4. Quantification Techniques

This chapter describes various techniques for quantifying and monetizing (measuring in monetary units) transport impacts.

"Not everything that can be counted counts, and not everything that counts can be counted."
-Albert Einstein

4.1 Chapter Index

4.2 Valuing Market Goods

Accountants have standard procedures for valuing economic resources and activities, such as land, buildings, equipment, labor and productivity. These are commonly reported in national accounts (which provide Gross Domestic Product), property appraisals and corporate accounts. In general, economic evaluation should be based on lifecycle cost analysis, which can take into account all impacts (benefits and costs) over a project or asset's lifespan. This allows unbiased comparisons between options with, for example, high-capital-and-low-operating-cost and low-capital-and-high-operating-cost profiles.

The value of an asset or service can be assessed in various ways:

- *What did it cost?* This is often the easiest valuation method, but it is important to use an appropriate depreciation factor to determine its current value.[1]
- *What is its market value?* This is the value of the asset if sold on the open market. This is generally appropriate for equipment and land.
- *What is its replacement value?* This reflects what it would cost to purchase or construct a replacement that provides comparable services.
- *What is its use value?* This is similar to replacement value but takes into account the asset's actual performance, which may be more or less than a replacement, for example, it newer products would be better technololgy or design.
- *What is its deprival cost?* This refers to the cost incurred if users were deprived of an asset, indicating the incremental cost of using the next best alternative.

Special care may be required to determine which valuation method is most appropriate in a particular situation. Transport facilities often occupy unique locations, and often affect nearby land values, both negatively (due to air and noise pollution) and positively (due to

[1] TC (2004), *Methodological Options for Estimation of Infrastructure Capital Costs in FCI Project*, Transport Canada Policy Group (www.tc.gc.ca/pol); at www.tc.gc.ca/pol/en/aca/fci/transmodal/menu.htm.

improved accessibility). Similarly, the deprival value of a highway or airport may be very high in the short-term but decline over time if substitutes are upgraded. These factors should be considered when applying a particular technique.

4.3 Valuing Non-Market Goods

You are far wealthier than you may realize. In addition to your financial wealth, such as your income, savings, property you also have generous amounts non-market wealth including your health, friendships, community, free time and beauty. Although it may be difficult to quantify their total value, it is possible to measure the value of a marginal change in these resources, for example, how much extra you might willingly pay for a more attractive view, or savings you would require to accept a nosier home location.

Decision-making can be biased by a tendency to focus on easy-to-measure impacts. For this reason, it is often helpful to monetize (measure in dollar values) non-market impacts so they can be incorporated into economic analysis. Impacts that are not monetized (often called *intangibles*) tend to be overlooked and undervalued. Monetizing nonmarket goods is increasingly common for planning and policy analysis, allowing more consistent and equitable decision-making. For example, it could be inefficient and unfair to spend $10,000,000 per reduced human fatality in one situation (perhaps through investments in a medical treatment) but not spend $100,000 to provide comparable human health benefits in another sector or location (perhaps by improving pedestrian safety).

Transport economists have long used monetized values of travel time and crash damages,[2] and in recent years have monetized environmental and social impacts.[3] There is nothing unusual or mysterious about non-market valuation. Individuals and public officials often make decisions involving trade-offs between market and non-market goods. For example:

- Homebuyers must decide how much extra they will pay (in dollars or by giving up other amenities) for a residence that is subject to less noise or air pollution, or has a nicer view.
- Public agencies must decide how much society should spend to achieve goals such as increased travel speeds, health care, and environmental improvements.
- Individuals choose how much to spend on safety (such as buying optional vehicle safety equipment), or how much compensation they require for dangerous work.

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[2] Henrik Lindhjem, Ståle Navrud and Nils Axel Braathen (2010), *Valuing Lives Saved From Environmental, Transport And Health Policies: A Meta-Analysis Of Stated Preference Studies*, Environment Directorate, Organisation for Economic Co-operation and Development (www.oecd.org); at www.oecd.org/officialdocuments/displaydocumentpdf?cote=env/epoc/wpnep(2008)10/final&doclanguage=en.

