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Transportation Cost and Benefit Analysis

Techniques, Estimates and Implications

Second Edition

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Abstract
This 500+ page document is a comprehensive study of transportation benefit and costing, and a guidebook for applying this information. It includes detailed analysis of various transport costs and benefits. These impacts are described in detail and categorized by various attributes: whether they are internal or external, fixed or variable, market or nonmarket. Using the best available data, it provides monetized estimates of twenty three costs for eleven travel modes under three travel conditions.

This document is unique in several important ways. It is one of the most comprehensive studies of its kind, including many often-overlooked impacts. It is the only transport cost study regularly updated as new information becomes available. It explains economic concepts and evaluation techniques. It provides costs values in a format designed to help users easily apply this information to policy analysis and planning situations. It includes a spreadsheet that automates cost analysis. It discusses the implications and applications of analysis results. It provides extensive references, many available through the Internet, so users can obtain more detailed information as needed.

This study indicates that on average about a third of automobile costs are external and about a quarter are internal but fixed. Fuel efficient and alternative fuel vehicles tend to have somewhat lower external costs. Transit tends to have lower total costs under urban-peak conditions. Ridesharing tends to have the lowest marginal costs. Motorcycles tend to have relatively high costs due to their high crash risk. Nonmotorized modes (walking and cycling) have minimal external costs. This study describes various policy and planning reforms that can help increase economic efficiency and equity.

Chapter Index

Notes:

1. Unless stated otherwise, costs in this guidebook are in 2007 U.S. dollars and measured in U.S. units (mile, foot, US gallons). Cost and units in summaries of studies are mainly in the original form used in the studies. Conversions have been done by first converting other currencies to US dollars in the base year and then adjusting for inflation by Consumer Price Index (CPI), based on data at www.measuringworth.com.[1] Other inflation adjustment methods may provide different results.[2]
2. This report is available at www.vtpi.org/tca. The *Transportation Cost Analyzer* spreadsheet is available at www.vtpi.org/tca/tca.xls.
3. This guide is updated regularly. Users should check for possible revisions if working with a version that is more than 12 months old.

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[1] Lawrence H. Officer (2008), *Exchange Rates Between the United States Dollar and Forty-one Currencies*, MeasuringWorth (www.measuringworth.org); at www.measuringworth.org/exchangeglobal ; Lawrence H. Officer (2008), *The Annual Consumer Price Index for the United States, 1774-2007*, MeasuringWorth (www.measuringworth.org); at www.measuringworth.org/uscpi.
[2] Samuel H. Williamson (2008), *Six Ways to Compute the Relative Value of a U.S. Dollar Amount, 1790 to Present*, MeasuringWorth (www.measuringworth.com); at www.measuringworth.com/uscompare

1.1 Introduction

This chapter describes this guidebook's context and scope, discusses the value of measuring transport impacts, and discusses concepts of "transport" and "cost."

Smart consumers investigate all costs and benefits before making major purchase decisions. Prior to buying a car you want accurate information on its fuel, maintenance, repair and insurance costs. Similarly, before buying a train or airline ticket you want to know about all fees and taxes, and the ease of schedule changes. You also want information on each option's reliability, comfort and safety.

Just as consumers need accurate and comprehensive information when making personal travel decisions, communities need accurate and comprehensive information on all significant impacts when making transport policy and planning decisions.

Most people have limited knowledge of transport economics. They would say, "I just want to be able to travel conveniently, safely and affordably, without higher taxes, pollution or conflict with other road users." Notice the *just* in this statement, reflecting the assumption that these aspirations are modest and reasonable. Yet, they are actually expensive, complex and contradictory. Accommodating ever-growing motor vehicle travel requires significant resources to continually expand roadway and parking capacity, and provide traffic services, in addition to accident risk, pollution emissions and other undesirable impacts. A motorist thinks, "I pay vehicle taxes and fees so I should get parking and traffic services," little realizing that their user charges are insufficient to cover the full costs imposed by their driving.

Transportation policy and planning decisions affect virtually every aspect of life. Such decisions often involve tradeoffs between conflicting objectives. For example, strategies to increase vehicle travel speeds can increase crash risk and degrade walking conditions. Some emission reduction strategies increase vehicle costs or reduce total motor vehicle travel. Expanding parking supply increases building costs and taxes. This report provides a framework for evaluating and rationalizing such decisions. Some transport impacts, such as vehicle operation costs and travel time values, have been widely studied and estimates of their magnitude are easily available, making them relatively easy to evaluate. Other impacts, such as changes in walking conditions and greenhouse gas emissions, are more difficult to quantify, and so are often dismissed by decision-makers as *intangibles*, with the implication that they are less important than *tangible* impacts. The result is decision-making biased in favor of easy-to-measure impacts at the expense of more-difficult-to-measure impacts.

This guidebook is intended to support more comprehensive transport policy and planning analysis by providing benefit and cost information in a format that is convenient and flexible for evaluating a wide range of options.

1.2 Guidebook Scope

This guidebook provides detailed information on transportation economic impacts (benefits and costs). It examines how benefits and costs vary for different travel modes and conditions. It primarily considers personal land transport, plus some information on freight and air transport. It includes data from North America, Europe, Australia, New Zealand, Japan, and other parts of the world. This document is regularly updated as new information becomes available.

This guide uses the best available data to develop estimates of the full costs and benefits of various forms of transport, including those that are commonly recognized and some that are often overlooked. It provides an analysis framework which includes estimates of costs per vehicle-mile or passenger-mile for eleven passenger travel modes under three travel conditions (urban-peak, urban off-peak and rural). The active transportation health benefits of walking and cycling are also included. These values can be used to estimate the incremental benefits or costs that result from transport changes, such as faster, safer or more affordable travel options. This analysis framework helps compare and evaluate transportation activities and planning options.

Transportation Cost/Benefit Categories

1. Vehicle Ownership	7. Healthful Activity	13. Traffic Services	19. Barrier Effect
2. Vehicle Operation	8. Internal Parking	14. Transport Diversity Value	20. Land Use Impacts
3. Operating Subsidies	9. External Parking	15. Air Pollution	21. Water Pollution
4. Travel Time	10. Congestion	16. Greenhouse Gas Emissions	22. Waste Disposal
5. Internal Crash	11. Road Facilities	17. Noise	
6. External Crash	12. Roadway Land Value	18. Resource Consumption	

This guidebook includes individual chapters on various transport costs. Each of these chapters includes a description and discussion of the cost, summaries of *monetized* (measured in monetary values) estimates of its value, discussion of its variability and equity impacts, plus references and resources for more information. Each of these chapters provides default values reflecting typical costs for the eleven modes under the three travel conditions, plus detailed information for modifying the default values to reflect specific conditions. Users can use this information to develop more appropriate cost values for a particular mode, used at a particular time, at a particular location.

