

**Environmental and Economic Cost-Benefit Analyses for Recommendations of the  
Transportation Implementation Working Group: Synthesis**

**Prepared for  
Anne Criss, Climate Change Program Lead  
WSDOT Public Transportation Division**

**Prepared by  
Aaron Poor, TRAC Synthesis Editor  
Kathy Lindquist, WSDOT Research Office  
Michel Wendt, WSDOT Library**

**May 22, 2009**

Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WSDOT staff. Online and print sources may include newspaper and periodical articles, NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs and related academic and industry research. Internet hyperlinks in the TSRs are active at the time of publication, but host server changes can make them obsolete.

**Request for Synthesis:**

Anne Criss, Climate Change Program Lead in WSDOT's Public Transportation Division, requested a synthesis of environmental and economic cost-benefit analyses of recommendations of the Climate Action Team's Transportation Implementation Working Group (TIWG).

**Background:**

In November 2008, the TIWG published five prioritized recommendation areas of the most promising GHG and VMT reduction strategies ([Reducing GHG Emissions and Increasing Transportation Choices for the Future](#)):

1. Transit, rideshare, and commuter choice,
2. Compact and transit oriented development,
3. Climate change funding,
4. Transportation pricing, and
5. Non-VMT recommendations.

In April 2009, Representative Eddy requested a determination of probable environmental and economic costs and benefits of these recommendations in amendment [5735-S2.E AMH EDDY FORD 243](#).

**Databases Searched:**

TRIS World

Google Scholar

**Synthesis Summary:**

Transit, Rideshare, and Commuter Choice  
Compact and Transit Oriented Development  
Climate Change Funding  
Transportation Pricing

Non-VMT Recommendations to Reduce  
GHG Emissions  
Related Impact Analyses

**TRANSIT, RIDESHARE, AND COMMUTER CHOICE**

**Transit**

**Transport 2020 Bus Rapid Transit: A Cost Benefit Analysis**

Jennifer Blonn et al, December 2006, Prepared for Susan DeVos, Chair, Madison Area Bus Advocates, Madison, Wisconsin

*From Executive Summary:* Growth in transportation infrastructure has failed to keep pace with the rapid growth in population across the greater Madison metropolitan area, placing a strain on the region's public transportation system. In an effort to prevent the region's transportation troubles from reaching crisis proportions, a study called Transport 2020, evaluated several transportation improvement alternatives for the region. The report considers and dismisses one alternative, Bus Rapid Transit (BRT), without rigorous evaluation. In this report, we analyze the costs and benefits of implementing a BRT system in the greater Madison metropolitan area.

<http://www.cityofmadison.com/metro/AdHoc/BRT-Transport2020.pdf>

### **Measuring Economic Value of Transit**

David Lewis, March 2006, From: Moving Forward: the Economic and Community Benefits and Investment Value of Transportation Options for Greater Cincinnati, HDR/HLB Decision Economics

Today, governments and the people they serve want hard, quantitative evidence that the benefits of publicly financed ventures truly justify the costs taxpayers incur. HDR/HLB Decision Economics, under contracts with the Federal Transit Administration and Transport Canada, developed a framework that enables planning authorities to quantify economic value—benefits relative to cost—of proposed bus and rail projects. This article focuses on how to use this framework to measure and compare economic benefits and costs of proposed light rail transit investments.

<http://www.hdrinc.com/Assets/documents/Publications/transitline/march2006/EconomicValue.pdf>

### **Healthy Returns: The Economic Impact of Public Investment in Surface Transportation**

Robert J. Shapiro and Kevin A. Hassett, American Public Transportation Association Web site

*Executive Summary:* America's highways, roads, and public transportation systems contribute to virtually everything of value in our economy and lives – from linking businesses to their suppliers and customers, to bringing jobs, education, health care, recreation, and government services within every American's reach. Economists have explored the economic impact of public investment for over two decades and consistently found that surface transportation systems increase economic output, reduce prices, and raise incomes and profits. Investing in this extensive network has produced enormous economic returns for virtually every person and business in the United States.

[http://www.apta.com/research/info/online/healthy\\_returns.cfm](http://www.apta.com/research/info/online/healthy_returns.cfm)

### **Benefit-Cost Analysis Framework for Evaluating Inter-City Transit Investment**

Jessica Y. Guo et al, October 2008, Accession No. 01126876, Report No. MRUTC 08-03

*From abstract:* This report describes the development and application of a benefit/cost analysis (BCA) model to support the evaluation of investment decisions for intercity bus services. The model recognizes two principle types of intercity bus benefits: benefits that accrue to users of the transportation system and benefits that accrue to local areas from the presence of intercity bus services . . . Four out of the thirteen intercity bus routes proposed in Wisconsin's long range plan, Connections 2030, were analyzed using the IBBCA model. The analysis results indicate that most routes have relatively high benefit-cost ratios and are therefore worthwhile investments for Wisconsin . . . The results also show that user benefits are the dominating effects of intercity bus investments. Safety and environmental impacts – although they are smaller in magnitude – also provide significant societal benefits.

[http://www.mrutc.org/research/0803/08-03\\_FR\(1-09\)3.pdf](http://www.mrutc.org/research/0803/08-03_FR(1-09)3.pdf)

### **Linking Land Use and Transit: Planning at the Corridor Level**

Tim Baldwin, September 2008, Accession No. 01114137

Environmental and Economic Cost-Benefit Analyses for Recommendations of the Transportation Implementation Working Group  
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*Abstract:* This article focuses on the Fort Worth Transportation Authority's (The T's) comprehensive corridor planning efforts. In 2005, the T's board of directors completed a strategic plan that included a proposal for a second commuter rail system to begin operation within four to 10 years. The project, the Southwest-to-Northeast Rail Corridor projects, links southwest Fort Worth with downtown as well as the rapidly growing northeastern side of Tarrant County, downtown Grapevine and Dallas-Fort Worth International Airport. A final Environmental Impact Statement is expected in 2009. The 37-mile system includes 13 new stations, and the T is proactively encouraging transit-oriented development around these proposed station sites. The process includes four components: constraints and opportunities analysis; economic analysis; a transit-oriented development scenario framework; and a final report. The author explains in detail how to handle these components thus far.

[Check WSDOT Library for availability]

### **Urban Transit Systems in the US**

Research and Markets, 2008, Accession No. 01104544

*Abstract:* This report covers the scope, size, disposition, and growth of the transit industry including the key sensitivities and success factors. Also included are five year industry forecasts, growth rates and an analysis of the industry key players and their market shares. The transit industry is part of the Transportation sector in the US. The five most common means of transportation provided by transit industry are: buses, subways, light rail, commuter rail, and trolley buses.