[3] EC, (2005), *ExternE: Externalities of Energy - Methodology 2005 Update*, Directorate-General for Research Sustainable Energy Systems, European Commission (www.externe.info); Anming Zhang, Anthony E. Boardman, David Gillen and W.G. Waters II (2005), *Towards Estimating the Social and Environmental Costs of Transportation in Canada*, Centre for Transportation Studies, University of British Columbia (www.sauder.ubc.ca/cts), for Transport Canada; at www.sauder.ubc.ca/cts/docs/Full-TC-report-Updated-November05.pdf.

Several techniques are used to quantify and monetize non-market impacts:[4]

1. *Damage Costs*

This reflects the total estimated amount of economic losses produced by an impact. For example, the damage costs of traffic crashes include vehicle damages, costs of providing medical and emergency services, lost productivity when people are disabled or killed, plus any non-market costs, such as pain, suffering and grief. Since this often involves different types of costs, measuring them requires different approaches and techniques.

2. *Hedonic Methods (also called "Revealed Preference")*

Hedonic pricing infers values for non-market goods from their effect on market prices, property values and wages. For example, if houses on streets with heavy traffic are valued lower than otherwise comparable houses on low traffic streets, the cost of traffic (conversely, the value of neighborhood quiet, clean air, safety, and privacy) can be estimated. If employees who face a certain discomfort or risk are paid higher than otherwise comparable employees who don't, the costs of that discomfort or risk can be estimated.

3. *Contingent Valuation (also called "Stated Preference")*

Contingent valuation involves asking people how much they value a particular non-market good. For example, residents may be asked how much they would be willing to pay for a certain improvement in air quality, or acceptable compensation for the loss of a recreational site. Such surveys must be carefully structured and interpreted to obtain accurate results.

4. *Control or Prevention Costs*

A cost can be estimated based on prevention, control or mitigation expenses. For example, if industry is required to spend $1,000 per ton to reduce emissions of a pollutant, we can infer that society considers those emissions to impose costs at least that high. If both damage costs and control costs can be calculated, the lower of the two are generally used for analysis on the assumption that a rational economic actor would choose prevention if it is cheaper, but will would accept damages if prevention costs are higher. For more discussion see Chapter 5.10.

5. *Compensation Rates*

Legal judgments and other compensation rates for damages can be used as a reference for assessing nonmarket costs. For example, if crash victims are compensated at a certain rate, this can be considered to represent the damages. However, many damages are never compensated, and it would be poor public policy to fully compensate all such damages, since this may encourage some people (those who put a relatively low value on their injuries) to take excessive risks or even to cause a crash in order to receive compensation. As a result, compensation costs tend to be lower than total damage costs.

6. *Travel Cost*

This method uses visitors' travel costs (monetary expenses and time) to measure consumer surplus provided by a recreation site such as a park or other public lands.

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[4] Hanley and Spash (1993), *Cost-Benefit Analysis and the Environment*, Elgar (Brookfield); John Gowdy and Sabine O'Hara (1995), *Economic Theory for Environmentalists*, St. Lucie Press; 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/nchrp); at www.statewideplanning.org/_resources/63_NCHRP8-36-61.pdf.

Care is needed to accurately interpret and apply monetized cost values. For example, many nonmotorized impacts are measured based on analysis of consumers' *willingness-to-pay* for improved safety or environmental quality, or *willingness-to-accept* compensation for reduced safety or environmental quality. Although the analysis methodologies are basically the same, the results often differ. For example, people may only be willing to pay a $20 per month rent premium for a 20% reduction in noise impacts (perhaps by moving to a quieter street or installing sound insulation in their homes), but would demand $100 per month in compensation for a 20% increase in residential noise. This reflects a combination of budget constraints (they simply don't have much extra money to pay more for rent), and consumer inertia (the tendency of people to become accustomed to a particular situation, so they place a relatively small value on improvements and a relatively large value on degradation).

Whether willingness-to-pay or willingness-to-accept is the proper perspective for evaluating an impact depends on *property right*, that is, people's right to impose impacts on others. If safety and environmental quality are considered rights then traffic crash risk and pollution emission costs should be based on recipients' willingness-to-accept incremental harms. If people are considered to have a certain right to impose risk or release pollution, then crash and pollution costs should be calculated based on victims' willingness to pay for an incremental reduction in risk and environmental degradation.

