7. Evaluating Transportation Benefits

This chapter discusses techniques for evaluating transportation benefits including marginal savings, consumer surplus, external benefits, economic productivity, and benefits by mode.

7.1 Chapter Index

7.2 Introduction

Transportation is essential for most personal and economic activities, so transportation improvements can benefit individuals and communities. This chapter discusses ways to evaluate these benefits. As discussed in Chapter 8, benefits and costs often have mirror-image relationships: benefits are measured as reductions in costs, and costs are measured as reduced benefits. For example, roadway improvement benefits are measured by their travel time, vehicle operation and crash cost reductions. As a result, transportation benefit analysis often starts by calculating costs.

In the past, transportation planning focused on a limited set of benefits, primarily related to faster and cheaper automobile travel, but over time has become more comprehensive as summarized below.

Table 7.2-1 **Benefits Considered in Transportation Planning**[1]

Conventional	Comprehensive
	• Affordability (cost savings to lower-income households) • Inclusivity (accommodates all types of travellers) • Social equity • Public fitness and health • More cohesive communities (positive interactions among neighbors)
• Travel time savings • Vehicle operating cost savings • Reduced crash rates • Reduced emission rates	• Reduced per capita crash rates • Reduced per capita emission rates • Reduced stormwater costs and heat island effects • Reduced sprawl and habitat preservation

Conventional transportation planning tends to focus on a limited set of benefits. More comprehensive planning considers additional benefits to travellers and communities.

[1] Todd Litman (2022), *Toward More Comprehensive and Multimodal Transport Planning*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/comp_evaluation.pdf.

Transportation activities provide benefits and impose costs. The goal of transportation planning is to maximize *net benefit*, that is, benefits minus costs, which is sometimes calculated using *benefit/cost ratios* (total benefits divided into total costs), *lifecycle analysis* (total future benefits minus total future costs, discounted by an interest rate), or *net present value* (future net benefits discounted by an interest rate).

Conventional planning tends to evaluate transportation system performance based on vehicle travel conditions, using indicators such as average traffic speeds, roadway level of service, and vehicle operating costs. This assumed that the goal is simply to maximize *mobility* (physical travel). Comprehensive planning evaluates transportation system performance based on *accessibility* (people's ability to reach desired activities), taking into account a variety of accessibility factors including automobile and non-auto travel conditions, transportation network connectivity (the density of connections between roadways, and the quality of connections between modes), land use density and mix (and therefore proximity between destinations), plus user information and travel affordability.[2] This significantly changes the way that transportation benefits are evaluated. Accessibility-based planning evaluates transport system performance based on the quantity and quality destinations that people can access with a given time and money budget, for example, the number of shops they can reach within a 15-minutes trip, or the number of appropriate jobs they can reach within a 30-minute commute.[3] Accessibility-based planning recognizes various trade-offs between different accessibility factors, for example, when expanding roadways degrades walking and bicycling conditions, and encourages more sprawled development patterns which reduce non-auto accessibility.

Accessibility-based planning therefore expands the range of potential transportation system improvements to consider, as indicated in the table below. For example, mobility based planning invests in roadway expansions to increase traffic speed. Accessibility-based planning recognizes that wider roads improve automobile access but reduce non-auto access, it therefore justifies more investments in non-auto facility improvements and land use policies to create more compact and mixed neighborhoods.

Table 7.2-2 Potential Transportation System Improvements

Mobility	Accessibility
• Faster vehicle travel • Cheaper vehicle travel • Safer vehicle travel	• Improved walking and bicycling conditions. • Improved and cheaper public transit and taxi services. • Increased roadway connectivity. • Improved connections between modes (such a bike racks at bus stops, and integrated bus fares). • Denser and more mixed development. • More affordable housing in multimodal neighborhoods.

Shifting to accessibility-based planning expands the range of transport system improvements.

[2] David Levinson and David King (2020), *Transport Access Manual: A Guide for Measuring Connection between People and Places*, University of Sydney (https://ses.library.usyd.edu.au); at https://bit.ly/3vkJBeE.
[3] SSTI (2021), *Measuring Accessibility: A Guide for Transportation and Land Use Practitioners*, State Smart Transportation Initiative (https://ssti.us); at https://ssti.us/accessibility-analysis.