[Check WSDOT Library for availability]

### **Bus Rapid Transit: Assessing Costs and Effects**

Herbert S. Levinson et al, 2008, Accession No. 01088632, TRB Annual Meeting 2008 Paper No. 08-2081

*Abstract:* This paper shows how to assess the costs and effects of various bus rapid transit (BRT) components and systems. Analysis of six illustrative BRT systems found that, as development costs increase, there is a consistent reduction in travel times and a consistent growth in BRT ridership. Existing experience suggests that the systems exhibiting permanence would have the greatest land development benefits.

[Check WSDOT Library for availability]

### **The Role of Transit**

David Taylor, December 2007, Accession No. 01103910, in special supplement "Sustainability Concepts: Enhancing Communities through TOD"

*Abstract:* This article discusses integrating sustainability into various transit modalities. The first aspect of transportation discussed in terms of sustainability is that of transit planning. The areas of planning that need addressing are sustainable urban design, system planning, environmental documentation, socio-economic analysis, and public involvement. The article also discusses sustainable approaches in design and construction, transit operations, modal review, heavy rail, commuter rail, light rail transit (LRT), bus rapid transit (BRT), and streetcars. The article discusses the last three in relative detail due to their particular salience for transit-oriented development (TOD). It discusses streetcars in terms of their common characteristics and urban revitalizing effect. The article explains that there are currently 20 new streetcar projects under development in North America.

[Check WSDOT Library for availability]

### **Evaluating Rail Transit Benefits: A Comment**

Todd Litman, January 2007, Transport Policy 14(1): 94-97, Accession No. 01042307

*Abstract:* Several recent articles criticize urban rail transit investments on grounds that they are ineffective at reducing traffic congestion and financially wasteful. This commentary challenges Environmental and Economic Cost-Benefit Analyses for Recommendations of the Transportation Implementation Working Group  
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that view. It summarizes some of the findings of more detailed analyses of transit benefits and suggests that there is abundant evidence that high quality, grade-separated transit does reduce urban traffic congestion, and that urban transit improvements can be cost effective investments when all economic impacts are considered.

[Check WSDOT Library for availability]

### **The Socio-Economic Benefits of Transit in Wisconsin Phase II: Benefit Cost Analysis**

HDR/HLB Decision Economics Inc., May 2006, For WisDOT, Report No. 0092-05-14, Accession No. 01036748

*From abstract:* This study furthers the research begun in 2003 (The Socioeconomic Benefits of Transit in Wisconsin). There were two principal objectives of the study. First, to perform a thorough cost-benefit analysis of transit in the state, assess and compare all transit benefits and costs over the life cycle of the investment (20 years in the case of transit capital investment projects). Second, develop a comprehensive benefit-cost analysis model that decision-makers use for quantifying transit benefits under various funding scenarios.

<http://on.dot.wi.gov/wisdotresearch/database/reports/05-14tranbenefits-f.pdf>

### **Congestion, Pollution, and Benefit-to-Cost Ratios of US Public Transit Systems**

Jon D. Harford, October 2006, Transportation Res. D 11(1): 45-58, Accession No. 01018044

*Abstract:* This paper presents a broad set of benefit-cost analyses of the public transit systems of 81 urbanized areas. The calculated sources of benefits are to riders and the reduction of congestion costs. Other sources of benefits are quite small. Calculate costs based upon operating costs and adjustment factors to account for capital costs and the excess burden of taxes used to support public transit. For the medium estimates, the aggregate benefit-cost ratio is 1.34. Only 23 of the urbanized areas have a benefit-cost ratio of one or greater for the medium estimates, but these were mainly the largest in population and transit use. Even for the high estimates, the benefit-cost ratio was less than one for almost half the areas considered.

[Check WSDOT Library for availability]

### **Economic Benefits of the Los Angeles Transit System**

Pat Flynn, Chris Burner, and Monica Born, June 2006, Investing Today for a Brighter Tomorrow: The 2006 Rail Conference, APTA, Accession No. 01033673

*Abstract:* This paper describes how the Los Angeles, California area has a transit system that continues to expand as the demand grows due to its congested freeways and streets. This paper focuses on examples where the transit system and the concept of transit-oriented development are evolving as part of the backbone of this region's transit expansion. Where possible, the paper will identify how the impacts of transit-oriented development have changed over time as the transit system has evolved. In addition, this paper focuses on what incremental value, if any, created by transit-oriented development. The work effort will distinguish between transit-oriented and transit adjacent development, and will attempt to measure the benefits associated with transit-oriented development. Benefits will include the differential effect of transit-orientation on site-specific measures such as land prices, rental rates, and other financial measures associated with the development. Benefits beyond the immediate site might include accelerated development for surrounding properties, short-term and long-term job creation, fiscal impacts, and increases in transit ridership. The paper concludes with an overview of a new study initiated by the Foothill Extension Construction Authority on the Gold Line light rail transit 24-mile extension to determine potential joint development opportunities adjacent to and around the extension's twelve stations.

[Check WSDOT Library for availability]

### **Highlights of an Expert Panel: The Benefits and Costs of Highway and Transit Investments**

U.S. Government Accountability Office, May 2005, Report No. GAO-05-423SP, Accession No. 01000363

Environmental and Economic Cost-Benefit Analyses for Recommendations of the Transportation Implementation Working Group  
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*From abstract:* The House Appropriations Committee report accompanying the fiscal year 2004 Departments of Transportation and Treasury and Independent Agencies Appropriations Bill, required the Government Accountability Office (GAO) to review the benefits and costs of various transportation modes. (See GAO-05-172.) As part of this study, GAO convened an expert panel that included some of the leading transportation economists and practitioners from throughout the nation. The panel discussed the benefits and costs of highway and transit investments. GAO asked expert panel participants to discuss how to conceptualize measure, improve, and use information about the benefits and costs of highway and transit investments. The expert panel, although not designed to reach a consensus on these issues, produced several themes including: (1) Benefit-cost analysis can be a useful tool to inform transportation investment decisions. (2) Requiring benefit-cost analysis can be useful if fully integrated into the decision making process and not seen as a compliance checklist. (3) Transportation investments seldom compare across modes. (4) We need better analytic tools to evaluate land use and distributional impacts of investments. (5) Improve the quality of state and local transportation data needs so that travel models can accurately predict patterns, trends, and needs.

<http://www.gao.gov/new.items/d05423sp.pdf>

**Rural transit systems benefits in Tennessee: methodology and an empirical study**

F. Southworth, D.P. Vogt, and T.R. Curlee, May 2005, *Environmental Planning A* 37(5): 861-75, Accession No. 01012322

*Abstract:* This paper describes the application of a detailed benefits assessment framework and sensitivity analysis of the operation of rural public transit services in the state of Tennessee. The paper describes the major components of this benefits framework and its application to the demand-responsive services operated within the state during the 1998/99 fiscal year. An empirical analysis yields a benefit/cost ratio greater than 1.0, with benefits dominated by accessibility gains to current transit patrons through the provision of mobility-enhancing vanpool services. Without these services, the costs of providing an equivalent level of access to health care, job training, and other important household activities would be much higher. The authors recommend Improved and expanded transit rider-based data collection methods.