Many monetized estimates of pollution costs only reflect a portion of total damages. For example, some air pollution cost estimates only reflect human health impacts of ozone or particulates, but other harmful emissions, and agricultural and ecological impacts, are ignored (Chapter 5.10). Some estimates only count health impacts that require medical treatment, but ignore less severe discomfort, and preventive actions such as foregoing outdoor recreation. It is important that people working with such values understand what portion of total impacts they reflect and what impacts may be excluded. For example, it may be inaccurate to say that a particular study indicates *the* costs of vehicle pollution, rather, it should be considered to indicate *certain* vehicle pollution costs. Which impacts are included, and which are not, should be identified.

Accuracy Versus Precision[5]
People involved in economic evaluation should understand the difference between *accuracy* and *precision*. Accuracy refers to correctness of information. Precision refers to the level of detail in measurements. A measurement can be very precise but inaccurate. With computers it is easy to calculate analysis with a greater degree of precision than justified by the source data accuracy.

Nonmarket cost estimates are often criticized because they lack precision. For example, estimates of air pollution costs may vary by an order of magnitude, depending on the methodology that is used. However, if such impacts are likely to be significant in magnitude, it would be more *accurate* to incorporate them *imprecisely* than to omit them in ways that bias results.

[5] Donald Shoup (2002), "Roughly Right or Precisely Wrong," *ACCESS 20* (www.uctc.net), Spring 2002, pp.20-25; at www.uctc.net/access/access20.shtml

5.4 Monetizing Human Health and Life[6]

Some transportation impact valuaton, particularly crash and pollution costs, depend on the value assigned human health and life. People are sometimes offended at the idea of assigning monetary values to human life, but that reflects a misunderstanding of the concept. Although most people assign infinite value to their own life (they would not sell it for any amount of money), people, businesses and governments frequently make decisions that involve tradeoffs between monetary costs and incremental changes in health and safety risks. Valuaiton of human health and life simply reflect what people and society seem willing to pay monetarily for marginal change in health and safety risks.[7]

For example, vehicle purchasers must sometimes decide whether to pay extra for safety features such as airbags, businesses must decide whether to incorporate such equipment into vehicles as standard or optional features, and governments must decide whether to mandate such equipment for all vehicle. Similarly, roadway design, emergency services and medical care decisions often involve tradeoffs between financial expenditures and small changes in human injury and death risks. All of these decisions implicitly reflect an estimate of the monetary value of a statistical change in human injury and death.

Research on these values can help increase efficiency and equity. For example, it would be inequitable and inefficient for a community to spent $50,000,000 per life saved for one safety strategy but failed to invest in another strategy that only cost $50,000 per life saved. Policy makers often find it useful to develop reference values of human life and health (or conversely, values of human injury and death) for evaluating decisions that affect human health and safety risks.

Two general approaches are used to quantify human health risks.[8] The *Human Capital* method only measures market costs (property damage, medical treatment, and lost productivity). This typically places the value of saving a human life at about one million dollars, with lesser values for injuries. The *Comprehensive* approach adds non-market costs, including pain, grief, and reduced quality of life, as reflected by people's willingness-to-pay for increased safety (reduced crash risk and damages), or willingness-to-accept increased crash risk and damages. It is a more appropriate measure of the true cost to society of crashes, and the appropriate value to use when assessing crash prevention. This typically places the value of preventing a fatality at $3-6 million. (Blincoe, et al. estimate that the value of a fatality lies in the range of $2-7 million, and assign a "working value" of $3,366,388 in 2000 U.S. dollars).[9] The U.S. Environmental Protection Agency reviewed twenty-six studies that attempted to determine the value of a

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[6] Henrik Lindhjem, Ståle Navrud and Nils Axel Braathen (2010), *Valuing Lives Saved From Environmental, Transport And Health Policies: A Meta-Analysis Of Stated Preference Studies*, Environment Directorate, Organisation for Economic Co-operation and Development (www.oecd.org); at www.oecd.org/officialdocuments/displaydocumentpdf?cote=env/epoc/wpnep(2008)10/final&doclanguage=en.