Marginal Analysis

Transportation planning generally involves marginal analysis, that is, the incremental differences between various options. It is therefore important to clearly define the *base* or *alternative cases* when evaluating transportation policies and projects. For example, a roadway expansion's benefits should be compared with a no action case, and alternative investments that could include various combinations of walking, bicycling and public transit improvements and transportation demand management programs.

Most developed countries have extensive roadway networks that allow motorists to reach most destinations with reasonable convenience and comfort. Roadway improvement benefits can generally be measured based on their marginal travel time, vehicle operation and crash cost savings. Non-auto travel options tend to be much more limited. Many communities have incomplete sidewalk and bikeway networks, limited public transit and expensive taxi services. As a result, non-drivers are often unable to access essential services and activities within their limited time and money budgets. Non-auto travel improvements that significantly improve basic access can therefore provide larger, non-marginal benefits. For example, a combination of walking, bicycling, public transit and taxi service improvements may allow non-drivers to access healthcare services, shops, school and jobs, allowing them to live comfortable and productive lives in that community.

Transportation net benefits tend to be maximized by policies that reflect market principles, such as consumer sovereignty, efficient pricing and economic neutrality, as discussed in Chapter 3. These principles favor higher value trips and resource-efficient modes over lower-value trips and resource-intensive modes, and discourage travel in which benefits are less than total costs. More optimal transport markets, with efficient road and parking pricing and more neutral planning practices are likely to increase total benefits while reducing total vehicle travel.[4]

Consumer Surplus Analysis

User transportation benefits can be evaluated using *consumer surplus* analysis, which refers to the value consumers place on consuming a good (in this case, mobility can be considered a consumer good).[5] For example, if in a particular situation you would willingly pay up to $10 to reach a particular destination, but your actual cost is $4, you would enjoy net benefits worth $6. If another person were only willing to pay up to $5 for the same trip, their net benefit would be $1. The total consumer surplus of the two trips would be $7. This represents *travel demand*, that is, the amount and type of travel that people would consume under specific conditions.

When evaluating consumer surplus, benefits from trips that would occur anyway are calculated at their full value, and benefits from trips that occur as a result of reduced costs are calculated using the "rule of half," as described in the box on the following page. For example, a 50¢ per trip transit fare reduction would provide a $500 consumer surplus gain from 1,000 transit trips that would have been made anyway (1,000 x 50¢), and a $100 consumer surplus gain if this price reduction resulted in 400 additional transit trips (400 x 50¢ x ½).

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[4] EU (1996), *Towards Fair And Efficient Pricing in Transport*, European Union (www.europa.eu); Todd Litman (2007), *Socially Optimal Transport Pricing and Markets*, VTPI; at www.vtpi.org/sotpm.pdf; "Market Reforms," *Online TDM Encyclopedia*, VTPI, at www.vtpi.org/tdm/tdm29.htm.

[5] Kenneth Small (1999), "Project Evaluation," in *Transportation Policy and Economics*, Brookings (www.brookings.edu); DfT (2003), *National Transport Model*, UK Dept. for Transport (www.dft.gov.uk).

Explaining the "Rule of Half"[6]
Economic theory suggests that when financial incentives (higher or lower prices) cause changes in consumption, the net consumer surplus averages half of the price change (called the "rule of half"). This takes into account total changes in financial costs, travel time, convenience and mobility as perceived by consumers.

Let's say that vehicle operating costs increased by 10¢ per mile due to higher fuel prices, road tolls or parking fees, and as a result you reduced your annual vehicle use by 1,000 miles. You would not give up highly valuable vehicle travel but there are probably some lower-value vehicle-miles that you would reduce by shifting modes or choosing closer destinations. The vehicle-miles foregone have an incremental value to you, the consumer, between 0¢ and 10¢. If you consider the additional mile worth less than 0¢ (i.e., it has no value), you would not take it anyway. If its worth is 1¢ to 9¢ per mile, a 10¢ per mile incentive will convince you to give it up – you would rather have the money. If the additional mile is worth more than 10¢ per mile, a 10¢ per mile increase is inadequate to convenience you to give it up – you will keep driving. Of the 1,000 miles foregone, we can assume that the average net user benefit (called the *consumer surplus*) is the mid-point of this range, that is, 5¢ per vehicle mile. Thus, we can calculate that miles foregone by a 10¢ per mile financial incentive have an average consumer surplus value of 5¢. This means, for example, that if a $100 increase in vehicle operating costs reduces automobile travel by 1,000 miles, this reduces consumer surplus by $50, and if a $100 reward causes motorists to drive 1,000 miles less, this provides $50 net consumer benefits.