Eleven Travel Modes (definitions in Chapter 5.0)

1. Average Automobile.
2. Compact (Fuel Efficient) Car.
3. Electric Car.
4. Van or Light Truck.
5. Rideshare Passenger (the incremental cost of an additional carpool, vanpool or transit rider).
6. Diesel Bus.
7. Electric Bus/Trolley.
8. Motorcycle.
9. Bicycle.
10. Walk.
11. Telework (telecommunications that substitutes for physical travel).

1.3 Why Measure Transportation Impacts?

Transportation costing and benefit analysis has many specific applications, as summarized below and described in detail in Chapter 3.

Improved Vocabulary for Discussing Impacts

There is often confusion over how various transport impacts are defined and categorized. This guidebook provides definitions and discussions of the nature of each impact, plus reference information of additional information.

Policy and Planning Evaluation

Policy and planning decisions often involve economic analysis to determine whether a particular option is cost-effective, and which option provides the greatest overall benefits. Conventional evaluation practices often exclude some impacts, which can result in solutions to one problem that exacerbate other problems. This guidebook provides a comprehensive economic evaluation framework that can help evaluate the full costs of a particular transport activity or project, and compare the incremental benefits and costs of different options.

Optimal Pricing

A general economic principle is that prices should reflect full marginal costs[3]. Cost analysis is important to help identify fair and efficient pricing, including fuel taxes, road and parking fees, insurance pricing, vehicle fees and taxes, and road pricing.

TDM Evaluation

Transportation Demand Management (TDM, also called *Mobility Management*) includes various strategies that result in more efficient use of transport resources. TDM evaluation requires more comprehensive analysis than normally used for transport planning because it requires determining the economic impacts of various travel changes, including changes in transport diversity and shifts in travel time, distance, destination and mode. This guidebook provides information on the costs and benefits of different transport modes and conditions to help calculate incremental benefits and costs from various TDM strategies.

Equity Evaluation

There are several types of transportation equity analysis, each of which requires different types of benefit and cost information. This guidebook describes different types of transportation equity, discusses the equity impacts of various transport modes and costs, and provides information on the benefits and costs for use in equity analysis.

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[3] Marginal costs is the incremental cost per additional unit of consumtpion. For example, the marginal cost of accommodating an additional passenger with existing vehicle capacity includes any additional loading time and crowding, and incremental increases in fuel consumption and pollution emissions to carry additional weight.

Economic Development Impacts

Economic Development refers to progress toward a community's economic goals, including increases in economic productivity, employment, business activity and investment. Various techniques can be used to measure the economic development impacts of a particular transport policy or project. This guidebook discusses how such impacts can be evaluated and provides information on economic benefits and costs that can be used for evaluation.

1.4 Defining Traffic, Mobility and Accessibility

How transportation is measured affects planning and evaluation decisions.[4] Transport is often defined as *mobility*, the movement of people and goods, measured in terms of travel distance and speed. But movement is seldom an end in itself. Even recreational travel usually has a destination. The ultimate goal of most transport is accessibility, the ability to reach desired goods, services, activities, and destinations.[5]

Planners often measure transport system performance based on *vehicle traffic* conditions (e.g. average vehicle speed, roadway Level of Service, congestion delay). This tends to skew planning decisions to favor automobile travel improvements For example, wider roads, higher traffic speeds and larger parking facilities benefit motorists, but tend to create land use patterns less suited for transit, cycling and walking. If the benefits to motorists are measured, but disbenefits to other modes are not, transport planning decisions will tend to favor automobile travel at the expense of other modes. [6]

Defining transport as *mobility* (measured as person-miles or person-trips) acknowledges that other modes (transit, ridesharing, bicycling and walking) also provide access. But even this definition is limited. Only if transport is evaluated in terms of *access* can strategies that reduce the need for travel, such as telework and more efficient land use, be considered as solutions to transport problems. Increased mobility may simply indicate an overall reduction in access. John Whitelegg states,

> "It is the ease of access to other people and facilities that determines the success of a transportation system, rather than the means or speed of transport. It is relatively easy to increase the speed at which people move around, much harder to introduce changes that enable us to spend less time gaining access to the facilities that we need."[7]

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[4] VTPI (2007) "Measuring Transport: Traffic, Mobility and Accessibility" *Online TDM Encyclopedia*, Victoria Transport Policy Institute (www.vtpi.org/tdm/tdm55.htm).

[5] BTS (2001), *Special Issue on Methodological Issues in Accessibility: Journal of Transportation and Statistics*, Vol. 4, No. 2/3, Bureau of Transportation Statistics (www.bts.gov). Also see *Evaluating Transportaton Accessibility* (www.vtpi.org/access.pdf).

[6] The term 'disbenefit' is used in cost benefit analysis when a category of impact is categorized as a benefit, but the value is negative (meaning that it is a cost, but one grouped with benefits in the report). e.g. Land Transport New Zealand (2005) *Economic Evaluation Manual (EEM) – volume 2* (www.landtransport.govt.nz); at www.landtransport.govt.nz/funding/manuals.html

[7] John Whitelegg (1993), "Time Pollution," *The Ecologist* (www.theecologist.org), Vol. 23, No. 4, p. 131.

Evaluating Accessibility[8]
During a typical week you probably visit many destinations. The time and expense required for these trips indicates your quality of access. This depends on both individual factors such as your physical ability, wealth and whether you can drive; and community factors such as the capacity of roads, quality of transit service, ease of pedestrian travel, and land use patterns.

Some destinations, such as the home of a friend or a special attraction, are unique. The only way to improve access to them is to improve mobility. Other destinations are more flexible. You usually choose a store or bank branch that is nearby. Access to these destinations can be improved if your mobility improves, if their proximity increases, if they are grouped more efficiently (so you can perform more errands at once), or if alternative forms of access (such as a new communication or a delivery service) reduce your need to visit destinations in person.

1.5 Defining "Cost"

What most people call *problems*, economists call *costs*. For example, if somebody says, "Traffic congestion is a terrible problem," an economist might say, "Traffic congestion is a significant cost." The term *cost* is more neutral. *Problem* implies something is flawed and must be corrected, while *cost* recognizes that solving a problem involves tradeoffs. Calling congestion a *problem* implies that it must be fixed, but describing it as a *cost* recognizes that a certain amount of congestion may be acceptable compared with the costs involved in eliminating it. Also, *costs* implies that impacts can be quantified. Calling congestion a *problem* indicates nothing about its magnitude but calling congestion a *cost* suggests that it can be measured and compared with other impacts.

