

NAR (2020), *National Community Preference Surveys*, National Association of Realtors (www.realtor.org); at https://bit.ly/304XFwz.

NCDOT (2021), *VMT (Vehicle Miles Traveled) Study*, North Carolina Department of Transportation (www.ncdot.gov); at https://bit.ly/3SUzwPG.

Gavin Newsom (2022), *California Releases World's First Plan to Achieve Net Zero Carbon Pollution*, California Office of Governor (www.gov.ca.gov); at https://bit.ly/3j0fpm1.

NextGen (2023), *California at a Crossroads: Unleashing Climate Progress in Transportation Planning*, Climate 100 (https://climate100.nextgenpolicy.org); at https://bit.ly/3rJK0ZM.

NZMoE (2022), *Aotearoa New Zealand's First Emissions Reduction Plan: Table of Actions*, New Zealand Ministry for the Environment (https://environment.govt.nz); at https://bit.ly/3wqqmlg.

Randal O'Toole (2019), *Transportation Costs & Subsidies by Mode*, The Antiplanner (https://ti.org); at https://ti.org/antiplanner/?p=16441.

Alan Pisarski (2009), "The Nexus of Energy, Environment and the Economy: A Win, Win, Win Opportunity," *ITE Journal*, pp. 30-41; at https://bit.ly/3pSob5r.

Robert Poole (2009), "'Moving Cooler' Not So Cool," *Surface Transportation Innovations*, Issue 70, August; http://reason.org/news/show/surface-transportation-innovat-70.

Randall J. Pozdena (2009), *Driving the Economy: Automotive Travel, Economic Growth, and the Risks of Global Warming Regulations*, Cascade Policy Institute (www.cascadepolicy.org).

Carlton Reid (2020), "Scottish Government Plans 20% Cut in Car Use Within Ten Years—And that Includes Electric Cars," *Forbes* (www.forbes.com); at https://bit.ly/2Kg2jAn.

Carlton Reid (2022), "Major New Roads in England May Have Funding Pulled if They Increase Carbon Emissions or Don't Boost Active Travel," *Forbes* (www.forbes.com); at https://bit.ly/3q6pheG.

RMI (2021), *SHIFT Calculator: The State Highway Induced Frequency of Travel (SHIFT)*, Rocky Mountain Institute (https://rmi.org); at https://shift.rmi.org. It is based on methodologies developed for California's Transportation Analysis Framework.

RMI (2024), *Smarter MODES Calculator: Smarter Mobility Options for Decarbonization, Equity, and Safety*, Rocky Mountain Institute (https://rmi.org); at https://tinyurl.com/yx893pd2.

Jeff Sabatini (2018), "The War on Cars Is Real, and It's Being Led by Cities," *Car and Driver* (www.caranddriver.com); at www.caranddriver.com/features/a25634960/the-war-on-cars.

Daniel Schröder, et al. (2022), "Ending the Myth of Mobility at Zero Costs: An External Cost Analysis," *Research in Transportation Economics* (https://doi.org/10.1016/j.retrec.2022.101246).

SDOT (2020), *Seattle Commute Trip Reduction Program: 2019/2020 Performance Update*, Seattle Department of Transportation (www.seattle.gov); at https://bit.ly/3gikKDU.

Gregory H. Shill (2019), "Americans Shouldn't Have to Drive, but the Law Insists on It," *The Atlantic* (www.theatlantic.com); at https://bit.ly/3CfBxP8.

Michael J. Smart and Nicholas J. Klein (2015), *A Longitudinal Analysis of Cars, Transit, and Employment Outcomes*, Mineta Institute (http://transweb.sjsu.edu); at https://bit.ly/3841t25.

Mike Spack and Jonah Finkelstein (2014), *Travel Demand Management: Analysis of the Effectiveness of TDM Plans*, Spack Consulting (www.spackconsulting.com); at https://bit.ly/2K97eTj.

Street Smart (www.thinkstreetsmart.org) is a clearinghouse that provides comprehensive information for integrating climate change, public health, and equity concerns into transportation.

STTI (2018), *Modernizing Mitigation: A Demand-Centered Approach*, Smart State Transportation Initiative (www.ssti.us); at https://bit.ly/2Nri7Ok.