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**Highway and Transit Investments: Options for Improving Information on Projects' Benefits and Costs and Increasing Accountability for Results**

U.S. Government Accountability Office, January 2005, Report No. GAO-05-172, Accession No. 00984969

*From abstract:* In this report the Government Accountability Office (GAO) identifies (1) the categories of benefits and costs that can be attributed to new highway and transit investments and the challenges in measuring them; (2) how state, local, and regional decision makers consider the benefits and costs of new highway and transit investments when comparing alternatives; (3) the extent to which investments meet their projected outcomes; and (4) options to improve the information available to decision makers. A range of direct and indirect benefits, such as savings in travel time and positive land-use changes, and costs can result from new highway and transit investments. The extent to which any particular highway or transit investment will result in certain benefits and costs, however, depends on the nature of the project and the local economic and transportation conditions in the location of the investment decision. In addition, measuring project benefits and costs can be challenging and is subject to several sources of error.

<http://www.gao.gov/new.items/d05172.pdf>

**Evaluating Public Transit Benefits and Costs: Best Practices Guidebook**

Todd Litman, October 2004, Victoria Transport Policy Inst., Accession No. 00981870

*Abstract:* This guidebook discusses how to create a comprehensive framework for evaluating the complete economic impacts (costs and benefits) of a specific transit improvement or service. It Environmental and Economic Cost-Benefit Analyses for Recommendations of the Transportation Implementation Working Group  
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describes categories of impacts and notes how to measure them. It presents best practices for evaluating public transit and points out typical evaluation errors that distort results. The guidebook describes various types of public transit incentives and system changes and notes their impacts on travel. It discusses three methods of public transit benefits optimization: (1) creating more land use patterns that are transit oriented, (2) increasing efficiency of the transit system, and (3) increasing transit ridership. It compares public transit and automobile costs, and the disadvantages and advantages of rail and bus transit

<http://www.vtpi.org/tranben.pdf>

### **Capacity and Cost Comparisons of Rapid Transit Modes**

John E. Jay Evans IV, August 2005, Inst. of Transportation Engineers 2005 Annual Meeting and Exhibit Compendium of Technical Papers, Melbourne, ISBN: 1933452080, Accession No. 01006823

*From abstract.* This paper assembles relevant data and considers the capacity and cost of various rapid transit modes, especially BRT and LRT. The article explores the factors that influence capacity of modes, including the critical importance of station dwell time and exclusive right-of-way. The findings support the notion that determining the appropriateness of a particular mode to serving a particular market is on a case-by-case basis, specifically reflecting current and anticipated future ridership demand. While capital and operating cost differences are noted, the paper concludes that system "right sizing" should be the paramount consideration in mode selection.

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### **Transit Demand and Commuter Rail Growth**

Robert Babbitt, June 2005, Rail Transit Conference Proceedings, Pittsburgh, ISBN: 1931594155, Accession No. 01002158

*From abstract.* This paper describes how, when Pushkarev and Zupan published Transportation and Land Use Policy in 1977, the data indicated that cities the size of Toronto and larger expect to provide commuter rail service. The critical variables were a downtown of seventy million square feet or larger. Therefore, the commuter rail systems which grew in Los Angeles (Metrolink), San Diego (Coaster), Dallas - Fort Worth (TRE), San Francisco, San Jose (Caltrain), Seattle (Sounder), Washington D.C. (VRE, MARC), and Miami (Tri Rail) were predicted by that research and the commuter rail lines planned for Charlotte and Minneapolis will meet that criteria by opening day. Commuter rail has proved more "In Demand" than that prediction. Albuquerque, Austin, Columbus, Denton County, Kansas City, Las Vegas, Milwaukee, Nashville, Orlando, Raleigh-Durham, St. Paul, Salt Lake City and San Antonio are among the cities planning or developing commuter rail lines. What caused the broader demand? Why commuter rail? For most cities, the low cost per mile makes commuter rail an obvious alternative. Cities that outgrew freeway only transportation, but did not project sufficient cost-benefit or demand for light rail, leaned toward commuter rail.

[Check WSDOT Library for availability]

### **Rideshare and Urban Commute Reduction**

#### **An economic and operational evaluation of urban car-sharing**

N.T. Fellows and D.E. Pitfield, 2000, Transportation Res. Pt. D 5(1): 1-10

*Abstract.* Utilising cost benefit analysis techniques, in exactly the same way as the UK Government evaluates new roads and public transport schemes (i.e. COBA), car-sharing produced very high net benefits to society. This paper shows that if a scheme were to be set up in the West Midlands area, UK, then even with the most conservative estimates of car-share participation, net benefits would be comparable to those produced by major road schemes. Indeed, slightly less conservative estimates of participation give net benefits in excess of road schemes.

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**Costs and Benefits of Home-Based Telecommuting: A Monte Carlo Simulation Model Incorporating Telecommuter, Employer, and Public Sector Perspectives**

Kevan R. Shafizadeh et al, March 2007, J. of Infrastructure Systems 13(1): 12-25

*From abstract.* This paper reviews and utilizes the current body of telecommuting related research to study the costs and benefits of home-based telecommuting. Monte Carlo simulation methods help account for costs or benefits that remain highly variable and not been well documented by past research. This study illustrates the conditions under which the business case supports or weakens telecommuting. Conditions for the employee (the telecommuter) are generally most favorable when: (1) the employer bears the equipment cost; (2) commute distances are above average; (3) the commute vehicle has below-average fuel economy; (4) travel time is highly valued; and (5) telecommuting is frequent, while conditions for the employer are most favorable when: (1) the telecommuter bears the equipment cost; (2) there is low telecommuter attrition; (3) the employee is highly productive on telecommuting days; (4) the employee's time is highly valued; and (5) telecommuting is frequent. For the employer, telecommuting is also favorable if parking and office space savings result. While public sector benefits are conceivable, they remain insignificant in most situations because the impacts on the transportation network are probably not concentrated enough over a specific transportation corridor to realize infrastructure benefits and not quantified or valued enough within a regional air district to realize significant air quality benefits. Further, the public sector loses fuel tax revenue. Altogether, this paper provides insight into the potential public sector impacts of telecommuting, as well as the federal, state, regional, and local public policy implications that arise when considering telecommuting among other transportation demand management alternatives.

[Check WSDOT Library for availability]

**Perspectives on Successful Telework Initiatives**

Rick Kunkle, February 2000, WSDOT Research Report No. WA-RD 485.1

*From description:* We conducted research about telework in three areas: telework and the changing nature of work, telework in organizations, and telework and transportation. We used a combination of research methods including secondary research, analysis of successful telework initiatives at three organizations (involving 31 interviews with coordinators, managers and teleworkers), and interviews with key informants.