Cost refers to the trade-offs between uses of resources. This can involve money, time, land, or the loss of an opportunity to enjoy a benefit. Costs and benefits have a mirror-image relationship: a cost can be defined as a reduction in benefits, and a benefit can be defined in terms of reduced costs. For example, time spent traveling is a cost if the same time could be used in other beneficial ways. Lee states,

> "The economist's notion of cost—which is used here—is the value of resources (used for a given input) in their best alternative use . . . If less time were used in travel, how valuable would the time be for whatever purpose travelers chose to use it? If clean air were less consumed in dispersing vehicle pollutants, how much would society benefit from using the air to disperse non-highway pollutants or from breathing cleaner air? This concept of costs depends, then, on benefits foregone; there is no separate measure of cost that is distinct from valuation of benefits."[9]

[8] Todd Litman (2008), *Evaluating Transportaton Accessibility*, VTPI (www.vtpi.org); at www.vtpi.org/access.pdf.
[9] Douglass Lee (1995), *Full Cost Pricing of Highways*, National Transportation Systems Center (www.volpe.dot.gov), p. 7.

Costs have various attributes that affect their impacts, which are described below.

Internal, External and Social Costs

Internal (also called *user* or *private*) costs are borne by a good's consumer. *External* costs are borne by others. *Social* costs are the total costs to society, including both internal and external impacts.

Some costs, such as traffic congestion and crash damages are largely imposed by motorists on other motorists, and so are external to individuals but internal within a group (sector). Whether such costs should be considered internal or external depends on the type of problem being addressed.

If the only concern is sector level equity ("*It's unfair that trucks impose costs on car users.*"), sector level analysis may be appropriate. If the concern is either individual level equity ("*It's unfair that risky drivers endanger safe drivers.*"), or economic efficiency ("*Underpriced road use leads to congestion and inefficiency.*") then external costs *must* be defined at the individual level. As Mark Delucchi states,

> It is generally true that, for society to use resources efficiently, each individual who makes a resource-use decision must count as a cost of that use everything that in fact is an opportunity cost from the standpoint of society. It does not matter whether or not motor-vehicle users as a class pay for a particular cost generated "within" the class; what matters is whether or not each individual decision maker recognizes and pays the relevant social marginal-cost prices. If the responsible individual decision maker does not account for the cost, it does not matter then who actually pays for it, fellow user or non-user; the resource [usually] is misallocated, regardless of who pays. To account for a cost, a consumer must know its magnitude and be required or feel obliged to bear it. Generally, a price accomplishes both of these things: it tells the consumer what he must give up in order to consume the item.[10]

Sector level analysis implies that society is unconcerned with costs individuals impose on others in their group. This is arbitrary because it depends on how groups are defined. Should groups be defined by travel mode, geography, income class, or some combination of these attributes? For example, is traffic noise caused by motorists from another neighborhood an internal or external cost? Are motorcyclists included in the same group as car drivers for evaluating noise costs? Are noise costs internal if imposed on cyclists who live in an automobile owning household? Defining externalities at the sector level makes no more sense than to suggest that stealing is acceptable if committed against somebody who shares a common ethnic, consumer or income status.

[10] Mark Delucchi (1997), *Annualized Social Cost of Motor Vehicle Use in the U.S. 1990-1991*, Vol. 1, Institute of Transportation Studies (www.its.ucdavis.edu), UCD-ITS-RR-96-3 (1), p. 19; at www.its.ucdavis.edu/people/faculty/delucchi/index.php.

External Costs Among Automobile Users
Every household in Francis' neighborhood owns a car, but that does not eliminate external costs or mean that each household's external transport costs offset each other. A household that drives more than average, drives dangerously, or has a particularly polluting car imposes net costs on other households, even though they all own cars.

Francis also owns a bike. Her neighbors benefit when she cycles rather than drives because it reduces congestion, crash risk and pollution. These external impacts are economically inefficient if Francis does not receive an incentive to cycle equal to the benefits her neighbors enjoy when she shifts mode. With such an incentive everybody could be better off because Francis would choose to bicycle whenever her neighbors' benefits is sufficient to induce a shift.

Whether this incentive is positive (neighbors reward each other for bicycling) or negative (motorists must compensate neighbors for their negative impacts) depends on "property rights." If driving is a right then the neighbors must reward bicycling. If safety and quiet are rights, then motorists must compensate their neighbors for these external costs. These property rights are often unclear, so in practice a combination of positive and negative incentives are typically applied to encourage individuals to use modes that impose fewer external costs. Regardless of property rights, driving imposes external costs to the degree that not driving provides an external benefit.

Variable or Fixed Costs

Variable (also called *marginal*) costs are the incremental costs resulting from an incremental change in consumption, and so reflect costs that can be reduced by reduced consumption, for example, if motorists reduce their annual mileage. *Fixed* costs are not affected by consumption. *Sunk* costs are fixed costs incurred in the past which cannot be recovered. For example, equipment, buildings and land are fixed cost, but they can be sold and their value partly recovered. Expenditures such as planning for a project that is never built or building a structure with no value are sunk costs, resources spent on them cannot be recovered in the future.[11]

Fuel, travel time and crash risk are variable vehilce costs; they increase with mileage. Depreciation, insurance, and registration fees are considered fixed. The distinction between fixed and variable often depends on perspective. For example, although depreciation is usually considered a fixed cost, a vehicle's operating life and resale value are affected by its mileage, so depreciation is partly variable over the long term.

[11] There is a well established tendency for people and institutions to justify earlier decisions based on past expenditures or commitments and therefore fall into sunk cost traps, a *nonrational escalation of commitment*. For example, a person who bought shares at $20 that are now worth $7 is more likely to hold onto the shares, or even buy more, than if the same person inherited the shares today, in order to validate their original decision. The same tendency may apply to planning decisions. For example, decision-makers may be reluctant to favor new approaches, such as transportation demand management, which contradict policies and investments they previously supported, such as low fuel taxes and highway building. Guidance for avoiding such traps is available in: Max Bazerman (1995), *Judgement in Managerial Decision Making: 4th Edition*, John Wiley & Sons (www.wiley.com), p 66 – 77.

Market or Non-Market Costs

Market costs involve goods that are traded in a competitive market, such as vehicles, land and fuel. *Nonmarket* costs involve goods that are not regularly traded in markets such as clean air, crash risk, and quiet. *Monetary* costs are called *expenditures*.