Some people complicate this analysis by trying to value each change in travel time, convenience and vehicle operating costs, but that is unnecessary information. To determine the net consumer benefits we only need to know perceived price changes, either positive or negative, and the resulting consumption changes. This incorporates all of the complex trade-offs between money, time, convenience and the value off mobility.

Some travel provides much more consumer surplus than others. For example, an emergency or urgent errand can provide large consumer benefits, while an low-value vehicle trip may provide negative net benefits because consumer benefits is smaller than external costs. Policies that favor higher-value trips can increase net benefits. For example, efficient road and parking pricing can benefit consumers by allowing them to avoid congestion when they are in a hurry.

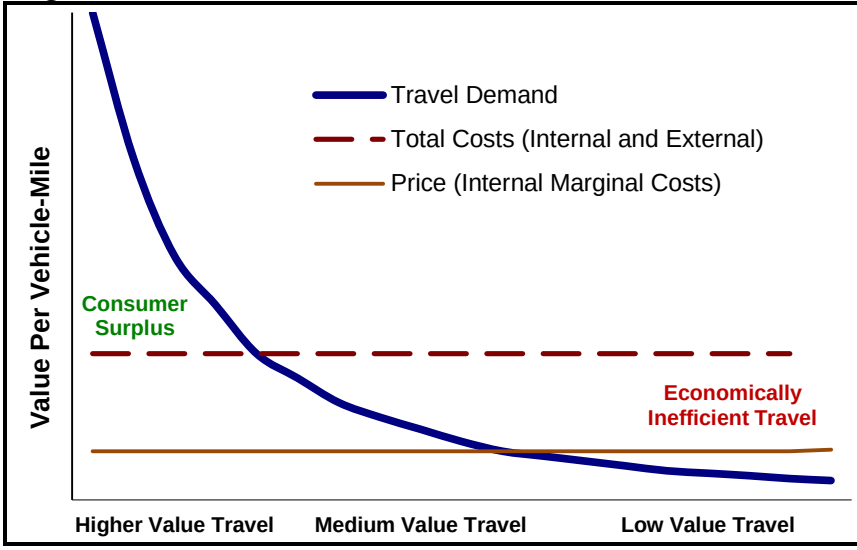
Mobility tends to experience diminishing marginal benefits: user benefits decline with increased travel since rational consumers choose more valuable trips over lower value trips, so each additional mile consists of increasingly less valuable travel that users would forego if their costs increased. For example, if a person can only afford one thousand annual vehicle-miles, those will consist of the highest value vehicle trips, such as urgent errands and special events; the second thousand annual vehicle-miles will be the next most valuable vehicle trips, and so on. Travel demand tends to have a long tail, meaning that if user costs (including money, time, discomfort, etc.) decline, consumers can find reasons to travel more even if the benefits are small. For example, if travel costs were low enough (for example, if somebody else paid for first class service), many consumers would regularly travel to other continents or accept long-distance commutes, even if their net benefits are modest. To the degree that this travel is underpriced (subsidized or imposes external costs), an increasing portion of this travel has negative net costs (total benefits are smaller than total costs).

Figure 7.2-1 illustrates this concept. The consumer demand curve (blue) indicates the value that people place on their vehicle travel, ranging from very high (important trips with no convenient

[6] NAS (2017), *Guide for Conducting Benefit-Cost Analyses of Multimodal, Multijurisdictional Freight Corridor Investments*, National Academy of Sciences (https://doi.org/10.17226/24680).

alternatives) to very low (trips that are low value or could easily shift to more resource-efficient modes. Price (orange line) indicates the internal marginal costs that affects annual vehicle-miles they will travel; the lower the price the more they drive. As driving becomes cheaper households and communities become more mobile and automobile dependent; people and businesses organize their activities around automobile travel. The area above the Price and below the demand curve represents net consumer surplus; user benefits minus user costs. However, automobile travel imposes significant external costs: it requires costly roads and parking facilities, imposes congestion, crash risk and pollution, and displaces non-auto modes which reduces accessibility for non-drivers. Total costs (dashed red line), including indirect and external costs, are about three times the Price of driving. As a result, a major portion of vehicle travel is economically inefficient; its total costs exceed its total benefits.