[7] M. Maibach, et al. (2008), *Handbook on Estimation of External Cost in the Transport Sector*, CE Delft (www.ce.nl).

[8] Ted Miller (1991), *The Costs of Highway Crashes*, FHWA (www.fhwa.dot.gov), Publ. No. FHWA-RD-055.

[9] Lawrence Blincoe, et al. (2002), *Economic Cost of Motor Vehicle Crashes 2000*, NHTSA (www.nhtsa.dot.gov), DOT HS 809 446, Appendix A.

statistical life and recommended a central estimate of $6.1 million per life saved (1999 dollars).[10] A meta-analysis of studies of the value of life conducted by Mrozek and Taylor concluded that a more reliable benefit estimate is $2 million per life saved (in 1998 dollars).[11] In 2008 the U.S. Department of Transportation established the economic value of a statistical human life to be $5.8 million, with a range of $3.2 million to $8.4 million for cost-benefit calculations of transportation projects that affect fatality rates.[12]

These cost values can depend on the demographic attributes of the population under consideration. For example, values are generally considered higher for people in the prime of life than older people who expect to live fewer years. Some studies evaluate risks based on *Potential Years of Life Lost* (PYLL), which accounts for age when people are harmed, or *Disability Adjusted Life Years* (DALYs), which also accounts for years of disability. Vehicle crashes tend to injure younger people than other common health risks such as heart disease and cancer (traffic crash death age averages 39 years, compared with 71 years for all causes), and so impose a relatively high cost per death or disability.[13]

The proper conceptual framework for determining fair and efficient compensation for damages caused by another person is *willingness-to-accept*, that is, the amount of financial compensation that a particular victim requires before he or she would volunteer to experience such damages. This reflects the assumption that individuals have a right to live without being injured by others. Most crash cost studies are intended to evaluate crash *prevention*, and so tend to reflect willingness-to-pay, that is, the amount consumers would voluntarily pay for a marginal reduction in crash risk.[14] Willingness-to-pay tends to result in lower values than willingness-to-accept due to budget constraints (i.e., consumers may value increased safety but cannot afford to pay for it, so willingness-to-pay values are low, yet they would be unwilling to accept reduced safety in exchange for a financial reward, so willingness-to-accept values are relatively high). As a result, non-market cost values based on willingness-to-pay represents a lower-bound of the true fair crash compensation costs.

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[10] USEPA (2000), *Guidelines for Preparing Economic Analyses*, U.S. Environmental Protection Agency (www.epa.gov); at http://yosemite1.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0228C-01.pdf/$file/EE-0228C-01.pdf. A revised version is currently under development at http://yosemite.epa.gov/EE/epa/eerm.nsf/vwRepNumLookup/EE-0516?OpenDocument.

[11] Janusz R. Mrozek and Laura O. Taylor (2002), "What Determines the Value of Life? A Meta-analysis, *Journal of Policy Analysis and Management*, Vol. 21 No. 2, pp. 253-270.

[12] Tyler D. Duvall (2008), *Treatment of the Economic Value of a Statistical Life in Departmental Analyses*, Office of the Secretary of Transportation, U.S. Department of Transportation (http://ostpxweb.dot.gov/policy/reports/080205.htm).

[13] Henri Richardson (1992), *Motor Vehicle Traffic Crashes as a Leading Cause of Death in the U.S., 1992*, National Highway Traffic Safety Administration (www.nhtsa.dot.gov), DOT HS 808 552.

[14] The difference between willingness-to-pay and willingness-to-accept reflects the allocation of rights, including the right of individuals to be free from injuries caused by other people's actions. Standard legal and economic practice assume that individuals have a right to be safe from damages caused by other people's actions, indicating that willingness-to-accept is appropriate for crash compensation analysis.