Perceived or Actual Costs

There is sometimes a difference between users' *perceived* and *actual* costs. Consumers tend to be most aware of immediate costs such as travel time, fuel, parking fees and individual transit fares, while costs that are only paid occasionally, such as insurance, depreciation, maintenance, repairs and residential parking, are often underestimated.

Price

Price refers to perceived-internal-variable cost, that is, the incremental costs that a user bears for consuming a good. These are the costs that directly affect consumption decisions. For example, a change in fuel prices, parking fees and transit fares affect consumers' travel decisions. Economic efficiency requires that prices reflect the full costs of producing a good to give accurate *market signals*, as discussed in Chapter 3. Price is often defined narrowly to only include monetary costs, but it can also include nonmarket user impacts such as time and risk, since they also affect consumption decisions. Transport planners call this the *generalized cost* of travel.

Direct or Indirect Costs

Some impacts are *indirect*, with several steps between an activity and its ultimate outcomes.[12] For example, expanding urban freeways tends to stimulate low-density, urban-fringe development (sprawl) and reduce mobility options for non-drivers, resulting in various economic, social and environmental costs. Although it may be difficult to measure a particular vehicle-mile's contribution to such costs, the cumulative impacts are significant and so should not be ignored. This is similar to the effects of tobacco and alcohol: a single cigarette or drink may do little harm, but is no question that smoking and excessive drinking impose significant costs on society that justify public campaigns to encourage responsible use. Quantifying indirect impacts requires an understanding of the various steps connecting an activity with its ultimate effects. Whether an activity imposes an indirect cost can be determined using a "*with and without*" test: the difference in impacts with and without a policy or project.[13]

It is sometimes best to incorporate indirect impacts qualitatively rather than quantitatively. For example, rather than assigning dollar values to land use and transport diversity impacts a study can note whether each option supports or contradicts strategic objectives to reduce sprawl and improve travel options for non-drivers.

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[12] Louis Berger & Associates (1998), *Guidance for Estimating the Indirect Effects of Proposed Transportation Projects*, Report 403, Transportation Research Board (www.trb.org).
[13] C. van Kooten (1993), *Land Resource Economics and Sustainable Dev.*, UBC Press (www.ubcpress.ubc.ca), p. 86.

Economic Transfers, Resource Costs and Taxes

Economic transfers involve costs or benefits shifts that do not change the total amount of resources available. Pricing and taxes are economic transfers; they are a cost to one group and a benefit (revenue) to another; only additional transaction costs of paying or collecting such fees are true resource costs. Economic transfers can involve nonmarket costs. For example, larger vehicles tend to increase safety for their occupants but increase risk to other road user, a transfer of risk. When evaluating such impacts it is important to account for both the benefit and the costs of economic transfers.

Taxes require special consideration in cost analysis. Taxes are usually considered an economic transfer from consumers to governments, and are excluded when calculating costs and benefits.[14] Special charges, such as fuel taxes and vehicle registration fees can be considered user fees that internalize external costs, but general taxes, such as standard sales taxes on vehicles, are not, since consumers pay such taxes on other goods.[15] For example, if automobile travel imposes external costs of 10¢ per mile, a policy that adds one million vehicle-miles of travel would impose $100,000 in additional external costs. However, if motorists pay 3¢ per mile on average in special fuel taxes, the additional driving would generate $30,000 in additional fuel tax revenue so the net external cost is $70,000. Similarly, a mobility management program that reduces a million vehicle-miles of travel provides $100,000 in cost savings, minus $30,000 in reduced fuel tax revenue, resulting in a net $70,000 gain. General taxes are not considered to offset costs because motorists who drive less are assumed to spend their fuel cost savings on other taxed goods (e.g. rents, clothing, and entertainment), so general tax revenue would not change.

If special taxes are charged instead of, rather than in addition to, general taxes, then only the level of tax above the general tax rate is considered a user fee. For example, if a jurisdiction charges a 6% general tax, but charges only a 20¢ per gallon special tax on fuel, and gasoline costs $1.50 per gallon, the first 9¢ of the fuel tax can be considered a general tax equivalent, and only the remaining 11¢ would be considered a user fee.

If an activity is exempted from a broad-based tax, the amount exempted can be considered an expenditure. Lee states, "*Referring to these as 'expenditures' derives from the idea that the result would be the same if all taxpayers paid the tax, and the revenues were then paid out to the favored subset.*"[16] Examples include exemptions of roadway rights-of-way from property taxes (Chapter 5.6), vehicle fuel exemptions from general sales taxes, and special petroleum industry tax deductions (Chapter 5.12). Careful analysis is required to determine how tax rates compare with other comparable goods.

Costs—A Pet Example

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[14] Ian Heggie and Simon Thomas (1982), "Economic Considerations," *Transportation and Traffic Engineering Handbook*, ITE/Prentice Hall (www.ite.org / www.prenticehall.com), p. 426.
[15] FHWA (1997 – 2000), *1997 Federal Highway Cost Allocation Study Final Report* (and *Addendum*), Federal Highway Administration, (www.fhwa.dot.gov); at www.fhwa.dot.gov/policy/hcas/summary/index.htm.
[16] Douglass Lee (1995), *Full Cost Pricing of Highways*, National Transport Systems Center (www.volpe.dot.gov), p. 31.

A pet dog can often be obtained for a low *price* or for free (*unpriced*). But pet owners quickly discover that dogs impose many *costs*. Some, such as pet food purchased at the store, are *market costs*. Others, such as the nuisance of cleaning up after the animal, are *non-market costs*. Non-market costs can often be estimated relative to a market cost, such as the price to hire somebody else to clean up after the dog. Some pet costs, such as registration fees and vet fees, are *fixed*, the price is the same for any size dog, while others such as food, are *variable* because they depend on the animal's size. Some costs, such as a flea infestation, are *indirect*, since it may be difficult to know whether a particular pet introduced a particular flea. Some costs are not separate expenses; they are price *premiums* or extra costs to other expenditures, such as more frequent rug cleaning, or additional housing cost for a larger yard. In addition to the *internal* costs borne by their owners, dogs can impose *external* costs on other people, including noise, smells, messes, and fear. Some of these costs, such as animal control programs, are *government expenditures*. Payments for dog licenses are economic transfers, a cost to pet owners and revenue to government coffers, minus any *transaction* costs involved in collecting such fees. Although owners are concerned mainly with their internal costs, public policies, such as pet licensing and leash laws, must reflect the full social costs of dog ownership.