Figure 7.2-1 **Travel Demand Curve**



Travel demand curves (blue) tend to have long tails: as prices decline mobility increases even if the additional travel provides little benefit and imposes significant external costs. As a result, an increasing portion of travel is economically inefficient (total benefits are less than total costs) because consumer demand is below its total costs.

Serving these trips tends to provide particularly large benefits. Due to declining marginal benefits, improving transportation options for mobility-constrained people tends to provide more benefit per additional trip or mile than similar improvements for high-mobility people, all else being equal. For example, a transportation improvement that allows people with disability or low incomes who currently only make five weekly out-of-home trips to make ten weekly trips is likely to provide more benefits than an improvement that allows people who currently make 20 weekly out-of-home trips to make 25. Because physically and economically disadvantaged groups are mobility constrained, increasing their mobility tends to provide greater value.

This implies that improving non-auto mobility and accessibility tends to provide large benefits to users and their communities, as discussed in Chapter 5.9. It also implies that increasing transportation affordability also provides large benefits.[7] Improving inclusive and affordable travel options gives disadvantaged groups more independent mobility; improves their economic opportunities, such as education, employment and affordable shopping, and therefore their productivity; and reduces chauffeuring burdens.

[7] Todd Litman (2008), *Evaluating Transportation Affordability*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/affordability.pdf.

This implies that improving inclusive and affordable modes, such as universal design standards that accommodate people with disabilities, better walking and bicycling conditions, better and cheaper public transit and taxi services, affordable telecommunications, and more affordable housing in multimodal neighborhoods, tend to provide larger user benefits per additional passenger trip or passenger-mile than transportation improvements which increase vehicle travel by high-annual-mileage groups.

Current transportation planning does a poor job of accounting for these impacts. Planning often supports universal design standards and "basic mobility" services for people with disabilities and low incomes, but seldom recognizes the additional consumer surplus provided by more inclusive and affordable transportation planning, or development policies that create more compact, multimodal communities where non-drivers have good mobility and accessibility options. More comprehensive user benefit analysis is likely to support more multimodal transportation planning and Smart Growth development policies.

Transportation benefits are also affected by the tendency of some travel activities to be *positional goods*, that is, they enhance users' social status.[8] For example, driving is considered more prestigious than other modes, and some automobiles have higher status than others. This creates an economic trap: a situation in which people compete in ways that increase costs but provide no net-benefits.[9] It represents a form of inflation, popularly called "keeping up with the Joneses," which raises everybody's costs without increasing overall welfare. Since automobile travel has higher external costs than other modes, this tends to increase total costs to society. For example, if public transit becomes stigmatized, most commuters will shift to driving for prestige sake, resulting in no net gain in status, and causing roadway costs, traffic and parking congestion, crash risk and pollution to increase.

[8] Todd Litman (2009), "Mobility as a Positional Good: Implications for Transport Policy and Planning," *Car Troubles: Critical Studies of Automobility and Auto-Mobility* (Jim Conley and Arlene Tigar McLaren eds), Ashgate (www.ashgate.com); at www.vtpi.org/prestige.pdf.

[9] Robert H. Frank (2005), "Positional Externalities Cause Large and Preventable Welfare Losses," *American Economic Review*, Vo. 95/2, pp. 137-141 (www.aeaweb.org/articles?id=10.1257/000282805774670392).

External Benefits

This guidebook finds that transport activities impose many external costs. Critics sometimes argue that external benefits offset these external costs. For example, The Highway Users Federation,[10] the International Road Union, the Deutsche Strassenliga (a German freight organization), and the German Club of Automobilists have published reports arguing that driving provides significant external benefits.[11] Supposed benefits include improved personal mobility, improved economic productivity, and general regional economic development.