[Cost benefits presented on page 22 of PDF]

<http://www.wsdot.wa.gov/Research/Reports/400/485.1.htm>

**Economics of Travel Demand Management: Comparative Cost Effectiveness and Public Investment**

Sisinnio Concas and Philip L. Winters, March 2007, Natl. Ctr. for Transit Res., Prepared for Florida DOT, Report No.'s: NCTR 77704-00, FDOT BD549-26

*From abstract.* The objective of this study is to develop a methodology that combines academic and practitioner experiences within a theoretical framework that truly captures consumers' price responsiveness to diverse transportation options by embracing the most relevant trade-offs faced under income, modal price and availability constraints. The development of the theoretical model leads to the design and implementation of TRIMMS (Trip Reduction Impacts for Mobility Management Strategies), a practitioner oriented sketch planning tool.

<http://www.nctr.usf.edu/pdf/77704.pdf>

**Travel Demand Management Targeting Reduced Private Car Use: Effectiveness, Public Acceptability, and Political Feasibility**

Tommy Garling and Geertje Schuitema, March 2007, J. of Social Issues 63(1): 139-153

*From abstract.* Although breakthroughs in clean automobile technology may be under way, reducing car use seems necessary in order to achieve a sustainable transportation system. This article proposes several travel demand management (TDM) measures and some implemented with this aim. The article reviews research addressing the question of how effective, acceptable to the public, and politically feasible such measures are. The conclusion is that noncoercive TDM measures alone are unlikely to be effective in reducing car use. Therefore, coercive TDM measures such as increasing cost for or prohibiting car use may be necessary but are difficult to implement because of public opposition and political infeasibility. If combined with noncoercive TDM measures providing attractive travel alternatives and communicating the benefits of car-use reduction to the public, coercive TDM measures are likely to become more effective, acceptable, and politically feasible.

[Check WSDOT Library for availability]

### **Benefits and Costs Associated with the WSDOT CTR Program**

Nicolas P. Lovich, David Nice, and Edward Weber, June 1999, Report No. WA-RD 468.1

<http://www.wsdot.wa.gov/Research/Reports/400/468.1.htm>

### **Commuter Choice**

#### **Individualized Marketing Programs: Synthesis**

Aaron Poor and Kathy Lindquist, February 2009, WSDOT Synthesis Program

This report contains links to information, including cost benefit analyses, on many individualized marketing programs.

[Check WSDOT Library for availability]

### **COMPACT AND TRANSIT ORIENTED DEVELOPMENT**

#### **Transit-Oriented Development and Joint Development in the United States: A Literature Review**

Transit Cooperative Research Program, October 2002, Research Results Digest 52

*From Chapter 3, p. 27:* Evaluations of the impacts of TOD and TJD fall into two main categories: (1) impacts of public policies; and (2) impacts on public and private outcomes. The former traces how to translate inputs (e.g., legislation and grants) into outputs (e.g., TODs). The latter traces the degree to which outputs (e.g., TJD projects) have yielded hoped-for benefits to both the public (e.g., increased patronage) and private (e.g., rent premiums) sectors.

[http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp\\_rrd\\_52.pdf](http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_rrd_52.pdf)

#### **Measuring the Success of Transit-Oriented Development: Retail Market Dynamics and Other Key Determinants**

John Niles and Dick Nelson, 1999

*Abstract.* Transit-oriented development (TOD) has become the dominant urban growth planning paradigm in the United States. Yet scant evidence indicates that it will produce significant environmental and social benefits commensurate with the costs of the major transportation system improvements that it requires.

Sixteen distinct planning issues will determine whether TOD significantly changes travel behavior in a metropolitan region. While some analysis exists, understanding of these issues needs improvement. In particular, we need more research on non-work travel, retail market dynamics, and the likely constraints this \$2.3 trillion area of business and human behavior imposes on TOD.

<http://design.asu.edu/apa/proceedings99/NILES/NILES.HTM>

#### **Transit Oriented Development: Moving From Rhetoric to Reality**

Dena Belzer and Gerald Autler, June 2002

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Intensive mixed-use development projects around transit stations, commonly known as transit-oriented development or TOD, have moved into the mainstream debate over metropolitan growth and development. Such projects have positive benefits in terms of economic development and transit ridership. However, this report finds that true, comprehensive TOD projects remain relatively scarce in this country and that often projects labeled "transit-oriented" are merely "transit-related," in that they do not take full advantage of their potential to also be environmentally sustainable and socially just. In order to reframe the debate, this paper offers an expanded definition of TOD that focuses primarily on functions and outcomes rather than on physical form and project configuration. It identifies challenges that to address and offers policy recommendations to achieve optimal TOD projects.

[http://www.brookings.edu/reports/2002/06cities\\_dena-belzer-and-gerald-autler.aspx](http://www.brookings.edu/reports/2002/06cities_dena-belzer-and-gerald-autler.aspx)

### **Bicycling and Pedestrian Infrastructure**

#### **Cost-Benefit Analysis of Cycling Infrastructure: A Case Study of Pilsen**

Hana Foltýnová and Markéta Braunkohlová, July 2006

*Abstract.* The paper analyses impacts of improved cycling infrastructure on demand for this means of transport. We use a stated preferences design for the elicitation of willingness to use the bicycle in the event of various improvements to the cycling environment in the city (in strict and tolerant level).

In the CBA applied to the planned cycling infrastructure network. In Pilsen, we include the following benefits: i) improvements in health by regular physical activity of new cyclists (quantification of impacts based on costs of illness); ii) changes in number and severity of accidents (based on accident costs); iii) changes in atmospheric pollution (using the ExternE data).

In calculating the demand change according to the strict level, the social benefits do not cover social costs of building the new cycling infrastructure.

<http://www.czp.cuni.cz/ekonomie/letskolacraj/bruhovakohlova.pdf>

### **Economic Impact of Investments in Bicycle Facilities**

The North Carolina Department of Transportation (NCDOT) Division of Bicycle and Pedestrian Transportation (DBPT) commissioned a study to examine the value of public investment in bicycle facilities. We selected the northern Outer Banks for the study because of existing high levels of bicycle activity and the presence of an extensive system of special bicycle facilities. Over the past ten years, we spent an estimated \$6.7 million of public funds to construct off-road paths and add wide paved shoulders to roads in the region.

<http://www.americantrails.org/resources/economics/NCouterbanks.html>

### **A Review of Literature: The Economic Benefits of Bicycling**

Lynn Weigand, June 2008, Centers for Transportation and Urban Studies, Portland St. Univ.

*From introduction:* The intent of this paper is to review what we know about the economic impact of bicycling. It will summarize the studies that have examined the impact of bicycling on local, regional, and state economies in the forms of production, sales, jobs, income and tax revenues, primarily from industry (manufacturing and retail) and tourism.