1.6 Summary

Table 1.6-1 shows how motor vehicle costs can be categorized. These distinctions determine how a cost affects decisions. Automobile owners decide how much to drive based primarily on perceived, internal, variable costs. Public agencies tend to be influenced by costs perceived by their constituents, however defined. Current transport planning and investment decisions tend to focus on direct market costs. Indirect and nonmarket costs tend to be undervalued because they are more difficult to measure.

Table 1.6-1 **Motor Vehicle Cost Distribution** (Italics = Non-market)

	Variable	Fixed
Internal (User)	Fuel	Vehicle purchase
	Short term parking	Vehicle registration
	Vehicle maintenance (part)	Insurance payments
	User time & stress	Long-term parking facilities
	User crash risk	Vehicle maintenance (part)
External	Road maintenance	Road construction
	Traffic services	Subsidized parking
	Insurance disbursements	Traffic planning
	Congestion delays	Street lighting
	Environmental impacts	*Land use impacts*
	Uncompensated crash risk	*Social inequity*

How a cost affects transport decisions tends to vary depending on whether it is internal, external, fixed, variable, market, or non-market.

Discount Rate in Cost Analysis

When an economic impact occurs can affect its economic value. In general, future impacts are discounted.[17] Discount rates reflect the *time value of money*, which recognizes that wealth can be invested to generate profits (increased benefits), so current resources have greater value than future resources, even after adjusting for inflation. *Nominal* discount rates include inflation, while those that are net of inflation are called *real* discount rates. Selecting the correct discount rate is particularly important when evaluating impacts that occur many years in the future, such as highway improvement benefits or changes in land use development. The higher the rate, the more weight is given to present over future benefits. Capital investment discount rates are typically 6-10%. These rates reflect the return capital could earn in typical alternative investments.

A debate exists as to the discount rate to use for impacts on future generations. Conventional discounting implies that costs many years in the future are of little concern now.[18] For example, at 8% discount, costs and benefits occurring 20 years in the future (a typical planning horizon) are worth less than a tenth their current value. Some analysts argue that these financial assumptions are inappropriate for evaluating human health risk and irreversible environmental impacts.[19] They recommend using a lower, or zero, discount rate for human health and irreversible environmental costs to give fair consideration to future generations' interests.[20] More detailed discussion of discount rates concerning climate change is included in Chapter 5.10.

Variability and Uncertainty

Any cost or benefit estimate incorporates some degree of variability and uncertainty. Consider, for example, the valuation of a common commodity such as an apple. At first, it may seem easy to estimate apple costs since they are sold almost everywhere. But their cost varies depending on which apple, and when, where and how it is bought. If purchased in bulk directly from a farmer an apple might cost just a few cents, but if purchased individually at a convenience store, the same apple may cost more than a dollar. Apples are cheaper if purchased wholesale, in bulk or during a special sale, and more expensive if they are imported, out-of-season, organic, or specialty varieties. Estimates of apple costs can vary significantly depending on how they are defined and measured.

Similarly with transport costs and benefits. The values in this report are generic. Of course, actual costs vary depending on factors such as location, time, vehicle condition, etc. For example, average air pollution costs may not apply to a particular situation because vehicle or exposure conditions are not average. Ideally, each cost value should be adjusted to reflect each specific application. For example, when calculating parking cost savings from reduced automobile trips in a particular area, an analyst might first use

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[17] EC (2005), *ExternE: Externalities of Energy*, European Commission (www.externe.info).

[18] One justification for discounting costs imposed on future generations is the assumption that they will be wealthier, on average, than current generations. Some economists consider this assumption optimistic.

[19] John Gowdy and Sabine O'Hara (1995), *Economic Theory for Environmentalists*, St. Lucie Press (www.crcpress.com).

[20] Robert Costanza and Herman Daly (1992), "Natural Capital," *Conservation Biology*, Vol. 6, No. 1.

the generic numbers from this report, and adjust them based on local conditions (such as land values). If even greater precision is needed, a detailed study of local parking costs could be done, in which case some references in this report may be useful guides.

Because transport cost analysis involves new areas of research, limited data sources, and complex modeling, estimates incorporate various levels of uncertainty. This is not a unique problem; individuals, businesses, and society often face uncertainty when assessing costs and benefits. For example, a business must invest in a new factory without knowing exactly what the project will cost or the future prices they will get from the factory's products. As stated by one expert in non-market costing, "*A crude approximation, made as exact as possible and changed over time to reflect new information, would be preferable to the manifestly unjust approximation caused by ignoring these costs, and thus valuing environmental damage as zero.*"[21]

'Conservative' Cost Estimates

Some economic analyses only include costs that are commonly accepted and easily quantified, and dismiss difficult-to-quantify impacts as *intangibles* (impacts that cannot be perceived by the senses). This tends to bias decision-making toward easy-to-measure impacts (such as project costs, vehicle operating expenses, and travel time savings) at the expense of more difficult-to-measure social and environmental impacts, and concentrated, short-term impacts at the expense of more dispersed, long-term impacts. This biases decision-making in various ways. For example, it tends to favor economic objectives (because they involve market resources) over social and environmental objectives; industries (which have more financial transactions) over communities (which involve more non-market transactions); wealthier people (because they purchase more market goods) over poorer people; and the current generation over future generations.

Excluding or using low estimates of relatively uncertain costs is often defended as being *conservative*, implying that this approach is cautious. But use of the word conservative in this context is confusing because it often results in the opposite of what is implied. Low *cost* estimates undervalue damages and risks, which is less cautious and conservative than using higher cost values. In practice, low estimates of indirect and non-market costs can lead to increased social and environmental damages. For example, low estimates of pollution costs reduce the justification for control measures, resulting in more emissions.

The *precautionary principle* applies a high standard of protection to damages that are potentially catastrophic.[22] *Option value* refers to the benefits of maintaining choices and avoiding irreversible losses.[23] Examples of irreversible impacts include species extinction and climate change. Many land use impacts, such as draining wetlands may be irreversible within human lifetimes, although not totally irreversible.

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21 Richard Ottinger (1993), "Incorporating Externalities - The Wave of the Future," in *Expert Workshop on Lifecycle Analysis of Energy Systems*, OECD (www.oecd.org), p. 54.

22 Andrew Jordan and Timothy O'Riordan (1994), *The Precautionary Principle In UK Environmental Law and Policy*, Center for Social and Economic Research (www.uea.ac.uk/env/cserge).