These studies fail to distinguish between internal and external benefits, counting economic transfers as benefits, and non-marginal analysis.[12] A 1982 USDOT study concluded, "*the preponderance of expert opinion probably lies on the side of saying that there are no external benefits of highway consumption beyond the benefits to the users.*"[13] Other studies reach similar conclusions.[14] An Office of Technology Assessment report also concludes that there are no significant marginal external benefits of transportation.[15]

Studies of external transportation benefits are often used to justify underpricing and other policies that favor motor vehicle travel on the grounds that everybody benefits. But such underpricing would only justified if the project provides *external marginal benefits* that exceed *external marginal costs*. Most transport benefits are internal, that is, benefits to the people or businesses that use a transport activity or service. Economic studies have found few external benefits from increased automobile travel, and virtually no external *marginal* benefits in economically developed countries.[16] That is, you are unlikely to benefit if your neighbors increase their vehicle ownership and use, so there is little rationale for underpricing or other policies that encourage vehicle use.

External benefits tend to be much smaller than external costs because rational consumers and producers try to internalize benefits and externalize costs. For example, if shifting from gasoline to electric vehicles provided external benefits, such as reduced pollution emissions, motorists demand that governments subsidize their purchase, as is now common. External benefits are usually lost through competition.[17] For example, communities often subsidize roads and parking

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[10] Eric Beshers (1993), *External Costs of Automobile Travel and Appropriate Policy Responses*, Highway Users Federation (Washington DC).

[11] Cited in Werner Rothengatter (1991), "Do External Benefits Compensate for External Costs of Transport?", *Transportation Research*, Vol. 28A, p. 321-328 (doi.org/10.1016/0965-8564(94)90006-X).

[12] Per Kageson (1993), *Getting the Prices Right*, European Fed. for Transport & Env. (www.transportenvironment.org), p. 37; Werner Rothengatter (1994), "Obstacles to the Use of Economic Instruments in Transport Policy," in *Internalising the Social Costs of Transport*, OECD (www.oecd.org).

[13] USDOT (1982) *Final Report on the Federal Highway Cost Allocation Study*, (www.dot.gov), p. E-9.

[14] Rothengatter (1991); Heini Sommer, Felix Walter and Rene Neuenschwander (1993), *External Benefits of Transport?*, ECOPLAN (Bern); Jacques Girard and Christopher Hurst (1994), *Investment and Growth: Quality versus Quantity*, European Investment Bank (www.eib.org).

[15] Office of Technology Assessment (1994), *Saving Energy in U.S. Transportation*, (www.access.gpo.gov/ota), p. 97.

[16] Rothengatter (1991); Sommer, Walter and Neuenschwander (1993).

[17] Kenneth Button (1994), *Internalising the Social Costs of Transport*, OECD (www.oecd.org), p.12.

to attract development.[18] This benefits the first communities to use this approach, but other communities are then forced to provide comparable subsidies until most benefits are captured by developers or new residents. Similarly, vehicle manufacturing can provide external benefits to a community by creating employment and tax revenues so they rationally try to extract subsidies and tax discounts from jurisdictions, internalizing much of these benefits.

As explained by a Swiss study of external transportation benefits,[19]

> There exists no justification for subsidizing transport with the motivation of creating additional benefits and not either for compensating non-existing external benefits. The main elements of a modern transport policy will consist in a correct financing of infrastructure, a social marginal tariffication and an optimal regulation of the market. For the evaluation of single projects cost benefit analyses should be undertaken.

Even vehicle travel activity that provides indirect benefits, such as employees driving to work or shoppers driving to stores, only provide external marginal benefits if reduced driving would reduce the total amount of beneficial economic activity that occurs. For example, if employees who currently drive to work could otherwise commute by walking, cycling, ridesharing, public transit or telecommuting, there is no external benefit from automobile use; the benefit of driving over other modes consists of the *internal* benefit to the commuter from the additional speed, convenience, comfort or prestige they gain. Similarly, if shoppers who cannot drive on a particular road would otherwise spend the same money at local stores, there is no external benefit from driving, only an economic transfer from one store to another.