<http://ibpi.usp.pdx.edu/media/Economic%20Benefits%20of%20Bicycling.pdf>

### **Active Transportation for America: The Case for Increased Investment in Bicycling and Walking**

Thomas Gotschi and Kevin Mills, 2008, Rails to Trails Conservancy

[http://www.railstotrails.org/resources/documents/whatwedo/atfa/ATFA\\_20081020.pdf](http://www.railstotrails.org/resources/documents/whatwedo/atfa/ATFA_20081020.pdf)

## **Brownfield Redevelopment**

### **The Environmental and Economic Impacts of Brownfields Redevelopment, Working Draft for Distribution, Executive Summary**

Evans Paull, July 2008, Northeast Midwest Institute

*From Executive Summary:* This paper seeks to summarize established quantifiable impacts of brownfields redevelopment in the areas of environmental, economic, community, and fiscal effects . . .

This paper reviews the evidence related to each of these purported benefits and attempts to quantify the impacts. The approach is primarily a literature review. The author relied on existing research and assembled, compared, and analyzed it to highlight the most relevant data and reconcile different findings. Then, using this refined impact data, the report applies the findings to two hypothetical public investment scenarios which seek to estimate the impacts of additional federal spending on brownfields.

<http://www.nemw.org/EnvironEconImpactsBFRedev.pdf>

### **Return on Regional Redevelopment Investment: Economic Impact of Brownfields Redevelopment**

National Association of Development Organizations

EPA provides millions of dollars in funding for brownfields assessment, cleanup, revolving loan fund, and job training grants annually. The most commonly reported outcomes of these regional projects were increased community awareness of environmental concerns, additional community involvement, job creation and increased tax revenues.

Brownfields redevelopment is an environmental and public health issue, since it involves identifying and remediating contamination. In many regions, the most significant outcomes of brownfields projects relate to community and economic development: job creation and retention, increased tax revenues and downtown revitalization. Typically, priority sites are in downtown areas because these projects can bring new economic and social activity to areas in disrepair.

<http://www.nado.org/rf/innocenters/eimpact.php>

## **Transportation Concurrency**

### **Background Information and Research for LUCC Potential Recommendation on Transportation Concurrency**

Land Use and Climate Change Advisory Committee, CTED, October 2008

Impacts analysis of concurrency begins on page 4 of the PDF.

[http://www.ecy.wa.gov/climatechange/2008GMAdocs/071108\\_gma\\_transpconcurrency.pdf](http://www.ecy.wa.gov/climatechange/2008GMAdocs/071108_gma_transpconcurrency.pdf)

## **CLIMATE CHANGE FUNDING**

### **The Fuel Tax and Alternatives for Transportation Funding**

TRB, 2006, Committee for the Study of the Long-Term Viability of Fuel Taxes for Transportation Finance, Special Report 285

TRB Special Report 285: The Fuel Tax and Alternatives for Transportation Funding examines the viability of existing revenue sources, the merits of present transportation finance arrangements, and potential directions for reform of transportation finance. According to the report, fuel taxes can remain the primary funding source for the nation's highways for at least another decade, but eventually replacing them with a system for metering road use and charging accordingly could benefit travelers and the public. In addition, the committee that developed the report suggests that while the current funding system helps maintain existing highways and build new ones and ensures that users pay most of these costs, it does not help transportation agencies alleviate congestion or target investment in the most valuable projects.

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[http://www.trb.org/news/blurb\\_detail.asp?ID=5810](http://www.trb.org/news/blurb_detail.asp?ID=5810)

### **Untangling Transportation Funding**

Robert Puentes and Adie Tomer, February 2009, The Brookings Institution

As the recent kerfuffle between the Transportation secretary, the White House, and a key congressional leader demonstrate, issues around funding and finance dominate the discussion about surface transportation in the U.S. today.

While that flap was about taxing miles traveled instead of, or in addition to, gasoline consumed, they provide a window into the long simmering quandary over how we move the nation.

Already, we have had not one—but two—national commissions on the topic, and the U.S. Government Accountability Office (GAO) recently added transportation financing to its annual list of high-risk areas suggested for oversight by the current Congress.

Why the high anxiety?

Put simply: the money flowing out of the federal transportation trust fund (often referred to as the "highway" trust fund) is greater than the money flowing into it. This past September Washington shifted \$8 billion from the general fund to cover a shortfall in the transportation account. Estimates for how short the fund will be this summer hover around \$9 billion.

Despite the sharp, and perhaps simplistic, rhetoric of late, the origins of the shortfall are the result of multiple trends converging.

[http://www.brookings.edu/opinions/2009/0226\\_vehicle\\_miles\\_traveled\\_puentes.aspx](http://www.brookings.edu/opinions/2009/0226_vehicle_miles_traveled_puentes.aspx)

### **New Partners: Congestion pricing and transportation finance**

The panel at the New Partners conference on transportation finance featured NYC's congestion pricing hero Bruce Schaller, and Michael Replogle of Environmental Defense. As David Burwell of Project for Public Spaces said when he introduced the panel: The transportation trust fund is broke—not just broken, but broke. Actually, the highway fund is broke now, and the transit fund has a few years left in it . . .

In any case, we need to find innovative ways to fund transportation. There are a variety of strategies, like a VMT (Vehicle Miles Traveled) tax, congestion pricing, and more.

Since the same committee that has to reauthorize the transportation fund also is the one considering the climate cap-and-trade proposal to auction off CO2 allowances. One program is bankrupt; the other will generate lots of money. Maybe we can use the CO2 revenue to finance the transportation system.

<http://greatergreaterwashington.org/post.cgi?id=605>

## **TRANSPORTATION PRICING**

### **The Impacts of Tolling on Low-Income Persons in the Puget Sound Region**

Robert Plotnick, Jennifer Romich, and Jennifer Thacker, April 2009, Report No. WA-RD 721.1

To improve our understanding of how tolling is likely to affect low-income populations in the Puget Sound region, this report accomplishes four objectives. It

1. reviews existing research on the impacts of tolling on low-income households in the United States
2. assesses the usefulness of currently available Washington and Puget Sound data for estimating the impacts of tolling on low-income populations
3. develops a preliminary estimate of the impacts of tolling on low-income populations living in the Puget Sound region

4. suggests data collection and methodological strategies for future research that yield better estimates of the impacts of tolling on low-income populations in the Puget Sound region and other parts of Washington State.

<http://www.wsdot.wa.gov/Research/Reports/700/721.1.htm>

#### **Equity in Tolling and Pricing: Synthesis**

Aaron Poor, Kathy Lindquist, and Michel Wendt, October 2008

<http://www.wsdot.wa.gov/NR/rdonlyres/7AF4DF32-F50D-41D6-A093-A880ABCD8EF0/0/EquityinTollingandPricingSynthesis.pdf>

#### **Toll Revenue Projections: Synthesis of Issues**

Kathy Lindquist and Michel Wendt, September 2006

<http://www.wsdot.wa.gov/NR/rdonlyres/38306964-9827-4E42-AADA-53F7CB9B52C2/0/TollRevenueProjectionsSynthesisFINALSept06.pdf>

#### **A socio-economic assessment of proposed road user charging schemes in Copenhagen**

Jeppe Rich and Otto Anker Nielsen, July 2007, Transport Policy 14(1): 330-345

*From abstract.* The article presents such a socio-economic analysis of four different proposed road pricing schemes for the Copenhagen area. The purpose was to assess all benefits and costs involved, including impacts on traffic and environment, maintenance and financing costs as well as tax distortion effects. It concludes that the socio-economic surplus of the projects depends crucially on the congestion level. With the current traffic level, road pricing will not yet be socially expedient in Copenhagen. However, if postponing opening year to 2015, the two most favourable schemes turn positive. The analyses also showed that the magnitude of demand response by introducing road pricing is likely to have significant impact on the project surplus. This is an important observation because most short-term driven traffic models will then underestimate the projected surplus. Finally, the degree to which benefits outweigh costs depends considerably on the use of revenue. Although it may contribute to decreasing road congestion, recycling all of the revenue back to the transport sector turned out to be inefficient and costly.