23 Hanley and Spash (1993), *Cost-Benefit Analysis and the Environment*, Elgar (Brookfield), p. 153.

Another way to deal with uncertainty is to use cost ranges rather than point estimates. This makes it possible to perform sensitivity analysis by testing how higher and lower values affect results. For example, an analyst might see whether a mobility management program is still justified if relatively low parking and congestion cost estimates are used. Minimum and maximum estimates of automobile costs are provided in this report to facilitate this sort of analysis.

Some cost estimates with a relatively high degree of uncertainty are included in this report, provided that the existence of the cost can be demonstrated, there is compelling evidence that the cost is significant in magnitude, and the resulting estimate is within the expected range relative to other costs. Assuming that the variation among the uncertainty is random, the over- and under-estimates among these estimates will tend to cancel out. Including such estimates is more accurate and more conservative than setting their value at zero, which consistently underestimates total costs.

It may be unnecessary to use all of the cost estimates in this report in a particular application. Some costs are controversial and may invoke disputes that cannot be resolved in a transport planning process. For example, some people refuse to recognize costs associated with climate-changing air emissions or low-density, urban-fringe development patterns. Other costs may be so small in a particular situation that they can be considered insignificant. Users should apply those that make sense in their political and geographic circumstances. However, if cost categories are excluded from quantitative analysis they can often be described qualitatively.

For example, when evaluating various transportation improvements in a community you might choose to not quantify land use and transport diversity impacts, on the grounds that they are indirect and difficult to measure. But you could still describe how increased urban roadway capacity is likely to stimulate low-density, urban-fringe, automobile-dependent development patterns, while other types of transport improvements usually results in more infill and clustered land use, and can increase travel options for non-drivers. This discussion could include information from the *Land Use Impacts* and *Transportation Diversity* chapters of this report concerning the economic, social and environmental value of these impacts, even if they are not quantified in monetary units.

1.7 Information Resources

Additional resources are grouped with each chapter and a more extensive bibliography is included as Chapter 12.

Apogee Research, Inc (1994), *The Costs of Transportation* Conservation Law Foundation (www.clf.org), March 1994.

Silvia Banfi, et al (2000), *External Costs of Transport: Accident, Environmental and Congestion Costs in Western Europe*, INFRAS (www.infras.ch) and IWW (www.iww.uni-karlsruhe.de).

Louis Berger & Associates (1998), *Guidance for Estimating the Indirect Effects of Proposed Transportation Projects*, Report 403, Transportation Research Board (www.trb.org).

Peter Bein (1997), *Monetization of Environmental Impacts of Roads*, Planning Services Branch, B.C. Ministry of Transportation and Highways (www.gov.bc.ca/tran); at www.geocities.com/davefergus/Transportation/0ExecutiveSummary.htm

William Black, Dean Munn, Richard Black, and Jirong Xie (1996), *Modal Choices: An Approach to Comparing the Costs of Transportation Alternatives*, Transportation Research Center, Indiana University (www.research.indiana.edu/centers/trc.html), 20 May 1996.

Booz Allen Hamilton (2005), *Surface Transport Costs and Charges Study*, Ministry of Transportation New Zealand (www.transport.govt.nz).

Robert Burchell, Anthony Downs, Barbara McCann and Sahan Mukherji (2005), *Sprawl Costs: Economic Impacts of Unchecked Development*, Island Press (www.islandpress.org).

CMHC (2006), *Tool For Costing Sustainable Community Planning*, Canadian Mortgage and Housing Corporation (www.cmhc-schl.gc.ca); at www.dcs.sala.ubc.ca/UPLOAD/RESOURCES/links/CMHC_CostingToolUserGuide.pdf.

CTA (1998), *The Real Price of Gasoline; Analysis of the Hidden External Costs Consumers Pay to Fuel Their Automobiles*, Center for Technology Assessment (www.icta.org); at www.icta.org/doc/Real Price of Gasoline.pdf

Clifford Cobb (1998), *The Roads Aren't Free; Estimating the Full Social Costs of Driving and the Effects of Accurate Pricing*, Redefining Progress (www.rprogress.org); at www.rprogress.org/publications/1998/wpts3_execsum.htm

CUTR (2007), *Economics of Travel Demand Management: Comparative Cost Effectiveness and Public Investment*, Center for Urban Transportation Research (www.nctr.usf.edu); at www.nctr.usf.edu/pdf/77704.pdf.

John DeCicco and Hugh Morris (1998), *The Costs of Transportation in Southeastern Wisconsin*, American Council for an Energy-Efficient Economy (www.aceee.org); at www.aceee.org/pubs/t982.htm.

Mark Delucchi, et al. (1996 – 2007), *Annualized Social Cost of Motor Vehicle Use in the United States, Based on 1990-1991 Data*, Vol. 1-21, Institute of Transportation Studies (www.its.ucdavis.edu); at www.its.ucdavis.edu/people/faculty/delucchi/index.php.

Mark Delucchi (2007), "Do Motor-Vehicle Users in the US Pay Their Way?," *Transportation Research Part A* (www.elsevier.com/locate/tra), Volume 41, Issue 10, Dec. 2007, pp. 982-1003.

S. Donovan, et al. (2008), *Managing Transport Challenges When Oil Prices Rise*, Research Report 357, New Zealand Transport Agency (www.ltsa.govt.nz); at www.ltsa.govt.nz/research/reports/357.pdf.

EC (2005), *ExternE: Externalities of Energy - Methodology 2005 Update*, Directorate-General for Research Sustainable Energy Systems, European Commission (www.externe.info).

EcoNorthwest and Parsons Brinckerhoff Quade & Douglas (1995), *Evaluation of Transportation Alternatives; Least Cost Planning: Principles, Applications and Issues*, FHWA (www.fhwa.dot.gov), Metropolitan Planning Technical Report #6, Sept. 1995.

Ecorys Transport and Ce Delft (2005), *Infrastructure Expenditures and Costs: Practical Guidelines to Calculate Total Infrastructure Costs for Five Modes of Transport*, CE Delft (www.ce.nl) for the European Commission (www.ec.europa.eu); at http://ec.europa.eu/ten/transport/documentation/doc/2005_11_30_guidelines_infrastructure_report_en.pdf.

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

European Environment Agency (2008), *Climate for a transport change*, (www.eea.europa.eu); at http://reports.eea.europa.eu/eea_report_2008_1/en/EEA_report_1_2008_TERM.PDF.