7.3 Economic Productivity and Development Benefits

Transportation is essential for most economic activities so transport planning decisions can have significant impacts. Various techniques can be used to estimate the economic impacts of a particular transport policy or project.[20] Projects that reduce commercial transportation costs, such as freight and service vehicle travel, tend to increase productivity, but projects that reduce personal travel costs often does little to increase productivity, and by increasing external costs can reduce productivity.[21] A region that lacks paved roads may experience significant economic growth from a new highway or bridge that improves accessibility but additional highway capacity provides less marginal benefit.[22] Economic returns from highway expenditures have declined below that of private investments, a trend that can be expected as the most cost

[18] Samuel Nunn (1995), "Role of Local Infrastructure Policies and Economic Development Incentives in Interjurisdictional Cooperation," *Journal of Urban Planning and Development*, Vol. 121, No. 2 (http://pubs.asce.org/journals/urban), June 1995, pp. 41-56.

[19] Swiss ARE (2006), *The Debate on Benefits of Transport*, Swiss Federal Office of Spatial Development (www.are.admin.ch); at www.are.admin.ch/themen/verkehr/00252/00472/00486/index.html?lang=en.

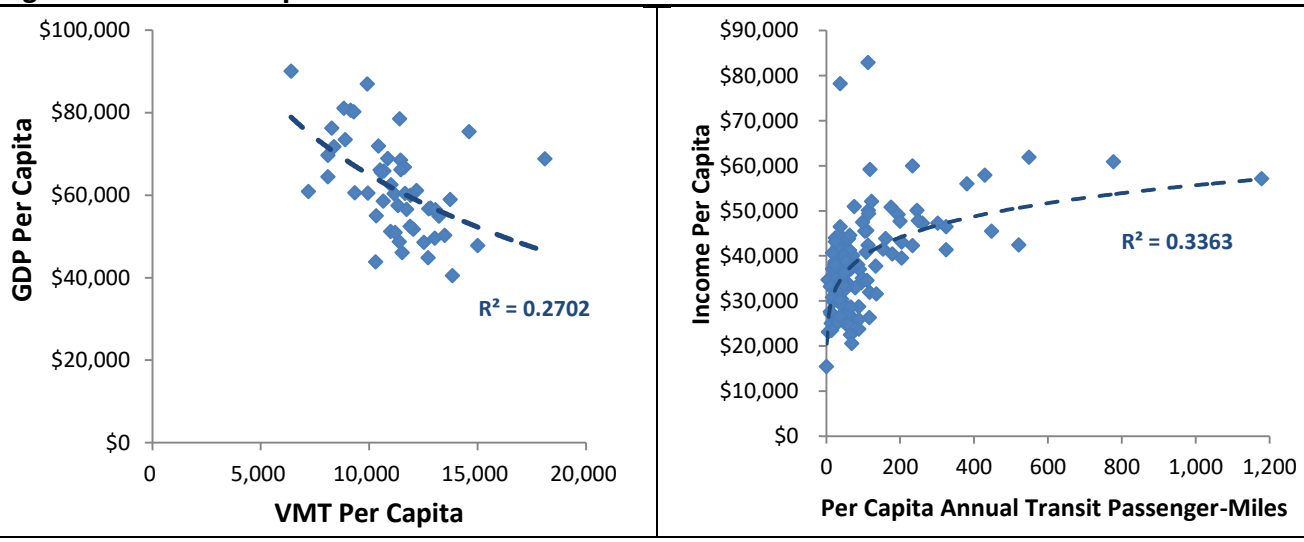
[20] Glen Weisbrod (2000), *Synthesis of Current Practice for Assessing Economic Development Impacts from Transportation Projects*, NCHRP Study 20-5, TRB, National Academy Press (www.nap.edu); Phil Goodwin and Stefan Persson (2001), *Assessing the Benefits of Transport*, OECD (www.oecd.org).

[21] Todd Litman (2014), *The Mobility-Productivity Paradox: Exploring The Negative Relationships Between Mobility and Economic Productivity*, International Transportation Economic Development Conference (https://tti.tamu.edu/conferences/ited2014); at www.vtpi.org/mob_paradox.pdf.

[22] Marlon Boarnet (1997), "New Highways & Economic Productivity: Interpreting Recent Evidence," *Journal of Planning Literature*, Vol. 11, No. 4 (http://jpl.sagepub.com), May 1997, pp. 476-486.

effective and beneficial projects have already been completed.[23] Higher levels of vehicle travel are associated with less productivity, while higher levels of public transit, and the compact development patterns they create, are associated with higher productivity. Investments in resource-efficient modes and transportation demand management programs that result in more efficient use of existing capacity tend to increase productivity more than expanding highways.