SUM4All (2019), *Catalogue of Policy Measures Toward Sustainable Mobility*, Sustainable Mobility for All (www.sum4all.org); at https://sum4all.org/key-products. Also see Global Roadmap of Action.

Eric Sundquist, Chris McCahill and Michael Brenneis (2021), *Measuring Accessibility: A Guide for Transportation and Land Use Practitioners*, State Smart Transportation Initiative (https://ssti.us); at https://ssti.us/accessibility-analysis. Summarized in Eric Sundquist and Chris McCahil (2021), "Accessibility: From Ivory Tower to Practice," *ITE Journal*; May, pp. 44-49; at https://bit.ly/3ThTIeb.

TfA and SGA (2020), *Driving Down Emissions: Transportation, Land Use and Climate Change*, Transportation for America (https://t4america.org) and Smart Growth America (https://smartgrowthamerica.org); at https://bit.ly/3tLZBEw.

Lewis Thorwaldson (2020), *LoS-less Planning: VKT for Equitable Outcomes*, Engineering New Zealand Transportation Group Annual Conference, Christchurch; at https://bit.ly/39EVX5W.

Adie Tomer and Caroline George (2023), *Building for Proximity: The Role of Activity Centers in Reducing Total Miles Traveled*, Brookings Ins. (www.brookings.edu); at https://bit.ly/44yOArB.

Paul Joseph Tranter (2010), "Speed Kills: The Complex Links Between Transport, Lack of Time and Urban Health," *Journal of Urban Health*, Vol. 87/2 (doi:10.1007/s11524-009-9433-9); at https://bit.ly/3zicfxN.

TRICS (2021), *Guidance Note on the Practical Implementation of the Decide & Provide Approach*, TRICS Consortium (www.trics.org); at https://tinyurl.com/mvm5pxbz. Also see *Implementing 'Decide & Provide': Requirements for Transport Assessments*, at https://bit.ly/3BfZt8t.

TTI (2022), *Travel Options Strategies*, Texas Transportation Institute (http://mobility.tamu.edu/mip/strategies.php).

TUMI (2019), *Sustainable Urban Transport: Avoid-Shift-Improve [A-S-I]*, Transformative Urban Mobility Initiative (www.transformative-mobility.org); at https://bit.ly/3RFeyUL.

VTPI (2020), *Online TDM Encyclopedia*, Victoria Transport Policy Institute (www.vtpi.org/tdm).

Jerrett Walker (2016), *How to Read the Best Anti-Transit Writing*, Human Transit (https://humantransit.org); at https://humantransit.org/2016/01/how-to-read-randal-otoole.html.

White House (2021), *President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target*, White House (www.whitehouse.gov); at https://bit.ly/3O0tPyf.

WRI (2019), *Reducing Demand for Vehicle Trips in Cities – Learning Guide*, The City Fix (https://thecityfixlearn.org); at https://bit.ly/3u4qtC1.

WSL (2008), *Adoption of Statewide Goals to Reduce Annual Per Capita Vehicle Miles Traveled by 2050*, Washington State Legislature (https://apps.leg.wa.gov); at https://bit.ly/3rdP6KH.

Hao Wu, et al. (2021), "Urban Access Across the Globe: An International Comparison," *Urban Sustainability* (doi.org/10.1038/s42949-021-00020-2); at https://go.nature.com/3PyK7yY.

Qiyao Yang, et al. (2021), "Bikeway Provision and Bicycle Commuting: City-Level Empirical Findings from the US," Sustainability, Vo. 13, (https://doi.org/10.3390/su13063113).

Peter Yeung (2022), *Cars Are Vanishing from Paris*, Reasons to be Cheerful (https://reasonstobecheerful.world); at https://bit.ly/3CTwKoo.

Asaf Zagrizak (2022), "Israel's Transport Ministry plans Cutting Car Use in Half," *Globes* (https://en.globes.co.il); at https://bit.ly/3JWZrSx.

Jason Zheng, et al. (2011), "Quantifying the Economic Domain of Transportation Sustainability," *Transportation Research Record 2242*, TRB (www.trb.org), pp. 19-28 (DOI: 10.3141/2242-03).

www.vtpi.org/vmt_red.pdf