FHWA (1997), *1997 Federal Highway Cost Allocation Study*, USDOT (www.fhwa.dot.gov); at www.fhwa.dot.gov/policy/hcas/summary/index.htm

FHWA (2007), *Growth in Highway Construction and Maintenance Costs*, Federal Highway Administration (www.fhwa.dot.gov); at www.oig.dot.gov/StreamFile?file=/data/pdfdocs/Growth_in_Highway_Construction_and_Maintenance_Costs_Final.pdf

Lawrence Frank, Sarah Kavage and Todd Litman (2006), *Promoting Public Health Through Smart Growth: Building Healthier Communities Through Transportation And Land Use Policies*, Smart Growth BC (www.smartgrowth.bc.ca); at www.vtpi.org/sgbc_health.pdf

Luc Gagnon (2006); *Greenhouse Gas Emissions from Transportation Options*, Hydro Quebec (www.hydroquebec.com); at www.hydroquebec.com/sustainable-development/documentation/pdf/options_energetiques/transport_en_2006.pdf

Ross Garnault et al. (2008) *The Garnault Climate Change Review:Final Report*, Australian Government Department of Climate Change (www.climatechange.gov.au); at www.garnautreview.org.au

Stephen Goddard (1994), *Getting There: The Epic Struggle Between Road and Rail in the American Century*, Basic Books.

David Greene, Donald Jones and Mark Delucchi eds. (1997), *The Full Costs and Benefits of Transportation*, Springer (www.springer.com), 1997.

Susan Grant-Muller and James Laird (2007), *International Literature Review of the Costs of Road Traffic Congestion*, Scottish Executive (www.scotland.gov.uk); at www.scotland.gov.uk/Publications/2006/11/01103351/0.

L. Hyndman (Chair), (1992), *Directions: the Final Report of the Royal Commission on National Passenger Transportation,* Minister of Supply and Services Canada (www.tpsgc-pwgsc.gc.ca).

IBI Group (1995), *Full Cost Transportation and Cost-Based Pricing Strategies,* Nat. Round Table on the Env. and Economy, Transportation and Climate Change Collaborative (www.nrtee-trnee.ca), 1995.

ICLEI (1997), *Uncovering Auto Subsidies: Calculating How Much Your Local Government Spends Subsidizing Cars*, Cities for Climate Protection, International Council for Local Environmental Initiatives (www.iclei.org).

IEA (2005), *Saving Oil in a Hurry,* International Energy Agency (www.iea.org); at www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1474.

IPCC Working Group III (2007) *Mitigation of Climate Change - Technical Summary* (www.ipcc.ch); at www.mnp.nl/ipcc/pages_media/FAR4docs/final_pdfs_ar4/TS.pdf

IPCC Working Group III (2007), *5 Transport and its Infrastructure* (www.ipcc.ch); at www.ipcc.ch/ipccreports/ar4-wg3.htm

Luke H. Klipp (2004), *The Real Costs Of San Francisco's Off-Street Residential Parking Requirements: An Analysis Of Parking's Impact On Housing Finance Ability And Affordability*, Transportation for a Livable City (www.livablecity.org); at www.livablecity.org/resources/Parking_Housing_Affordability_Final.pdf.

KPMG (Van Seters, Levelton, Pammenter, Powell, Paul, Litman), (1993) *Cost of Transporting People in the British Columbia Lower Mainland,* Greater Vancouver Regional District (www.metrovancouver.org).

KPMG (1996), *The Costs of Transporting People in the City of Edmonton*, City of Edmonton, (www.edmonton.ca).

Land Transport New Zealand (2006 / 2005) *Economic Evaluation Manual (EEM) – volumes 1 & 2* (www.landtransport.govt.nz); at www.landtransport.govt.nz/funding/manuals.html

Douglass Lee (1995), *Full Cost Pricing of Highways,* National Transportation Systems Center (www.volpe.dot.gov).

Todd Litman (1997), "Full Cost Accounting of Urban Transportation: Implications and Tools," *Cities*, Vol. 14, No. 3 (www.elsevier.com), June 1997, pp. 169-174.

Todd Litman (2006), *Well Measured: Developing Indicators for Comprehensive and Sustainable Transport Planning*, VTPI (www.vtpi.org); at www.vtpi.org/wellmeas.pdf

Todd Litman (2006), *Evaluating Transportation Land Use Impacts*, VTPI (www.vtpi.org); at www.vtpi.org/landuse.pdf

Todd Litman (2007), *Socially Optimal Transport Prices and Markets*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/sotpm.pdf

Todd Litman (2007), *Build for Comfort, Not Just Speed: Valuing Service Quality Impacts In Transport Planning*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/quality.pdf.

Todd Litman, Charles Komanoff and Douglas Howell (1998), *Road Relief; Tax and Pricing Shifts for a Fairer, Cleaner, and Less Congested Transportation System in Washington State*, Energy Outreach Center/Climate Solutions (www.climatesolutions.org).

M. Maibach, et al. (2008), *Handbook on Estimation of External Cost in the Transport Sector*, CE Delft (www.ce.nl); at http://ec.europa.eu/transport/costs/handbook/doc/2008_01_15_handbook_external_cost_en.pdf

Virginia McConnell and Margaret Walls (2005). *The Value of Open Space: Evidence from Studies of Nonmarket Benefits*, Resources of the future (www.rff.org); at www.rff.org/rff/documents/rff-report-open%20spaces.pdf

Paul Mees (2000), *A Very Public Solution: Transport in the Dispersed City*. Melbourne University Press (www.mup.com.au).

Donald Miller and Domenico Patassini (2005), *Beyond Benefit Cost Analysis: Accounting for Non-Market Values in Planning Evaluation*, Ashgate Urban Planning and Environment Series (www.ashgate.com).

Norman Myers (1998), *Perverse Subsidies; Tax $s Undercutting Our Economies and Environments Alike*, International Institute for Sustainable Development (www.iisd.org).

National Highway Institute (1995), *Estimating the Impacts of Urban Transportation Alternatives*, Federal Highway Administration (www.fhwa.dot.gov), #FHWA-HI-94-053, Dec. 1995.

Peter Newman and Jeff Kenworthy (1998), *Sustainability and Cities; Overcoming Automobile Dependency*, Island Press (www.islandpress.org).

Margaret O'Mahony, Kieran Kirwan and Sean McGrath (1997), "Modeling the Internalization of External Costs of Transport," *Transportation Research Record 1576* (www.trb.org), pp. 93-98.

Steven E. Polzin, Xuehao Chu and Vishaka Shiva Raman (2008), *Exploration of a Shift in Household Transportation Spending from Vehicles to Public Transportation*, Center for Urban Transportation Research (www.nctr.usf.edu); at www.nctr.usf.edu/pdf/77722.pdf.