Figure 7.3-2 **Per Capita GDP and VMT For U.S. States**[24]



Per capita economic productivity increases as vehicle travel declines (left) and public transit travel increases (right). This and other research indicate that compact development and multimodal transportation systems tend to increase productivity overall.

When evaluating highway impacts it is important to differentiate between net productivity gains and economic transfers, one group or area benefits at another's' expense. For example, expanding urban-fringe highways may increase economic development in suburban areas at the expense of existing urban areas, but generally do not increase total regional economic activity.

[23] M. Ishaq Nadiri and Theofanis Mamuneas (1998), *Contribution of Highway Capital to Output and Productivity Growth in the US Economy and Industries*, FHWA (www.fhwa.dot.gov).

[24] FHWA (annual reports), *Highway Statistics*, Federal Highway Administration (www.fhwa.dot.gov/policy/ohpi/hss/index.htm).

7.4 Benefits by Mode

Because most communities have well-developed roadway networks, expanding these facilities tends to provide only marginal benefits; small travel time or vehicle operating savings, or small increases in accessibility. However, non-auto transportation networks are often incomplete and inferior, so completing those networks and improving intermodal connections can provide large benefits to non-drivers and reductions in external costs. Increasing transportation system diversity can increase benefits by allowing travellers to choose the best mode for each trip: walking and bicycling for local errands, public transit on bus corridors, and automobiles when they are truly most efficient, considering all benefits and costs.

The table below summarizes benefits provided by different modes.

Table 7.5-1 Benefits by Mode

Mode	Major Benefits
Average Automobile	High level of user mobility and convenience.
Compact Car	Somewhat more affordable and reduces some external costs (fuel consumption and external crash risk) compared with an average automobile, otherwise provides similar benefits.
Electric Car	Reduces some external costs (fuel consumption and pollution emissions) compared with an average automobile, otherwise provides similar benefits.
Van or Light Truck	Greater carrying capacity compared with an average automobile, otherwise provides similar benefits. Important for many economically productive activities (deliveries, construction, tourism, etc.).
Rideshare Passenger	Lowest incremental costs. Does not require ability to drive and so provides equity benefits.
Diesel Bus	Relatively low costs per passenger-mile compared with automobile travel, particularly under urban-peak conditions. Provides equity benefits. Complements walking and bicycling which provides physical activity benefits.
Electric Bus/Trolley	Reduces some external costs (fuel consumption and pollution emissions) compared with diesel bus, otherwise provides similar benefits.
Motorcycle	Relatively low purchase and fuel costs compared with average automobile.
Bicycle	Low costs compared with automobile travel. Does not require ability to drive and so provides equity benefits. Provides internal and external health benefits of physical activity.
Walk	Low costs compared with automobile travel. Does not require ability to drive and so provides equity benefits. Provides internal and external health benefits of physical activity.
Telework	Minimal external costs. Does not require ability to drive and so provides equity benefits.

Table 7.5-2 rates modes ability to achieve various benefits. Automobile and motorcycle travel tend to maximize mobility but provide few other benefits. Rideshare and public transit reduce external costs (particularly under urban-peak conditions) and provide affordability and mobility for non-drivers. Walking and cycling minimize external costs, and provide affordability, mobility for non-drivers and physical fitness. Transit passengers often walk or cycle far enough to provide health benefits. Telework reduces external costs and provides accessibility for non-drivers. Of course, these benefits may vary depending on the particular situation.

Table 7.5-2 **Benefits by Mode Evaluation**

Mode	Mobility	Affordability	Reduced External Costs	Access for Non-Drivers	Public Fitness and Health
Average Automobile	3				
Compact Car	3	1			
Electric Car	3				
Van or Light Truck	3				
Rideshare Passenger	1	3	3	3	
Diesel Bus	1	2	1	3	2
Electric Bus/Trolley	1	2	2	3	2
Taxi	1	1		3	
Motorcycle	2	1			
Bicycle	2	2	3	3	3
Walk	1	3	3	2	3
Telework		1	3	2	

Rating from 1 (small benefit) to 3 (very beneficial).