4.5 Determining Discount Rates

Social Discount Rates (SDR) and Social Opportunity Cost of Capita (SCOC) reflect the change in value of impacts and assets over time. For example, many transport investments are *legacy* projects that provide benefits for decades into the future. Discount rates should be adjusted to reflect the risks associated with a particular type of project or impact.[15] Based on this analysis, the proposed risk-adjusted SOCC should range from about 6.0% for lower-risk projects to 8.6% for higher-risk projects.[16] Impacts such as climate change and habitat loss may impose costs that persist for centuries. Special consideration is needed to select the proper discount rate to apply when evaluating transportation impacts and options that have durable effects.[17]

[15] Donald Brean, David Burgess, Ronald Hirshhorn and Joseph Schulman (2005), *Treatment Of Private And Public Charges For Capital In A "Full-Cost Accounting" Of Transportation*, Transport Canada Policy Group (www.tc.gc.ca/pol); at www.tc.gc.ca/pol/en/aca/fci/transmodal/menu.htm

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

[17] e.g. 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.

4.6 Information Resources

Information sources on transportation costing and monetization techniques are described below. Also see documents described in Chapter 2 of this guidebook.

H. Spencer Banzhaf and Puja Jawahar (2005), *Public Benefits of Undeveloped Lands on Urban Outskirts: Non-Market Valuation Studies and their Role in Land Use Plans*, Resources for the Future (www.rff.org).

CUTEP (2001), *Guide to Transportation Benefit-Cost Analysis*, American Society of Civil Engineers (www.asce.org); at http://ceenve.calpoly.edu/sullivan/cutep/cutep_bc_outline_main.htm

Mark Delucchi (1996), *Annualized Social Cost of Motor Vehicle Use in the United States, Based on 1990-1991 Data*, University of California at Davis (www.its.ucdavis.edu); at www.its.ucdavis.edu/people/faculty/delucchi/index.php

Mark Delucchi (2000), "Should We Try to Get the Prices Right?" *Access*, Number 16, Spring 2000, University of California Transportation Center (www.uctc.net).

Tyler D. Duvall (2008), *Treatment of the Economic Value of a Statistical Life in Departmental Analyses*, Office of the Secretary of Transportation, U.S. Department of Transportation (http://ostpxweb.dot.gov/policy/reports/080205.htm).

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

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. Also see *Monetary Valuation Per Dollar Of Investment In Different Performance Measures*, AASHTO (www.transportation.org); at www.dot.state.tx.us/services/transportation_planning_and_programming/la_entrada/files/nchrp.pdf.

EEA (2001), *Indicators Tracking Transport and Environment Integration in the European Union*, European Environment Agency, European Union (www.eea.europa.eu).

EEB (1994), *Guide to Benefit-Cost Analysis in Transport Canada*, Economic Evaluation Branch, Transport Canada (www.tc.gc.ca).

Rune Elvik (1994), "The External Costs of Traffic Injury: Definition, Estimation, and Possibilities for Internalization," *Accident Analysis and Prevention*, Vol. 26, No. 6, (www.elsevier.com/locate/aap), pp. 719-732.

Environmental Economics Website (europa.eu.int/comm/environment/enveco), European Union

European Transport Pricing Initiatives (www.transport-pricing.net) has research projects that related to monetization of transportation that include:

> *CAPRI* (www.its.leeds.ac.uk/projects/capri) disseminates research on transport pricing.
>
> *MCICAM* (www.its.leeds.ac.uk/projects/mcicam/) investigates marginal cost pricing.
>
> *UNITE* (www.its.leeds.ac.uk/projects/unite) involves transport cost accounting.

Environmental Valuation Reference Inventory (www.evri.ca) is a searchable storehouse of empirical studies on the economic value of environmental benefits and human health effects. It is sponsored by a number of major North American and European organizations.

David J. Forkenbrock and Glen E. Weisbrod (2001), *Guidebook for Assessing the Social and Economic Effects of Transportation Projects*, NCHRP Report 456, TRB (www.trb.org); at http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_456-a.pdf

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

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

David Hensher and Kenneth J. Button (2003), *Handbook of Transport and the Environment*, Handbooks On Transport Vol. 4, Elsevier (www.elsevier.com).

International Society for Ecological Economics (www.ecoeco.org) provides non-market evaluation tools.

Integral Economics (www.integraleconomics.org) is an organization that develops economic tools and policies to implement comprehensive economic analysis and support sustainability.