John Quiggin (2006), *Stern and the critics on discounting*, University of Queensland (www.uq.edu.au); at http://johnquiggin.com/wp-content/uploads/2006/12/sternreviewed06121.pdf

Donald Shoup (2005), *The High Cost of Free Parking*, Planners Press (www.planning.org).

Kenneth Small, Clifford Winston and Carol Evans (1989), *Road Work*, Brookings Institute (www.brookings.edu).

Sir Nicholas Stern et al.(2006), *Stern Review on the Economics of Climate Change*, UK Office of Climate Change (www.occ.gov.uk); at www.sternreview.org.uk

Transportation and Climate Change Collaborative (1995), *A Strategy for Sustainable Transportation in Ontario*, Na. Round Table on the Envv and Economy (www.nrtee-trnee.ca).

Transport Canada (2003-2007), *The Full Cost Investigation of Transportation in Canada*, (www.tc.gc.ca); at www.tc.gc.ca/pol/en/aca/fci/menu.htm .

Paul J. Tranter (2004), *Effective Speeds: Car Costs are Slowing Us Down*, University of New South Wales, for the Australian Greenhouse Office (www.climatechange.gov.au); at www.environment.gov.au/settlements/transport/publications/effectivespeeds.html.

H.P. van Essen, B.H. Boon, M. Maibach and C. Schreyer (2007), *Methodologies For External Cost Estimates And Internalization Scenarios: Discussion Paper For The Workshop On Internalisation On March 15, 2007*, CE Delft (www.ce.nl); at www.ce.nl/4288_Inputpaper.pdf.

Costâ€“benefit analysis (CBA), sometimes also called benefitâ€“cost analysis, is a systematic approach to estimating the strengths and weaknesses of alternatives used to determine options which provide the best approach to achieving benefits while preserving savings (for example, in transactions, activities, and functional business requirements). A CBA may be used to compare completed or potential courses of actions, or to estimate (or evaluate) the value against the cost of a decision, project, or policy Cost-benefit analysis is a technique which is based on welfare economics. There are many textbooks explaining in detail the problems encountered in a cost-benefit analysis and how to solve these [6][20][28][30][1][33]. Only the main features of the technique are described here. The main steps of a cost-benefit analysis are as followsÂ When cost-benefit analysis of transport projects started in the 1960s, the only impacts that were included in the first analyses were travel time, vehicle operating costs and accidents. The benefits of preventing accidents were normally valued according to the so called â€œhuman capitalâ€ approach, which assigned a value to preventing a fatality or an injury proportional to the value of production lost. Clouding the analysis is the fact that this decision process takes place in a political environment. Politicians love the publicity they get at the opening of a high-occupancy vehicle lane or the expansion of a mass transit system. To voters, it may look as if their elected officials are doing something about a regionâ€™s transportation problems. More often than not, however, the projects do little in mitigating transportation related problems.Â Academic researchers have examined the track record of cost-benefit estimates of past transportation infrastructure projects. Bent Flybjerg, Mette Skamris Holm, and SÃ¸ren Buhl looked at the cost estimates for 258 transportation projects valued at $90 billion built in countries around the world during the 20. th. Century. It investigates the costs of different types of parking facilities, the number of spaces per vehicle, and the distribution of parking costs.Â The costs of unpriced parking are borne by businesses and governments, and ultimately by customers and taxpayers. Most employee parking is income tax exempt, a benefit to automobile commuters worth up to $1,800 per year. The foregone taxes can also be considered a parking subsidy. Figure 5.4.3-3. Benefit-cost analyses have been used as a tool by project managers to help evaluate preliminary concepts during early planning studies, to evaluate alternatives and select a Preferred Alternative as part of project environmental documentation, and to evaluate potential design and construction staging options as part of detailed design and/or construction.Â Guidance for conducting benefit-cost analyses for other types of transportation improvements is referenced in Technical Memorandum No. 04-05-1M-01 Implementation of Minnesota Statewide Transportation Plan Cost-Effectiveness Policy. Highway improvement projects generally increase the capacity of existing facilities or systems, and/or improve the safety of existing facilities or systems.

Benefit-cost analyses have been used as a tool by project managers to help evaluate preliminary concepts during early planning studies, to evaluate alternatives and select a Preferred Alternative as part of project environmental documentation, and to evaluate potential design and construction staging options as part of detailed design and/or construction. A benefit-cost analysis provides monetary measure of the relative economic desirability of project alternatives, but decision-makers often weigh the results against other non-monetized effects and impacts of the project, such as environmental...Â Within a benefit-cost analysis period, future investments may be needed to maintain the serviceability of a major transportation facility. You are here. Home â€º. Transportation Benefit-Cost Analysis. Transportation Benefit-Cost Analysis. This website, written in the context of transportation policy, is of use to any investigator looking for step-by-step guidance on the cost-benefit analysis process. It provides a directed overview of procedures for conducting cost-benefit analysis, while explaining relevant concepts methodologies. In particular, users will learn how to. Define the problem that the the project addresses and set up analysis. Measure and value benefits and costs. Calculate benefit-cost measures. Interpret and present results of benefit-cost analysis. Sample benefit-cost models. Source: (Transportation Research Board). Contents. Specific Options Mentioned. This 500-page+ document is a comprehensive study of transportation benefit and costing research, and a guidebook for applying this information in planning and policy analysis. This document is unique in several important ways. It is one of the most comprehensive studies of its type, including many categories of costs and benefits that are often overlooked, and the only one that is regularly expanded and updated as new information becomes available. It provides extensive reference information, mostly available through the Internet, allowing users to obtain additional information when needed. It explains economic evaluation techniques and how to apply them. Benefit-cost analyses have been used as a tool by project managers to help evaluate preliminary concepts during early planning studies, to evaluate alternatives and select a Preferred Alternative as part of project environmental documentation, and to evaluate potential design and construction staging options as part of detailed design and/or construction.Â Guidance for conducting benefit-cost analyses for other types of transportation improvements is referenced in Technical Memorandum No. 04-05-1M-01 Implementation of Minnesota Statewide Transportation Plan Cost-Effectiveness Policy. Highway improvement projects generally increase the capacity of existing facilities or systems, and/or improve the safety of existing facilities or systems. As mentioned previously, cost benefit analysis is the foundation of the decision-making process across a wide variety of disciplines. In business, government, finance, and even the nonprofit world, cost benefit analysis offers unique and valuable insight when: Developing benchmarks for comparing projects. Deciding whether to pursue a proposed project.