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#### **Impacts of Toll Roads on the Regional Economy: Suggested Measures**

Terry L. Clower and Bernard L. Weinstein, July 2006, Center for Economic Development and Research, Univ. of N. Texas

*From Summary of the Task, page seven of PDF:* In this report, we examine the type of metrics employed in evaluating the economic, developmental, and fiscal impacts of toll roads. We have drawn these metrics from the literature of analyses and case studies of toll and non-toll facilities. Where the literature does not address a specific metric for a relevant impact, we suggest one. We use these metrics in later components of this research project to assess impacts realized or projected for selected case studies of local and regional economies from the construction and operation of toll facilities in Texas in urban, suburban, and rural settings. The information gathered from these case studies will support the development of project deliverables.

This report is a draft document.

<http://www.unt.edu/cedr/tollroadimpacts.pdf>

#### **Road pricing in Great Britain - winners and losers - technical report**

Stephen Glaster and D. Graham, March 2006, Independent Transport Commission, Univ. of Southampton, Accession No. 01027293

*From abstract.* This report investigates the gains and losses for individuals resulting from the introduction of road user charges for different regions in Great Britain. We assessed the simple policy of making a charge per vehicle kilometer for the use of all roads at a rate that reflects the level of congestion and environmental damages. This charge rate will vary by the current traffic

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level, the size of the vehicle, capacity of the road and the nature of the locality . . . This study examines additional revenue and revenue neutral situations. The revenue additional policy does more to reduce accidents, fuel consumption, and vehicle emissions. The traffic reduction in Outer London would be Greatest in Great Britain and typically greater than in Inner London. There is significant traffic reduction in other conurbations. Rural areas would experience a traffic increase. A revenue additional scheme would affect the rural poor more than the urban poor. There was not a marked relationship between deprivation and the study found road pricing as high deprivation in most types of area in Great Britain. The study found no systematic relationship between electoral ward income deprivation and the speed and price changes that might arise from road pricing. Car-less people would benefit from clearer roads with no increase in cost. Under a revenue additional policy for most other regions, the additional spending would be 1-2% of household budgets for car users, except in the North East where the additional spending might be 3%.

<http://www.trg.soton.ac.uk/itc/reports.htm>

### **A System of Tradable CO2 Permits Applied to Fuel Consumption by Motorists**

Charles Raux and Gregoire Marlot, May 2005, Transport Policy 12(3): 255-265, Accession No. 01002078

*Abstract.* Decentralized transferable permit systems in the transportation sector may help in reducing greenhouse gas emissions. This paper describes a potential application of a domestic market for car fuel consumption permits, and investigates the technical and economic feasibility of such a system. The marginal costs of consumption reduction vary sufficiently according to motorists' residential locations to consider permit exchanges. Economic evaluation of this system shows that there are transfers of surplus between the various groups of motorists according to their residential locations. The central government may lose significant revenues when compared with a conventional fuel tax. Although this system would be complex and administratively more costly than a simple fuel tax increase, it does provide strong incentives for reducing consumption because of the tangible benefits perceived by those who reduce their emissions below their initial allocation. The free allocation of permits proves a means of overcoming problems of accessibility and equity.

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### **A cost-benefit analysis of the Stockholm congestion charging system**

Jonas Eliasson, May 2009, Transportation Res. Pt. A 43(4): 468-480, Accession No. 01127028

*From abstract.* This paper presents a cost-benefit analysis of the Stockholm congestion charging system, based on the observed rather than on the model-forecasted data . . . The system is shown to yield a significant social surplus, well enough to cover both investment and operating costs, provided that it is kept for a reasonable lifetime: investment and startup costs are "recovered" in terms of social benefits in around 4 years.

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## **NON-VMT RECOMMENDATIONS**

### **Rail**

#### **Sustainable development and the railway in Great Britain**

S. Atkins and J. Hayat, October 2007, Proceedings of the European Transport Conference, Leiden, The Netherlands, Accession No. 01100061

*From abstract.* This report discusses the five greatest challenges and opportunities for the railway in Great Britain to become more sustainable (energy, noise, sustainable procurement, taking externalities into account and social exclusion). In addressing these issues, the railway will need to meet the challenges posed by modal competition and the wider economic and social obligations that are required within both European and national legislation. First, the imperative of climate change is considered, alongside the requirement to reduce noxious pollution that affects local air quality.

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<http://www.etcproceedings.org/paper/sustainable-development-and-the-railway-in-great-britain>

### **Diesel Emissions and Fuel Efficiency**

#### **Cost-minimizing retrofit/replacement strategies for diesel emissions reduction**

H. Oliver Gao and Timon H. Stasko, March 2009, Transportation Res. Pt. D 14(2): 111-119, Accession No. 01123286

*Abstract.* This report analyzes cost effectiveness of various emission reduction diesel retrofits as is early vehicle retirement. An integer program finds cost-minimizing cleanup strategies, given reduction goals for various pollutants, as well as technological and budget constraints. We assume retrofits take place in the present, but benefits and costs distributed over time. Budget constraints deal with short-term expenditures, while the overall objective is to minimize the net present value of short and long-term costs. The intent of the model is as a tool both for fleet owners and for government administrators. A case study examines the potential to clean up a diesel school bus fleet.

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#### **Quantification of local and global benefits from air pollution control in Mexico City**

G. McKinley et al, April 2005, Environmental Science, and Technology 39(7): 1954-61, Accession No. 01011926

Provides cost-benefit analyses of proposed pollution control measures, including taxi fleet renovation, Metro expansion, and hybrid buses.

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#### **New York City Fleet Upgrades: Conventional Diesel, Hybrid, or CNG? In Media Res Cost-Benefit Analysis**

Maria Catalina Ochoa, January 2008, TRB Annual Meeting Paper #08-2708, Accession No. 01090948

*From abstract.* Based on the case study of the New York City Transit Authority, this paper completes an in media res cost benefit analysis (CBA), from a societal point of view, of upgrading their fleet to cleaner buses. The three alternatives considered in the CBA are renewing the fleet with: (i) traditional diesel buses, (ii) hybrid-diesel buses, and (iii) compressed natural gas (CNG) buses . . . Results show a higher net present value for CNG buses than for hybrid or conventional diesel buses in almost every scenario. Yet, these results are heavily dependent on the price of gas; the willingness to pay more in order to not be dependent on foreign oil and on the price society is willing to pay to reduce greenhouse gas emissions.