Henrik Lindhjem, Ståle Navrud and Nils Axel Braathen (2010), *Valuing Lives Saved From Environmental, Transport And Health Policies: A Meta-Analysis Of Stated Preference Studies*, Environment Directorate, Organisation for Economic Co-operation and Development (www.oecd.org); at www.oecd.org/officialdocuments/displaydocumentpdf?cote=env/epoc/wpnep(2008)10/final&doclanguage=en.

Todd Litman (2001), *What's It Worth? Life Cycle and Benefit/Cost Analysis for Evaluating Economic Value*, Presented at Internet Symposium on Benefit-Cost Analysis, Transportation Association of Canada (www.tac-atc.ca); at www.vtpi.org/worth.pdf

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

David Luskin (1999), *Facts and Furphies in Benefit-Cost Analysis: Transport*, Bureau of Transport Economics (www.bitre.gov.au); at www.bitre.gov.au/publications/24/Files/r100.pdf.

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

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

Stale Navrud and Richard Ready (2002), *Valuing Cultural Heritage: Applying Environmental Valuation Techniques to Historic Buildings, Monuments and Artifacts*, E Elgar (www.e-elgar.com).

NHI (1995), *Estimating the Impacts of Urban Transportation Alternatives*, National Highway Institute, Course 15257, USDOT (www.nhi.fhwa.dot.gov).

National Association of Forensic Economics (www.nafe.net) is a professional organization for litigation experts, which includes valuation of non-market impacts, such as injury costs.

NRC (2009), *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, National Research Council, National Academy of Sciences (www.nap.edu/catalog/12794.html).

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.

Richard C. Porter (1999), *Economics at the Wheel; The Costs of Cars and Drivers*, Academic Press (www.academicpress.com).

Niklas Sieber and Peter Bicker (2008), *Assessing Transportation Policy Impacts on the Internalization of Externalities of Transport*, Transport & Mobility Leuven for the European Commission; at www.tmleuven.be/project/refit/d3-3.pdf.

Nariida C. Smith, Daniel W. Veryard and Russell P. Kilvington (2009), *Relative Costs And Benefits Of Modal Transport Solutions*, Research Report 393, NZ Transport Agency (www.nzta.govt.nz); at www.nzta.govt.nz/resources/research/reports/393/docs/393.pdf.

TC (2003-2007), *The Full Cost Investigation of Transportation in Canada*, Transport Canada (www.tc.gc.ca); at www.tc.gc.ca/pol/en/aca/fci/menu.htm . For technical analysis see Anming Zhang, Anthony E. Boardman, David Gillen and W.G. Waters II (2005), *Towards Estimating the Social and Environmental Costs of Transportation in Canada*, Centre for Transportation Studies, University of British Columbia (www.sauder.ubc.ca/cts); at www.bv.transports.gouv.qc.ca/mono/0965490.pdf.

USEPA (1996), *Indicators of the Environmental Impacts of Transportation*, USEPA (www.itre.ncsu.edu/cte); at http://ntl.bts.gov/lib/6000/6300/6333/indicall.pdf

USEPA, *Environmental Economics Report Inventory* (http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/homepage) is a large database of documents concerning environmental economics.

USEPA (2000), *Guidelines for Preparing Economic Analyses*, U.S. Environmental Protection Agency (www.epa.gov); at http://yosemite1.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0228C-01.pdf/$file/EE-0228C-01.pdf and http://yosemite.epa.gov/EE/epa/eerm.nsf/vwRepNumLookup/EE-0516?OpenDocument.

USEPA (2002), *Full Cost Accounting: Common Questions and Answers*, US Environmental Protection Agency (www.epa.gov); at www.epa.gov/epawaste/conserve/tools/fca/questions.htm

van Essen, et al (2004), *Marginal Costs of Infrastructure Use – Towards a Simplified Approach*, CE Delft (www.ce.nl); at www.ce.nl/?go=home.downloadPub&id=456&file=04_4597_15.pdf.

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.

Vermeulen, et al (2004), *The Price of Transport: Overview of the Social Costs of Transport*, CE Delft (www.ce.nl).

World Bank Environmental Economics and IndicatorsWebsite (http://go.worldbank.org/8PNA0NWT80), provides economic evaluation and non-market monetization resources.