Conventional planning tends to overlook and undervalue many of these benefits. It recognizes mobility benefits and some external cost reductions (such as reduced air pollution) but not others (such as parking subsidies or sprawl-related costs), and gives little consideration to affordability, accessibility for non-drivers, public fitness and health. More comprehensive transportation benefit analysis can significantly change transportation planning priorities.

7.5 Travel Prioritization Benefits

Because transportation benefits and costs vary widely between trips and modes, net benefits (benefits minus costs) can be increased by prioritizing higher value trips and resource-efficient modes (modes that are more affordable and impose lower external costs) over lower-value trips and resource-intensive modes. Higher value trips include emergency, freight and service vehicles, and urgent errands. Resource-efficient modes include walking, bicycling, ridesharing, public transit, and telework. Prioritizing efficient modes is sometimes called a sustainable transportation hierarchy.

A variety of strategies can be used to prioritize travel, often called Transportation Demand Management (TDM). Prioritization policies include bike-, bus-, HOV- and truck-lanes; road space reallocation; efficient road and parking pricing; commute trip reduction programs.

Efficient transportation pricing tests travellers' willingness to pay for their travel activity, so society avoids bearing ten dollars in costs for a trip that the user only values at five dollars, and encourages travellers to choose more resource-efficient modes when possible. It ensures that high value vehicle trips, such as urgent errands and freight deliveries, have freeflow traffic and convenient parking.

7.7 Information Resources

Information sources on transportation benefit evaluation techniques are described below.

BIC (2014), *Measuring the External Benefits of Public Transport: A Bus Industry Perspective*, Bus Industry Confederation (https://movingpeople.com.au); at https://bit.ly/3WkK7W1.

Ulrich Blum (1998), "Positive Externalities and the Public Provision of Transportation Infrastructure," *Journal of Transportation Statistics*, Vo. 1/3 (www.bts.gov), pp. 81-88; at https://bit.ly/3Icvtf4.

EDRG (2007), *Monetary Valuation of Hard-to-Quantify Transportation Impacts: Valuing Environmental, Health/Safety & Economic Development Impacts*, NCHRP 8-36-61, TRB (www.trb.org); at www.statewideplanning.org/_resources/63_NCHRP8-36-61.pdf.

Hays Gamble and Thomas Davinroy (1978), *Beneficial Effects Associated with Freeway Construction*, Report 193, TRB (www.trb.org); at https://bit.ly/3tyayLC.

Phil Goodwin and Stefan Persson (2001), *Assessing the Benefits of Transport*, European Conference of Ministers of Transport; OECD (www.oecd.org).

Thomas Hogarty (1998), "Social Benefits of Personal Vehicle Travel," *Transportation Quarterly*, Vol. 52, No 2, (www.enotrans.com), Spring, pp. 5-9.

Walter Hook (2003), *Appraising the Social Costs and Benefits of Road Projects*, Institute of Transportation and Development Policy (www.itdp.org) at https://bit.ly/3HUMwSV.

IPART (2014), *External Benefits and Costs*, Independent Pricing and Regulatory Tribunal (www.ipart.nsw.gov.au); at https://bit.ly/3vwtQBD.

ITF (2017), *Economic Benefits of Improving Transport Accessibility*, The International Transport Forum (www.itf-oecd.org); at https://bit.ly/3jgMoCK.

Todd Litman (2008), *Evaluating Accessibility for Transportation Planning*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/access.pdf.

Werner Rothengatter (1991), "Do External Benefits Compensate for External Costs of Transport?", *Transportation Research*, Vol. 28A, p. 321-328 (doi.org/10.1016/0965-8564(94)90006-X).

Swiss ARE (2005, 2010 and 2021), *External Cost and Benefits of Transport in Switzerland*, Swiss Federal Office of Spatial Development (www.are.admin.ch); at https://bit.ly/2G7lIRd and https://bit.ly/3WjF1t6.

William Vickrey (1994), *Public Economics; Selected Papers by William Vickrey*, Cambridge University Press (www.cambridge.org).

Wiki (2018), "Positive Externalities," *Transportation Economics*, Wiki Books (https://en.wikibooks.org); at https://en.wikibooks.org/wiki/Transportation_Economics/Positive_externalities.