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#### **A performance assessment of environmentally friendly fuels in council's vehicle fleet**

A. Reed, August 2007, Cairns Intl. Public Works Conference, Cairns, Queensland, Australia, Accession No. 01094922

*Abstract.* In 1992, Waverley Council adopted the Southern Sydney Region of Councils Greenhouse Strategy. This strategy included the use of vehicles and plant that used environmentally friendly fuels. As a result, Council introduced a passenger vehicle fleet containing a mix of liquefied petroleum gas (LPG), liquefied petroleum gas/unleaded petrol (LPG/ULP), unleaded petrol (ULP), and in recent times hybrid vehicles. Since 2004, Council has undertaken annual testing of the vehicle emissions of the various vehicles utilizing alternative fuel technology at the NSW Roads and Traffic Authority testing facility at Botany. Council now possesses a comprehensive data set on the quality of emissions from the various types of vehicles using alternative fuel technology. This paper presents the emission data and attempts to undertake a comprehensive benefit cost analysis of Council's greenhouse strategy of introducing environmentally friendly fuels to its passenger vehicle fleet. The conclusion of the paper raises serious concerns over the valuation of carbon credits.

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**Economic costs and environmental impacts of alternative fuel vehicle fleets in local government: An interim assessment of a voluntary ten-year fleet conversion plan**

Megan Haller et al, May 2007, Transportation Res. Pt. D 12(3): 219-230, Accession No. 01050189

*From abstract.* This paper examines the cost effectiveness and environmental impact of the conversion of a 180 plus vehicle fleet to alternative fuel vehicle technologies by a public organization at the mid-point of the project implementation. Using multi-year micro data on fuel usage, operational and capital expenditures, mileage and emissions, the paper examines conversion costs and infrastructure investments required, extent of user adoption, and emissions reductions achieved. We discussed results in terms of their implications for managerial practice in local government fleet agencies and for future research.

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**Transportation Systems Management**

**Sustainability and Highways Technology Schemes**

J. Conquest, A. Holt, and I. Patey, 2007, Smart Moving Conference, Accession No. 01081955

*From abstract.* This study considers how to harness technology (in the form of Intelligent Transport Systems (ITS)), to reduce harmful emissions and therefore enhance air quality and reduce the effect on climate change from CO<sub>2</sub>. It does so from two angles; firstly it considers the benefits that achieved by managing and reducing congestion through the use of technology based systems, and secondly, it considers the balance in carbon use between the building and operating of traffic congestion management schemes and the resultant reduction in emissions from traffic. Often overlooked is the CO<sub>2</sub> produced when constructing, operating and decommissioning technology schemes. To determine the true impact that an ITS scheme has on CO<sub>2</sub> emissions it is essential to quantify both the benefits and dis-benefits over the life of the scheme.

<http://www.its-sweden.com/UserFiles/archive/2Member%20support/Conferenses/Old/Aalborg2007/CD/papers/2619.pdf>

**Demonstrating the Value of ITS for Reducing Near Road Pollution**

William Lilley et al, November 2005, Proceedings of the 12th World Congress on Intelligent Transport Systems, Accession No. 01015784

*From abstract.* Addressing air pollution impacts of ITS is important because air quality rates as a major environmental concern in urban areas, especially with regards to health impacts on vulnerable people. Estimation of the outcomes of ITS on air pollution may show potential benefits and allay fears that improved traffic efficiency will just increase traffic volumes and hence increase air pollution. This paper describes the application of a planning tool using a Lagrangian Wall Model (LWM) to estimate levels of air pollution within and around major roads.

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**Low Carbon Fuel Standard**

**Economic Analysis of Feebates to Reduce Greenhouse Gas Emissions from Light Vehicles for California**

Walter S. McManus, May 2007, Univ. of Mich Transportation Res. Inst., Report No. UMTRI-2007-19-2, Accession No. 01076632

*From abstract.* This study explores the economic impacts on consumers and manufacturers of the existing Pavley regulation and a feebates program by analyzing four alternative scenarios, using information from 2002 as the base year. The author's findings show that a feebates

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program is an effective strategy to reduce global warming pollution by up to 25% more than Pavley alone.

<http://deepblue.lib.umich.edu/handle/2027.42/55180>

## **RELATED IMPACT ANALYSES**

### **Determining Optimal Integrated Strategies for European Cities**

Anthony D. May et al, September 2004, Transport Research Laboratory, Accession No. 00982618

*From abstract.* A regression-based methodology determined an optimal combination of policy instruments using the predictions from a conventional transport model. We applied this method to eight European cities, using three models. We presented results for Edinburgh, Leeds, Oslo, and Vienna. Sustainability is an overarching objective and selected a cost benefit analysis approach or indicator targets of transport access, accidents, travel time, noise, and emissions. Policy instruments included public transport fares, public transport frequencies, cordon charges to enter the city centre, and low cost changes in road capacity. The appraisal period was 30 years . . . Outcomes of the project indicated that with the cost benefit analysis approach, increased public transport frequencies in all cities except Vienna and a consistent reduction in fares (except off-peak fares in Leeds and Oslo) were desirable. We recommend cordon charges in all cities. This approach achieves half or more of the targets. With the target-based approach the resulting strategies were more variable but half or all of the cost benefit analysis approach benefits were lost.

<http://www.etcproceedings.org/paper/determining-optimal-integrated-transport-strategies-for-european-cities>

### **Appraisal: including more economic impacts could offset additional environmental costs**

A. Forster, December 2006, Local Transport Today (458), ISSN: 0962-6220, Accession No. 01045832

*Abstract.* Sir Rod Eddington's new report discusses the links between transport and economic productivity in the UK. The study examined the cost-benefit of over 170 transport scheme business cases and submitted them to the Department for Transport. Four different forms of measurement used include conventional benefit: cost ratios, an estimate of GDP impact, and monetized environmental impacts (including carbon emissions). The inclusion of GDP benefits boosted schemes in urban networks. Agglomeration impacts were greatest in London. Adding in the environmental effects deflated the benefit: cost ratio of many projects. The report concluded that even after building in environmental effects, road investment was still able to offer among the highest returns of any improvements. The study was less enthusiastic about major rail schemes. We recommend a series of changes to better capture the economic benefits of transport schemes: valuation of time savings, freight valuation, valuations of reliability and agglomeration, and gains from trade.

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### **Interdisciplinary perspectives on environmental appraisal and valuation techniques**

G. Hammond and A.B. Winnett, August 2006, Proceedings of Institution of Civil Engineers, Waste and Resource Management: 117-130, Accession No. 01060928

*From abstract.* This report examines a range of interrelated environmental project appraisal techniques to determine their relative merits. Practical examples involving resource (energy and hydraulic oil) use, pollutant emissions, and waste disposal and recycling (of hydraulic oils) indicate that many of these methods can play an important evaluative role as part of an interdisciplinary toolkit within a general systems framework. Nevertheless, use caution when adopting economic and engineering analysis to ensure they are fit for their sustainability purpose.

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## **Speed limit adherence and its effect on road safety and climate change - final report**

O. Carsten et al, January 2008, Accession No. 01127736

*From abstract.* Intelligent Speed Adaptation (ISA) is the system which uses information and communications technology to provide speed limit information on a vehicle's dashboard, usually with a digital road map of the kind used in satellite navigation systems with the speed limit data for every road added in. ISA can be advisory, or linked to the vehicle's engine management system to provide an intervening ISA, which can be voluntary and therefore able to be overridden, or mandatory and unable to override. The study aimed to estimate, through the voluntary use of an ISA system, the impact on people killed or injured in road accidents; the impact on pollutants emissions and fuel consumption; other benefits or non-benefits; cost benefits; critical mass at which benefits increase rapidly; how greater take-up and usage of voluntary ISA can be encouraged; and ways of advising how to overcome non-benefits.

[http://www.trb.org/news/blurb\\_detail.asp?id=10120](http://www.trb.org/news/blurb_detail.asp?id=10120)

## **Costs of Climate Change and Air Pollution**

### **The Cost of Climate Policy in the United States**

Sergey Paltsev, John M. Reilly, Henry D. Jacoby, and Jennifer F. Morris, April 2009, MIT Joint Program on Climate Change Report No. 173

*Abstract:* We consider the cost of meeting emissions reduction targets consistent with a G8 proposal of a 50 percent global reduction in emissions by 2050, and an Obama Administration proposal of an 80 percent reduction over this period. We apply the MIT Emissions Prediction and Policy Analysis (EPPA), modeling these two policy scenarios if met by applying a national cap-and-trade system, and compare results with an earlier EPPA analysis of reductions of this stringency. We also test results to alternative assumptions about program coverage, banking behavior, and cost of technology in the electric power sector. Two main messages emerge from the exercise.

First, technology uncertainties have a huge effect on the generation mix but only a moderate effect on the emissions price and welfare cost of achieving the assumed targets. Measured in terms of changes in economic welfare, the economic cost of 80 percent reduction by 2050 is in the range of 2 to 3% by 2050, with CO<sub>2</sub> prices between \$48 and \$67 in 2015 rising to between \$190 and \$266 by 2050. Second, implementation matters.

When replaced with an idealized economy-wide cap-and-trade by coverage omitting some sectors, or if the credibility of long-term target is weak (limiting banking behavior) prices and welfare costs change substantially.

[http://globalchange.mit.edu/files/document/MITJPSPGC\\_Rpt173.pdf](http://globalchange.mit.edu/files/document/MITJPSPGC_Rpt173.pdf)

## **Climate Change: Expert Opinion on the Economics of Policy Options to Address Climate Change**

U.S. GAO, May 2008, Report No. GAO-08-605, Accession No. 01103351

*Abstract.* The U.S. Government Accountability Office (GAO) elicited the opinions of experts on (1) actions the Congress might consider to address climate change and known about the potential benefits, costs, and uncertainties of these actions and (2) the key strengths and limitations of policies or actions to address climate change. GAO worked with the National Academy of Sciences to identify a panel of noted economists with expertise in analyzing the economic impacts of climate change policies and gathered their opinions through iterative, Web-based questionnaires. The findings reported here represent the views of the 18 economists who responded to both questionnaires.

<http://www.gao.gov/new.items/d08605.pdf>

## **The MIT Emissions Prediction and Policy Analysis (EPPA) Model: Version 4**

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Sergey Paltsev et al, 2005, MIT Joint Program on the Science and Policy of Global Change, Report 125

*From abstract.* The Emissions Prediction and Policy Analysis (EPPA) model is the part of the MIT Integrated Global Systems Model (IGSM) that represents the human systems. EPPA is a recursive-dynamic multi-regional general equilibrium model of the world economy, built on the GTAP dataset and additional data for the greenhouse gas and urban gas emissions. The design is to develop projections of economic growth and anthropogenic emissions of greenhouse related gases and aerosols. The main purpose of this report is to provide documentation of a new version of EPPA, EPPA version 4.

[http://globalchange.mit.edu/files/document/MITJPSPGC\\_Rpt125.pdf](http://globalchange.mit.edu/files/document/MITJPSPGC_Rpt125.pdf)

#### **Scottish road network climate change study**

R.M. Galbraith, D.J. Price, and L. Shackman, 2005, Accession No. 01113803

The report examines trends in climate changes in Scotland are examined to see how they may affect the road network. The report assesses the implications of current climate change predictions to determine the impact. The conclusions show climatic changes in the near future may be sufficiently significant to warrant adjustment of current practices. The report puts forward recommendations from the realms of design, operation, further research, and policy review . . . Recommendations include the revision of the design of water drainage facilities; identification of road network flooding locations with potential solutions evaluated on a cost/benefit basis; pre-emptive clearing of detritus from drainage facilities; further research into the estimation of catchment runoff.

<http://www.scotland.gov.uk/Publications/2005/07/08131510/15117>

#### **Economic Costs of Motor Vehicle Emissions in China: A Case Study**

Xin Deng, May 2006, Transportation Res. Pt. D 11(3): 216-226, Accession No. 01026149

*From abstract.* This paper uses Beijing as a case study to evaluate the magnitudes of air pollution concerning motor vehicles. The report presents a monetary estimation of air pollution regarding motor vehicles based on data for Beijing in 2000. Two methods—willingness-to-pay and human capital methods—are used to analyze the high and low points of estimation.

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#### **Uncertainty of Air Pollution Cost Estimates: To What Extent Does It Matter?**

A. Rabl and J.V. Spadaro, January 2005, Environmental Sci. and Tech. 39(2): 399-408, Accession No. 00987083

*From abstract.* Using abatement cost curves for NO<sub>x</sub>, SO<sub>2</sub>, dioxins, and CO<sub>2</sub>, this paper evaluates the cost penalty for errors in the following: national emission ceilings for NO<sub>x</sub> and SO<sub>2</sub> in each of 12 countries of Europe, an emission ceiling for dioxins in the UK, and limits for the emission of CO<sub>2</sub> in Europe. The cost penalty turns out to be remarkably insensitive to errors. An error by a factor of 3 due to uncertainties in the damage estimates for NO<sub>x</sub> and SO<sub>2</sub> increases the total social cost by at most 20% and in most cases much less. For dioxins, the total social cost increases by at most 10%. For CO<sub>2</sub>, the report examines several different possible cost curves: for some the sensitivity to uncertainties is greater than for the other pollutants, but the penalty is less than 30% and in most cases much less, if the true damage costs are twice as high as the ones estimated.

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